PETITION TO LIST THE
Rio Grande Chub (*Gila pandora*)
UNDER THE ENDANGERED SPECIES ACT

Photo of Rio Grande Chub (*Gila pandora*) by Chad Thomas, Texas State University – San Marcos

Petition Submitted to the U.S. Secretary of the Interior acting through the U.S. Fish and Wildlife Service

Petitioner:
WildEarth Guardians
1536 Wynkoop Street, Suite 301
Denver, Colorado 80202
505-490-5141
Address correspondence to: Taylor Jones
tjones@wildearthguardians.org

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Petition prepared by:
Kevin Blake, Michael Daugherty, Michael Howard, and Brian O'Neill, Student Attorneys, and
Michael C. Soules, Supervising Attorney
Getches-Green Natural Resources and Environmental Law Clinic
University of Colorado Law School
Wolf Law Building, UCB 404
Boulder, CO 80309-0404

WILDEARTH GUARDIANS
A FORCE FOR NATURE

I. INTRODUCTION

WildEarth Guardians ("Guardians") respectfully requests that the Secretary of Interior, acting through the U.S. Fish and Wildlife Service ("FWS"), list the Rio Grande Chub (*Gila pandora*) ("Chub") as "threatened" or "endangered" under the Endangered Species Act ("ESA"). *See* 16 U.S.C. §§ 1531-1544. Guardians also requests that FWS designate critical habitat throughout the species' historical range.

The Chub is a small fish located primarily in the Rio Grande Basin in Colorado and New Mexico, with an isolated population in Texas. Rees et al. 2005 at 9. Its historic range has been reduced by 75%. *Id.* Having been extirpated from the main stem of the Rio Grande, the Chub lives only in a few select tributaries. *Id.* The species is at high risk for future population declines; isolated populations are more susceptible to catastrophic events because recolonization from nearby populations is unlikely. *Id.* at 16.

The Chub is threatened by four of the five listing factors identified by the ESA. *See* 16 U.S.C. § 1533. First, the Chub is losing significant portions of its habitat to a range of threats, such as timber harvesting, livestock grazing, stream diversion, low stream flow, and fragmentation. Second, the Chub is in danger due to predation from several species of fish, including the non-native Northern Pike and Brown Trout. Third, existing regulatory mechanisms are inadequate to protect the Chub from threats such as habitat modification and loss, or predation. And fourth, within the foreseeable future, the effects of climate change will exacerbate current threats to the Chub's habitat.

WildEarth Guardians seeks listing of the Rio Grande Chub as "threatened" or "endangered" under the ESA to ensure the species' continued survival. Listing the Chub under the ESA would provide needed protection for this species by limiting or restricting activities that harm the Chub and its habitat. In addition, an ESA listing would provide vital protection for critical habitat important for the species' recovery.

II. ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS

The ESA, 16 U.S.C. §§ 1531 *et seq*., was enacted in 1973 "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species." 16 U.S.C. § 1531(b). The protections of the ESA only apply to species that have been listed as endangered or threatened according to the provisions of the statute. The ESA delegates authority to determine whether a species should be listed to the Secretary of Interior, who has in turn delegated authority to the Director of FWS. As defined in the ESA, an "endangered" species is one that is "in danger of extinction throughout all or a significant portion of its range." 16 U.S.C. § 1532(6). A "threatened species" is one that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20). FWS must evaluate whether a species is threatened or endangered as a result of any of the following five listing factors set forth in 16 U.S.C. § 1533(a)(1):

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.

A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing. 50 C.F.R. § 424.11.

FWS is required to make these listing determinations "solely on the basis of the best scientific and commercial data available to [it] after conducting a review of the status of the species and after taking into account" existing efforts to protect the species. 16 U.S.C. § 1533(b)(1)(A); *see also* 50 C.F.R. §§ 424.11(b), (f). In making a listing determination, FWS must give consideration to species which have been "identified as in danger of extinction, or likely to become so within the foreseeable future, by any State agency or by any agency of a foreign nation that is responsible for the conservation of fish or wildlife or plants." 16 U.S.C. § 1533(b)(1)(B)(ii); *see also* 50 C.F.R. § 424.11(e) (the fact that a species has been identified by a State agency as being in danger of extinction may constitute evidence that the species is endangered or threatened). Listing may be done on the initiative of FWS or in response to a petition. 16 U.S.C. § 1533(b)(3)(A).

After receiving a petition to list a species, FWS is required to determine "whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). Such a finding is termed a "90-day finding." A positive 90-day finding leads to a status review and a determination of whether the species will be listed, to be completed within twelve months. *Id.* § 1533(b)(3)(B). A negative initial finding ends the listing process, and the ESA authorizes judicial review of such a finding. *Id.* § 1533(b)(3)(C)(ii).

The ESA's implementing regulations define "substantial information," for purposes of a 90-day finding, as "that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted." 50 C.F.R. § 424.14(b)(1). The regulations further specify four factors to guide FWS's consideration on whether a particular listing petition provides "substantial" information.

i. Clearly indicates the administrative measure recommended and gives the scientific and any common name of the species involved;
ii. Contains detailed narrative justification for the recommended measure; describing, based on available information, past and present numbers and distribution of the species involved and any threats faced by the species;
iii. Provides information regarding the status of the species over all or significant portion of its range; and

iv. Is accompanied by appropriate supporting documentation in the form of bibliographic references, reprints of pertinent publications, copies of reports or letters from authorities, and maps.

