

DEPARTMENT OF THE INTERIOR**Fish and Wildlife Service****50 CFR Part 17**

[Docket No. FWS–R2–ES–2024–0143;
FXES1111090FEDR–256–FF09E21000]

RIN 1018–BH76

Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Pecos Pupfish and Designation of Critical Habitat

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to list the Pecos pupfish (*Cyprinodon pecosensis*), a fish species from the Pecos River Basin of New Mexico and Texas, as a threatened species and designate critical habitat under the Endangered Species Act of 1973, as amended (Act). This determination also serves as our 12-month finding on a petition to list the Pecos pupfish. After a review of the best available scientific and commercial information, we find that listing the species is warranted. Accordingly, we propose to list the Pecos pupfish as a threatened species with a rule issued under section 4(d) of the Act (“4(d) rule”). If we finalize this rule as proposed, the Pecos pupfish would be added to the List of Endangered and Threatened Wildlife and the Act’s protections would be extended to the species. We also propose to designate critical habitat for the Pecos pupfish under the Act. In total, 136.12 river miles (219.06 river kilometers) and 26,555.54 acres (10,746.64 hectares) in Chaves and Eddy Counties, New Mexico, and Culberson and Reeves Counties, Texas, fall within the boundaries of the proposed critical habitat designation. We also announce the availability of an economic analysis of the proposed designation of critical habitat for Pecos pupfish.

DATES: We will accept comments received or postmarked on or before January 21, 2025. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT**, by January 6, 2025.

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: <https://www.regulations.gov>. In the Search box, enter FWS–R2–ES–2024–0143, which is the docket number for this rulemaking.

Then, click on the Search button. On the resulting page, in the panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may submit a comment by clicking on “Comment.” Comments submitted electronically using the Federal eRulemaking Portal must be received by 11:59 p.m. eastern time on the closing date.

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn: FWS–R2–ES–2024–0143, U.S. Fish and Wildlife Service, MS: PRB/3W, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on <https://www.regulations.gov>. This generally means that we will post any personal information you provide us (see Information Requested, below, for more information).

Availability of supporting materials: Supporting materials, such as the species status assessment report, are available on the Service’s website at <https://www.fws.gov/office/new-mexico-ecological-services>, at <https://www.regulations.gov> at Docket No. FWS–R2–ES–2024–0143, or both. If we finalize the critical habitat designation, we will make the coordinates or plot points or both from which the maps are generated available at <https://www.regulations.gov> at Docket No. FWS–R2–ES–2024–0143 and on the Service’s website at <https://www.fws.gov/office/new-mexico-ecological-services>.

FOR FURTHER INFORMATION CONTACT: Shawn Sartorius, Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, 2105 Osuna NE, Albuquerque, NM 87113; telephone 505–697–7606. 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. Please see Docket No. FWS–R2–ES–2024–0143 on <https://www.regulations.gov> for a document that summarizes this proposed rule.

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 an endangered species 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 Pecos pupfish meets the definition of a threatened species; therefore, we are proposing to list it as such, and we are proposing a designation of its critical habitat. Both listing a species as an endangered or threatened species and making a critical habitat designation 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. We propose to list the Pecos as a threatened species with a rule issued under section 4(d) of the Act, and we propose the designation of critical habitat for the species.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of 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 Pecos pupfish meets the definition of a threatened species due to the following threats: (1) introgression of the sheepshead minnow (*Cyprinodon variegatus*) (Factor E), (2) the loss and decline of surface and ground waters (Factor A), (3) degradation of water quality (Factor A), and (4) habitat loss and fragmentation (Factor A), all of which are exacerbated by the ongoing and expected effects of climate change (Factor E).

Section 4(a)(3) of the Act requires that the Secretary of the Interior (Secretary), to the maximum extent prudent and determinable, concurrently with listing, designate critical habitat for the species. 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 or 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.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other governmental agencies, Native American Tribes, the scientific community, industry, or any other interested parties concerning this proposed rule. We particularly seek comments concerning:

- (1) The species' biology, range, and population trends, including:
 - (a) Biological or ecological requirements of the species, including habitat requirements for feeding, breeding, and sheltering;
 - (b) Genetics and taxonomy;
 - (c) Historical and current range, including distribution patterns and the locations of any additional populations of this species;
 - (d) Historical and current population levels, and current and projected trends; and
 - (e) Past and ongoing conservation measures for the species, its habitat, or both.
- (2) Threats and conservation actions affecting the species, including:
 - (a) Factors that may be affecting the continued existence of the species, which may include habitat modification or destruction, overutilization, disease, predation, the inadequacy of existing regulatory mechanisms, or other natural or manmade factors.
 - (b) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to this species.
 - (c) Existing regulations or conservation actions that may be addressing threats to this species.
- (3) Additional information concerning the historical and current status of this species.
- (4) Information to assist with applying or issuing protective regulations under section 4(d) of the Act that may be necessary and advisable to provide for the conservation of the Pecos pupfish. In particular, information concerning:
 - (a) The extent to which we should include any of the Act's section 9

prohibitions in the proposed 4(d) rule; or

(b) Whether we should consider any additional or different exceptions from the prohibitions in the proposed 4(d) rule.

(5) Specific information related to critical habitat, such as:

(a) The amount and distribution of Pecos pupfish habitat;

(b) Any additional areas occurring within the range of the species, Chaves and Eddy Counties, New Mexico, and Culberson and Reeves Counties, Texas, that should be included in the designation because they (i) are occupied at the time of listing and contain the physical or biological features that are essential to the conservation of the species and that may require special management considerations or protection, or (ii) are unoccupied at the time of listing and are essential for the conservation of the species; and

(c) Special management considerations or protection that may be needed in critical habitat areas we are proposing, including managing for the potential effects of climate change.

(6) Land use designations and current or planned activities in the subject areas and their possible impacts on proposed critical habitat.

(7) Any probable economic, national security, or other relevant impacts of designating any area that may be included in the final designation, and the related benefits of including or excluding specific areas.

(8) Information on the extent to which the description of probable economic impacts in the economic analysis is a reasonable estimate of the likely economic impacts and the description of the environmental impacts in the environmental assessment is complete and accurate and any additional information regarding probable economic impacts that we should consider.

(9) Whether any specific areas we are proposing for critical habitat designation should be considered for exclusion under section 4(b)(2) of the Act, and whether the benefits of potentially excluding any specific area outweigh the benefits of including that area, in particular for those covered by the Pecos Pupfish Conservation Agreement (see more details in *Conservation Efforts and Regulatory Mechanisms* below). If you think we should exclude any additional areas, please provide information supporting a benefit of exclusion.

(10) Whether we could improve or modify our approach to designating critical habitat in any way to provide for

greater public participation and understanding, or to better accommodate public concerns and comments.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, do not provide substantial information necessary to support a determination. Section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made solely on the basis of the best scientific and commercial data available, and section 4(b)(2) of the Act directs that the Secretary shall designate critical habitat on the basis of the best scientific data available.

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via <https://www.regulations.gov>, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on <https://www.regulations.gov>.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on <https://www.regulations.gov>.

Our final determination may differ from this proposal because we will consider all comments we receive during the comment period as well as any information that may become available after this proposal. Based on the new information we receive (and, if relevant, any comments on that new information), we may conclude that the species is endangered instead of threatened, or we may conclude that the species does not warrant listing as either an endangered species or a threatened species. For critical habitat, our final designation may not include all areas proposed, may include some additional areas that meet the definition of critical habitat, or may exclude some areas if we find the benefits of exclusion outweigh

the benefits of inclusion and exclusion will not result in the extinction of the species. In addition, we may change the parameters of the prohibitions or the exceptions to those prohibitions in the protective regulations under section 4(d) of the Act if we conclude it is appropriate in light of comments and new information received. For example, we may expand the prohibitions if we conclude that the protective regulation as a whole, including those additional prohibitions, is necessary and advisable to provide for the conservation of the species. Conversely, we may establish additional or different exceptions to the prohibitions in the final rule if we conclude that the activities would facilitate or are compatible with the conservation and recovery of the species. In our final rule, we will clearly explain our rationale and the basis for our final decision, including why we made changes, if any, that differ from this proposal.

Public Hearing

Section 4(b)(5) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing. We may hold the public hearing in person or virtually via webinar. We will announce any public hearing on our website, in addition to the **Federal Register**. The use of virtual public hearings is consistent with our regulations at 50 CFR 424.16(c)(3).

Previous Federal Actions

We identified the Pecos pupfish as a Category 2 candidate in both the December 30, 1982, Review of Vertebrate Wildlife, Notice of Review (47 FR 58454); and the September 18, 1985, Review of Vertebrate Wildlife, Notice of Review (50 FR 37958). Category 2 candidates were those species for which the Service had information that proposed listing was possibly appropriate, but conclusive data on biological vulnerability and threats were not available to support a proposed rule at the time. This situation changed when the Pecos pupfish was identified as a Category 1 candidate in the January 6, 1989, Animal Notice of Review (54 FR 554) and in the November 21, 1991, Animal Notice of Review (56 FR 58804). Category 1

candidates were those species for which the Service had on file sufficient information to support issuance of proposed listing rules. In the February 28, 1996, Candidate Notice of Review (61 FR 7596), we discontinued the designation of multiple categories of candidates, and only former Category 1 species are now recognized as candidates for listing purposes. The Pecos pupfish remained a candidate species in the 1996 Notice of Review and also in the September 19, 1997, Notice of Review (62 FR 49398).

The Pecos pupfish was proposed for listing as an endangered species without critical habitat on January 30, 1998 (63 FR 4608). Within the ensuing year between the proposal of the species for listing and the required final determination, a conservation agreement was developed. The conservation agreement was cited in the March 17, 2000, withdrawal of the proposed rule to list (65 FR 14513) as sufficient to ensure the viability of the Pecos pupfish.

On June 18, 2007, we were petitioned to list the Pecos pupfish as an endangered species as part of a multi-species petition to list 475 species in the Service's Southwest Region by WildEarth Guardians (WEG, formerly Forest Guardians). On December 16, 2009, we issued a positive 90-day finding that the petition presented information indicating that the listing of the Pecos pupfish may be warranted (74 FR 66866) and initiated a status review. Per a court-approved settlement agreement, we agreed to send a 12-month petition finding for the Pecos pupfish to the **Federal Register** by December 1, 2024.

Peer Review

A species status assessment (SSA) team prepared an SSA report for the Pecos pupfish. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species.

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and in our August 22, 2016, memorandum updating and clarifying the role of peer review in listing and recovery actions under the Act (<https://www.fws.gov/sites/default/files/documents/peer-review-policy-directors-memo-2016-08-22.pdf>), we solicited independent scientific review of the

information contained in the Pecos pupfish SSA report. We sent the SSA report to four independent peer reviewers and received four responses. Results of this structured peer review process can be found at <https://www.regulations.gov> and <https://www.fws.gov/office/new-mexico-ecological-services>. In preparing this proposed rule, we incorporated the results of these reviews, as appropriate, into the SSA report, which is the foundation for this proposed rule.

Summary of Peer Reviewer Comments

As discussed in Peer Review above, we received comments from four peer reviewers on the draft SSA report. We reviewed all comments we received from the peer reviewers for substantive issues and new information regarding the contents of the SSA report. The peer reviewers generally concurred with our methods and conclusions and provided additional information, clarifications, and suggestions, including clarifications in terminology, additional literature on habitat fragmentation, discussions of severity of threats, and other editorial suggestions. Otherwise, no substantive changes to our analysis and conclusions within the SSA report were deemed necessary, and peer reviewer comments are addressed in version 1.2 of the SSA report (Service 2024, entire).

I. Proposed Listing Determination Background

A thorough review of the taxonomy, life history, and ecology of the Pecos pupfish is presented in the SSA report (version 1.2; Service 2024, pp. 1–21). The following sections are a synopsis of that information.

The Pecos pupfish is a small, deep-bodied (28 to 46 millimeter (mm) (1.1 to 1.8 inch (in.)), freshwater fish from the Pecos River Basin of New Mexico and Texas. It occurs in a variety of aquatic environments including wetlands, sinkholes, waterfowl impoundments, streams, springs and the Pecos River mainstem. The species historically inhabited the upper, middle, and lower Pecos River from just above Bitter Lake National Wildlife Refuge (NWR), Chaves County, NM, in the north, to south of the mouth of Independence Creek, in Crockett and Terrell Counties, TX, in the south. The Pecos pupfish is a member of the Cyprinodontidae family (pupfish and killifish), a group that includes 9 genera, 115 species, and 8 subspecies (ITIS 2023, entire). It is recognized as a valid taxon by the American Fisheries Society, and the Service accepts this taxonomy.

The Pecos pupfish varies in body color from gray to brown to iridescent blue. Pecos pupfish vary phenotypically amongst isolated habitat types, which may be advantageous for adapting to different food availability, dissolved oxygen availability, and salinity levels (Collyer et al. 2015, entire; Xu 2017, p. 22). Pecos pupfish are opportunistic omnivores; their diet is primarily composed of a diatom-detritus mixture, but may also include animal material, filamentous algae, macrophytes, sand, and seeds (Davis 1981, p. 536).

Pupfish are a euryhaline group of fish and are able to withstand conditions such as elevated salinity, higher water temperatures, and lower dissolved oxygen, that many other fish cannot tolerate (Kodric-Brown 1975, pp. 3, 6). The Pecos pupfish occurs in a variety of aquatic environments including wetlands, sinkholes, waterfowl impoundments, streams, springs, and the Pecos River mainstem (Hoagstrom and Brooks 1999, pp. 14–16; Collyer et al. 2015, p. 182). Pecos pupfish prefer environments with little to no water flow, and, in areas with flows, they typically occupy pools and shallow runs and riffles (Hoagstrom and Brooks 1999, pp. 36, 45). Within their occupied habitat, Pecos pupfish require a diverse set of microscale habitat conditions. A variety of underwater features such as crevices, boulders, large rocks, scattered pebbles, and aquatic plants provide topographic diversity throughout the range of the Pecos pupfish (Kodric-Brown 1975, p. 35; 1977, pp. 750–751, 753–756, and 761–762).

Pecos pupfish are sexually mature at 20 mm (0.79 in), within a few months of hatching (Kodric-Brown 1983, p. 128). Female Pecos pupfish lay an average of 10 eggs per day that adhere to spawning substrate, such as vegetation or rocks (Kodric-Brown 1977, pp. 751, 761–762, 764; Garrett 1982, pp. 360, 363; Farrington and Brandenburg 2003, p. 1). Spawning occurs May through September, peaking in late June through July when water temperatures consistently exceed 30 degrees Celsius (°C) (86 degrees Fahrenheit (°F)) in shallow waters less than 2 meters (m) (6.56 feet (ft)) deep, and in areas with a variety of silt-free underwater features such as crevices, boulders, large rocks, scattered pebbles, and aquatic plants (Kodric-Brown 1975, p. 35; 1977, pp. 750–751, 753–756, and 761–762). Pecos pupfish generally live for 1 year but can live an average of 2.5 years in captivity (Kodric-Brown 1977, p. 752m 765; Doege 2023, entire).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and the implementing regulations in title 50 of the Code of Federal Regulations 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.

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

species’ expected response 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.

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, which is further described in the 2009 Memorandum Opinion on the foreseeable future from the Department of the Interior (DOI), Office of the Solicitor (M–37021, January 16, 2009; “M-Opinion,” available online at <https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/M-37021.pdf>). The foreseeable future extends as far into the future as the U.S. Fish and Wildlife Service and National Marine Fisheries Service (hereafter, the Services) can make reasonably reliable predictions about the threats to the species and the species’ responses to those threats. We need not identify the foreseeable future in terms of a specific period of time. We will describe the foreseeable future on a case-by-case basis, using the best available data and taking into account considerations such as the species’ life-history characteristics, threat-projection timeframes, and environmental variability. In other words, the foreseeable future is the period of time over which we can make reasonably reliable predictions. “Reliable” does not mean “certain”; it means sufficient to provide a reasonable degree of confidence in the prediction, in light of the conservation purposes of the Act.

Analytical Framework

The SSA report documents the results of our comprehensive biological review of the best scientific and commercial data regarding the status of the species, including an assessment of the potential threats to the species. The SSA report does not represent our decision on

whether the species should be proposed for listing as an endangered or threatened species under the Act. However, it does 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 Pecos pupfish 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 conditions, pathogens). 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, which we then used to inform our regulatory decision.

The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket No. FWS–R2–ES–2024–0143 on <https://www.regulations.gov> and at <https://www.fws.gov/office/new-mexico-ecological-services>.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species, its resources, and the threats that influence the species’ current and future condition, in order to assess the species’ overall viability and the risks to that viability.

We analyze these factors both individually and cumulatively to determine the current condition of the species and project the future condition of the species under both plausible future scenarios at mid- and late-century.

Species Needs

For the Pecos pupfish to have sufficient resiliency, redundancy, and representation, individuals need suitable habitat that supports essential life functions at all life stages (see table 1, below). Based upon the best available scientific and commercial information, and acknowledging existing ecological uncertainties, the Pecos pupfish needs include: (1) adequate population abundance, (2) sufficient water quantity, (3) suitable water quality, and (4) habitat diversity.

TABLE 1—SUMMARY OF PECOS PUPFISH INDIVIDUAL ENVIRONMENTAL NEEDS BY LIFE STAGE

Life stage	Resource/environmental needs
Spawning adult	<ul style="list-style-type: none"> • Warm water temperatures between May and September. • Suitable oviposition sites (such as crevices, boulders, pebbles, scattered rocks, and subsurface vegetation mats). • Shallow water less than 2 m (6.56 ft) deep. • Salinities greater than 35,000 milligrams/liter (mg/L). • Adequate abundance of food (algae, insects, vegetation, etc.). • Dense vegetation. • Deeper water. • Hydrologic conditions conducive to survival (sufficient water levels, sufficient water temperature, etc.).
Egg	
Juvenile/non-breeding adults	
Overwintering adults and juveniles	
All	

Adequate Population Abundance

Two demographic factors, adult survival and fecundity, influence Pecos pupfish population trends and stability (Kodric-Brown and Mazzolini 1992, p. 175; Echelle and Connor 1989, p. 725; Echelle et al. 2003b, entire). The best available information indicates that Pecos pupfish can live up to 1 year in the wild and 2.5 years in captivity; however, we have no data on egg and juvenile survival (Kodric-Brown 1977, pp. 756–758; Garrett et al. 2002, p. 366; Doege 2023, entire). Data collected annually as part of a 23-year monitoring effort for the Pecos Pupfish Conservation Agreement (see more details in *Conservation Efforts and Regulatory Mechanisms* below) have consistently detected Pecos pupfish;

however, there are typically significant year-to-year variations in the number of fish caught at each sampling location (Hatt 2021, p. 6). To be resilient, populations of Pecos pupfish need to have enough individuals (abundance) to withstand stochastic events. Additionally, populations need to exist in locations where environmental conditions provide suitable habitat and water quality such that adequate numbers of individuals can be supported, and where there is an absence of sheepshead minnow. Without all these factors, a population has an increased likelihood for localized extirpation.

The sheepshead minnow, once confined to shallow, brackish, coastal waters of the Gulf and Atlantic coasts of the continental United States, was

introduced via a bait-bucket transfer into Red Bluff Reservoir near Pecos, Texas, in the early 1980s (Echelle and Connor 1989, p. 717; Childs et al. 1996, p. 2020;). By the late 1980s, Pecos pupfish were extirpated from this area and replaced by the Pecos pupfish × sheepshead minnow hybrid (Connor 1987, p. 2; Echelle and Connor 1989, pp. 717–720). In 1997, Pecos pupfish × sheepshead minnow hybrids were discovered in the Pecos River at Loving Crossing, Eddy County, NM (Echelle et al. 1997, p. 338; Echelle and Echelle 2007, p. 4). Records from 2016 and 2017 indicate that sheepshead minnow likely occur as far north as the Brantley Dam, Eddy County, NM, and that non-introgressed Pecos pupfish are extirpated from the Pecos River below

Brantley Reservoir, with the exception of the Salt Creek Texas (TX) population (Davenport 2023a, entire).

Sufficient Water Quantity

Pecos pupfish depend on sufficient water quantity to complete all stages of their lifecycle. While Pecos pupfish persist in shallow habitats less than 1 m (3.3 ft) deep (Salt Creek, NM), they may need deeper water to provide thermal refugia and winter habitat (Kodric-Brown 1977, p. 755). Sufficient water quantity is also necessary throughout the year for breeding and adult survival (Kodric-Brown 1977, p. 754; Hoagstrom et al. 2015, p. 14). It is surmised that water quantity changes in small, ephemeral streams have led to Pecos pupfish mortality events in both Bitter Creek and Salt Creek (NM) (Davenport 2023a and 2023b, entire; Jacobsen 2023, entire; Hoagstrom 2009, p. 28).

Water quantity for the Pecos pupfish is influenced by a variety of factors depending on the specific aquatic environment of a particular Pecos pupfish site or population. Sinkhole environments in the Pecos Basin are largely spring-fed systems derived from the San Andres artesian aquifer (Land 2003, p. 230). Similarly, permanent water in the Bitter Creek and Salt Creek (NM) likely originates from spring flow from the San Andres aquifer (Land and Huff 2009, p. 1). Salt Creek (TX) likely is supported by spring flows from the Toyah Aquifer, though no direct modeling has been done on this particular stream (LaFave 1987, p. 34). These streams also hold water during precipitation events. Water in Bitter Lake NWR is managed through a series of constructed impoundments and water conveyance structures. The Bureau of Land Management (BLM) Overflow Wetlands are supported by outflows of water from Lea Lake, a sinkhole in Bottomless Lakes State Park, as well as precipitation. Finally, water in the Pecos River is managed by the Bureau of Reclamation (BOR) for water deliveries, environmental flows, and fulfilling obligations under the 1948 Pecos River Compact (Llewellyn et al. 2021, pp. 39–42).

Karst aquifer systems, like that found in Bitter Lake NWR, may affect sinkhole systems, as groundwater pumping may tap into conduits that feed springs or sinkholes (Veni 2013, p. 47). Precipitation cycles and agricultural activity appear to be the two main factors causing variation in the aquifer levels (Land and Newton 2008, p. 189). However, the Roswell Artesian Basin provides an example of a rechargeable artesian aquifer, where water reduction measures and high levels of rainfall in

the 1970's led to a reversal in long-term hydraulic head declines and allowed this aquifer to recharge (Land and Newton 2008, p. 190).

Suitable Water Quality

Members of the *Cyprinodon* genus are known for their wide physiological tolerance relative to many other freshwater fishes. Pecos pupfish are able to tolerate a wide range of water quality conditions (Hoagstrom and Brooks 1999 entire). In areas where the salinity gradient changes, Pecos pupfish dominate the areas with the highest salinities (Hoagstrom and Brooks 1999 p. 12). However, at salinities greater than 35,000 mg/L, larval and egg development are suppressed or halted (Hoagstrom and Brooks 1999, p. 21; Propst 1999, p. 67). Pecos pupfish can also tolerate low dissolved oxygen for at least short periods, with measurements of dissolved oxygen levels as low as 2.5 mg/L during Pecos pupfish sampling (Hoagstrom and Brooks, 1999, p. 31; Propst 1999, pp. 67–68). These tolerance limits are further supported by extremes of temperature, dissolved oxygen, and salinity, often resulting in pupfish mortality (Hoagstrom and Brooks 1999, p. 21; Propst 1999, p. 67). In addition to natural impacts to water quality, industrial and agricultural pollutants have been shown to negatively impact Pecos pupfish (Houston et al. 2019, p. 33).

