

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2020–0010;
FF09E21000 FXES1111090FEDR 234]

RIN 1018–BD32

Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Longsolid and Round Hickorynut and Designation of Critical Habitat

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine threatened species status under the Endangered Species Act of 1973 (Act), as amended, for the longsolid (*Fusconaia subrotunda*) and round hickorynut (*Obovaria subrotunda*), freshwater mussels. We also designate critical habitat for both species. For the longsolid, in total, approximately 1,115 river miles (1,794 river kilometers) fall within 12 units of critical habitat in Pennsylvania, Kentucky, West Virginia, Virginia, Tennessee, and Alabama. For the round hickorynut, in total, approximately 921 river miles (1,482 river kilometers) fall within 14 units of critical habitat in Pennsylvania, Ohio, Indiana, Kentucky, West Virginia, Tennessee, Alabama, and Mississippi. We also finalize a rule under the authority of section 4(d) of the Act for both species that provides measures that are necessary and advisable to provide for the conservation of these species.

DATES: This rule is effective April 10, 2023.

ADDRESSES: This final rule is available on the internet at <https://www.regulations.gov>. Comments and materials we received are available for public inspection at <https://www.regulations.gov> at Docket No. FWS–R4–ES–2020–0010.

Supporting materials we used in preparing this rule, such as the species status assessment reports and supporting information that we developed for the critical habitat designation, are available at <https://www.regulations.gov> at Docket No. FWS–R4–ES–2020–0010. For the critical habitat designation, the coordinates or plot points or both from which the maps are generated are included in the decision file and are available at <https://www.regulations.gov> at Docket No. FWS–R4–ES–2020–0010, and on the Service’s Environmental Conservation

Online System (ECOS) website at <https://ecos.fws.gov/ecp/species/9880> and <https://ecos.fws.gov/ecp/species/9879>.

FOR FURTHER INFORMATION CONTACT:

Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St., Asheville, NC 28801; telephone 828–258–3939. Individuals in the United States who are deaf, deafblind, hard of hearing, or have a speech disability may dial 711 (TTY, TDD, or TeleBraille) to access telecommunications relay services. Individuals outside the United States should use the relay services offered within their country to make international calls to the point-of-contact in the United States.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, a species warrants listing if it meets the definition of an endangered species (in danger of extinction throughout all or a significant portion of its range) or a threatened species (likely to become endangered within the foreseeable future throughout all or a significant portion of its range). If we determine that a species warrants listing, we must list the species promptly and designate the species’ critical habitat to the maximum extent prudent and determinable. We have determined that the longsolid and round hickorynut meet the definition of threatened species; therefore, we are listing them as such and finalizing a designation of their critical habitat. Both listing a species as an endangered or threatened species and designating critical habitat can be completed only by issuing a rule through the Administrative Procedure Act rulemaking process (5 U.S.C. 551 *et seq.*).

What this document does. This rule lists the longsolid and round hickorynut as threatened species, and issues regulations under section 4(d) of the Act (a “4(d) rule”) for the conservation of both species. This rule designates critical habitat for the longsolid in 12 units totaling approximately 1,115 river miles (mi) (1,794 river kilometers (km)) within portions of 7 counties in Pennsylvania, 16 counties in Kentucky, 10 counties in West Virginia, 4 counties in Virginia, 6 counties in Tennessee, and 3 counties in Alabama. Additionally, this rule designates critical habitat for the round hickorynut in 14 units totaling approximately 921 river mi (1,482 river km) within portions of 2 counties in Pennsylvania,

3 counties in Ohio, 4 counties in Indiana, 18 counties in Kentucky, 11 counties in West Virginia, 3 counties in Tennessee, 3 counties in Alabama, and 1 county in Mississippi.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that the longsolid and round hickorynut are threatened species due to the following threats: habitat degradation or loss (Factor A) from a variety of sources (*e.g.*, dams and other barriers, resource extraction); degraded water quality from chemical contamination and erosion from development, agriculture, mining, and forest conversion (Factor A); direct mortality from dredging (Factor E); residual impacts (reduced population size) from historical harvest (Factor B); and the proliferation of invasive, nonnative species (Factor E). These threats also contribute to the negative effects associated with the species’ small population sizes (Factor E).

Section 4(a)(3) of the Act requires the Secretary of the Interior (Secretary) to designate critical habitat concurrent with listing to the maximum extent prudent and determinable. Section 3(5)(A) of the Act defines critical habitat as (i) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations and protections; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination by the Secretary that such areas are essential for the conservation of the species. Section 4(b)(2) of the Act states that the Secretary must make the designation on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impacts of specifying any particular area as critical habitat.

Previous Federal Actions

Please refer to the proposed listing and critical habitat rule (85 FR 61384) for the longsolid and round hickorynut published on September 29, 2020, for a

detailed description of previous Federal actions concerning these species.

Peer Review

A species status assessment (SSA) team prepared SSA reports for the longsolid and round hickorynut. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA reports represent a compilation of the best scientific and commercial data available concerning the status of each of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting them.

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we solicited independent scientific review of the information contained in the SSA reports. As discussed in the proposed rule, we sent the SSA reports to 10 independent peer reviewers on both the longsolid and round hickorynut and received 3 responses on the longsolid SSA report, and no responses on the round hickorynut SSA report. The peer reviews for the longsolid SSA report can be found at <https://www.regulations.gov> at Docket No. FWS-R4-ES-2020-0010. In preparing the proposed rule, we incorporated the results of these reviews, as appropriate; both SSA reports were the foundation for the proposed rule and this final rule. A summary of the peer review comments and our responses can be found in the *Peer Reviewer Comments* section of this final rule.

Summary of Changes From the Proposed Rule

This final rule incorporates several changes from what was contained in our proposed rule (85 FR 61384; September 29, 2020) based on the comments we received during the comment period. Minor, nonsubstantive changes and corrections were made throughout this rule and in the SSA reports in response to comments (e.g., updated range map for round hickorynut based on survey information in Ohio, revised forest conversion section in the discussion of threats). The information we received during the comment period did not change our determination that the longsolid and round hickorynut are threatened species.

We received substantive comments on the proposed listing and proposed 4(d) rule (see Summary of Comments and Recommendations, below), and we made changes as follows:

- We received comments from multiple State agencies across the ranges of the longsolid and round hickorynut. The State agencies generally concurred with our methods and conclusions, and provided additional information, clarifications, and suggestions associated with threats to the longsolid and round hickorynut. Minor edits associated with threats and their association with populations in West Virginia have been incorporated into the preamble of this rule, and additional citations have been added to support statements regarding contaminants and resource extraction and their effects on stream habitats and macroinvertebrates. These added citations are Pond et al. (2008) and Entrekin et al. (2015). Additionally, special management recommendations for the nonnative round goby (*Neogobius melanostomus*) have been incorporated into the discussion of the longsolid's French Creek critical habitat unit (Unit LS 1) in Pennsylvania.

- We received comments requesting clarification of broodstocking activities as they relate to the 4(d) exception associated with conservation and restoration efforts by State wildlife agencies. Accordingly, the first exception for incidental take associated for both species' 4(d) rules clarifies this activity includes population monitoring, relocation, and collection of broodstock; tissue collection for genetic analysis; captive propagation; and subsequent stocking into currently occupied and unoccupied areas within both species' historical ranges.

- We received comments requesting clarification on the third exception in the 4(d) rule for bank restoration projects that use bioengineering methods to reduce bank erosion and instream sedimentation and improve habitat conditions for both species. Specifically, the commenter indicated, and we agree, that this exception should be referred to as bank stabilization projects, which may include channel restoration activities, and relocation of mussels prior to implementation of these types of projects may be (as opposed to must be) necessary. Accordingly, this exception of the 4(d) rule reflects these changes.

- Several commenters indicated that the Service should consider forest management best management practices (BMPs; i.e., practices that reduce the amount of nonpoint pollution from forest management) as part of the overall conservation benefit for the species, account for these beneficial actions in any threat analysis, and incorporate an associated exception into the 4(d) rules for both species. Additionally,

Warrington et al. (2017) was described as being cited erroneously in the proposed rule's preamble. Forested watersheds contribute to the current condition of each species and have been factored in as a positive factor (i.e., benefit) in the SSAs and proposed rule. State-approved forest management BMPs vary across the large geographic areas occupied by the longsolid and round hickorynut, but we support and encourage their use throughout the species' ranges. Accordingly, this final rule includes an exception to the prohibitions in both species' 4(d) rules for State-approved forest management BMPs in response to public comments we received on the proposed rule.

We also note that forestry activities were not a primary threat in our current and future condition analyses, and that the conversion of forested habitats to other land uses, such as agriculture or urban development, contribute to greater habitat and water quality degradation than forest management. Clarity regarding forest conversion to other land uses, not forestry, and its contribution to freshwater mussel habitat degradation and loss has been incorporated into the preamble of this rule. Several populations of the longsolid and round hickorynut occur on U.S. Forest Service lands; therefore, any actions that may affect these populations are subject to section 7 consultation under the Act (16 U.S.C. 1531 *et seq.*).

This rule does not make any changes to the boundaries of the proposed critical habitat designation for either species based on public comments we received.

I. Final Listing Determination Background

Please refer to the September 29, 2020, proposed rule (85 FR 61384) and the SSA reports for full summaries of species information. These documents are available at <https://www.regulations.gov> under Docket No. FWS-R4-ES-2020-0010, and on the ECOS website at <https://ecos.fws.gov/ecp/species/9880> and <https://ecos.fws.gov/ecp/species/9879>.

The longsolid (*Fusconaia subrotunda*) is a freshwater river mussel belonging to the Unionidae family, also known as the naiads and pearly mussels. Longsolid adults are light brown in color, darkening with age. The shell is thick and medium-sized (up to 5 inches (in) (125 millimeters (mm))), and typically has a dull sheen (Williams et al. 2008, p. 322). There is variability in the inflation of the shell depending on population and latitudinal location

(Ortmann 1920, p. 272; Watters et al. 2009, p. 130).

The longsolid is currently found in the Ohio, Cumberland, and Tennessee River basins, overlapping within the States of Alabama, Kentucky, New York, North Carolina, Ohio, Pennsylvania,

Tennessee, Virginia, and West Virginia (Service 2018, appendix A; see figure 1, below). It is considered extirpated from Georgia, Indiana, and Illinois.

Additionally, it is classified as an endangered species by the State of Ohio, and considered to have various levels of

concern, imperilment, or vulnerability (see table 1–1 in the SSA report) by the States of Alabama, Kentucky, North Carolina, Pennsylvania, Tennessee, Virginia, and West Virginia.

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Rangewide Distribution of Longsolid

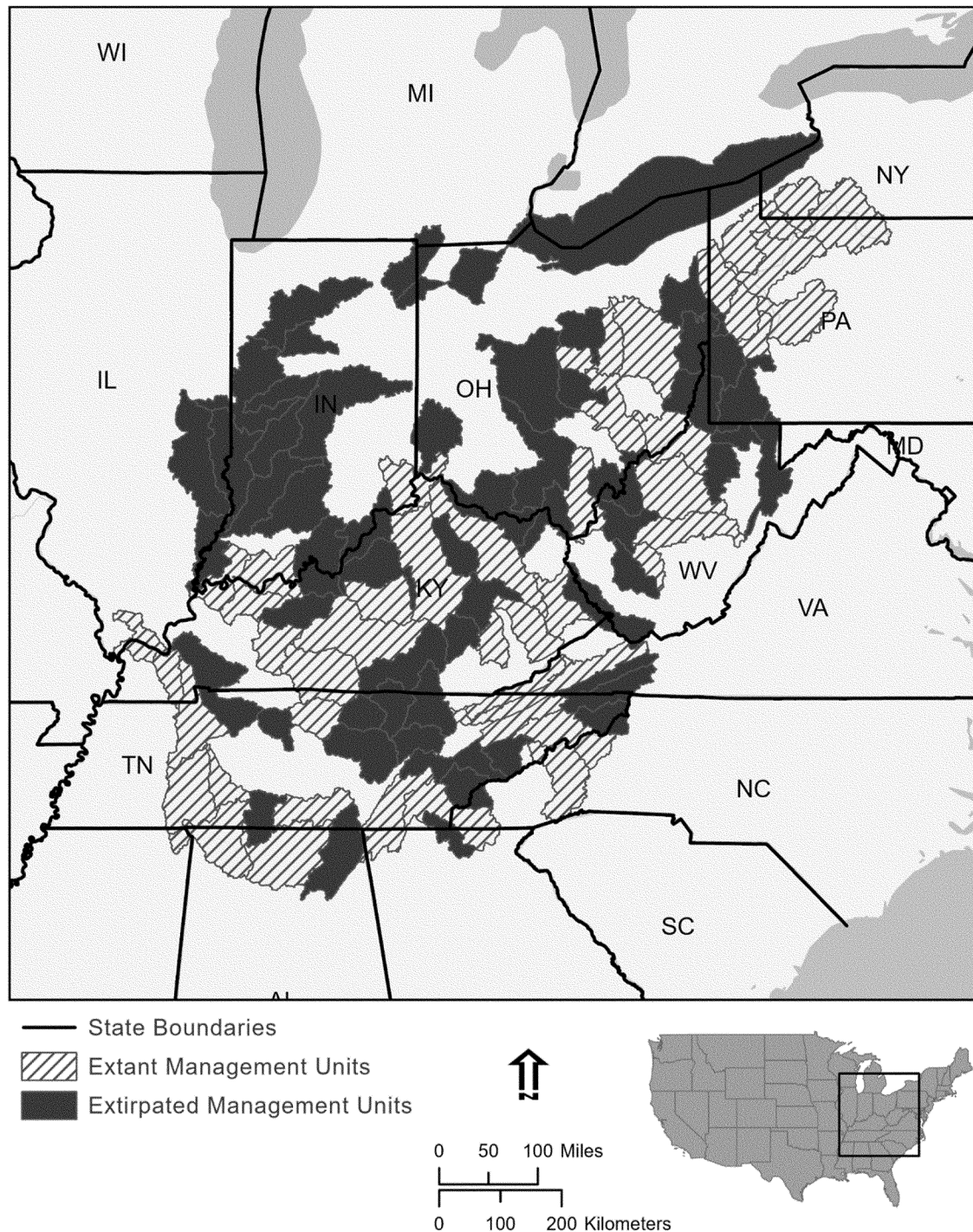


Figure 1. Longsolid range map, distributed across the Ohio, Cumberland, and Tennessee River basins. A total of 60 populations within 45 management units (i.e., 8-digit hydrologic unit code (HUC) watersheds (HUC-8)) are currently considered extant.

Similar to the longsolid, the round hickorynut also belongs to the Unionidae family of naiads and pearly mussels. Round hickorynut adult mussels are greenish-olive to dark or

chestnut brown, sometimes blackish in older individuals, and may have a yellowish band dorsally (Parmalee and Bogan 1998, p. 168). Inflation of the shell is variable depending on

population and latitudinal location (Ortmann 1920, p. 272; Williams et al. 2008, p. 474). The shell is thick, solid, and up to 3 in (75 mm) in length, but usually is less than 2.4 in (60 mm)

(Williams et al. 2008, p. 473; Watters et al. 2009, p. 209). A distinctive characteristic is that the shell is round in shape, nearly circular, and the umbo (the raised portion of the dorsal margin of a shell) is centrally located.

Within the United States, the round hickorynut is currently found in the Great Lakes, Ohio, Cumberland, Tennessee, and Lower Mississippi River basins, overlapping within the States of Alabama, Indiana, Kentucky, Michigan,

Mississippi, Ohio, Pennsylvania, Tennessee, and West Virginia (Service 2019, appendix A; see figure 2, below). It is considered extirpated from Georgia, Illinois, and New York. Additionally, it has State-level conservation status, ranging across various levels of concern, imperilment, or vulnerability (see table 1–1 in the SSA report), in the States of Alabama, Indiana, Kentucky, Michigan, Pennsylvania, Tennessee, and West Virginia. The round hickorynut also

occurs within the Canadian Province of Ontario, where it was listed as an endangered species in 2005, due to the loss of and significant declines in populations (Committee on the Status of Species at Risk in Ontario 2013, p. 4); a single remaining population (showing no recruitment (Morris 2018, pers. comm.)) occurs in Lake St. Clair and the East Sydenham River.

Rangewide Distribution of Round Hickorynut

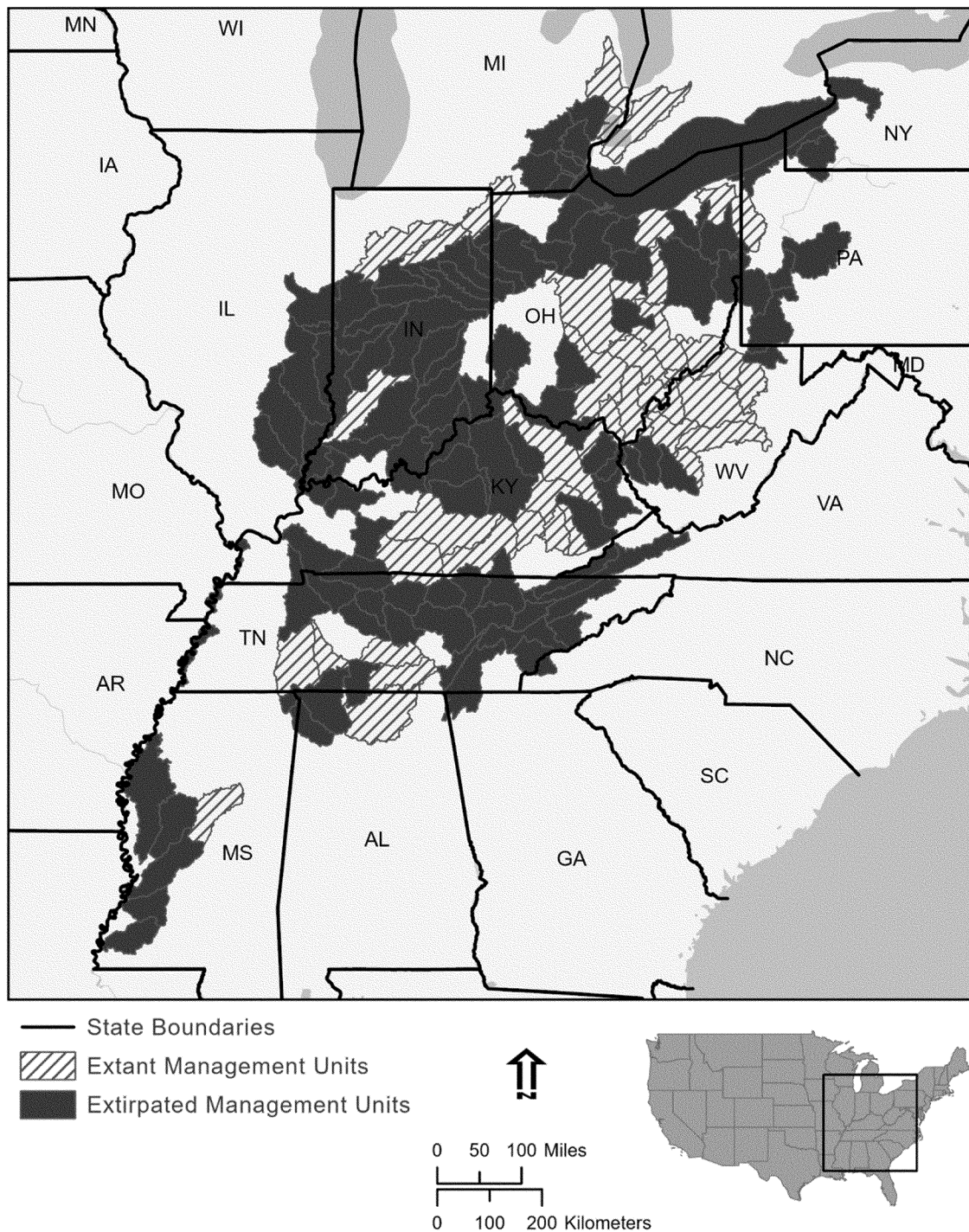


Figure 2. Round hickorynut range map, distributed across the Great Lakes, Ohio, Cumberland, Tennessee, and Lower Mississippi River basins, and the Ontario Province of Canada. A total of 69 populations within 36 management units (HUC-8) are currently considered extant.

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Thorough reviews of the taxonomy, life history, ecology and State listing status of the longsolid and round hickorynut are presented in detail in the SSA reports (Service 2018, pp. 14, 15, 22–30; Service 2019, pp. 14, 15, 22–29).

Regulatory and Analytical Framework*Regulatory Framework*

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations in title 50 of the Code of Federal Regulations (CFR) set forth the procedures for determining whether a species is an endangered species or a threatened species, issuing protective regulations for threatened species, and designating critical habitat for endangered and threatened species. In 2019, jointly with the National Marine Fisheries Service, the Service issued a final rule that revised the regulations in 50 CFR part 424 regarding how we add, remove, and reclassify endangered and threatened species and the criteria for designating listed species' critical habitat (84 FR 45020; August 27, 2019). On the same day, the Service also issued final regulations that, for species listed as threatened species after September 26, 2019, eliminated the Service's general protective regulations automatically applying to threatened species the prohibitions that section 9 of the Act applies to endangered species (84 FR 44753; August 27, 2019). We collectively refer to these actions as the 2019 regulations.

As with the proposed rule, the regulations that are in effect and therefore applicable to this final rule are 50 CFR part 424, as amended by (a) revisions that we issued jointly with the National Marine Fisheries Service in 2019 regarding both the listing, delisting, and reclassification of endangered and threatened species and the criteria for designating listed species' critical habitat (84 FR 45020; August 27, 2019); and (b) revisions that we issued in 2019 eliminating for species listed as threatened species are September 26, 2019, the Service's general protective regulations that had automatically applied to threatened species the prohibitions that section 9 of the Act applies to endangered species (84 FR 44753; August 27, 2019).

The Act defines an "endangered species" as a species that is in danger of extinction throughout all or a significant portion of its range, and a "threatened species" as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The Act requires that we determine whether any species is an endangered

species or a threatened species because of any of the following factors:

- (A) The present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) Overutilization for commercial, recreational, scientific, or educational purposes;
- (C) Disease or predation;
- (D) The inadequacy of existing regulatory mechanisms; or
- (E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term "foreseeable future" extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define the foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA reports document the results of our comprehensive biological review of the best scientific and commercial data regarding the status of both species, including an assessment of potential threats to the species. The SSA reports do not represent our decision on whether either species should be listed as an endangered or threatened species under the Act. However, they do provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies.

To assess the longsolid's and round hickorynut's viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency is the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy is the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation is the ability of the species to adapt to both near-term and long-term changes in its physical and

biological environment (for example, climate changes, pathogen). In general, species viability will increase with increases in resiliency, redundancy, and representation (Smith et al. 2018, p. 306). Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. Throughout all of these stages, we used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

The following is a summary of the key results and conclusions from the SSA reports for the longsolid and round hickorynut; the full SSA reports can be found on <https://www.regulations.gov> at Docket FWS-R4-ES-2020-0010, and on the Service's ECOS website at <https://ecos.fws.gov/ecp/species/9880> and <https://ecos.fws.gov/ecp/species/9879>.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the longsolid and round hickorynut, their resources, and the threats that influence both species' current and future condition, in order to assess each species' overall viability and the risks to that viability.

Species Needs

We assessed the best available information to identify the physical and biological needs to support individual fitness at all life stages for the longsolid and round hickorynut. Full descriptions of all needs are available in chapter 4 of the SSA reports (Service 2018, pp. 25–30; Service 2019, pp. 30–36), which can be found in docket number FWS-R4-ES-2020-0010 on <https://www.regulations.gov>. Based upon the best available scientific and commercial information, and acknowledging existing ecological uncertainties (see section 4.3 in the SSA reports), the resource and demographic needs for

both the longsolid and round hickorynut are characterized as:

- Clean, flowing water with appropriate water quality and temperature conditions, such as (but not limited to) dissolved oxygen above 2 to 3 parts per million (ppm), ammonia generally below 0.5 ppm total ammonia-nitrogen, temperatures generally below 86 degrees Fahrenheit (°F) (30 degrees Celsius (°C)), and (ideally) an absence of excessive total suspended solids and other pollutants.
- Natural flow regimes that vary with respect to timing, magnitude, duration, and frequency of river discharge events.
- Predominantly silt-free, stable sand, gravel, and cobble substrates.
- Suspended food and nutrients in the water column including (but not limited to) phytoplankton, zooplankton, protozoans, detritus, and dissolved organic matter.
- Availability of sufficient host fish numbers to provide for glochidia infestation and dispersal. Host fishes for the longsolid are currently unknown but likely include (but may not be limited to): minnows of the family Cyprinidae as well as potentially freshwater sculpins of the genus *Cottus*. Host fish species documented for the round hickorynut include the banded sculpin (*Cottus caroliniae*), eastern sand darter (*Ammocrypta pellucida*), emerald darter (*Etheostoma baileyi*), greenside darter (*Etheostoma blennioides*), Iowa darter (*Etheostoma exile*), fantail darter (*Etheostoma flabellare*), Cumberland darter (*Etheostoma gore*), spangled darter (*Etheostoma obama*), variegated darter (*Etheostoma variatum*), blackside darter (*Percina maculata*), and frecklebelly darter (*Percina stictogaster*).
- Connectivity among populations.

Although the species' capability to disperse is evident through historical occurrence of a wide range of rivers and streams, the fragmentation of populations by small and large impoundments has resulted in isolation and only patches of what once was occupied contiguous river and stream habitat. Genetic exchange occurs between and among mussel beds via sperm drift, host fish movement, and movement of mussels during high flow events. For genetic exchange to occur, connectivity must be maintained. Most freshwater mussels, including the longsolid and round hickorynut, are typically found in mussel beds that vary in size and are often separated by stream reaches in which mussels are absent or rare (Vaughn 2012, p. 983). These species are often a component of a healthy mussel assemblage within optimal mussel habitats; therefore, the beds in which they occur are necessary

for the species to be sufficiently resilient over time.

Current Conditions

Current (and future) conditions are described using categories that estimate the overall condition of the longsolid and round hickorynut mussel populations. These categories include:

- High—Sufficiently resilient populations with evidence of recruitment and multiple age classes represented. They are likely to maintain viability and connectivity among populations, and populations are not linearly distributed (*i.e.*, occur in tributary streams within a management unit). Populations are expected to persist in 20 to 30 years and beyond and withstand stochastic events. (*Thriving; capable of expanding range.*)
- Medium—Spatially restricted populations with limited connectivity and reduced levels of recruitment or age class structure. Resiliency is less than under high conditions, but the majority of populations (approximately 75 percent) are expected to persist beyond 20 to 30 years. (*Stable; not necessarily thriving or expanding its range.*)
- Low—Small and highly restricted populations, with no evidence of recent recruitment or age class structure, and limited detectability. These populations have low resiliency, are not likely to withstand stochastic events, and potentially may be extirpated in 20 to 30 years. Populations are linearly distributed within a management unit. (*Surviving and observable, but population likely declining.*)

Given the longsolid's and round hickorynut's ranges include lengthy rivers, such as the Ohio, Allegheny, Cumberland, and Tennessee Rivers, all of which include populations fragmented primarily by dams, we identified separate populations for each hydrologic unit code (HUC) (Seaber et al. 1987, entire; U.S. Geological Survey 2018, entire) at the fourth of 12 levels (*i.e.*, HUC-8 watershed). The HUC-8 watersheds are analogous to medium-sized river basins across the United States. Our analysis describes conditions relevant to longsolid and round hickorynut populations and the overarching HUC-8 watersheds, identified herein as a "management unit." A management unit could harbor one or more populations. See chapter 2 in the SSA reports for further explanation of the analysis methodology (Service 2018, pp. 15–19; Service 2019, pp. 17–22).

Longsolid

The longsolid's current range extends over nine States, including New York,

Pennsylvania, West Virginia, Ohio, Kentucky, Virginia, Tennessee, North Carolina, and Alabama; the species is now considered extirpated in Georgia, Illinois, and Indiana. This range encompasses three major river basins (the Ohio, Cumberland, and Tennessee basins); the species now no longer exists in the Great Lakes basin (loss of six historical populations and four management units). In addition, its representation in the Cumberland River basin is currently within a single population and management unit (loss of nine historical populations and eight management units). Overall, the longsolid is presumed extirpated from 62 percent (100 of 160 populations) of its historically occupied populations, including 6 populations (the entirety) in the Great Lakes basin, 62 populations in the Ohio River basin, 8 populations in the Cumberland River basin, and 24 populations in the Tennessee River basin (see appendix B in the SSA report (Service 2018, pp. 131–154)). Of the current populations, 3 (5 percent) are estimated to be highly resilient, 8 (13 percent) are estimated to be moderately resilient, and 49 (79 percent) are estimated to have low resiliency.

The longsolid was once a common, occasionally abundant component of the mussel assemblage in rivers and streams where it is now extirpated. Examples include the Beaver River, Pennsylvania (Ortmann 1920, p. 276); Ohio River, Pennsylvania (Tolin 1987, p. 11); Mahoning River, Pennsylvania (Ortmann 1920 p. 276); Wabash River, Indiana/Illinois (Cummings et al. 1992, p. 46); Nolin River, Kentucky (Taylor 1983a, p. 111); and the South Fork Holston River, Virginia/Tennessee (Parmalee and Pohemus 2004, p. 234). Significant declines of the longsolid have been observed and documented in the Ohio and Cumberland Rivers (Neel and Allen 1964, p. 434, Haag and Cicerello 2016, p. 139) and in the Muskingum River system, which harbors the last remaining populations (Muskingum, Tuscarawas, and Walhonding) in Ohio (Watters and Dunn 1993–94, p. 252; Watters et al. 2009, p. 131).

Round Hickorynut

The current range of the round hickorynut extends over nine States, including Alabama, Indiana, Kentucky, Michigan, Mississippi, Ohio, Pennsylvania, Tennessee, and West Virginia; the species is now considered extirpated in Georgia, Illinois, and New York. This range encompasses five major river basins (Great Lakes, Ohio River, Cumberland River, Tennessee River, and Lower Mississippi River).

Round hickorynut representation in the Cumberland River basin is restricted to two linear populations within two management units, while it exists in the Lower Mississippi River basin in a single population. Therefore, while the species currently maintains representation from historical conditions, it is at immediate risk of losing 40 percent (2 of 5 basins) of its representation due to these small, isolated populations under a high degree of threats from habitat loss and water quality degradation.

Overall, the round hickorynut has lost approximately 232 of 301 known populations (77 percent), and 102 of 138 management units (74 percent). This includes 25 populations in the Great Lakes basin, 146 populations in the Ohio River basin, 23 populations in the Cumberland River basin, 29 populations in the Tennessee River basin, and 9 populations in the Lower Mississippi River basin (see appendix B in the SSA report (Service 2019, pp. 191–212)). Of the current populations, 4 (6 percent) are estimated to be highly resilient, 16 (23 percent) are estimated to be moderately resilient, and 49 (71 percent) are estimated to have low resiliency.

The round hickorynut was once a much more common, occasionally abundant component of the mussel assemblage in rivers and streams across much of the eastern United States. Population extirpations have been extensive and widespread within every major river basin where the round hickorynut is found. Surveys throughout eastern North America have not targeted the round hickorynut specifically, and as a result, there could have been additional population losses or declines that have gone undocumented. Conversely, it is possible that there are populations that have gone undetected. However, the majority of the species' range has been relatively well-surveyed for freshwater mussel communities, and the likelihood is low that substantial or stronghold populations remain undetected. Patterns of population extirpation and declines are pronounced, particularly in the Ohio River basin, which appears to be the basin most important for redundancy and representation for the species due to its documented historical distribution and remaining concentration of populations within the basin.

Populations of the round hickorynut have been lost from entire watersheds and management units in which the species once occupied multiple tributaries, such as the Allegheny, Coal, Little Scioto, Miami, and Vermilion River management units in the Ohio River basin. The State of Ohio, for

example, has lost 49 populations of round hickorynut, along with 17 management units (Watters et al. 2009, p. 210). The species is also critically imperiled in Canada, and as a result, the future of the species in Canada may be reliant on hatchery-supported activities or augmentation activities coordinated with the United States.

Precipitous declines and extirpations of round hickorynut populations have been documented in the Great Lakes, Ohio, Cumberland, Tennessee, and Lower Mississippi basins. Chronological museum collections and published literature accounts of the species demonstrate that individuals were more abundant in populations and there were more populations across the range (see appendix D in the SSA report (Service 2019, pp. 214–238)). While this documentation could be a result of more intensive survey effort in the core of the species' distribution, regardless, the extirpation of formerly abundant and extensive populations, has been most pronounced in the Ohio and Cumberland basins.

Examples of rivers where the round hickorynut is extirpated within these basins include: Crooked Creek, Pennsylvania (Ortmann 1913, p. 298); West Branch Mahoning River, Ohio (Swart 1940, p. 42); Coal River, West Virginia (Carnegie Museum and University of Michigan Museum of Zoology records); Olentangy River, Ohio (Stein 1963, p. 109); Blaine Creek, Kentucky (Bay and Winford 1984, p. 19); Embarras River, Illinois (Parmalee 1967, p. 80); Big Vermilion River, Illinois (Parmalee 1967, p. 80); Cumberland River, Kentucky (Neel and Allen 1964, p. 442); Stones River, Tennessee (Ohio State University Museum records); and Red River, Tennessee/Kentucky (Ohio State University Museum records).

Threats Analysis

The following discussions include evaluations of three threats and associated sources that are affecting the longsolid and round hickorynut and their habitats: (1) Habitat degradation or loss, (2) invasive and nonnative species, and (3) negative effects associated with small population size, including potential cumulative or synergistic effects (Service 2018 and 2019, chapter 6). We note that potential impacts associated with overutilization were evaluated, but we found no evidence of current effects on the species' viability (noting historical effects from harvest on the longsolid that no longer occur). In addition, potential impacts from disease, parasites, and predation, as well as potential impacts to host

species, were evaluated but were found to have minimal effects on viability of either species based on current knowledge (Service 2018, pp. 70, 73–74; Service 2019, pp. 91–95). Finally, we also considered effects associated with enigmatic population declines, which have been documented in freshwater river mussel populations since the 1960s; despite speculation and repeated aquatic organism surveys and water quality monitoring, the causes of these events are unknown (Haag 2019, p. 43). In some cases, the instream habitat often remains basically intact and continues to support other aquatic organisms such as fish and crayfish. Full descriptions of each of the threats and their sources, including specific examples across the species' range where threats are impacting the species or its habitat, are available in chapter 6 and appendix A of the SSA reports (Service 2018, pp. 43–76, 134–157; Service 2019, pp. 58–96, 169–187).

We note that, by using the SSA framework to guide our analysis of the scientific information documented in both the longsolid and round hickorynut SSA reports, we have not only analyzed individual effects on the two species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. To assess the current and future condition of each of the species, we undertake an iterative analysis that encompasses and incorporates the threats individually and then accumulates and evaluates the effects of all the relevant factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Habitat Degradation or Loss

Development/Urbanization

Development and urbanization activities that may contribute to longsolid and round hickorynut habitat degradation and loss, including reduced water quality, occur throughout the species' range. The term “development” refers to urbanization of the landscape, including (but not limited to) land conversion for residential, commercial, and industrial uses and the accompanying infrastructure. The effects of urbanization may include alterations to water quality, water

quantity, and habitat (both in-stream and streamside) (Ren et al. 2003, p. 649; Wilson 2015, p. 424). Urban development can lead to increased variability in streamflow, typically increasing the extent and volume of water entering a stream after a storm and decreasing the time it takes for the water to travel over the land before entering the stream (Giddings et al. 2009, p. 1). Deleterious effects on streams (*i.e.*, water collection on impervious surfaces that rapidly flows into storm drains and local streams), including those that may be occupied by the longsolid and round hickorynut include:

(1) *Water Quantity*: Storm drains deliver large volumes of water to streams much faster than would naturally occur, often resulting in flooding and bank erosion that reshapes the channel and causes substrate instability, resulting in destabilization of bottom sediments. Increased, high-velocity discharges can cause species living in streams (including mussels) to become stressed, displaced, or killed by fast-moving water and the debris and sediment carried in it. Displaced individuals may be left stranded out of the water once floodwaters recede.

(2) *Water Quality*: Pollutants (*e.g.*, gasoline, oil drips, fertilizers) that accumulate on impervious surfaces may be washed directly into streams during storm events. Contaminants contained in point and non-point source discharges degrade water and substrate quality, and can result in reduced survival, growth, and reproduction of mussels.

(3) *Water Temperature*: During warm weather, rain that falls on impervious surfaces becomes superheated and can stress or kill freshwater species when it enters streams.

Other development-related impacts to the longsolid and round hickorynut, or their habitats, may occur as a result of:

- **Water infrastructure.** This includes water supply, reclamation, and wastewater treatment, which results in pollution point discharges to streams. Concentrations of contaminants (including nitrogen, phosphorus, chloride, insecticides, polycyclic aromatic hydrocarbons, and personal care products) increase with urban development (Giddings et al. 2009, p. 2; Bringolf et al. 2010, p. 1,311).

- **Utility crossings and right-of-way maintenance.** Direct impacts from utility crossings include direct exposure or crushing of individuals, sedimentation, and habitat disturbance. The greatest cumulative impact involves cleared rights-of-way that result in direct runoff and increased stream temperature at the

crossing location, and potentially promote maintenance utility and all-terrain vehicle access from the rights-of-way (which destroys banks and instream habitat, and thus can lead to increased erosion (see also Service 2017, pp. 48–49)).

- **Anthropogenic activities.** These types of activities may act to lower water tables, making the longsolid or round hickorynut susceptible to depressed flow levels. Water infrastructure (see above) and water withdrawals for irrigation, municipal, and industrial water supplies are an increasing concern due to expanding human populations. It is currently unknown whether anthropogenic effects of development and urbanization are likely to impact the longsolid or round hickorynut at the individual or population level. However, secondary impacts such as the increased likelihood of potential contaminant introduction, stream disturbance caused by impervious surfaces, barrier construction, and forest conversion are likely to act cumulatively on longsolid and round hickorynut populations.

Agricultural activities are pervasive across the range of the longsolid and round hickorynut. Examples include (but are not limited to):

- **Longsolid:** Agricultural erosion is listed among the factors affecting the Clinch and Powell Rivers (Ahlstedt et al. 2016, p. 8).

- **Longsolid:** Sedimentation and other non-point source pollution, primarily of agricultural origin, are identified as a primary threat to aquatic fauna of the Nolichucky River (Tennessee Valley Authority (TVA) 2006, p. 11).

- **Longsolid:** Agricultural impacts have been noted to take a toll on mussel fauna in the Goose Creek watershed of the South Fork Kentucky River (Evans 2010, p. 15).

- **Longsolid and round hickorynut:** The Elk River in Tennessee is a watershed with significant agricultural activity (Woodside et al. 2004, p. 10).

- **Round hickorynut:** Water withdrawals for irrigation for agricultural uses have increased recently in the Tippecanoe River (Fisher 2019, pers. comm.).

- **Round hickorynut:** Sedimentation and other point and non-point source pollution, primarily of agricultural origin, are identified as a primary threat to aquatic fauna of Big Darby Creek and Killbuck Creek, Ohio (Ohio Department of the Environmental Protection Agency 2004, p. 1; Ohio Department of the Environmental Protection Agency 2011, p. 31).

- **Round hickorynut:** Approximately 25 percent of the land use area in the

West Fork River management unit in West Virginia is in agriculture, increasing by as much as 9 percent as most recently reported in 2010 (U.S. Department of Agriculture 2010, p. 8).

- Round hickorynut: Large-scale mechanized agricultural practices threaten the last remaining population in the Lower Mississippi River basin, in the Big Black River, where the species has already undergone range reduction (Peacock and James 2002, p. 123).

- Round hickorynut: The Duck, Buffalo, and Elk Rivers in Tennessee are watersheds with significant agricultural activity in their headwaters and tributaries and are a suspected cause for mussel community declines throughout those rivers (Reed 2014, p. 4).

Transportation

Transportation-related impacts include both road development and river navigation. By its nature, road development increases impervious surfaces as well as land clearing and habitat fragmentation. Roads are generally associated with negative effects on the biotic integrity of aquatic ecosystems, including changes in surface water temperatures and patterns of runoff, changes in sedimentation levels, and increased heavy metals (especially lead), salts, organics, and nutrients to stream systems (Trombulak and Frissell 2000, p. 18). The adding of salts through road de-icing results in high salinity runoff, which is toxic to freshwater mussels. In addition, a major impact of road development is improperly constructed culverts at stream crossings, which can act as barriers if flow through the culvert varies significantly from the rest of the stream, or if the culvert ends up becoming perched (*i.e.*, sitting above the downstream streambed), and fishes that serve as mussel hosts cannot pass through them.

With regard to river navigation, dredging and channelization activities (as a means of maintaining waterways) have altered riverine habitats nationwide (Ebert 1993, p. 157). Channelization affects many physical characteristics of streams through accelerated erosion, increased bed load, reduced depth, decreased habitat diversity, geomorphic instability, and riparian canopy loss (Hartfield 1993, p. 139). All of these impacts contribute to loss of habitat for the longsolid and round hickorynut and alter habitats for host fish. Changes in both the water velocity and deposition of sediments not only alters physical habitat, but the associated increases in turbulence, suspended sediment, and turbidity affect mussel feeding and respiration

(Aldridge et al. 1987, p. 25). The scope of channel maintenance activities over extensive areas alters physical habitat and degrades water quality. In addition to dredging and channel maintenance, impacts associated with barge traffic, which includes construction of fleeting areas, mooring cells, docking facilities, and propeller wash, also destroy and disrupt mussel habitat (see Miller et al. (1989, pp. 48–49) as an example for disturbance from barges).