50 C.F.R. § 424.14(b)(2)(i)-(iv).

Both the language of the regulation itself (by setting the "reasonable person" standard for substantial information) and the relevant case law underscore the point that the ESA does not require "conclusive evidence of a high probability of species extinction" in order to support a positive 90-day finding. *Ctr. for Biological Diversity v. Morgenweck*, 351 F. Supp. 2d 1137, 1140; *see also Moden v. U.S. Fish & Wildlife Serv.*, 281 F. Supp. 2d 1193, 1203 (D. Or. 2003) (holding that the substantial information standard is defined in "non-stringent terms"). Rather, the courts have held that the ESA contemplates a "lesser standard by which a petitioner must simply show that the substantial information in the Petition demonstrates that listing of the species *may* be warranted" (emphasis added). *Morgenweck*, 351 F. Supp. 2d at 1141 (quoting 16 U.S.C. § 1533(b)(3)(A)); *see also Ctr. for Biological Diversity v. Kempthorne*, N.D. Cal. January 19, 2007, No. C 06-04186 WHA, 2007 WL 163244, at *3 (holding that in issuing negative 90-day findings for two species of salamander, FWS "once again" erroneously applied "a more stringent standard" than that of the reasonable person).

III. CLASSIFICATION AND NOMENCLATURE

Common Name. *Gila pandora* is known by the common name "Rio Grande Chub." This petition refers to the species by its common name or simply as the "Chub."

Taxonomy. The petitioned species is *Gila pandora*. The species' taxonomic classification is shown in Table 1. NatureServe 2013 at 1.

Table 1. Taxonomy of *Gila pandora*.

Kingdom	Animalia
Phylum	Craniata
Class	Actinopterygii
Order	Cypriniformes
Family	Cyprinidae
Genus	*Gila*
Species	*Pandora*

IV. SPECIES DESCRIPTION

The Chub is a fish that reaches up to 9.8 inches (250 millimeter) in total length, averaging between 5.1 and 5.9 inches (130mm to 150mm). Rees et al. at 9. During the spawning season, which runs from spring to early summer, the Chub exhibits orange-red coloration along the lower fins, mouth, and lower sides of the head and body. Bestgen et al. 2003 at 6; *see also*

Figure 1 (below). The Chub is an omnivore and is known to feed on: aquatic and terrestrial insects; crustaceans and other small invertebrates; small fish; plankton; and some vegetation. Bestgen et al. 2003 at 6.

The Chub spawns in riffle habitat without building nests, and provides no parental care after egg laying. *Id.* at 7. A riffle is a short, relatively shallow and coarse-bedded length of stream over which the stream flows at higher velocity and higher turbulence than it normally does in comparison to a pool. Spawning of the Rio Grande Chub occurs mostly in spring and early summer, with autumn spawning occasionally occurring when environmental conditions are suitable. *Id.* at 6. Hybridization has been documented with the Longnose Dace (*Rhinichthys cataractae*); this may have occurred due to fish crowding in limited habitat, compounded by drought and irrigation diversions. *Id.* at 7.

Once the most abundant fish in the Rio Grande, the Chub's population has been drastically reduced. NatureServe 2013 at 2. Although no significant studies of the Chub have been completed since 2005, the threats that had already caused a 75% reduction in the Chub's population continue to have detrimental impacts to the present day. Rees et al. at 17. Thus, its population has likely declined even further.

Figure 1. Rio Grande Chub (*Gila pandora*). Forest Service Technical Conservation Assessment (2005). Photo taken by John Woodling and Don Domenick (Woodling 1985).

Habitat. The Chub is commonly found in pools of small to moderate-sized perennial streams at higher elevations, where the water is cooler and the substrate consists of sand, gravel, or cobble. Bestgen et al. 2003 at 6. They are often adjacent to or in vegetative cover that is located in deeper pools that are cool enough to support trout. *Id.* Chub are most often found where sand dominates the river bottom and less often when the river bottom consists of larger sediment, such as cobble. *Id.* at 21. In a 2003 sampling of Chub, some type of instream cover (*e.g.*, undercut bank, large woody debris, overhanging vegetation, or aquatic plants) was found to be an "important component of suitable habitat" and was nearly always present. *Id.* Small substrate particle size, wide stream width, and presence of brown trout are all significantly correlated with the presence of Chub in the Rio Grande Basin. *Id.*

V. GEOGRAPHIC DISTRIBUTION: HISTORIC AND CURRENT

Historic Range. The Chub's historic range included the main stem of the Rio Grande and most of its tributaries, the Pecos River basins, and the San Luis Closed Basin. Bestgen et al. 2003 at 25; Rees et al. 2005 at 10. Chub were once so common that pre-Columbian residents of the San Luis Valley harvested them as a food source. Rees. et al 2005 at 10. Chub were probably the most common fish in the San Luis River and Rio Grande Basins, occupying the majority of streams in both high and low elevations. Bestgen et al. 2003 at 25. Jordan (1891) described the Rio Grande Chub as "everywhere abundant" and Ellis (1914) called it "very abundant." Bestgen et al. 2003 at 25. Chub were widespread in creeks of the upper Rio Grande and Pecos watersheds in New Mexico and the Rio Grande and San Luis basin in southern Colorado, with a single isolated population in the Davis Mountains of Texas. Figure 2 (below); Bestgen et al. 2003 at 6; Rees et al. 2005 at 9. Because of an absence of complete historical records of distribution, it is not possible to identify all the streams from which the Chub has been extirpated. Bestgen et al. 2003 at 4.