Habitat Diversity

The Pecos pupfish occurs in a variety of aquatic environments with a variety of underwater features that provide topographic diversity, such as crevices, boulders, large rocks, scattered pebbles, and aquatic plants provide topographic diversity throughout the range (Kodric-Brown 1975, p. 35; 1977, pp. 750–751, 753–756, and 761–762). Pecos pupfish typically occupy pools and shallow runs and riffles (Hoagstrom and Brooks 1999, pp. 36, 45). For reproduction, Pecos pupfish require shallow water less than 2 m (6.56 ft) deep and in areas with topographic diversity (Kodric-Brown 1977, pp. 750–751). Rocky embankments appear to be the most desirable breeding substrate, as the most aggressive and largest males occupy these areas at Mirror Lake, Bottomless Lakes State Park, Chaves County, NM (Kodric-Brown 1975, pp. 34–35). The percentage of males holding territory can vary year to year and is influenced by the amount of breeding and foraging habitat available (dependent on water levels), and that density of territorial males was highest in dense patches of aquatic vegetation, and lowest in flat silty areas with isolated rocks (Kodric-

Brown 1975, pp. 20, 34–35). During the colder months when water temperatures drop below 10 °C (50 °F), Pecos pupfish become inactive and can be found in deeper water with dense vegetation and flocculent material (such as fine detritus or non-living organic matter) present in the substrate (Kodric-Brown 1977, p. 752; Hoagstrom et al. 2015, p. 17).

For the Pecos pupfish to be resilient, each population needs to be able to withstand stochastic events or disturbances that can drastically alter local ecosystems. Populations of Pecos pupfish need to have enough individuals (abundance) and occupy multiple types of habitats with sufficient water quantity and quality, (habitat diversity), such as sinkholes, streams, and wetlands to withstand stochastic events. Additionally, populations need to exist in locations where environmental conditions provide suitable habitat and water quality such that adequate numbers of individuals can be supported. Without all these factors, a population has an increased likelihood for localized extirpation.

For a species to persist over time, it must exhibit attributes across its range that relate to either representation or redundancy. Representation describes the ability of a species to adapt to changing environmental conditions over time and is characterized by the breadth of genetic and environmental diversity within and among populations (Shaffer and Stein 2000, p. 308). For the Pecos pupfish to exhibit adequate representation, resilient populations should occur within the Pecos River Basin to which it is native. The breadth of morphological, genetic, and behavioral variation should be preserved to maintain the evolutionary variation of the species.

Redundancy describes the ability of a species to withstand catastrophic events (Tear et al. 2005, p. 841; Redford et al. 2011, p. 42). Adequate redundancy minimizes the effect of localized extirpation on the range-wide persistence of a species (Shaffer and Stein 2000, p. 308). Redundancy for the Pecos pupfish is characterized by having multiple, resilient, and representative populations across the range of the species. Also important for measuring redundancy is the connectivity among discrete populations that allows for immigration and emigration between populations and increases the likelihood of recolonization should a population become extirpated. In the case of the Pecos pupfish, however, increasing connectivity among populations can present a hybridization risk.

Threats

Following are summary evaluations of four threats analyzed in the SSA report for the Pecos pupfish: introgression of the sheepshead minnow (Factor E), the loss and decline of surface and ground water, degradation of water quality, and habitat loss and fragmentation (Factor A), which are exacerbated by the effects of climate change (Factor A). We also evaluate existing regulatory mechanisms (Factor D) and ongoing conservation measures.

In the SSA report, we also considered two additional threats: golden algal blooms (Factor A) and competition for food resources (Factor C). We concluded that, as indicated by the best available scientific and commercial information, these threats are currently having little to no impact on Pecos pupfish populations and thus the overall effect of these threats now and into the future is expected to be minimal. Therefore, we will not present summary analyses of those threats in this document, but we considered them in the current and future condition assessments in the SSA report. For full descriptions of all threats and how they impact the species, please see the SSA report (Service 2024, pp. 43–44).

Sheepshead Minnow Introgression

The sheepshead minnow is a threat to the Pecos pupfish through hybridization and competition for resources (Echelle et al. 2003b, entire; Echelle and Connor 1989, pp. 725–726). Pecos pupfish and sheepshead minnow lack isolating mechanisms and readily interbreed, and within as few as 5 to 7 years hybridization leads to the complete loss of genetically pure (non-introgressed) Pecos pupfish in the area of introgression (Cokendolpher 1980, entire; Echelle and Connor 1989, pp. 725–726; Echelle et al. 2003b, entire; Kodric-Brown and Rosenfield 2004, entire). Once a population is no longer genetically pure, it no longer exists. In addition, research suggests that the hybrid fish grow faster and are larger than pure Pecos pupfish, and thus outcompete genetically pure Pecos pupfish for resources (Rosenfield et al. 2004, p. 1595). Pecos pupfish hybridization with the sheepshead minnow is one of the greatest threats to this species and is cited as the cause of extirpation from historical sites (Echelle and Connor 1989, pp. 725–726; Echelle et al. 2003b, entire; Pecos Pupfish Conservation Team (Conservation Team) 2022, p. 5).

The New Mexico State Game Commission and Texas Parks and Wildlife Department (TPWD)

implemented State fishing regulations that prohibit use of sheepshead minnow in the bait harvest and use program since 1999. However, this nonnative invasive species occurs within the lower Pecos River, below the Red Bluff Reservoir, and may be unintentionally captured, transferred, and released into Pecos pupfish habitat, and thus remains an ongoing threat (Conservation Team 2022, pp. 3, 5). While the Red Bluff Reservoir provides a physical barrier that prevents sheepshead minnow from naturally moving into the middle Pecos River, and the Brantley Dam and Reservoir provide a barrier that prevents the sheepshead minnow from naturally moving into the upper Pecos River, recreational fishing occurs throughout the river, so it is highly likely that a bait-bucket transfer would lead to an introduction of sheepshead minnow and result in the introgression of the population of Pecos pupfish within the upper Pecos River. Fish barriers have been installed at Bitter Lake NWR and at the BLM Overflow Wetlands to prevent entrance of sheepshead minnow from the mainstem Pecos River.

Loss and Decline of Surface and Groundwater

Adverse impacts to both water quantity and, to a lesser extent, water quality, are threats to Pecos pupfish viability. As anthropogenic uses of water increase from urban, agricultural, and industrial development, water management will become more important to maintain adequate water for the Pecos pupfish. While the demand on water in the Pecos River Basin is expected to increase based on climate change projections (Sites Southwest 2008, pp. 6–3, 6–6), we have reasonable certainty that there will be adequate aquifer levels until 2100 (Llewellyn et al. 2021, pp. 99–100). Although diversions from the Pecos River are capped by existing water rights, agreements, and regulations, decreasing surface water availability can increase the demand for pumped ground water (Dunbar et al. 2022, p. 87).

In New Mexico, population growth in Chaves County, which contains the majority of current occupied Pecos pupfish sites, averaged a 1.3 percent annual growth rate between 1960 and 2010 (Consensus Planning, Inc. 2016, p. 10) but a 1.9 percent annual decline between 2010 and 2020. The Pecos Valley Artesian Conservancy District (PVACD) regulates ground water use within the aquifer and supplies water to about 110,000 acres of crops/year (Llewellyn et al. 2021, p. 47). The amount of water withdrawn causes seasonal variability in aquifer levels, but

yearly fluctuations in ground water levels typically remain similar (PVACD 2023, entire). The long-term average water level has remained constant. Water availability in the Pecos River is influenced by a variety of factors including human development, primarily agriculture. However, this river is currently managed for multiple uses, including endangered species conservation, and future human water use from the river is not expected to substantially increase in the future.

In Texas, the Delaware River, 12 mi (19.31 km) north of Salt Creek (TX), is experiencing an increase in ground water pumping to support hydraulic fracturing (fracking) operations, and we expect the increased water usage to continue around Salt Creek (TX) (Scanlon et al. 2020, pp. 3510–3513). Both a deep and shallow aquifer (Rustler and Pecos Valley complex) may support the springs feeding Salt Creek (TX) (George et al. 2011, pp. 4, 58, 146). However, there are no specific hydrologic models detailing how the aquifers influence the flows in Salt Creek (TX). Conversely, fracking is not a threat to the Pecos pupfish populations in New Mexico as the oil formations there are structured differently than those in Texas.

Water use may increase with a growing human population, potentially further depleting ground-water storage and negatively influencing the Pecos pupfish's future (Llewellyn et al. 2021, p. 84). Activities such as surface and groundwater withdrawals, as well as impoundments, have decreased streamflow resulting in direct habitat loss and increased habitat fragmentation (Llewellyn et al. 2021, p. 138). Karst aquifer systems, like that found on Bitter Lake NWR, may affect sinkhole systems, as groundwater pumping may tap into conduits that feed springs or sinkholes (Veni 2013, p. 47). Precipitation cycles and agricultural activity appear to be the two main factors causing variation in the aquifer levels (Land and Newton 2008, p. 189). We are uncertain of how the aquifers will be affected and recover (rainfall and recharge), if at all, and how reduced surface flows (irrigation) would be affected by human population growth (Land and Newton 2008, p. 190).

The Pecos River provides connected wetted habitat year-round. There are four federally owned reservoirs on the Pecos River: Santa Rosa (U.S. Army Corps of Engineers (Corps)); Sumner (BOR); Brantley (BOR); and Avalon (BOR), and the ground water rights are owned by the NM Interstate Stream Commission (Service 2017, pp. 7 and 11). The State and Federal agencies

work together to maintain river flows that provide water for a variety of reasons, including environmental reasons. For the last few decades, the only releases from Fort Sumner Reservoir to Brantley Reservoir have been block releases that occur several times a year at intervals and timing contrary to the historical flow regimes, leading to artificially low flows (Hoagstrom et al. 2008, p. 6). These block releases manage for the threatened Pecos bluntnose shiner (*Notropis simus pecosensis*) and act as a buffer to drying events even though the water may be repurposed from environmental use to consumptive irrigation use, and will be beneficial to the Pecos pupfish (Hoagstrom et al. 2008, p. 6).

Degradation of Water Quality

Because Pecos pupfish are relatively tolerant of more extreme water quality conditions (high temperatures, low dissolved oxygen, high salinity), minor changes to water quality are generally seen as less of a concern (Propst 1999, p. 68). However, throughout the Pecos pupfish's range, water temperatures have the potential to exceed the fish's thermal tolerance (Brown and Feldmeth 1971, entire). Furthermore, it is surmised that extreme salinity caused declines in two historical Pecos pupfish populations in two springs in Laguna Grande De la Sal, NM (Hoagstrom and Brooks 1999, pp. 13–16).

The entirety of the Pecos pupfish range in the Pecos River has ongoing water quality concerns and is considered impaired by the New Mexico Environmental Department (Llewellyn et al. 2021, pp. 27–29). Below Sumner Reservoir, the river improves for 160 km (100 mi) before becoming impaired by nutrients from irrigation return flow, urban runoff, and municipal wastewater treatment plant effluent to the State line (Llewellyn et al. 2021, pp. 27–28). Another stressor is contamination of water by oil and gas development (Bonetti et al. 2021, entire). Pipelines present another potential route of contamination, as leaks or ruptures may allow oil, gas, or brines to enter underground aquifers that contribute to spring flow or by point sources from spills and leaks on the surface (Ashworth 1990, p. 31). Oil and brine contamination may impair water quality to the extent that Pecos pupfish will be unable to carry out metabolic functions (e.g., breathing) (Bonetti et al. 2021, p. 4). However, the pipelines in the vicinity of Bitter Lake NWR, BLM Area of Critical Environmental Concern (ACEC), and Bottomless Lakes State Park are protected and managed to keep

these systems conserved and free from contamination.

Global Climate Change and Drought

The Southwest United States is thought to be extremely sensitive to increased drought and higher average temperatures caused by climate change (Sheffield and Wood 2008, p. 101). In particular, temperatures across New Mexico, including in the Pecos River Basin, have risen approximately 1.1 °C (2 °F) between 1970 and 2020 (Dunbar et al. 2022, pp. 4–5). While Pecos pupfish have persisted through historical drought conditions, observations from Bitter Lake NWR suggest that prolonged drought or higher temperatures have likely led to mortality events (Jacobsen 2023, entire). Because Pecos pupfish are able to persist in degraded, saline water conditions, they are likely to be somewhat resilient to adverse water flow and temperature impacts (Propst 1999, pp. 67–68). However, Pecos pupfish are likely persisting at or near their thermal maximum, particularly during the hottest parts of the year (Matthews and Zimmerman 1990, p. 27). The increasing temperatures predicted by climate modeling suggest that water temperatures have the potential to exceed the thermal maximum for Pecos pupfish (Llewellyn et al. 2021, p. 88). This is particularly crucial for sites that are shallower, have limited freshwater input, or are isolated from any potential thermal refugia. Observations of the Conchos pupfish (*C. eximius*), a close relative of the pupfish, suggest that drought may have caused declines in fish numbers (Davis 1980, p. 83).

Climate change manifests in a variety of ways. An average increase in temperature manifests itself locally as higher daytime temperatures and higher overnight low temperatures (Hayhoe et al. 2018, p. 88). In terms of precipitation, broadly speaking, wet areas are expected to get wetter and experience more intense precipitation events, while dry areas are expected to get drier and experience more intense drought events (Shafer et al. 2014, pp. 443–445; Kloesel et al. 2018, pp. 995–996, 1004). Another effect of climate change is exacerbated drought due to feedback loops between high air temperatures, low humidities, and low soil moisture (Cheng et al. 2019, pp. 4437–4440). Potential effects of climate change that are likely to affect water quality and quantity include increased temperatures, evaporation, evapotranspiration, drought, earlier runoff, and reduced or increased precipitation (Llewellyn et al. 2021, p.

98). The main uncertainty of a changing climate is the resulting demands on surface and ground water aquifers that support habitat for the Pecos pupfish, thereby reducing water quantity and leading to impaired water quality.

Habitat Loss and Fragmentation

Groundwater depletion has dried up several marshes, playas, and spring ponds formerly occupied by Pecos pupfish adjacent to the Pecos River in New Mexico and Texas (Hoagstrom and Brooks 1999, p. 11). Direct habitat loss was also believed to have caused the extirpation of Comanche Springs pupfish (*C. elegans*) in Texas near Fort Stockton (Echelle et al. 2003a, p. 114). Habitat loss occurs when streams are dewatered, and surface flow is eliminated. To date, we are unaware of habitat loss within the range of the species at a scale that has caused the extirpation of Pecos pupfish in an entire population. However, significant habitat impairment has occurred throughout the range of the Pecos pupfish. For example, the Pecos River has been significantly altered through dam construction, channelization, and water diversions resulting in the loss of off-channel marshes, oxbows, and changes to mainstem flows (Hoagstrom and Brooks 1999, pp. 10–12).

While we have no data regarding to what extent the Pecos pupfish use off-channel marshes and oxbows, based on habitat descriptions of the current known occupied locations we presume that at least a portion of the available off-channel habitat may have been used by Pecos pupfish for connectivity (Hoagstrom and Brooks 1999, p. 22). Furthermore, research suggests that habitat fragmentation and alteration may have rendered Pecos pupfish populations in the lower Pecos River more vulnerable to hybridization with the sheepshead minnow, and identified morphological differences between populations that are linked to aquatic habitat type and diversity (Collyer et al. 2015, p. 191). Similarly, pupfish need large and connected populations to have a chance to potentially withstand introgression (Collyer et al. 2015, p. 191). More recently, in 2020, 2022, and 2023, drought events led to the loss of portions of Bitter Creek on Bitter Lake NWR, with Pecos pupfish mortality observed in 2020 and 2022. Data collected during winter surveys suggest that the Pecos pupfish is able to return to sections of the creek once sufficient water quantities are present. Although data are lacking from the Pecos River mainstem, this scenario likely occurs there as well.

Habitat fragmentation is the disruption of continuous habitat resulting in smaller disconnected areas and can be either temporary or permanent (Wiegand et al. 2005, p. 109). The natural landscape for the Pecos pupfish comprises isolated sinkholes with unknown subsurface connectivity, disjunct wetlands and ephemeral streams, and a historically well-connected river system. Much of the direct habitat loss and fragmentation within the range of the Pecos pupfish is the result of dewatering of habitat as a result of anthropogenic development, and water management and use, such as demand for water for agriculture and oil and gas development (Hoagstrom et al. 2008, p. 6). Climate change impacts in the Pecos River Basin will likely result in higher overall surface temperatures. In general, warming surface temperatures directly impact evapotranspiration rates and can lead to lowered surface water (Llewellyn et al. 2021, p. 21). However, throughout the range of the Pecos pupfish the hydrology impacting their habitat is a complicated mix of evaporation, spring flow, and groundwater recharge.

The loss of habitat connectivity and the resulting fragmentation can lead to isolation among populations, which may have caused a genetic bottleneck in some Pecos pupfish populations (Collyer et al. 2015, p. 191; Whiteley 2023, pp. 6–7). Isolated and small populations are also more susceptible to stochastic events and amplify the effects of inbreeding depression and genetic drift (Rieman and Allendorf 2001, p. 762). Fragmentation and isolation of habitats can increase the risk of local extirpation as recolonization from adjacent populations is less likely (Hoagstrom et al. 2008, p. 13). As habitat loss and fragmentation increases, habitat diversity decreases.

Summary of Threats

The greatest threats to the Pecos pupfish are introgression with sheepshead minnow, loss and decline of surface and ground water, degradation of water quality, habitat loss and fragmentation, and the effects of climate change. Introduction of sheepshead minnow into new locations occupied by Pecos pupfish could lead to rapid introgression, replacing the genetically pure population with Pecos pupfish hybrids. Research has found Pecos pupfish populations that are already negatively impacted by habitat alteration are likely more at risk of introgression because the reduction in habitat increases competition for breeding substrate (Kodric-Brown and Rosenfield 2004, pp. 121–122; Collyer et

al. 2015, p. 191). Anthropogenic water use and management has impacts on most of the surface water and groundwater within the range of the Pecos pupfish, and continued development and climate-driven changes to water availability will continue to impact the species in the future. Climate change impacts including higher average annual temperatures, more variable or lower average annual precipitation, and increased drought frequency, are currently impacting the Pecos pupfish and will likely continue to do so. Increasing temperatures increase the risk that shallow habitat could exceed the thermal tolerance of Pecos pupfish, and the resulting increased evapotranspiration leads to lowering of water levels with the potential for corresponding increases in salinity and water temperatures and lowered dissolved oxygen.

Conservation Efforts and Regulatory Mechanisms

In 1999, a conservation agreement was developed to address the threats to Pecos pupfish (Conservation Team 1999; entire). Since implementation of the conservation agreement, conservation efforts have included sheepshead minnow eradication, installation of fish barriers, and enforcement of State fishing rules in an effort to protect the Pecos pupfish from further introgression of sheepshead minnows or hybrids and alleviate other threats affecting the Pecos pupfish (Conservation Team 2022, p. 3). The conservation agreement was amended in 2013 and in 2022 (Conservation Team 2022, pp. 1, 4).

These above-mentioned stressors—introgression, water quantity, and habitat degradation and loss—have been considered and some have been reduced through the implementation of the conservation agreement (Conservation Team 2022, entire). The agreement has eight signatory agencies: TPWD; New Mexico Department of Game and Fish (NMDGF); New Mexico Energy, Minerals, and Natural Resources Department; New Mexico Department of Agriculture; New Mexico Interstate Stream Commission; Commissioner of Public Lands; New Mexico State Land Office; BLM; and the Service (Conservation Team 2022, pp. 8–23). The duration of the conservation agreement is indefinite with formal review every 10 years (Conservation Team 2022, p. 12).

Since 1999, one fish barrier has been installed at Bitter Lake NWR, near the confluence with the Pecos River. In 2019, two fish barriers were replaced at

the BLM Overflow Wetlands, where north and south concrete barriers were installed to prevent the entrance of fish from the mainstem Pecos River into the complex. The barrier on the BLM Overflow Wetlands not only protects the wetlands, but also protects the Bottomless Lakes complex from the threat of hybridization.

Moving forward, the conservation agreement will continue to provide guidance for agencies and partners working towards Pecos pupfish conservation, help provide for ongoing maintenance of fish barriers, installation of additional fish barriers, and enforcing existing State and Federal baitfish regulations.

The Fort Worth Zoo and other collaborating zoos have successfully bred Pecos pupfish in captivity since 2000. Captive conservation efforts have focused on propagation techniques, animal husbandry research, and propagation for stocking. Beginning in 2012, the State of Texas began working with private landowners within the Pecos River watershed to identify opportunities for the development of Pecos pupfish production ponds. Two ponds were established in 2024; recruitment of additional landowners and establishment of additional ponds is ongoing. The goal of the ponds is to sustain the genetic lineage from the Salt Creek, TX, population, create stable habitats isolated from potential sheepshead minnow incursion with secure water sources, and provide a stock of fish that can be used to establish other locations.

Current Condition

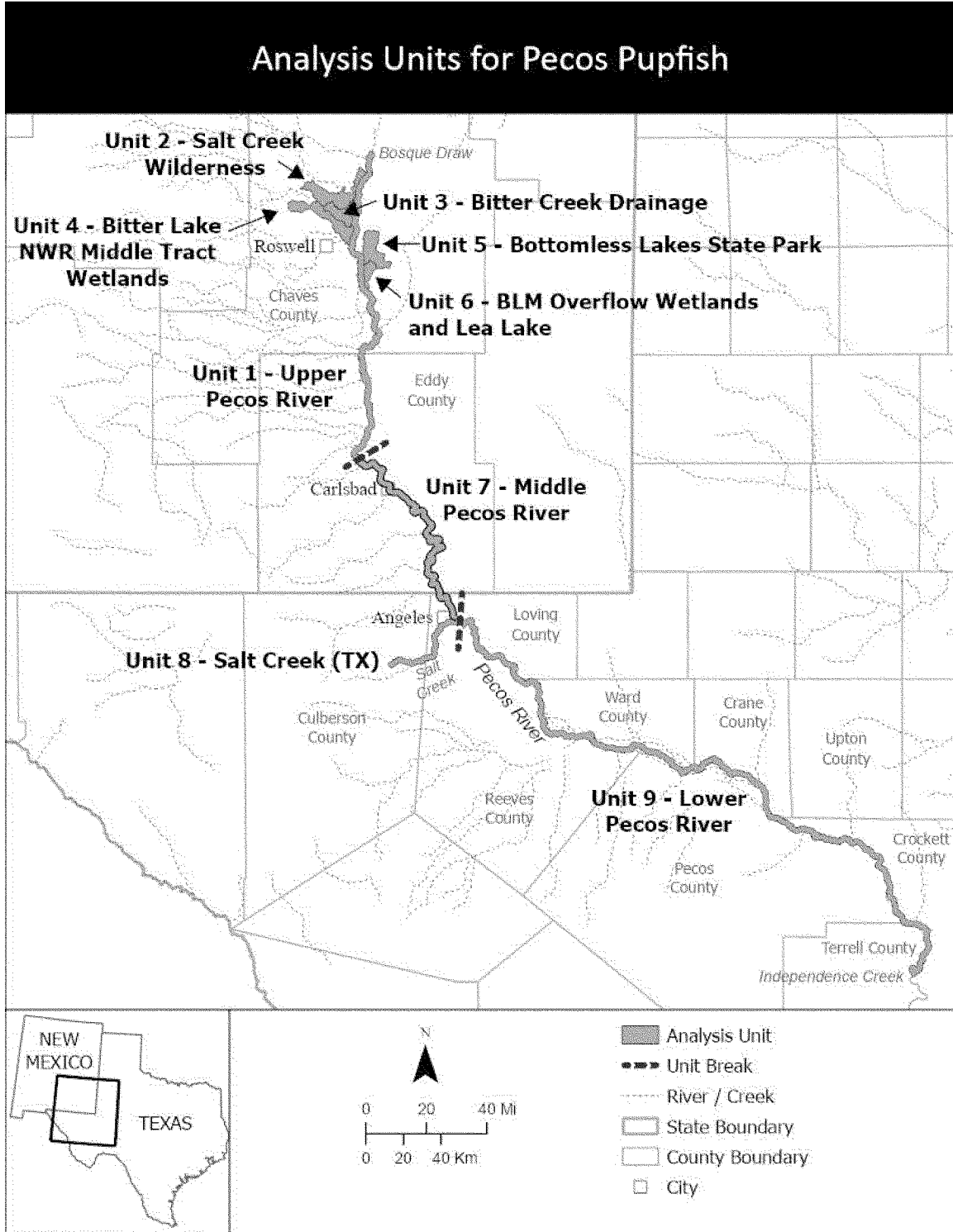
A thorough review of the Pecos pupfish's current condition is presented in chapter 4 of the SSA report (version 1.2, Service 2024, pp. 46–74).