Transportation-related impacts across the range of the longsolid and round hickorynut include (but are not limited to) the following examples:

- Channelization and dredging—Longsolid populations in the Eel, Vermilion, and Embarras Rivers and Killbuck Creek are extirpated. Round hickorynut populations in the Vermilion and Embarras Rivers are extirpated, while populations in the Eel and Killbuck Creek management units are in low condition; these streams have been extensively dredged and channelized (Butler 2007, p. 63; Appendix B). Additionally, dredging for barge traffic and navigation is identified as the primary cause for suitable habitat loss in the Kanawha River (below river mile 79) in West Virginia (Taylor 1983b, p. 3).

- Barge traffic, which includes construction of fleeting areas, mooring cells, docking facilities, and propeller wash, destroys and disrupts mussel habitat, currently affecting at least 15 (25 percent) of the longsolid populations in the Ohio, Cumberland, and Tennessee River basins (Hubbs et al. 2006, p. 169; Hubbs 2012, p. 3; Smith and Meyer 2010, p. 555; Sickel and Burnett 2005, p. 7; Taylor 1983b, p. 5). All six of the Ohio River mainstem longsolid populations that are considered in low condition are affected by channel maintenance and navigation operations; at least five (8 percent) of the round hickorynut populations in the Ohio basin are affected.

- Channel maintenance and navigation are affecting the low condition populations in the lower Allegheny, Kanawha, and Tennessee Rivers due to their clustered distribution and proximity to locks and dams. For the longsolid, these include two Allegheny River populations below Redbank, Pennsylvania (Smith and Meyer 2010, p. 556); one population in the Kanawha River, West Virginia; and three low condition populations in the Tennessee River main stem above Kentucky Dam.

- Although most prevalent on the mainstem Ohio and Tennessee Rivers, commerce and commercial navigation currently affect round hickorynut

populations in the Black and Muskingum Rivers.

Contaminants

Contaminants contained in point and non-point discharges can degrade water and substrate quality and adversely impact mussel populations. Although chemical spills and other point sources of contaminants may directly result in mussel mortality, widespread decreases in density and diversity may result in part from the subtle, pervasive effects of chronic, low-level contamination (Naimo 1995, p. 354). The effects of heavy metals, ammonia, and other contaminants on freshwater mussels were reviewed by Mellinger (1972), Fuller (1974), Havlik and Marking (1987), Naimo (1995), Keller and Lydy (1997), and Newton et al. (2003).

The effects of contaminants such as metals, chlorine, and ammonia are profound on juvenile mussels (Augspurger et al. 2003, p. 2,571; Bartsch et al. 2003, p. 2,566). Juvenile mussels may readily ingest contaminants adsorbed to sediment particles while pedal feeding (Newton and Cope 2007, p. 276). These contaminants also affect mussel glochidia, which are sensitive to some toxicants (Goudreau et al. 1993, p. 221; Jacobson et al. 1997, p. 2,386; Valenti et al. 2005, p. 1,243).

Mussels are noticeably intolerant of heavy metals (Havlik and Marking 1987, p. 4). Even at low levels, certain heavy metals may inhibit glochidial attachment to fish hosts. Cadmium appears to be the heavy metal most toxic to mussels (Havlik and Marking 1987, pp. 4–9), although chromium, copper, mercury, and zinc also negatively affect biological processes (Naimo 1995, p. 355; Jacobson et al. 1997, p. 2,389; Valenti et al. 2005, p. 1,243). Chronic mercury contamination from a chemical plant on the North Fork Holston River, Virginia, destroyed a diverse mussel fauna downstream of Saltville, Virginia, and potentially contributed to the extirpation of the longsolid from that river (Brown et al. 2005, p. 1,459). An example of long-term declines and extirpation of mussels attributed to copper and zinc contamination originating from wastewater discharges at electric power plants includes the Clinch River in Virginia (a portion of which the longsolid currently occupies) (Zipper et al. 2014, p. 9). This highlights that, despite localized improvements, these metals can stay bound in sediments, affecting recruitment and densities of the mussel fauna for decades (Price et al. 2014, p. 12; Zipper et al. 2014, p. 9).

Examples of contaminant-related impacts across the range of longsolid and/or round hickorynut include (but are not limited to):

- Contaminants have affected mussel glochidia on the Clinch River, which is a stronghold population for the longsolid (Goudreau et al. 1993, p. 221; Jacobson et al. 1997, p. 2,386; Valenti et al. 2005, p. 1,243); round hickorynut is now considered extirpated in the Tennessee section of the river.
- The toxic effects of high salinity wastewater from oil and natural gas drilling on juvenile and adult freshwater mussels were observed in the Allegheny River, Pennsylvania, and in the Ohio River basin (Patnode et al. 2015, p. 55).
- Numerous streams throughout both species' ranges have experienced mussel and fish kills from toxic chemical spills, such as Fish Creek in Indiana for the round hickorynut (Sparks et al. 1999, p. 12), and the upper Tennessee River system in Virginia for the longsolid (Ahlstedt et al. 2016, p. 8; Neves 1987, p. 9; Jones et al. 2001, p. 20; Schmerfeld 2006, p. 12). Also in the Tennessee River basin, high counts of coliform bacteria originating from wastewater treatment plants have been documented, contributing to degradation of water quality being a primary threat to aquatic fauna (Neves and Angermeier 1990, p. 50).
- Heavy metals and their toxicity to mussels have been documented in the Great Lakes and in the Clinton, Muskingum, Ohio, Fox, Powell, Clinch, and Tennessee Rivers where one or both of these species occur (Havlik and Marking 1987, pp. 4–9; van Hees et al. 2010, p. 606). Coal plants are also located on the Kanawha, Green, and Cumberland Rivers, and the effects of these facilities on water quality and the freshwater mussel fauna, including the longsolid and round hickorynut, are likely similar.

The degradation of water quality as a result of land-based oil and gas drilling activities has a significant adverse effect on freshwater mussels, and specifically on the longsolid in the Ohio River basin and populations in the Allegheny River, as well as the Kanawha, Little Kanawha, and Elk Rivers (Entrekin et al. 2015, p. 2; Ecological Specialists, Inc. 2009, p. 27; Pond et al. 2008, p. 723; Patnode et al. 2015, p. 55).

Agricultural Activities

The advent of intensive row crop agricultural practices has been cited as a potential factor in freshwater mussel decline and species extirpation in the eastern United States (Peacock et al. 2005, p. 550). Nutrient enrichment and water withdrawals, which are threats

commonly associated with agricultural activities, are most likely to affect individual longsolid and round hickorynut mussels, although in some instances may be localized and limited in scope. However, chemical control using pesticides, including herbicides, fungicides, insecticides, and their surfactants and adjuvants, are highly toxic to juvenile and adult freshwater mussels (Bringolf et al. 2007, p. 2,092). Waste from confined animal feeding and commercial livestock operations is another potential source of contaminants that comes from agricultural runoff. The concentrations of these contaminants that emanate from fields or pastures may be at levels that can affect an entire population, especially given the highly fragmented distributions of the longsolid and round hickorynut (also see *Contaminants*, above).

Agencies such as the U.S. Department of Agriculture's Natural Resources Conservation Service and Soil and Water Conservation Districts provide technical and financial assistance to farmers and private landowners. Additionally, county resource development councils and university agricultural extension services disseminate information on the importance of minimizing land use impacts, specifically agriculture, on aquatic resources. These programs help identify opportunities for conservation through projects such as exclusion fencing and alternate water supply sources, which help decrease nutrient inputs and water withdrawals, and help keep livestock off of stream banks and shorelines, thus reducing erosion. However, the overall effectiveness of these programs over a large scale is unknown given the longsolid's and round hickorynut's wide distribution and varying agricultural intensities.

Given the large extent of private land and agricultural activities within the ranges of the longsolid and round hickorynut, the effects of agricultural activities that degrade water quality and result in habitat deterioration (also see *Development/Urbanization*, above) are not frequently detected until after the event(s) occur. In summary, agricultural activities are pervasive across the ranges of the longsolid and round hickorynut. The effects of agricultural activities on the longsolid and round hickorynut are a factor in their historical decline and localized extirpations.

Agricultural activities are pervasive across the range of the longsolid and round hickorynut. Specifically, agricultural impacts have affected and continue to affect high, medium, and

low condition longsolid populations within these basins, including:

- Longsolid only: French Creek and Allegheny River (Pennsylvania), Hughes River (West Virginia), Tuscarawas River (Ohio), Rolling Fork River (Kentucky), Little River and Valley River (North Carolina), Nolichucky River (Tennessee), Clinch and Powell Rivers (Tennessee and Virginia), and Estill Fork (Alabama).
- Round hickorynut only: South Fork Hughes River (West Virginia), and Pine, Belle, and Black Rivers (Michigan).
- Both species: Shenango River (Pennsylvania); Middle Island Creek, Elk, Little Kanawha, and North Fork Hughes Rivers (West Virginia); Licking and Kentucky Rivers (Kentucky); Elk and Buffalo Rivers (Tennessee); and Paint Rock River (Alabama).

Dams and Barriers

The effects of impoundments and barriers on aquatic habitats and freshwater mussels are relatively well-documented (Watters 2000, p. 261). Dams alter and disrupt connectivity, and alter water quality, which affect longsolid and round hickorynut species. Extinction/extirpation of North American freshwater mussels can be traced to impoundment and inundation of riffle habitats in all major river basins of the central and eastern United States (Haag 2009, p. 107). Humans have constructed dams for a variety of reasons: flood prevention, water storage, electricity generation, irrigation, recreation, and navigation (Eissa and Zaki 2011, p. 253). Dams, either natural (by beavers or by aggregations of woody debris) or manmade, have many impacts on stream ecosystems. Reductions in the diversity and abundance of mussels are primarily attributed to habitat shifts caused by impoundments (Neves et al. 1997, p. 63). The survival of mussels and their overall reproductive success are influenced:

- *Upstream of dams*, by the change from flowing to impounded waters, increased depths, increased buildup of sediments, decreased dissolved oxygen, and the drastic alteration in resident fish populations.

- *Downstream of dams*, by fluctuations in flow regimes, minimal releases and scouring flows, seasonal depletion of dissolved oxygen, reduced or increased water temperatures, and changes in fish assemblages.

Additionally, improperly constructed culverts at stream crossings may act as barriers and have some similar negative effects as dams on stream systems. Fluctuating flows through the culvert can vary significantly from the rest of the stream, preventing fish passage and

scouring downstream habitats. For example, if a culvert sits above the streambed, aquatic organisms cannot pass through it. These barriers fragment habitats along a stream course and contribute to genetic isolation of the aquatic species inhabiting the streams.

Whether constructed for purposes such as flood control, navigation, hydropower, water supply or multipurpose uses, the construction and continued operation of dams (per existing licensing schedules) is a pervasive negative influence on the longsolid, round hickorynut, and their habitats throughout their ranges. Although there are recent efforts to remove older, failing dams within the ranges of the longsolid and round hickorynut, such as Lock and Dam 6 on the Green River, and Six Mile Dam on the Walhonding River, dams and their effects on longsolid and round hickorynut population distributions have had perhaps the greatest documented negative influence on these species (Hardison and Layzer 2001, p. 79; Layzer et al. 1993, p. 68; Parmalee and Polhemus 2004, p. 239; Smith and Meyer 2010, p. 543; Hubbs 2012, p. 8; Watters and Flaute 2010, p. 2).

Over 20 of the rivers and streams currently occupied by the longsolid are directly affected by dams, thus directly influencing the species' distribution rangewide. For the round hickorynut, all occupied rivers and streams are directly or indirectly affected by dams. See section 6.1.5 of the SSA reports for specific areas where dams and other impoundments occur within the range of the species (Service 2018, pp. 59–63; Service 2019, pp. 73–77).

Changing Climate Conditions

Changing climate conditions that can influence freshwater mussels include increasing or decreasing water temperatures and precipitation patterns that result in increased flooding, prolonged droughts, or reduced stream flows, as well as changes in salinity levels (Nobles and Zhang 2011, pp. 147–148). An increase in the number of days with heavy precipitation over the next 25 to 35 years is expected across the longsolid's range (U.S. Global Climate Change Research Program 2017, p. 207). Although changing climate conditions have potentially affected the longsolid, the timing, frequency, and extent of these effects is currently unknown. Possible impacts to the species could include alteration of the fundamental ecological processes, such as thermal suitability; changes in seasonal patterns of precipitation and runoff, which could alter the hydrology of streams; and

changes in the presence or combinations of invasive, native or nonnative species.

We examined information on anticipated climate effects to wide-ranging mussels, which included a study that used representative concentration pathways (RCPs) 2.6 and 8.5 and was conducted on the federally endangered spectaclecase (*Cumberlandia monodonta*). Our analysis of the best available climate change information revealed that within the range of both the longsolid and round hickorynut, shifts in the species-specific physiological thresholds in response to altered precipitation patterns and resulting thermal regimes are possible. Additionally, the expansion of invasive, nonnative species because of climatic changes has the potential for long-term detriments to the mussels and their habitats. Other potential impacts are associated with changes in food web dynamics and the genetic bottleneck that can occur with low effective population sizes (Nobles and Zhang 2011, p. 148). The influences of these changes on the longsolid and round hickorynut are possible in the future (see Scenario 3 discussions under *Future Conditions*, below). Multi-scale climate models that can be interpreted at both the rangewide and population levels, and are tailored to benthic invertebrates, which incorporate genetic and life-history information, are needed before the longsolid and round hickorynut declines can be correlated with climate change. At this time, the best available information indicates that climate change is considered a secondary factor influencing the viability of the longsolid and round hickorynut and is not currently thought to be a primary factor in the longsolid's or round hickorynut's occurrence and distribution across their ranges.

Resource Extraction

The most intensive resource extraction activities affecting the longsolid, round hickorynut, and their habitats are coal mining and oil and gas exploration, which are summarized here. Additional less intensive resource extraction activities affecting the species include gravel mining/dredging, which is detailed in the SSA reports (Service 2018, pp. 64–65; Service 2019, pp. 79–83).

Activities associated with coal mining and oil and gas drilling can contribute chemical pollutants to streams. Acid mine and saline drainage (AMD) is created from the oxidation of iron-sulfide minerals such as pyrite, forming sulfuric acid (Sams and Beer 2000, p. 3). This AMD may be associated with high concentrations of aluminum,

manganese, zinc, and other constituents (Tennessee Department of Environment and Conservation (TDEC) 2014, p. 72). These metals, and the high acidity typically associated with AMD, can be acutely and chronically toxic to aquatic life (Jones 1964, p. 96).

Natural gas extraction has negatively affected water quality through accidental spills and discharges, as well as increased sedimentation due to increases in impervious surface and tree removal for drill pads and pipelines (Vidic et al. 2013, p. 6). Disposal of insufficiently treated brine wastewater is known to adversely affect freshwater mussels (Patnode et al. 2015, p. 62). Contaminant spills are also a concern.

Unconsolidated sediment appears to be the largest impact to mussel physical habitat in streams as a result of gas extraction activities (Entrekin et al. 2015, p. 23). Excessive suspended sediments can impair feeding processes, leading to acute short-term or chronic long-term stress. Both excessive sedimentation and excessive suspended sediments can lead to reduced mussel fitness (Ellis 1936, p. 29; Anderson and Kreeger 2010, p. 2). This sediment is generated by construction of the well pads, access roads, and pipelines (for both gas and water).

Examples of the variety of resource extraction activities (coal, oil, gas, and gravel mining) that occur across the range of the longsolid and round hickorynut include (but are not limited to):

- Longsolid: The Cumberland Plateau and Central Appalachian regions of Tennessee and Kentucky (upper Cumberland River system and upper Tennessee River system) continue to experience mining activity that impairs water quality in streams (TDEC 2014, p. 62).
- Longsolid: High levels of copper, manganese, and zinc, metals toxic to freshwater mussels, were found in sediment samples from both the Clinch and Powell Rivers, and mining impacts close to Big Stone Gap, Virginia, have almost eliminated the mussel fauna in the upper Powell River. The longsolid is considered extirpated from the South Fork Powell River and Cane Creek, both tributaries to the upper portion of the Powell River (Ahlstedt and Tuberville 1997, p. 75; appendix D in the SSA report).
- Round hickorynut: Although populations persist in the Rockcastle River and Buck Creek in the Cumberland basin, coal and gravel mining continue to occur in these watersheds.
- Round hickorynut: The extensive mining of gravel in riparian zones

reduces vegetative buffers and causes channel instability and has been implicated in mussel declines in the Walhonding River, Ohio, which harbors a low condition population (Hoggarth 1995–96, p. 150).

- Round hickorynut: The West Fork River in West Virginia has oil and gas activity within the watershed, as well as legacy mining issues, which have resulted in biological impairment throughout the drainage (West Virginia Department of Environmental Protection 2014, pp. 23–29).

- Both species: Impacts from natural gas pipelines have a high potential to occur in West Virginia and Pennsylvania. Tank trucks hauling such fluids can overturn into mussel streams, which has occurred in Meathouse Fork of Middle Island Creek (Clayton 2018, pers. comm.).

- Both species: Natural gas extraction in the Marcellus Shale region (the largest natural gas field in the United States that runs through northern Appalachia) has negatively affected water quality through accidental spills and discharges in populations in the Shenango, Elk, Little Kanawha, and Kanawha management units.

- Both species: Coal mining has been implicated in sediment and water chemistry impacts in the Kanawha River in West Virginia, potentially limiting the Kanawha River populations of both species (Morris and Taylor 1978, p. 153).

- Both species: Resource extraction and AMD have been cited as contributors to the loss of mussel species in the Cumberland basin (Haag and Cicerello 2016, p. 15), including the loss of longsolid from Rockcastle and Caney Fork Rivers, and the loss of round hickorynut in the Caney Fork, Little South Fork, Big South Fork, and Cumberland Rivers (Anderson et al. 1991, p. 6; Layzer and Anderson 1992, p. 97; Warren and Haag 2005, p. 1,383).

- Both species: In the upper Kentucky River watershed, where both species exhibit a lack of recruitment (and also in the Red River for round hickorynut), historical un-reclaimed mines and active coal mines are prevalent (Kentucky Department for Environmental Protection 2015, p. 66).

Forest Conversion

Clearing large areas of forested wetlands and riparian systems eliminates shade once provided by tree canopies, exposing streams to more sunlight and increasing the in-stream water temperature (Wenger 1999, p. 35). The increase in stream temperature and light after deforestation alters macroinvertebrate (and other aquatic

species) richness, abundance, and composition in streams to various degrees depending on a species' tolerance to temperature changes and increased light in the aquatic system (Kishi et al. 2004, p. 283; Couceiro et al. 2007, p. 272; Caldwell et al. 2014, p. 2,196).

Sediment runoff from clearing forested areas is a known stressor to aquatic systems (e.g., Webster et al. 1992, p. 232; Jones III et al. 1999, p. 1,455; Broadmeadow and Nisbet 2004, p. 286; Aust et al. 2011, p. 123). The physical characteristics of stream channels are affected when large quantities of sediment are added or removed (Watters 2000, p. 263). Mussels and fishes are potentially affected by changes in suspended and bed material load, changes in bed sediment composition associated with increased sediment production and runoff, changes in channel formation, stream crossings, and inadequately buffered clear-cut areas, all of which can be sources of sediment entering streams (Taylor et al. 1999, p. 13).

Forest conversion to other land uses such as agriculture and urban development has occurred across the range of the longsolid and round hickorynut. Siltation and erosion from forest conversion to other land use activities without BMPs is a well-documented stressor to aquatic systems throughout the eastern United States, and can have an impact depending on the physical, chemical, and biological characteristics of adjacent streams (Allan and Castillo 2007, p. 107). Forest conversion has been documented in all basins in which these species occur.

Also, some forestry practices have the potential to result in increased siltation in riparian systems through the cycle of forest thinning, final harvest, site preparation, and re-planting activities. However, implementation of BMPs and establishment of SMZs can minimize these impacts (Service 2018 and 2019, chapter 6); adherence to these BMPs and SMZs broadly protects water quality, particularly related to sedimentation (as reviewed by Cristan et al. 2016, entire; Warrington et al. 2017, entire; and Schilling et al. 2021, entire).

Invasive and Nonnative Species

When a nonnative species is introduced into an ecosystem, it may have many advantages over native species, such as easy adaptation to varying environments and a high tolerance of living conditions that allow it to thrive in its new habitat. There may not be natural predators to keep the nonnative species in check; therefore, it can potentially live longer and

reproduce more often, further reducing the biodiversity in the system. The native species may become an easy food source for invasive, nonnative species, or the invasive species may carry diseases that extirpate populations of native species. Invasive, nonnative species are pervasive across the longsolid's and round hickorynut's ranges. Examples of invasive, nonnative species that affect freshwater mussels like the longsolid and round hickorynut are the Asian clam (*Corbicula fluminea*), zebra mussel (*Dreissena polymorpha*), quagga mussel (*Dreissena bugensis*), black carp (*Mylopharyngodon piceus*), didymo (also known as rock snot; *Didymosphenia geminata*), and hydrilla (also known as water-thyme; *Hydrilla verticillata*).

- The Asian clam alters benthic substrates, may filter mussel sperm or glochidia, competes with native species for limited resources, and causes ammonia spikes in surrounding water when they die off en masse (Scheller 1997, p. 2).

- Dreissenid mollusks, such as the zebra mussel and quagga mussel, adversely affect native species through direct colonization, reduction of available habitat, changes in the biotic environment, or a reduction in food sources (MacIsaac 1996, p. 292). Zebra mussels are also known to alter the nutrient cycle in aquatic habitats, affecting other mollusks and fish species (Strayer 1999, p. 22).

- Given their size and diet preferences, black carp have the potential to restructure benthic communities. Mussel beds consisting of smaller individuals and juvenile recruits are probably most vulnerable to being consumed by black carp (Nico et al. 2005, p. 192). Furthermore, because black carp attain a large size (well over 3.28-ft (1-m) long), and their life span is reportedly over 15 years, they are expected to persist for many years. Therefore, they have the potential to cause harm to native mollusks by way of predation on multiple age classes (Nico et al. 2005, p. 77).

- The two nonnative plant species that are most problematic for the longsolid and round hickorynut (i.e., impacting the species throughout their ranges) are hydrilla and didymo. Hydrilla is an aquatic plant that alters stream habitat, decreases flows, and contributes to sediment buildup in streams (National Invasive Species Council Management Plan 2018, p. 2). High sedimentation can cause suffocation, reduce stream flow, and make it difficult for mussels' interactions with host fish necessary for development. Didymo can alter the

habitat and change the flow dynamics of a site (Jackson et al. 2016, p. 970). Invasive plants grow uncontrolled and can smother habitat, affect flow dynamics, alter water chemistry, and increase water temperatures, especially in drought conditions (Colle et al. 1987, p. 416).

- Specifically for the round hickorynut, the nonnative round goby can out-compete native benthic fishes (such as darters and sculpin) for food and other resources, and may also prey especially heavily on juvenile native mussels, such as round hickorynut (Bradshaw-Wilson et al. 2019, p. 268)

Effects Associated With Small Population Size

Without the level of population connectedness that the species experienced historically (*i.e.*, without barriers such as reservoirs), small, isolated populations that may now be comprised predominantly of adult individuals could be slowly dying out. Even given the very improbable absence of other anthropogenic threats, these disjunct populations could be lost simply due to the consequences of below-threshold effective population sizes. Because only 60 primarily disjunct streams among 160 historically occupied areas continue to harbor populations of the longsolid, and 69 primarily disjunct streams of 301 historically occupied areas continue to harbor populations of the round hickorynut, this is likely partial testimony to the principle of effective population size and its role in population loss.

The longsolid and round hickorynut exhibit several traits that influence population viability, including relatively small population size and low fecundity at many locations compared to other mussels (see appendix A in Service 2018 and 2019). Small population size puts the species at greater risk of extirpation from stochastic events (*e.g.*, drought) or anthropomorphic changes and management activities that affect habitat. In addition, small longsolid or round hickorynut populations may have reduced genetic diversity, be less genetically fit, and be more susceptible to disease during extreme environmental conditions compared to large populations (Frankham 1996, p. 1,505).

Genetic drift occurs in all species, but the lack of drift is more likely to negatively affect populations that have a smaller effective population size (number of breeding individuals) and populations that are geographically spread out and isolated from one

another. Relatively low fecundity, commonly observed in species of *Fusconaia*, is another inherent factor that could influence population viability (Geist 2010, p. 91). Survival of juveniles in the wild is already low, and females produce fewer offspring than other mussel species (Haag and Staton 2003, p. 2,125). Factors such as low effective population size, genetic isolation, relatively low levels of fecundity and recruitment, and limited juvenile survival could all affect the ability of these species to maintain current population levels and to rebound if a reduction in population occurs (*e.g.*, through predation, toxic releases or spills, or poor environmental conditions that inhibit successful reproduction). Additionally, based on our presumption of fish hosts of the longsolid and the known species of fish hosts for the round hickorynut, they are small-bodied fishes that have comparatively limited movement (Vaughn 2012, p. 6); therefore, natural expansion of longsolid and round hickorynut populations is limited.

Dendritic (branched) streams and rivers are highly susceptible to fragmentation and may result in multiple habitat fragments and isolated populations of variable size (Fagan 2002, p. 3,247). In contrast to landscapes where multiple routes of movement among patches are possible, pollution or other habitat degradation at specific points in dendritic landscapes can completely isolate portions of the system (Fagan 2002, p. 3,246).

Future Conditions

In the SSA reports, we forecast the longsolid's and round hickorynut's response to plausible future scenarios of environmental conditions and conservation efforts. The future scenarios project the threats into the future and consider the impacts those threats could have on the viability of the longsolid and round hickorynut. We apply the concepts of resiliency, redundancy, and representation to the future scenarios to describe possible future conditions of the longsolid and round hickorynut. The scenarios described in the SSA reports represent only three possible future conditions for each of the species. Uncertainty is inherent in any risk assessment, so we must consider plausible conditions to make our determinations. Viability is not a specific state, but rather a continuous measure of the likelihood that the species will sustain populations over time.

In the SSA reports, we considered three future scenarios. Scenario 1 assesses the species' response to factors

influencing current longsolid and round hickorynut populations and management units, assuming the current level of impacts remains constant into the future. Scenario 2 assesses the species' response when factors that negatively influence most of the extant populations and management units are reduced by additional conservation. Scenario 3 assesses the species' response to worsening conditions of the factors that most influence the species due to the implementation of known existing and projected development, resource extraction, hydroelectric projects, etc. An important assumption of the predictive analysis presented herein is that future population resiliency for each species is largely dependent on water quality, water flow, instream habitat conditions, and condition of riparian vegetation (see *Species Needs*, above).

The future conditions timeframe for our analysis is different for each species. A timeframe of 50 to 70 years into the future is evaluated for the longsolid, and 20 to 30 years into the future is evaluated for the round hickorynut. We selected these timeframes based on the availability of trends and threat information, planning documents, and climate modeling that could be reliably projected into the future, and also the consideration of at least two generations for each species (*i.e.*, 25 to 35 years for the long-lived longsolid, and on average 12–13 years (Shepard 2006, p. 7; Ehlo and Layzer 2014, p. 11) for the round hickorynut).

Longsolid

Our assessment predicts that if conditions remain the same or worsen into the future, all 60 populations would experience negative changes to the species' important habitat requisites (see *Species Needs*, above), including the loss of the single remaining population in the Cumberland River basin, and potentially resulting in no highly resilient populations (Scenario 3). Alternatively, the scenario that incorporates additive conservation measures beyond those currently implemented (Scenario 2) could result in the continued persistence of all 60 populations in the future. However, we note that approximately 30 of 60 (50 percent) of these are currently low condition populations, based on either surveys that pre-date 2000 or on the collection of only five or fewer older, non-reproducing individuals. Some of these populations may already be extirpated. The risks facing the longsolid populations varied among scenarios and are summarized below

(see table 8–1 and table ES–1 in the SSA report).

Under Scenario 1, lowered resiliency, representation, and redundancy are expected. Under this scenario, we predict that 1 population of the current 3 high condition populations would remain in high condition, 6 populations (10 percent) in medium condition, and 15 populations (25 percent) in low condition. Redundancy would be reduced with likely extirpation of 38 out of 60 (63 percent) currently extant populations; only the Ohio River basin (one of the three basins currently occupied by the species) would retain one highly resilient population (*i.e.*, the Green River population in the Upper Green management unit). Representation would be reduced, with two of the three currently occupied river basins continuing to harbor longsolid populations.

Under Scenario 2, we predict higher levels of resiliency in some areas of the longsolid's range than was estimated for Scenario 1; representation and redundancy would remain the same level as current conditions, with the species continuing to occur within all currently occupied management units and States across its range. Seven populations (12 percent) are predicted to be in high condition, compared to the current four populations in high condition. Scenario 2 also predicts 20 populations (33 percent) in medium condition and 33 populations (52 percent) in low condition; no populations would become extirpated. All three currently occupied major river basins would remain occupied, and the existing levels of redundancy and representation would improve. It is possible that this scenario is the least likely to occur in the future as compared to Scenario 1 or 3 only because it will take many years (potentially beyond the 50- to 70-year timeframe analyzed in the SSA report) for all of the beneficial effects of management actions that are necessary to be implemented and realized on the landscape.

Under Scenario 3, we predict a significant decrease in resiliency, representation, and redundancy across the species' range. Redundancy would be reduced from three major river basins to two basins with no high condition populations remaining, and the likely extirpation of 44 (73 percent) of the currently extant populations. The resiliency of the remaining 16 populations is expected to be reduced to 3 populations (5 percent) in medium condition and 13 (22 percent) in low condition. In addition to the loss of 44 populations, 32 (29 percent) of the management units are predicted to

become extirpated. Representation would be reduced to 13 management units, 2 major river basins, and 3 States (as compared to the current 9 States) occupied by the species.

Round Hickorynut

Our assessment predicts that if conditions remain the same (Scenario 1), 44 of 69 populations (62 percent) would experience negative changes to the important habitat requisites, including the potential loss of 23 populations. This includes the predicted extirpation of the two populations in the Cumberland River basin and the population in the Lower Mississippi River basin. Additionally, under Scenario 3, no highly resilient populations are able to persist, and 90 percent of remaining populations are in low condition. Alternatively, the scenario that includes additive conservation measures beyond those currently implemented (Scenario 2) could result in the continued persistence of all 69 populations in the future. However, approximately 49 of 69 (71 percent) of these populations are currently in low condition. Many of the known populations of the round hickorynut have been collected as 10 or fewer individuals, with limited extent information available, due to the lack of survey effort targeting the species (Service 2019, appendix A). The risks facing round hickorynut populations varied among scenarios and are summarized below (see also table 8–1 and table ES–1 in the SSA report).

Under Scenario 1, lowered resiliency, representation, and redundancy are expected. We predict that only one of the current four high condition populations would remain in high condition. Under this scenario, only the Great Lakes basin (one of the five basins currently occupied by the species) would retain a highly resilient population (*i.e.*, the Grand River). Of the 69 extant populations, 14 (20 percent) would be in medium condition and 31 (45 percent) would be in low condition. We estimate extirpation of 23 out of 69 (33 percent) populations. Redundancy would decline due to these population and management unit losses, resulting in a loss of the species from Pennsylvania and Mississippi. Representation would be reduced through extirpation of populations and management units in the Cumberland and Great Lakes basins, a 40 percent loss of redundancy compared to current conditions. Under this scenario, only three of the five currently occupied river basins (Great Lakes, Ohio, and Tennessee) continue to harbor round hickorynut populations.

Under Scenario 2, we predict higher levels of resiliency in some areas of the round hickorynut's range than is estimated for Scenario 1; representation and redundancy would remain the same level as current conditions with the species continuing to occur within all currently occupied management units and States across the species' 9-State range. Up to 15 populations (23 percent) are predicted to be high condition compared to the current 4 populations in high condition. Scenario 2 also predicts 39 populations (56 percent) in medium condition and 15 populations (22 percent) in low condition. All currently occupied major river basins would remain occupied, and the existing levels of redundancy and representation would improve. There are sufficient population sizes within each basin to facilitate augmentation and restoration efforts, whether it be within-basin translocations or captive propagation techniques. It is possible that this scenario is the least likely to occur in the future as compared to Scenario 1 or 3. This is because it will take many years (potentially beyond the 20- to 30-year time frame analyzed in the SSA report) for all of the beneficial effects of management actions that are necessary to be implemented on the landscape to be realized.

Under Scenario 3, we predict a significant decrease in resiliency, representation, and redundancy across the species' range. Redundancy would be reduced from five major river basins to three basins, with extirpations expected to occur in the Cumberland and Lower Mississippi River basins. No high condition populations would remain, and 49 (71 percent) of the 69 extant populations are likely to become extirpated. The resiliency of the remaining 20 populations is expected to be reduced to 2 populations (10 percent) in medium condition and 18 (90 percent) in low condition. In addition to the potential loss of 49 populations, 23 (68 percent) of the currently extant 36 management units are predicted to no longer harbor the species. Representation could be reduced to 14 management units across 3 major river basins. Extirpations are expected from the States of Pennsylvania, Michigan, and Mississippi, leaving 6 States (as compared to the current 9, and historically 12) occupied by the species.

Determination of Status for the Longsolid and Round Hickorynut

Introduction

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures

for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines an “endangered species” as a species in danger of extinction throughout all or a significant portion of its range, and a “threatened species” as a species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The Act requires that we determine whether a species meets the definition of endangered species or threatened species because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

In conducting our status assessment of the longsolid and round hickorynut, we evaluated all identified threats under the Act’s section 4(a)(1) factors and assessed how the cumulative impact of all threats acts on the viability of the species as a whole. That is, all the anticipated effects from both habitat-based and direct mortality-based threats are examined in total and then evaluated in the context of what those combined negative effects will mean to the current and future condition of the longsolid and round hickorynut. However, for the vast majority of potential threats, the effect on the longsolid and round hickorynut (*e.g.*, total losses of individual mussels or their habitat) cannot be quantified with available information. Instead, we use the best available information to gauge the magnitude of each individual threat on the longsolid and round hickorynut, and then assess how those effects combined (and as may be ameliorated by any existing regulatory mechanisms or conservation efforts) will impact the longsolid’s or round hickorynut’s current and future viability.

Longsolid—Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the species’ distribution and abundance has been reduced across its range as demonstrated by both the number of occupied management units and the number of populations where it historically occurred. Historically, the species occurred within 160 populations and 105 management units across 12 States; currently, the species

occurs in 60 populations and 45 management units across 9 States, which represents a 62 percent reduction of its historically occupied populations (although we note that the remaining populations are well-distributed as opposed to concentrated within its range). The conditions of the remaining 60 extant populations vary between being highly resilient, moderately resilient, or having low resiliency (see *Current Conditions*, above, and section 5.2 in the SSA report (Service 2018, pp. 34–37)).

Currently, 3 populations (5 percent) are highly resilient, 8 (13 percent) are moderately resilient, and 49 (71 percent) have low resiliency. Although downward trends are evident compared to historical information, 11 highly to moderately resilient populations are present within three of the four major river basins the species is historically known to occupy. Current and ongoing threats from habitat degradation or loss (Factor A), residual impacts from past harvest and overutilization (Factor B), and invasive, nonnative species (Factor E) contribute to the species’ negative effects associated with small population size (Factor E). The continued occupancy of these 11 populations (in addition to some survey information) implies that recent recruitment is occurring in some populations to help maintain a level of resiliency, redundancy, and representation. Thus, after assessing the best available information, we conclude that the longsolid is not currently in danger of extinction throughout all of its range. Therefore, we proceed with determining whether the longsolid is likely to become an endangered species within the foreseeable future throughout all of its range.

At this point in time, and as noted above, the threats currently acting on the species include habitat degradation or loss from a variety of sources and invasive, nonnative species, all of which contribute to the negative effects associated with the species’ small population size. Our analysis revealed that these threats are likely to continue into the foreseeable future, or approximately 50 to 70 years. This timeframe accounts for reasonable predictions of threats continuing into the future based on our examination of empirical data available over the last 30 years (*e.g.*, survey data, how threats are manifesting themselves on the landscape and the species, implementation of management plans and voluntary conservation actions), and also takes into consideration the biology of the species (multiple generations of a long-lived species) and

the licensing schedules of dams within the species’ range.

The best available information, including our consideration of comments we received on the September 29, 2020 (85 FR 61384), proposed rule, indicates that the threats currently acting upon the longsolid are expected to continue into the foreseeable future, some of which (*e.g.*, water quality and habitat degradation, and invasive, nonnative species) are reasonably expected to worsen over time, including concurrent with increasing human population trends that further reduce the species’ resiliency, redundancy, and representation across its range. Our analysis reveals the potential for either none or a single population (*i.e.*, the Green River in Kentucky) to persist as highly resilient (*i.e.*, continued reproduction with varied age classes present) in the foreseeable future, assuming threats remain or worsen on the landscape. Additionally, the majority of the remaining populations would exhibit low resiliency, while many (between 30 and 73 percent of the current low condition populations) would potentially become extinct or functionally extinct (*e.g.*, significant habitat degradation; no reproduction due to highly isolated, non-recruiting individuals). Our future analysis also reveals a high risk that the species would become extirpated in one of the four historically occupied river basins (*i.e.*, Cumberland River basin); it has already been lost from the Great Lakes basin. Thus, after assessing the best available information, we conclude that the longsolid is not currently in danger of extinction but is likely to become in danger of extinction within the foreseeable future throughout all of its range.

Longsolid—Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. The court in *Center for Biological Diversity v. Everson*, 435 F. Supp. 3d 69 (D.D.C. 2020) (*Everson*), vacated the aspect of the Final Policy on Interpretation of the Phrase “Significant Portion of Its Range” in the Endangered Species Act’s Definitions of “Endangered Species” and “Threatened Species” (Final Policy; 79 FR 37578; July 1, 2014) that provided that the Service does not undertake an analysis of significant portions of a species’ range if the species warrants listing as threatened throughout all of its range.

Therefore, we proceed to evaluating whether the species is endangered in a significant portion of its range—that is, whether there is any portion of the species' range for which both (1) the portion is significant; and (2) the species is in danger of extinction in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

Following the court's holding in *Everson*, we now consider whether there are any significant portions of the species' range where the species is in danger of extinction now (*i.e.*, endangered). In undertaking this analysis for the longsolid, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify portions of the range where the species may be in danger of extinction.

We evaluated the range of the longsolid to determine if the species is in danger of extinction now in any portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways. We examined the species entire range in an attempt to focus this analysis on portions of the species' range that may meet the definition of an endangered species. For the longsolid, we considered whether the threats or their effects on the species are greater in any biologically meaningful portion of the species' range than in other portions such that the species is in danger of extinction now in that portion.

The statutory difference between an endangered species and a threatened species is the timeframe in which the species becomes in danger of extinction; an endangered species is in danger of extinction now while a threatened species is not in danger of extinction now but is likely to become so in the foreseeable future. Thus, we considered the time horizon for the threats that are driving the longsolid to warrant listing as a threatened species throughout all of its range. We then considered whether these threats or their effects are occurring in any portion of the species' range such that the species is in danger of extinction now in that portion of its range. We examined the following threats: habitat degradation or loss; invasive, nonnative species; effects associated with small population size;

and the potential for cumulative effects. We also considered whether these threats may be exacerbated by small population size (or low condition). Overall, we found that threats are likely acting on individuals or populations, or even basins, similarly across the species' range. These threats are certain to occur, and in those basins with few populations that are predominantly in low condition, these populations are facing the same threats, and these threats can be of greater magnitude in some areas or of greater impact, given small population sizes.

One basin—the Cumberland River—has been reduced by 91 percent with one remaining low condition population. Although there are low condition populations in all three basins in which the species occurs, because this basin has seen its populations significantly reduced to a single population currently in low condition, this circumstance—in combination with the other threats acting on the species throughout its range—may indicate that the species may be in danger of extinction now in this portion of the range.

Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species' capacity to adapt and respond to environmental changes, thereby decreasing the probability of long-term persistence. Small populations may experience reduced reproductive vigor, for example, due to inbreeding depression. Isolated individuals may have difficulty reproducing. The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as those discussed above. Based on our review of information and the synergistic effects of threats exacerbated by a single low-condition population in the Cumberland River basin, we find that this basin is a portion of the longsolid's range with a potential difference in biological condition.

Because we have determined the Cumberland River basin is a portion of the range that may be in danger of extinction now, we next evaluate whether this portion may be significant. We first examined this area's contribution to the resiliency, redundancy, and representation of the species. We determined that this basin contains 1 of 60 populations (1.7 percent) identified in the SSA report. Therefore, this single population does not contribute significantly, either currently or in the foreseeable future, to

the species' total resiliency at a biologically meaningful scale compared to other representative areas. The overall representation described herein would likely be the same under two of the three scenarios. We conclude that the Cumberland River basin population does not contribute meaningfully to the species' viability overall. We evaluated the best available information for the Cumberland River basin in this context, assessing its significance in terms of these conservation concepts and determined that this single portion is not biologically significant to the species.

The single population in the Cumberland River basin does not act as a refugia for the species or as an important spawning ground. In addition, the water quality is similar throughout the species' range with impaired water quality occurring in all three basins. Since the longsolid occurs in similar aquatic habitats across its range, the Cumberland River basin portion provides similar habitat characteristics as the remainder of the range. Therefore, there are no unique habitat characteristics attributable to just the Cumberland River basin portion of the range, and this portion serves a similar role in supporting the species' viability as compared to the rest of the range.