Current Range. Once the most common fish in the Rio Grande, the Chub's population has been reduced by as much as 75%. Rees et al. 2005 at 9. The Chub has been extirpated from the main stem of the Rio Grande and remains only in isolated tributaries, comprising less than 25% of the Rio Grande Basin. Rees et al. 2005 at 9; Bestgen et al. 2003 at 15. In Colorado and New Mexico, the species has declined substantially from historical levels, and it is struggling even in the Rio Grande's tributaries. *See* Bestgen et al 2003. The Chub has been extirpated from the Conjeos River, Rock Creek, Alamosa River, Rio Chamita, Sexto Creek, Hot Springs Creek, and the lower reaches of Saguache Creek. *See* Figure 2 (below); Rees et al. 2005 at 10; Bestgen et al. 2003 at 24. Small populations persist in short reaches of the Rio San Antonio, Rio de los Pinos, La Jara Creek, and in the Closed Basin, Rock and San Luis creeks. *Id.* Although not entirely extirpated in McIntyre Spring and San Luis Creek, the Chub's historically large population has significantly declined in those areas. Bestgen et al. at 24. The Chub's overall decline has paralleled that of the Rio Grande Sucker, *Catostomus plebuius*, and the Rio Grande Cutthroat trout, *Oncorhynchus clarki virginali.* Bestgen et al. 2003 at 29.

Currently, the Chub is present only in the following isolated areas: the Pecos System (New Mexico and Texas), Davis Mountains (Texas), Dome Lake (Gunnison National Forest, Colorado) and various tributary streams of the Rio Grande. Rees et al. 2005 at 9. Because the Chub is the least studied native fish of the Rio Grande, scientists do not know its precise population count. Bestgen et al. 2003 at 4. Over the past eight years, its population may have fallen below the 2005 low-end estimate of 10,000. NatureServe 20013 at 2.

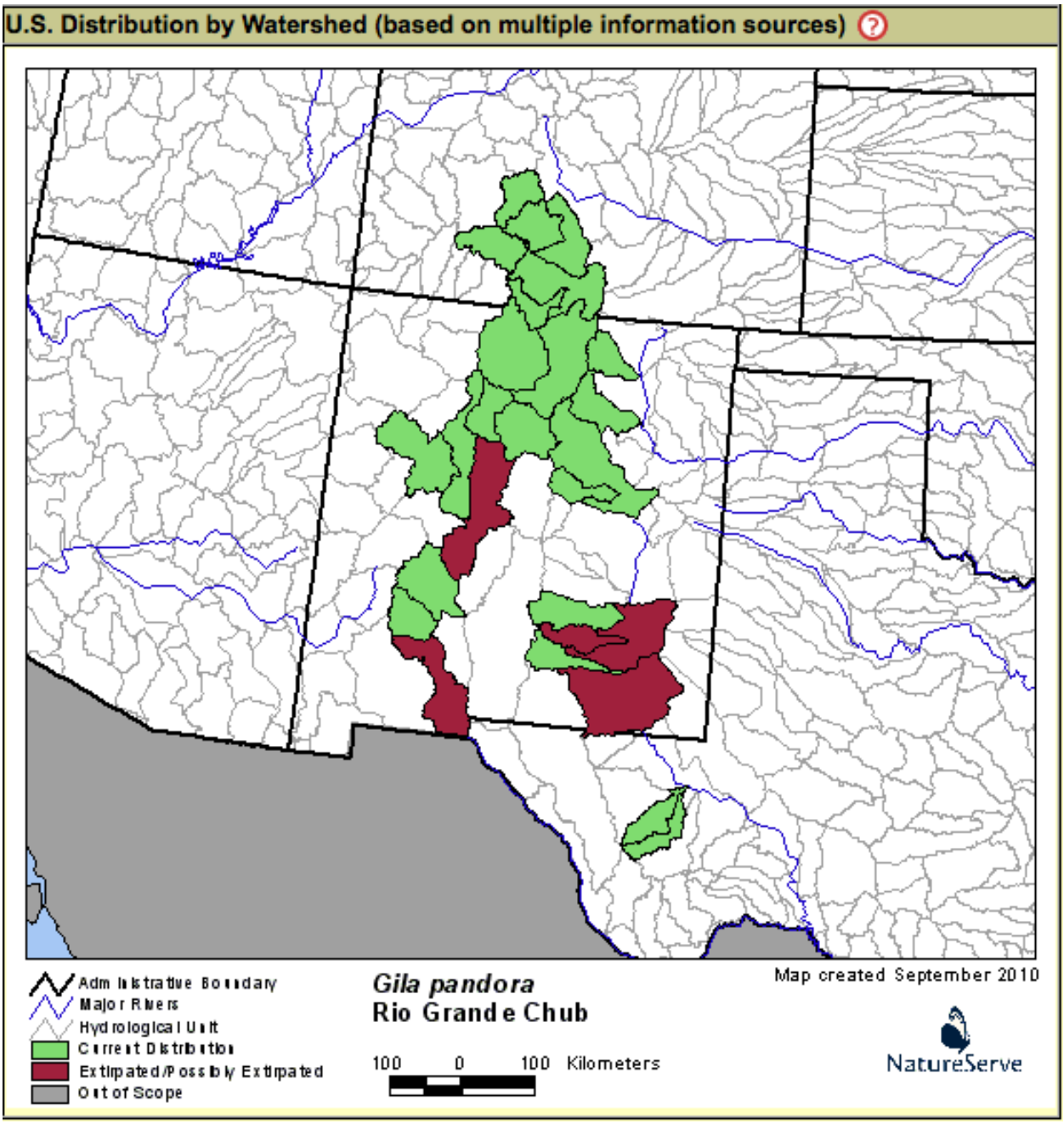

Figure 2. Current geographic distribution of the Rio Grande Chub. NatureServe 2013 at 4.