We divided the Pecos pupfish's range into nine analysis units (AU) (Figure 1). Currently, the Pecos pupfish is distributed across seven of nine AUs covering the historical range; two of the AUs are considered extirpated (figure 1; table 3; Service 2024, figure 20, p. 52). We defined Pecos pupfish AUs based on documented occurrences, U.S. Geological Survey hydrological unit code (HUC)—12 sub-watershed boundaries, stream and river features, and barriers (such as Brantley Reservoir and Red Bluff Reservoir) (Service 2024, p. 51). This approach is based on the assumption that the closer occurrences are (such as within the same AU), the more likely similar environmental processes are influencing the sites where the fish occurs. We evaluated the current viability of Pecos pupfish using

population resiliency and species' redundancy and representation.

BILLING CODE 4333-15-P

Figure 1—Pecos pupfish range map, distributed across the Pecos River Basin.



BILLING CODE 4333-15-C

The species is known from nine analysis units.

TABLE 2—ANALYSIS UNITS FOR THE PECOS PUPFISH

Analysis unit	Land ownership
1: Upper Pecos River	BLM, State, private.
2: Salt Creek Wilderness	FWS.
3: Bitter Creek Drainage	FWS.
4: Bitter Lake NWR Middle Tract Wetlands	FWS.
5: Bottomless Lakes State Park	State.
6: BLM Overflow Wetlands and Lea Lake	BLM, State.
7: Middle Pecos River	BLM, State, private.
8: Salt Creek (TX)	Private.
9: Lower Pecos River	BLM, State, private.

To assess resiliency, we developed a qualitative model that incorporates one demographic metric (occurrence) and three habitat metrics (water quantity, water quality, and habitat diversity), and genetic security into the overall status for each unit (table 3). We selected habitat diversity as a metric as habitats with multiple aquatic environments may better allow the fish to withstand changing or adverse conditions.

To assess redundancy of the Pecos pupfish, we examined (1) how many extant sites exist within each AU, (2) how connected these sites are within the unit, and (3) how connected each unit is to nearby units. Importantly though, the diversity of the habitat, and not the number of sites Pecos pupfish have been detected, reflects the extent of the occupied Pecos pupfish habitat within the unit. For example, Bitter Creek (on Bitter Lake NWR) is approximately 1,546 m (5,072 ft) of variably wetted stream and is counted as a single site. Similarly, the BLM Overflow Wetlands cover over 1,000

acres (405 ha) and is also counted as a single site. However, we assume that with the exception of the sites delineated on the upper Pecos River, which is a riverine environment, each site is representative of a discrete aquatic environment.

To assess representation, we used aquatic environment (riverine, shallow stream, sinkholes, and wetlands) as a surrogate for genetic data. Genetic studies of Pecos pupfish have revealed important genetic relationships across the range of the species. The population of Pecos pupfish in the upper reaches of Salt Creek (TX) shows a specific allele that is unique to this location (Echelle et al. 2003b, p. 6). Recent work in the northern portion of their range has found that Pecos pupfish populations in the Bottomless Lakes State Park and BLM Overflow Wetland (AUs 5 and 6, respectively), are highly genetically differentiated from each other and from other populations (Whiteley 2023, pp. 7–9, 18). Additionally, individuals sampled from Bottomless Lakes State Park showed high inbreeding

coefficient, (Whiteley 2023, p. 26). Analysis showed distinct clustering of Pecos pupfish at two sites at Bottomless Lakes State Park (Mirror Lake and Lazy Lagoon) and all of the sampled sites at Bitter Lake NWR (Whiteley 2023, p. 18). On Bitter Lake NWR, two distinct clusters were observed that may indicate gene flow (Whiteley 2023, p. 19). The sampled sites in the Middle Tract Wetlands clustered with each other and Bitter Creek, while the four sample sinkholes all clustered with each other (Whiteley 2023, p. 8). While that data analyzed by Whiteley (2023, entire) did not attempt to infer a relationship between environmental factors, a result that might reflect either developmental plasticity or local genetic adaptation, research does suggest that Pecos pupfish morphology differs depending on the aquatic environments (*i.e.*, habitat diversity) (Echelle and Echelle 2007, p. 7; Collyer et al. 2015, p. 187–189; Xu 2017, pp. 22, 26–27; Whiteley 2023, entire).

TABLE 3—CONDITION CRITERIA RESILIENCY ANALYSIS METRICS AS APPLIED TO EACH ANALYSIS UNIT

Condition	Genetic security	Occurrence	Water quantity	Water quality	Habitat diversity
High condition (high resiliency).	No evidence of introgression with sheepshead minnow.	Extant or presumed extant observed at, or in the vicinity of, each of these sites at least once within the last 5 years.	Stable and sufficient water availability throughout the unit. Low flow or drying events documented, but no long-term drying events recorded.	No severe impairments to water quality documented and no recorded contamination events.	Unit has a diverse habitat assemblage within the unit (streams/river, wetlands, and sinkholes).
Moderate condition (moderate resiliency).	Introgression possible in the unit, but no confirmation.	Two or fewer of the known occupied sites confirmed or presumed extirpated.	Occasional low flows or drying events across <50% of the unit with rare long-term drying events documented.	Occasional water quality impairments documented, likely linked to low flows. No documented exposure to surface contaminants.	Fish restricted to just a single habitat type within the unit.
Low condition (low resiliency).	Introgression only in a portion of the unit.	Pupfish extant at 50% or fewer of sites identified. Populations low enough that fish are not detected on 50% or more visits to occupied locations.	Routine low flows and drying events across the majority of the unit and regular long-term drying events.	Documented exposure to surface contaminants within much of the unit.	N/A.
Likely extirpated	Confirmed introgression throughout the unit.	N/A	N/A	N/A	N/A.

Fundamental to our analysis of the Pecos pupfish was the determination of scientifically sound analytical units at a scale useful for assessing the species. As there is little information available regarding the demographic or genetic processes that define the spatial structure of Pecos pupfish populations, we relied on spatial occurrence data to define a suitable extent for our AUs. Within each AU, we identified discrete sites where Pecos pupfish have been documented to occur during past sampling and inventory efforts (Brooks 1992, entire; Hoagstrom and Brooks 1999, entire; National Heritage New Mexico (NHNM) 2021, entire; GBIF

2022, entire). These sites represent the documentation of at least one Pecos pupfish at a specific location at a point in time. Many of these sites have not been routinely visited or have been visited only once. Eleven sampling locations representing nine sites have been annually sampled (Hatt 2022, p. 5). In some cases, such as sinkholes, these sites are analogous to subpopulations. In others, such as the Pecos River or BLM Overflow Wetlands, the documented sites represent only the accessible portion of the habitat and likely do not represent the entire population in the area.

Based on the available data and our understanding of Pecos pupfish ecology, we developed a basis for assigning a risk category for each metric at the population AU level (table 4). The risk category reflects a qualitative determination of the likelihood that the species' response to the conditions described in each individual metric, over the 20-year period following the year 2023, would be extirpated from a given population AU. This 20-year timeframe correlates with approximately 20 1-year generations, which is near the maximum of the presumed Pecos pupfish lifespan in the wild.

TABLE 4—QUALITATIVE AND QUANTITATIVE DESCRIPTIONS OF THE THREE RISK CATEGORIES USED IN THE RESILIENCY ANALYSIS

Risk category	Analysis unit condition	Estimated chance of extirpation for 20 years	Numerical extirpation risk estimate	Threats characterization
Low risk	High condition	Extirpation is very unlikely	<10%	Threats to pupfish needs are minimized or limited in spatial extent within the unit.
Moderate risk	Moderate condition	Extirpation is unlikely	10–40%	Threats to pupfish needs are widespread throughout the unit but limited in duration or severity.
High risk	Low condition	Extirpation risk ranges from being about as likely as not to being very likely.	>40%	Threats to pupfish are severe and pervasive throughout the unit.

We ranked and scored the individual metrics as one (low), two (moderate) or three (high), based on criteria described in table 3, then combined them to produce a categorical condition score for each AU. We then averaged that score across all four categories to develop an overall unit score. For the overall unit score, an average of greater than 2.6 was considered high condition, 1.6 to 2.5 was considered moderate condition, and 1.5 or less was considered low condition. To aid in the comparison of AUs (with each other and under various future scenarios (see the *Future Condition* section, below)) and assess the species' viability, we categorized the final condition scores as "high" (population generally secure), "moderate" (population marginally secure), or "low" (population generally insecure). We based these categories primarily on our understanding of Pecos pupfish habitat needs, known stressors, and the principles of conservation biology. We acknowledge that there is uncertainty associated with this model and some of the supporting data; however, the methodology is appropriate for assessing the status of the Pecos pupfish across its range given the best available information.

Resiliency

Unit 1: Upper Pecos River: Pecos pupfish remain extant in the upper Pecos River. Based on their preference for slower, warmer, and more saline conditions, and observations from surveys conducted in support of other routine fish monitoring, Pecos pupfish are limited to specific areas within the upper Pecos River channel and these areas likely shift both spatially and temporally. This situation is reflected in data that show varying numbers of Pecos pupfish in year-to-year sampling and seem to indicate that, during periods of drying, Pecos pupfish are often more represented in samples (Davenport 2023b, entire). Although it is unclear if any particular site in the upper Pecos River has been lost, the highly variable nature of this river section and shifting populations likely means that sampling at the same site will not always detect the Pecos pupfish.

The upper Pecos River is subject to regular severe low flows and intermittent drying (Follansbee et al. 1915, p. 452; Hatch et al. 1985, p. 561; Hoagstrom et al. 2008, p. 6). Because this situation threatens the persistence of the federally threatened Pecos bluntnose shiner, conservation measures are in place by the BOR

through a biological opinion (under section 7 of the Act) to minimize intermittent drying. These measures buffer the threat of river drying for Pecos bluntnose shiner and, by extension, Pecos pupfish. The entire Pecos pupfish range in the Pecos River has ongoing water quality concerns and is considered impaired due to nutrient loading, discharges from municipal wastewater treatment plant discharges, and livestock grazing (Llewellyn et al. 2021, pp. 28–29). The current condition evaluation for the upper Pecos River population determined that occurrence, water quality, and habitat diversity are in moderate condition, and water quality is in low condition. Thus, the Upper Pecos River population is determined to be in overall moderate current condition and has moderate resiliency.

Unit 2: Salt Creek Wilderness: No routine Pecos pupfish monitoring occurs within the Salt Creek Wilderness AU. Pecos pupfish remain extant in Salt Creek (NM) and likely at three sinkholes in the unit (Inkpot, Little Inkpot, and New Sinkhole). A visit to Salt Creek (NM) in February 2023 confirmed presence of the pupfish but also documented a mortality event of several thousand mostly juvenile pupfish from an undetermined cause (Jacobsen 2023,

entire). Although Pecos pupfish remain extant at several locations in the unit, the habitat available within the unit is small, so this stream unit may be subject to mortality events. Pecos pupfish are presumed to have been extirpated from Pren's Hole, though the cause is unknown (Hatt 2019, p. 5). Pren's Hole seemingly was colonized by a flash flood (Hoagstrom and Brooks 1999, p. 16).

We have no recent data on water quality or quantity within this unit from the sinkholes or Salt Creek (NM). Deeper sinkholes generally have stable conditions, both in water quantity and quality, and thus we assume that likely holds true for the sinkholes in this unit as pupfish need large populations and room for expansion (Collyer et al. 2015, p. 191). Salt Creek (NM) likely experiences routine drying events throughout the year, and concurrently with those drying events, impairments to temperature, dissolved oxygen, and salinity.

Though the permanent water in both stream and sinkhole aquatic environments is supported by water from the San Andres aquifer, the depth of the sinkholes likely provides a more stable long-term environment. Conversely, Salt Creek (NM), although more ephemeral, allows for Pecos pupfish dispersal throughout the unit and provides a potential connection to the Pecos River. This diversity of habitat helps buffer the unit against both gradual environmental changes as well as stochastic events, such as floods or golden algae, that may impact a single aquatic environment. The current condition evaluation for the Salt Creek Wilderness determined that habitat diversity is in high condition, and occurrence, water quality, and water quantity are in moderate condition. Thus, the Salt Creek Wilderness population is determined to be in overall moderate current condition and has moderate resiliency.

Unit 3: Bitter Creek Drainage: Routine monitoring occurs in Bitter Creek as well as two of the sinkholes in the unit. We extrapolated both formal and informal monitoring data to the remainder of the unit, and based on habitat availability presumed the Pecos pupfish remains extant at all documented occupied sites in the unit. There have been documented fish kills on Bitter Creek, but routine monitoring indicates that Pecos pupfish populations in the creek remain extant, though highly variable (Hatt 2021).

Water quality is routinely sampled, and no impairments have been detected. Much of the water in this unit is derived from underground springs from the San

Andres aquifer. This includes all of the sinkholes as well as the springs that feed Bitter Creek such as the Dragonfly Spring and Lost River. The closest monitoring well to this unit shows a long-term stable water depth trend that likely corresponds to stable spring flows in the unit (Pecos Valley Artesian Conservancy District (PVACD) 2023, entire). The water in Bitter Creek is supplemented by precipitation. Because evaporation exceeds precipitation across the Pecos River Basin, during drought years, portions of Bitter Creek dry out (Land 2003, p. 230).

Though the permanent water in both the stream and sinkhole aquatic environments is supported by water from the San Andres aquifer, the depth of the sinkholes likely provides a more stable long-term environment. Bitter Creek is supported by both seasonal precipitation as well as spring flows from Dragonfly Spring and the Lost River. This diversity of habitat helps buffer the unit against both gradual environmental changes as well as stochastic events, such as floods or golden algae, that may impact a single aquatic environment. The Bitter Creek Drainage population's current condition evaluation determined that occurrence, water quality, and habitat diversity are in high condition, and water quantity is in moderate condition. Thus, the Bitter Creek Drainage population is determined to be in overall high current condition and has high resiliency.

Unit 4: Bitter Creek Middle Tract Wetlands: Pecos pupfish are routinely monitored at three sites within the Middle Tract Wetlands AU, however, most of the impoundments listed as occupied have not been surveyed in decades (Hatt 2022, p. 5). Despite this lack of data, we presume that the Pecos pupfish remains extant at all documented occupied sites in the unit, due to both their connection to occupied habitat and the absence of any known mortality event. While Pecos pupfish are not always detected at the monitoring sites during consecutive surveys, they have been shown to remain extant within those sites (Hatt 2019, p. 5; Hatt 2022, p. 5).

This unit is composed of artificial wetlands and ditches that are managed by Bitter Lake NWR. The ditches are spring fed and retain permanent water. The wetland impoundments vary widely in habitat extent, and while many are likely to retain permanent water in most years, given the variable nature of the water in the impoundments, the amount of habitat is presumed to vary widely in any given year, and may be extremely limited in particularly dry years.

There are no known water quality impairments in the unit that would impact the Pecos pupfish. When water levels are low, the shallow impoundments and wetlands in the unit are subject to adverse water quality such as increased temperature and salinity, and decreased available dissolved oxygen because water becomes lentic or stagnant and soon evaporates.

Aquatic environments in this unit area are a mix of manmade channels, impoundments, and wetlands. While we do not have data on how Pecos pupfish move between these environments, the diversity of habitats likely helps buffer the Pecos pupfish from short-term environmental changes such as drought, provides ample sheltering and breeding habitat, and provides protection from stochastic events such as floods or golden algae blooms. Thus, the Bitter Lake NWR Middle Tract Wetlands population's current condition evaluation determined that occurrence, water quantity, water quality, and habitat diversity are in overall high current condition and the population has high resiliency.

Unit 5: Bottomless Lakes State Park: Pecos pupfish have been routinely monitored at three sites in this AU and are found exclusively in sinkhole habitat. While Pecos pupfish were confirmed extirpated from Upper Figure 8 Lake during the 2021 monitoring, they remain extant throughout the remainder of the known occupied sites within the unit, including the adjacent Lower Figure 8 Lake sinkhole (Hatt 2021, p. 7).

All of the Pecos pupfish sinkholes at Bottomless Lakes State Park are fed by springs from the San Andres artesian aquifer (Land 2003, p. 229). Though some historical lowering of sinkhole levels has occurred, the recent trend is an increase in surface water levels in the sinkholes. Water levels in the sinkholes appear to be closely related to the overall fluctuation in water levels in the artesian aquifer (Land 2003, p. 231). No documented water contamination either from surface sources or natural water quality parameters has been recorded in the unit. Although sinkholes may exhibit more stable water quantity and quality, a mortality event was documented in 2020 in Upper Figure 8 Lake, which illustrates the susceptibility of these habitats to stochastic events. The Bottomless Lakes State Park population's current condition evaluation determined that occurrence, water quantity, and water quality are in high condition, and habitat diversity is in moderate condition. Thus, the Bottomless Lakes State Park population is in overall high current condition and high resiliency.

Unit 6: BLM Overflow Wetlands and Lea Lake: Pecos pupfish in this unit are surveyed in limited accessible areas of the BLM Overflow Wetlands (Hatt 2022, p. 2). Pecos pupfish are presumed extant throughout the suitable habitat within the wetland because installed fish barriers protect the unit from sheepshead minnow introgression (Hoagstrom et al. 2015, p. 16).

Lea Lake typically exhibits stable water quantity throughout the year (Hoagstrom and Brooks 1999, p. 16). In addition, wetland water is supplied by several springs throughout the complex as well as surface flows during precipitation events. As a result of the different sources of water, the extent of aquatic habitat varies both seasonally and annually. However, owing to the constant source of water from Lea Lake, as well as the springs in the complex, permanent water remains in many locations. Additionally, there are no known water contamination issues in this unit.

This unit contains a large wetland complex and the largest sinkhole in Bottomless Lakes State Park. This sinkhole was not included in Unit 5 as it is not hydrologically connected to the other sinkholes in Unit 5 and is hydrologically connected to the BLM Overflow Wetlands. The habitat diversity represented by these aquatic environments provides a buffer from stochastic events.

The BLM Overflow Wetlands AU is the only other unit that has high internal redundancy. Similar to the Pecos River, the BLM Overflow Wetlands provide a large area with many microhabitats. This unit was historically connected to the Pecos River during high flows, but fish barriers installed to protect the unit from sheepshead minnow introgression have limited this connection. The BLM Overflow Wetlands and Lea Lake population's current condition evaluation determined that occurrence, water quantity, and habitat diversity are in high condition, and water quality is in moderate condition. Thus, the BLM Overflow Wetlands and Lea Lake population is in overall high current condition and has high resilience.

Unit 7: Middle Pecos River: It is likely that Pecos pupfish are extirpated from the Pecos River between Brantley Dam and Red Bluff Reservoir. Sheepshead minnow are regularly caught between Brantley Dam and Red Bluff Reservoir, which indicates that they are present throughout this segment of the Pecos River system (Davenport 2023a, entire). Additionally, the middle Pecos River has regular issues with severe low flows and intermittency, water quality

impairments, and stochastic events (Zymonas and Propst 2007, p. 45). The middle Pecos River population's current condition evaluation determined that water quantity and habitat diversity are in moderate condition, and water quality is in low condition. Due to the presence of sheepshead minnow, the middle Pecos River population is considered extirpated.

Unit 8: Salt Creek (TX): Pecos pupfish in Salt Creek (TX) are currently present in only a single reach of the stream. While the fish at this location are not routinely monitored, a visit to this unit in 2023 confirmed that fish are present (Montagne 2023, p. 2). Pecos pupfish from the lower reach of Salt Creek (TX), near the confluence with the Pecos River, were confirmed introgressed with sheepshead minnow from the Pecos River. An unidentified physical barrier in the lower reaches of Salt Creek (TX) appears to have limited the spread of sheepshead minnow and introgressed pupfish into the upper reaches that comprise this AU (Echelle et al. 2003b, pp. 4–6). The Salt Creek (TX) population's current condition evaluation determined that occurrence, water quantity, and habitat diversity are in moderate condition, and water quality is in low condition. Thus, the Salt Creek (TX) population is in overall moderate current condition and has moderate resilience.

Unit 9: Lower Pecos River: Pecos pupfish have been extirpated from the lower Pecos River due to introgression with the sheepshead minnow. The flow of the lower Pecos River north of Independence Creek is subject to frequent and ongoing intermittency issues, regularly experiencing no flow events, especially during the irrigation season and during periods of drought. South of Independence Creek the character of the river changes to one with steeper bank and canyon and permanent water flow. The water in this unit has very high salinity and increasing ongoing impacts from contaminants (Hoagstrom 2009, pp. 35–36). Hazardous material spills or leaks associated with oil and gas production are an ongoing problem in this unit and may be increasing in both number and frequency (Scanlon et al. 2020, p. 3511). The lower Pecos River population's current condition evaluation determined that water quantity and habitat diversity are in moderate condition, and water quality is in low condition. Due to the presence of sheepshead minnow, the lower Pecos River population is considered extirpated.

Redundancy

Redundancy describes the ability of a species to withstand catastrophic events by maintaining multiple, resilient populations distributed (and connected, as appropriate) within the species' varied habitats and across the species' range. We assessed Pecos pupfish redundancy at two scales, within the individual AUs and across the range of the species. Within the analysis unit we looked at connection both internal to the unit and across adjacent units to characterize the overall redundancy of a unit. The overall redundancy of the unit could not be higher than the lowest internal or external redundancy score. Important to the discussion of redundancy in Pecos pupfish populations is the consideration of sheepshead minnow introgression. While connectivity enhances redundancy within and among AUs, this same connectivity increases the threat of sheepshead minnow introgression. A well-connected Pecos pupfish population is one that allows for dispersal and recolonization but is also one that is at increased risk of introgression. Redundancy throughout the species' range, coupled with healthy populations, may help lower the risk of introgression. A healthy, robust Pecos pupfish population may be more resistant to introgression and, thus, less likely to contribute to spread of hybrid fish (Kodric-Brown and Rosenfield 2004, p. 122).

The Upper Pecos AU (Unit 1) is well connected throughout its length and the pattern of flow within the river likely creates a variety of microhabitat sites that are suitable for the Pecos pupfish. The Upper Pecos is moderately connected to adjacent off-channel units, though only at times of high flow.