Overall, and in summary, we found one portion of the longsolid's range, the Cumberland River basin, that may have a different status as compared to the remaining portion of the longsolid's range. We found the Cumberland River basin was not a biologically meaningful portion of the longsolid's range; in other words, we found it was not significant in terms of its overall contribution to the species' resiliency, redundancy, and representation, nor was it found to be significant in terms of high-quality habitat or habitat that is otherwise important for the species' life history. As a result, while Cumberland River basin may have a different status, we determined it is not a significant portion of the range. Accordingly, no portion of the longsolid's range provides a basis for determining that the species is in danger of extinction in a significant portion of its range, and we determine that the species is likely to become in danger of extinction within the foreseeable future throughout all of its range. This does not conflict with the courts' holdings in *Desert Survivors v. U.S. Department of the Interior*, 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018) and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d 946, 959 (D. Ariz. 2017) because, in reaching this conclusion, we did not apply the aspects of the Final

Policy, including the definition of “significant” that those court decisions held to be invalid.

Longsolid—Determination of Status

Our review of the best available scientific and commercial information indicates that the longsolid meets the definition of a threatened species. Therefore, we are listing the longsolid as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

Round Hickorynut—Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the Act’s section 4(a)(1) factors, we determined that the round hickorynut’s abundance has been reduced across its range as demonstrated by both number of occupied management units and the number of populations where the species has historically occurred. Historically, the species occurred within 301 populations and 138 management units across 12 States (plus at least 10 populations and 8 management units within the Canadian Province of Ontario); currently, the species occurs in 69 populations and 36 management units across 9 States, which represents a 77 percent reduction of its historically occupied populations (although we note that the remaining populations are widely distributed as opposed to concentrated within its range). The species also continues to occur in Canada, although it is estimated to have declined by greater than 92 percent, as reported in 2013 (Committee on the Status of Species at Risk in Ontario 2013, p. 4). The conditions of the remaining 69 currently extant populations in the United States vary between being highly resilient, moderately resilient, or having low resiliency (see *Current Conditions*, above, and section 5.2 in the SSA report (Service 2019, pp. 43–47)).

Currently, 4 round hickorynut populations (6 percent) are highly resilient, 16 (23 percent) are moderately resilient, and 49 (71 percent) have low resiliency. Although downward trends are evident compared to historical information, 20 highly to moderately resilient populations in the United States continue to occupy 4 of the 5 major river basins where the species is historically known to occur. Current and ongoing threats from habitat degradation or loss (Factor A), and invasive, nonnative species (Factor E), contribute to the negative effects associated with the species’ small population size (Factor E). The continued occupancy of these 20

populations (in addition to some survey information) implies that recent recruitment is occurring in some populations, and they maintain a level of resiliency, redundancy, and representation. Thus, after assessing the best available information, we conclude that the round hickorynut is not currently in danger of extinction throughout all of its range. Therefore, we proceed with determining whether the round hickorynut is likely to become an endangered species within the foreseeable future throughout all of its range.

As noted above, the threats acting on the species include habitat degradation or loss from a variety of sources and invasive, nonnative species, both of which contribute to the negative effects associated with the species’ small population size. Our analysis revealed that these threats are likely to continue into the foreseeable future, or approximately 20 to 30 years. This timeframe accounts for reasonable predictions of threats continuing into the future based on our examination of empirical data in our files (e.g., survey data, how threats are manifesting themselves on the landscape and the species, implementation of management plans and voluntary conservation actions), and also takes into consideration the biology of the species and the licensing schedules of dams within the species’ range.

The best available information, including our consideration of comments we received on the September 29, 2020 (85 FR 61384), proposed rule, suggests that the threats currently acting upon the round hickorynut are expected to continue into the foreseeable future. The effects of water quality and habitat degradation, and invasive, nonnative species, are reasonably expected to worsen over time, including concurrent with increasing human population trends, thus further reducing the species’ resiliency, redundancy, and representation across its range. Our analysis reveals the potential for either none or a single population (i.e., the Grand River in Ohio) to persist as highly resilient (i.e., continued reproduction with varied age classes present) in the foreseeable future, assuming threats remain or worsen on the landscape. Additionally, the majority of the remaining populations would exhibit low resiliency, while many (between 33 and 71 percent of the current low condition populations) would potentially become extinct or functionally extinct (e.g., significant habitat degradation; no reproduction due to highly isolated, non-recruiting

individuals). Our future analysis also reveals a high risk that the species would become extirpated in two of the five historically occupied river basins (i.e., Cumberland River basin and Lower Mississippi River basin). Overall, the current threats acting on the species and its habitat are expected to continue, and there are no indications that these threats would be lessened or that declining population trends would be reverted. Thus, after assessing the best available information, we conclude that the round hickorynut is not currently in danger of extinction but is likely to become in danger of extinction within the foreseeable future throughout all of its range.

Round Hickorynut—Status Throughout a Significant Portion of Its Range

See above, under *Longsolid—Status Throughout a Significant Portion of Its Range*, for a description of our evaluation methods and our policy application.

In undertaking the analysis for the round hickorynut, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify portions of the range where the species may be endangered.

We evaluated the range of the round hickorynut to determine if the species is in danger of extinction now in any portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways. We examined the species entire range in an attempt to focus this analysis on portions of the species’ range that may meet the definition of an endangered species. For the round hickorynut, we considered whether the threats or their effects on the species are greater in any biologically meaningful portion of the species’ range than in other portions such that the species is in danger of extinction now in that portion.

As similarly described above for the longsolid, the statutory difference between an endangered species and a threatened species is the timeframe in which the species becomes in danger of extinction; an endangered species is in danger of extinction now while a threatened species is not in danger of extinction now but is likely to become so in the foreseeable future. Thus, we considered the time horizon for the threats that are driving the round hickorynut to warrant listing as a threatened species throughout all of its range. We then considered whether these threats or their effects are occurring in any portion of the species’ range such that the species is in danger

of extinction now in that portion of its range. We examined the following threats: habitat degradation or loss; invasive, nonnative species; negative effects associated with small population size; and the potential for cumulative effects. We also considered whether these threats may be exacerbated by small population size (or low condition). Overall, we found that threats are likely acting on individuals or populations, or even basins, similarly across the species' range. These threats are certain to occur, and in those basins with few populations that are predominantly in low condition, these populations are facing the same threats, and these threats can be of greater magnitude in some areas or of greater impact, given small population sizes.

Three of five basins where round hickorynut has historically occurred (Great Lakes, Cumberland River, and Lower Mississippi River basins) have been reduced to predominantly low condition populations. Specifically, the Great Lakes basin has been reduced from 25 populations to 5 low condition populations, 1 medium condition population, and 1 high condition population; the Cumberland River basin has been reduced from 23 populations to 2 low condition populations; and the Lower Mississippi River basin has been reduced from 9 populations to a single remaining low condition population. Although there are low condition populations in every basin in which the species occurs, because these three basins have seen their populations significantly reduced and a predominance of the Great Lakes basin populations and the remaining populations for the other two basins are currently in low condition, these circumstances—in combination with the other threats acting on the species throughout its range—may indicate that the species may be in danger of extinction now in these portions of the range.

As similarly described above for the longsolid, small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species' capacity to adapt and respond to environmental changes, thereby decreasing the probability of long-term persistence. Small populations may experience reduced reproductive vigor, for example, due to inbreeding depression. Isolated individuals may have difficulty reproducing. The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as those

discussed above. Based on our review of information and the synergistic effects of threats exacerbated by a predominance of populations in low condition within the Great Lakes, Cumberland, and Lower Mississippi River basins (where populations have been significantly extirpated), we find that these three basins are portions of the round hickorynut's range with a potential difference in biological condition.

Because we have determined the Great Lakes, Cumberland, and Lower Mississippi River basins are portions of the range that may be in danger of extinction now, we next evaluate whether those portions may be significant (see additional discussion above for the longsolid). We first examined each of these areas' contributions to the resiliency, redundancy, and representation of the species. Although these basins contain 10 of 69 populations (15 percent) identified in the SSA report, the Great Lakes basin consists of 1 population currently with moderate resiliency and 1 with high resiliency, and the remaining 5 populations demonstrate low resiliency; the remaining 3 populations in the Cumberland River basin and the Lower Mississippi River basin are all low condition populations. These low condition populations do not contribute significantly, either currently or in the foreseeable future, to the species' total resiliency at a biologically meaningful scale compared to other representative areas. Although the low condition populations in these basins are relatively small, the current and future redundancy suggests that threats would be unlikely to extirpate round hickorynut in the Great Lakes basin, but there is potential to lose the remaining three low condition populations under the current level of threats scenario (Scenario 1). Overall representation would be modified through loss of two currently occupied basins. We evaluated the best available information for the Great Lakes, Cumberland River, and Lower Mississippi River basins in this context, assessing each portion's significance in terms of these conservation concepts (*i.e.*, resiliency, representation, and redundancy), and determined that there is not substantial information to indicate that any of these areas may be biologically significant to the species.

Round hickorynut populations are widely distributed over nine States and five major river basins, and we considered geographic range as a surrogate for geographic variation and proxy for potential local adaptation and adaptive capacity. A river basin is any

area of land where precipitation collects and drains off into a common outlet, such as into a river, bay, or other body of water. The river basin includes all the surface water from precipitation runoff and nearby streams that run downslope towards the shared outlet, as well as the groundwater underneath the earth's surface. River basins connect into other drainage basins at lower elevations in a hierarchical pattern, with smaller sub-drainage basins. Given there are no data indicating genetic or morphological differentiation between the five major river basins for the species, and these specific portions of the range do not provide high value or high quality habitat to the species as compared to the rest of the range, we conclude that these areas are not biologically significant to the round hickorynut. Further, the round hickorynut occurs in similar aquatic habitats across its range and does not use unique observable environmental or behavioral characteristics attributable to just the Great Lakes, Cumberland River, or Lower Mississippi River basin populations. Therefore, the species exhibits similar basin-scale use of habitat.

The Great Lakes, Cumberland River, and Lower Mississippi River basin portions occur in stream habitat comprised of substrate types similar to the other basins where the round hickorynut performs the important life-history functions of breeding, feeding, and sheltering, and occur in areas with water quality sufficient to sustain these essential life-history traits. These three basins do not act as refugia for the species or as an important spawning ground. In addition, the water quality is similar throughout the species' range with impaired water quality occurring in all basins. Since the round hickorynut occurs in similar aquatic habitats across its range, the Great Lakes, Cumberland River, and Lower Mississippi River basin portions provide similar habitat characteristics as the remainder of the species' range. Therefore, there are no unique habitat characteristics attributable to just these basins, and these portions serve a similar role in supporting the species' viability as compared to the rest of the range.

Overall, and in summary, we found three portions of the round hickorynut's range—the Great Lakes, Cumberland, and Lower Mississippi River basins—that may have a different status than the remaining portion of the round hickorynut's range. Our analysis indicated these three basins are not significant in terms of their contribution to the species' resiliency, redundancy,

and representation, nor were they found to be significant in terms of high-quality habitat or habitat that is otherwise important for the species' life history. As a result, while these portions may have a different biological status, we determined they are not significant portions of the species' range. Accordingly, no portion of the round hickorynut's range provides a basis for determining that the species is in danger of extinction in a significant portion of its range, and we determine that the round hickorynut is likely to become in danger of extinction within the foreseeable future throughout all of its range. This does not conflict with the courts' holdings in *Desert Survivors v. U.S. Department of the Interior*, 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018) and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d 946, 959 (D. Ariz. 2017) because, in reaching this conclusion, we did not apply the aspects of the Final Policy, including the definition of “significant” that those court decisions held to be invalid.

Round Hickorynut—Determination of Status

Our review of the best available scientific and commercial information indicates that the round hickorynut meets the definition of a threatened species. Therefore, we are listing the round hickorynut as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition as a listed species, planning and implementation of recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, Tribal, and local agencies, private organizations, and individuals. The Act encourages cooperation with the States and other countries and calls for recovery actions to be carried out for listed species. The protection required by Federal agencies, including the Service, and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Section 4(f) of the Act calls for the Service to develop and

implement recovery plans for the conservation of endangered and threatened species. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning consists of preparing draft and final recovery plans, beginning with the development of a recovery outline shortly after a species is listed. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan also identifies recovery criteria for review of when a species may be ready for reclassification from endangered to threatened (“downlisting”) or removal from protected status (“delisting”), and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our websites (<https://ecos.fws.gov/ecp/species/9880>, and <https://ecos.fws.gov/ecp/species/9879>), or from our Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

Following publication of this rule, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental

organizations. In addition, pursuant to section 6 of the Act, the States of New York, Pennsylvania, Ohio, Indiana, Michigan, Kentucky, West Virginia, Virginia, North Carolina, Tennessee, Alabama, and Mississippi would be eligible for Federal funds to implement management actions that promote the protection or recovery of the longsolid or round hickorynut or both species. Information on our grant programs that are available to aid species recovery can be found at: <https://www.fws.gov/service/financial-assistance>.

Please let us know if you are interested in participating in recovery efforts for the longsolid or round hickorynut. Additionally, we invite you to submit any new information on these species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency (action agency) must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require conference, consultation, or both as described in the preceding paragraph may include management and any other landscape-altering activities on Federal lands administered by the following agencies:

(1) U.S. Army Corps of Engineers (channel dredging and maintenance; dam projects including flood control, navigation, hydropower, bridge projects, stream restoration, and Clean Water Act permitting).

(2) U.S. Department of Agriculture, including the Natural Resources Conservation Service and Farm Service Agency (technical and financial assistance for projects) and the Forest Service (aquatic habitat restoration, fire management plans, fire suppression, fuel reduction treatments, forest plans, mining permits).

(3) U.S. Department of Energy (renewable and alternative energy projects).

(4) Federal Energy Regulatory Commission (interstate pipeline construction and maintenance, dam relicensing, and hydrokinetics).

(5) U.S. Department of Transportation (highway and bridge construction and maintenance).

(6) U.S. Fish and Wildlife Service (issuance of section 10 permits for enhancement of survival, habitat conservation plans, and safe harbor agreements; National Wildlife Refuge planning and refuge activities; Partners for Fish and Wildlife program projects benefiting these species or other listed species; Wildlife and Sportfish Restoration program sportfish stocking).

(7) Environmental Protection Agency (water quality criteria, permitting).

(8) Tennessee Valley Authority (flood control, navigation, hydropower, and land management for the Tennessee River system).

(9) Office of Surface Mining Reclamation and Enforcement (land resource management plans, mining permits, oil and natural gas permits, abandoned mine land projects, and renewable energy development).

(10) National Park Service (aquatic habitat restoration, fire management plans, fire suppression, fuel reduction treatments, land management plans, mining permits).

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a listing on proposed and ongoing activities within the range of the listed species. The discussion below regarding protective regulations under section 4(d) of the Act complies with our policy.

II. Final Rule Issued Under Section 4(d) of the Act

Background

Section 4(d) of the Act contains two sentences. The first sentence states that the Secretary shall issue such regulations as she deems necessary and advisable to provide for the conservation of species listed as threatened. The U.S. Supreme Court has noted that statutory language like “necessary and advisable” demonstrates a large degree of deference to the agency (see *Webster v. Doe*, 486 U.S. 592 (1988)). Conservation is defined in the Act to mean the use of all methods and

procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Additionally, the second sentence of section 4(d) of the Act states that the Secretary may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1), in the case of fish or wildlife, or section 9(a)(2), in the case of plants. Thus, the combination of the two sentences of section 4(d) provides the Secretary with wide latitude of discretion to select and promulgate appropriate regulations tailored to the specific conservation needs of the threatened species. The second sentence grants particularly broad discretion to the Service when adopting the prohibitions under section 9.

The courts have recognized the extent of the Secretary’s discretion under this standard to develop rules that are appropriate for the conservation of a species. For example, courts have upheld rules developed under section 4(d) as a valid exercise of agency authority where they prohibited take of threatened wildlife or include a limited taking prohibition (see *Alsea Valley Alliance v. Lautenbacher*, 2007 U.S. Dist. Lexis 60203 (D. Or. 2007); *Washington Environmental Council v. National Marine Fisheries Service*, 2002 U.S. Dist. Lexis 5432 (W.D. Wash. 2002)). Courts have also upheld 4(d) rules that do not address all of the threats a species faces (see *State of Louisiana v. Verity*, 853 F.2d 322 (5th Cir. 1988)). As noted in the legislative history when the Act was initially enacted, “once an animal is on the threatened list, the Secretary has an almost infinite number of options available to [her] with regard to the permitted activities for those species. [She] may, for example, permit taking, but not importation of such species, or [s]he may choose to forbid both taking and importation but allow the transportation of such species” (H.R. Rep. No. 412, 93rd Cong., 1st Sess. 1973).

Exercising its authority under section 4(d), we have developed a rule that is designed to address the longsolid’s and round hickorynut’s specific threats and conservation needs. Although the statute does not require us to make a “necessary and advisable” finding with respect to the adoption of specific prohibitions under section 9, we find that this rule as a whole satisfies the requirement in section 4(d) of the Act to issue regulations deemed necessary and advisable to provide for the conservation of the longsolid and round hickorynut. As discussed above under

Summary of Biological Status and Threats, we have concluded that the longsolid and round hickorynut are likely to become in danger of extinction within the foreseeable future primarily due to declines in water quality; loss of stream flow; fragmentation, alteration, and deterioration of instream habitats; and nonnative species. These threats, which are expected to be exacerbated by continued urbanization and the effects of climate change, were central to our assessment of the future viability of the longsolid and round hickorynut. The provisions of this 4(d) rule will promote conservation of the longsolid and round hickorynut by encouraging management of the landscape in ways that meet both land management considerations and the conservation needs of the longsolid and round hickorynut and are consistent with land management considerations. The provisions of this rule are one of many tools that we will use to promote the conservation of the longsolid and round hickorynut.

Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they fund, authorize, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat of such species.

If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency (action agency) must enter into consultation with us. Examples of actions that are subject to the section 7 consultation process are actions on State, Tribal, local, or private lands that require a Federal permit (such as a permit from the U.S. Army Corps of Engineers under section 404 of the Clean Water Act (33 U.S.C. 1251 *et seq.*) or a permit from the Service under section 10 of the Act) or that involve some other Federal action (such as funding from the Federal Highway Administration, Federal Aviation Administration, or the Federal Emergency Management Agency). Federal actions not affecting listed species or critical habitat—and actions on State, Tribal, local, or private lands that are not federally funded, authorized, or carried out by a Federal agency—do not require section 7 consultation.

This obligation does not change in any way for a threatened species with a species-specific 4(d) rule. Actions that result in a determination by a Federal agency of “not likely to adversely affect” continue to require the Service’s written concurrence and actions that are “likely to adversely affect” a species

require formal consultation and the formulation of a biological opinion.

Provisions of the 4(d) Rule

This 4(d) rule will provide for the conservation of the longsolid and round hickorynut by prohibiting the following activities, except as otherwise authorized or permitted: importing or exporting; take; possession and other acts with unlawfully taken specimens; delivering, receiving, carrying, transporting, or shipping in interstate or foreign commerce in the course of commercial activity; or selling or offering for sale in interstate or foreign commerce. This protective regulation includes most of these prohibitions because the longsolid and round hickorynut are at risk of extinction in the foreseeable future and putting these prohibitions in place will help to prevent further declines, preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other ongoing or future threats.

As discussed above under Summary of Biological Status and Threats, multiple factors are affecting the status of the longsolid and round hickorynut. A range of activities have the potential to affect these species, including declines in water quality, loss of stream flow, riparian and instream fragmentation, alteration and deterioration of instream habitats, and nonnative species. These threats, which are expected to be exacerbated by continued urbanization and the effects of climate change, were central to our assessment of the future viability of the longsolid and round hickorynut. Therefore, we prohibit actions resulting in the incidental take of longsolid and round hickorynut by altering or degrading the habitat. Regulating incidental take resulting from these activities will help preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other stressors.

Under the Act, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Some of these provisions have been further defined in regulation at 50 CFR 17.3. Take can result knowingly or otherwise, by direct and indirect impacts, intentionally or incidentally. Regulating incidental and intentional take of the longsolid and round hickorynut will help preserve and recover remaining populations of these species, including slowing their rate of decline and decreasing negative effects from threats. Therefore, we prohibit intentional take of longsolid and round

hickorynut, except for take resulting from those actions and activities specifically excepted by the 4(d) rule.

The 4(d) rule provides for the conservation of the species by allowing exceptions, including certain standard exceptions, to incidental take prohibitions caused by actions and activities that, while they may have some minimal level of disturbance to the longsolid and round hickorynut, are not expected to negatively impact the species' conservation and recovery efforts. The proposed exceptions to these prohibitions include incidental take associated with (1) conservation and restoration efforts by State wildlife agencies, (2) channel restoration projects, (3) bank restoration projects, and (4) forest management activities that implement State-approved BMPs.

The first exception is for incidental take associated with conservation and restoration efforts for listed species conducted by State wildlife agencies, and including, but not limited to, population monitoring, relocation, and collection of broodstock; tissue collection for genetic analysis; captive propagation; and subsequent stocking into currently occupied and unoccupied areas within the historical range of the species. We recognize our special and unique relationship with our State natural resource agency partners in contributing to conservation of listed species. State agencies often possess scientific data and valuable expertise on the status and distribution of endangered, threatened, and candidate species of wildlife and plants. State agencies, because of their authorities and their close working relationships with local governments and landowners, are in a unique position to assist us in implementing all aspects of the Act. In this regard, section 6 of the Act provides that we shall cooperate to the maximum extent practicable with the States in carrying out programs authorized by the Act. Therefore, in addition to the first exception for incidental take described above, any qualified employee or agent of a State conservation agency that is a party to a cooperative agreement with us in accordance with section 6(c) of the Act, who is designated by his or her agency for such purposes, and coordinates these activities with us, would be able to conduct activities designed to conserve the longsolid and round hickorynut that may result in otherwise prohibited take without additional authorization.

The second exception is for incidental take resulting from channel and bank restoration projects for creation of natural, physically stable, ecologically

functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers. These projects can be accomplished using a variety of methods, but the desired outcome is a natural channel with low shear stress (force of water moving against the channel); bank heights that enable reconnection to the floodplain; a reconnection of surface and groundwater systems, resulting in perennial flows in the channel; riffles and pools composed of existing soil, rock, and wood instead of large imported materials; low compaction of soils within adjacent riparian areas; and inclusion of riparian wetlands.

The third exception is for incidental take caused by bank stabilization projects that use bioengineering methods to replace pre-existing, bare, eroding stream banks with vegetated, stable stream banks, thereby reducing bank erosion and instream sedimentation and improving habitat conditions for the species. Following these bioengineering methods, stream banks may be stabilized using native species live stakes (live, vegetative cuttings inserted or tamped into the ground in a manner that allows the stake to take root and grow), native species live fascines (live branch cuttings, usually willows, bound together into long, cigar-shaped bundles), or native species brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). Native species vegetation includes woody and herbaceous species appropriate for the region and habitat conditions. These methods will not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion structures. Prior to channel restoration and bank stabilization actions, surveys conducted in coordination with the appropriate Service field office to determine presence of longsolid and round hickorynut must be performed, and if located, relocation prior to project implementation may be necessary, with post-implementation monitoring.

The fourth exception is for incidental take associated with forest management activities that implement State-approved BMPs. Forest landowners who properly implement these BMPs are helping conserve the longsolid and round hickorynut, and this 4(d) rule is an incentive for all landowners to properly implement BMPs to avoid any take implications.

We reiterate that these actions and activities may result in some minimal level of take of the longsolid and round hickorynut, but they are unlikely to negatively impact the species'

conservation and recovery efforts. To the contrary, we expect they would have a net beneficial effect on the species. Across the species' range, instream habitats have been degraded physically by sedimentation and by direct channel disturbance. The activities in the 4(d) rule are intended to improve habitat conditions for the species in the long term.

We may issue permits to carry out otherwise prohibited activities, including those described above, involving threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.32. With regard to threatened wildlife, a permit may be issued for the following purposes: For scientific purposes, to enhance propagation or survival, for economic hardship, for zoological exhibition, for educational purposes, for incidental taking, or for special purposes consistent with the purposes of the Act. The statute also contains certain exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

We recognize the special and unique relationship with our State natural resource agency partners in contributing to conservation of listed species. State agencies often possess scientific data and valuable expertise on the status and distribution of endangered, threatened, and candidate species of wildlife and plants. State agencies, because of their authorities and their close working relationships with local governments and landowners, are in a unique position to assist us in implementing all aspects of the Act. In this regard, section 6 of the Act provides that we must cooperate to the maximum extent practicable with the States in carrying out programs authorized by the Act. Therefore, any qualified employee or agent of a State conservation agency that is a party to a cooperative agreement with us in accordance with section 6(c) of the Act, who is designated by his or her agency for such purposes, will be able to conduct activities designed to conserve the longsolid and round hickorynut that may result in otherwise prohibited take without additional authorization.

Nothing in this 4(d) rule will change in any way the recovery planning provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or the ability of the Service to enter into partnerships for the management and protection of the longsolid and round hickorynut. However, interagency cooperation may be further streamlined through planned programmatic consultations for the

species between Federal agencies and the Service.

III. Critical Habitat for the Longsolid and Round Hickorynut

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features:

(a) Essential to the conservation of the species, and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Our regulations at 50 CFR 424.02 define the geographical area occupied by the species as an area that may generally be delineated around species' occurrences, as determined by the Secretary (*i.e.*, range). Such areas may include those areas used throughout all or part of the species' life cycle, even if not used on a regular basis (*e.g.*, migratory corridors, seasonal habitats, and habitats used periodically, but not solely by vagrant individuals).

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and translocation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation also

does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the Federal agency would be required to consult with the Service under section 7(a)(2) of the Act. However, even if the Service were to conclude that the proposed activity would likely result in destruction or adverse modification of the critical habitat, the Federal action agency and the landowner are not required to abandon the proposed activity, or to restore or recover the species; instead, they must implement "reasonable and prudent alternatives" to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat).

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106-554; H.R. 5658)), and our associated Information Quality Guidelines provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original

sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information from the SSA report and information developed during the listing process for the species. Additional information sources may include any generalized conservation strategy, criteria, or outline that may have been developed for the species; the recovery plan for the species; articles in peer-reviewed journals; conservation plans developed by States and counties; scientific status surveys and studies; biological assessments; other unpublished materials; or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act; (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species; and (3) the prohibitions found in the section 4(d) rule. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of these species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation

will not control the direction and substance of future recovery plans, habitat conservation plans (HCPs), or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Physical or Biological Features Essential to the Conservation of the Species

In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12(b), in determining which areas we will designate as critical habitat from within the geographical area occupied by the species at the time of listing, we consider the physical or biological features that are essential to the conservation of the species and which may require special management considerations or protection. The regulations at 50 CFR 424.02 define "physical or biological features essential to the conservation of the species" as the features that occur in specific areas and that are essential to support the life-history needs of the species, including, but not limited to, water characteristics, soil type, geological features, sites, prey, vegetation, symbiotic species, or other features. A feature may be a single habitat characteristic or a more complex combination of habitat characteristics. Features may include habitat characteristics that support ephemeral or dynamic habitat conditions. Features may also be expressed in terms relating to principles of conservation biology, such as patch size, distribution distances, and connectivity. For example, physical features essential to the conservation of the species might include gravel of a particular size required for spawning, alkaline soil for seed germination, protective cover for migration, or susceptibility to flooding or fire that maintains necessary early-successional habitat characteristics. Biological features might include prey species, forage grasses, specific kinds or ages of trees for roosting or nesting, symbiotic fungi, or absence of a particular level of nonnative species consistent with conservation needs of the listed species. The features may also

be combinations of habitat characteristics and may encompass the relationship between characteristics or the necessary amount of a characteristic essential to support the life history of the species.

In considering whether features are essential to the conservation of the species, we may consider an appropriate quality, quantity, and spatial and temporal arrangement of habitat characteristics in the context of the life-history needs, condition, and status of the species. These characteristics include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing (or development) of offspring; and habitats that are protected from disturbance.

As described above under Summary of Biological Status and Threats, longsolid and round hickorynut mussels occur in river or stream reaches. Occasional or regular interaction among individuals in different reaches not interrupted by a barrier likely occurs, but in general, interaction is strongly influenced by habitat fragmentation and distance between occupied river or stream reaches. Once released from their fish host, freshwater mussels are benthic, generally sedentary aquatic organisms and closely associated with appropriate habitat patches within a river or stream.

We derive the specific physical or biological features essential for the longsolid and round hickorynut from studies of these species' (or appropriate surrogate species') habitat, ecology, and life history. The primary habitat elements that influence resiliency of the longsolid and round hickorynut include water quality, water quantity, substrate, habitat connectivity, and the presence of host fish species to ensure recruitment. These features are also described above as resource needs under Summary of Biological Status and Threats, and a full description is available in the SSA reports; the individuals' needs are summarized below in Table 1.

TABLE 1—REQUIREMENTS FOR EACH LIFE STAGE OF THE LONGSOLID AND ROUND HICKORYNUT MUSSELS

Life stage	Resources needed to complete life stage ¹	Source
Fertilized eggs—early spring	• Clear, flowing water • Sexually mature males upstream from sexually mature females	Berg et al. 2008, p. 397; Haag 2012, pp. 38–39.
Glochidia—late spring to early summer	• Appropriate spawning temperatures • Clear, flowing water • Enough flow to keep glochidia or conglutinates adrift and to attract drift-feeding host fish • Presence of host fish for attachment	Strayer 2008, p. 65; Haag 2012, pp. 41–42.
Juveniles—excystment from host fish to approx. 0.8 in (~20 mm) shell length.	• Clear, flowing water • Host fish dispersal • Appropriate interstitial chemistry; low salinity, low ammonia, low copper and other contaminants, high dissolved oxygen • Appropriate substrate (clean gravel/sand/cobble) for settlement	Dimock and Wright 1993, pp. 188–190; Sparks and Strayer 1998, p. 132; Augspurger et al. 2003, p. 2,574; Augspurger et al. 2007, p. 2,025; Strayer and Malcom 2012, pp. 1,787–1,788.
Adults—greater than 0.8 in (20 mm) shell length.	• Clear, flowing water • Appropriate substrate (stable gravel and coarse sand free from excessive silt) • Adequate food availability (phytoplankton and detritus) • High dissolved oxygen • Appropriate water temperature	Yeager et al. 1994, p. 221; Nichols and Garling 2000, p. 881; Chen et al. 2001, p. 214; Spooner and Vaughn 2008, p. 308.

¹ These resource needs are common among North American freshwater mussels; however, due to lack of species-specific research, parameters specific to longsolid and round hickorynut are unavailable.

Summary of Essential Physical or Biological Features

We derive the specific physical or biological features essential to the conservation of the longsolid and round hickorynut from studies of the species' habitat, ecology, and life history as described below. Additional information can be found in chapter 4 of the SSA reports (Service 2018, pp. 27–32; Service 2019, pp. 30–39), both of which are available on <https://www.regulations.gov> under Docket No. FWS–R4–ES–2020–0010. We have determined that the following physical or biological features are essential to the conservation of the longsolid and round hickorynut:

(1) Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussels' and fish host's habitat and food availability, maintenance of spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats. Adequate flows ensure delivery of oxygen, enable reproduction, deliver food to filter-feeding mussels, and reduce contaminants and fine sediments from interstitial spaces. Stream velocity is not static over time, and variations

may be attributed to seasonal changes (with higher flows in winter/spring and lower flows in summer/fall), extreme weather events (e.g., drought or floods), or anthropogenic influence (e.g., flow regulation via impoundments).

(2) Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffle-run-pool habitats that provide flow refuges consisting of predominantly silt-free, stable sand, gravel, and cobble substrates).

(3) Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to): Dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °F (°F) (30 °Celsius (°C))). Additionally, water and sediment should be low in ammonia (generally below 0.5 ppm total ammonia-nitrogen) and heavy metal concentrations, and lack excessive total suspended solids and other pollutants (see Threats Analysis, above).

(4) The presence and abundance of fish hosts necessary for recruitment of the longsolid (currently unknown, likely includes minnows of the family

Cyprinidae and banded sculpin (*Cottus caroliniae*) and the round hickorynut (i.e., eastern sand darter (*Ammocrypta pellucida*), emerald darter (*Etheostoma baileyi*), greenside darter (*E. blennioides*), Iowa darter (*E. exile*), fantail darter (*E. flabellare*), Cumberland darter (*E. susanae*), spangled darter (*E. obama*), variegated darter (*E. variatum*), blackside darter (*Percina maculata*), frecklebelly darter (*P. stictogaster*), and banded sculpin).

Special Management Considerations or Protection

When designating critical habitat, we assess whether the specific areas within the geographical area occupied by the species at the time of listing contain features which are essential to the conservation of the species and which may require special management considerations or protection.

The features essential to the conservation of the longsolid and round hickorynut may require special management considerations or protections to reduce the following threats: (1) Alteration of the natural flow regime (modifying the natural hydrograph and seasonal flows), including water withdrawals, resulting in flow reduction and available water quantity; (2) urbanization of the landscape, including (but not limited to) land conversion for urban and commercial use, infrastructure (pipelines, roads, bridges, utilities), and urban water uses (resource extraction activities, water supply reservoirs,

wastewater treatment, etc.); (3) significant alteration of water quality and nutrient pollution from a variety of activities, such as mining and agricultural activities; (4) impacts from invasive species; (5) land use activities that remove large areas of forested wetlands and riparian systems; (6) culvert and pipe installation that creates barriers to movement for the longsolid and round hickorynut, or their host fishes; (7) changes and shifts in seasonal precipitation patterns as a result of climate change; and (8) other watershed and floodplain disturbances that release sediments, pollutants, or nutrients into the water.

Management activities that could ameliorate these threats include, but are not limited to: Use of BMPs designed to reduce sedimentation, erosion, and bank destruction; protection of riparian corridors and woody vegetation; moderation of surface and ground water withdrawals to maintain natural flow regimes; improved stormwater management; and reduction of other watershed and floodplain disturbances that release sediments, pollutants, or nutrients into the water.

In summary, we find that the occupied areas we are designating as critical habitat contain the physical or biological features that are essential to the conservation of the species and that may require special management considerations or protection. Special management considerations or protection may be required of the Federal action agency to eliminate, or to reduce to negligible levels, the threats affecting the physical and biological features of each unit.

Criteria Used To Identify Critical Habitat

As required by section 4(b)(2) of the Act, we use the best scientific data available to designate critical habitat. In accordance with the Act and our implementing regulations at 50 CFR 424.12(b), we review available information pertaining to the habitat requirements of the species and identify specific areas within the geographical area occupied by the species at the time of listing and any specific areas outside the geographical area occupied by the species to be considered for designation as critical habitat. We are not designating any areas outside the geographical area occupied by the longsolid or round hickorynut because we have not identified any unoccupied areas that meet the definition of critical habitat, and we have determined that occupied areas are sufficient to conserve these two species.

Methodology Used For Selection of Units

First, we included stronghold (high) or medium condition populations (resiliency) remaining from historical conditions. These populations show recruitment or varied age class structure, and could be used for recovery actions to re-establish populations within basins through propagation activities or augment other populations through direct translocations within their basins.

Second, we evaluated spatial representation and redundancy across the species' ranges, to include last remaining consistently observable population(s) in major river basins and the last remaining population(s) in States if necessary, as States are crucial partners in monitoring and recovery efforts.

Third, we examined the overall contribution of medium condition populations and threats to those populations. Adjacency and connectivity to stronghold and medium populations was considered, and we did not include populations that have a potentially low likelihood of recovery due to limited abundances or populations currently under a high level of threats.

Finally, we evaluated overlap of longsolid and round hickorynut occurrences, as well as other listed aquatic species and designated critical habitat, to see if there are ongoing conservation and monitoring efforts that can be capitalized on for efficiency. Rangeland recovery considerations, such as maintaining existing genetic diversity and striving for representation of all major portions of the species' current ranges, were considered in formulating these critical habitat designations. For example, in the Cumberland River basin, there is only one remaining population of the longsolid (mainstem Cumberland River) and only two populations remaining of the round hickorynut (Buck Creek and Rockcastle River). In addition, in the Mississippi River basin, only one population of the round hickorynut remains (Big Black River). The distribution of the longsolid and round hickorynut in these basins is substantially reduced when compared to historical data that indicate these species were formerly much more widespread within these drainages. Therefore, these rivers and streams were included to maintain basin representation.

The critical habitat designation does not include all rivers and streams currently occupied by the species, nor

all rivers and streams known to have been occupied by the species historically. Instead, it includes only the occupied rivers and streams within the current range that we determined have the physical or biological features that are essential to the conservation of these species and meet the definition of critical habitat. These rivers and streams contain populations large and dense enough and most likely to be self-sustaining over time (despite fluctuations in local conditions), and also have retained the physical or biological features that will allow for the maintenance and expansion of existing populations. These units also represent populations that are stable and distributed over a wide geographic area. We are not designating any areas outside the geographical area currently occupied by either the longsolid or round hickorynut because we determined that occupied areas are sufficient to conserve the two species. Accordingly, we did not find any unoccupied areas to be essential to the conservation of these species.

Sources of data for these critical habitat designations include multiple databases maintained by universities, information from State agencies throughout the species' ranges, and numerous survey reports on streams throughout the species' ranges (see SSA reports (Service 2018, entire; Service 2019, entire)). We have also reviewed available information that pertains to the habitat requirements of these species. Sources of information on habitat requirements include studies conducted at occupied sites and published in peer-reviewed articles, agency reports, and data collected during monitoring efforts (Service 2018, entire; Service 2019, entire).

In summary, for areas within the geographic area occupied by these species at the time of listing, we delineated critical habitat unit boundaries using a precise set of criteria. Specifically, we identified river and stream reaches with observations from 2000 to present, given the variable data associated with timing and frequency of mussel surveys conducted throughout the species' ranges. We determined it is reasonable to find these areas occupied due to the longevity of the longsolid, the potential for incomplete survey detections for the round hickorynut, highly variable recent survey information across both species' ranges, and available State heritage databases and information support for the likelihood of both species' continued presence in these areas within this timeframe. Specific habitat areas were delineated based on Natural

Heritage Element Occurrences, and unpublished survey data provided by States, universities, and nongovernmental organizations. These areas provide habitat for longsolid and round hickorynut populations and are large enough to be self-sustaining over time, despite fluctuations in local conditions. The areas within the critical habitat units represent continuous river and stream reaches of free-flowing habitat patches capable of sustaining host fishes and allowing for seasonal transport of glochidia, which are essential for reproduction and dispersal of longsolid and round hickorynut. We consider portions of the following rivers and streams to be occupied by the species at the time of listing, and meet the definition of critical habitat:

(1) Longsolid—French Creek, Allegheny River, Shenango River, Middle Island Creek, Little Kanawha River, Elk River, Kanawha River, Licking River, Green River, Cumberland River, Clinch River, and Paint Rock River (see Final Critical Habitat Designation, below).

(2) Round hickorynut—Shenango River, Grand River, Tippecanoe River, Middle Island Creek, Little Kanawha River, Elk River, Kanawha River, Licking River, Rockcastle River, Buck Creek, Green River, Paint Rock River, Duck River, and Big Black River (see Final Critical Habitat Designation, below).

Critical Habitat Maps

When determining critical habitat boundaries, we made every effort to avoid including developed areas such as lands covered by buildings, pavement,

and other structures because such lands lack physical or biological features necessary for the longsolid and round hickorynut. The scale of the maps we prepared under the parameters for publication within the Code of Federal Regulations may not reflect the exclusion of such developed lands. Any such lands inadvertently left inside critical habitat boundaries shown on the maps of this rule have been excluded by text in the rule and are not designated as critical habitat. Therefore, a Federal action involving these lands will not trigger section 7 consultation with respect to critical habitat and the requirement of no adverse modification unless the specific action will affect the physical or biological features in the adjacent critical habitat.

We are designating as critical habitat stream reaches that we have determined are occupied at the time of listing (*i.e.*, currently occupied) and that contain one or more of the physical or biological features that are essential to support life-history processes of these species. Twelve units for the longsolid and 14 units for the round hickorynut are designated based on the presence of the physical or biological features that support the longsolid's or round hickorynut's life-history processes. All of the units for both species contain all of the identified physical or biological features and support multiple life-history processes.

The critical habitat designation is defined by the map or maps, as modified by any accompanying regulatory text, presented at the end of this document under Regulation

Promulgation. We include more detailed information on the boundaries of the critical habitat designation in the preamble of this document. We will make the coordinates or plot points or both on which each map is based available to the public on <https://www.regulations.gov> at Docket No. FWS-R4-ES-2020-0010.

Final Critical Habitat Designation

We are designating a total of 1,115 river mi (1,794 km) in 12 units as occupied critical habitat for the longsolid and a total of 921 river mi (1,482 km) in 14 units as occupied critical habitat for the round hickorynut. All or portions of some of these units overlap, and all 26 units are occupied by one or both species. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for the longsolid and round hickorynut. The 12 areas designated as critical habitat for the longsolid are: French Creek, Allegheny River, Shenango River, Middle Island Creek, Little Kanawha River, Elk River, Kanawha River, Licking River, Green River, Cumberland River, Clinch River, and Paint Rock River. The 14 areas designated as critical habitat for the round hickorynut are: Shenango River, Grand River, Tippecanoe River, Middle Island Creek, Little Kanawha River, Elk River, Kanawha River, Licking River, Rockcastle River, Buck Creek, Green River, Paint Rock River, Duck River, and Big Black River. Tables 2 and 3 show the critical habitat units and the approximate river miles of each unit.