VI. IDENTIFIED THREATS TO THE PETITIONED SPECIES: CRITERIA FOR LISTING

The Rio Grande Chub meets at least four of the criteria for listing identified in § 4 of the ESA. (in bold):

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.

16 U.S.C. § 1533(a)(1)

The main threats to the Chub are primarily the result of human activities. Rees et al. 2005 at 14. First, habitat fragmentation and modification pose a significant threat to the survival of the Chub. *Id.* at 16. Diversion projects, dams, forest management practices, grazing, water-use, and pollution have all accelerated habitat destruction. *Id.* Second, predation by invasive fish species, particularly the Northern Pike and Brown Trout, threaten the Chub, and these fish also compete for limited resources. *Id.* Third, the current regulatory mechanisms being used to protect the Chub are inadequate to combat the threats to the species. *Id.* at 9. Fourth, climate change will continue to exacerbate many of these threats due to warming temperatures and habitat alternations. BOR 2013.

Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The Rio Grande has been ranked as one of the top ten most endangered rivers in the world due to significant manmade modifications. Wong et al. 2007 at 17. Most of the main stem has been modified by a series of dams and irrigation diversions, which have altered its flow, discharge, and biodiversity. *Id.* at 19.

Low Stream Flow. Low stream flow is a present and significant threat to the Chub's habitat. Reduced flows may impact the Chub directly, by causing habitat fragmentation, or indirectly via reduced water quality, increased stress due to crowding, increased vulnerability to terrestrial predators, or higher water temperatures. Bestgen et al. 2003 at 33.

A high level of water extraction for agriculture and domestic use threatens the Rio Grande Chub. In 2005, 451,456,974 m^3 (366,000 acre feet) of water were diverted from the middle Rio Grande during the irrigation season. Wong et al 2007 at 18. While irrigation accounts for more than 80% of all water taken from the river, municipal needs are growing as urban areas expand. *Id.* Along the Rio Grande main stem, there are only four major cities, but the urban population is growing at a rapid rate of 2-4% per year. *Id.*

Habitat Fragmentation. Habitat fragmentation due to water over-extraction is a direct threat to the Chub. Bestgen et al. 2003 at 26. For example, the average channel width of the Rio Grande has steadily decreased by 30 meters from 1996 to 2008. Swanson 2012 at 52. Wide stream width is significantly correlated with the presence of Chub in the Rio Grande Basin. Bestgen et

al. 2003 at 21. Moreover, reduced stream flow causes tributaries to separate from the main stem of the Rio Grande, reducing the size of the Chub's habitat by interrupting normal population exchange. Rees et al. 2005 at 16. Given that the Chub has been extirpated from the main stem of the Rio Grande, continued low stream flow prevents the Chub from being able to repopulate the main stem. *Id.* Scientists have sporadically sampled the Rio Grande for over 130 years. Bestgen et al. 2003 at 24-25. Yet a 2003 study found that many previously viable sampling sites had completely dried up due to water over-extraction and drought, extirpating the following historical populations: Rock Creek near Alamosa, Hot Springs Creek, and Saguache Creek. *Id.*

Water Temperature. In addition to habitat fragmentation, low stream flows have reduced the Chub's habitat quality and quantity by causing water temperatures to increase. In a 2003 study, Chub were found only in water temperatures below 20°C. Bestgen et al. 2003 at 26. Most historic sampling sites along the Rio Grande exceeded 20°C (26°C maximum) during August 2002 when flow was low. Summer is the most stressful time for Chub because stream flow is lowest and water temperatures are warmest. Because the Chub is not suited to such high water temperatures, low stream flow is preventing the Chub from establishing a year-round presence in the Rio Grande. *Id.*

The rising Rio Grande water temperatures are reflected by the growing presence of fish that prefer warmer water. A 2003 study detected widespread occurrence of Flathead Chub – which prefer warmer water – in the Rio Grande and lower Conejos River. Bestgen et al. 2003 at 24. The absence of Flathead Chub in historical samples (Ellis 1914, Zuckerman 1984, Zuckerman and Langlois 1990) suggests a recent invasion upstream due to warming water temperatures. *Id.*

Low stream flows – and an accompanying rise in water temperatures - are projected to continue throughout the 21st century as climate change reduces runoff from mountain snowpack and the river's water resources are increasingly utilized. BOR 2013.

Channelization. The Rio Grande has undergone significant modification. Wong et. al. 2007 at 18. Channelization is a leading force in this modification because it causes increased sedimentation, removal of vegetation, reduction in food sources, and decreased water quality. Rees 2005 at 16.

Historically, the Rio Grande has had a sandy, wide, and braided structure – the Chub's ideal habitat. Bestgen et al. at 23. Channelization has significantly altered this habitat. *Id.* Stream channelization describes any activity that moves, straightens, shortens, cuts off, diverts, or fills a stream channel. Such activities include the widening, narrowing, straightening, or lining of a stream channel that alters the amount and speed of the water flowing through the channel. EPA Stream Channelization Fact Sheet 2005. Examples of channelization include: lining channels with concrete; pushing gravel from the streambed and placing it along the banks; and placing streams into culverts. *Id.*

Channelization has altered the Rio Grande habitat in four ways that negatively impact the Chub. First, channelization increases the river's speed, washing away smaller sand particles and transforming the substrate into larger gravel. The grain size in the Rio Grande's substrate has increased from .19 mm to 4.37 mm between 1971 and 1998. Bauer 2002 at 114. Because Chub are more likely to be found where sand, rather than cobble, dominates the river bottom, increased grain size is degrading the Chub's habitat. Bestgen et al. 2003 at 21.