The Salt Creek Wilderness unit (Unit 2) is one of two units that are currently connected to the Pecos River during periods of high flow. In the Salt Creek Wilderness unit, the connection to the unit is limited to Salt Creek (NM) proper where the Pecos pupfish may be found in only one permanent pool in Salt Creek (NM). Within this unit, Pecos pupfish are distributed among several sinkholes and in Salt Creek (NM); there is no known, above-ground connection between these areas.

Bitter Creek Drainage unit (Unit 3) does not have any known connection to adjacent AUs. Internally, many of the occupied sites within the Bitter Creek Drainage are isolated sinkholes. There is connection along Bitter Creek and to the springs that feed the creek; however, there is no known connection between the creek and adjacent sinkholes. It is

also surmised that there may be some underground connection between the springs in the Dragonfly Spring sinkhole area (Land and Huff 2009, p. 20). It is currently unknown how extensive this connection is (if at all) or if a Pecos pupfish would be able to move between sinkholes underground.

The Middle Tract unit (Unit 4) is connected to the Upper Pecos at the southern end of the unit during periods of high flow. While pupfish are likely widely distributed within the Middle Tract unit, connection among the different occupied sites is managed through a series of diversions and manmade impoundments. Water flow through the unit is generally north to south, and when the gates between the impoundments are open, flow is likely too great to allow Pecos pupfish to move up the current.

The Bottomless Lakes State Park unit (Unit 5) does not have any known connection to adjacent AUs and is fully isolated from all other AUs.

The BLM Overflow Wetlands unit (Unit 6) is the only other unit that has high internal redundancy. Similar to the Pecos River, the Overflow Wetlands provide a large area with many microhabitats. This unit was historically connected to the Pecos River during high flows, but fish barriers installed to protect the unit from sheepshead minnow introgression have limited this connection.

Salt Creek (TX) unit (Unit 8) is directly connected to the lower Pecos River. There is a presumed natural barrier within Salt Creek (TX) upstream from the confluence that moderates this connectivity. The barrier has allowed non-introgressed Pecos pupfish to remain extant in the upper reaches of Salt Creek (TX) despite the presence of an introgressed population downstream. It is currently unknown how many extant sites are found in the upper areas of Salt Creek (TX), but the connection between them likely varies seasonally with the amount of water in the creek.

We did not analyze the redundancy in the middle or lower Pecos River units (AUs 7 and 9), as the Pecos pupfish populations there are considered to be extirpated.

Representation

Representation describes the ability of a species to adapt to changing environmental conditions over time and is characterized by the breadth of genetic and environmental diversity within and among populations. As previously discussed, Pecos pupfish are known from a variety of different aquatic environmental settings and show specific morphological variation

related to these environmental settings. Populations have been documented in sinkholes, streams, marshes, managed wetlands, and rivers with varying physical characteristics (*i.e.*, size, gradient, elevation, temperature, etc.).

Although some limited genetic analysis has been done on the Pecos pupfish that indicated potential geographic structure to Pecos pupfish populations, research cautioned against a rigorous application of the results since the divergence was minor (Echelle and Echelle 2007, p. 7). More recent research has shown differences between Pecos pupfish populations among the samples from Bitter Lake NWR, Bottomless Lakes State Park, and the BLM Overflow Wetlands (Whiteley 2023, entire), and morphological divergence in Pecos pupfish populations that corresponded to differing habitat use (Collyer et al. 2015, p. 187; Xu 2017, p. 22). While there are no studies that directly relates morphological differences in Pecos pupfish to genetic differentiation, the best available information suggests that including a range of aquatic environments (*i.e.*, habitat diversity) represents much of the current diversity of the Pecos pupfish species (Echelle and Echelle 2007, p. 7; Collyer et al. 2015, p. 187; Xu 2017, p. 22; Whiteley 2023, entire). Therefore, we are using environmental setting as a surrogate for genetics to measure representation.

Currently, the Pecos pupfish is found within nearly all of the historically occupied environmental settings but is considered extirpated from the Pecos River in southern New Mexico and northwestern Texas and is likely extirpated from several off-channel locations in that same region. However, the upper Pecos River, the only remaining riverine AU, has moderate resiliency, which reflects a potential increase in the loss of representation of riverine Pecos pupfish in New Mexico. The only remaining extant AU in Texas also has moderate resiliency, which presents a risk to representation of Pecos pupfish in Texas. Pecos pupfish have likely experienced some reduction in representation as a result of the large range reduction following extirpations from the Pecos River and off-channel locations in Texas and southern New Mexico.

Assessment of Current Viability

The Pecos pupfish is currently distributed across seven of nine AUs covering the historical range. Within those seven AUs, four were assessed to be in high resiliency condition and three in moderate condition. Across the range of the species, we identified 66

distinct locations (sites) where Pecos pupfish have been recorded since 1992. As of 2023, 8 (12.1 percent) of these 66 sites are confirmed or presumed extirpated and four are in unknown status. The remaining 54 sites (81.2 percent) are extant or presumed extant. Twenty-one sites (31.8 percent) have been confirmed as extant within the last 5 years. This does not consider losses that may have occurred before the first comprehensive range-wide surveys occurred in 1999 (Hoagstrom and Brooks 1999, entire). There has been a large decline in the extent of the occupied range because of the extirpation of Pecos pupfish from their historical range in the Pecos River below Brantley Dam (southern New Mexico and Texas). Pecos pupfish were historically found in riverine, stream, wetland, and sinkhole habitats and currently continue to be recorded in all of these habitats. Because of the reduction in the range caused by the extirpation of Pecos pupfish from a large section of the Pecos River, the species has experienced a reduction in both redundancy and representation. However, we do not have the data on the historical size of the Pecos pupfish population in the Pecos River or the genetic relationship between this population and others to adequately assess the relative importance of this population to the species. Regardless, the species has four populations in high condition, three in moderate condition, and none in low condition. These populations are well distributed throughout the range and among habitat types.

Although there is uncertainty surrounding the demography of differing Pecos pupfish populations and their genetic relationships, data suggests that the Pecos pupfish still occurs in multiple populations representing the historical range of habitat variation for the species. Though declines in range extent and, likely, population size have occurred, 11 years of monitoring data suggest that the Pecos pupfish continues to have multiple, long-term persistent populations throughout its range.

Future Condition

Using the same methods described for Current Condition, we assessed viability of the Pecos pupfish under three future scenarios at two timesteps, years 2050 and 2100, consistent with the best available information (Service 2024, pp. 76–102). Each scenario focused on a different climate projection for the Pecos River Basin, because changing climate conditions will affect the Pecos pupfish's required water quality and quantity parameters. We also assessed

the risk of sheepshead minnow introgression into other parts of the species' range.

Although development such as urbanization, agriculture, and oil and gas extraction may have local effects on some Pecos pupfish sites, we do not expect substantial effects from these sources at the species or AU level. The exception to this situation is the potential for oil and gas development in the vicinity of Salt Creek (TX) to cause significant variation in stream flow. Oil and gas development in this area is expected to increase as energy demands are needed with increased human development (Llewellyn et al. 2021, pp. 81, 163, 171). While we do not have ongoing monitoring on Salt Creek (TX), stream gauges on the Black River in New Mexico have shown a direct correlation between oil and gas activities and reductions in stream flow, which provides relevant context for how Salt Creek (TX) may be impacted.

Water availability in the Pecos River is influenced by a variety of factors including human development, primarily agriculture (see Loss and Decline of Surface and Groundwater above). However, this river is currently managed for multiple uses, including endangered species conservation, and future human water use from the river is not expected to substantially increase in the future. Given these factors, we find that the most important abiotic factors affecting Pecos pupfish viability will result from potential changes in water availability resulting from changing climatic conditions.

The most important biotic factor is the potential for hybridization and genetic introgression by sheepshead minnow. If sheepshead minnow gain access to the upper Pecos River, the Salt Creek Wilderness and Middle Tract Wetlands AUs are most at risk of introgression because they are both connected hydrologically to the Pecos River during flooding events, thus allowing for potential movement of sheepshead minnow into these off-channel habitats. In the case of the Salt Creek Wilderness, only Salt Creek (NM) itself is vulnerable to sheepshead minnow invasion, as the isolated sink holes in that AU are not likely to be inundated during Pecos River flooding events. Because of the managed nature of the Middle Tract Wetlands by the Bitter Lake NWR staff and the existence of numerous water control structures that can reduce opportunities for fish movement, the vulnerability within the unit decreases with distance from the Pecos River. Managed water flows, manmade barriers, and direct human intervention would likely be employed to manage the

spread of sheepshead minnow throughout the unit if the species were to gain access to the upper Pecos River. The lower portion of Salt Creek (TX) is already introgressed with sheepshead minnow, although some upstream portions of the stream have maintained non-introgressed pupfish. However, there is no clear barrier preventing additional upstream movement, so we assume the risk of introgression remains high there. The remaining three units adjacent to the Pecos River (Bitter Creek Drainage, Bottomless Lakes State Park, and the isolated sinkholes with the Salt Creek Wilderness) have either manmade or natural barriers that would prevent or minimize the chance of the spread of sheepshead minnow from the Pecos River into these units resulting in low introgression risk.

The Intergovernmental Panel on Climate Change uses representative concentration pathways (RCPs) in climate change scenarios to project future concentrations of greenhouse gases (IPCC 2014, entire). Among the RCPs, the higher values mean higher greenhouse gas emissions and therefore higher global surface temperatures and more pronounced effects of climate change.

To assess potential future conditions for the Pecos pupfish, we utilized results from a study that developed projections of future water management and hydrologic conditions to assess future water availability across the Pecos River Basin in New Mexico (Llewellyn et al. 2021, entire) and selected three scenarios to represent the variability of potential future conditions that could impact the Pecos pupfish and its habitat:

- *Scenario 1: Hot and dry (RCP 8.5)*—Steep increase in annual average temperature coupled with steep decreases in annual precipitation.
- *Scenario 2: Hot and wet (RCP 8.5)*—Steep increase in annual average temperature coupled with an increase in annual average precipitation.
- *Scenario 3: Warm and dry (RCP 4.5)*—Modest increase in annual average temperature and modest decrease in annual average precipitation.

For each of the scenarios we assumed that the Pecos Pupfish Conservation Agreement will remain active, and the signatory agencies will continue monitoring the biological condition of the species and working to prevent spread of sheepshead minnow (Conservation Team 2022, p. 3).

Assumptions and Limitations

As with any analysis, we made many assumptions that have consequences for our projections and interpretation of

Pecos pupfish viability. First, we only used occurrence data starting in 1992 as the basis for our analysis. This was the first published range-wide survey of the Pecos pupfish and therefore provided the most comprehensive data set on Pecos pupfish occurrence. Sites that were only recorded prior to 1992 were excluded from our analysis but were included in the overall picture of historical distribution.

We were unable to locate information on thresholds or water body sizes that equate to an increase in extirpation risk specifically for Pecos pupfish. It is logical to assume populations that occupy smaller and shallower habitats are less resilient, but there are no clear thresholds in the literature at which the size raises extinction risk. We also did not find any specific thresholds for water quality impacts to Pecos pupfish populations that equate to a specific extirpation risk. Pupfish, including the Pecos pupfish, are known for their tolerance for water quality conditions that inhibit the fecundity and survival of other fish. We assumed that populations experiencing long-term high temperatures or elevated salinity are less resilient, but there are no clear thresholds at which this long-term exposure raises extirpation risk. Thus, our categorization methodology may over- or under-estimate resiliency of populations depending on the actual biological thresholds.

A critical assumption is that the primary stressors we identified, sheepshead minnow presence, and water quality and quantity alteration that leads to habitat loss and fragmentation, which are exacerbated due to climate change, are the primary threats to the species' long-term viability. Although land use practices and development have impacted the species historically, given the current distribution of Pecos pupfish populations, we anticipate that these activities would not have a large future impact.

In order to characterize sheepshead minnow introgression into the future, we separately assessed this stressor. This stressor is a low probability, high consequence event where, if the event occurs, a population could be extirpated or highly degraded. The future scenarios included climate effects but assumed no change in sheepshead minnow presence. Both the climate change scenarios and the risk of sheepshead minnow introgression should be considered when assessing the status of the species.

Another assumption in this SSA regards the role of conservation in future viability of the Pecos pupfish.

With the current conservation agreement in place, the Conservation Team has been proactive in supporting the species. We incorporated these efforts into several aspects of our analysis, such as our evaluation of the probability of current Pecos pupfish populations being invaded by nonnatives, taking into consideration conservation measures to prevent such invasion. However, we did not incorporate water conservation efforts into our future projects. While past water conservation, particularly in the PVACD, has had beneficial impacts to groundwater supply within the range of the Pecos pupfish, we were uncertain of the direct link between these measures and Pecos pupfish habitat. Based on this, we assume that water conservation efforts that maintain current aquifer levels, or limit future declines could improve resilience of Pecos pupfish populations. However, because both the implementation and success of any water conservation efforts and response of Pecos pupfish habitat to changing aquifer levels is unknown, were unable to incorporate this into our analysis.

Surface Temperature

Average annual surface temperatures as well as the incidence of extreme heat events are projected to increase across the entirety of the Southwest including the Pecos Basin (Vose et al. 2017, entire). Within the Pecos Basin, average surface temperatures could increase by as much as 13.32 °F (– 10.4 °C) to an average surface temperature in excess of 70 °F (21.1 °C).

As temperatures increase across the region, we anticipate a corresponding increase in evapotranspiration rates. Both temperature and evapotranspiration rates can have negative effects on Pecos pupfish and their habitat. Increasing temperatures increase the risk of golden algae blooms as well as increasing the chances that shallow habitat could exceed the thermal tolerance of Pecos pupfish. Greater evapotranspiration leads to lowering of water levels with the potential for corresponding increases in salinity and water temperatures and lowered dissolved oxygen. Lowered water levels also may lead to a reduction in the overall habitat available to Pecos pupfish along with the potential of the complete loss of water in shallow aquatic environments.

Precipitation and Aquifer Levels

Precipitation changes related to climate change are more variable and less certain than those changes projected for temperature. In the Southwest, the occurrence of seasonal monsoons complicates the picture for

overall projected changes to precipitation in the Pecos River Basin. Though generally models predict a drying trend across the Pecos Basin, under certain RCP 8.5 conditions, monsoon moisture increases, leading to an increase in average annual precipitation. Under both RCP 4.5 and RCP 8.5 scenarios, snowpack in the headwater of the Pecos River decreases with a corresponding earlier snowmelt runoff (Llewellyn et al. 2021, p. 191). Though precipitation changes could potentially reduce flows into the San Andres aquifer from the Sacramento Mountains, the effect of lower snowpack and runoff will likely be most impactful to the Pecos River.

The level of the San Andres aquifer likely directly impacts the water sources for most non-riverine Pecos pupfish habitats, except for those in Salt Creek (TX) (Land 2003, p. 228). Although we do not know the exact relationship between aquifer levels and the springs that provide flows to sinkholes, wetlands, and streams that provide Pecos pupfish habitat, we can infer that changes to the aquifer level will likely produce a corresponding change in spring flows. Levels in the San Andres aquifer are influenced by the amount of historical water in the aquifer and current inputs (Land and Huff 2009, p. 20) as well as pumping by users in the PVACD.

Future Scenarios

Scenario 1—Hot and Dry (RCP 8.5)

In this scenario, future annual air temperature increases slightly, and annual precipitation decreases throughout the Pecos River Basin. Though temperatures increase in all seasons, summer and autumn temperatures are predicted to increase more than winter and spring temperatures. By 2100 (and likely much sooner), conditions in the Pecos River Basin would be much drier than the historical average. Precipitation would be greatly decreased in all seasons, though decreases would be most extreme during the monsoon season. Runoff inflow into the Pecos River Basin will decrease across every season, and the inflow that will occur is anticipated to be the result of very few large storm events (Llewellyn et al. 2021, p. 105).

Scenario 2—Hot and Wet (RCP 8.5)

In this scenario, both temperature and annual precipitation increase throughout the Pecos River Basin. Increased temperatures retain more moisture in the atmosphere leading to increased monsoons. This scenario is more seasonally variable, with sharply

increased inflow during the monsoon season and a steep decrease of inflow during the spring runoff. In this scenario, spring and summer temperatures increase more rapidly than fall and winter temperatures. While precipitation decreases during winter and spring, precipitation increases during the summer and autumn monsoon season, leading to an overall increase in precipitation within the Pecos River Basin. As a result of decreased winter precipitation, spring runoff is anticipated to decrease. However, a large increase in monsoon flows make up for the spring runoff decrease (Llewellyn et al. 2021, pp. 105–106).

Scenario 3—Warm and Dry (RCP 4.5)

This scenario anticipates the smallest changes to temperature and precipitation of the three scenarios. By 2100, this scenario predicts slightly higher average temperatures and a slightly dryer climate. Importantly, summer and fall temperatures are anticipated to increase almost twice as much as winter and spring temperatures (Llewellyn et al. 2021, p. 101).

Future Condition Projections

Using the projections for temperature, precipitation, and San Andres aquifer under the three scenarios outlined above, we then predicted the potential range of outcomes these scenarios could have on the Pecos pupfish. Future conditions were analyzed for each resiliency metric and summarized for each unit (Service 2024, appendix C, entire).

Scenario 1—Hot and Dry (RCP 8.5)

This scenario forecasts extreme drying and higher temperatures across the Pecos River Basin. A decrease in precipitation across the basin along with increased air temperatures and overall drying trends is projected to lead to decreases in stream flow, spring output, and potentially a lowering of the aquifer that supports wetland and sinkhole habitats for the pupfish. Although the Pecos River is managed for flows that support endangered species such as the Pecos bluntnose shiner, decreasing precipitation will lead to an increase in drying days, impeding the ability of the upstream storage to deliver reliable water to both downstream users and retain adequate flow in the Pecos River and. Higher temperatures, particularly during the summer, will lead to an increase in water needs and increased groundwater pumping by agriculture in the PVACD. Higher temperatures also increase evaporative loss from water

bodies and could lead to decreases in habitats available for the pupfish.

This scenario will have some negative effects on all Pecos pupfish AUs. The most severe impacts are anticipated to be to small streams. Salt Creek (TX), Salt Creek (NM), and Bitter Creek are all projected to dry and cease flowing during the hottest parts of the year leading to local fish kills, or in the case of Salt Creek (TX), possibly the loss of all habitats in the AU. All of these creeks currently experience intermittent drying events, and lower precipitation and increased temperatures in the future will exacerbate this existing condition that stresses these habitats. Wetland areas such as the BLM Overflow Wetlands and the managed wetlands on Bitter Lake NWR are also anticipated to be significantly impacted in this scenario. At the 2050 timestep, given the climate projections, habitat conditions are projected to be similar to current conditions with minimal changes to most aquatic environments, with the exception of small streams that are already experiencing impacts from warming and drying temperatures. By 2100, significant degradation to Pecos pupfish habitat and a decline in its distribution are expected. Shallow streams will likely no longer support permanent water leading to the loss of fish in Bitter Creek, Salt Creek (NM), and Salt Creek (TX), which would mean the extirpation of Pecos pupfish from Texas. Habitat extent in wetland habitats in the BLM Overflow Wetlands and Middle Tract on Bitter Lake NWR will be greatly reduced, and pupfish would be expected to persist only in deeper channels or near springs.

Historically, the San Andres aquifer has been resilient and rebounded after extended drought (Land and Newton 2008, pp. 189–190). However, the conditions under this scenario, RCP 8.5, at 2100 will be much hotter and drier than the historical average and are expected to lead to unprecedented conditions in aquifer levels and surface water quality and quantity. Across the range of the Pecos pupfish, we anticipate substantial increases in salinity as a result of increased evapotranspiration. Although Pecos pupfish can tolerate higher salinity levels than most fish, significant salinity impairment (salinities greater than 35,000 mg/L) could lead to a reduction in suitable conditions for breeding. Increasing surface temperatures will lead to an increase in water temperatures and likely lowered dissolved oxygen saturation. This will be particularly pronounced in shallow habitat such as streams and wetlands. A substantial reduction in the aquifer level

would reduce the outflow of springs leading to a loss of fish in habitats that rely on steady, perennial spring flow and a reduction (or elimination) of available habitat in shallower sinkholes. Additionally, the increasing temperature and evaporation could cause shallower habitats to exceed the thermal and saline tolerances of the Pecos pupfish. Consequently, we anticipate a reduction in both the number, extent, and population sizes of extant sites in sinkhole units. Finally, we anticipate greatly reduced flows in the Pecos River under this scenario. While reduced flows in the Pecos River have the potential to benefit the pupfish on a seasonal basis, long-term drying events will lead to the disconnection of occupied sites and increased impairment of water quality.

Given these assumed future changes in the environment, by 2050, three AUs (Bitter Lake NWR Middle Tract Wetlands, Bottomless Lakes State Park, and BLM Overflow Wetlands and Lea Lake) are projected to remain in high condition, three units (Upper Pecos River, Salt Creek Wilderness, and Bitter Creek Drainage) are in moderate condition, and one unit (Salt Creek (TX)) is in low condition (Service 2024, p. 83). At 2100, only one AU (Bottomless Lakes State Park) is in high condition, four units (Upper Pecos River, Bitter Creek Drainage, Bitter Lake NWR Middle Tract Wetlands, and BLM Overflow Wetlands and Lea Lake) are in moderate condition, one unit (Salt Creek Wilderness) is in low condition, and one AU (Salt Creek (TX)) is extirpated. Although habitat conditions are expected to generally decline across the range, the Bottomless Lakes State Park AU is anticipated to remain in high condition because the sinkhole habitats there are expected to be less affected by potential aquifer declines. While only two units (Bitter Creek Drainage and Salt Creek (TX)) experience declines from current condition at 2050, by 2100 all units except Bottomless Lakes State Park experience declines from current condition.

Scenario 2—Hot and Wet (RCP 8.5)

This scenario forecasts a significantly higher average annual surface temperature across the Pecos River Basin. Unlike Scenario 1, higher summer temperatures result in more moisture in the atmosphere, consequently leading to an increase in precipitation during the summer monsoon season (June–September). Overall higher surface temperatures will lead to similar outcomes as described under Scenario 1, such as water quality impairment, and reduction in habitat

extent. However, the predicted increased monsoons may buffer some systems from the most severe impacts of increasing average temperatures.

As with Scenario 1, the small streams are most likely to experience the most severe adverse impacts from increasing annual temperatures. These aquatic environments will likely experience more drying events and subsequent impairments to salinity, water temperatures, and dissolved oxygen. At the 2050 timestep, conditions appear similar to current conditions throughout much of the Pecos pupfish range. However, small streams will likely stop flowing during the hottest parts of the year, leading to local fish kills, or in the case of Salt Creek (TX), possibly the loss of all habitats in the AU. By 2100, rising annual temperatures may eliminate year-round stream flow in all but the wettest years. Consequently, we anticipate the loss of the Pecos pupfish population at Salt Creek (TX) and a reduction in occupied sites in Bitter Creek and the Salt Creek Wilderness. Increased temperatures will have an impact on shallower wetlands in the BLM Overflow Wetlands and Bitter Lake NWR Middle Tract Wetlands. Prolonged extreme air temperatures can adversely impact water quality and could result in decreased fitness, hinder breeding, or lead to fish kills. Sinkholes are the most stable environment for the Pecos pupfish, and this is unlikely to change in this scenario. The San Andres aquifer responds quickly to precipitation inputs, and an increase in monsoon season precipitation will likely prevent significant declines in sinkhole water levels.