TABLE 2—CRITICAL HABITAT UNITS FOR THE LONGSOLID. ALL UNITS ARE OCCUPIED BY THE SPECIES

[Area estimates reflect all land within critical habitat unit boundaries]

Critical habitat unit (State)	Adjacent riparian land ownership by type	Approximate river miles (kilometers)
LS 1. French Creek (Pennsylvania)	Public (Federal, State);	14 (22.1)
	Private	106 (170.6)
		Total = 120 (191.5)
LS 2. Allegheny River (Pennsylvania)	Public (Federal, State);	84 (135.8)
	Private	15 (24.1)
		Total = 99 (159.3)
LS 3. Shenango River (Pennsylvania)	Public (Federal, State);	7 (11.3)
	Private	15 (24.3)
		Total = 22 (35.5)
LS 4. Middle Island Creek (West Virginia)	Public (Local);	0.13 (0.2)
	Private	14 (23.5)
		Total = 14 (23.7)
LS 5. Little Kanawha River (West Virginia)	Public (Federal, State);	0.53 (0.9)
	Private	122 (197.2)
		Total = 123 (198)
LS 6. Elk River (West Virginia)	Public (Federal, State, Local);	7 (12.7)
	Private	93 (150.3)
		Total = 101 (163)
LS 7. Kanawha River (West Virginia)	Public (Federal, State, Local);	2 (4.6)
	Private	18 (29.3)
		Total = 21 (33.9)
LS 8. Licking River (Kentucky)	Public (Federal, State, Local);	19 (31.7)

TABLE 2—CRITICAL HABITAT UNITS FOR THE LONGSOLID. ALL UNITS ARE OCCUPIED BY THE SPECIES—Continued
[Area estimates reflect all land within critical habitat unit boundaries]

Critical habitat unit (State)	Adjacent riparian land ownership by type	Approximate river miles (kilometers)
LS 9. Green River (Kentucky)	Private Public (Federal, State, Local); Private	161 (259.7) Total = 181 (291.5) 51 (82.4) 105 (169.2) Total = 156 (251.6)
LS 10. Cumberland River (Tennessee)	Public (Federal)	Total = 48 (77.5)
LS 11. Clinch River (Virginia and Tennessee) ..	Public (Federal, State); Private	17 (27.3) 160 (258.8) Total = 177 (286.1)
LS 12. Paint Rock River (Alabama)	Public (Federal, State); Private	56 (90.4) 2 (4.1) Total = 58 (94.5)
Public		305 (491)
Private		810 (1,304)
Total		1,115 (1,794)

Note: River miles may not sum due to rounding.

TABLE 3—CRITICAL HABITAT UNITS FOR THE ROUND HICKORYNUT. ALL UNITS ARE OCCUPIED BY THE SPECIES
[Area estimates reflect all land within critical habitat unit boundaries]

Critical habitat unit	Adjacent riparian land ownership by type	Approximate river miles (kilometers)
RH 1. Shenango River (Pennsylvania)	Public (Federal, State); Private	7 (11.1) 15 (24.3) Total = 22 (35.5)
RH 2. Grand River (Ohio)	Public (State, Local); Private	33 (53) 59 (95.2) Total = 92 (148.2)
RH 3. Tippecanoe River (Indiana)	Public (State, Easement); Private	9 (14.5) 66 (105.6) Total = 75 (120.8)
RH 4. Middle Island Creek (West Virginia)	Public (Federal, State); Private	0.2 (0.4) 74.8 (120.4) Total = 75 (120.8)
RH 5. Little Kanawha River (West Virginia)	Public (Federal, State, Local); Private	0.7 (1.2) 109 (175.4) Total = 110 (176.6)
RH 6. Elk River (West Virginia)	Public (Federal, State, Local); Private	7 (12.7) 93 (150.3) Total = 101 (163)
RH 7. Kanawha River (West Virginia)	Public (Federal, State, Local); Private	4 (7.2) 33 (53.2) Total = 37.5 (60.4)
RH 8. Licking River (Kentucky)	Public (Federal, State, Local); Private	18 (30) 131 (211.8) Total = 150 (241.9)
RH 9. Rockcastle River (Kentucky)	Public (Federal); Private	15 (24.2) 0.3 (0.4) Total = 15.3 (24.6)
RH 10. Buck Creek (Kentucky)	Public (State, Local); Private	3 (5.5) 33 (52.6) Total = 36 (58.1)
RH 11. Green River (Kentucky)	Public (Federal, State); Private	37 (59.4) 61 (98.4) Total = 98 (157.7)
RH 12. Paint Rock River (Alabama)	Public (Federal, State); Private	46 (73.4) 2 (4.1) Total = 48 (77.5)
RH 13. Duck River (Tennessee)	Public (State, Local); Private	32 (51.1) 27 (43.7) Total = 59 (94.8)
RH 14. Big Black River (Mississippi)	Private	Total = 4 (7)

TABLE 3—CRITICAL HABITAT UNITS FOR THE ROUND HICKORYNUT. ALL UNITS ARE OCCUPIED BY THE SPECIES—
Continued

[Area estimates reflect all land within critical habitat unit boundaries]

Critical habitat unit	Adjacent riparian land ownership by type	Approximate river miles (kilometers)
Public		212 (341)
Private		709 (1,141)
Total		921 (1,482)

Note: River miles may not sum due to rounding.

We present brief descriptions of all units, and reasons why they meet the definition of critical habitat for the longsolid and round hickorynut, below. There are a total of 12 units for the longsolid and 14 units for round hickorynut, 8 of which overlap in part or whole for both species, and all of which contain all of the physical and biological features essential to the conservation of both species. Also, the majority of units overlap in part or whole with existing critical habitat designated for other federally endangered species (*i.e.*, diamond darter (*Crystallaria cincotta*), Short's bladderpod (*Physaria globosa*), purple bean (*Villosa perpurpurea*), rough rabbitsfoot (*Quadrula cylindrica strigillata*), Cumberlandian combshell (*Epioblasma brevirens*), oyster mussel (*Epioblasma capsaeformis*), slabside pearl mussel (*Pleurobema (=Lexingtonia) dolabelliformis*), and fluted kidneyshell (*Ptychobranhus subtentus*)) or federally threatened species (*i.e.*, rabbitsfoot (*Quadrula cylindrica cylindrica*), yellowfin madtom (*Noturus flavipinnis*), and slender chub (*Erimystax (=Hybopsis) cahnii*)), as specified below.

LS 1: French Creek

Unit LS 1 consists of 120 stream mi (191.5 km) of French Creek in Crawford, Erie, Mercer, and Venango Counties, Pennsylvania, from Union City Dam west of Union City, Erie County, downstream to its confluence with the Allegheny River near the City of Franklin, Venango County. Riparian lands that border the unit include approximately 106 stream mi (170.6 km; 76 percent) in private ownership and 14 stream mi (22.1 km; 24 percent) in public (Federal or State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes agriculture, several State-managed game lands, the communities of Cambridge Springs and Venango, and the cities of Meadville and Franklin. Union City Dam is operated by the U.S. Army Corps of

Engineers. Unit LS 1 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. The entire 120 stream mi (191.5 km) of this unit overlap with designated critical habitat for the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within this unit include the degradation of habitat and water quality from impoundments, siltation and pollution due to resource extraction, agriculture, timbering practices, and human development; flow reduction and water quality degradation due to water withdrawals and wastewater treatment plants; and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include monitoring water quality degradation within the species' range resulting from row crop agriculture and oil and gas development, and efforts to prevent the spread of invasive, nonnative species, specifically the round goby (see Special Management Considerations or Protection, above).

LS 2: Allegheny River

Unit LS 2 consists of 99 river mi (159.3 km) of the Allegheny River in Warren, Crawford, Forest, Venango, and Clarion Counties, Pennsylvania, from Kinzua Dam east of Warren, Warren County, downstream to the Pennsylvania Route 58 crossing at Foxburg, Clarion County, Pennsylvania. Riparian lands that border the unit include approximately 15 river mi (24.1 km; 14 percent) in private ownership and 84 river mi (135.8 km; 86 percent) in public (Federal or State government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and State-managed game lands. The public land ownership for this unit is a combination of Allegheny National Forest lands and State lands, and the Kinzua Dam is operated by the U.S. Army Corps of Engineers. Unit LS 2 is

occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 35 river mi (57 km) of this unit with designated critical habitat for the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit LS 2 include the degradation of habitat and water quality from impoundments, channelization, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Kinzua Dam to mimic the natural hydrograph, improvements to water quality to reverse degradation resulting from row crop agriculture and oil and gas development, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 3: Shenango River

Unit LS 3 is the same as Unit RH 1, described below for the round hickorynut. Unit LS 3 consists of 22 river mi (35.5 km) of the Shenango River in Crawford County, Pennsylvania, from Pymatuning Dam downstream to the point of inundation by Shenango River Lake near Big Bend, Mercer County, Pennsylvania. Riparian lands that border the unit include approximately 15 river mi (24.3 km; 32 percent) in private ownership and 7 river mi (11.3 km; 68 percent) in public (Federal or State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes the City of Greenville and its associated industry, and the unincorporated communities of Jamestown and New Harrisburg. Pymatuning Dam is owned by the State of Pennsylvania. Unit LS 3 is occupied by the species and contains all of the physical or biological features essential

to the conservation of the species. There is overlap of approximately 14.5 river mi (23.4 km) of this unit with designated critical habitat for the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit LS 3 include the degradation of habitat and water quality from impoundments, domestic and industrial pollution due to human development, resource extraction, water withdrawals, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Pytmatuning Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 4: Middle Island Creek

Unit LS 4 partially overlaps with Unit RH 4 for the round hickorynut, described below. Unit LS 4 consists of 14 stream mi (23.7 km) of Middle Island Creek in Doddridge and Tyler Counties, West Virginia, from the mouth of Meathouse Fork south of Smithburg, Doddridge County, downstream to its confluence with Arnold Creek at the Tyler/Doddridge County line. Riparian lands that border the unit include approximately 14 stream mi (23.5 km; 99 percent) in private ownership and 0.13 river mi (0.2 km; less than 1 percent) in public (local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry and the communities of Smithburg, Avondale, and West Union. Unit LS 4 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit LS 4 include degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include actions to alleviate the threats of water quality and habitat degradation from hydrofracking wastewater discharges and impoundments downstream on the Ohio River, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 5: Little Kanawha River

Unit LS 5 partially overlaps with Unit RH 5 for the round hickorynut, described below. Unit LS 5 consists of 123 river mi (198 km) of the Little Kanawha River in Calhoun, Gilmer, Ritchie, and Wood Counties, West Virginia, from Burnsville Dam (which is in neighboring Braxton County) downstream to its confluence with the Ohio River in Parkersburg, Wood County, West Virginia. Riparian lands that border the unit include approximately 122 river mi (197.2 km; 99 percent) in private ownership and 0.53 river mi (0.9 km; less than 1 percent) in public (Federal or State government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. Burnsville Dam is operated by the U.S. Army Corps of Engineers. Unit LS 5 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit LS 5 include the degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Burnsville Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 6: Elk River

Unit LS 6 is the same as Unit RH 6, described below for the round hickorynut. Unit LS 6 consists of 101 river mi (163 km) of the Elk River in Braxton, Clay, and Kanawha Counties, West Virginia, from Sutton Dam in Braxton County downstream to its confluence with the Kanawha River at Charleston, Kanawha County, West Virginia. Riparian lands that border the unit include approximately 93 river mi (150.3 km; 92 percent) in private ownership and 7 river mi (12.7 km; 8 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC-8 level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. Sutton Dam is operated by the U.S. Army Corps of

Engineers. Unit LS 6 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 28 river mi (44.6 km) of this unit with designated critical habitat for the federally endangered diamond darter (78 FR 52364; August 22, 2013).

Threats identified within Unit LS 6 include the degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Sutton Dam to mimic the natural hydrograph and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 7: Kanawha River

Unit LS 7 partially overlaps with Unit RH 7 for the round hickorynut, described below. Unit LS 7 consists of 21 river mi (33.9 km) of the Kanawha River in Fayette and Kanawha Counties, West Virginia, from Kanawha Falls in Fayette County downstream to its confluence with Cabin Creek at Chelyan, Kanawha County, West Virginia. Riparian lands that border the unit include approximately 18 river mi (29.3 km; 90 percent) in private ownership and 2 river mi (4.6 km; 10 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. London and Marmet locks and dams within this unit are operated by the U.S. Army Corps of Engineers. Unit LS 7 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit LS 7 include the degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include riparian vegetation re-establishment in addition to restoration efforts along shorelines to minimize sediment and contaminant inputs, and efforts to

prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 8: Licking River

Unit LS 8 partially overlaps with Unit RH 8 for the round hickorynut, described below. Unit LS 8 consists of 181 river mi (291.5 km) of the Licking River in Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky, from Cave Run Dam in Bath/Rowan Counties downstream to its confluence with the Ohio River at Newport, Campbell/Kenton County, Kentucky. Riparian lands that border the unit include approximately 161 river mi (259.7 km; 90 percent) in private ownership and 19 river mi (31.7 km; 10 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture industry, and numerous cities and municipalities. The Cave Run Dam is operated by the U.S. Army Corps of Engineers. Unit LS 8 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit LS 8 include the degradation of habitat and water quality from impoundments and associated cold water discharges, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Cave Run Dam to mimic the natural hydrograph and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 9: Green River

Unit LS 9 partially overlaps with Unit RH 11 for the round hickorynut, described below. Unit LS 9 consists of 156 river mi (251.6 km) of the Green River in Butler/Warren, Edmonson, Green, Hart, and Taylor Counties, Kentucky, from Green River Lake Dam south of Campbellsville in Taylor County downstream to its confluence with the Barren River at Woodbury, Warren/Butler County, Kentucky. Riparian lands that border the unit include approximately 105 river mi (169.2 km; 67 percent) in private ownership and 51 river mi (82.4 km; 33

percent) in public (Federal, State, and local government) ownership; Federal lands include a portion of Mammoth Cave National Park. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities, and Green River Lake Dam is operated by the U.S. Army Corps of Engineers. Unit LS 9 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. The entire approximately 156-river-mi (252-km) unit overlaps with designated critical habitat for the federally endangered diamond darter (78 FR 52364; August 22, 2013) and the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit LS 9 include the degradation of habitat and water quality from impoundments and associated cold water discharges, siltation and pollution due to improper timbering and agricultural practices, resource extraction, water withdrawals, and development, all of which affect channel stability; wastewater treatment plants; and the presence of invasive, nonnative species. Special management considerations or protection measures may be needed to reduce or alleviate habitat degradation such as channelization and channel instability. Additional special management considerations or protection measures may be needed to address thermal and flow regimes associated with tail water releases from the Green River Lake Dam, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 10: Cumberland River

Unit LS 10 consists of 48 river mi (77.5 km) of the Cumberland River in Smith, Trousdale, and Wilson Counties, Tennessee, from Cordell Hull Dam north of Carthage in Smith County downstream to reservoir influence of Old Hickory Reservoir at U.S. Route 231 north of Lebanon, Wilson County, Tennessee. Riparian lands that border the unit are all public (Federal) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and the municipalities of Carthage and Rome, Tennessee; both Cordell Hull and Old Hickory Dams upstream and downstream of this unit are operated by the U.S. Army Corps of Engineers. Unit LS 10 is occupied by the species and contains all of the physical or biological features essential to the conservation of

the species. There is overlap of approximately 1 river mi (1.7 km) of this unit with designated critical habitat for the federally endangered Short's bladderpod (79 FR 50990; August 26, 2014).

Threats identified within Unit LS 10 include the degradation of habitat and water quality from upstream and downstream impoundments and associated cold water discharges, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include channel stability, thermal regimes, altered flow regimes associated with tail water releases from Cordell Hull Reservoir, actions to address channelization, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 11: Clinch River

Unit LS 11 consists of 177 river mi (286.1 km) of the Clinch River in Russell, Scott, Tazewell, and Wise Counties in Virginia, and Claiborne, Hancock, and Hawkins Counties in Tennessee. This unit extends from Secondary Highway 637 west of Pounding Mill in Tazewell County, Virginia, downstream to County Highway 25, Claiborne County, Tennessee, northwest of Thorn Hill. The Tennessee portion of this unit is also encompassed by the Tennessee Wildlife Resources Agency's Clinch River Sanctuary. Riparian lands that border the unit include approximately 160 river mi (258.8 km; 90 percent) in private ownership and 17 river mi (27.3 km; 10 percent) in public (Federal and State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. Unit LS 11 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 171 river mi (274.4 km) of this unit with designated critical habitat for the federally endangered purple bean, oyster mussel, rough rabbitsfoot, and Cumberlandian combshell (69 FR 53136; August 31, 2004); the federally endangered slabside pearlymussel and fluted kidneyshell (78 FR 59556; September 26, 2013); and with the federally threatened yellowfin madtom and slender chub (42 FR 45526; September 9, 1977).

Threats identified within Unit LS 11 include the degradation of habitat and water quality from downstream impoundment, mining discharges, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include management of the Norris Reservoir downstream to provide additional riverine habitat, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

LS 12: Paint Rock River

Unit LS 12 partially overlaps with Unit RH 12 for the round hickorynut, described below. Unit LS 12 consists of 58 river mi (94.5 km) of the Paint Rock River in Jackson and Madison/Marshall Counties, Alabama, from the confluence of Hurricane Creek and Estill Fork in Jackson County, Alabama, downstream to its confluence with the Tennessee River west of Hebron, Madison/Marshall County, Alabama. Riparian lands that border the unit include approximately 2 river mi (4.1 km; 3 percent) in private ownership and 56 river mi (90.4 km; 97 percent) in public (Federal and State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and several small municipalities (Princeton, Hollytree, Trenton, and Paint Rock). Unit LS 12 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 53 river mi (85 km) of this unit with designated critical habitat for the federally endangered slabside pearl mussel (78 FR 59556; September 26, 2013) and the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit LS 12 include the degradation of habitat and water quality from downstream impoundment, siltation and pollution due to improper agricultural and timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include management of Wheeler Reservoir downstream to provide additional riverine habitat, working with landowners to implement BMPs to reduce erosion and sedimentation

associated with agricultural lands, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 1: Shenango River

Unit RH 1 is the same as Unit LS 3 for the longsolid, described above. It consists of 22 river mi (35.5 km) of the Shenango River in Crawford County, Pennsylvania, from Pymatuning Dam downstream to the point of inundation by Shenango River Lake near Big Bend, Mercer County, Pennsylvania. Riparian lands that border the unit include approximately 15 river mi (24.3 km; 32 percent) in private ownership and 7 river mi (11.1 km; 68 percent) in public (Federal or State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes the City of Greenville and its associated industry, and the unincorporated communities of Jamestown and New Harrisburg. Pymatuning Dam is owned by the State of Pennsylvania. Unit RH 1 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 14.5 river mi (23.4 km) of this unit with designated critical habitat for the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit RH 1 include the degradation of habitat and water quality from impoundments, domestic and industrial pollution due to human development, resource extraction, water withdrawals, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Pymatuning Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 2: Grand River

Unit RH 2 consists of 92 river mi (148.2 km) of the Grand River in Ashtabula, Lake, and Trumbull Counties, Ohio, from the Trumbull/Geauga County line south of Lake County, Ohio State Route 88, downstream to the mouth of the Grand River at its confluence with Lake Erie. Riparian lands that border the unit include approximately 59 river mi (95.2 km; 64 percent) in private ownership and 33 river mi (53 km; 36 percent) in public (State and local government) ownership. The Grand River is a State

Wild and Scenic River, with a “Wild River” designation for approximately 23 river mi (37 km) from the Harpersfield Covered Bridge downstream to the Norfolk and Western Railroad Trestle in Lake County, and “Scenic River” designation for approximately 33 river mi (53 km) from the U.S. 322 Bridge in Ashtabula County downstream to the Harpersfield Covered Bridge. General lands use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and several municipalities (West Farmington, Windsor, Rock Creek, and Perry). Harpersfield Dam is operated by the U.S. Army Corps of Engineers. Unit RH 2 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit RH 2 include degradation of habitat and water quality from impoundments, domestic and industrial pollution due to human development, resource extraction, water withdrawals, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from the Harpersfield Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 3: Tippecanoe River

Unit RH 3 consists of 75 river mi (120.8 km) of the Tippecanoe River in Fulton, Marshall, Pulaski, and Starke Counties, Indiana, from the railroad crossing west of the communities of Tippecanoe, Marshall County, downstream to the Pulaski/White County line, southwest of the community of Star City, Indiana. Riparian lands that border the unit include approximately 66 river mi (105.6 km; 89 percent) in private ownership and 9 river mi (14.5 km; 11 percent) in public ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes agriculture and the communities of Tippecanoe, Pershing, and Ora. Unit RH 3 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 19 river mi (29.9 km) of this unit with designated critical habitat for the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit RH 3 include the degradation of habitat and

water quality from impoundments, domestic and industrial pollution due to human development, resource extraction, water withdrawals, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying operations of downstream impoundments to provide additional riverine habitats, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 4: Middle Island Creek

Unit RH 4 partially overlaps with Unit LS 4 for the longsolid, described above. Unit RH 4 consists of 75 stream mi (120.8 km) of the Middle Island Creek in Doddridge, Pleasants, and Tyler Counties, West Virginia, from the Tyler/Doddridge County line northeast of Deep Valley downstream to the confluence with the Ohio River, at St. Mary's, Pleasants County, West Virginia. Riparian lands that border the unit include approximately 74.8 stream mi (120.4 km; 99 percent) in private ownership and 0.2 stream mi (0.4 km; less than 1 percent) in public (Federal and State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes the communities of Smithburg, Avondale, West Union, Alma, and Centerville. Unit RH 4 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit RH 4 include the degradation of habitat and water quality from siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include monitoring hydrofracking wastewater discharges and impoundments downstream on the Ohio River, and implementing efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 5: Little Kanawha River

Unit RH 5 partially overlaps with Unit LS 5 for the longsolid, also described above. Unit RH 5 consists of 110 river mi (176.6 km) of the Little Kanawha River in Calhoun, Gilmer, Ritchie, and Wood Counties, West Virginia, from Burnsville Dam (which is in

neighboring Braxton County) downstream to West Virginia Route 47 at Parkersburg, Wood County, West Virginia. Riparian lands that border the unit include approximately 109 river mi (175.4 km; 99 percent) in private ownership and 0.7 river mi (1.2 km; 1 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. Burnsville Dam is operated by the U.S. Army Corps of Engineers. Unit RH 5 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit RH 5 include the degradation of habitat from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Burnsville Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 6: Elk River

Unit RH 6 is the same as Unit LS 6 for the longsolid, described above. Unit RH 6 consists of 101 river mi (163 km) of the Elk River in Braxton, Clay, and Kanawha Counties, West Virginia, from the Sutton Dam in Braxton County downstream to its confluence with the Kanawha River at Charleston, Kanawha County, West Virginia. Riparian lands that border the unit include approximately 93 river mi (150.3 km; 92 percent) in private ownership and 7 river mi (12.7 km; 8 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. Sutton Dam is operated by the U.S. Army Corps of Engineers. Unit RH 6 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 28 river mi (44.6 km) of this unit with the designated critical habitat for the federally endangered diamond darter (78 FR 52364; August 22, 2013).

Threats identified within Unit RH 6 include the degradation of habitat and

water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Sutton Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 7: Kanawha River

Unit RH 7 partially overlaps with Unit LS 7 for the longsolid, described above. Unit RH 7 consists of 37.5 river mi (60.4 km) of the Kanawha River in Fayette and Kanawha Counties, West Virginia, from Kanawha Falls in Fayette County downstream to its confluence with the Elk River at Charleston, Kanawha County, West Virginia. Riparian lands that border the unit include approximately 33 river mi (53.2 km; 90 percent) in private ownership and 4 river mi (7.2 km; 10 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities. London and Marmet locks and dams within this unit are operated by the U.S. Army Corps of Engineers. Unit RH 7 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit RH 7 include the degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include riparian vegetation re-establishment in addition to restoration efforts along shorelines to minimize sediment and contaminant inputs, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 8: Licking River

Unit RH 8 partially overlaps with Unit LS 8 for the longsolid, described above. Unit RH 8 consists of 150 mi (241.9 km) of the Licking River in Bath, Campbell, Fleming, Harrison, Kenton, Morgan,

Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky, from Cave Run Dam in Bath/Rowan Counties downstream to the Railroad crossing at the Campbell/Kenton/Pendleton County line at De Mossville, northwest of Butler, Pendleton County, Kentucky. Riparian lands that border the unit include approximately 131 river mi (211.8 km; 87 percent) in private ownership and 18 river mi (30 km; 13 percent) in public (Federal, State, and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture industry, and numerous cities and municipalities. Cave Run Dam is operated by the U.S. Army Corps of Engineers. Unit RH 8 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit RH 8 include the degradation of habitat and water quality from impoundments and associated cold water discharges, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include modifying dam releases from Cave Run Dam to mimic the natural hydrograph, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 9: Rockcastle River

Unit RH 9 consists of 15.3 river mi (24.6 km) of the Rockcastle River in Laurel, Pulaski, and Rockcastle Counties, Kentucky, from Kentucky Route 1956 at Billows downstream to Kentucky Route 192, near its confluence with Cane Creek along the Laurel/Pulaski County line, northwest of Baldrock, Laurel County, Kentucky. Riparian lands that border the unit include approximately 0.3 river mi (0.4 km; less than 1 percent) in private ownership and 15 river mi (24.2 km; 99 percent) in public (Federal) ownership. Federal ownership is the Daniel Boone National Forest. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit is predominantly forestry. Unit RH 9 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 15 river mi (23.7 km) of this unit with designated critical habitat for the federally endangered fluted

kidneyshell (78 FR 59556; September 26, 2013).

Threats identified within Unit RH 9 include the degradation of habitat and water quality from siltation and pollution due to improper timbering practices and resource extraction, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include management of Lake Cumberland, located downstream, to provide more riverine habitat upstream, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 10: Buck Creek

Unit RH 10 consists of 36 stream mi (58.1 km) of Buck Creek in Pulaski County, Kentucky, from its confluence with Glade Fork Creek northeast of Goochtown, downstream to its confluence with Whetstone Creek, northeast of Dykes, Pulaski County, Kentucky. Riparian lands that border the unit include approximately 33 stream mi (52.6 km; 92 percent) in private ownership and 3 stream mi (5.5 km; 8 percent) in public (State and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and several small communities. Unit RH 10 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 35 stream mi (56.7 km) with designated critical habitat for the federally endangered Cumberlandian combshell and oyster mussel (69 FR 53136; August 31, 2004), and the federally endangered fluted kidneyshell (78 FR 59556; September 26, 2013).

Threats identified within Unit RH 10 include the degradation of habitat and water quality from instream gravel mining, forest clearing activities, illegal off-road vehicle use, nonpoint source pollution from agriculture, and development activities, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include management of Lake Cumberland, located downstream, to provide more riverine habitat upstream, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 11: Green River

Unit RH 11 partially overlaps with Unit LS 9 for the longsolid, described above. Unit RH 11 consists of 98 river mi (157.7 km) of the Green River in Butler/Warren, Edmonson, Green, and Hart Counties, Kentucky, from the mouth of Lynn Camp Creek east of Linwood in Hart County downstream to its confluence with the Barren River at Woodbury, Warren/Butler Counties, Kentucky. Riparian lands that border the unit include approximately 61 river mi (98.4 km; 62 percent) in private ownership and 37 river mi (59.4 km; 38 percent) in public (Federal and State) ownership; Federal lands include a portion of Mammoth Cave National Park. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, industry, and numerous cities and municipalities, and Green River Lake Dam (located upstream of this unit) is operated by the U.S. Army Corps of Engineers. Unit RH 11 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. The entire 98-river-mi (157.7-km) unit overlaps with designated critical habitat for the federally endangered diamond darter (78 FR 52364; August 22, 2013) and the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit RH 11 include the degradation of habitat and water quality from Green River Lake Dam and associated cold water discharges, siltation and pollution due to improper timbering and agricultural practices, resource extraction, water withdrawals, and development, all of which affect channel stability; wastewater treatment plants; and the presence of invasive, nonnative species. Special management considerations or protection measures may be needed to reduce or alleviate habitat degradation such as channelization and channel instability. Additional special management considerations or protection measures may be needed to address thermal and flow regimes associated with tail water releases from the Green River Lake Dam, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 12: Paint Rock River

Unit RH 12 partially overlaps with Unit LS 12 for the longsolid, described above. Unit RH 12 consists of 48 river mi (77.5 km) of the Paint Rock River in Jackson and Madison/Marshall

Counties, Alabama, from the confluence of Hurricane Creek and Estill Fork in Jackson County, Alabama, downstream to U.S. Route 431, south of New Hope, Madison/Marshall Counties, Alabama. Riparian lands that border the unit include approximately 2 river mi (4.1 km; 2 percent) in private ownership and 46 river mi (73.4 km; 98 percent) in public (Federal and State) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and several small municipalities (Princeton, Hollytree, Trenton, and Paint Rock). Unit RH 12 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. The entire approximately 48-river-mi (77.5-km) unit overlaps with designated critical habitat for the federally endangered slabside pearl mussel (78 FR 59556; September 26, 2013), and the federally threatened rabbitsfoot mussel (80 FR 24692; April 30, 2015).

Threats identified within Unit RH 12 include the degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, resource extraction, water withdrawals, development, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include management of Wheeler Reservoir downstream to provide additional riverine habitat, working with landowners to implement BMPs to reduce erosion and sedimentation associated with agricultural lands, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 13: Duck River

Unit RH 13 consists of 59 river mi (94.8 km) of the Duck River in Bedford, Marshall, and Maury Counties, Tennessee, from its confluence with Sinking Creek in Bedford County, downstream to the mouth of Goose Creek, east of Columbia, Maury County, Tennessee. Riparian lands that border the unit include approximately 27 river mi (43.7 km; 47 percent) in private ownership and 32 river mi (51.1 km; 53 percent) in public (State and local government) ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit includes forestry, agriculture, and several municipalities (Milltown, Leftwich, and Philadelphia). Normandy Dam is operated by the Tennessee

Valley Authority. Unit RH 13 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species. There is overlap of approximately 55 river mi (88.9 km) of this unit with designated critical habitat for the federally endangered slabside pearl mussel and fluted kidneyshell (78 FR 59556; September 26, 2013), and the federally endangered Cumberlandian combshell and oyster mussel (69 FR 53136; August 31, 2004).

Threats identified within Unit RH 13 include the degradation of habitat and water quality from impoundments, siltation and pollution due to improper timbering practices, agricultural activities (livestock), row crop agriculture and channelization, resource extraction, water withdrawals, and wastewater treatment plants, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include seasonally adjusted flow regimes associated with tail water releases from Normandy Dam, working with landowners to implement BMPs to reduce erosion and sedimentation associated with agricultural lands, planting adequate riparian buffers to minimize agriculture impacts, and implementing efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

RH 14: Big Black River

Unit RH 14 consists of 4 river mi (7 km) of the Big Black River in Montgomery County, Mississippi, from its confluence with Poplar Creek in Montgomery County, downstream to its confluence with Lewis Creek, Mississippi. Riparian lands that border the unit are all (100 percent) in private ownership. General land use on adjacent riparian lands and the surrounding HUC 8-level management unit is predominantly agricultural activities. Unit RH 14 is occupied by the species and contains all of the physical or biological features essential to the conservation of the species.

Threats identified within Unit RH 14 include degradation of habitat and water quality from impoundments, siltation and pollution due to improper agricultural activities, row crop agriculture and channelization, and water withdrawals, and the presence of invasive, nonnative species. Special management considerations or protection measures to reduce or alleviate the threats may include working with landowners to implement BMPs to reduce erosion and

sedimentation associated with agricultural lands and water quality degradation, and efforts to prevent the spread of invasive, nonnative species (see Special Management Considerations or Protection, above).

Effects of Critical Habitat Designation

Section 7 Consultation

Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they fund, authorize, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat of such species.

We published a final rule revising the definition of destruction or adverse modification on August 27, 2019 (84 FR 44976). Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency (action agency) must enter into consultation with us. Examples of actions that are subject to the section 7 consultation process are actions on State, Tribal, local, or private lands that require a Federal permit (such as a permit from the U.S. Army Corps of Engineers under section 404 of the Clean Water Act (33 U.S.C. 1251 *et seq.*) or a permit from the Service under section 10 of the Act) or that involve some other Federal action (such as funding from the Federal Highway Administration, Federal Aviation Administration, or the Federal Emergency Management Agency). Federal actions not affecting listed species or critical habitat, and actions on State, Tribal, local, or private lands that are not federally funded, authorized, or carried out by a Federal agency—do not require section 7 consultation.

Compliance with the requirements of section 7(a)(2) is documented through our issuance of:

(1) A concurrence letter for Federal actions that may affect, but are not likely to adversely affect, listed species or critical habitat; or

(2) A biological opinion for Federal actions that may affect, and are likely to adversely affect, listed species or critical habitat.

When we issue a biological opinion concluding that a project is likely to jeopardize the continued existence of a listed species and/or destroy or adversely modify critical habitat, we provide reasonable and prudent

alternatives to the project, if any are identifiable, that would avoid the likelihood of jeopardy and/or destruction or adverse modification of critical habitat. We define “reasonable and prudent alternatives” (at 50 CFR 402.02) as alternative actions identified during consultation that:

(1) Can be implemented in a manner consistent with the intended purpose of the action,

(2) Can be implemented consistent with the scope of the Federal agency’s legal authority and jurisdiction,

(3) Are economically and technologically feasible, and

(4) Would, in the Service Director’s opinion, avoid the likelihood of jeopardizing the continued existence of the listed species and/or avoid the likelihood of destroying or adversely modifying critical habitat.

Reasonable and prudent alternatives can vary from slight project modifications to extensive redesign or relocation of the project. Costs associated with implementing a reasonable and prudent alternative are similarly variable.

Regulations at 50 CFR 402.16 set forth requirements for Federal agencies to reinstate formal consultation on previously reviewed actions. These requirements apply when the Federal agency has retained discretionary involvement or control over the action (or the agency’s discretionary involvement or control is authorized by law) and, subsequent to the previous consultation: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

In such situations, Federal agencies sometimes may need to request reinitiation of consultation with us, but Congress also enacted some exceptions in 2018 to the requirement to reinstate consultation on certain land management plans on the basis of a new species listing or new designation of critical habitat that may be affected by the subject Federal action. See 2018 Consolidated Appropriations Act, Public Law 115–141, Div. O, 132 Stat. 1059 (2018).

Overall, and as stated above under Final Critical Habitat Designation, the

majority of units overlap in part or whole with existing critical habitat designated for other federally endangered aquatic species (*i.e.*, diamond darter, Short’s bladderpod, purple bean, rough rabbitsfoot, Cumberlandian combshell, oyster mussel, slabside pearl mussel, and fluted kidneyshell) or federally threatened aquatic species (*i.e.*, rabbitsfoot, yellowfin madtom, and slender chub). The conservation measures we would recommend for the longsolid and round hickorynut are likely to be the same or very similar to those we already recommend for these other listed aquatic species.

Application of the “Adverse Modification” Standard

The key factor related to the destruction or adverse modification determination is whether implementation of the proposed Federal action directly or indirectly alters the designated critical habitat in a way that appreciably diminishes the value of the critical habitat as a whole for the conservation of the listed species. As discussed above, the role of critical habitat is to support physical or biological features essential to the conservation of a listed species and provide for the conservation of the species.

Section 4(b)(8) of the Act requires us to briefly evaluate and describe, in any proposed or final regulation that designates critical habitat, activities involving a Federal action that may violate section 7(a)(2) of the Act by destroying or adversely modifying such habitat, or that may be affected by such designation.

Activities that we may, during a consultation under section 7(a)(2) of the Act, consider likely to destroy or adversely modify critical habitat include, but are not limited to actions that would: (1) Alter the geomorphology of their stream and river habitats (*e.g.*, instream excavation or dredging, impoundment, channelization, sand and gravel mining, clearing riparian vegetation, and discharge of fill materials); (2) significantly alter the existing flow regime where these species occur (*e.g.*, impoundment, urban development, water diversion, water withdrawal, water draw-down, and hydropower generation); (3) significantly alter water chemistry or water quality (*e.g.*, hydropower discharges, or the release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater at a point source or by dispersed release (nonpoint source)); and (4) significantly alter stream bed

material composition and quality by increasing sediment deposition or filamentous algal growth (*e.g.*, construction projects, gravel and sand mining, oil and gas development, coal mining, livestock grazing, timber harvest, and other watershed and floodplain disturbances that release sediments or nutrients into the water). Consulting agencies and such activities could include, but are not limited to:

(1) U.S. Army Corps of Engineers (channel dredging and maintenance; dam projects including flood control, navigation, hydropower, and water supply; and Clean Water Act permitting including bridge projects and stream restoration activities).

(2) U.S. Department of Agriculture, including the Natural Resources Conservation Service and Farm Service Agency (technical and financial assistance for projects) and the Forest Service (aquatic habitat restoration, fire management plans, fire suppression, fuel reduction treatments, forest plans, and mining permits).

(3) U.S. Department of Energy (renewable and alternative energy projects).

(4) Federal Energy Regulatory Commission (interstate pipeline construction and maintenance, dam relicensing, and hydrokinetics).

(5) U.S. Department of Transportation (highway and bridge construction and maintenance).

(6) U.S. Fish and Wildlife Service (issuance of section 10 permits for enhancement of survival, habitat conservation plans, and safe harbor agreements; Partners for Fish and Wildlife program projects benefiting these species or other listed species; and Wildlife and Sportfish Restoration program sportfish stocking).

(7) Environmental Protection Agency (water quality criteria and permitting).

(8) Tennessee Valley Authority (flood control, navigation, hydropower, and land management for the Tennessee River system).

(9) Office of Surface Mining Reclamation and Enforcement (land resource management plans, mining permits, oil and natural gas permits, abandoned mine land projects, and renewable energy development).

(10) National Park Service (land management plans and permitting).

Exemptions

Application of Section 4(a)(3) of the Act

Section 4(a)(3)(B)(i) of the Act (16 U.S.C. 1533(a)(3)(B)(i)) provides that the Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the

Department of Defense (DoD), or designated for its use, that are subject to an integrated natural resources management plan (INRMP) prepared under section 101 of the Sikes Act Improvement Act of 1997 (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. There are no DoD lands with a completed INRMP within the critical habitat designation.

Consideration of Impacts Under Section 4(b)(2) of the Act

Section 4(b)(2) of the Act states that the Secretary shall designate and make revisions to critical habitat on the basis of the best available scientific data after taking into consideration the economic impact, national security impact, and any other relevant impact of specifying any particular area as critical habitat. The Secretary may exclude an area from critical habitat based on economic impacts, impacts on national security, or any other relevant impacts. Exclusion decisions are governed by the regulations at 50 CFR 424.19 and the Policy Regarding Implementation of Section 4(b)(2) of the Endangered Species Act, 81 FR 7226 (Feb. 11, 2016) (2016 Policy)—both of which were developed jointly with the National Marine Fisheries Service (NMFS). We also refer to a 2008 Department of the Interior Solicitor's opinion entitled "The Secretary's Authority to Exclude Areas from a Critical Habitat Designation under Section 4(b)(2) of the Endangered Species Act" (M–37016). We explain each decision to exclude areas, as well as decisions not to exclude, to demonstrate that the decision is reasonable.

The Secretary may exclude any particular area if she determines that the benefits of such exclusion outweigh the benefits of including such area as part of the critical habitat, unless she determines, based on the best scientific data available, that the failure to designate such area as critical habitat will result in the extinction of the species. In making the determination to exclude a particular area, the statute on its face, as well as the legislative history, are clear that the Secretary has broad discretion regarding which factor(s) to use and how much weight to give to any factor. In this final rule, we are not excluding any areas from critical habitat.

Exclusions Based on Economic Impacts

Section 4(b)(2) of the Act and its implementing regulations require that we consider the economic impact that may result from a designation of critical

habitat. In order to consider economic impacts, we prepared an incremental effects memorandum (IEM) and screening analysis which, together with our narrative and interpretation of effects, we consider our economic analysis of the critical habitat designation and related factors (Service 2020, entire). The analysis, dated March 19, 2020, was made available for public review from September 29, 2020, through December 28, 2020 (Industrial Economics, Inc. 2020, entire). The economic analysis addressed probable economic impacts of critical habitat designation for the longsolid and round hickorynut. Following the close of the comment period, we reviewed and evaluated all information submitted during the comment period that may pertain to our consideration of the probable incremental economic impacts of this critical habitat designation. Additional information relevant to the probable incremental economic impacts of critical habitat designation for the longsolid and round hickorynut is summarized below and available in the screening analysis for the longsolid and round hickorynut (Industrial Economics, Inc. 2020, entire), available at <https://www.regulations.gov>.

Executive Orders (E.O.s) 12866 and 13563 direct Federal agencies to assess the costs and benefits of available regulatory alternatives in quantitative (to the extent feasible) and qualitative terms. Consistent with the E.O. regulatory analysis requirements, our effects analysis under the Act may take into consideration impacts to both directly and indirectly affected entities, where practicable and reasonable. If sufficient data are available, we assess, to the extent practicable, the probable impacts to both directly and indirectly affected entities. As part of our screening analysis, we considered the types of economic activities that are likely to occur within the areas likely affected by the critical habitat designation. In our evaluation of the probable incremental economic impacts that may result from the designation of critical habitat for the longsolid and round hickorynut, first we identified, in the IEM dated February 13, 2020 (Service 2020, entire), probable incremental economic impacts associated with the following categories of activities: instream excavation or dredging; impoundments; channelization; sand and gravel mining; clearing riparian vegetation; discharge of fill materials; urban development; water diversion; water withdrawal; water draw-down; hydropower generation and discharges; release of

chemicals, biological pollutants, or heated effluents into surface water or connected ground water at a point source or by dispersed release (nonpoint); construction projects; oil and gas development; coal mining; livestock grazing; timber harvest; and other watershed or floodplain activities that release sediments or nutrients into the water. We considered each industry or category individually. Additionally, we considered whether their activities have any Federal involvement.