Second, channelization removes vegetation along the banks. *Id.* Because Chub are found most often near the banks and brush or adjacent to vegetative cover, the removal of this vegetation is degrading its habitat. *Id.*

Third, channelization may harm plant species that serve as food for the Chub. Plants can be affected by changes in the quantity and timing of flooding and changes in the amount of sediment in flows. When plants are affected, those changes can affect the fish species that use those plants for food, cover, and resting. EPA Stream Channelization Fact Sheet 2005; Bestgen et al. 2003 at 21. Removing plants in and along streams also reduces the amount of leaf litter that serves as food for animals at the bottom of food webs. *Id.* Because the instream cover and aquatic vegetation is crucial for the Chub's habitat and also provides an important food source, channelization is degrading the Chub's habitat. Bestgen et al. 2003 at 21.

Fourth, channelization can degrade stream water quality. When streams are channelized for development, the removal of trees and vegetation along the stream bank can increase pollutants such as phosphorous, nitrogen, pesticides, sediment, and heavy metals because the presence of vegetation filters out pollutants and soaks up agricultural runoff. Rees et al. 2005 at 16. Removal of trees and vegetation can also result in increased water temperature and decreased oxygen. *Id.* Because the Chub prefers cool water temperatures, these changes will further degrade the Chub's habitat. Bestgen et al. 2003 at 21.

Water Quality. By causing low stream flow, channelization can also increase the concentrations of pollutants and change the composition of the water, resulting in increased salinity, acidity, and additional flowing debris. Richard 2003 at 95. This altered flow has caused the concentration of salts in the Rio Grande to increase at an annual rate of 15-18 mg/L. Miyamoto 1995 at 28. This level of salinity may have detrimental effects on the Chub. *Id.* Trace elements of metals were also found in fish samples within the Rio Grande at concentrations high enough to pose a threat to native fish. *Id.*

Additionally, estrogenic compounds in the Rio Grande downstream from municipal sewage effluent outfalls were found in excess of the levels that have been shown to disrupt the reproduction of fish species. McQuillan 2002 at 2. These water quality alterations – in addition to other factors that harm the Chub's population size, such as habitat fragmentation – significantly impair the species' ability to reproduce and proliferate. *Id.*

Dams and Diversions. There are 68 dams and 13 reservoirs on the Rio Grande. Dudley et al. 2007 at 2074; *see also* Figure 3 (below). These dams and diversions are detrimental to the Chub because they reduce channel complexity and isolate fish populations. Dudley et al. 2007 at 2074. The Rio Grande Basin historically provided over 4,000 km of free-flowing habitat. *Id.* Today there are only five remaining unfragmented portions over 100 km, leaving little free-flowing habitat to support native fish populations. *Id*; *see* Figure 3. Habitat loss and fragmentation significantly reduces genetic exchange between Chub populations. Furthermore, these dams and diversions make isolated populations especially susceptible to complete extirpation from single catastrophic events, because these populations cannot be recolonized from unaffected areas. Rees et al. 2005 at 16. These effects are particularly detrimental during times of low stream flow because the smaller passages become impassable and further isolate Chub populations. *Id.*

Figure 3. Hydrology of the Middle Rio Grande From Velarde to Elephant Butte Reservoir, New Mexico. Bullard, T. F. and S. G. Wells. 1992. U.S. Fish and Wildlife Service Resource Publication 179, Washington, D.C.

Land Management Practices. Land-use practices such as grazing, forest management, and road construction damage the Chub's habitat. Rees et al. 2005 at 10.

Grazing. Even moderate grazing around the Rio Grande has been shown to negatively impact the Chub's riverine habitat. Moderate grazing has similar detrimental effects as channelization – it decreases vegetation, decreases channel complexity, destabilizes banks, and adds to sedimentation. Rees et al. 2005 at 12.

Grazing may increase competition from invasive species. Wong et al 2007 at 18. For example, the invasive Salt Cedar degrades the Chub's habitat by increasing sedimentation and consuming large quantities of water. *Id.* This invasive species has proliferated throughout large portions of the Big Bend area (where the Rio Conchos joins the Rio Grande), and is known to consume large quantities of water. *Id.* One monoculture of Salt Cedar is believed to have choked 150 miles of the river corridor downstream of El Paso/Ciudad Juarez and may be the most extensive infestation of this species in the world. *Id.* As explained above, increased sedimentation and reduced water flow affects the composition of the water and the river bottom, decreasing the likelihood of Chub occurrence.

Further, grazing reduces the presence of instream cover and abundant vegetation, which are important components of suitable Chub habitat. Bestgen et al. 2003 at 30. This has been seen, for example, in the San Luis Creek, where there is no such cover and Chub populations have been rapidly declining – only three Chub were found residing in a partially submerged cardboard box. *Id.* Because the Chub is commonly associated with aquatic vegetation, instream woody debris, and overhanging riparian vegetation, grazing threatens the Chub's habitat. Bestgen et al. 2003 at 30.

Chub populations have already been reduced by 75%. Rees et al. 2005 at 9. Because low stream flow, increased channelization, increased sedimentation, substrate transformation, loss of river segment connectivity, and decreased water quality will all continue to modify and destroy the Chub's habitat, the Chub should be listed under the ESA. 16 U.S.C. § 1533(a)(1)(A).