Given these assumed future changes in the environment, at 2050, three units (Bitter Lake NWR Middle Tract Wetlands, Bottomless Lakes State Park, and BLM Overflow Wetlands and Lea Lake) are projected to remain in high condition, three units (Upper Pecos River, Salt Creek Wilderness, and Bitter Creek Drainage) are in moderate condition, one unit (Salt Creek (TX)) is in low condition, and two units (Middle Pecos River and Lower Pecos River) remain extirpated. Under this scenario, only two units (Bitter Creek Drainage and Salt Creek (TX)) experience a decrease from current condition. At 2100, two units (Bottomless Lakes State Park and BLM Overflow Wetlands and Lea Lake) are in high condition, three units (Upper Pecos River, Bitter Creek Drainage, and Bitter Lake NWR Middle Tract Wetlands) are in moderate condition, one unit (Salt Creek Wilderness) is in low condition, and three units (Middle Pecos River, Salt Creek (TX), and Lower Pecos River) are

extirpated, with all units except Upper Pecos River, Bottomless Lakes State Park, and BLM Overflow Wetlands and Lea Lake experiencing a decrease from current condition.

Scenario 3—Warm and Dry (RCP 4.5)

This scenario forecasts a minimal increase in yearly average temperatures and a minimal decrease in precipitation across the basin. Even minimal decreases in precipitation could have consequences for shallow streams in several units (Salt Creek Wilderness, Bitter Creek Drainage, and Salt Creek (TX)). Like the prior scenarios, the 2050 time step appears fairly similar to current condition. By 2100, small streams are likely experiencing increased water stress, and in dry years likely most of the stream environments will be dry. However, under this scenario, we anticipate minimal impacts to groundwater resources and thus minimal impacts to sinkhole, spring fed, and river habitats.

At 2050, four units (Bitter Creek Drainage, Bitter Lake NWR Middle Tract Wetlands, Bottomless Lakes State Park, and BLM Overflow Wetlands and Lea Lake) are projected to be in high condition, and three units (Upper Pecos River, Salt Creek Wilderness, and Salt Creek (TX)) are in moderate condition, and two units (Middle Pecos River and Lower Pecos River) are extirpated. At 2100, three units (Bitter Lake NWR Middle Tract Wetlands, Bottomless Lakes State Park, and BLM Overflow Wetlands and Lea Lake) are projected to be in high condition, three units (Upper Pecos River, Salt Creek Wilderness, and Bitter Creek Drainage) are in moderate condition, one unit (Salt Creek (TX)) is in low condition, and two units (Middle Pecos River and Lower Pecos River) are extirpated. In Scenario 3, no units experience decreases from current condition at 2050; however, at 2100 two units (Bitter Creek Drainage and Salt Creek (TX)) experience decreases from current condition.

Sheepshead Minnow

Along with the three scenarios described above, we also considered the risk of sheepshead minnow introgression into the different AUs. Because sheepshead minnow are often used as bait fish, the most likely path for the sheepshead minnow to move into units existing with non-introgressed Pecos pupfish populations is through a bait bucket transfer into the Pecos River upstream of Brantley Reservoir. Based on data collected from the lower Pecos River, this scenario would be highly likely to result in the introgression of the entire population of Pecos pupfish

in the Pecos River (Unit 1, Upper Pecos River) (Whiteley 2023, p. 2). Bait bucket transfers are highly unlikely to occur in any of the other AUs, as these units are generally either well controlled or do not contain game fish species. As such, the most likely route for sheepshead minnow introgression into other AUs would be natural movement of sheepshead minnow from the Upper Pecos River AU, if they gained access there.

The AUs most at risk of sheepshead minnow introgression from the upper Pecos River are the Salt Creek Wilderness and Middle Tract Wetlands, which are both connected hydrologically to the upper Pecos River during flooding events, allowing for potential movement of sheepshead minnow into these off-channel habitats. In the case of the Salt Creek Wilderness, only Salt Creek (NM) itself is vulnerable to sheepshead minnow invasion, as the isolated sink holes in that AU are not likely to be inundated during Pecos River flooding events. Because of the managed nature of the Middle Tract Wetlands by the Bitter Lake NWR staff and the existence of numerous water control structures that can reduce opportunities for fish movement, the vulnerability within the unit decreases with distance from the Pecos River. Managed water flows, manmade barriers, and direct human intervention would likely be employed to manage the spread of sheepshead minnow throughout the unit if the species were to gain access to the Upper Pecos River. The lower portion of Salt Creek (TX) is already introgressed with sheepshead minnow; however, despite the lack of a clear barrier preventing upstream movement, upstream portions of the stream have maintained non-introgressed pupfish. Because we cannot identify a barrier, we assume the risk of introgression remains high. The remaining three units adjacent to the Pecos River (Salt Creek Wilderness, Bitter Creek Drainage, and Bottomless Lakes State Park) have either manmade or natural barriers that would prevent or minimize the chance of the spread of sheepshead minnow from the Pecos River into these units, resulting in low introgression risk.

Assessment of Future Viability

We considered what the Pecos pupfish needs to maintain viability and characterized the status of the species in terms of its resiliency, redundancy, and representation. For the purpose of this assessment, we define viability as the ability of the species to sustain populations in natural ecosystems within a biologically meaningful

timeframe: in this case, out to 2100. We chose 2100 because we have information to reasonably project the potential significant effects of stressors within the range of the Pecos pupfish within this timeframe. Based on the Pecos pupfish life history and habitat needs, and in consultation with the species' experts, we identified the potential stressors (negative influences), and the contributing sources of those stressors, that are likely to affect the species' future viability. We then evaluated how these potential future stressors would interact with current stressors, and how, and to what extent they would affect the species in the future. Based on the best available information, we believe the two largest influences on the future viability of the Pecos pupfish are the potential of introgression with sheepshead minnow and climate change-driven impacts to water quantity, water quality, and loss of habitat diversity. While water pollution and human development (particularly agricultural and oil and gas development) activities have likely influenced the species' current condition and may affect some areas (Salt Creek (TX)) in the future, we found that the changing climate and the related effects to water availability to sustain habitats has, and will continue to have, the greatest influence on the status of the Pecos pupfish. Sheepshead minnow introduction, while much less predictable, does have the potential to impact Pecos pupfish populations above Brantley Dam should an introduction occur.

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have analyzed the cumulative effects of identified threats and conservation actions on the species. To assess the current and future condition of the species, we evaluate 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.

Determination of Pecos Pupfish Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 224) 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 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.

Status Throughout All of Its Range

Our assessment of best available information indicates that currently two of the nine known Pecos pupfish populations have been extirpated, and three others are in moderate condition. The majority of known occupied Pecos pupfish sites are within the other five units around Bitter Lake NWR and Bottomless Lakes State Park in New Mexico (AUs 2–6). Within these units, four were found to be in high condition and one in moderate condition, indicating that multiple areas across the species’ core range have high resiliency. The small Salt Creek AU in Texas is currently in moderate condition. This unit is disconnected from the remainder of the species’ range in New Mexico, providing some redundancy in maintaining a relatively large geographic range. The two large units of the Lower and Middle Pecos River have been previously extirpated due to the introgression of the sheepshead minnow. Loss of these parts of the range represent a significant reduction in the overall range and redundancy for the species and loss of a large segment of the riverine habitats historically available to the species. The riverine habitats continue to be represented by the Upper Pecos River Unit.

Under all three plausible future scenarios, species condition would be reduced by 2100. In the hottest and driest scenario (Scenario 1), shallow streams are likely to be lost, leading to the extirpation of Pecos pupfish in Salt Creek (TX) and a reduction in redundancy and representation in the Salt Creek Wilderness and Bitter Creek Drainage units. Deeper sinkholes and wetlands are more stable and are expected to maintain suitable conditions for the Pecos pupfish under all scenarios. However, units such as Bitter Creek Drainage, Middle Tract, and

BLM Overflow Wetlands are more vulnerable to losses in redundancy in Scenario 1 due to susceptibility to habitat losses from future drying climatic conditions. The Pecos River may also be unable to sustain year-round flows under conditions predicted in Scenario 1. The increased stream flows from projected increase in monsoons in Scenario 2 help maintain sinkhole habitats throughout the range of the Pecos pupfish, and to a lesser extent, likely may buffer wetland habitats from the most severe impacts of increased temperatures. However, small streams are likely still at elevated risk of being lost or experiencing long-term drying or mortality events. Finally, in the mildest future climate scenario (Scenario 3), further effects to most habitat (wetlands, sinkholes, and riverine) are anticipated to be minimal. However, like the other two scenarios, shallow streams likely will experience drying and mortality events.

Under all three scenarios, we anticipate some reductions to resilience, redundancy, and representation. Although some additional changes to Pecos pupfish status are projected to occur by 2050, we anticipate that measurable changes to viability will be more apparent by 2100. The resilience of the aquifer to small year-to-year variation and the adaptability of the Pecos pupfish to variable habitat conditions will likely offset some of the climate changes through 2050. Under all scenarios, at least one AU remains in high condition. Under both Scenarios 1 and 2, Pecos pupfish are projected to be extirpated from Salt Creek (TX), eliminating the only population outside of New Mexico that has been described as genetically different from the core populations in New Mexico. Pecos pupfish experience most losses of known occupied sites under Scenario 1, though losses would be likely to occur under scenarios 2 and 3 as well. Bottomless Lakes State Park remains the only AU that would be in high condition under all three scenarios.

Concurrent with the effects of climate change is the risk of expansion of sheepshead minnow and subsequent hybridization with Pecos pupfish. Salt Creek (TX) is already at high risk of loss due to sheepshead minnow introgression. The Upper Pecos River is currently highly vulnerable to sheepshead minnow introduction via a bait bucket transfer. Should this introduction occur, non-introgressed Pecos pupfish would likely be extirpated from this unit, and, as a consequence there would be no remaining Pecos pupfish in the Pecos River. This would also increase the

potential for sheepshead minnow invasion into portions of the Salt Creek Wilderness, the Middle Tract Wetlands, and possibly the Overflow Wetlands units.

The Pecos Pupfish Conservation Agreement will continue to provide guidance for agencies and partners working toward Pecos pupfish conservation through several means. First, the monitoring outlined in the conservation agreement will provide a long-term data set on the persistence of Pecos pupfish and, as methods are refined, population trends within four AUs (Bitter Creek Drainage and Bitter Lake NWR Middle Tract Wetlands, BLM Overflow Wetlands and Lea Lake, and Bottomless Lakes State Park). This monitoring will allow partners to detect potential sheepshead minnow introgression and allow for the detection of long-term declines or extirpations of Pecos pupfish. Secondly, the conservation agreement will help provide for ongoing maintenance (or potentially additional) barriers to fish passage that may protect some of the AUs from sheepshead minnow introgression should a bait bucket transfer into the Upper Pecos River occur. Finally, the agreement can reduce the opportunity for further invasions by a collaborative effort of State and Federal entities to enforce existing baitfish regulations.

After evaluating threats to the species and assessing the cumulative effect of the threats under the Act’s section 4(a)(1) factors, we find that Pecos pupfish populations will continue to face the ongoing risk of sheepshead minnow introgression, and populations will remain small and isolated from one another. The risk of sheepshead minnow introgression is cumulative, meaning that the risk builds over time such that the risk of this species being introduced into the current Pecos pupfish range by a bait bucket transfer is higher in the future than it is currently. Additionally, Pecos pupfish populations will experience reductions in resiliency, redundancy, and representation through 2050, with more measurable declines by 2100 due to decreased surface water availability, increased frequency of drought, higher than average temperatures, and continued groundwater depletion.

We considered whether the Pecos pupfish is presently in danger of extinction and determined that endangered status is not appropriate. The current conditions assessed in the SSA report show that the Pecos pupfish is distributed across seven of nine AUs across the historical range. Although there may have been reductions from

the historical range and population sizes, monitoring data indicate that the Pecos pupfish continues to have multiple, long-term, persistent populations throughout the range. Currently only two of the seven AUs are at high risk for sheepshead minnow introgression, and four AUs are not subjected to declines in water quantity. While threats are currently acting on the species and many of those threats are expected to continue into the future, we did not find that the species is currently in danger of extinction throughout all of its range. We believe the demand on water in the Pecos River Basin is expected to increase based on climate change projections (Sites Southwest 2008, pp. 6–3, 6–6), but adequate aquifer levels may be maintained until 2100 (Llewellyn et al. 2021, p. 100). Thus, after assessing the best available information, we conclude that the Pecos pupfish is not in danger of extinction but is likely to become in danger of extinction within the foreseeable future throughout all of its range.

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 provision 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” (hereafter “Final Policy”; 79 FR 37578, July 1, 2014) that provided if the Services determine that a species is threatened throughout all of its range, the Services will not analyze whether the species is endangered in a significant portion 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 the

species is in danger of extinction in a significant portion of its range. In undertaking this analysis for Pecos pupfish, we choose to address the status question first.

We evaluated the range of the Pecos pupfish to determine if the species is in danger of extinction in any portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways. We focused our analysis on portions of the species’ range that may meet the definition of an endangered species. For Pecos pupfish, 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 in that portion.

We examined the range for biologically meaningful portions based on the four broad categories of aquatic environments that Pecos pupfish occupy throughout its range, which reflect phylogenetic relationships as well as physiogeographical differences in aquatic habitat. The aquatic environments germane to the range of the Pecos pupfish are riverine (includes the upper, middle, and lower Pecos River segments), shallow stream (includes Salt Creek (NM) and Salt Creek (TX)), sinkholes (includes Salt Creek Wilderness, Bitter Creek Drainage, and Bottomless Lakes State Park), and wetlands (includes Bitter Creek Middle Tract Wetlands and BLM Overflow Wetlands and Lea Lake).

Once we identified the biologically meaningful portions to examine, we then turned to the question of whether these portions may have a different biological status. Of these aquatic environments, the riverine environment contains just one population, the upper Pecos River, which is in moderate condition. The other environments have multiple populations, including four in high condition. Therefore, we are examining the riverine environment to determine if it has a different status than the remainder of the range.

We evaluated the available information about this portion of the range of Pecos pupfish that occupies the upper Pecos River in this context, assessing its biological significance in terms of condition criteria (genetic security, occurrence, water quality, water quantity, and habitat diversity; see *Current Condition*) used to assign the current condition of Pecos pupfish populations. While the entire Pecos River is characterized as a sometimes fairly shallow and meandering riverine habitat with ephemeral tributaries, the primary risk to the upper Pecos River population is the introduction of

sheepshead minnow. The single population in this aquatic habitat is also affected by severe low flow or no flow events and intermittency, as well as water quality impairments. Sheepshead minnow were introduced to portions of the Pecos River in the 1980s; Brantley Dam currently serves as a barrier to prevent sheepshead minnow from naturally moving north into the upper Pecos River. Because sheepshead minnow are often used as bait fish, the most likely path for the sheepshead minnow to move into non-introgressed Pecos pupfish populations is through a bait bucket transfer into the Pecos River upstream of Brantley Reservoir. At that point, sheepshead minnow could naturally spread from the upper Pecos River to additional Pecos pupfish populations. Because the risk of introduction of sheepshead minnow is equal across all habitat types and is the primary reason that we found the Pecos pupfish to be threatened rangewide, there is not a difference in risk that would cause the upper Pecos River to have a different status than the remainder of the range.

Therefore, no portion of the species’ 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.

Determination of Status

Based on of the best scientific and commercial data available, we determine that the Pecos pupfish meets the Act’s definition of a threatened species. Therefore, we propose to list the Pecos pupfish 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, foreign governments, 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.

The recovery planning process begins with development of a recovery outline made available to the public soon after a final listing determination. The recovery outline guides the immediate implementation of urgent recovery actions while a recovery plan is being developed. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) may be established to develop and implement recovery plans. The recovery planning process involves the identification of actions that are necessary to halt and reverse the species' decline by addressing the threats to its survival and recovery. The recovery plan 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. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery outline, draft recovery plan, final recovery plan, and any revisions will be available on our website as they are completed (<https://www.fws.gov/program/endangered-species>), or from our New Mexico 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.

If this species is listed, 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 State(s) of New Mexico and Texas would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Pecos pupfish. Information on our grant programs that are available to aid species recovery can be found at: <https://www.fws.gov/service/financial-assistance>.

Although the Pecos pupfish is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7 of the Act is titled Interagency Cooperation and mandates all Federal action agencies to use their existing authorities to further the conservation purposes of the Act and to ensure that their actions are not likely to jeopardize the continued existence of listed species or adversely modify critical habitat. Regulations implementing section 7 are codified at 50 CFR part 402.

Section 7(a)(2) states that each Federal action agency shall, in consultation with the Secretary, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Each Federal agency shall review its action at the earliest possible time to determine whether it may affect listed species or critical habitat. If a determination is made that the action may affect listed species or critical habitat, formal

consultation is required (50 CFR 402.14(a)), unless the Service concurs in writing that the action is not likely to adversely affect listed species or critical habitat. At the end of a formal consultation, the Service issues a biological opinion, containing its determination of whether the federal action is likely to result in jeopardy or adverse modification.

In contrast, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action which *is likely* to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of critical habitat proposed to be designated for such species. Although the conference procedures are required only when an action is likely to result in jeopardy or adverse modification, action agencies may voluntarily confer with the Service on actions that may affect species proposed for listing or critical habitat proposed to be designated. In the event that the subject species is listed or the relevant critical habitat is designated, a conference opinion may be adopted as a biological opinion and serve as compliance with section 7(a)(2).

Examples of discretionary actions for the Pecos pupfish that may be subject to conference and consultation procedures under section 7 are management of Federal lands administered by the BLM, the BOR, the Corps, and the Service's NWR System as well as actions that require a Federal permit (such as a permit from the Corps under section 404 of the Clean Water Act (33 U.S.C. 1251 *et seq.*) or actions funded by Federal agencies such as 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. Federal agencies should coordinate with the New Mexico Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**) with any specific questions on section 7 consultation and conference requirements.

II. Protective Regulations 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 species. 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. With these two sentences in section 4(d), Congress delegated broad authority to the Secretary to determine what protections would be necessary and advisable to provide for the conservation of threatened species, and even broader authority to put in place any of the section 9 prohibitions, for a given species.

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, as a valid exercise of agency authority, rules developed under section 4(d) that included limited prohibitions against takings (see *Alesea Valley Alliance v. Lautenbacher*, 2007 WL 2344927 (D. Or. 2007); *Washington Environmental Council v. National Marine Fisheries Service*, 2002 WL 511479 (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 [she] 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).

The provisions of this species' proposed protective regulations under section 4(d) of the Act are one of many tools that we would use to promote the conservation of the Pecos pupfish. The proposed protective regulations would apply only if and when we make final the listing of the Pecos pupfish as a threatened species. Nothing in 4(d) rules 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 Pecos pupfish. As mentioned previously in Available Conservation Measures, section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they authorize, fund, 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. In addition, even before the listing of any species or the designation of its critical habitat is finalized, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of critical habitat proposed to be designated for such species. These requirements are the same for a threatened species regardless of what is included in its 4(d) rule.

Section 7 consultation is required for Federal actions that "may affect" a listed species regardless of whether take caused by the activity is prohibited or excepted by a 4(d) rule (under application of a "blanket rule" (for more information, see 89 FR 23919, April 5, 2024) or a species-specific 4(d) rule). A 4(d) rule does not change the process and criteria for informal or formal consultations and does not alter the analytical process used for biological opinions or concurrence letters. For example, as with an endangered species, if a Federal agency determines that an action is "not likely to adversely affect" a threatened species, this will require the Service's written concurrence (50 CFR 402.13(c)). Similarly, if a Federal agency determines that an action is "likely to adversely affect" a threatened species, the action will require formal consultation with the Service and the formulation of a biological opinion (50 CFR 402.14(a)). Because consultation obligations and processes are unaffected by 4(d) rules, we may consider developing tools to streamline future intra-Service and inter-agency consultations for actions that result in forms of take that are not prohibited by the 4(d) rule (but that still require consultation). These tools may include consultation guidance, online consultation processes via the Service's digital project planning tool (Information for Planning and Consultation; <https://ipac.ecosphere.fws.gov/>), template language for biological opinions, or programmatic consultations.

Exercising the Secretary's authority under section 4(d) of the Act, we

propose to apply the protections for the Pecos pupfish through our regulations at 50 CFR 17.31(a). In our April 5, 2024, final rule revising those regulations (89 FR 23919 at 23922–23923), we found that applying those regulations 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 threatened species. We have not identified any ways in which a protective regulation for this threatened species would need to differ from the regulations at 50 CFR 17.31(a) in order to contain the protections that are necessary and advisable to provide for the conservation of the Pecos pupfish. Therefore, if we finalize this rule as proposed, the regulations at 50 CFR 17.31(a) apply. This means that except as provided in 50 CFR 17.4 through 17.8, or in a permit issued pursuant to 50 CFR 17.32, all of the provisions of 50 CFR 17.21 for endangered wildlife, except § 17.21(c)(3) and (5), would apply to the Pecos pupfish, and the provisions of 50 CFR 17.32(b) concerning exceptions for certain entities would also apply to the species.

Provisions of the Proposed 4(d) Rule

Exercising the Secretary's authority under section 4(d) of the Act, we have developed a proposed rule that is designed to address the Pecos pupfish's conservation needs. As discussed previously in Summary of Biological Status and Threats, we have concluded that the Pecos pupfish is likely to become in danger of extinction within the foreseeable future primarily due to risk of introduction of nonnative invasive sheepshead minnow into new locations occupied by Pecos pupfish, loss and declines of surface and ground water, degradation of water quality, and habitat loss and fragmentation. Section 4(d) requires the Secretary to issue such regulations as she deems necessary and advisable to provide for the conservation of each threatened species and authorizes the Secretary to include among those protective regulations any of the prohibitions that section 9(a)(1) of the Act prescribes for endangered species. We are not required to make a "necessary and advisable" determination when we apply or do not apply specific section 9 prohibitions to a threatened species (In re: Polar Bear Endangered Species Act Listing and 4(d) Rule Litigation, 818 F. Supp. 2d 214, 228 (D.D.C. 2011) (citing *Sweet Home Chapter of Communities for a Great Oregon v. Babbitt*, 1 F.3d 1, 8 (D.C. Cir. 1993), *rev'd on other grounds*, 515 U.S. 687 (1995))). Nevertheless, even though

we are not required to make such a determination, we have chosen to be as transparent as possible and explain below why we find that, if finalized, the protections, prohibitions, and exceptions in this proposed rule as a whole satisfy the requirement in section 4(d) of the Act to issue regulations deemed necessary and advisable to provide for the conservation of the Pecos pupfish.

The protective regulations we are proposing for Pecos pupfish incorporate prohibitions from section 9(a)(1) to address the threats to the species. The prohibitions of section 9(a)(1) of the Act, and implementing regulations codified at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit or to cause to be committed any of the following acts with regard to any endangered wildlife: (1) import into, or export from, the United States; (2) take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect) within the United States, within the territorial sea of the United States, or on the high seas; (3) possess, sell, deliver, carry, transport, or ship, by any means whatsoever, any such wildlife that has been taken illegally; (4) deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever and in the course of commercial activity; or (5) sell or offer for sale in interstate or foreign commerce. This protective regulation includes all of these prohibitions because the Pecos pupfish is 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 its rate of decline, and decrease synergistic, negative effects from other ongoing or future threats.

In particular, this proposed 4(d) rule would provide for the conservation of the Pecos pupfish by prohibiting the following activities, unless they fall within specific exceptions or are 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.

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 regulations at 50

CFR 17.3. Take can result knowingly or otherwise, by direct and indirect impacts, intentionally or incidentally. Regulating take would help preserve the species' remaining populations, slow their rate of decline, and decrease cumulative effects from other ongoing or future threats. Therefore, we propose to prohibit take of the Pecos pupfish, except for take resulting from those actions and activities specifically excepted by the 4(d) rule.