Critical habitat designation generally will not affect activities that do not have any Federal involvement; under the Act, the designation of critical habitat only affects activities conducted, funded, permitted, or authorized by Federal agencies. In areas where the longsolid or round hickorynut are present, Federal agencies are required to consult with the Service under section 7 of the Act on activities they fund, permit, or implement that may affect the species. Consultations to avoid the destruction or adverse modification of critical habitat will be incorporated into the existing consultation process.

In our IEM, we attempted to clarify the distinction between the effects that would result from the species being listed and those attributable to the critical habitat designation (*i.e.*, difference between the jeopardy and adverse modification standards) for the longsolid's and round hickorynut's critical habitat. Because we are designating critical habitat for the longsolid and round hickorynut concurrently with listing the species, it has been our experience that it is more difficult to discern which conservation efforts are attributable to the species' being listed and those which will result solely from the designation of critical habitat; this is particularly difficult where there is no unoccupied critical habitat and, thus, there will be consultations for all areas based on the species' presence in those areas. However, the following specific circumstances in this case help to inform our evaluation: (1) The essential physical or biological features identified for critical habitat are the same features essential for the life requisites of the species, and (2) any actions that would result in sufficient harm or harassment to constitute jeopardy to the longsolid or round hickorynut would also likely adversely affect the essential physical or biological features of critical habitat. The IEM outlines our rationale concerning this limited distinction between baseline conservation efforts and incremental impacts of the designation of critical habitat for this species. This evaluation of the

incremental effects has been used as the basis to evaluate the probable incremental economic impacts of this designation of critical habitat.

The final critical habitat designation for the longsolid includes 12 units, all of which are occupied by the species. Ownership of riparian lands adjacent to the units includes 810 river mi (1,304 km; 74 percent) in private ownership and 305 river mi (491 km; 26 percent) in public (Federal, State, or local government) ownership. The final critical habitat designation for the round hickorynut includes 14 units, all of which are occupied by the species. Ownership of riparian lands adjacent to the units includes 709 river mi (1,141 km; 77 percent) in private ownership and 212 river mi (341 km; 23 percent) in public (Federal, State, or local government) ownership.

Total incremental costs of critical habitat designation for the longsolid and round hickorynut are anticipated to be approximately \$327,000 (2020 dollars) per year for the next 10 years. The costs are reflective of the critical habitat area (*i.e.*, 1,115 river mi (1,794 km) for the longsolid and 921 river mi (1,482 km) for the round hickorynut (some of which overlap each other)), the presence of the species (*i.e.*, occupied) in these areas, and the presence of other federally listed species and designated critical habitats. Since consultation is already required in these areas as a result of the presence of other listed species and critical habitats and will be required as a result of the listing of the longsolid and round hickorynut, the economic costs of the critical habitat designation will likely be primarily limited to additional administrative efforts to consider adverse modification for these two species in section 7 consultations. In total, 159 section 7 consultation actions (approximately 3 formal consultations, 114 informal consultations, and 38 technical assistance efforts) are anticipated to occur annually in designated critical habitat areas. Critical habitat may also trigger additional regulatory changes. For example, the designation may cause other Federal, State, or local permitting or regulatory agencies to expand or change standards or requirements. Regulatory uncertainty generated by critical habitat may also have impacts. For example, landowners or buyers may perceive that the rule restricts land or water use activities in some way and, therefore, value the use of the land less than they would have absent critical habitat.

We solicited data and comments from the public regarding the economic analysis, as well as all aspects of the

September 29, 2020 (85 FR 61384), proposed rule. We did not receive any additional information on economic impacts during the public comment period to determine whether any specific areas should be excluded from the final critical habitat designation under authority of the Act's section 4(b)(2) and our implementing regulations at 50 CFR 424.19.

As discussed above, we considered the economic impacts of the critical habitat designation, the Secretary is not exercising her discretion to exclude any areas from this designation of critical habitat for the longsolid and round hickorynut based on economic impacts.

A copy of the IEM and screening analysis with supporting documents may be obtained by contacting the Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**) or by downloading from the internet at <https://www.regulations.gov>.

Exclusions Based on Impacts on National Security and Homeland Security

In preparing this rule, we determined that there are no lands within the designated critical habitat for the longsolid or round hickorynut that are owned or managed by the DoD or Department of Homeland Security, and, therefore, we anticipate no impact on national security or homeland security. We did not receive any additional information during the public comment period for the proposed designation regarding impacts of the designation on national security or homeland security that would support excluding any specific areas from the final critical habitat designation under authority of section 4(b)(2) and our implementing regulations at 50 CFR 424.19, as well as the 2016 Policy.

Exclusions Based on Other Relevant Impacts

Under section 4(b)(2) of the Act, we consider any other relevant impacts, in addition to economic impacts and impacts on national security as discussed above. To identify other relevant impacts that may affect the exclusion analysis, we consider a number of factors, including whether there are permitted conservation plans covering the species in the area such as HCPs, safe harbor agreements, or candidate conservation agreements with assurances, or whether there are non-permitted conservation agreements and partnerships that would be encouraged by designation of, or exclusion from, critical habitat. In addition, we look at whether Tribal conservation plans or partnerships, Tribal resources, or

government-to-government relationships of the United States with Tribal entities may be affected by the designation. We also consider any State, local, social, or other impacts that might occur because of the designation.

We are not excluding any areas from critical habitat. In preparing this final rule, we have determined that there are currently no HCPs or other management plans for the longsolid and round hickorynut, and the designation does not include any Tribal lands or trust resources. We anticipate no impact on Tribal lands, partnerships, or HCPs from this final critical habitat designation. We did not receive any additional information during the public comment period for the proposed rule regarding other relevant impacts to support excluding any specific areas from the final critical habitat designation under authority of section 4(b)(2) and our implementing regulations at 50 CFR 424.19, as well as the 2016 Policy. Accordingly, the Secretary is not exercising her discretion to exclude any areas from this designation based on other relevant impacts.

Summary of Comments and Recommendations

In the proposed rule published on September 29, 2020 (85 FR 61384), we requested that all interested parties submit written comments on the proposal by December 28, 2020. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. Newspaper notices inviting general public comment were published in the USA Today legal notice section on September 30, 2020. Although we invited requests for a public hearing in the proposed rule, we did not receive any requests for a public hearing. All substantive information received during the comment period has either been incorporated directly into this final determination or is addressed below.

Peer Reviewer Comments

As discussed in Peer Review above, we received comments from three specialists for the longsolid (which informed the SSA report and this final rule), and no responses for the round hickorynut. We reviewed all comments we received from the peer reviewers for substantive issues and new information regarding the information contained in the longsolid's SSA report. The peer reviewers generally concurred with our methods and conclusions, and provided additional information, clarifications, and suggestions to improve the final

SSA report. Peer reviewer comments were incorporated into the SSA report and this final rule as appropriate.

State Agency Comments

We received comments from agencies in six States: Michigan, Ohio, Pennsylvania, West Virginia, North Carolina, and Mississippi.

(1) *Comment:* The Michigan Department of Natural Resources (DNR) requested that we not list the longsolid as an endangered species in the State of Michigan, and that we postpone listing the round hickorynut as an endangered species until additional information concerning their distribution and status is available. Additionally, the Michigan DNR requested we partner with them to conduct additional surveys in Michigan to evaluate the current population status of the round hickorynut due to information gaps for this species in Michigan.

Our Response: The longsolid does not occur in Michigan, nor are there any historical records for the State; therefore, we did not propose to list, and are not listing in this rule, the longsolid within the State of Michigan. We agree that there is limited information available for round hickorynut in Michigan; however, we must make a decision based the best available scientific and commercial information. Accordingly, our analysis of the best available data indicates that the species meets the definition of a threatened species under the Act (see Determination of Status for the Longsolid and Round Hickorynut, above). We support the State conducting additional surveys due to its status as a “State trust species,” and we will continue to coordinate with Michigan DNR to ensure that the best available information is also used for any future conservation actions.

(2) *Comment:* The State of West Virginia recommended that the Kanawha River be included in the discussion of transportation threats regarding barge traffic given it is navigable and subject to barge traffic activity.

Our Response: The Kanawha River is incorporated by reference (*i.e.*, the listed populations in this section of the proposed rule include Taylor (1983b, p. 5)), which is a mussel survey of the Kanawha River. Our intent was that the threat discussion of transportation include all major river basins (HUC 2 level), which includes the Kanawha River, where the longsolid is extant.

(3) *Comment:* The State of West Virginia recommended that Unit RH 4 (Middle Island Creek) include Meathouse Fork, which is a major

tributary of Middle Island Creek. The State indicated that West Virginia DNR surveys have found greater numbers of round hickorynut in Meathouse Fork than in the whole of the Elk River.

Our Response: Meathouse Fork, although occupied by the round hickorynut, was not proposed as critical habitat and is not designated as critical habitat in this rule. We have determined that the “core” population in Middle Island Creek is sufficient to maintain resiliency in the watershed, as it is considered a stronghold population (which was part of the criteria for critical habitat selection). At this time, the Meathouse Fork population exhibits low resiliency and is subject to a high level of threats, such as contaminant spills, as discussed under Threats Analysis, above. We determined it does not contain the physical or biological features essential for the conservation of the species and, therefore, does not meet the definition of critical habitat.

(4) *Comment:* The State of Ohio stated that listing these species will increase their costs for complying with the Act and the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), mainly through increased species surveys, the costs associated with formal consultations (the production of biological assessments), and possible costs associated with project delays due to the length of time to conduct formal consultation versus informal consultation. The State indicated that due to listing the round hickorynut, it will be necessary to conduct two additional survey efforts and two possible formal consultations per year on average. The State asserts these formal consultations will add approximately \$100,000–\$200,000 per year in project costs, potentially increasing the State’s compliance costs by 4 percent per year.

Our Response: The Act requires the Secretary to base listing determinations solely on the best scientific and commercial data available; thus, we cannot factor in possible economic costs into a decision to list a species. However, we acknowledge that listing either species could result in additional costs to the State to comply with the Act, and potentially other laws, given the protections that are afforded listed species. Separately, we are required to consider economic costs for designating critical habitat. As such, the economic analysis for the longsolid and round hickorynut focuses on the incremental impact of the critical habitat designation. The economic analysis conducted for the critical habitat designation uses the rate of past consultations conducted on similar

listed aquatic species that occur within the critical habitat areas to forecast the rate of future section 7 consultations that may occur for the longsolid and round hickorynut (IEc 2020, entire; Service 2020, entire). Critical habitat designation is not anticipated to result in additional conservation efforts being included as part of section 7 consultations beyond what would have already been required absent critical habitat designation.

(5) *Comment:* The State of Ohio commented that although listing round hickorynut is logical, they are concerned and disagree with designating critical habitat in the Grand River through the shipping channel. Further, they stated that the shipping channel portion of the Grand River is regularly dredged to provide access to Lake Erie, and the dredging has resulted in stream channel modifications for marinas and docks.

Our Response: We agree that the Grand River has experienced human-caused modifications over time. However, the Grand River population of round hickorynut is considered one of only two stronghold management units that remain, and the best available information indicates that the shipping channel portion of the river is occupied. Further, because the round hickorynut appears to have adapted to conditions at river outflows and along shorelines of impoundments (*e.g.*, Lake St. Clair), we find it is important at this time that the lower Grand River maintains some level of connectivity with other Lake Erie tributaries, such as the Black River in Ohio, and the Belle, Black, and Pine Rivers in Michigan.

The Grand River Unit (RH 2) is the only critical habitat unit designated for the round hickorynut in the Great Lakes basin. This area was once fully connected to Lake Erie, which allowed connectivity with other river tributary systems. The Grand River population, occurring within this unit, is important because it currently has high resiliency, it contains the only documented recruiting population in the Great Lakes basin, and the round hickorynut occurs throughout the river. Accordingly, we determined this unit contains features that are essential to the conservation of the species and that may require special management considerations or protection and, therefore, that it meets the definition of critical habitat.

(6) *Comment:* The State of Mississippi (Mississippi Forestry Association) requested that we take into consideration the State’s BMP compliance rate for certified forest lands when evaluating information for the

round hickorynut, specifically for SMZs.

The comment states that BMPs are nonregulated, voluntary guidelines for silviculture activities that, when properly applied, will protect water quality from non-point source pollutants while maintaining site productivity. Further, the comment noted that the 2019 BMP Implementation Survey (implemented on a 3-year cycle by the Mississippi Forestry Commission) revealed that 95.3 percent of the applicable BMPs were implemented. The Statewide compliance of the survey was determined to be 95 percent at the 95 percent confidence level. The comment asserts that the SMZs benefit the mussels by protecting water quality through filtering nutrients and trapping sediments, regulating water temperature, and acting as a protective barrier around the body of water to limit activity near the channel.

Our Response: We did take into consideration the Mississippi BMP compliance rate in SMZs. However, only one population of round hickorynut occurs within Mississippi, and it is currently in low condition. The Mississippi BMPs are nonregulated, voluntary guidelines for silviculture activities. We recognize the high compliance rates of BMPs on State-certified forest lands and we have incorporated an exception under the section 4(d) rule for silvicultural activities that implement state-approved BMPs.

(7) *Comment:* The State of Mississippi (Mississippi Forestry Association) stated that they interpret the critical habitat designation to include the river channel, and they requested clarification that the lands adjacent to the stream bank are not included in the critical habitat designation.

Our Response: The State of Mississippi's interpretation is correct. Lands adjacent to the stream bank are not included in the critical habitat designation, although certain activities on lands adjacent to occupied streams can influence the resource needs of the listed species that occurs within the river (e.g., increased sediments from activities on adjacent lands could reduce water quality).

Public Comments—Economics

(8) *Comment:* One commenter stated that the benefits of excluding the proposed areas in Kentucky from the critical habitat designations due to economic impact far outweigh the benefits of their inclusion. With over 2,000 river miles across 9 States, and an extensive list of industries and activities

impacted by the proposed critical habitat designations, the commenter asserted that the anticipated \$327,000 in annual costs outlined in the economic analysis does not fully capture the economic hardship placed on the surrounding communities.

Our Response: These comments do not identify specific data sources or assumptions used in the economic analysis of critical habitat designation, nor did the commenter provide new information that could be used to revise our economic analysis. We find our economic analysis presents a reasonable estimate of the incremental impact (the cost beyond what would be incurred without the designation of critical habitat for longsolid and round hickorynut). Our economic analysis focuses on the incremental impact of the critical habitat designation because the statutory purposes of the economic analysis are to inform the mandatory consideration of the economic impact of the designation of critical habitat, as well as to inform the discretionary section 4(b)(2) exclusion analysis, and to determine compliance with relevant statutes and Executive Orders.

(9) *Comment:* Multiple commenters expressed concern about impacts of the proposed rule on tourism and recreation; however, many commenters focused on impacts associated with the proposed listing rule as compared to impacts associated with the proposed 4(d) rule or critical habitat designation. These commenters described the importance of tourism to the local economies, particularly in the following Kentucky counties: Rockcastle, Laurel (county seat is London), and Taylor. Some commenters stated that they oppose any action that would limit the current or future levels of fishing, boating, hiking, or other recreational activities, including impacts to the lands adjoining the affected rivers. One commenter stated that the proposed rule would negatively impact the economy of this area to the point of halting the growth and development of a community.

Our Response: The Act requires the Secretary to base listing determinations solely on the best scientific and commercial data available; thus, we cannot factor possible economic costs to tourism or other industries into a decision to list a species. Although we acknowledge that listing either species could result in additional costs given the protections afforded to listed species, we do not anticipate these protections as affecting current or future levels of fishing, boating, hiking, or other recreational activities. Separately, we are required to consider economic

costs for designating critical habitat. Our economic analysis of critical habitat designation does not anticipate that the designation will result in additional conservation efforts that would not already occur due to the listing of longsolid and round hickorynut or presence of other listed species in critical habitat areas. As such, the critical habitat designation for the longsolid and round hickorynut is not anticipated to result in additional restrictions or requirements for recreation and tourism activities, beyond those already anticipated to occur absent of this critical habitat designation.

(10) *Comment:* Several commenters expressed concern that the proposed rule would adversely affect local farmers and livestock producers; many commenters were focused on impacts associated with listing the species. Commenters expressed concern that the proposed rule would cause a loss of farming revenue, which would have broad adverse effects on their communities. One commenter expressed concern that the proposed rule may halt agricultural operations.

Our Response: It is our statutory requirement to ensure that listing decisions are based solely on biological considerations and not economic impacts; thus, costs from listing the longsolid or the round hickorynut cannot be factored into the listing decisions. Because the primary purpose of the economic analysis is to facilitate the mandatory consideration of the economic impact of the designation of critical habitat, to inform the discretionary section 4(b)(2) exclusion analysis, and to determine compliance with relevant statutes and Executive Orders, the economic analysis focused on the incremental impact of the critical habitat designation. The economic analysis of the designation of critical habitat for the longsolid and round hickorynut follows this incremental approach. See also our responses to *Comments (8) and (9)*, above.

We recognize in the economic analysis that critical habitat designation may cause landowners to perceive that private lands (including farming, agricultural, or livestock operations) will be subject to use restrictions or litigation from third parties, resulting in costs. However, we are unable to quantify the degree to which the public's perception of possible restrictions on the use of private land designated as critical habitat may affect private property values. Further, we recognize that a number of factors may already result in perception-related effects on these private lands, including

the listing of the species and the presence of other listed species and critical habitats in these areas, which may temper any additional perception-related effects of this critical habitat designation.

(11) Comment: One commenter expressed concern that the economic analysis does not sufficiently address the potential benefits of the designation of critical habitat. Specifically, the commenter requests that we take into consideration the economic benefits of protecting habitat for these mussels, including ecosystem services, the protection of clean water, the reduced cost of water treatment for drinking water supplies, as well as public health benefits.

Our Response: The primary intended benefit of critical habitat designation for the longsolid and round hickorynut is to support the species' long-term conservation. Generally speaking, critical habitat designation could also generate ancillary benefits such as improved drinking water quality or public health benefits. However, as described in section 3 of the economic analysis (Industrial Economics, Inc. 2020, pp. 7–9), incremental land or water management changes are unlikely to result from the designation of critical habitat for the longsolid and round hickorynut. Similarly, no additional project modifications to avoid adverse modification of critical habitat for the longsolid or round hickorynut mussels are anticipated. Therefore, in this instance, critical habitat designation is unlikely to incrementally affect the types of ancillary benefits described by the commenter.

Public Comments—Forestry

(12) Comment: One commenter asserted that the information in the proposed rule and the SSA report would lead the casual reader to think that “forest clearing” is the same as “silviculture,” and that these two activities are the leading threats to the species, which is not the case.

Our Response: We agree that forest clearing and silviculture are not synonymous and note that the latter is not a primary threat to the longsolid or round hickorynut. For clarity, “forest clearing” is the removal of forested habitats through tree removal to facilitate a different land use, thereby altering ecosystem function. Silvicultural practices control the growth, composition, structure, and quality of forests at the stand-level to meet values and needs, specifically timber production; however, they do not alter land use. The SSA reports have been revised to clarify this distinction.

Please see more discussion and revised language regarding silviculture under *Forest Conversion* in Threats Analysis, above.

(13) Comment: Multiple commenters asserted that forestry BMPs are implemented at high rates nationally and in some States where one or both species occur, and thus requested an exception in the 4(d) rule for forestry activities.

Our Response: We recognize that silvicultural operations are widely implemented in accordance with State-approved best management practices (BMPs; as reviewed by Cristan et al. 2016, entire), and the adherence to these BMPs broadly protects water quality, particularly related to sedimentation (as reviewed by Cristan et al. 2016, entire; Warrington et al. 2017, entire; and Schilling et al. 2021, entire). We added that statement under *Forest Conversion* in Threats Analysis, above. In addition, we agree that the best available science indicates that proper implementation of forestry BMPs reduces negative effects on water quality outcomes compared to historical silvicultural practices or those that do not apply or properly implement BMPs. Given BMPs generally are implemented at high rates, we added an exception to incidental take in the section 4(d) rule resulting from forestry activities that follow state approved forest management BMPs (see II. Final Rule Issued Under Section 4(d) of the Act, above).

(14) Comment: One commenter stated that forest certification programs provide assurance that BMPs are implemented in the ranges of both species and requested the addition of an exception in the 4(d) rule for State-certified forestry programs.

Our Response: We acknowledge and support the continued implementation of the forest certification programs and their State-approved BMPs. Given that we added an exception to incidental take in the section 4(d) rule resulting from forestry activities that follow state approved forest management BMPs and all State-certified forestry programs implement these BMPs at high rates, an additional exception specifically targeting State-certified forestry programs would be redundant. We also note that most longsolid and round hickorynut populations occurring on forest lands are within U.S. National Forests (e.g., Allegheny, Daniel Boone, George Washington and Jefferson, and Wayne National Forests), which are subject to section 7 consultation even with the incidental take exception resulting from forestry and silviculture activities.

(15) Comment: One commenter stated that take resulting from silviculture activities should not be included in a 4(d) rule for the longsolid because of the limited scope of this species' potential nexus with silviculture activities; another commenter encouraged the Service to recognize the positive role of responsible forest management and to articulate this in the final rule. As such, the commenter recommended adding an exception to the 4(d) rule for silvicultural practices and forest management activities that implement State-approved BMPs.

Our Response: To the extent silvicultural practices are implemented in a manner that follows State-approved BMPs, we agree with the commenter that there is limited potential for the longsolid to be exposed to silvicultural activities. We recognize responsible forest management that implements State-approved BMPs as a land use activity that can promote stable riparian vegetation and aquatic habitats. The 4(d) rule is intended to provide exceptions for proactive conservation efforts, such as population and habitat restoration and protection. Therefore, in the 4(d) rule for longsolid and round hickorynut, we have added an exception for incidental take resulting from forestry activities that follow State-approved forest management BMPs.

Public Comments—Miscellaneous

(16) Comment: Several commenters claimed that the proposed critical habitat designations are insufficient. Generally, the commenters contend that the current occupied habitat does not provide enough space for the populations to recover and that unoccupied habitat should be included in the critical habitat designation in anticipation of the species' restoration or population expansion. One commenter requested designation of unoccupied habitat in the Cumberland, Ohio, and Tennessee River basins for both species, while a different commenter also included the Great Lakes and Lower Mississippi River basins specifically for the round hickorynut.

Our Response: Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific

and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical or biological features within an area, we focus on the specific features that support the life-history needs of the species, including but not limited to, water characteristics, soil type, geological features, prey, vegetation, symbiotic species, or other features.

We determine whether unoccupied areas are essential for the conservation of the species by considering the life-history, status, and conservation needs of the species. This determination is further informed by any generalized conservation strategy, criteria, or outline that may have been developed for the species to provide a substantive foundation for identifying which features and specific areas are essential to the conservation of the species and, as a result, the development of the critical habitat designation.

We are not proposing to designate as critical habitat any areas outside the geographical area currently occupied by the species because we determined that occupied areas are sufficient to conserve the longsolid and round hickorynut. For the longsolid, in total, we are designating approximately 1,115 river mi (1,794 river km) within 12 units of critical habitat; and for the round hickorynut, in total, we are designating approximately 921 river mi (1,482 river km) within 14 units of critical habitat. The critical habitat designation focuses on current strongholds and those populations with sufficient resiliency in determining the features that are essential for the conservation of the species (see *Criteria Used to Identify Critical Habitat*, above). These rivers and streams (identified as critical habitat for the longsolid and round hickorynut) contain populations that are large and dense enough, that are most likely to be self-sustaining over time (despite fluctuations in local conditions), and that also have retained the physical or biological features that will allow for the maintenance and expansion of existing populations. These units also represent populations that are stable and distributed over a wide geographic area. We recognize that habitat is dynamic, and species may move from one area to another over time. Thus, critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may

not be needed eventually for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act; (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species; and (3) the prohibitions found in section 9 of the Act.

Required Determinations

Regulatory Planning and Review (Executive Orders 12866 and 13563)

Executive Order 12866 provides that the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget will review all significant rules. OIRA has determined that this rule is not significant.

Executive Order 13563 reaffirms the principles of E.O. 12866 while calling for improvements in the nation's regulatory system to promote predictability, to reduce uncertainty, and to use the best, most innovative, and least burdensome tools for achieving regulatory ends. The executive order directs agencies to consider regulatory approaches that reduce burdens and maintain flexibility and freedom of choice for the public where these approaches are relevant, feasible, and consistent with regulatory objectives. E.O. 13563 emphasizes further that regulations must be based on the best available science and that the rulemaking process must allow for public participation and an open exchange of ideas. We have developed this final rule in a manner consistent with these requirements.

Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*)

Under the Regulatory Flexibility Act (RFA; 5 U.S.C. 601 *et seq.*), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA; 5 U.S.C. 801 *et seq.*), whenever an agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effects of the rule on small entities (*i.e.*, small businesses, small organizations, and small government jurisdictions). However, no regulatory flexibility analysis is required if the head of the agency certifies the rule will not have a significant economic impact on a substantial number of small

entities. The SBREFA amended the RFA to require Federal agencies to provide a certification statement of the factual basis for certifying that the rule will not have a significant economic impact on a substantial number of small entities.

According to the Small Business Administration, small entities include small organizations such as independent nonprofit organizations; small governmental jurisdictions, including school boards and city and town governments that serve fewer than 50,000 residents; and small businesses (13 CFR 121.201). Small businesses include manufacturing and mining concerns with fewer than 500 employees, wholesale trade entities with fewer than 100 employees, retail and service businesses with less than \$5 million in annual sales, general and heavy construction businesses with less than \$27.5 million in annual business, special trade contractors doing less than \$11.5 million in annual business, and agricultural businesses with annual sales less than \$750,000. To determine if potential economic impacts to these small entities are significant, we considered the types of activities that might trigger regulatory impacts under this designation as well as types of project modifications that may result. In general, the term "significant economic impact" is meant to apply to a typical small business firm's business operations.

Under the RFA, as amended, and following recent court decisions, Federal agencies are required to evaluate the potential incremental impacts of rulemaking on those entities directly regulated by the rulemaking itself; in other words, the RFA does not require agencies to evaluate the potential impacts to indirectly regulated entities. The regulatory mechanism through which critical habitat protections are realized is section 7 of the Act, which requires Federal agencies, in consultation with the Service, to ensure that any action authorized, funded, or carried out by the agency is not likely to destroy or adversely modify critical habitat. Therefore, under section 7, only Federal action agencies are directly subject to the specific regulatory requirement (avoiding destruction and adverse modification) imposed by critical habitat designation. Consequently, it is our position that only Federal action agencies will be directly regulated by this critical habitat designation. There is no requirement under the RFA to evaluate the potential impacts to entities not directly regulated. Moreover, Federal agencies are not small entities. Therefore, because no small entities will

be directly regulated by this rulemaking, we certify that this critical habitat designation will not have a significant economic impact on a substantial number of small entities.

During the development of this final rule, we reviewed and evaluated all information submitted during the comment period on the September 29, 2020, proposed rule (85 FR 61384) that may pertain to our consideration of the probable incremental economic impacts of this critical habitat designation. Based on this information, we affirm our certification that this critical habitat designation will not have a significant economic impact on a substantial number of small entities, and a regulatory flexibility analysis is not required.

Energy Supply, Distribution, or Use—Executive Order 13211

Executive Order 13211 (Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use) requires agencies to prepare Statements of Energy Effects when undertaking certain actions. Facilities that provide energy supply, distribution, or use occur within some units of the critical habitat designations (e.g., dams, pipelines) and may potentially be affected. We determined that consultations, technical assistance, and requests for species lists may be necessary in some instances. However, in our economic analysis, we did not find that these critical habitat designations would significantly affect energy supplies, distribution, or use. Therefore, this action is not a significant energy action, and no Statement of Energy Effects is required.

Unfunded Mandates Reform Act (2 U.S.C. 1501 et seq.)

In accordance with the Unfunded Mandates Reform Act (2 U.S.C. 1501 et seq.), we make the following findings:

(1) This rule will not produce a Federal mandate. In general, a Federal mandate is a provision in legislation, statute, or regulation that would impose an enforceable duty upon State, local, or Tribal governments, or the private sector, and includes both “Federal intergovernmental mandates” and “Federal private sector mandates.” These terms are defined in 2 U.S.C. 658(5)–(7). “Federal intergovernmental mandate” includes a regulation that “would impose an enforceable duty upon State, local, or Tribal governments” with two exceptions. It excludes “a condition of Federal assistance.” It also excludes “a duty arising from participation in a voluntary Federal program,” unless the regulation

“relates to a then-existing Federal program under which \$500,000,000 or more is provided annually to State, local, and Tribal governments under entitlement authority,” if the provision would “increase the stringency of conditions of assistance” or “place caps upon, or otherwise decrease, the Federal Government’s responsibility to provide funding,” and the State, local, or Tribal governments “lack authority” to adjust accordingly. At the time of enactment, these entitlement programs were: Medicaid; Aid to Families with Dependent Children work programs; Child Nutrition; Food Stamps; Social Services Block Grants; Vocational Rehabilitation State Grants; Foster Care, Adoption Assistance, and Independent Living; Family Support Welfare Services; and Child Support Enforcement. “Federal private sector mandate” includes a regulation that “would impose an enforceable duty upon the private sector, except (i) a condition of Federal assistance or (ii) a duty arising from participation in a voluntary Federal program.”

The designation of critical habitat does not impose a legally binding duty on non-Federal Government entities or private parties. Under the Act, the only regulatory effect is that Federal agencies must ensure that their actions are not likely to destroy or adversely modify critical habitat under section 7. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, may be indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency. Furthermore, to the extent that non-Federal entities are indirectly impacted because they receive Federal assistance or participate in a voluntary Federal aid program, the Unfunded Mandates Reform Act would not apply, nor would critical habitat shift the costs of the large entitlement programs listed above onto State governments.

(2) We do not believe that this rule will significantly or uniquely affect small governments because it will not produce a Federal mandate of \$100 million or greater in any year, that is, it is not a “significant regulatory action” under the Unfunded Mandates Reform Act. The designation of critical habitat for the longsolid and round hickorynut imposes no obligations on State or local governments. Therefore, a Small Government Agency Plan is not required.

Takings—Executive Order 12630

In accordance with E.O. 12630 (Government Actions and Interference with Constitutionally Protected Private Property Rights), we have analyzed the potential takings implications of designating critical habitat for the longsolid and round hickorynut in a takings implications assessment. The Act does not authorize us to regulate private actions on private lands or confiscate private property as a result of critical habitat designation. Designation of critical habitat does not affect land ownership, or establish any closures, or restrictions on use of or access to the designated areas. Furthermore, the designation of critical habitat does not affect landowner actions that do not require Federal funding or permits, nor does it preclude development of habitat conservation programs or issuance of incidental take permits to permit actions that do require Federal funding or permits to go forward. However, Federal agencies are prohibited from carrying out, funding, or authorizing actions that would destroy or adversely modify critical habitat. A takings implications assessment has been completed and concludes that this designation of critical habitat for the longsolid and round hickorynut does not pose significant takings implications for lands within or affected by the designation.

Federalism—Executive Order 13132

In accordance with E.O. 13132 (Federalism), this rule does not have significant Federalism effects. A federalism summary impact statement is not required. In keeping with Department of the Interior and Department of Commerce policy, we requested information from, and coordinated development of these critical habitat designations with, appropriate State resource agencies. From a federalism perspective, the designation of critical habitat directly affects only the responsibilities of Federal agencies. The Act imposes no other duties with respect to critical habitat, either for States and local governments, or for anyone else. As a result, this final rule does not have substantial direct effects either on the States, or on the relationship between the national government and the States, or on the distribution of powers and responsibilities among the various levels of government. The designations may have some benefit to these governments because the areas that contain the features essential to the conservation of the species are more clearly defined, and the physical or

biological features of the habitat necessary for the conservation of the species are specifically identified. This information does not alter where and what federally sponsored activities may occur. However, it may assist State and local governments in long-range planning because they no longer have to wait for case-by-case section 7 consultations to occur.

Where State and local governments require approval or authorization from a Federal agency for actions that may affect critical habitat, consultation under section 7(a)(2) of the Act will be required. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, may be indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency.

Civil Justice Reform—Executive Order 12988

In accordance with Executive Order 12988 (Civil Justice Reform), the Office of the Solicitor has determined that the rule will not unduly burden the judicial system and that it meets the requirements of sections 3(a) and 3(b)(2) of the Order. We are designating critical habitat in accordance with the provisions of the Act. To assist the public in understanding the habitat needs of the species, this final rule identifies the physical or biological features essential to the conservation of the species. The designated areas of critical habitat are presented on maps, and the rule provides several options for the interested public to obtain more detailed location information, if desired.

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.)

This rule does not contain information collection requirements, and a submission to the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.) is not required. We may not conduct or sponsor and you

are not required to respond to a collection of information unless it displays a currently valid OMB control number.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

Regulations adopted pursuant to section 4(a) of the Act are exempt from the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 et seq.) and do not require an environmental analyses under NEPA. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). This includes listing, delisting, and reclassification rules, as well as critical habitat designations and species-specific protective regulations promulgated concurrently with a decision to list or reclassify a species as threatened. The courts have upheld this position (e.g., *Douglas County v. Babbitt*, 48 F.3d 1495 (9th Cir. 1995) (critical habitat); *Center for Biological Diversity v. U.S. Fish and Wildlife Service*, 2005 WL 2000928 (N.D. Cal. Aug. 19, 2005) (concurrent 4(d) rule)).

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized federally recognized Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with Tribes in developing programs for healthy ecosystems, to acknowledge that Tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and

to make information available to Tribes. We have determined that no Tribal lands fall within the boundaries of the final critical habitat for the longsolid and round hickorynut, so no Tribal lands would be affected by the designations.

References Cited

A complete list of references cited in this rulemaking is available on the internet at <https://www.regulations.gov> and upon request from the Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this final rule are the staff members of the U.S. Fish and Wildlife Service's Species Assessment Team and the Service's Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation, Wildlife.

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

■ 1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

■ 2. Amend § 17.11(h) by adding entries for “Hickorynut, round” and “Longsolid” to the List of Endangered and Threatened Wildlife in alphabetical order under CLAMS to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
*	*	*	*	*
Clams				
*	*	*	*	*
Hickorynut, round	<i>Obovaria subrotunda</i>	Wherever found	T	88 FR [Insert Federal Register page where the document begins], March 9, 2023; 50 CFR 17.45(d); ^{4d} 50 CFR 17.95(f). ^{CH}

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
* * * * *	* * * * *	* * * * *	* * * * *	* * * * *
Longsolid	<i>Fusconaia subrotunda</i>	Wherever found	T	88 FR [Insert Federal Register page where the document begins], March 9, 2023; 50 CFR 17.45(d); ^{4d} 50 CFR 17.95(f). ^{CH}
* * * * *	* * * * *	* * * * *	* * * * *	* * * * *

■ 3. Amend § 17.45 by adding paragraphs (c) and (d) to read as set forth below:

§ 17.45 Special rules—snails and clams.

(c) [Reserved]

(d) Longsolid (*Fusconaia subrotunda*) and round hickorynut (*Obovaria subrotunda*).

(1) *Prohibitions.* The following prohibitions that apply to endangered wildlife also apply to the longsolid and round hickorynut. Except as provided under paragraph (d)(2) of this section and §§ 17.4 and 17.5, it is unlawful for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit, or cause to be committed, any of the following acts in regard to these species:

(i) Import or export, as set forth at § 17.21(b) for endangered wildlife.

(ii) Take, as set forth at § 17.21(c)(1) for endangered wildlife.

(iii) Possession and other acts with unlawfully taken specimens, as set forth at § 17.21(d)(1) for endangered wildlife.

(iv) Interstate or foreign commerce in the course of commercial activity, as set forth at § 17.21(e) for endangered wildlife.

(v) Sale or offer for sale, as set forth at § 17.21(f) for endangered wildlife.

(2) *Exceptions from prohibitions.* In regard to these species, you may:

(i) Conduct activities as authorized by a permit under § 17.32.

(ii) Take, as set forth at § 17.21(c)(2) through (c)(4) for endangered wildlife.

(iii) Take, as set forth at § 17.31(b).

(iv) Take incidental to an otherwise lawful activity caused by:

(A) Conservation and restoration efforts for listed species conducted by State wildlife agencies, including, but not limited to, population monitoring, relocation, and collection of broodstock; tissue collection for genetic analysis; captive propagation; and subsequent stocking into currently occupied and unoccupied areas within the historical range of the species.

(B) Channel and bank restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers. These projects can be

accomplished using a variety of methods, but the desired outcome is a natural channel with low shear stress (force of water moving against the channel); bank heights that enable reconnection to the floodplain; a reconnection of surface and groundwater systems, resulting in perennial flows in the channel; riffles and pools composed of existing soil, rock, and wood instead of large imported materials; low compaction of soils within adjacent riparian areas; and inclusion of riparian wetlands.

(C) Bank stabilization projects that use bioengineering methods to replace pre-existing, bare, eroding stream banks with vegetated, stable stream banks, thereby reducing bank erosion and instream sedimentation and improving habitat conditions for the species. Following these bioengineering methods, stream banks may be stabilized using native species live stakes (live, vegetative cuttings inserted or tamped into the ground in a manner that allows the stake to take root and grow), native species live fascines (live branch cuttings, usually willows, bound together into long, cigar-shaped bundles), or native species brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). Native species vegetation includes woody and herbaceous species appropriate for the region and habitat conditions. These methods will not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion structures. Prior to channel restoration and bank stabilization actions, surveys conducted in coordination with the appropriate Service field office to determine presence of longsolid and round hickorynut must be performed, and if located, relocation prior to project implementation may be necessary, with post-implementation monitoring. To qualify under this exemption, channel restoration and bank stabilization actions must satisfy all Federal, State, and local permitting requirements.

(D) Forest management activities that implement State-approved best management practices.

(v) Possess and engage in other acts with unlawfully taken wildlife, as set

forth at § 17.21(d)(2) for endangered wildlife.

■ 4. Amend § 17.95(f) by adding, immediately following the entry for “Carolina Heelsplitter (*Lasmigona decorata*),” entries for “Round Hickorynut (*Obovaria subrotunda*)” and “Longsolid (*Fusconaia subrotunda*)” to read as follows:

§ 17.95 Critical habitat—fish and wildlife.

(f) *Clams and Snails.*

Round Hickorynut (*Obovaria subrotunda*)

(1) Critical habitat units for the round hickorynut are depicted on the maps in this entry for Jackson, Madison, and Marshall Counties, Alabama; Fulton, Marshall, Pulaski, and Starke Counties, Indiana; Bath, Butler, Campbell, Edmonson, Fleming, Green, Harrison, Hart, Kenton, Laurel, Morgan, Nicholas, Pendleton, Pulaski, Rockcastle, Robertson, Rowan, and Warren Counties, Kentucky; Montgomery County, Mississippi; Bedford, Marshall, and Maury Counties, Tennessee; Ashtabula, Lake, and Trumbull Counties, Ohio; Crawford and Mercer Counties, Pennsylvania; and Braxton, Calhoun, Clay, Doddridge, Fayette, Gilmer, Kanawha, Pleasants, Ritchie, Tyler, and Wood Counties, West Virginia.

(2) Within these areas, the physical or biological features essential to the conservation of the round hickorynut consist of the following components:

(i) Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species is found and to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussel’s and fish host’s habitat and food availability, maintenance of spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats. Adequate flows ensure delivery of oxygen, enable reproduction, deliver food to filter-feeding mussels, and

reduce contaminants and fine sediments from interstitial spaces. Stream velocity is not static over time, and variations may be attributed to seasonal changes (with higher flows in winter/spring and lower flows in summer/fall), extreme weather events (*e.g.*, drought or floods), or anthropogenic influence (*e.g.*, flow regulation via impoundments).

(ii) Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (*i.e.*, channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffle-run-pool habitats that provide flow refuges consisting of predominantly silt-free, stable sand, gravel, and cobble substrates).

(iii) Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to): Dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °F (°F)

(30 °Celsius (°C)). Additionally, water and sediment should be low in ammonia (generally below 0.5 ppm total ammonia-nitrogen) and heavy metal concentrations, and lack excessive total suspended solids and other pollutants.

(iv) The presence and abundance of fish hosts necessary for recruitment of the round hickorynut (*i.e.*, eastern sand darter (*Ammocrypta pellucida*), emerald darter (*Etheostoma baileyi*), greenside darter (*E. blennioides*), Iowa darter (*E. exile*), fantail darter (*E. flabellare*), Cumberland darter (*E. susanae*), spangled darter (*E. obama*), variegate darter (*E. variatum*), blackside darter (*Percina maculata*), frecklebelly darter (*P. stictogaster*), and banded sculpin (*Cottus caroliniae*)).

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on April 10, 2023.