Factor C: Disease or Predation

Predation by non-native species is a serious threat to Chub population health and viability. The three most common native fish of the Rio Grande Basin – Rio Grande Cutthroat Trout (*Oncorhynchus clarki virginalis*), Rio Grande Sucker (*Catostomus plebeius*) and Rio Grande Chub – have all experienced significant population declines. *See* Calamusso 1999. Together, these three species once comprised the majority of fish in the Rio Grande Basin; however, these three species co-exist in only a few remaining sites. Rees et al. 2005 at 10. Of the 27 species of fish that were historically native to the Rio Grande in New Mexico, only 14 remain. Sallenave et al. 2010 at ¶ 2.

The Chub now occurs commonly with non-native species, such as the Brown Trout (*Salmo trutta*), White Sucker (*Catostomus commersonii*), and Northern Pike (*Esox Lucius)*. Rees et al. 2005 at 16. Some non-natives have been introduced purposefully by State or Federal agencies for sport fishing, while others entered the river due to the negligence of anglers or enthusiasts unaware of the ecological impacts of non-native species. Sallenave et al. 2010 at ¶ 2. These introduced fish prey on the Chub and compete for limited resources. Rees et al. 2005 at 10.

The Chub is a "desirable prey item" for both non-native predator species, such as the Northern Pike, Brown Trout, and native predator species, such as the Rio Grande Cutthroat Trout. Rees et al. 2005 at 16. For example, Brown Trout and Chub often co-occur because they both prefer cool water habitat. Bestgen et al. 2003 at 31. Because Brown Trout co-occur with Chub in most ideal Chub localities, there is limited refuge for the Chub from this predatory non-native species, causing a continual threat to the Chub's survival. *Id*. Salmonids, such as the Rainbow Trout, have been known to prey on Chub as well. *Id.* Other fish that are commonly found in Chub habitat, while not directly preying on the Chub, further contribute to increased competition for limited resources. *Id.*

Predation on the Chub is particularly troublesome in irrigation canals, where predation is magnified due to over-crowding. *See* Sallinave et al. 2010. These irrigation canals provide refuge for fish during periods when large sections of the river dry up due to heavy irrigation periods and drought. Sallenave et al. 2010 at ¶ 2. Irrigation canals retain water and allow fish to survive until flows are restored to the river. *Id.* Many fish species rely on irrigation canals for

survival. *Id.* For example, the Rio Grande Silvery Minnow (*Hybognathus amarus*) was found to be one of the most abundant species in these canals, making up 35% or more of all fishes. *Id.* at ¶ 5. The Rio Grande Silvery Minnow is adept at finding irrigation return flows because water in return canals is cooler than water in the river. *Id.*

However, non-native fish often make up the majority of species present in irrigation canals. *Id.* For example, a 2007 study found that non-native fish comprise 56% of all fish found in canals connected to the Rio Grande. *Id.* The most abundant non-native species have been Channel Catfish (*Ictalurus punctatus*) and Largemouth Bass (*Micropterus salmoides*) – both fish-eating predators – and White Sucker (*Catostomus commersonii*), an invasive species. *Id.* Although Sallenave et al. did not specifically study the Chub, the study focuses on many fish that are commonly found in close proximity to the Chub. Because the Rio Grande Silvery Minnow and the Chub prefer similar habitats with cooler water, it is reasonable to believe that both the Silvery Minnow and the Chub will continue to rely on these canals for habitat. Bestgen et al. 2003 at 21. Further, Chub are often found in close proximity to the following other fish species: White Suckers, Longnose Dace, Flathead Minnows, and Brown Trout – all of which are commonly found in the Rio Grande irrigation systems. Bestgen et al. 2003 at 23; *see* Sallenave et. al. 2010. Thus, the Chub will likely continue to inhabit these canals, subjecting it to non-native predators and increased competition due to overcrowding.

As river flows continue to decrease due to climate change, it is likely that the Chub will increasingly find refuge in these canals, where predation might further deplete its population. *See* BOR 2013. Because predation by non-native fish is a significant threat to the Chub's survival, FWS should list the Chub under 16 U.S.C. §1533(a)(1)(C).

Factor D: Inadequacy of Existing Regulatory Mechanisms

The Chub, once the most common fish in the Rio Grande Basin, has been completely extirpated from the main stem of the Rio Grande, and its population has declined significantly in all other areas. Rees et al. 2005 at 10. The current regulatory mechanisms are not adequate to protect the Chub against further population declines. In fact, there are currently no conservation or management plans on the federal or state level that specifically aim to protect the Chub or its habitat, although both state and federal agencies have recognized the Chub's vulnerability.

Federal. The U.S. Forest Service Region 2 considers the Chub to be a sensitive species. USFS 2009. The Forest Service defines a "sensitive species" as one for which "population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution." Bosch 2002 at 1; FSM 2670.5.

The Bureau of Land Management also considers the Chub to be a sensitive species in Colorado. BLM 2008 at 37. The BLM defines a "sensitive species" as one that has "recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range." *Id*.

Colorado. The State of Colorado considers the Chub a "species of concern." DNR 2011. This designation signifies that a species has not been petitioned or designated as "threatened" or "endangered," but has been identified as important to monitor. FWS 2012. Current Colorado law prohibits the taking of Chub by any means for any purpose, and the state has implemented a state recovery plan for a number of imperiled fish. But the state has yet to implement a recovery plan specifically for the Chub. Regulations associated with the recovery plan include limits on the use of certain fishing techniques and prohibitions on the release of non-native fish species. But these regulations are of limited benefit to the Chub, as they fail to address the most significant threats to the Chub's survival, such as habitat loss, habitat fragmentation, and reduced stream flow. Indeed, the Forest Service has recognized that "[a]ny future laws designed to assist in the recovery of this species should be directed toward protecting the limited habitat that the species is able to utilize." Rees 2005 at 9. Accordingly, the generalized fish recovery plan is inadequate to prevent the further population decline of the Chub.