Exceptions to the prohibition on take would include all of the general exceptions to the prohibition on take of endangered wildlife, as set forth in 50 CFR 17.21.

Despite these prohibitions regarding threatened species, we may under certain circumstances issue permits to carry out one or more otherwise-prohibited activities, including those described above. The regulations that govern permits for threatened wildlife state that the Director may issue a permit authorizing any activity otherwise prohibited with regard to threatened species. These include permits 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 (50 CFR 17.32). The statute also contains certain exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

In addition, to further the conservation of the species, any employee or agent of the Service, any other Federal land management agency, the National Marine Fisheries Service, a State conservation agency, or a federally recognized Tribe, who is designated by their agency or Tribe for such purposes, may, when acting in the course of their official duties, take threatened wildlife without a permit if such action is necessary to: (i) Aid a sick, injured, or orphaned specimen; or (ii) dispose of a dead specimen; or (iii) salvage a dead specimen that may be useful for scientific study; or (iv) remove specimens that constitute a demonstrable but nonimmediate threat to human safety, provided that the taking is done in a humane manner; the taking may involve killing or injuring only if it has not been reasonably possible to eliminate such threat by live-capturing and releasing the specimen unharmed, in an appropriate area.

We recognize the special and unique relationship that we have 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, would be able to conduct activities designed to conserve Pecos pupfish that may result in otherwise prohibited take without additional authorization.

The proposed 4(d) rule would also provide for the conservation of the species by allowing exceptions that incentivize conservation actions or that, while they may have some minimal impact on the Pecos pupfish, are not expected to rise to the level that would have a negative impact (*i.e.*, would have only de minimis impacts) on the species' conservation. The exceptions to these prohibitions include incidental and intentional take (described below) that are expected to have negligible impacts to the Pecos pupfish and its habitat.

Those exceptions include the following activities:

(1) Management and maintenance of ponds that are stocked with captive-bred Pecos pupfish by the State of Texas.

(2) Research activities on individual Pecos pupfish in those ponds by holders of a valid State-issued scientific research permit, zoological permit, or educational display permit. Individuals exercising this exception must provide to the State of Texas annual reports containing the following information: the nature of research performed; dates of fieldwork; the number of individuals collected or captured, and the methods used to obtain them; a description of any accidental injuries or mortalities; the number of individuals from which genetic material was collected, the type of tissue collected, and the institution or location where the genetic material is being stored. The location of fieldwork and landowner identifying information is not required. This exception applies only to individuals with a current, valid permit from the State of Texas and applies only to research conducted on pupfish ponds on private lands that are

part of the TPWD Pecos pupfish production pond effort. The State of Texas must provide annual reports to the Service regarding use of this exception.

III. Critical Habitat

Background

Section 4(a)(3) of the Act requires that, to the maximum extent prudent and determinable, we designate a species' critical habitat concurrently with listing the species. 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 each Federal action agency 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 designated 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. Rather, designation requires that, where a landowner requests Federal agency funding or authorization for an action that may affect an area designated as critical habitat, the Federal agency consult with the Service under section 7(a)(2) of the Act. If the action may affect the listed species itself (such as for occupied critical habitat), the Federal agency would have already been required to consult with the Service even absent the designation because of the requirement to ensure that the action is not likely to jeopardize the continued existence of the species. Even if the Service were to conclude after consultation that the proposed activity is likely to 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(b)(2) 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 compiled in 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 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 the species.

Similarly, critical habitat designations made on the basis of the best scientific data available 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 those 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.

The individual needs of Pecos pupfish vary somewhat by life stage (egg, hatchling, juvenile, adult); however, as an aquatic species, Pecos pupfish need adequate water quantity and water quality to meet their resource functions, which include feeding, growth, survival, and breeding. The Pecos pupfish occurs in a variety of aquatic environments including wetlands, sinkholes, impoundments, streams, springs, and rivers, specifically the Pecos River mainstem (Hoagstrom and Brooks 1999, pp. 14–16; Collyer et al. 2015, p. 182). All life stages of the Pecos pupfish prefer environments with little to no water flow, and, in areas with flows, they typically occupy pools and shallow runs and riffles (Hoagstrom and Brooks 1999, pp. 36, 45). Pecos pupfish tolerate high salinity (less than 35,000 mg/L) and low dissolved oxygen (greater than 2.5 mg/L), and while the specific thermal tolerance of Pecos pupfish is unknown, studies examining thermal tolerance of other pupfish found tolerance to range from below 0 °C to 45 °C (23 °F to 113 °F) (Bennett and Beitinger 1997, pp. 81–85; Hoagstrom and Brooks 1999, pp. 21, 31; Propst 1999, pp. 67–68). However, data collected in studies of desert pupfish found that temperatures above 42.7 °C (108.9 °F) may be lethal (Schoenher and Feldmeth 1992, p. 50; BEEC 2010, p. 8). These physical conditions (dissolved oxygen, salinity, and temperature) can be greatly affected by spring discharge and other flow parameters (Kodric-Brown 1975, pp. 3, 6). Overwintering juvenile and adult Pecos pupfish need dense aquatic vegetation and flocculent materials (such as fine detritus or non-living organic matter) in the substrate (Kodric-Brown 1977, p. 752; Hoagstrom et al. 2015, p. 17). Therefore, sufficient water quality and water quantity that provides the appropriate conditions for the Pecos pupfish is essential to the species.

Spawning adult Pecos pupfish require slow-moving waters that are less than 2 m (6.56 ft) deep, and in areas with topographic diversity that include a variety of underwater features such as crevices, boulders, large rocks, scattered

pebbles, and aquatic plants that are used for oviposition sites (Kodric-Brown 1975, p. 35; 1977, pp. 750–751, 753–756, and 761–762). Rocky embankments appear to be the most desirable breeding substrate, and the density of territorial males is highest in dense patches of aquatic vegetation, and lowest in flat silty areas with isolated rocks (Kodric-Brown 1975, pp. 20, 34–35). Female Pecos pupfish lay individual eggs that adhere to spawning substrate, such as vegetation or rocks (Kodric-Brown 1977, pp. 751, 761–762, 764). Therefore, habitat with crevices, boulders, large rocks, scattered pebbles, and aquatic plants is essential to the species.

The introduction of the nonnative, invasive sheepshead minnow has the potential to negatively affect Pecos pupfish through hybridization (Echelle et al. 2003b, entire; Echelle and Connor 1989, pp. 725–726). Hybridization eventually leads to the loss of non-introgressed (genetically pure) Pecos pupfish in the area of introgression (Echelle and Connor 1989, p. 725; Echelle et al. 2003b, entire). Sheepshead minnow also outcompetes the Pecos pupfish for resources (Echelle et al. 2003b, entire; Echelle and Connor 1989, pp. 725–726). Therefore, the absence of this nonnative invasive species is essential to the Pecos pupfish. Bait bucket transfers of sheepshead minnow are most likely in the Upper Pecos Unit. Bait bucket transfers are highly unlikely to occur in any of the other AUs as these generally are either well controlled or do not contain game fish species. As such, the most likely route for sheepshead minnow introgression would be from the Upper Pecos River AU to the Salt Creek Wilderness and Middle Tract Wetlands, which are both hydrologically connected to the upper Pecos River during flooding events, allowing for potential movement of sheepshead minnow into these off-channel habitats.

Summary of Essential Physical or Biological Features

We derive the specific physical or biological features essential to the conservation of Pecos pupfish from studies of the species’ habitat, ecology, and life history as described below. Additional information can be found in the SSA report (Service 2024, entire; available on <https://www.regulations.gov> under Docket No. FWS–R2–ES–2024–0143). We have determined that the following physical or biological features are essential to the conservation of Pecos pupfish:

(1) Water quality parameters that support all life stages of the Pecos pupfish, including:

(a) Absence of pollutants, or a level of contaminants low enough that it does not negatively impact necessary water quality conditions for Pecos pupfish individuals;

(b) Salinity less than 35,000 mg/L;

(c) Temperature less than 42.7 °C (108.9 °F); and

(d) Dissolved oxygen greater than 2.5 mg/L.

(2) Sufficient water quantity parameters that support all life stages of the Pecos pupfish, including:

(a) Permanent water in some area of habitat; and

(b) Water depth less than 2 m (6.56 ft) deep to allow for thermal refugia and breeding.

(3) Presence of silt-free underwater features such as crevices, boulders, large rocks, scattered pebbles, and aquatic plants that are used for egg deposition.

(4) Absence of nonnative invasive sheepshead minnow.

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 this species may require special management considerations or protection to reduce the following threats: introduction of sheepshead minnow, habitat degradation due to declines in water quantity and water quality, and habitat fragmentation.

Management activities that could ameliorate these threats include, but are not limited to: (1) construction and maintenance of barriers that prevent the spread of sheepshead minnow; (2) enforcement of existing State regulatory mechanisms that prohibit bait-bucket releases of sheepshead minnow in New Mexico and Texas; (3) active management of wetlands to provide for adequate water quantity and flow; (4) securing water rights to provide long-term spring flows; (5) monitoring and preventing water quality impairments from upland sources such as agricultural runoff and industrial pollutants; and (6) survey and monitoring to further characterize the extent and spread of hybridization with sheepshead minnows.

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 currently proposing to designate any areas outside the geographical area occupied by the species because (1) we have not identified any unoccupied areas that meet the definition of critical habitat, and (2) we have determined that the occupied areas are sufficient to conserve the species.

We anticipate that recovery will require conserving the genetic diversity of extant populations across the species' current range and maintaining and, where necessary, improving habitat and habitat connectivity to ensure the long-term viability of the Pecos pupfish. This proposed critical habitat designation delineates the habitat that is physically occupied and used by the species rather than delineating all land or aquatic areas that influence the species. We have determined that the areas currently occupied by the Pecos pupfish would maintain the species' resiliency, redundancy, and representation and are sufficient to conserve the species. Therefore, we are not currently proposing to designate any areas outside the geographical area occupied by the species. Sources of data for this proposed critical habitat include multiple databases maintained by universities and State agencies, scientific and agency reports, and numerous survey reports throughout the species' range (Service 2024, pp. 28–34).

In summary, for areas within the geographical area occupied by the species at the time of listing, we delineated critical habitat unit boundaries using the following criteria:

(1) We delineated areas within the historical range that had positive survey data between the year 1992 and the time of listing (see Service 2024).

(2) We terminated stream segments at barriers, confluences, areas where genetically pure Pecos pupfish have been extirpated, other obvious unsuitable habitat, or a location selected based on expert knowledge of a lack of presence.

(3) We included connecting stream segments between occupied stream segments as long as the inclusion does not disagree with criterion (2) and there are no data to suggest that the Pecos pupfish is not present.

When determining proposed 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 Pecos pupfish. 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 proposed rule have been excluded by text in the proposed rule and are not proposed for designation as critical habitat. Therefore, if the critical habitat is finalized as proposed, a Federal action involving these lands would not trigger section 7 consultation with respect to critical habitat and the requirement of no adverse modification unless the specific action would affect the physical or biological features in the adjacent critical habitat.

The proposed 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 Proposed Regulation Promulgation.

Proposed Critical Habitat Designation

We are proposing to designate five units of critical habitat for Pecos pupfish: 136.12 river mi (219.06 river km) of instream habitat (to the ordinary high water mark, not including riparian areas) and 26,555.54 acres (10,746.64 ha) of lands that encompass numerous isolated sinkholes and wetland areas. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for Pecos pupfish.

The five areas we propose as critical habitat are: (1) Upper Pecos River Unit; (2) Salt Creek Wilderness Unit; (3) Bitter Lake Unit; (4) BLM Overflow Wetlands/Bottomless Lakes Unit; and (5) Salt Creek (TX) Unit. Table 5 shows the proposed critical habitat units and the approximate area of each unit. The Bitter Lake Unit includes both the Bitter Creek Drainage and Bitter Lake NWR Middle Tract Wetlands AUs (see table 2 for a list of the AUs). The BLM Overflow Wetlands/Bottomless Lakes Unit includes both the Bottomless Lakes State Park and BLM Overflow Wetlands and Lea Lake AUs. Two AUs from the SSA report, the Middle Pecos River and Lower Pecos River units, are not proposed as critical habitat units because no extant genetically pure Pecos pupfish remain in these units.

TABLE 5—PROPOSED CRITICAL HABITAT UNITS FOR PECOS PUFFISH
 [Area estimates reflect all land within critical habitat unit boundaries.]

Critical habitat unit	Occupied?	Land ownership by type	Length of unit in river miles (km) or unit size in acres (ha)
1. Upper Pecos River	Yes	Federal	32.61 river mi (52.48 km).
	Yes	State	4.86 river mi (7.82 km).
	Yes	Private	84.41 river mi (135.84 km).
2. Salt Creek Wilderness	Yes	Federal	5,428.74 acres (2,196.93 ha).
	Yes		
3. Bitter Lake	Yes	Federal	9,663.15 acres (3,910.54 ha).
	Yes	State	87.87 acres (35.56 ha).
	Yes	Private	2,221.88 acres (899.16 ha).
4. BLM Overflow Wetlands/Bottomless Lakes	Yes	Federal	1,784 acres (721.96 ha).
	Yes	State	1,854.78 acres (750.60 ha).
	Yes	Private	5,515.12 acres (2,231.89 ha).
5. Salt Creek (TX)	Yes	Private	14.24 river mi (22.92 km)
Total			136.12 river mi (219.06 km). 26,555.54 acres (10,746.64 ha).

Note: Area sizes may not sum due to rounding.

We present brief descriptions of all units, and reasons why they meet the definition of critical habitat for Pecos pupfish, below.

Unit 1: Upper Pecos River

The Upper Pecos River Unit consists of 121.88 river mi (196.15 km). The Upper Pecos River Unit begins at Bosque Draw in Chaves County, New Mexico, and extends south on the Pecos River to (but not including) Brantley Lake, in Eddy County, New Mexico. The entire unit is currently occupied by the species and supports all of the physical and biological features (PBFs) essential to the conservation of the species. Ownership of the adjacent riparian areas is 26.76 percent Federal, 3.99 percent State, and 69.26 percent private.

Based on prior introductions, without barriers, sheepshead minnow could spread through all the accessible portions of the Upper Pecos River Unit. In addition, this unit is subject to regular severe low and intermittent flows. Conservation measures are in place by the BOR under a biological opinion to minimize river intermittency for the federally threatened Pecos bluntnose shiner. These measures buffer the threat of river drying for Pecos bluntnose shiner and, by extension, Pecos pupfish.

The entirety of this unit has ongoing water quality concerns and is considered impaired. Water availability in the unit is primarily influenced by the management of the upstream dam at Fort Sumner. River flows downstream of Bitter Lake NWR are influenced by groundwater pumping by PVACD water users and return flows from crop irrigation. Therefore, special management considerations may be

required to maintain barriers that prevent the spread of sheepshead minnow into the upper Pecos River, enforce prohibitions of bait-bucket releases of sheepshead minnow in New Mexico and Texas, maintain adequate water quantity and flow, monitor and prevent water quality impairments from upland sources such as agricultural runoff and industrial pollutants, routinely monitor for Pecos pupfish and to document the extent and spread of hybridization with sheepshead minnows. The Upper Pecos River Unit is occupied by two federally listed species, the threatened Pecos sunflower (*Helianthus paradoxus*) and the endangered Pecos bluntnose shiner. There is a complete overlap with designated critical habitat for the Pecos bluntnose shiner (see 50 CFR 17.95(e); 52 FR 5295, February 20, 1987).

Unit 2: Salt Creek Wilderness

The Salt Creek Wilderness Unit contains Salt Creek (New Mexico (NM)) and four sinkholes within 5,428.74 acres (2,196.93 ha) of land between Cottonwood Road and the confluence with the Pecos River in Chaves County, New Mexico. Areas within this proposed critical habitat unit are limited to the sinkholes and wetlands areas, and do not include the lands adjacent to the wetted areas. The wetted areas within this unit are currently occupied by the species and support all of the PBFs essential to the conservation of the species. Ownership of the adjacent riparian areas is 100 percent Federal, primarily encompassing the Refuge North Tract of Bitter Lake NWR. Salt Creek (NM) is an ephemeral stream with permanent water in deeper pools along the stream course. There is a low risk of

introgression with sheepshead minnow into the sinkholes within the Salt Creek Wilderness Unit, as they are isolated from the Pecos River. Although fish remain extant at several locations in the unit, the extent of habitat is small, and Salt Creek (NM) is subject to mortality events. Therefore, special management considerations may be required to enforce prohibitions of bait-bucket releases of sheepshead minnow in New Mexico and Texas, maintain fish barriers to prevent spread of sheepshead minnow, maintain adequate water quantity and flow in Salt Creek (NM), monitor and prevent water quality impairments from upland sources such as agricultural runoff and industrial pollutants, and routinely monitor for Pecos pupfish to document the spread and extent of hybridization with sheepshead minnows. There is no overlap with any designated critical habitat for other listed species.

Unit 3: Bitter Lake

The Bitter Lake Unit contains Bitter Creek and numerous isolated sinkholes, spring ditches, managed and natural wetlands, and oxbows of the Pecos River within 11,972.90 acres (4,845.26 ha) of land between Bitter Lake Road in the north and Miami Road in the South in Chaves County, New Mexico. All of the wetted areas in the entire unit are currently occupied by the species and support all of the PBFs essential to the conservation of the species. Ownership of the adjacent riparian areas is 80.71 percent Federal, 0.73 percent State, and 18.56 percent private. Most of the unit falls within Bitter Lake NWR. While the sinkholes in the Bitter Lake Unit are isolated and well protected from sheepshead minnow introgression, there

is a potential to introduce sheepshead minnow to the managed wetlands within Bitter Lake NWR if the fish barriers are overtopped in high flow events. Water quality surveys have not detected any impairment to the aquatic environments in the unit. Furthermore, most of the unit is within Bitter Lake NWR, which protects the unit from direct surface contamination.

The water in Bitter Creek is supplemented by precipitation during wet seasons or years, and during drought years, when precipitation is not sufficient to maintain surface flows, portions of Bitter Creek dry out. Therefore, special management considerations may be required to maintain adequate flows in Bitter Creek to maintain habitat connectivity and for routine monitoring for Pecos pupfish. The Bitter Lake Unit is occupied by seven federally listed species, the threatened Wright's marsh thistle (*Cirsium wrightii*), threatened Pecos sunflower, endangered Noel's amphipod (*Gammarus desperatus*), endangered Roswell springsnail (*Pyrgulopsis roswellensis*), endangered Pecos assimineae (*Assimineae pecos*), endangered Pecos gambusia (*Gambusia nobilis*), and the endangered Koster's springsnail (*Juturnia kosteri*). There is a complete overlap with designated critical habitat for the Wright's marsh thistle (see 50 CFR 17.96(a); 88 FR 25208, May 25, 2023), Noel's amphipod (see 50 CFR 17.95(h); 76 FR 33036, June 7, 2011), Roswell springsnail (see 50 CFR 17.95(f); 77 FR 33036, June 7, 2011), Pecos assimineae (see 50 CFR 17.95(f); 76 FR 33036, June 7, 2011), and Koster's springsnail (see 50 CFR 17.95(f); 76 FR 33036, June 7, 2011).

Unit 4: BLM Overflow Wetlands/ Bottomless Lakes

The BLM Overflow Wetlands/ Bottomless Lakes Unit contains a wetland and several sinkholes within 9,153.90 acres (3,704.45 ha) of land in Chaves County, New Mexico. This unit is east of the Pecos River and between Highway 380 in the north and the approximate southern border of the BLM Overflow Wetlands ACEC in the South. The wetlands and sinkholes within this unit are currently occupied by the species and support all of the PBFs essential to the conservation of the species. Ownership of the adjacent riparian areas is 19.49 percent Federal, 20.26 percent State, and 60.25 percent private. The majority of occupied habitat within this unit falls within Bottomless Lakes State Park and the BLM Overflow Wetlands ACEC.

Although the BLM Overflow Wetlands contain constructed and

maintained fish barriers, a severe flood could overtop or wash out these barriers, presenting a risk from sheepshead minnow, which are present near this population. The isolated sinkholes and wetlands within Bottomless Lakes State Park are well protected from sheepshead minnow introgression because (1) they do not contain game fish species and (2) fishing with baitfish is illegal, making these areas a low risk of bait-bucket releases. In 2020, a complete loss of pupfish in Upper Figure 8 Lake sinkhole is speculated to have been caused by a golden algae outbreak, but the actual causes are unknown. Therefore, special management considerations may be required for routine monitoring for Pecos pupfish to document the extent and spread of hybridization with sheepshead minnows. The BLM Overflow Wetlands/Bottomless Lakes Unit is occupied by one federally listed species, the threatened Pecos sunflower.

Unit 5: Salt Creek (TX)

The Salt Creek (TX) Unit consists of 14.24 river mi (22.92 km) in Culberson and Reeves Counties, Texas. The unit begins at RM 2119 in Culberson County, Texas, and extends northeast on Salt Creek to RM 652 in Reeves County, Texas. Ownership of the adjacent riparian areas is entirely under private ownership.

Pecos pupfish from the lower reach of the Salt Creek (TX) Unit, near the confluence with the Pecos River, were confirmed introgressed with sheepshead minnow, though an unidentified physical barrier appears to have limited the spread of introgressed fish further upstream. The entirety of this unit has ongoing water quality concerns and is considered impaired due to contaminants introduced from upland sources such as agricultural runoff and industrial pollutants from oil and gas extraction. While during wet seasons or years, the water in Salt Creek (TX) is supplemented by precipitation, during drought years, the precipitation is not sufficient to maintain surface flows. Therefore, special management considerations may be required to maintain barriers that prevent the spread of sheepshead minnow into the upper portion of Salt Creek (TX), enforce prohibitions of bait-bucket releases of sheepshead minnow in New Mexico and Texas, maintain adequate water quantity and flow, and monitor and prevent water quality impairments from upland sources such as agricultural runoff and industrial pollutants, and to survey and monitor the extent and spread of hybridization with sheepshead minnows. There is no

overlap with any designated critical habitat for other listed species in the Salt Creek (TX) Unit.

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 authorize, fund, 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. In addition, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of proposed critical habitat.

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 (50 CFR 402.02).

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 formal 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 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 reinitiate consultation. Reinitiation of consultation is required and shall be requested by the Federal agency, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (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. As provided in 50 CFR 402.16, the requirement to reinitiate consultations for new species listings or critical habitat designation does not apply to certain agency actions (*e.g.*, land management plans issued by the Bureau of Land Management in certain circumstances).

Destruction or Adverse Modification of Critical Habitat

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 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 that our **Federal Register** documents “shall, to the maximum extent practicable also include a brief description and evaluation of those activities (whether public or private) which, in the opinion of the Secretary, if undertaken may adversely modify [critical] habitat, or may be affected by such designation.” Activities that may be affected by designation of critical habitat for the Pecos pupfish include those that may affect the physical or biological features of the proposed critical habitat (see

Physical or Biological Features Essential to the Conservation of the Species).

Exemptions

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

Section 4(a)(3)(B)(i) of the Act 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. No DoD lands with a completed INRMP are within the proposed 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 if the benefits of exclusion outweigh those of inclusion, so long as exclusion will not result in the extinction of the species concerned. 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” (hereafter, the “2016 Policy”; 81 FR 7226, February 11, 2016), 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).