(4) Data layers defining map units were created by overlaying Natural Heritage Element Occurrence data and U.S. Geological Survey hydrologic data for stream reaches. The hydrologic data used in the critical habitat maps were extracted from the U.S. Geological

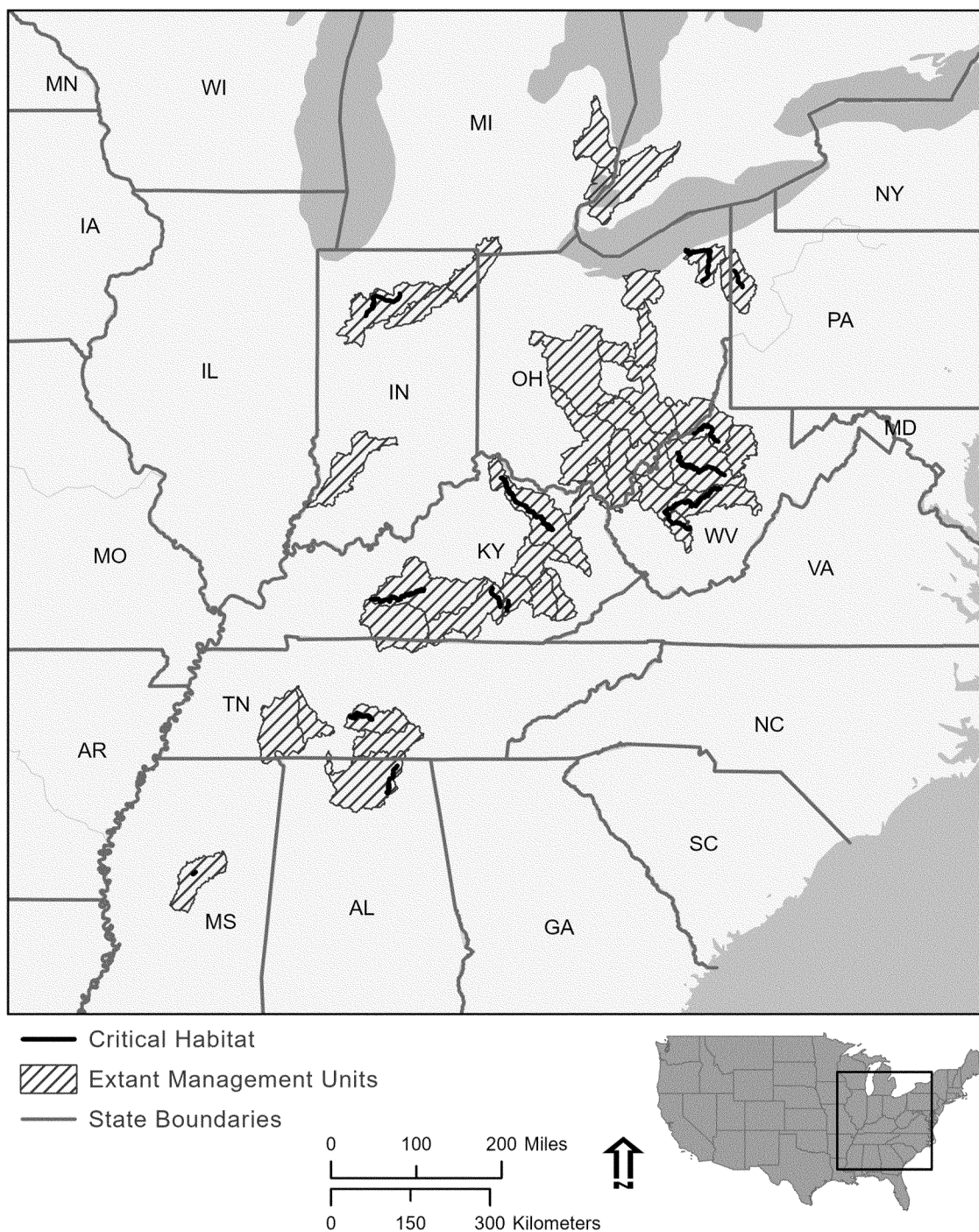
Survey 1:1M scale nationwide hydrologic layer (<https://www.usgs.gov/core-science-systems/ngp/national-hydrography>) with a projection of EPSG:4269—NAD83 Geographic. Natural Heritage program and State mussel database species presence data from Pennsylvania, Ohio, Indiana, West Virginia, Kentucky, Tennessee, Alabama, and Mississippi were used to select specific river and stream segments for inclusion in the critical habitat layer. The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at the Service's internet site at <https://www.regulations.gov> at Docket No. FWS-R4-ES-2020-0010, and at the field office responsible for this designation. You may obtain field office location information by contacting one of the Service regional offices, the addresses of which are listed at 50 CFR 2.2.

(5) Index map for the round hickorynut follows:

Figure 1 to Round Hickorynut (*Obovaria subrotunda*) paragraph (5)

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Round Hickorynut Extant Management Units and Critical Habitat



(6) Unit RH 1: Shenango River; Crawford and Mercer Counties, Pennsylvania.

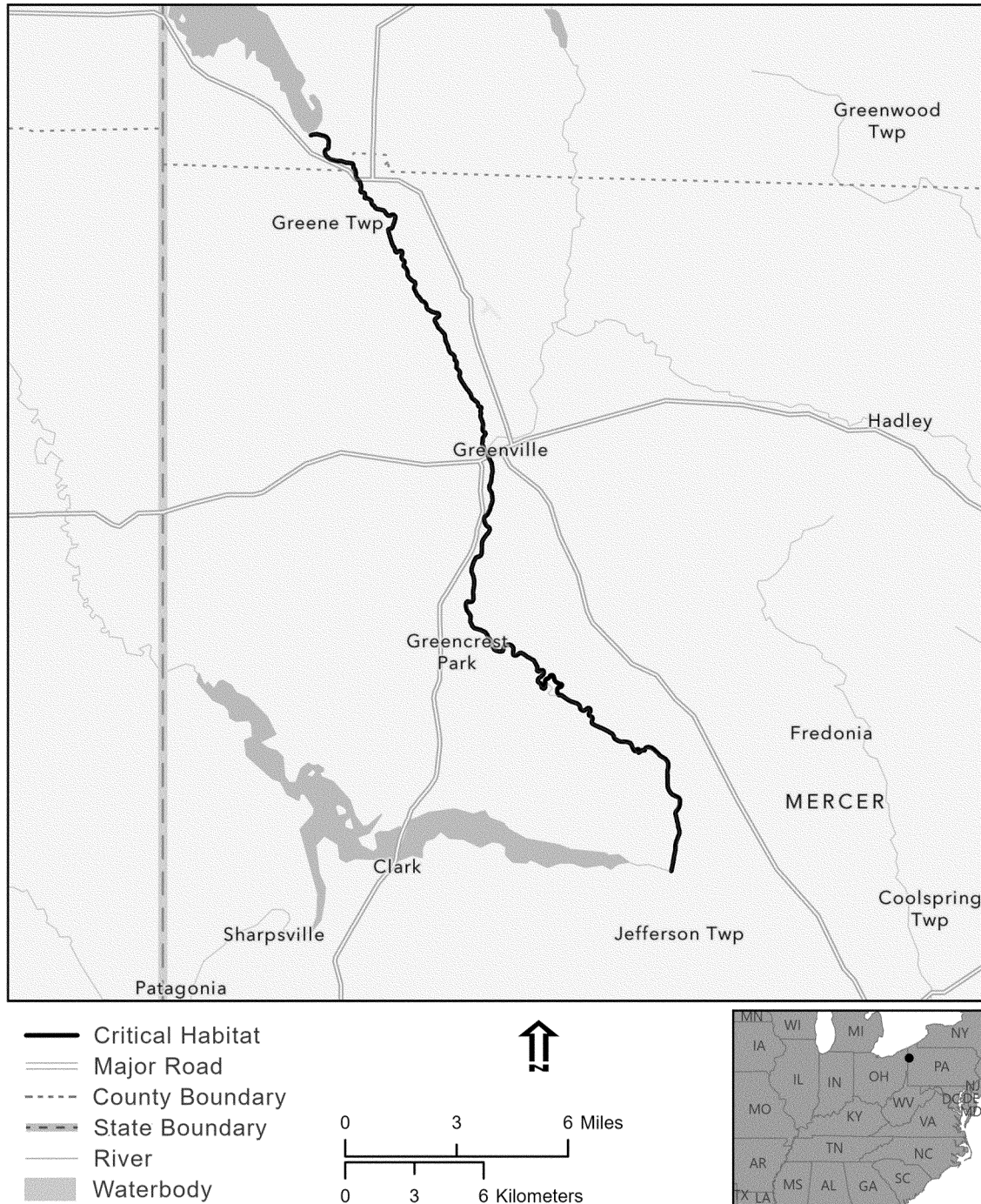
(i) Unit RH 1 consists of 22 river miles (mi) (35.5 kilometers (km)) of the Shenango River in Crawford County, Pennsylvania, from Pymatuning Dam

downstream to the point of inundation by Shenango River Lake near Big Bend, Mercer County, Pennsylvania. Approximately 15 river mi (24.3 km; 68 percent) of riparian lands that border the unit are private ownership, and 7 river mi (11.1 km; 32 percent) are public

(Federal or State) ownership. This unit is immediately downstream from Pymatuning Dam, which is owned by the State of Pennsylvania.

(ii) Map of Unit RH 1 follows: Figure 2 to Round Hickorynut (*Obovaria subrotunda*) paragraph (6)(ii)

Critical Habitat for Round Hickorynut
RH1 Shenango River; Crawford and Mercer Counties, Pennsylvania



(7) Unit RH 2: Grand River; Ashtabula, Lake, and Trumbull Counties, Ohio.

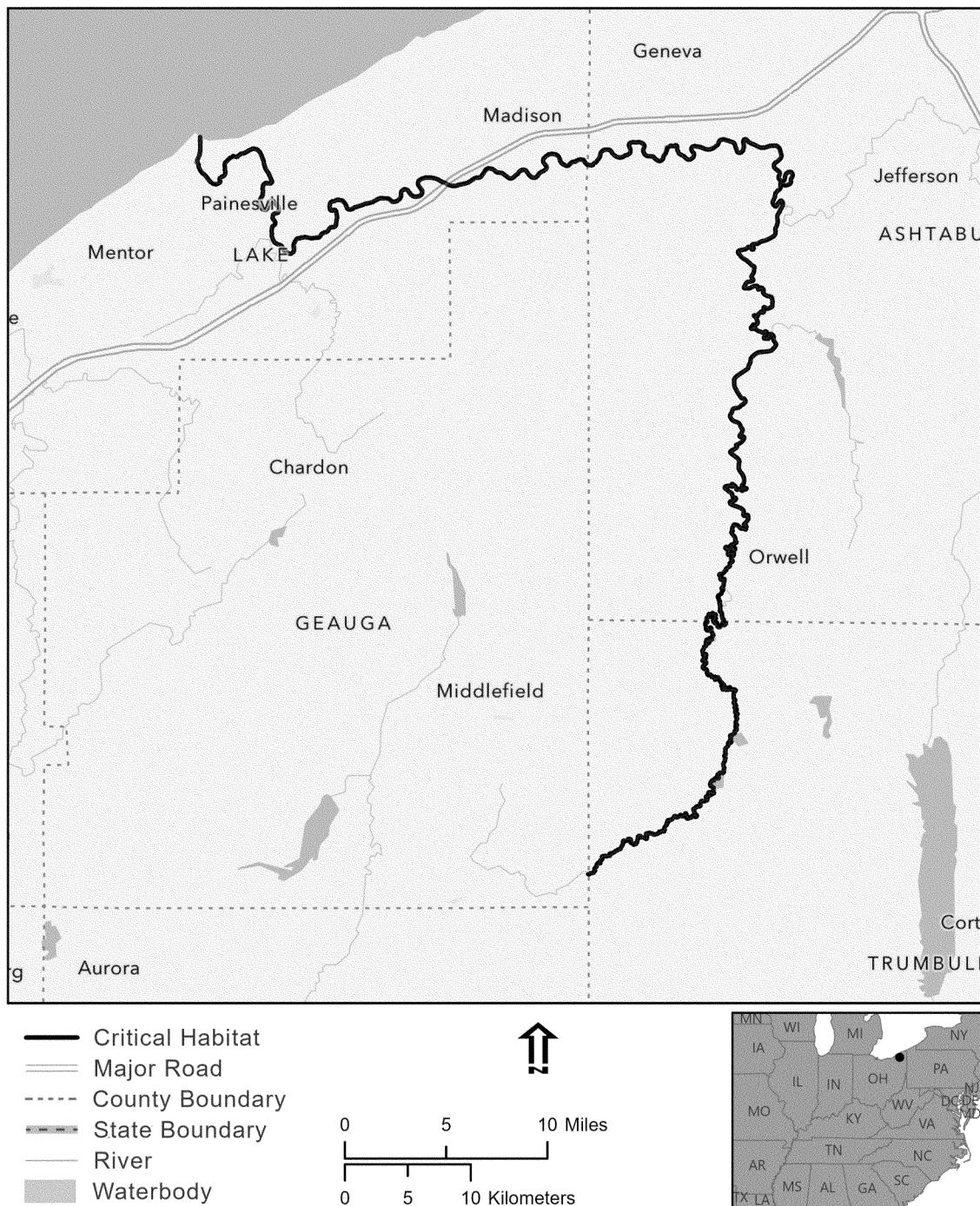
(i) Unit RH 2 consists of 92 river mi (148.2 km) of the Grand River in Ashtabula, Lake, and Trumbull Counties, Ohio. Approximately 59 river mi (95.2 km; 64 percent) of riparian lands that border the unit are private

ownership, and 33 river mi (53 km; 36 percent) are public (State or local) ownership. The Grand River is a State Wild and Scenic River. The Wild River designation includes approximately 23 river mi (37 km) from the Harpersfield Covered Bridge downstream to the Norfolk and Western Railroad Trestle in Lake County, and approximately 33 mi

(53 km) from the U.S. Route 322 Bridge in Ashtabula County downstream to the Harpersfield Covered Bridge. Harpersfield Dam within this unit is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit RH 2 follows: Figure 3 to Round Hickorynut (*Obovaria subrotunda*) paragraph (7)(ii)

Critical Habitat for Round Hickorynut
RH2 Grand River; Ashtabula, Lake, and Trumbull Counties, Ohio



(8) Unit RH 3: Tippecanoe River; Fulton, Marshall, Pulaski, and Starke Counties, Indiana.

(i) Unit RH 3 consists of 75 river mi (120.8 km) of the Tippecanoe River in

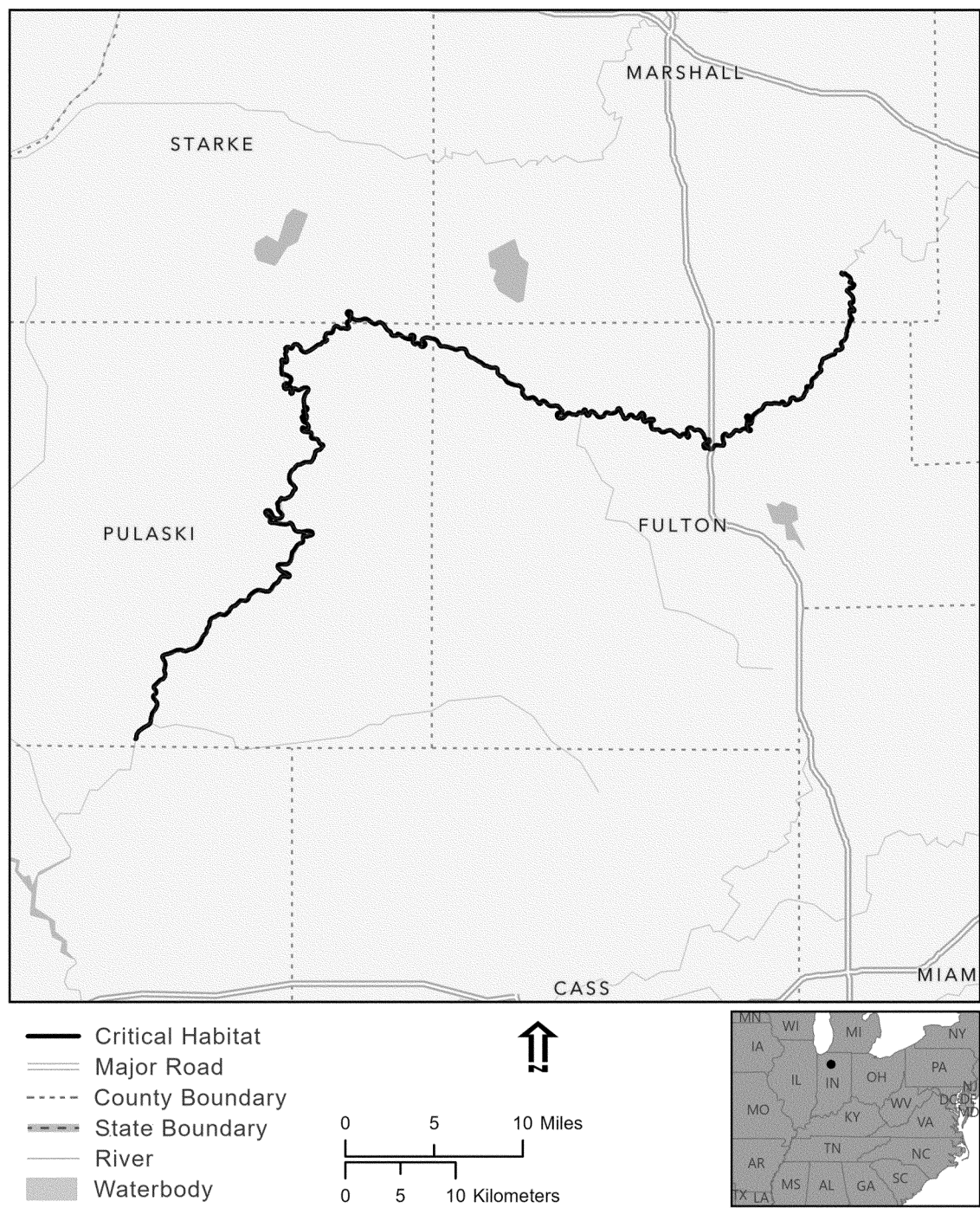
Fulton, Marshall, Pulaski, and Starke Counties, Indiana. Approximately 66 river mi (105.6 km; 89 percent) of riparian lands that border the unit are private ownership, and 9 river mi (14.5

km; 11 percent) are public (State or easement) ownership.

(ii) Map of Unit RH 3 follows: Figure 4 to Round Hickorynut (*Obovaria subrotunda*) paragraph (8)(ii)

Critical Habitat for Round Hickorynut

RH3 Tippecanoe River; Fulton, Marshall, Pulaski, and Starke Counties, Indiana



(9) Unit RH 4: Middle Island Creek; Doddridge, Pleasants, and Tyler Counties, West Virginia.

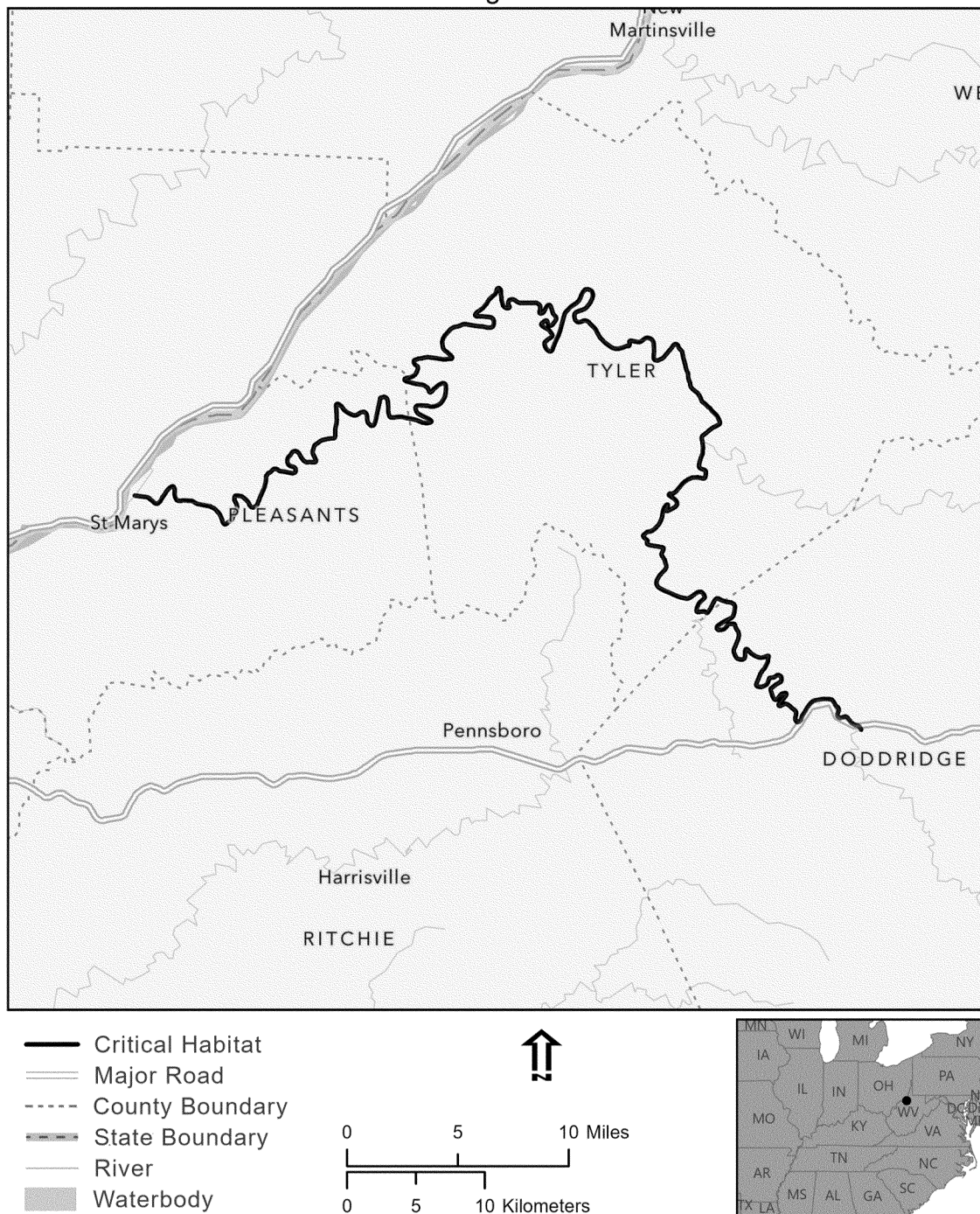
(i) Unit RH 4 consists of 75 stream mi (120.8 km) of Middle Island Creek in

Doddridge, Pleasants, and Tyler Counties, West Virginia. Approximately 74.8 stream mi (120.4 km; 99 percent) of riparian lands that border the unit are private ownership, and 0.2 stream mi

(0.4 km; less than 1 percent) is public ownership.

(ii) Map of Unit RH 4 follows: Figure 5 to Round Hickorynut (*Obovaria subrotunda*) paragraph (9)(ii)

Critical Habitat for Round Hickorynut
RH4 Middle Island Creek; Doddridge, Pleasants, and Tyler Counties, West
Virginia



(10) Unit RH 5: Little Kanawha River; Calhoun, Gilmer, Ritchie, and Wood Counties, West Virginia.

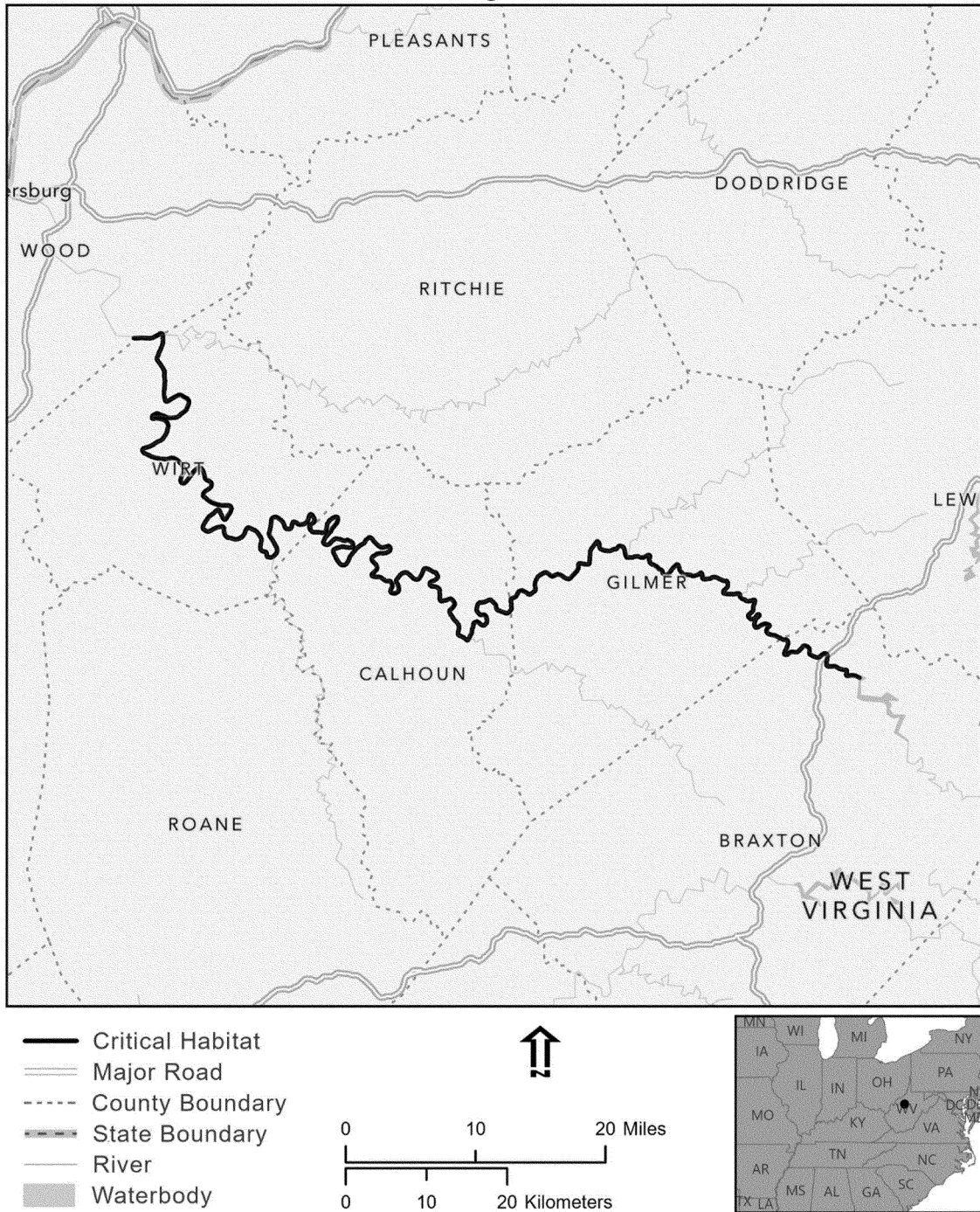
(i) Unit RH 5 consists of 110 stream mi (176.6 km) of the Little Kanawha River in Calhoun, Gilmer, Ritchie, and

Wood Counties, West Virginia. Approximately 109 river mi (175.4 km; 99 percent) of riparian lands that border the unit are private ownership, and 0.7 river mi (1.2 km; 1 percent) are public (Federal, State, or local) ownership.

This unit is directly below Burnsville Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit RH 5 follows: Figure 6 to Round Hickorynut (*Obovaria subrotunda*) paragraph (10)(ii)

Critical Habitat for Round Hickorynut
RH5 Little Kanawha River; Calhoun, Gilmer, Ritchie, and Wood Counties, West Virginia



(11) Unit RH 6: Elk River; Braxton, Clay, and Kanawha Counties, West Virginia.

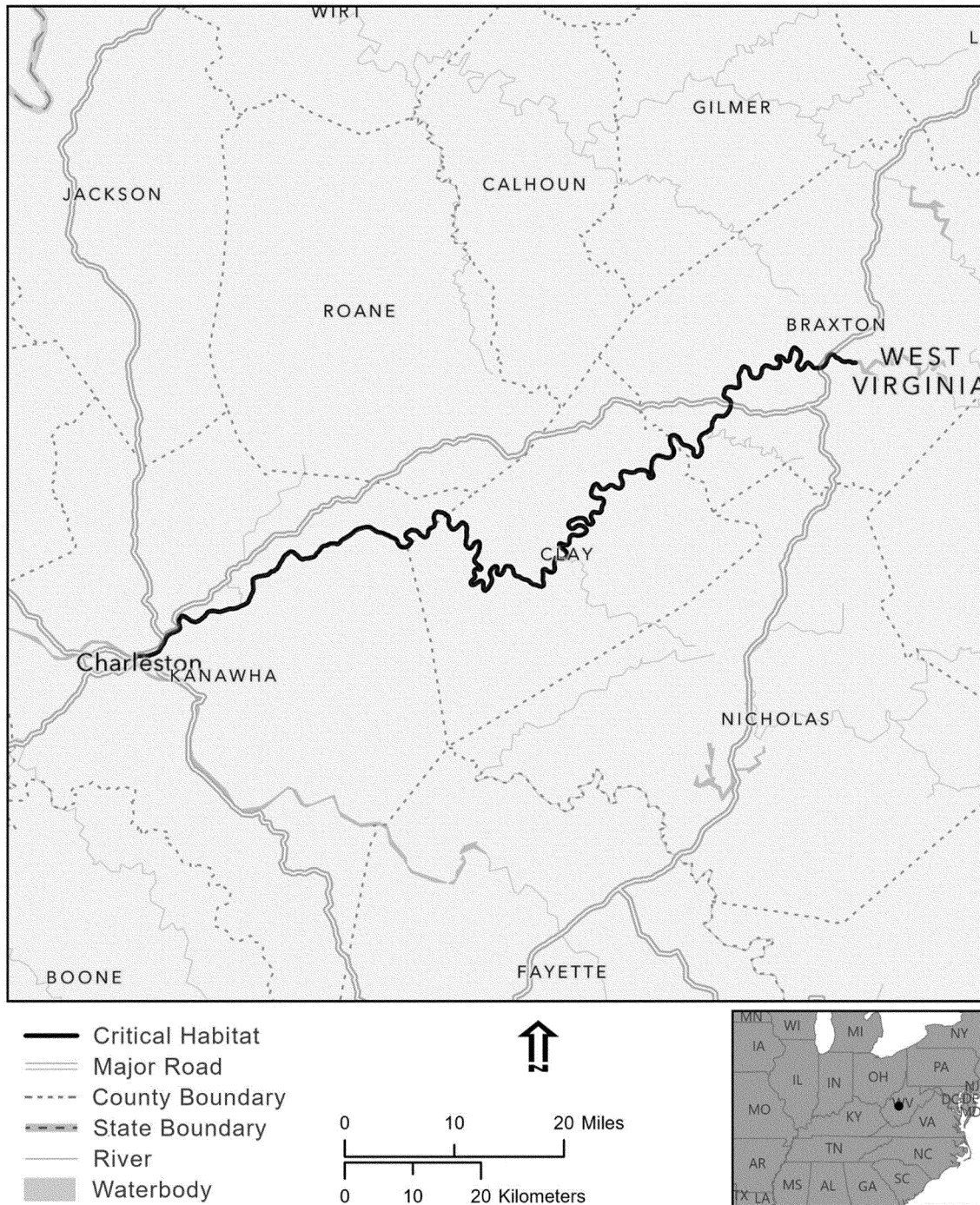
(i) Unit RH 6 consists of 101 river mi (163 km) of the Elk River in Braxton, Clay, and Kanawha Counties, West

Virginia. Approximately 93 river mi (150.3 km; 92 percent) of riparian lands that border the unit are private ownership, and 7 river mi (12.7 km; 8 percent) are public (Federal, State, or local) ownership. This unit is

immediately below Sutton Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit RH 6 follows: Figure 7 to Round Hickorynut (*Obovaria subrotunda*) paragraph (11)(ii)

Critical Habitat for Round Hickorynut
RH6 Elk River; Braxton, Clay, and Kanawha Counties, West Virginia



(12) Unit RH 7: Kanawha River; Fayette and Kanawha Counties, West Virginia.

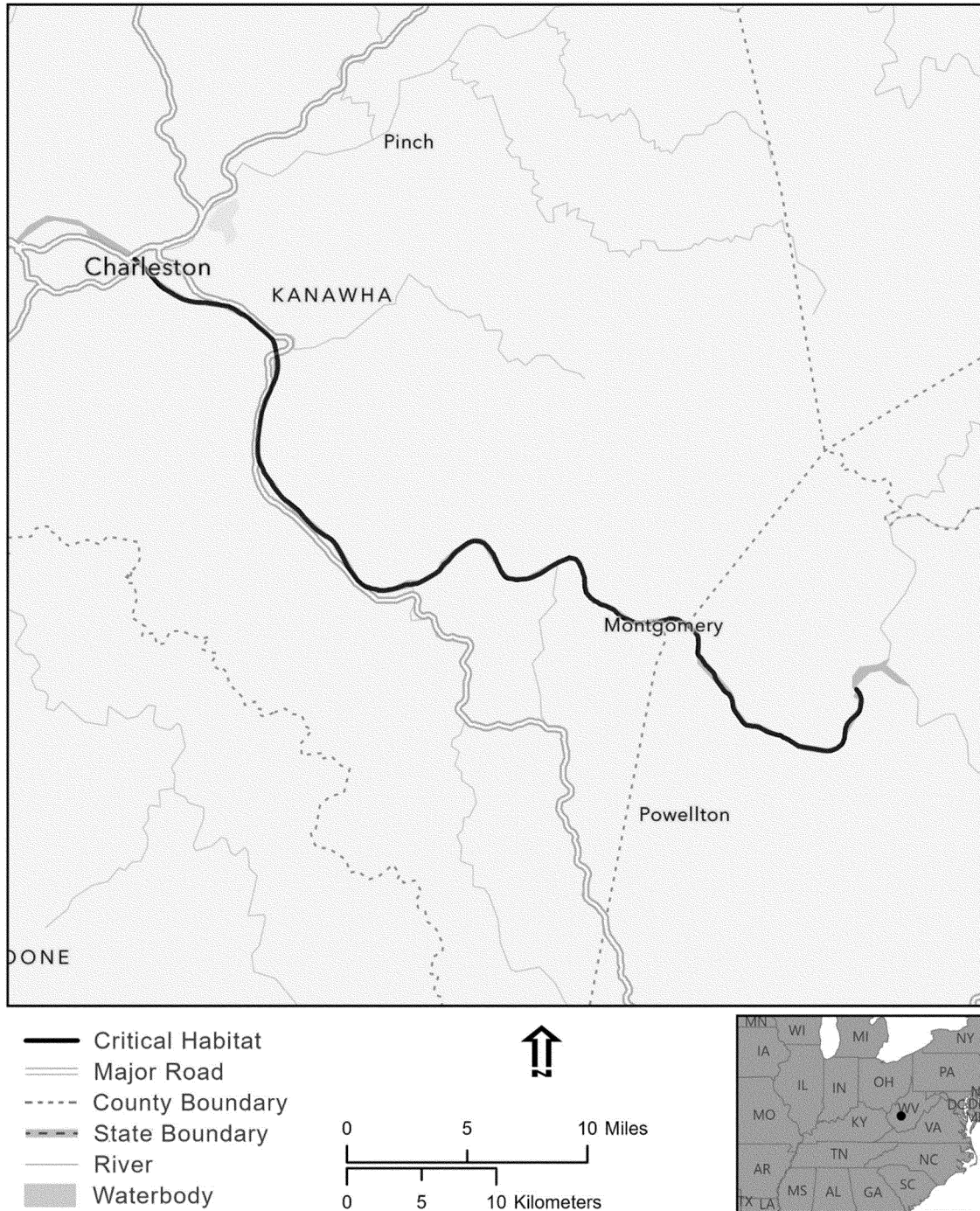
(i) Unit RH 7 consists of 37.5 river mi (60.4 km) of the Kanawha River in Fayette and Kanawha Counties, West

Virginia. Approximately 33 river mi (53.2 km; 90 percent) of riparian lands that border the unit are private ownership, and 4 river mi (7.2 km; 10 percent) are public (Federal, State, or local) ownership. London and Marmet

locks and dams within this unit are operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit RH 7 follows: Figure 8 to Round Hickorynut (*Obovaria subrotunda*) paragraph (12)(ii)

Critical Habitat for Round Hickorynut
RH7 Kanawha River; Fayette and Kanawha Counties, West Virginia



(13) Unit RH 8: Licking River; Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky.

(i) Unit RH 8 consists of 150 river mi (241.9 km) of the Licking River in Bath,

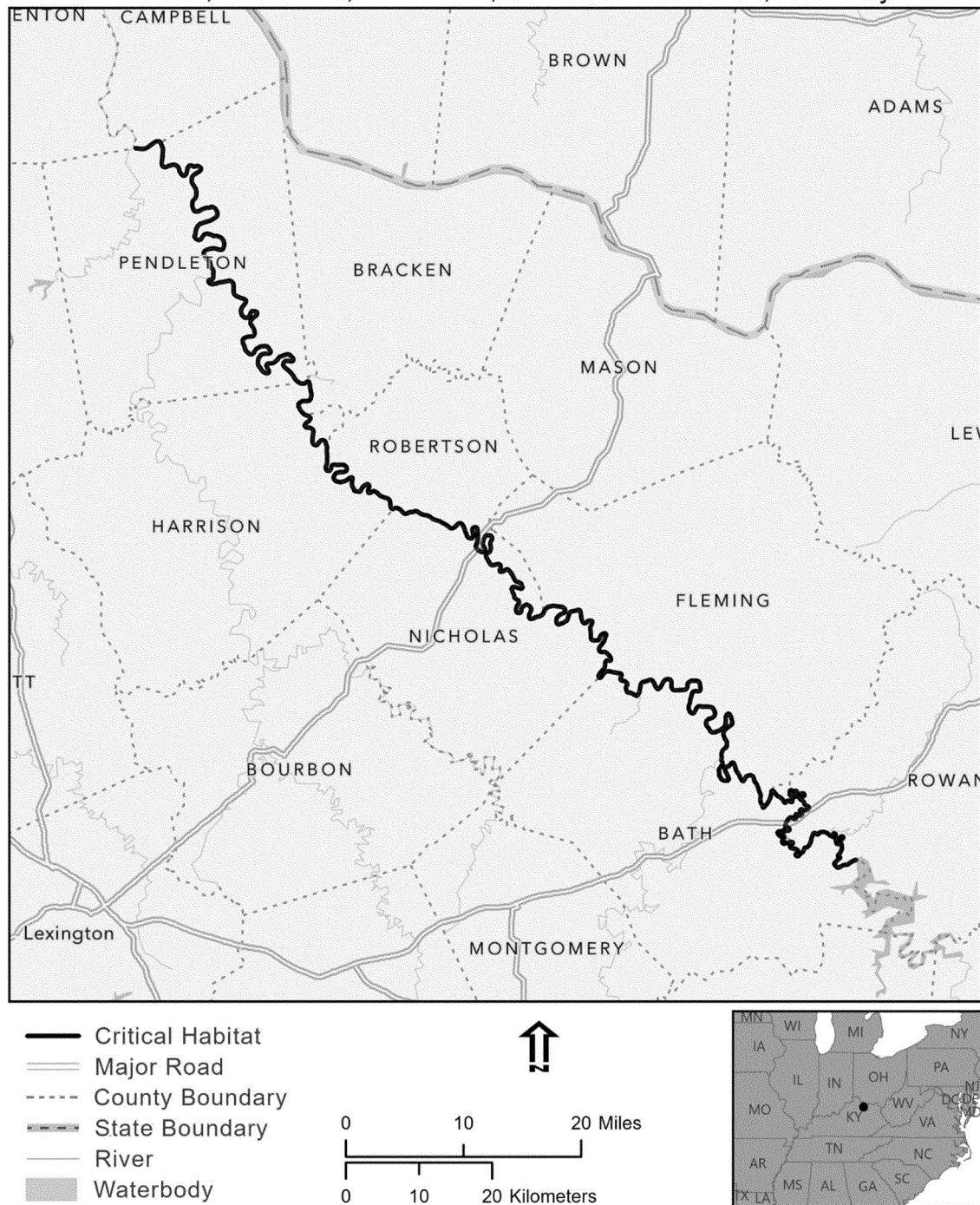
Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky. Approximately 131 river mi (211.8 km; 87 percent) of riparian lands that border the unit are private ownership, and 18 river mi (30 km; 13

percent) are public (Federal, State, or local) ownership. This unit is directly below Cave Run Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit RH 8 follows:

Figure 9 to Round Hickorynut (*Obovaria subrotunda*) paragraph (13)(ii)

Critical Habitat for Round Hickorynut
RH8 Licking River; Bath, Campbell, Fleming, Harrison, Kenton, Morgan,
Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky



(14) Unit RH 9: Rockcastle River; Laurel, Pulaski, and Rockcastle Counties, Kentucky.

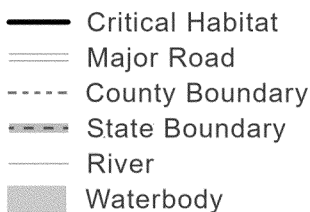
(i) Unit RH 9 consists of 15.3 river mi (24.6 km) of the Rockcastle River in Laurel, Pulaski, and Rockcastle

Counties, Kentucky. Approximately 0.3 river mi (0.4 km; 1 percent) of riparian lands that border the unit is private ownership, and 15 river mi (24.2 km; 99 percent) are public (Federal; Daniel Boone National Forest) ownership.