Texas. The State of Texas considers the Chub to be "threatened." TPWD 2013. A species may be listed as state threatened or endangered and not listed federally; the state list deals only with the status of the species within Texas. *Id*. "Threatened" species are "those species which the [Texas Parks and Wildlife Department] Commission has determined are likely to become endangered in the future." *Id*. Despite listing the Chub as "threatened," Texas has not enacted any Chub-specific conservation programs.

New Mexico. The State of New Mexico classifies the Chub as "sensitive." Hatchcock 2011 at 6. Although New Mexico is considered to have relatively stable populations of Chub, the overall population has declined significantly from historical levels. Rees 2005 et al. at 10. New Mexico has not enacted any Chub-specific conservation programs.

The Chub currently has a Natural Heritage Program[1] global rank of G3 (vulnerable) and a state rank of S1 (critically imperiled) in Colorado. The G3 ranking signifies that the species is either very rare throughout its range or found locally in a restricted range. The S1 ranking signifies that the species is critically imperiled because of extreme rarity or because of some factor of its biology that makes it especially vulnerable to extinction. Rees et al. 2005 at 8.

Additionally, NatureServe[2] classifies species in rankings based upon their conservation status, ranging between 1 (critically imperiled) and 5 (secure). In both Colorado and Texas, the Chub is

[1] The Colorado National Heritage Program tracks and ranks Colorado's rare and imperiled species and habitat and provides scientific information and expertise to promote the conservation of Colorado's wealth of biological resources. Established in 1979, the CNHP is a non-profit scientific organization affiliated with the Warner College of Natural Resources at Colorado State University.

[2] NatureServe is a non-profit organization whose mission is to provide a scientific basis for effective conservation action. It compiles the work of nearly 1,000 scientists and has an annual budget of approximately $45 million. NatureServe maintains an online encyclopedia, called NatureServe Explorer. NatureServe Explorer maintains the best available scientific information on approximately 50,000 plants, animals, and ecological communities in the United States and Canada. NatureServe ranks species by their degree of imperilment. The highest possible rank, indicating the highest degree of imperilment, is G1. A G1 ranking indicates a full species is critically imperiled and is at very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep population declines, or other factors. A G2 ranking indicates that a species is imperiled and is at a high risk of extinction due to very restricted range, very few populations, steep declines, or other factors. The state ranking system (S) is the same as the global ranking system (G), except that it specifically refers to a species' status in a particular state or province.

ranked 1 (critically imperiled). Like the Natural Heritage Program ranking of S1, this ranking signifies that the species is critically imperiled because of extreme rarity or because of some factor of its biology that makes it especially vulnerable to extirpation from the state. In New Mexico, the Chub is ranked 3 (vulnerable). Like the Natural Heritage Program ranking of G3, this ranking signifies that the species is either very rare throughout its range or found locally in a restricted range.

The current lack of federal and state regulations, protections, and management plans further jeopardizes the continued survival of the Chub. Listing the species as threatened or endangered under the ESA would lead to improved management and increased conservation.

Factor E: Other natural or manmade factors affecting continued existence

Climate Change. Climate change has and will continue to affect hydrology and ecosystems across the American West. Up to 60 percent of the climate-related trends in river flow, winter air temperature and snow pack between 1950-1999 were influenced by human-induced climate change. Barnett et al. 2008 at 1080. The negative effects of climate change on river ecosystems will likely further the Chub's decline.

The Rio Grande Basin faces particular threats from climate change. A water report prepared for Congress by the Bureau of Reclamation ("BOR") entitled "Reclamation Climate Change and Water 2011" found that climate change over the Rio Grande Basin likely will "lead to increased watershed evapotranspiration, decreased spring snowpack and snowmelt, and ultimately reduced water supplies." BOR 2011 at 1. These negative effects of climate change on the Rio Grande Basin threaten the survival of the Chub and the continued health of its habitat.

The average temperature of the Rio Grande Basin has increased by approximately 1-2°F over the course of the 20th century. BOR 2011 at 108. The Basin's average temperature increased steadily from the 1910s to the mid-1940s, before declining slightly until the 1970s. Since then, the temperature has increased steadily and will likely continue to rise. *Id*. The basin-average mean-annual temperature is expected to increase by roughly 5-6 °F during the 21st century. *Id*. at 111.

Additionally, BOR projections indicate that overall precipitation is projected to gradually decline over much of the basin during the course of the 21st century. And although the overall magnitude of precipitation is projected to decrease, the character of precipitation within the Upper Rio Grande Basin is expected to change as temperatures increase over time, resulting in more frequent rainfall events and less frequent snowfall events. BOR 2011 at 115.

Temperature and precipitation changes are expected to affect hydrology in various ways, including snowpack development. Warming is expected to diminish the accumulation of snow during the cool season and the availability of snowmelt to sustain runoff to the Upper Rio Grande during the warm season. BOR 2011 at 120.

For example, a rank of S1 would indicate that a species is critically imperiled within a particular state or province, even though it may be secure elsewhere.