In considering whether to exclude a particular area from the designation, we identify the benefits of including the area in the designation, identify the benefits of excluding the area from the designation, and evaluate whether the benefits of exclusion outweigh the benefits of inclusion. If the analysis indicates that the benefits of exclusion outweigh the benefits of inclusion, the Secretary may exercise discretion to exclude the area only if such exclusion would not 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 our final rules, we explain any decision to exclude areas, as well as decisions not to exclude, to make clear the rational basis for our decision. We describe below the process that we use for taking into consideration each category of impacts and any initial analyses of the relevant impacts.

Consideration of 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. To assess the probable economic impacts of a designation, we must first evaluate specific land uses or activities and projects that may occur in the area of the critical habitat. We then must evaluate the impacts that a specific critical habitat designation may have on restricting or modifying specific land uses or activities for the benefit of the species and its habitat within the areas proposed. We then identify which conservation efforts may be the result of the species being listed under the Act versus those attributed solely to the designation of critical habitat for this particular species. The probable economic impact of a proposed critical habitat designation is analyzed by comparing scenarios both “with critical habitat” and “without critical habitat.”

The “without critical habitat” scenario represents the baseline for the analysis, which includes the existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat (*e.g.*, under the Federal listing as well as other Federal, State, and local regulations). Therefore, the baseline represents the costs of all efforts attributable to the listing of the species under the Act (*i.e.*, conservation of the species and its habitat incurred regardless of whether critical habitat is designated). The “with critical habitat” scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental conservation efforts and associated impacts would not be expected without the designation of critical habitat for the species. In other words, the incremental costs are those attributable solely to the designation of critical habitat, above and beyond the baseline costs. These are the costs we use when evaluating the benefits of inclusion and exclusion of particular areas from the final designation of critical habitat should we

choose to conduct a discretionary section 4(b)(2) exclusion analysis.

Executive Order (E.O.) 14094 amends and reaffirms E.O. 12866 and E.O. 13563 and directs 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. Section 3(f) of E.O. 12866 identifies four criteria when a regulation is considered a “significant regulatory action” and requires additional analysis, review, and approval if met. The criterion relevant here is whether the designation of critical habitat may have an economic effect of \$200 million or more in any given year (section 3(f)(1) of E.O. 12866 as amended by E.O. 14094). Therefore, our consideration of economic impacts uses a screening analysis to assess whether a designation of critical habitat for Pecos pupfish is likely to exceed the threshold for a regulatory action significant under section 3(f)(1) of E.O. 12866, as amended by E.O. 14094.

For this particular designation, we developed an incremental effects memorandum (IEM) considering the probable incremental economic impacts that may result from this proposed designation of critical habitat. The information contained in our IEM was then used to develop a screening analysis of the probable effects of the designation of critical habitat for the Pecos pupfish (Industrial Economics, Inc. (IEc) 2024; entire). We began by conducting a screening analysis of the proposed designation of critical habitat in order to focus our analysis on the key factors that are likely to result in incremental economic impacts. The purpose of the screening analysis is to filter out particular geographical areas of critical habitat that are already subject to such protections and are, therefore, unlikely to incur incremental economic impacts. In particular, the screening analysis considers baseline costs (*i.e.*, absent critical habitat designation) and includes any probable incremental economic impacts where land and water use may already be subject to conservation plans, land management plans, best management practices, or regulations that protect the habitat area as a result of the Federal listing status of the species. Ultimately, the screening analysis allows us to focus our analysis

on evaluating the specific areas or sectors that may incur probable incremental economic impacts as a result of the designation. The presence of the listed species in occupied areas of critical habitat means that any destruction or adverse modification of those areas is also likely to jeopardize the continued existence of the species. Therefore, designating occupied areas as critical habitat typically causes little if any incremental impacts above and beyond the impacts of listing the species. As a result, we generally focus the screening analysis on areas of unoccupied critical habitat (unoccupied units or unoccupied areas within occupied units). Overall, the screening analysis assesses whether designation of critical habitat is likely to result in any additional management or conservation efforts that may incur incremental economic impacts. This screening analysis combined with the information contained in our IEM constitute what we consider to be our economic analysis of the proposed critical habitat designation for the Pecos pupfish and is summarized in the narrative below.

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 proposed designation of critical habitat for the Pecos pupfish, first we identified, in the IEM dated March 26, 2024, probable incremental economic impacts associated with the following categories of activities: (1) Federal lands management (BLM, Natural Resources Conservation Service, BOR, and our NWR System), (2) prescribed fire projects, (3) pipeline and utility crossings, (4) watershed restoration activities, (5) road maintenance and bridge replacement maintenance, (6) pesticide use, (7) construction of recreation improvements and management of recreation activities, (8) stocking practices, (9) surveys and monitoring, (10) agriculture, and (11) oil and gas exploration and extraction. 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, designation of critical habitat only affects activities conducted, funded, permitted, or authorized by Federal agencies. If we list the species, in areas where the Pecos pupfish is present, Federal agencies would be required to

consult with the Service under section 7 of the Act on activities they authorize, fund, or carry out that may affect the species. If when we list the species, we also finalize this proposed critical habitat designation, Federal agencies would be required to consider the effects of their actions on the designated habitat, and if the Federal action may affect critical habitat, our consultations would include an evaluation of measures to avoid the destruction or adverse modification of critical habitat.

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 Pecos pupfish’s critical habitat. Because the designation of critical habitat for Pecos pupfish is being proposed concurrently with the listing, 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. 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 likely adversely affect the essential physical or biological features of occupied critical habitat are also likely to adversely affect the Pecos pupfish itself. 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 proposed designation of critical habitat.

The proposed critical habitat designation for the Pecos pupfish includes a total of five units, all of which are occupied by the species. Ownership of the riparian lands adjacent to the two proposed riverine units includes 32.61 river mi (52.48 km; 23.95 percent) Federal, 4.86 river mi (7.82 km; 3.57 percent) State, and 98.65 river mi (158.76 km; 72.47 percent) private. Ownership of lands that encompass numerous isolated sinkholes and wetland areas that are currently occupied by the species in three proposed units includes 16,875.89 acres (6,829.43 ha, 63.55 percent) Federal, 1,942.65 acres (786.16 ha, 7.32 percent) State, and 7,737 acres (3131.05 ha, 29.14 percent) private. In these areas, any

actions that may affect the Pecos pupfish or its habitats would also affect designated critical habitat. Three of the five proposed units overlap with existing critical habitat for seven other federally listed species, including Pecos bluntnose shiner, Koster's springsnail, Pecos sunflower, Noel's amphipod, Wright's marsh thistle, Roswell springsnail, and Pecos assiminea.

The proposed critical habitat designation for the Pecos pupfish totals 136.12 river mi (219.06 river km) of instream habitat (to the ordinary high water mark, not including riparian areas) and 26,555.54 acres (10,746.64 ha) of lands that encompass numerous isolated sinkholes and wetland areas that are currently occupied by the species (the sinkholes and wetlands areas, not including the lands adjacent to the wetted areas). In these areas any actions that may affect the species or its habitat would also affect designated critical habitat, and it is unlikely that any additional conservation efforts would be recommended to address the adverse modification standard over and above those recommended to avoid jeopardizing the continued existence of the Pecos pupfish. Therefore, only administrative costs are expected in 100 percent of the proposed critical habitat designation. While this additional analysis will require time and resources by both the Federal action agency and the Service, it is believed that, in most circumstances, these costs would predominantly be administrative in nature and would not be significant.

The entities most likely to incur incremental costs are parties to section 7 consultations, including Federal action agencies and, in some cases, third parties, most frequently State agencies or municipalities. Activities that we expect would be subject to consultations that may involve private entities as third parties are oil and gas operations that may occur on private lands. However, based on coordination with State agencies, the cost to private entities is expected to be relatively minor (administrative costs of less than \$5,700 per consultation effort); therefore, they would not be significant.

The probable incremental economic impacts of the Pecos pupfish critical habitat designation are expected to be limited to additional administrative effort as well as minor costs of conservation efforts resulting from a small number of future section 7 consultations. This limitation is due to two factors: (1) the proposed units are considered occupied by the Pecos pupfish, and occupied units are afforded significant baseline protection under the Act due to the presence of the

listed species; and (2) the Pecos pupfish receives additional baseline protection from co-occurring listed species, which include species with overlapping critical habitat and similar resource and habitat needs. At approximately \$5,700 or less per consultation, the burden resulting from designation of critical habitat for the Pecos pupfish, based on the anticipated annual number of consultations and associated consultation costs, is not expected to exceed \$11,000 in most years. The designation is unlikely to trigger additional requirements under State or local regulations. Thus, the annual administrative burden is relatively low. Any future probable incremental economic impacts are not likely to exceed \$200 million in any single year, and impacts that are concentrated in any geographical area are not likely as a result of this critical habitat designation.

We are soliciting data and comments from the public on the economic analysis discussed above. During the development of a final designation, we will consider the information presented in the economic analysis and any additional information on economic impacts we receive during the public comment period to determine whether any specific areas should be excluded from the final critical habitat designation under authority of section 4(b)(2), our implementing regulations at 50 CFR 424.19, and the 2016 Policy. We may exclude an area from critical habitat if we determine that the benefits of excluding the area outweigh the benefits of including the area, provided the exclusion will not result in the extinction of this species.

Consideration of National Security Impacts

Section 4(a)(3)(B)(i) of the Act may not cover all DoD lands or areas that pose potential national-security concerns (e.g., a DoD installation that is in the process of revising its INRMP for a newly listed species or a species previously not covered). If a particular area is not covered under section 4(a)(3)(B)(i), then national-security or homeland-security concerns are not a factor in the process of determining what areas meet the definition of "critical habitat." However, we must still consider impacts on national security, including homeland security, on those lands or areas not covered by section 4(a)(3)(B)(i) because section 4(b)(2) requires us to consider those impacts whenever it designates critical habitat. Accordingly, if DoD, Department of Homeland Security (DHS), or another Federal agency has

requested exclusion based on an assertion of national-security or homeland-security concerns, or we have otherwise identified national-security or homeland-security impacts from designating particular areas as critical habitat, we generally have reason to consider excluding those areas.

However, we cannot automatically exclude requested areas. When DoD, DHS, or another Federal agency requests exclusion from critical habitat on the basis of national-security or homeland-security impacts, we must conduct an exclusion analysis if the Federal requester provides information, including a reasonably specific justification of an incremental impact on national security that would result from the designation of that specific area as critical habitat. That justification could include demonstration of probable impacts, such as impacts to ongoing border-security patrols and surveillance activities, or a delay in training or facility construction, as a result of compliance with section 7(a)(2) of the Act. If the agency requesting the exclusion does not provide us with a reasonably specific justification, we will contact the agency to recommend that it provide a specific justification or clarification of its concerns relative to the probable incremental impact that could result from the designation. If we conduct an exclusion analysis because the agency provides a reasonably specific justification or because we decide to exercise the discretion to conduct an exclusion analysis, we will defer to the expert judgment of DoD, DHS, or another Federal agency as to: (1) Whether activities on its lands or waters, or its activities on other lands or waters, have national-security or homeland-security implications; (2) the importance of those implications; and (3) the degree to which the cited implications would be adversely affected in the absence of an exclusion. In that circumstance, in conducting a discretionary section 4(b)(2) exclusion analysis, we will give great weight to national-security and homeland-security concerns in analyzing the benefits of exclusion.

In preparing this proposal, we have determined that the lands within the proposed designation of critical habitat for Pecos pupfish are not owned or managed by the DoD or DHS, and, therefore, we anticipate no impact on national security or homeland security.

Consideration of 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 discussed above. To identify other relevant impacts that may affect the exclusion analysis, we consider a number of factors, including whether there are approved and permitted conservation agreements or plans covering the species in the area—such as safe harbor agreements (SHAs), candidate conservation agreements with assurances (CCAAs) or “conservation benefit agreements” or “conservation agreements” (“CBAs”) (CBAs are a new type of agreement replacing SHAs and CCAAs in use after April 2024 (89 FR 26070; April 12, 2024)), or HCPs—whether there are non-permitted conservation agreements and partnerships that may be impaired 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.

Summary of Exclusions Considered Under 4(b)(2) of the Act

At this time, we are not considering any exclusions from the proposed designation based on economic impacts, national security impacts, or other relevant impacts—such as partnerships, management, or protection afforded by cooperative management efforts—under section 4(b)(2) of the Act. Some areas within the proposed designation are included in the Conservation Agreement for the Pecos Pupfish between and among TPWD; NMDGF; New Mexico Energy, Minerals and Natural Resources Department; New Mexico Department of Agriculture; New Mexico Interstate Stream Commission; New Mexico State Land Office; BLM; and the Service.

If through the public comment period we receive information that we determine indicates that there are economic, national security, or other relevant impacts from designating particular areas as critical habitat, then as part of developing the final designation of critical habitat, we will evaluate that information and may conduct a discretionary exclusion analysis to determine whether to exclude those areas under authority of section 4(b)(2) and our implementing regulations at 50 CFR 424.19. If we receive a request for exclusion of a particular area and after evaluation of supporting information we do not exclude, we will fully explain our decision in the final rule for this action. (Please see **ADDRESSES**, above, for

instructions on how to submit comments).

Required Determinations

Clarity of the Proposed Rule

We are required by E.O.s 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

- (1) Be logically organized;
- (2) Use the active voice to address readers directly;
- (3) Use clear language rather than jargon;
- (4) Be divided into short sections and sentences; and
- (5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rulemaking, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

Regulatory Planning and Review (Executive Orders 12866, 13563 and 14094)

Executive Order 14094 amends and reaffirms the principles of E.O. 12866 and E.O. 13563 and states that regulatory analysis should facilitate agency efforts to develop regulations that serve the public interest, advance statutory objectives, and are consistent with E.O.s 12866, 13563, and 14094. Regulatory analysis, as practicable and appropriate, shall recognize distributive impacts and equity, to the extent permitted by law. 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 proposed 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; title II of Pub. L. 104–121, March 29, 1996.), 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 whether 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, as understood in light of 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, only

Federal action agencies would be directly regulated if we adopt the proposed critical habitat designation. The RFA does not require evaluation of the potential impacts to entities not directly regulated. Moreover, Federal agencies are not small entities. Therefore, because no small entities would be directly regulated by this rulemaking, the Service certifies that, if made final as proposed, the proposed critical habitat designation will not have a significant economic impact on a substantial number of small entities.

In summary, we have considered whether the proposed designation would result in a significant economic impact on a substantial number of small entities. For the above reasons and based on currently available information, we certify that, if made final, the proposed critical habitat designation would not have a significant economic impact on a substantial number of small business entities. Therefore, an initial regulatory flexibility analysis is not required.

Energy Supply, Distribution, or Use—Executive Order 13211

E.O. 13211 (Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use) requires agencies to prepare statements of energy effects to the extent permitted by law when undertaking actions identified as significant energy actions (66 FR 28355, May 22, 2001). E.O. 13211 defines a “significant energy action” as an action that (i) meets the definition of a “significant regulatory action” under E.O. 12866, as amended by E.O. 14094, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy. In our economic analysis, we did not find that this proposed critical habitat designation 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 finding:

(1) This proposed rule would 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 proposed rule would significantly or uniquely affect small governments, because the lands being proposed for critical habitat designation are owned by the New Mexico State Parks, BLM,

BOR, and the Service’s NWR System. None of these government entities fits the definition of “small government jurisdiction.” 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 Pecos pupfish in a takings implications assessment. The Act does not authorize the Services 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 for the proposed designation of critical habitat for Pecos pupfish, and it concludes that, if adopted, this designation of critical habitat 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 proposed 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 this proposed critical habitat designation 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, the proposed rule does not have substantial direct effects either on the States, or on the relationship between the Federal Government and the States, or on the distribution of powers and responsibilities among the various levels of government. The proposed

designation 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 would 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 E.O. 12988 (Civil Justice Reform), the Office of the Solicitor has determined that the rule would not unduly burden the judicial system and that it meets the requirements of sections 3(a) and 3(b)(2) of the order. We have proposed designating critical habitat in accordance with the provisions of the Act. To assist the public in understanding the habitat needs of the species, this proposed rule identifies the physical or biological features essential to the conservation of the species. The proposed areas of critical habitat are presented on maps, and the proposed 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 proposed 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 analysis under NEPA. We published a rule-related 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)).

However, when we designate as “critical habitat” any of the areas that fall within the jurisdiction of the U.S. Court of Appeals for the Tenth Circuit, including this designation proposed for the Pecos pupfish, we undertake a NEPA analysis for that critical habitat designation consistent with the Tenth Circuit’s ruling in *Catron County Board of Commissioners v. U.S. Fish and Wildlife Service*, 75 F.3d 1429 (10th Cir. 1996). We invite the public to comment on the extent to which this proposed critical habitat designation may have a significant impact on the human environment, or fall within one of the categorical exclusions for actions that have no individual or cumulative effect on the quality of the human environment. We will complete our analysis, in compliance with NEPA, before finalizing this proposed 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, May 4, 1994), E.O. 13175 (Consultation and Coordination with Indian Tribal Governments), the President’s memorandum of November 30, 2022 (Uniform Standards for Tribal Consultation; 87 FR 74479, December 5, 2022), and the Department of the Interior’s manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with federally recognized Tribes and Alaska Native Corporations (ANCs) on a

government-to-government basis. In accordance with Secretary’s 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 will continue to work with relevant Tribal entities during the development of any final rules for the Pecos pupfish. We have determined that no Tribal lands fall within the boundaries of the proposed critical habitat for the Pecos pupfish, so no Tribal lands would be affected by the proposed designation.

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 New Mexico Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the Fish and Wildlife Service’s Species Assessment Team and the New Mexico Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

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

Proposed Regulation Promulgation

Accordingly, we propose to 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. In § 17.11, in paragraph (h), amend the List of Endangered and Threatened Wildlife by adding an entry for “Pupfish, Pecos” in alphabetical order under FISHES to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *
(h) * * *

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
*	*	*	*	*
FISHES				
*	*	*	*	*
Pupfish, Pecos	<i>Cyprinodon pecosensis</i>	Wherever found	T	[Federal Register citation when published as a final rule]; 50 CFR 17.44(bb); 4d 50 CFR 17.95(e). ^{CH}
*	*	*	*	*

■ 3. In § 17.44, add paragraph (bb) to read as follows:

§ 17.44 Species-specific rules—fishes.

(bb) Pecos pupfish (*Cyprinodon pecosensis*)—(1) *Prohibitions*. The following prohibitions that apply to endangered wildlife also apply to Pecos pupfish. Except as provided under paragraph (bb)(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 this 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 a 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 this 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) Possess and engage in other acts with unlawfully taken wildlife, as set forth at § 17.21(d)(2) for endangered wildlife.
- (v) Take incidental to an otherwise lawful activity caused by:

(A) Management and maintenance of ponds that satisfy Texas Parks and Wildlife Department (TPWD) permitting requirements and are stocked by TPWD with captive-bred Pecos pupfish.

(B) Research activities conducted by holders of a valid scientific research permit, zoological permit, or educational display permit issued by TPWD on individual Pecos pupfish in ponds that are part of the TPWD Pecos pupfish production effort. Researchers

must report annually to TPWD, and TPWD must annually report to the Service, the following information:

- (1) The nature of research performed;
- (2) The dates of fieldwork;
- (3) The number of individuals collected or captured and the methods used to obtain them;
- (4) A description of any accidental injuries or mortalities; and
- (5) The number of individuals from which genetic material was collected, the type of tissue collected, and the institution or location where the genetic material is being stored.

■ 4. In § 17.95, in paragraph (e), add an entry for “Pecos Pupfish (*Cyprinodon pecosensis*)” after the entry for “Leon Springs Pupfish (*Cyprinodon bovinus*)”, to read as follows:

§ 17.95 Critical habitat—fish and wildlife.

(e) *Fishes*.

Pecos Pupfish (*Cyprinodon pecosensis*)

(1) Critical habitat units are depicted for Chaves and Eddy Counties, New Mexico, and Culberson and Reeves Counties, Texas, on the maps in this entry.

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

(i) Water quality parameters that support all life stages of the Pecos pupfish, including:

- (A) Absence of pollutants, or a level of contaminants low enough that it does not negatively impact necessary water quality conditions for Pecos pupfish individuals;
- (B) Salinity less than 35,000 mg/L;
- (C) Temperature less than 42.7 °C (108.9 °F); and
- (D) Dissolved oxygen greater than 2.5 mg/L.

(ii) Sufficient water quantity parameters that support all life stages of the Pecos pupfish, including:

- (A) Permanent water in a portion of the habitat; and

(B) Water depth less than 2 m (6.56 ft) deep to allow for thermal refugia and breeding.

(iii) Presence of silt-free underwater features such as crevices, boulders, large rocks, scattered pebbles, and aquatic plants that are used for egg deposition.

(iv) Absence of nonnative invasive sheepshead minnow.

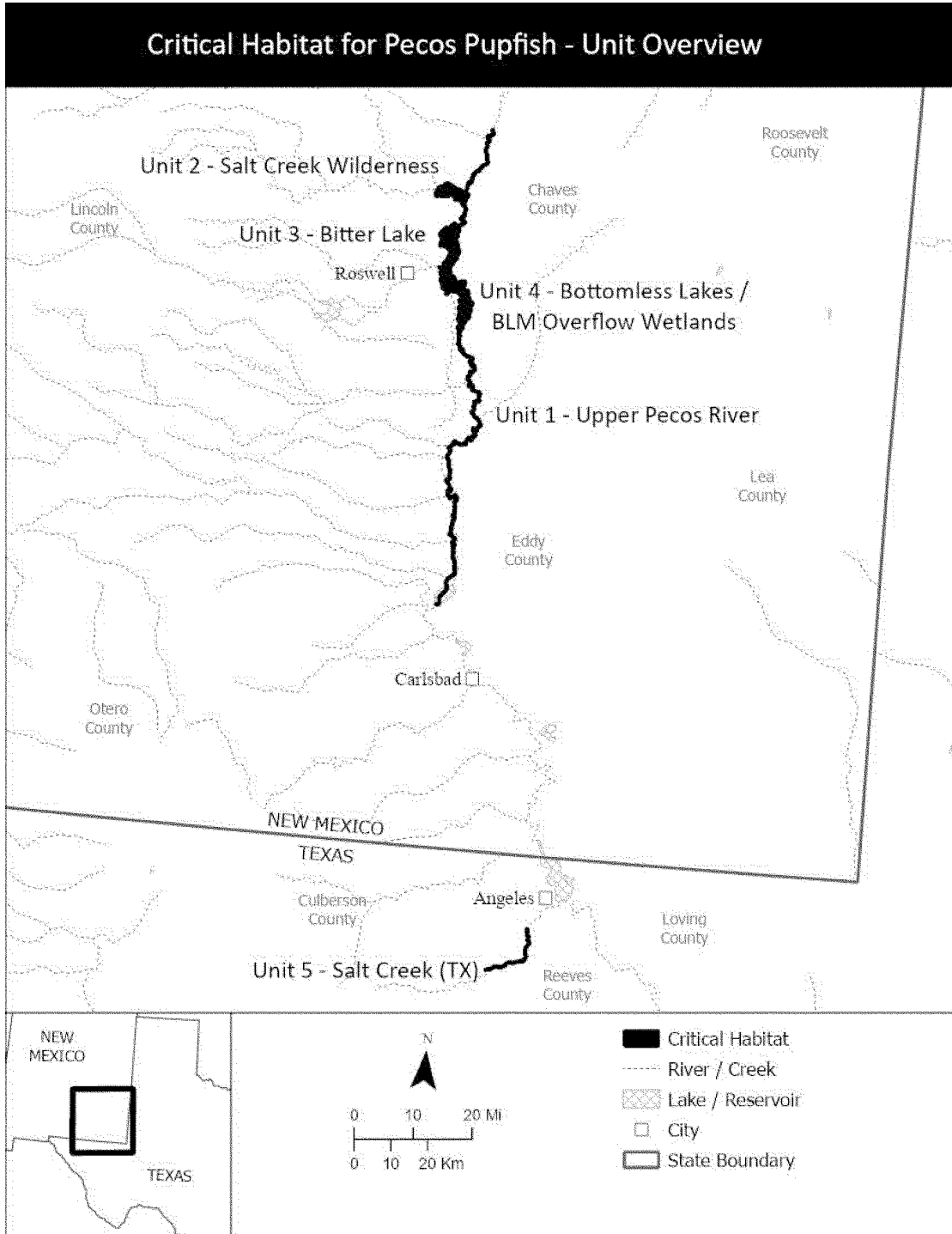
(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on the effective date of the final rule.