(ii) Map of Unit RH 9 follows: Figure 10 to Round Hickorynut (*Obovaria subrotunda*) paragraph (14)(ii)

Critical Habitat for Round Hickorynut

RH9 Rockcastle River; Laurel, Pulaski, and Rockcastle Counties, Kentucky

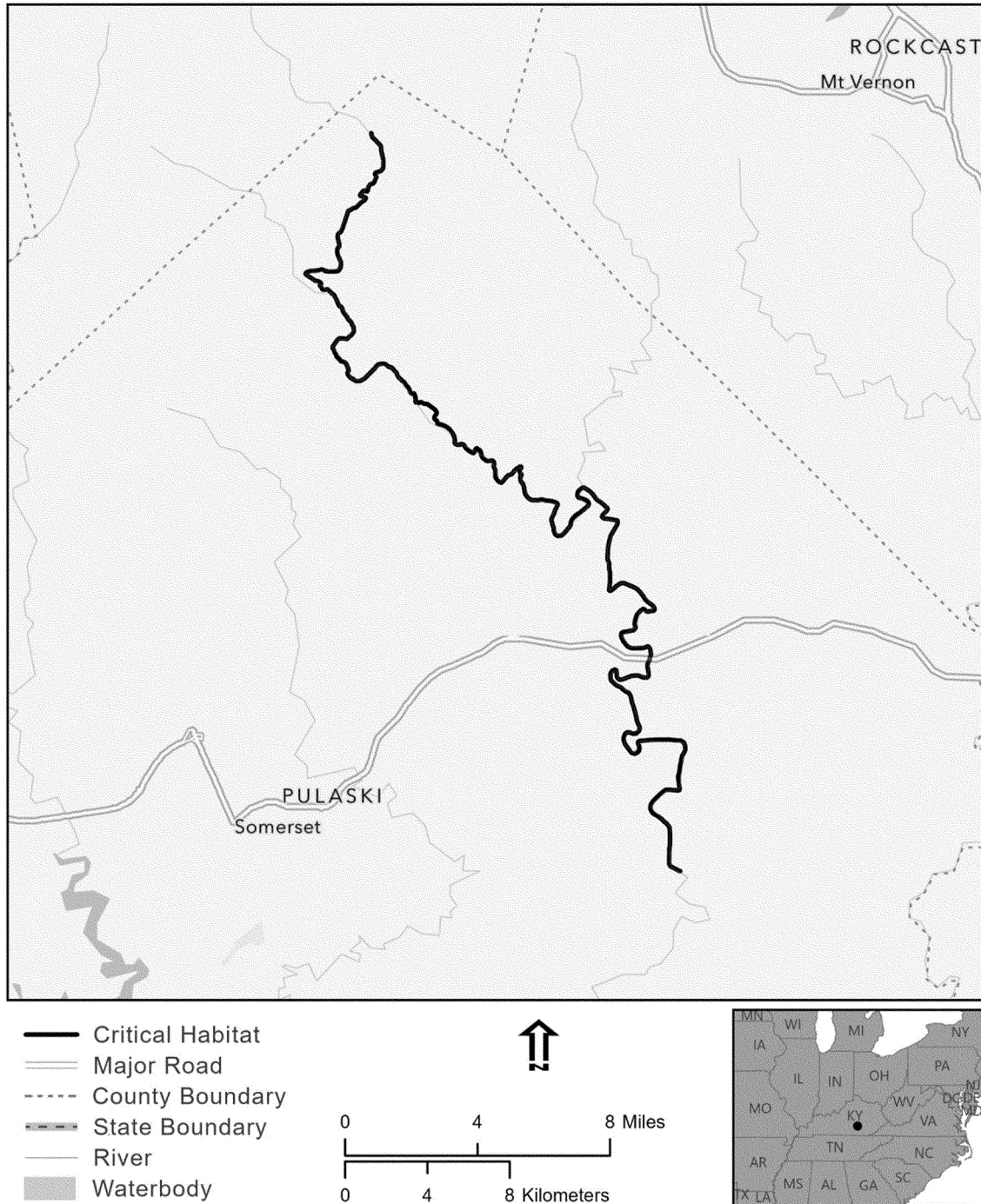


(i) Unit RH 10 consists of 36 stream mi (58.1 km) of Buck Creek in Pulaski County, Kentucky. Approximately 33

stream mi (52.6 km; 92 percent) of riparian lands that border the unit are private ownership, and 3 stream mi (5.5 km; 8 percent) are public (State or local) ownership.

(ii) Map of Unit RH 10 follows:
Figure 11 to Round Hickorynut
(*Obovaria subrotunda*) paragraph
(15)(ii)

Critical Habitat for Round Hickorynut
RH10 Buck Creek; Pulaski County, Kentucky



(16) Unit RH 11: Green River; Hart, Edmonson, Green, Butler, and Warren Counties, Kentucky.

(i) Unit RH 11 consists of 98 river mi (157.7 km) of the Green River in Butler, Edmonson, Green, Hart, and Warren Counties, Kentucky. Approximately 61

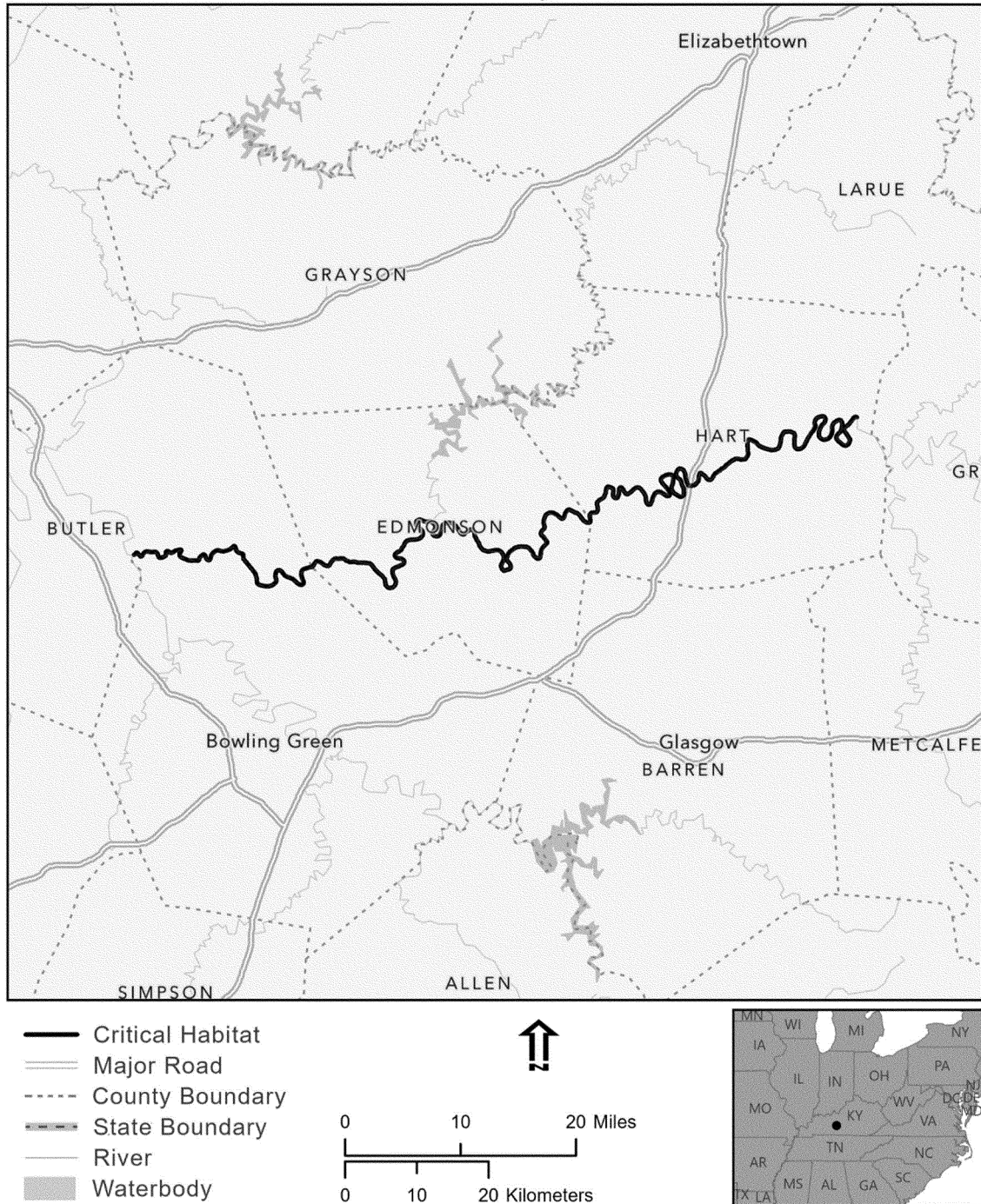
river mi (98.4 km; 62 percent) of riparian lands that border the unit are private ownership, and 37 river mi (59.4 km; 38 percent) are public (Federal or State) ownership, including portions of Mammoth Cave National Park. This unit is located directly below Green River

Lake Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit RH 11 follows:

Figure 12 to Round Hickorynut (*Obovaria subrotunda*) paragraph (16)(ii)

Critical Habitat for Round Hickorynut
RH11 Green River; Butler, Edmonson, Green, Hart, and Warren Counties,
Kentucky



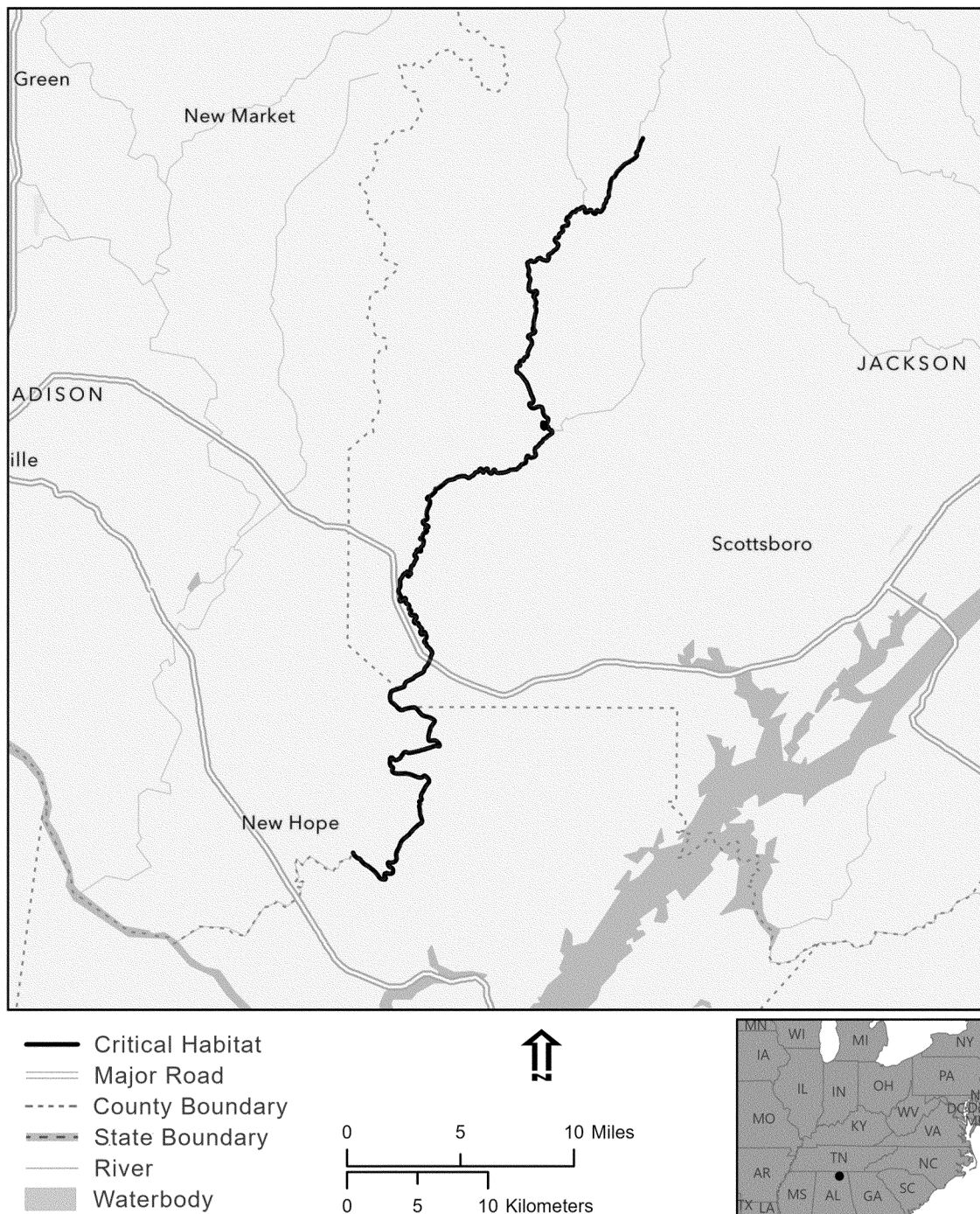
(17) Unit RH 12: Paint Rock River; Jackson, Madison, and Marshall Counties, Alabama.

(i) Unit RH 12 consists of 48 river mi (77.5 km) of the Paint Rock River in Jackson, Madison, and Marshall

Counties, Alabama. Approximately 2 river mi (4.1 km; 2 percent) of riparian lands that border the unit are private ownership, and 46 river mi (73.4 km; 98 percent) are public (Federal or State) ownership.

(ii) Map of Unit RH 12 follows: Figure 13 to Round Hickorynut (*Obovaria subrotunda*) paragraph (17)(ii)

Critical Habitat for Round Hickorynut
RH12 Paint Rock River; Jackson, Madison, and Marshall Counties, Alabama



(18) Unit RH 13: Duck River; Bedford, Marshall, and Maury Counties, Tennessee.

(i) Unit RH 13 consists of 59 river mi (94.8 km) of the Duck River in Bedford, Marshall, and Maury Counties,

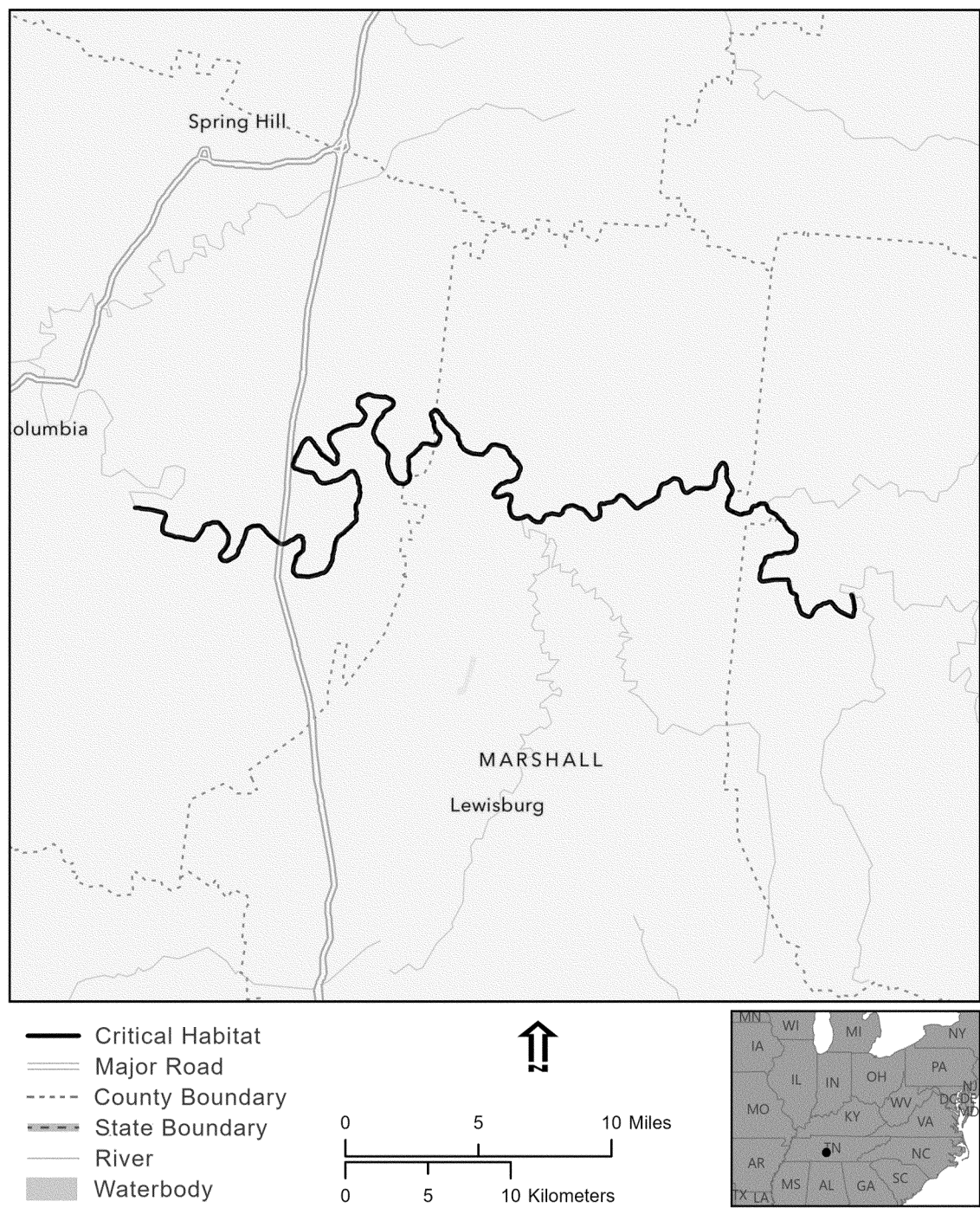
Tennessee. Approximately 27 river mi (43.7 km; 47 percent) of riparian lands that border the unit are private ownership, and 32 river mi (51.1 km; 53 percent) are public (State or local) ownership.

(ii) Map of Unit RH 13 follows:

Figure 14 to Round Hickorynut (*Obovaria subrotunda*) paragraph (18)(ii)

Critical Habitat for Round Hickorynut

RH13 Duck River; Bedford, Marshall, and Maury Counties, Tennessee



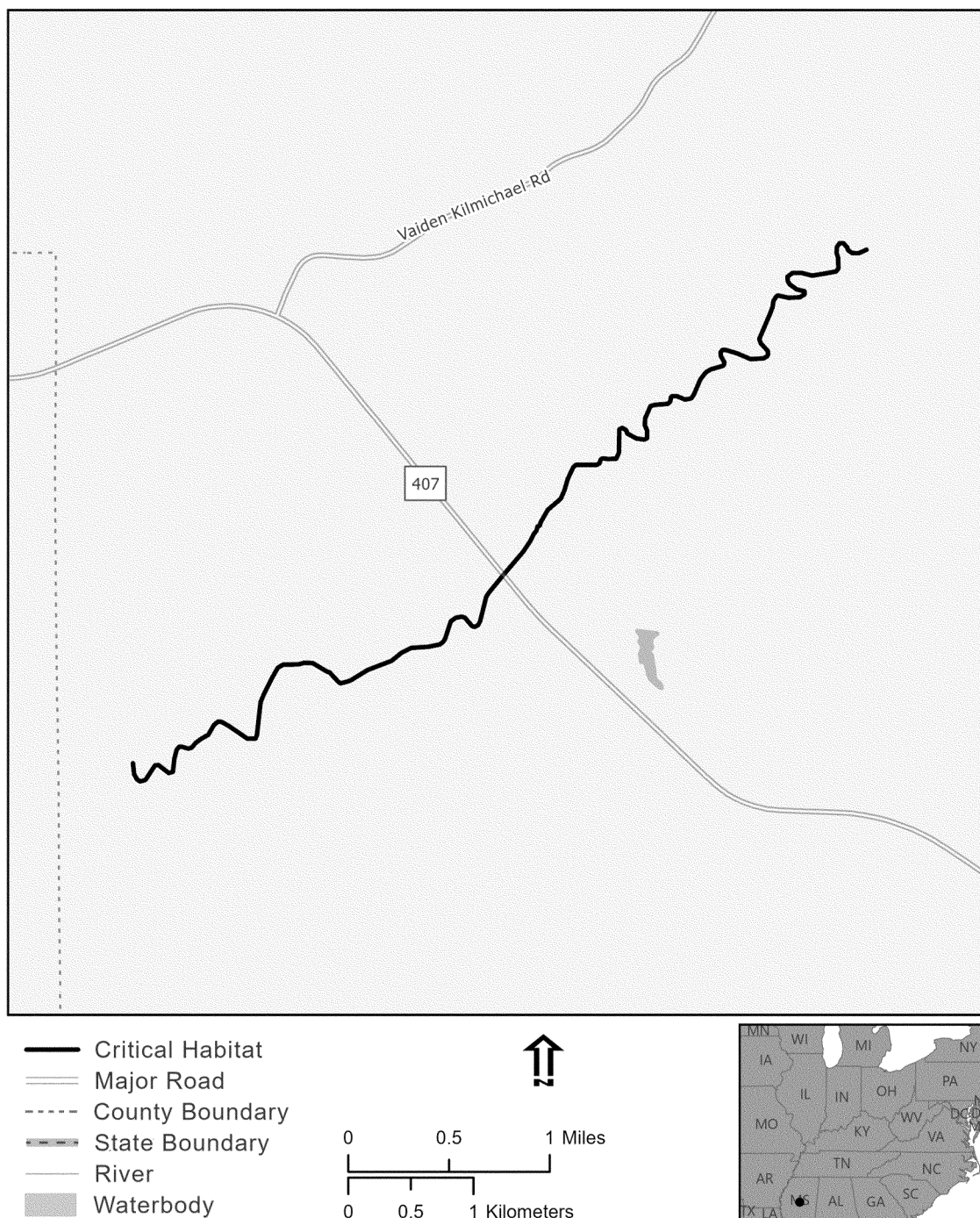
(19) Unit RH 14: Big Black River; Montgomery County, Mississippi. All of riparian lands that border the unit are private ownership.

(i) Unit RH 14 consists of 4 river mi (7 km) of the Big Black River in

(ii) Map of Unit RH 14 follows:

Figure 15 to Round Hickorynut (*Obovaria subrotunda*) paragraph (19)(ii)

Critical Habitat for Round Hickorynut
RH14 Big Black River; Montgomery County, Mississippi



Longsolid (*Fusconaia subrotunda*)

(1) Critical habitat units for the longsolid are depicted on the maps in this entry for Jackson, Madison, and Marshall Counties, Alabama; Bath, Butler, Campbell, Edmonson, Fleming, Green, Harrison, Hart, Kenton, Morgan, Nicholas, Pendleton, Robertson, Rowan, Taylor, and Warren Counties, Kentucky; Clarion, Crawford, Erie, Forest, Mercer,

Venango, and Warren Counties, Pennsylvania; Claiborne, Hancock, Hawkins, Smith, Trousdale, and Wilson Counties, Tennessee; Russell, Scott, Tazewell, and Wise Counties, Virginia; and Braxton, Calhoun, Clay, Doddridge, Fayette, Gilmer, Kanawha, Ritchie, Tyler, and Wood Counties, West Virginia.

(2) Within these areas, the physical or biological features essential to the conservation of the longsolid consist of the following components:

(i) Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species is found and

to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussel's and fish host's habitat and food availability, maintenance of spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats. Adequate flows ensure delivery of oxygen, enable reproduction, deliver food to filter-feeding mussels, and reduce contaminants and fine sediments from interstitial spaces. Stream velocity is not static over time, and variations may be attributed to seasonal changes (with higher flows in winter/spring and lower flows in summer/fall), extreme weather events (*e.g.*, drought or floods), or anthropogenic influence (*e.g.*, flow regulation via impoundments).

(ii) Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (*i.e.*, channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffle-run-pool habitats that provide flow refuges consisting of predominantly silt-free,

stable sand, gravel, and cobble substrates).

(iii) Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to): Dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °Fahrenheit (°F) (30 °Celsius (°C))). Additionally, water and sediment should be low in ammonia (generally below 0.5 ppm total ammonia-nitrogen) and heavy metal concentrations, and lack excessive total suspended solids and other pollutants.

(iv) The presence and abundance of fish hosts necessary for recruitment of the longsolid (currently unknown, likely includes the minnows of the family Cyprinidae and banded sculpin (*Cottus carolinae*)).

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on April 10, 2023.

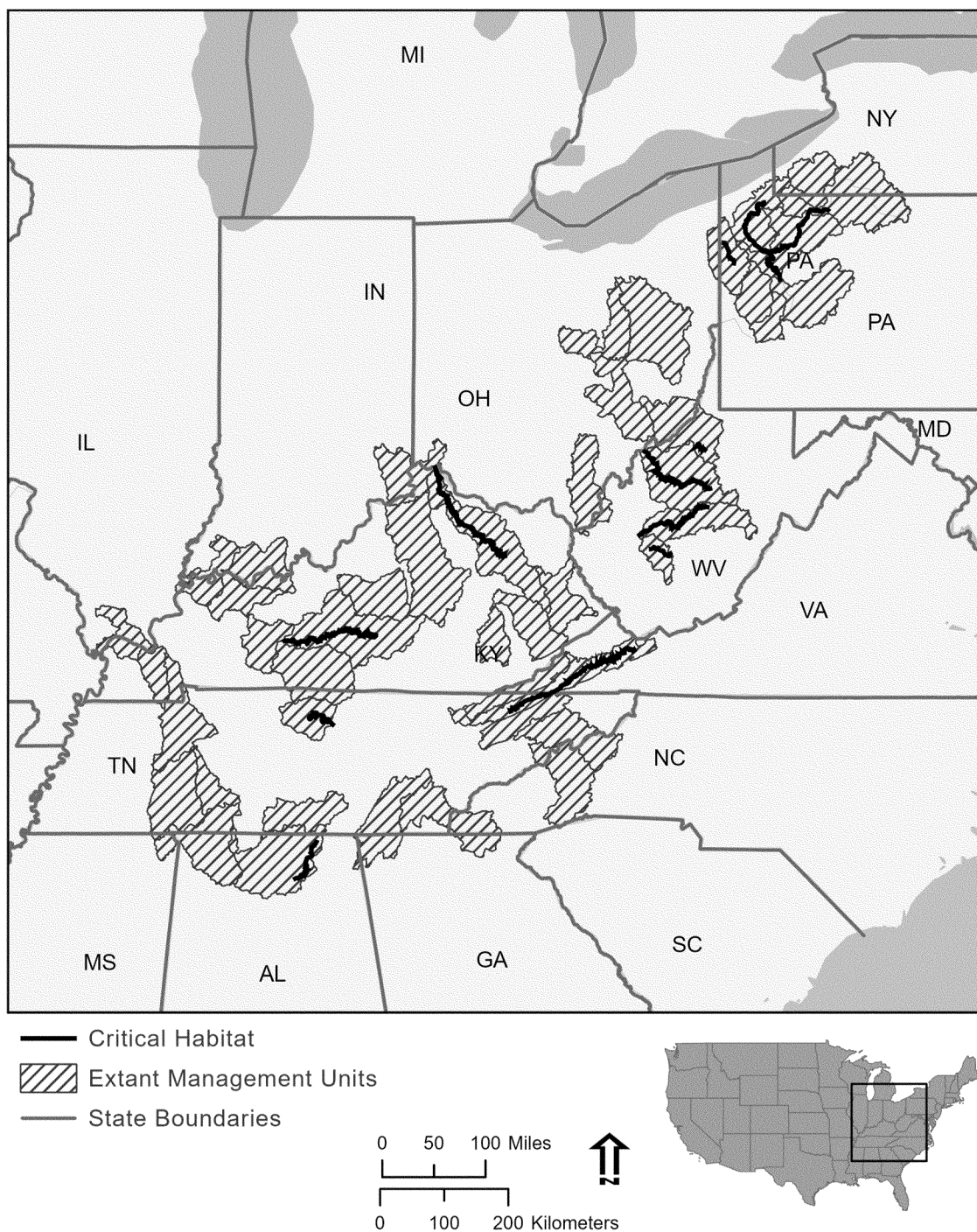
(4) Data layers defining map units were created by overlaying Natural Heritage Element Occurrence data and U.S. Geological Survey hydrologic data

for stream reaches. The hydrologic data used in the critical habitat maps were extracted from the U.S. Geological Survey 1:1M scale nationwide hydrologic layer (<https://www.usgs.gov/core-science-systems/ngp/national-hydrography>) with a projection of EPSG:4269—NAD83 Geographic. Natural Heritage program and State mussel database species presence data from Pennsylvania, West Virginia, Virginia, Kentucky, Tennessee, and Alabama were used to select specific river and stream segments for inclusion in the critical habitat layer. The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at the Service's internet site at <https://www.regulations.gov> at Docket No. FWS-R4-ES-2020-0010, and at the field office responsible for this designation. You may obtain field office location information by contacting one of the Service regional offices, the addresses of which are listed at 50 CFR 2.2.

(5) Index map for the longsolid follows:

Figure 1 to Longsolid (*Fusconaia subrotunda*) paragraph (5)

Longsolid Extant Management Units and Critical Habitat



(6) Unit LS 1: French Creek; Crawford, Erie, Mercer, and Venango Counties, Pennsylvania.

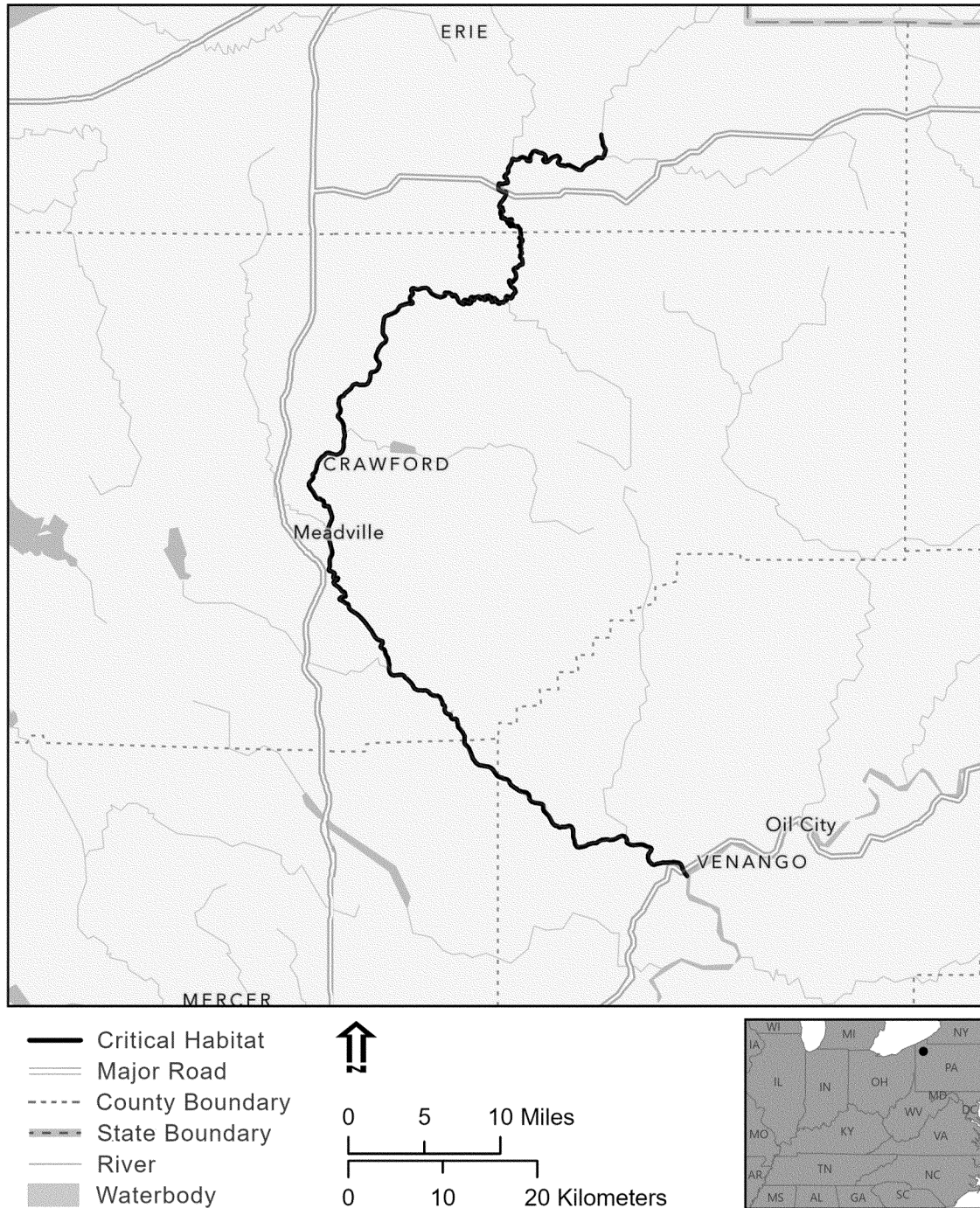
(i) Unit LS 1 consists of 120 stream mi (191.5 km) of French Creek in Crawford, Erie, Mercer, and Venango Counties,

Pennsylvania. Approximately 106 stream mi (170.6 km; 76 percent) of riparian lands that border the unit are private ownership, and 14 stream mi (22.1 km; 24 percent) are public (Federal or State) ownership. This unit begins

immediately downstream of the Union City Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 1 follows: Figure 2 to Longsolid (*Fusconaia subrotunda*) paragraph (6)(ii)

Critical Habitat for Longsolid
LS1 French Creek; Crawford, Erie, Mercer, and Venango Counties,
Pennsylvania



(7) Unit LS 2: Allegheny River; Clarion, Crawford, Forest, Venango, and Warren Counties, Pennsylvania.

(i) Unit LS 2 consists of 99 river mi (159.3 km) of the Allegheny River in Clarion, Crawford, Forest, Venango, and Warren Counties, Pennsylvania.

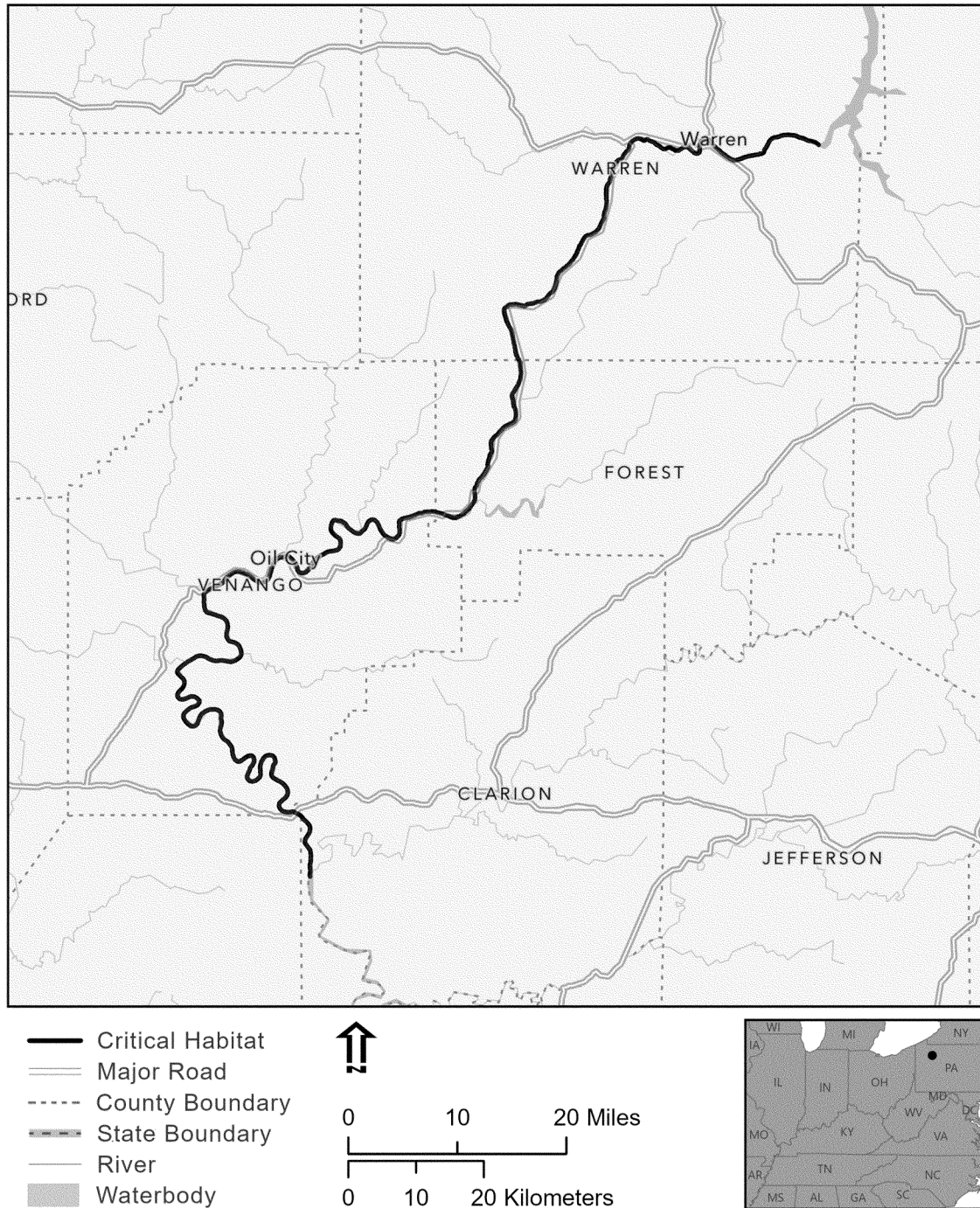
Approximately 15 river mi (24.1 km; 14 percent) of riparian lands that border the unit are private ownership, and 84 river mi (135.8 km; 86 percent) are public (Federal or State; primarily Allegheny National Forest) ownership.

This unit is immediately downstream of Kinzua Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 2 follows:

Figure 3 to Longsolid (*Fusconaia subrotunda*) paragraph (7)(ii)

Critical Habitat for Longsolid
LS2 Allegheny River; Clarion, Crawford, Forest, Venango, and Warren
Counties, Pennsylvania



(8) Unit LS 3: Shenango River; Crawford and Mercer Counties, Pennsylvania.

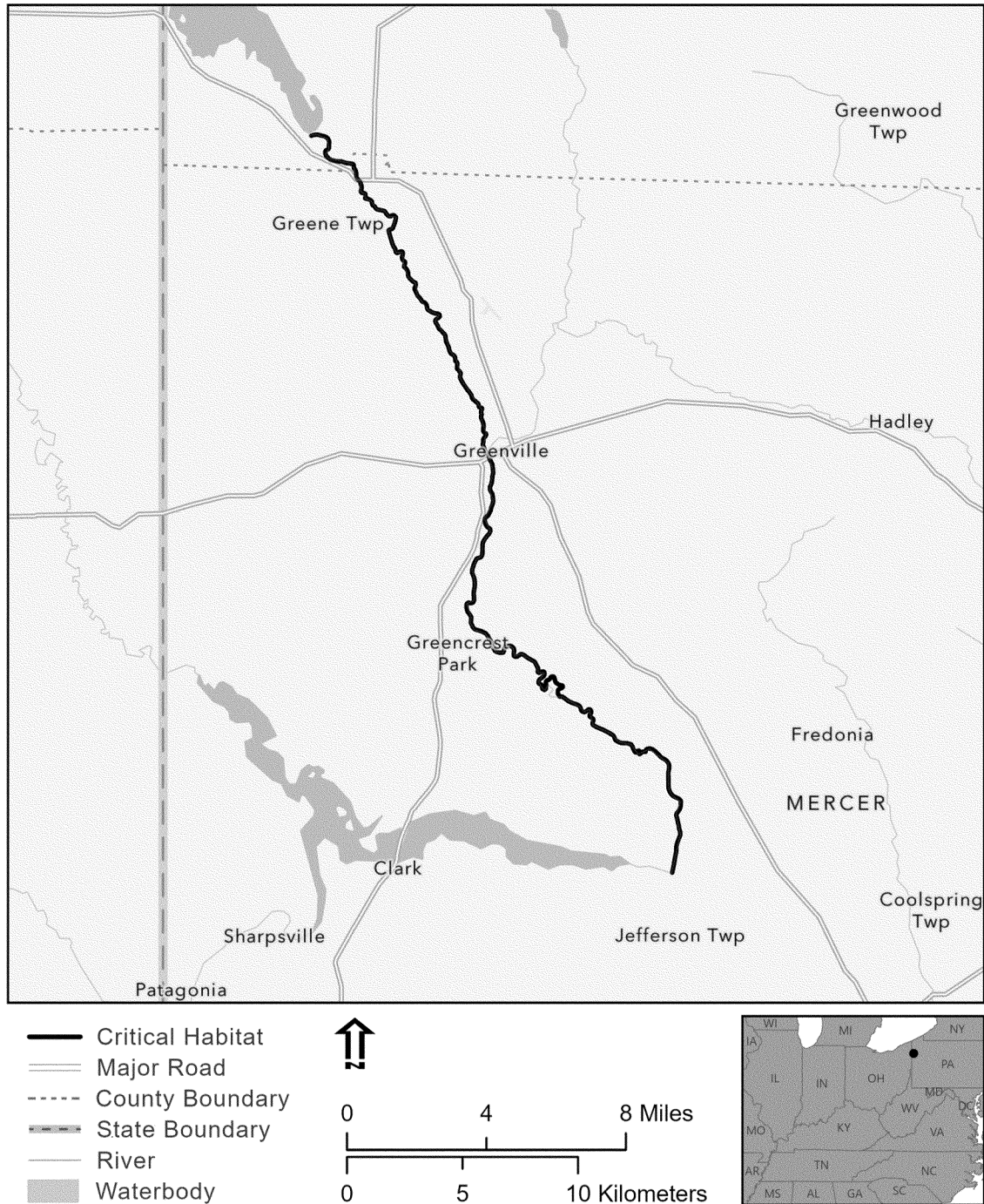
(i) Unit LS 3 consists of 22 river miles (mi) (35.5 kilometers (km)) of the Shenango River in Crawford County, Pennsylvania, from Pymatuning Dam

downstream to the point of inundation by Shenango River Lake near Big Bend, Mercer County, Pennsylvania. Approximately 15 river mi (24.3 km; 68 percent) of riparian lands that border the unit are private ownership, and 7 river mi (11.3 km; 32 percent) are public

(Federal or State) ownership. This unit is immediately downstream from the Pymatuning Dam, which is owned by the State of Pennsylvania.