(4) Data layers defining map units were created using ESRI OpenStreets and Imagery basemaps, USA Federal Lands data, and the National Hydrography Dataset (NHD) Plus dataset. Polygons for units 2, 3, and 4 were largely defined through heads-up digitization or land ownership boundaries (Unit 3, Bitter Lake NWR); acreage or mileage numbers in the designation came from these features. For online distribution, linear features in Unit 1 (the Pecos River) and Unit 5 (Salt Creek) were converted to polygons. We used NHD polygons when available. When polygons were unavailable, we buffered the linear features by a set distance; 20 m for the lower third of unit 1, and 5 m for the entirety of unit 5. The boundaries of units 2, 3, and 4 that abutted the Pecos River were adjusted to match the new Unit 1 polygon. 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 <https://www.regulations.gov> under Docket No. FWS-R2-ES-2024-0143 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 follows:

Figure 1 to Pecos Pupfish (*Cyprinodon pecosensis*) paragraph (5)

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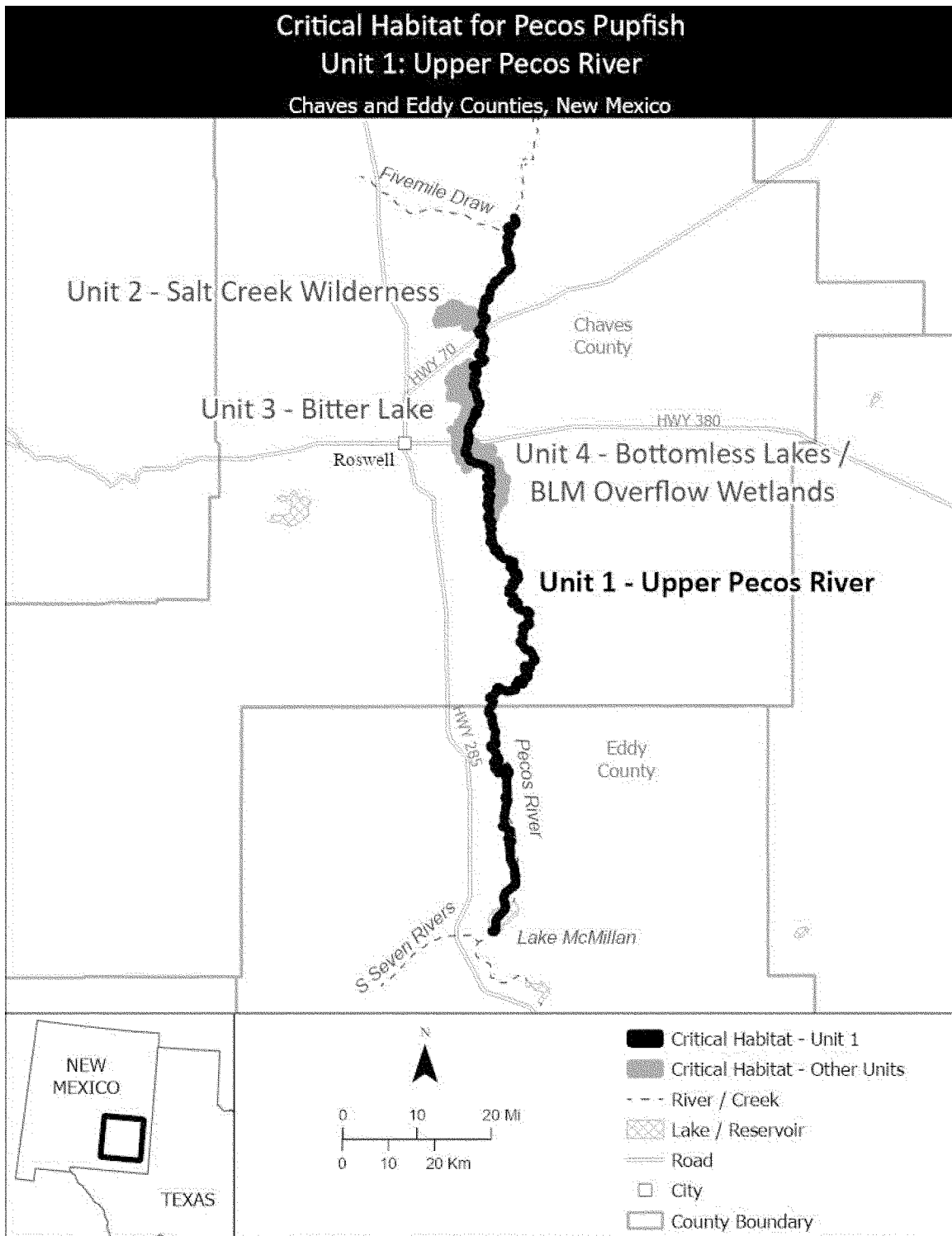
(6) Unit 1: Upper Pecos River, Chaves and Eddy Counties, New Mexico.

(i) Unit 1 consists of 121.88 river mi (196.15 km) of the upper Pecos River in Chaves and Eddy Counties, New

Mexico, and is composed of lands in Federal (32.61 river mi (52.48 km)), State (4.86 river mi (7.82 km)), and private (84.41 river mi (135.84 km)) ownership. Unit 1 includes river habitat up to bank full height.

(ii) Map of Unit 1 follows: Figure 2 to Pecos Pupfish (*Cyprinodon pecosensis*) paragraph (6)(ii)

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(7) Unit 2: Salt Creek Wilderness, Chaves County, New Mexico.

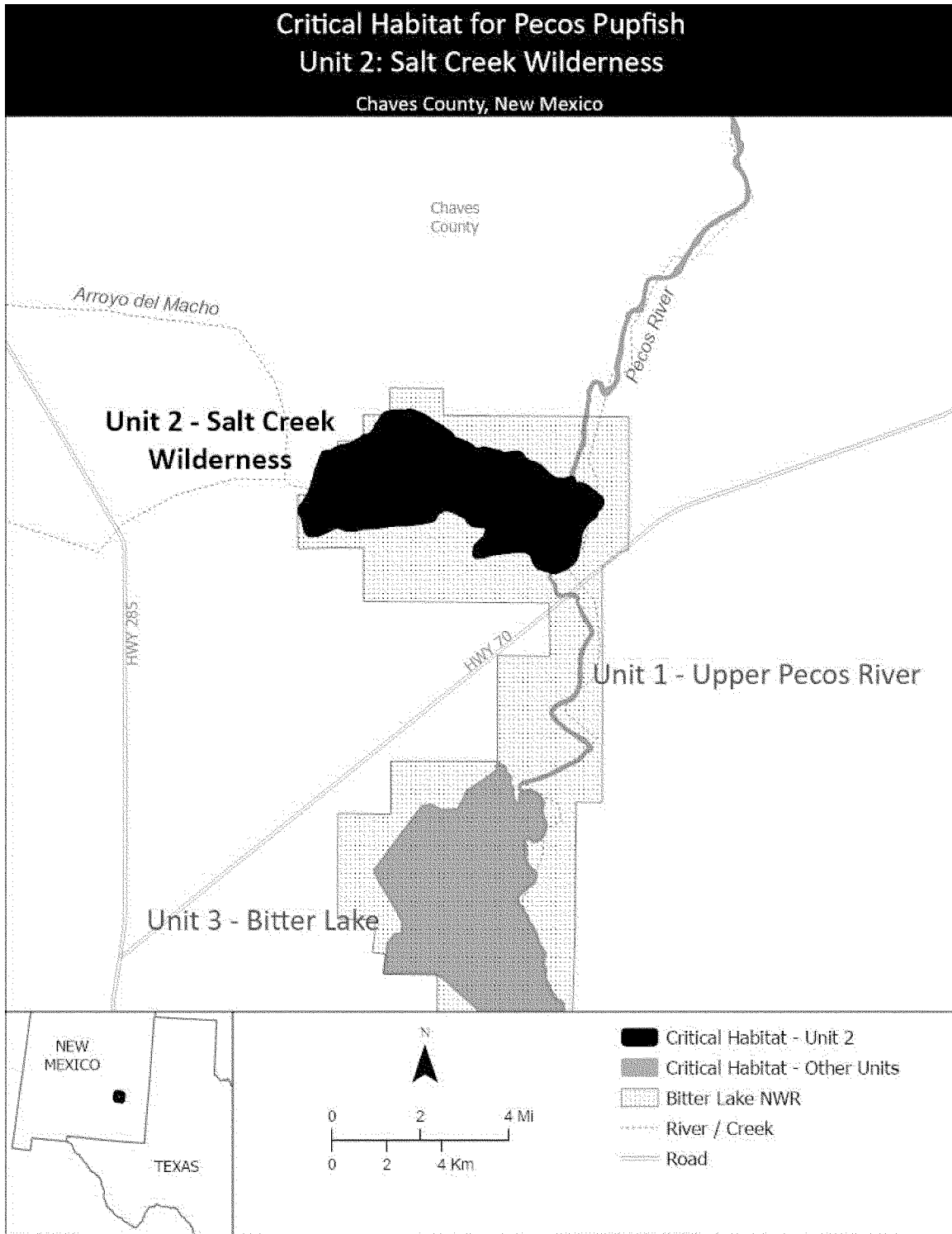
(i) Unit 2 contains Salt Creek (New Mexico) and four sinkholes within 5,428.74 acres (2,196.93 hectares (ha)) of

land in Chaves County, New Mexico. The wetted areas within this unit are entirely under Federal ownership, specifically the Service's Bitter Lake National Wildlife Refuge (NWR).

(ii) Map of Unit 2 follows:

Figure 3 to Pecos Pupfish (*Cyprinodon pecosensis*) paragraph (7)(ii)

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(8) Unit 3: Bitter Lake, Chaves County, New Mexico.

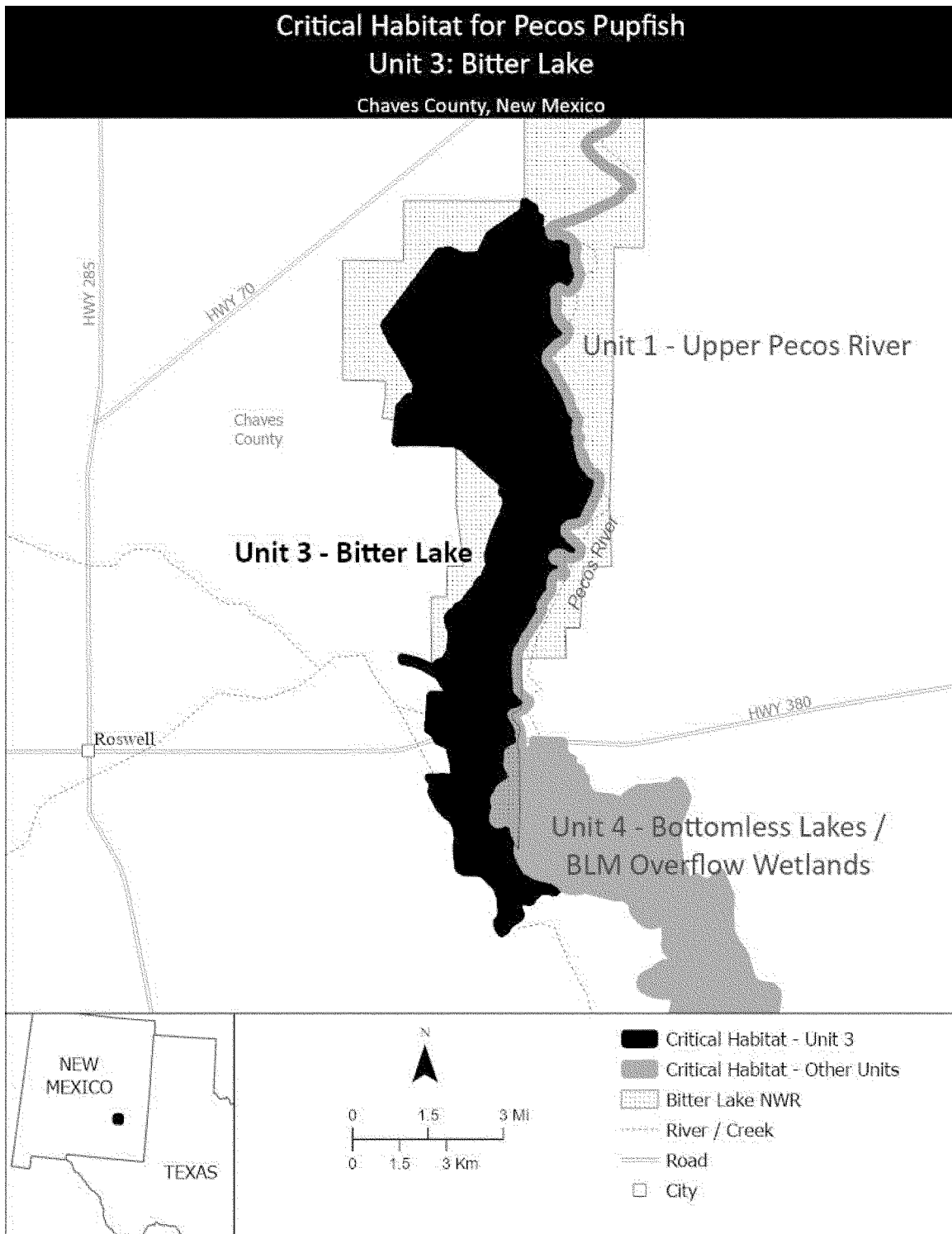
(i) Unit 3 contains Bitter Creek and numerous isolated sinkholes, spring ditches, managed and natural wetlands,

and oxbows of the Pecos River within 11,972.90 acres (4,845.26 ha) of Chaves County, New Mexico. The unit is composed of lands in Federal (9,663.15 acres (3,910.54 ha)), State (87.87 acres

(35.56 ha)), and private (2,221.88 acres (899.16 ha)) ownership.

(ii) Map of Unit 3 follows: Figure 4 to Pecos Pupfish (*Cyprinodon pecosensis*) paragraph (8)(ii)

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(9) Unit 4: Overflow Wetlands/ Bottomless Lakes, Chaves County, New Mexico.

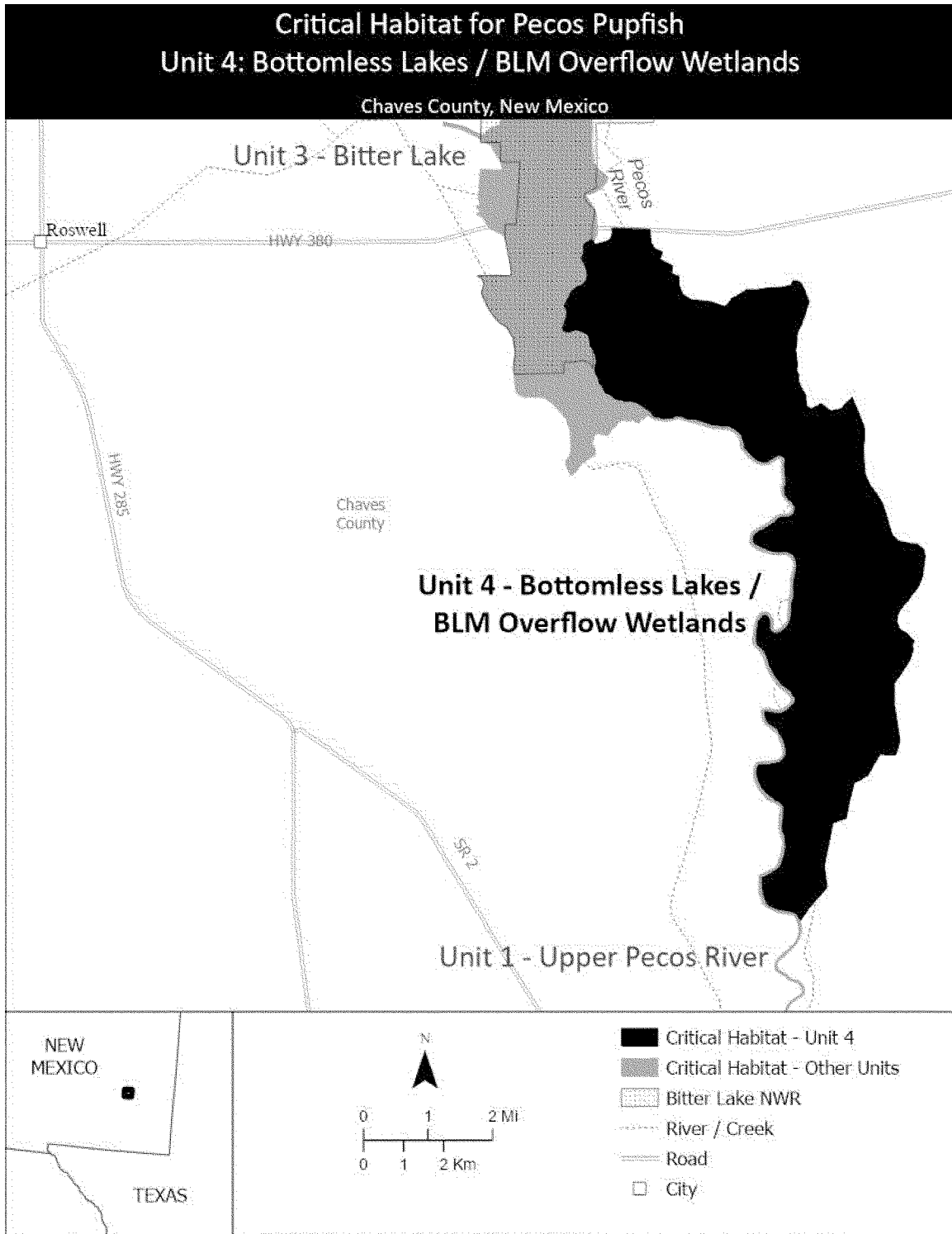
(i) Unit 4 contains a wetland and several isolated sinkholes within

9,153.90 acres (3,704.45 ha) in Chaves County, New Mexico. The unit is composed of lands in Federal (1,784 acres (721.96 ha)), State (1854.78 acres (750.60 ha)), and private (5,515.12 acres (2,231.89 ha)) ownership.

(ii) Map of Unit 4 follows:

Figure 5 to Pecos Pupfish (*Cyprinodon pecosensis*) paragraph (9)(ii)

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(10) Unit 5: Salt Creek (TX), in Culberson and Reeves Counties, Texas.

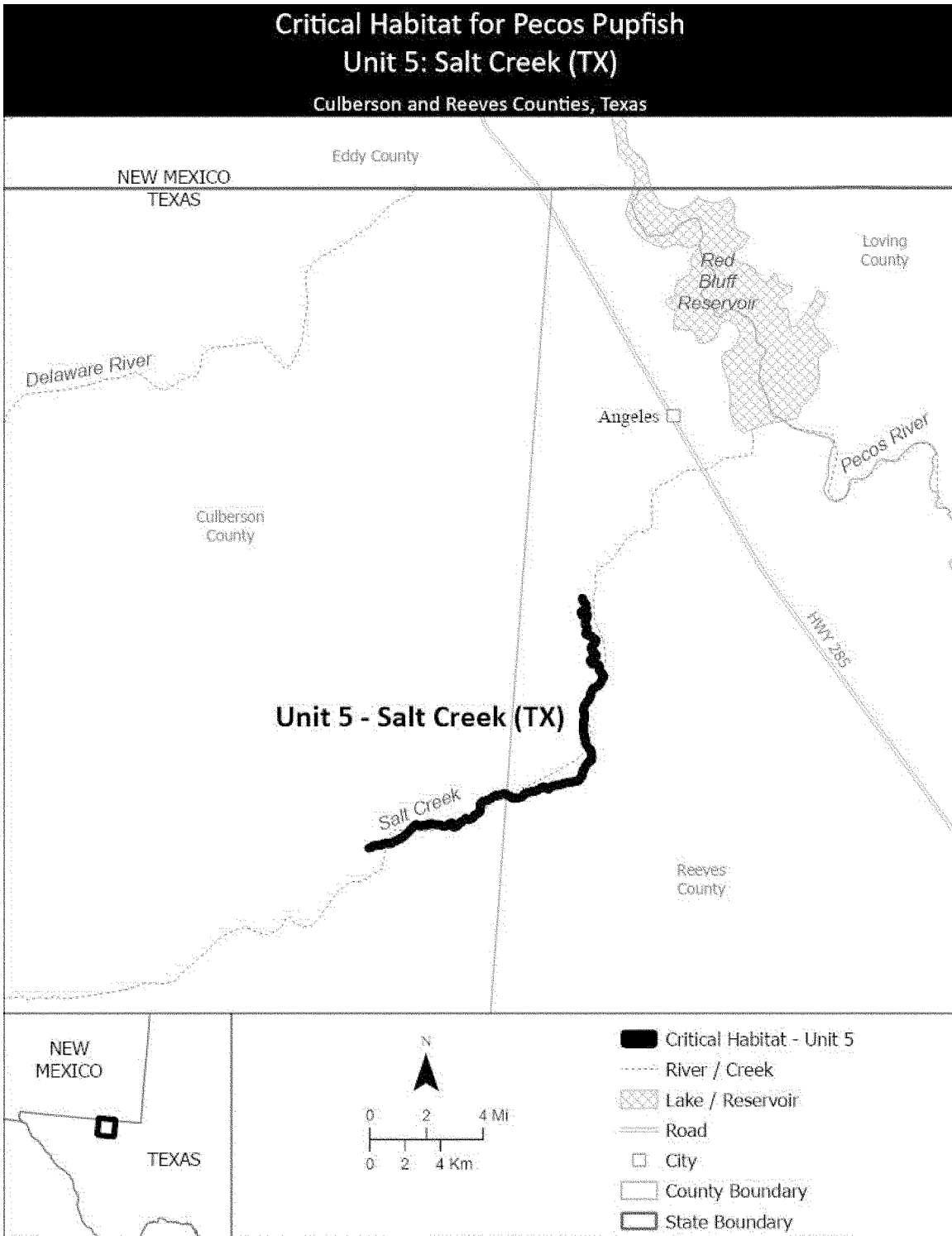
(i) Unit 5 consists of 14.24 river mi (23.20 km) in Culberson and Reeves

Counties, Texas, and is composed of lands in 100 percent private ownership. Unit 5 includes river habitat up to bank full height.

(ii) Map of Unit 5 follows:

Figure 6 to Pecos Pupfish (*Cyprinodon pecosensis*) paragraph (10)(ii)

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* * * * *

Martha Williams,

Director, U.S. Fish and Wildlife Service.

[FR Doc. 2024-27127 Filed 11-21-24; 8:45 am]

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