(ii) Map of Unit LS 3 follows:
Figure 4 to Longsolid (*Fusconaia subrotunda*) paragraph (8)(ii)

Critical Habitat for Longsolid
LS3 Shenango River; Crawford and Mercer Counties, Pennsylvania



(9) Unit LS 4: Middle Island Creek; Doddridge and Tyler Counties, West Virginia.

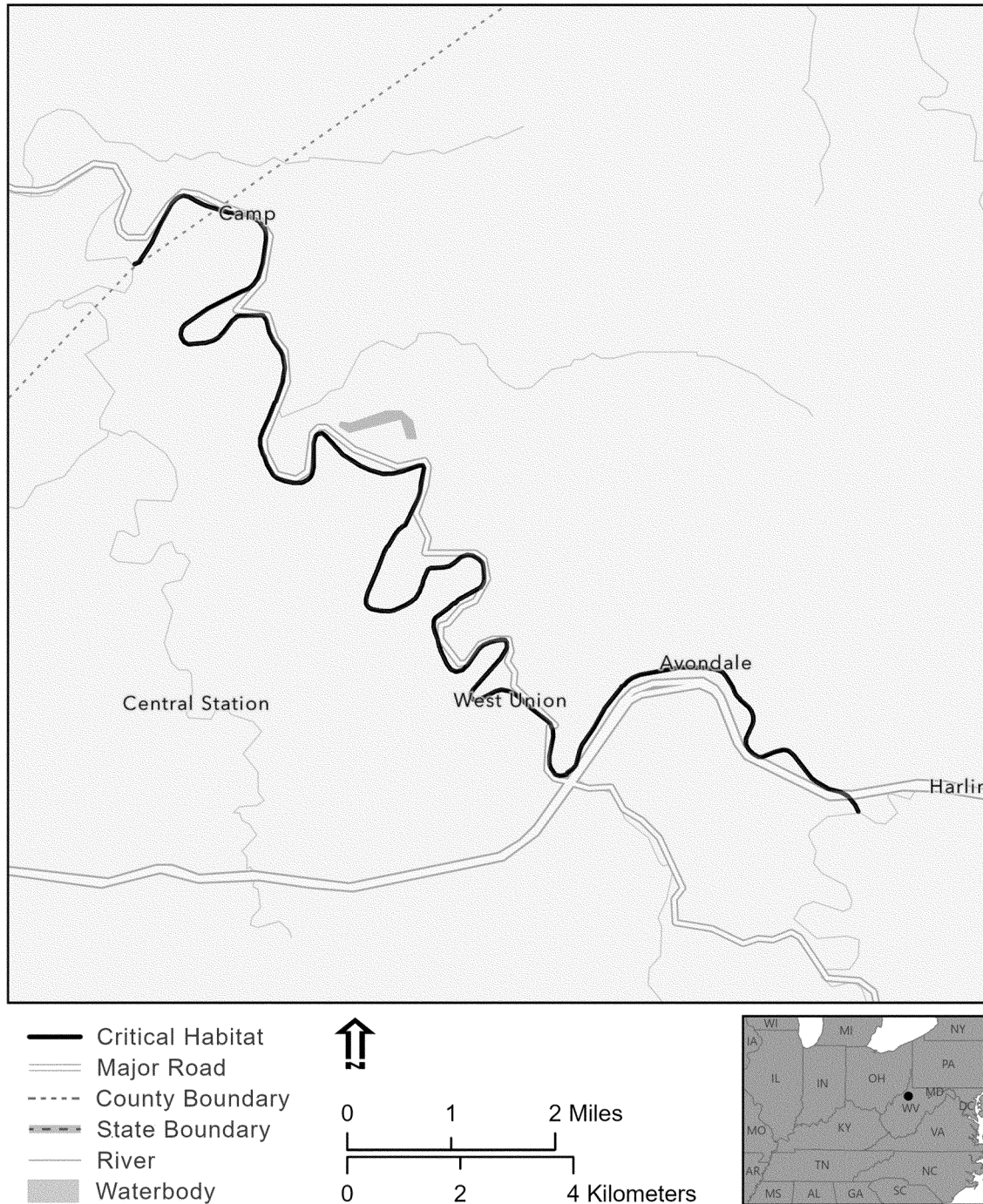
(i) Unit LS 4 consists of 14 stream mi (23.7 km) of Middle Island Creek in

Doddridge and Tyler Counties, West Virginia. Approximately 14 stream mi (23.5 km; 99 percent) of riparian lands that border the unit are private ownership, and 0.1 stream mi (0.2 km;

less than 1 percent) are public (local) ownership.

(ii) Map of Unit LS 4 follows: Figure 5 to Longsolid (*Fusconaia subrotunda*) paragraph (9)(ii)

Critical Habitat for Longsolid
LS4 Middle Island Creek; Doddridge and Tyler Counties, West Virginia



(10) Unit LS 5: Little Kanawha River; Calhoun, Gilmer, Ritchie, and Wood Counties, West Virginia.

(i) Unit LS 5 consists of 123 river mi (198 km) of the Little Kanawha River in Calhoun, Gilmer, Ritchie, and Wood

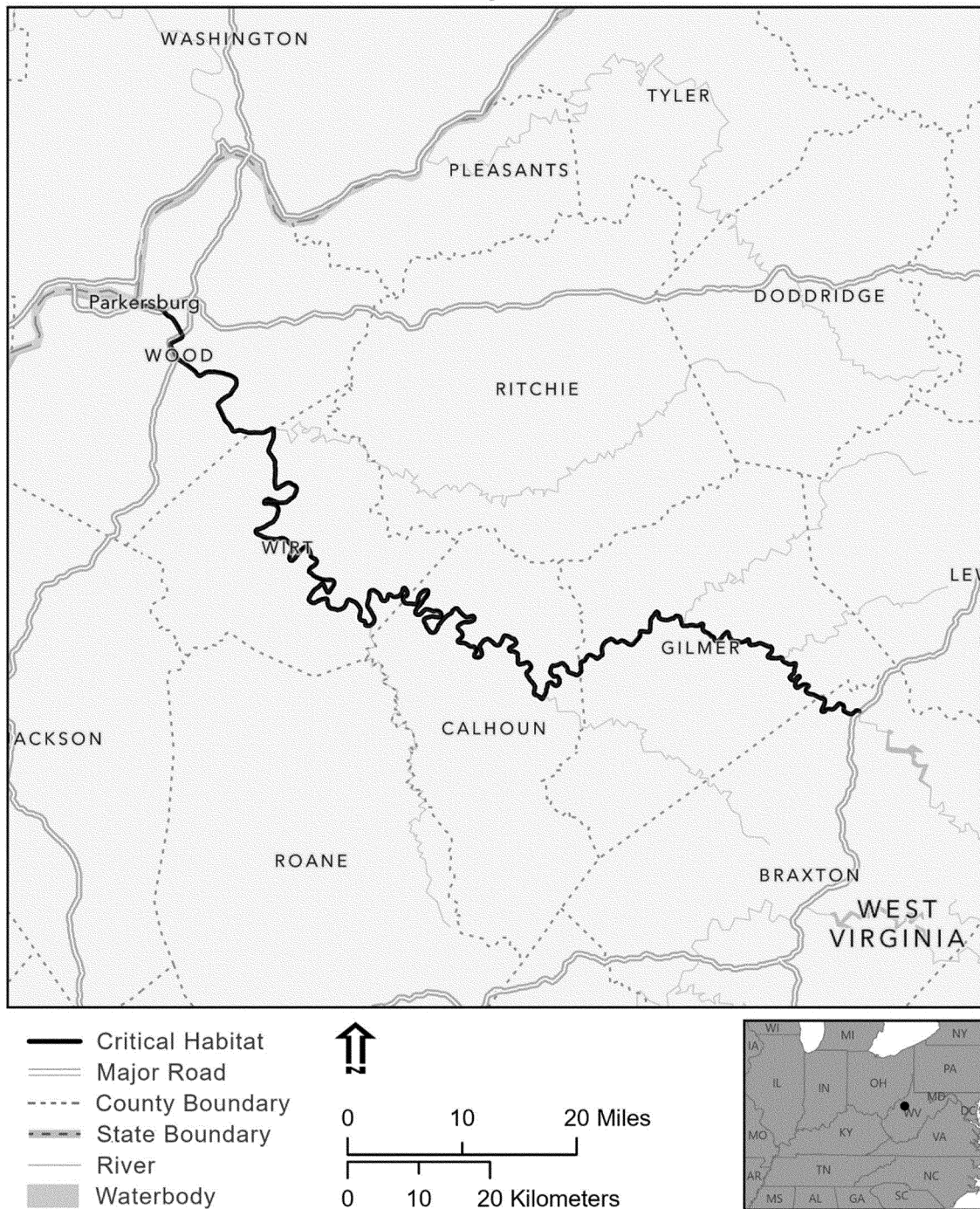
Counties, West Virginia. Approximately 122 river mi (197.2 km; 99 percent) are private ownership, and 0.53 river mi (0.9 km; 1 percent) are public (Federal or State) ownership. This unit is directly below the Burnsville Dam, which is

operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 5 follows:

Figure 6 to Longsolid (*Fusconaia subrotunda*) paragraph (10)(ii)

Critical Habitat for Longsolid
LS5 Little Kanawha River; Calhoun, Gilmer, Ritchie, and Wood Counties, West Virginia



(11) Unit LS 6: Elk River; Braxton, Clay, and Kanawha Counties, West Virginia.

(i) Unit LS 6 consists of 101 river mi (163 km) of the Elk River in Braxton, Clay, and Kanawha Counties, West

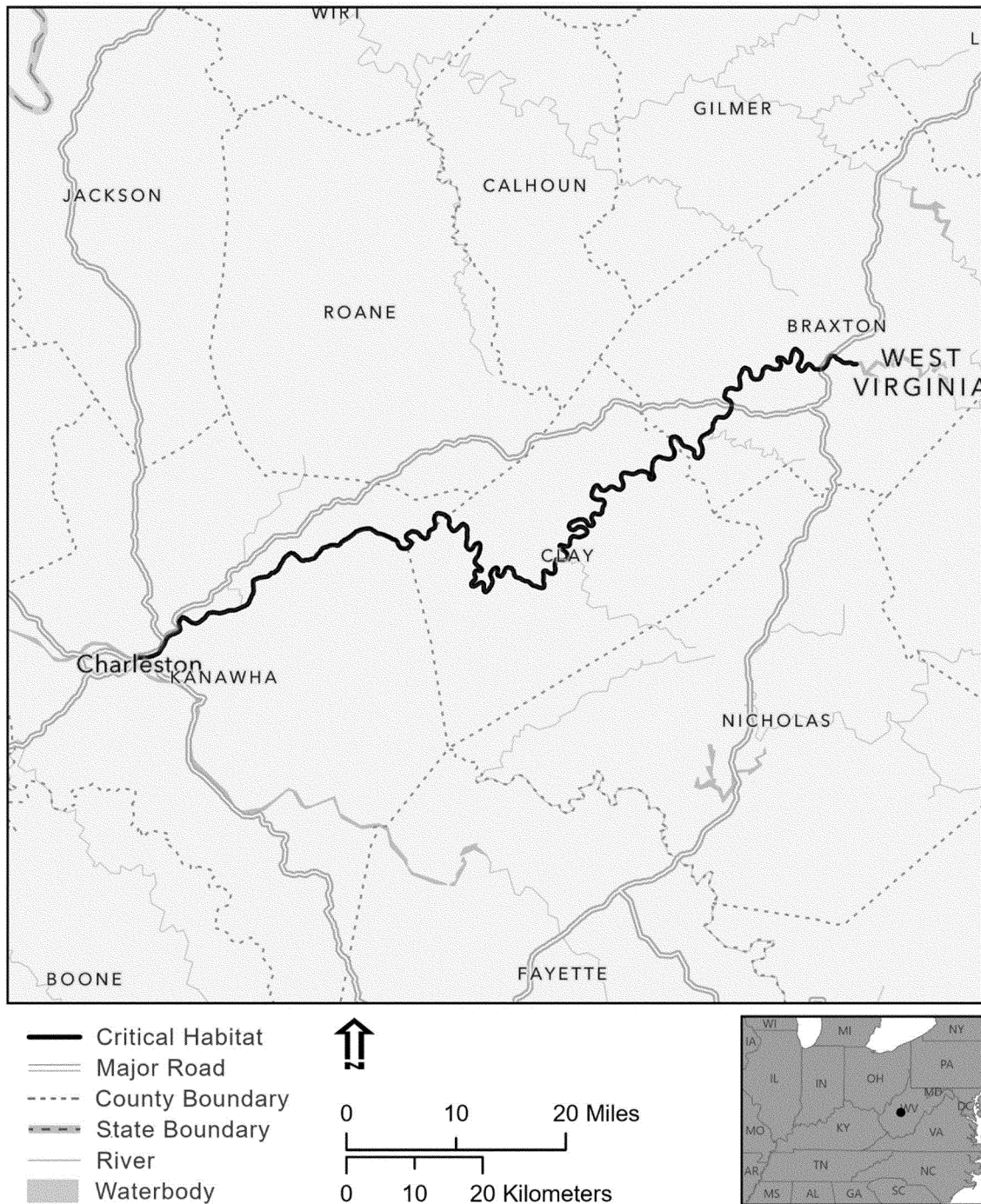
Virginia. Approximately 93 river mi (150.3 km; 92 percent) of riparian lands that border the unit are private ownership, and 7 river mi (12.7 km; 8 percent) are public (Federal, State, or local) ownership. This unit is directly

below Sutton Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 6 follows:

Figure 7 to Longsolid (*Fusconaia subrotunda*) paragraph (11)(ii)

Critical Habitat for Longsolid
LS6 Elk River; Braxton, Clay, and Kanawha Counties, West Virginia



(12) Unit LS 7: Kanawha River; Fayette and Kanawha Counties, West Virginia.

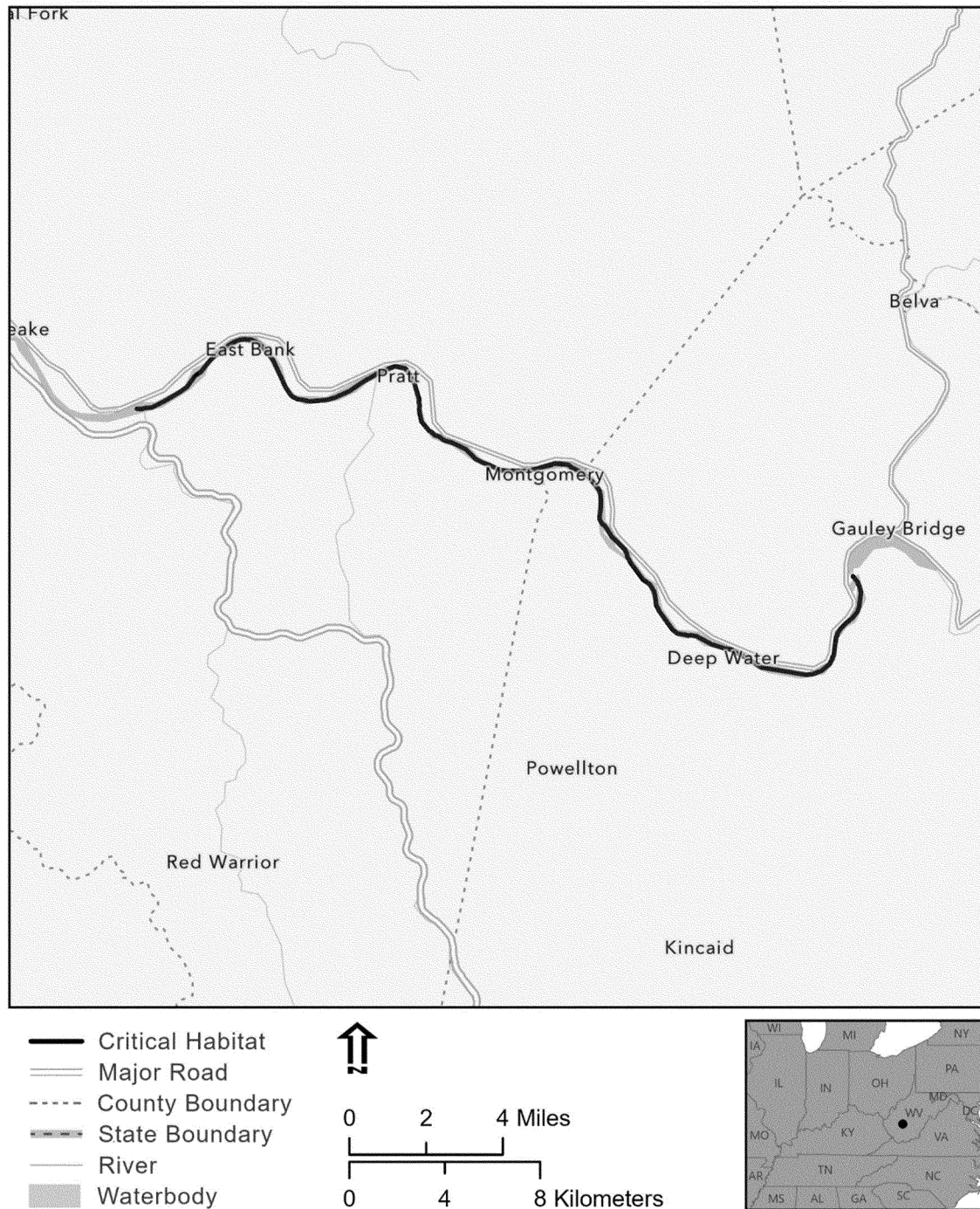
(i) Unit LS 7 consists of 21 river mi (33.9 km) of the Kanawha River in Fayette and Kanawha Counties, West

Virginia. Approximately 18 river mi (29.3 km; 90 percent) of riparian lands that border the unit are private ownership, and 2 river mi (4.6 km; 10 percent) are public (Federal, State, or local) ownership. London and Marmet

locks and dams within this unit are operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 7 follows: Figure 8 to Longsolid (*Fusconaia subrotunda*) paragraph (12)(ii)

Critical Habitat for Longsolid
LS7 Kanawha River; Fayette and Kanawha Counties, West Virginia



(13) Unit LS 8: Licking River; Bath, Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky.

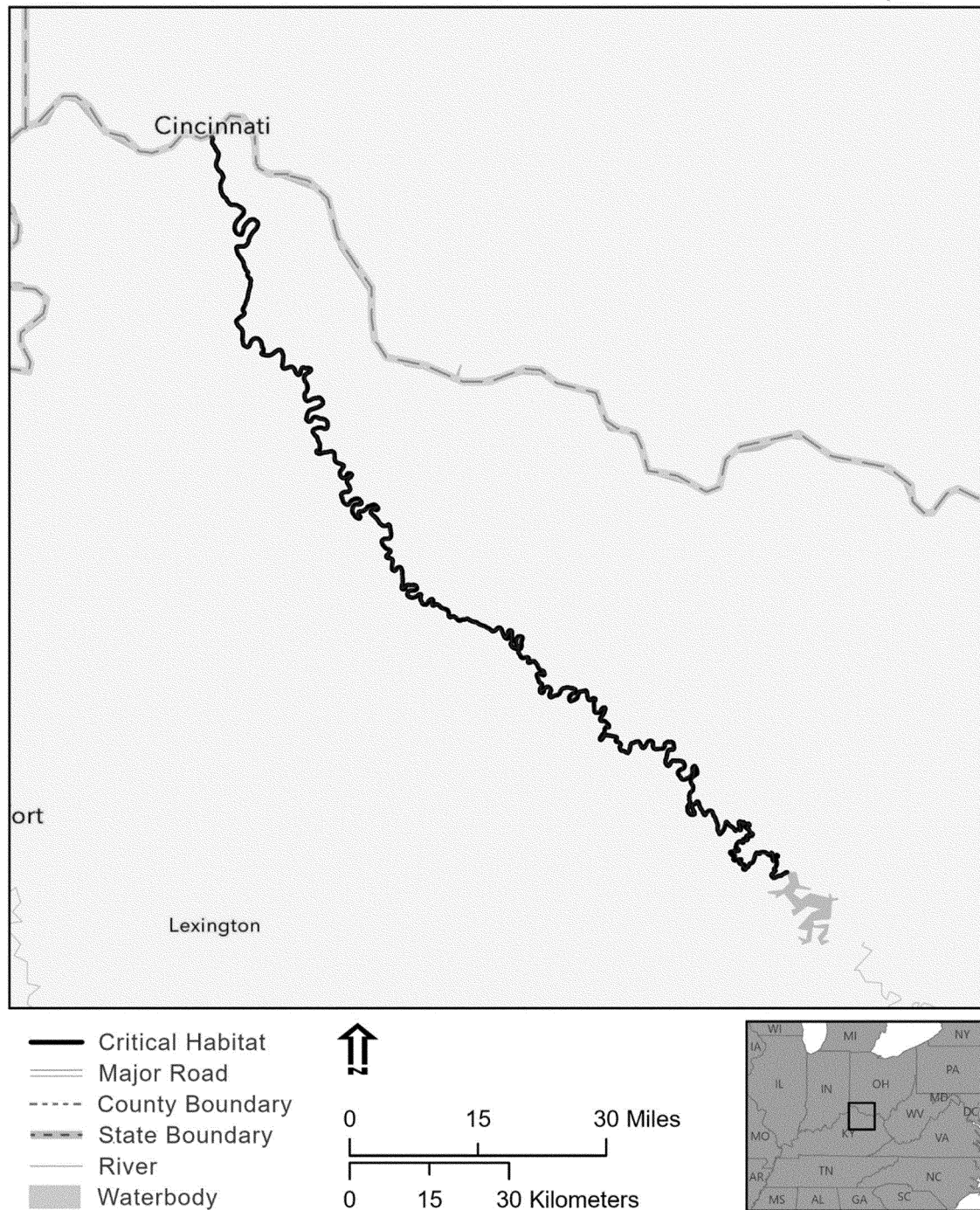
(i) Unit LS 8 consists of 181 river mi (291.5 km) of the Licking River in Bath,

Campbell, Fleming, Harrison, Kenton, Morgan, Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky. Approximately 161 river mi (259.7 km; 90 percent) of riparian lands that border the unit are private ownership, and 19 river mi (31.7 km; 10

percent) are public (Federal, State, or local) ownership. This unit is directly below Cave Run Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 8 follows:
 Figure 9 to Longsolid (*Fusconaia subrotunda*) paragraph (13)(ii)

Critical Habitat for Longsolid
LS8 Licking River; Bath, Campbell, Fleming, Harrison, Kenton, Morgan,
Nicholas, Pendleton, Robertson, and Rowan Counties, Kentucky



(14) Unit LS 9: Green River; Butler, Edmonson, Green, Hart, Taylor, and Warren Counties, Kentucky.

(i) Unit LS 9 consists of 156 river mi (251.6 km) of the Green River in Butler, Edmonson, Green, Hart, Taylor, and Warren Counties, Kentucky.

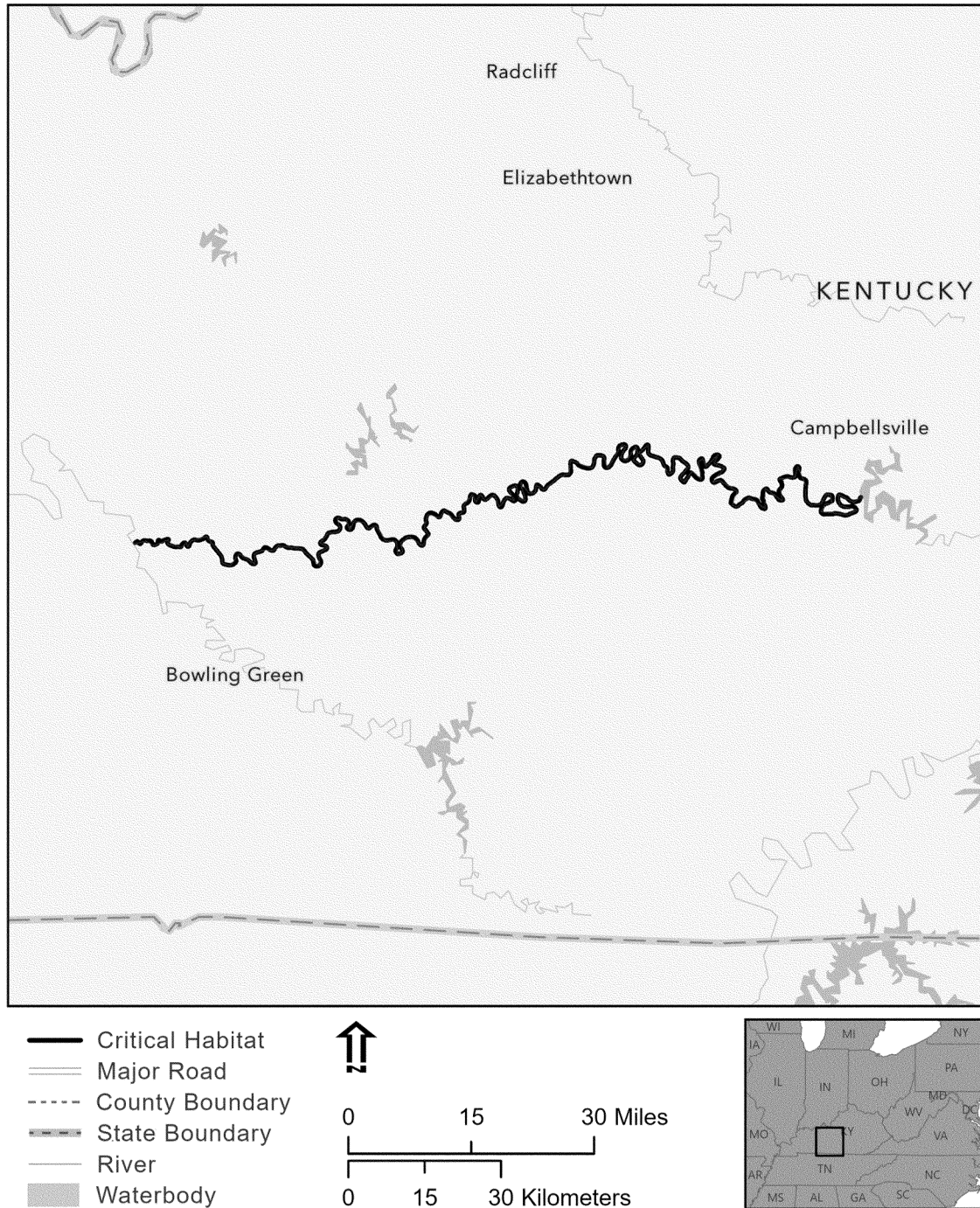
Approximately 105 river mi (169.2 km; 67 percent) of riparian lands that border the unit are private ownership, and 51 river mi (82.4 km; 33 percent) are public (Federal, State, or local) ownership, including Mammoth Cave National

Park. This unit is directly below Green River Dam, which is operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 9 follows:

Figure 10 to Longsolid (*Fusconaia subrotunda*) paragraph (14)(ii)

Critical Habitat for Longsolid
LS9 Green River; Butler, Edmonson, Green, Hart, Taylor, and Warren
Counties, Kentucky



(15) Unit LS 10: Cumberland River; Smith, Trousdale, and Wilson Counties, Tennessee.

(i) Unit LS 10 consists of 48 river mi (77.5 km) of the Cumberland River in Smith, Trousdale, and Wilson Counties, Tennessee. All riparian lands that

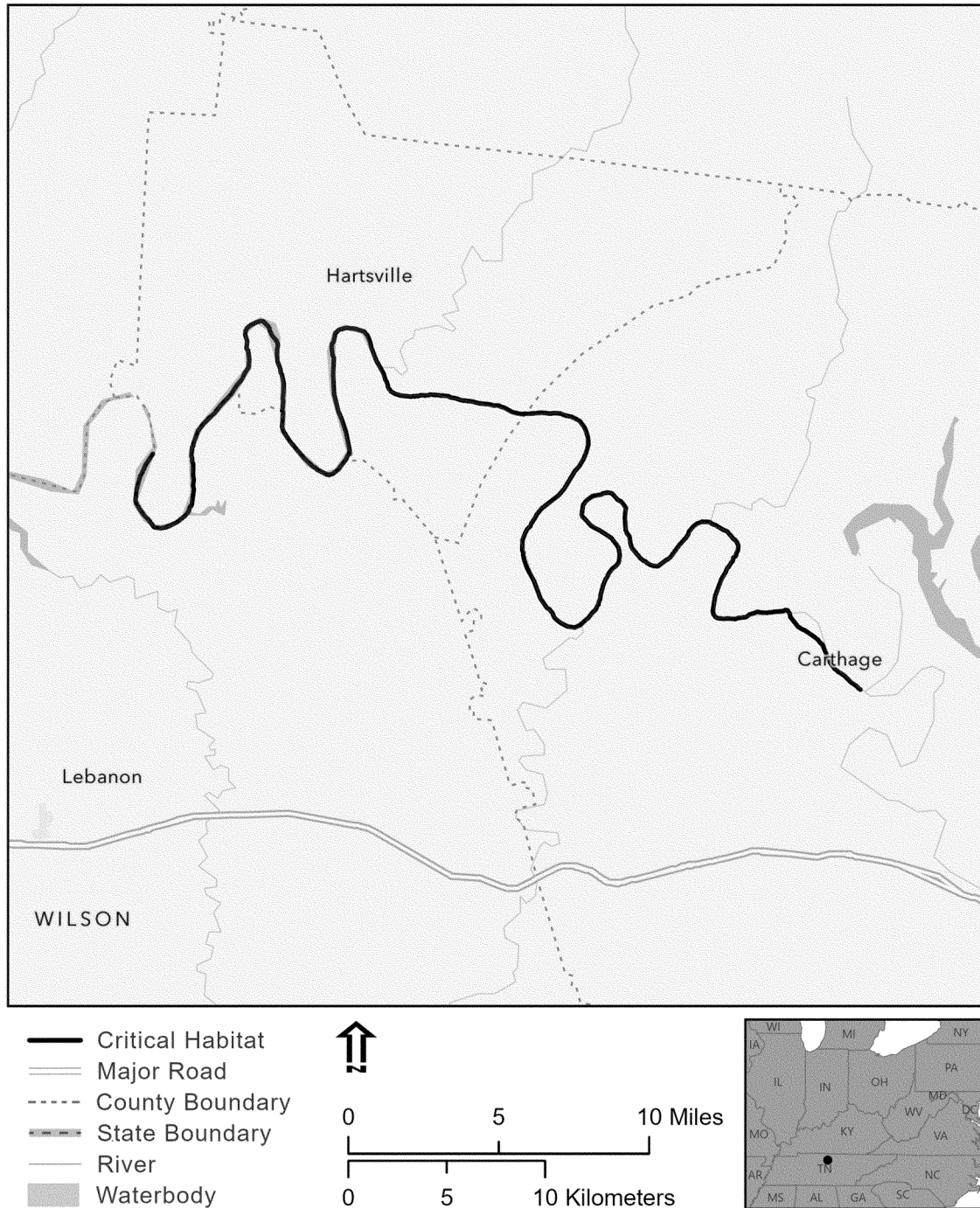
border the river are owned by the U.S. Army Corps of Engineers (Federal; 48 river mi (77.5 km)). This unit also falls within the Tennessee Wildlife Resources Agency's Rome Landing Sanctuary. Cordell Hull and Old Hickory Dams, upstream and

downstream of this unit, respectively, are operated by the U.S. Army Corps of Engineers.

(ii) Map of Unit LS 10 follows:

Figure 11 to Longsolid (*Fusconia subrotunda*) paragraph (15)(ii)

Critical Habitat for Longsolid
LS10 Cumberland River; Smith, Trousdale, and Wilson Counties, Tennessee



(16) Unit LS 11: Clinch River; Russell, Scott, Tazewell, and Wise Counties, Virginia; Claiborne, Hancock, and Hawkins Counties, Tennessee.

(i) Unit LS 11 consists of 177 river mi (286.1 km) of the Clinch River in Russell, Scott, Tazewell, and Wise

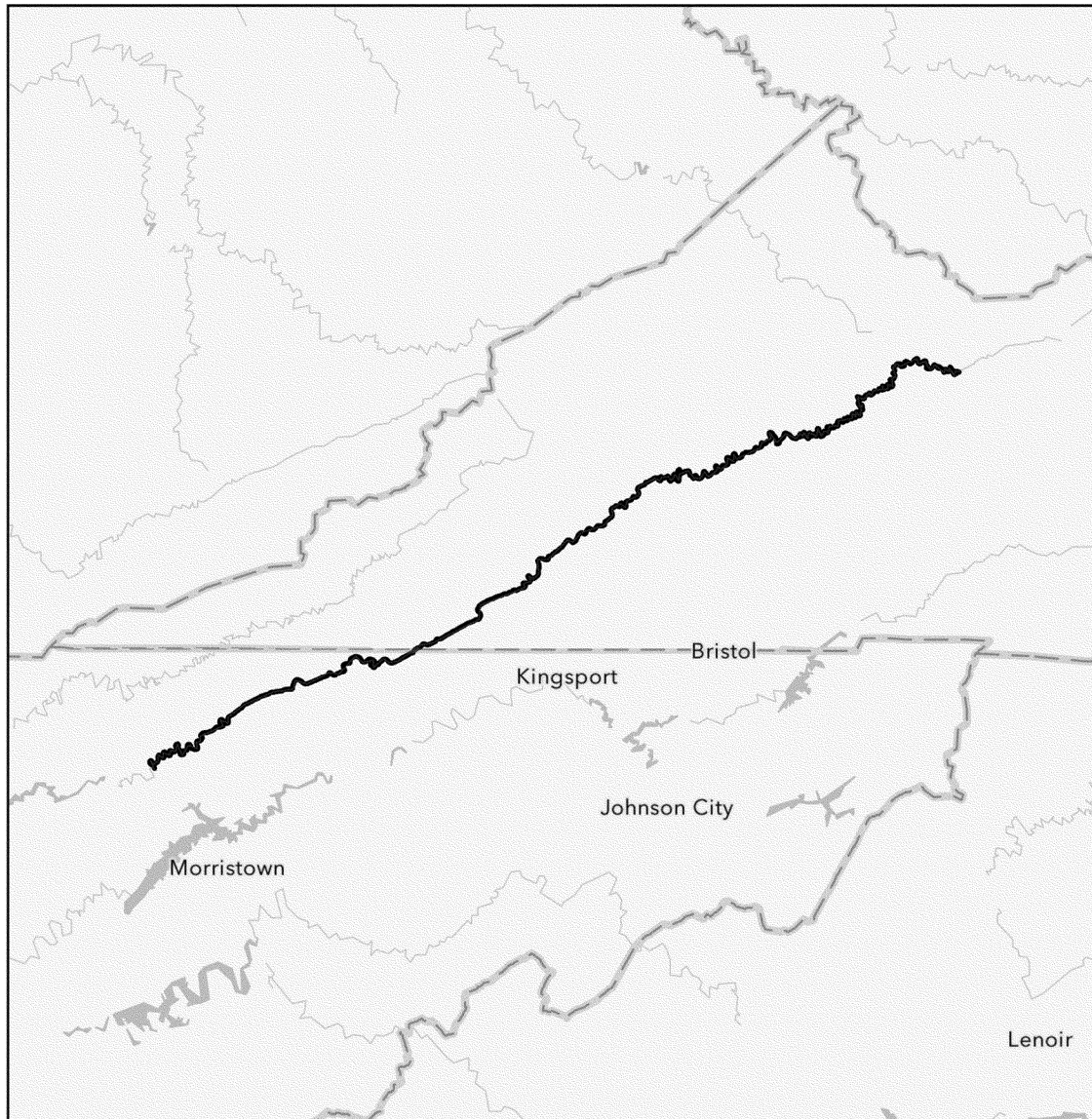
Counties, Virginia, and Claiborne, Hancock, and Hawkins Counties, Tennessee. Approximately 160 river mi (258.8 km; 90 percent) of riparian lands that border the unit are private ownership, and 17 river mi (27.3 km; 10 percent) are public (Federal or State)

ownership. The Tennessee portion of this unit is encompassed by the Tennessee Wildlife Resources Agency's Clinch River Sanctuary.

(ii) Map of Unit LS 11 follows:

Figure 12 to Longsolid (*Fusconaia subrotunda*) paragraph (16)(ii)

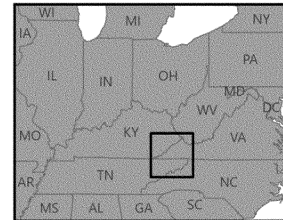
Critical Habitat for Longsolid
LS11 Clinch River; Russell, Scott, Tazewell, and Wise Counties, Virginia;
Claiborne, Hancock, and Hawkins Counties, Tennessee



- Critical Habitat
- Major Road
- - - County Boundary
- - - State Boundary
- River
- Waterbody



0 25 50 Miles
 0 25 50 Kilometers



(17) Unit LS 12: Paint Rock River; Jackson, Madison, and Marshall Counties, Alabama.

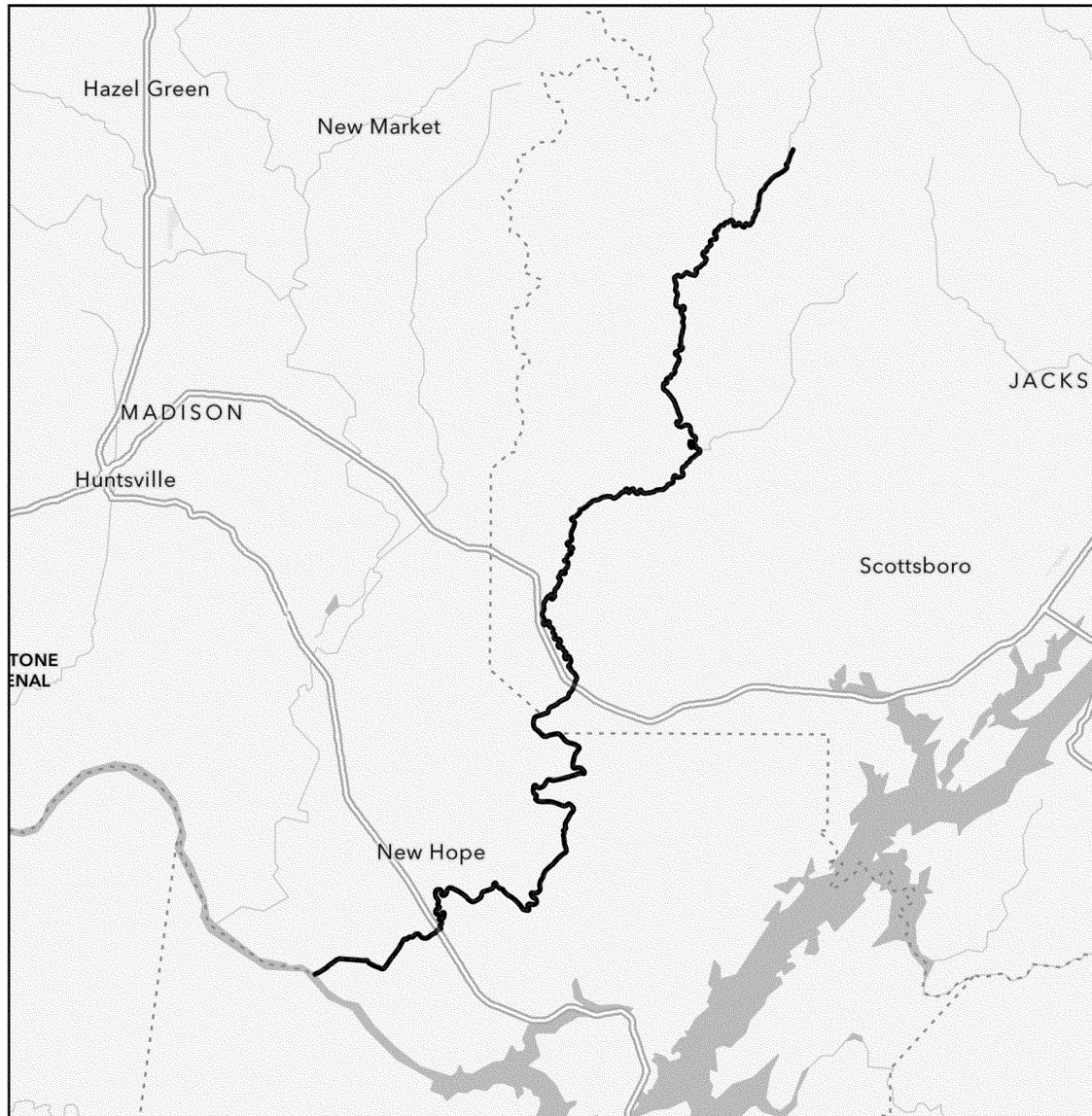
(i) Unit LS 12 consists of 58 river mi (94.5 km) of the Paint Rock River in

Jackson, Madison, and Marshall Counties, Alabama. Approximately 2 river mi (4.1 km; 3 percent) of riparian lands that border the unit are private ownership, and 56 river mi (90.4 km; 97

percent) are public (Federal or State) ownership.

(ii) Map of Unit LS 12 follows: Figure 13 to Longsolid (*Fusconaia subrotunda*) paragraph (17)(ii)

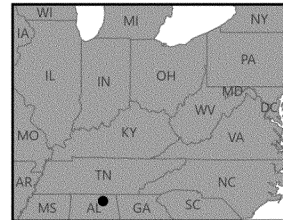
Critical Habitat for Longsolid
LS12 Paint Rock River; Jackson, Madison, and Marshall Counties, Alabama



- Critical Habitat
- Major Road
- - - County Boundary
- - - State Boundary
- River
- Waterbody



0 5 10 Miles
0 5 10 Kilometers



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Martha Williams,
Director, U.S. Fish and Wildlife Service.

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