Changes in climate and snowpack within the basin Upper Rio Grande Basin will alter runoff levels, flood peaks, and the availability of natural water supplies. Throughout the Rio Grande Basin, decade-mean annual runoff is projected to steadily decline through the 21st century as a result of decreasing precipitation and rising temperatures. BOR 2011 at 115. Total annual runoff could decline as much as 25%. *Id*. at 116. The most drastic decline in flow will occur in late spring and early summer, which coincides with the Chub's spawning season. Reduced flow during this time could seriously interrupt the Chub's reproduction patterns and also could create new barriers between Chub populations, increase habitat fragmentation, and decrease genetic exchange during the spawning season. *Id*. Furthermore, decreased runoff and the resulting reduced water flow adversely affect aquatic habitats, causing a reduction in suitable habitat area and higher water temperatures. *Id.* at 117. The figures below show the percentage of change predicted over the next thirty years based upon a 1990 baseline condition. *Id*. at 118.

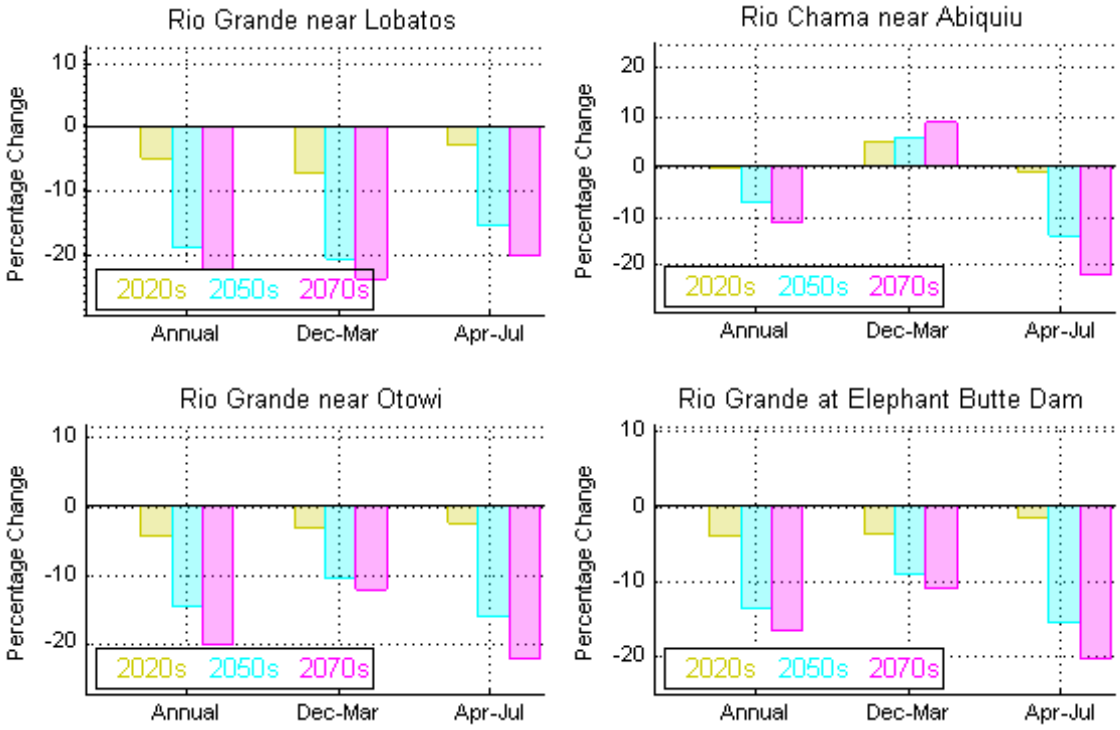

Figure 4: Simulated changes in decade-mean runoff for subbasins in the Rio Grande basin. BOR 2011 at 118.

Projected climate changes are likely to have an array of interrelated and cascading ecosystem impacts. CCSP 2008 at 3. Reduced snowpack, earlier runoff, and higher evaporative demands will affect vegetative cover and species' habitats. Hurd and Coonrod 2007 at 24. The effects of climate change pose a particular risk to fish species that are sensitive to a warming aquatic habitat, such as the Chub. Climate change can also exacerbate invasive species problems and trigger synergistic effects that could cause aggregated environmental damage. BOR 2011 at 123.

Research suggests that species and ecosystems will need to shift (northward, away from the equator) an average of .42 km per year to survive the deleterious effects of increasing temperatures associated with climate change. Loarie et al. 2009 at 1052. It is unlikely that small, isolated populations of the imperiled Chub, already dependent on diminished habitats, will be able to shift to other habitats to adapt to the effects of climate change.

Climate change could also result in changed demand for instream flow or reservoir release to satisfy human needs, such as hydropower generation, municipal and industrial water deliveries, river and reservoir navigation, and agricultural and recreational uses. BOR 2011 at 125. Species and habitats already stressed by water diversion will be less able to cope with climate change. Loarie et al. 2009 at 1054. Listing the Chub as "endangered" or "threatened" under the ESA will ensure human interests do not eliminate adequate water flow for the Chub's needs as climate change continues to affect the Rio Grande Basin.

Biological Vulnerability. The isolated nature of the Chub's remaining population further increases the likelihood of extinction. The Chub population consists of a limited number of isolated populations that exist in tributaries of the Rio Grande. Isolated populations are more susceptible to catastrophic events because of the impediment to recolonization by nearby populations. Rees et al. 2005 at 17. "Population size matters; small populations are more likely to go extinct as a result of chance effects (known as the small population paradigm)." Brook et al. 2008 at 455. FWS has frequently recognized small population size as a threat to species' persistence.[3] Similarly, isolation causes unknown genetic variability among existing populations and could lead to low levels of genetic diversity among distinct populations. Such isolation could also affect a species' ability to adapt to changes in its environment, such as habitat fragmentation, modification, and climate change. *Id.* at 458. Indeed, a new study concluded that fragmented populations face a particular and significant threat of catastrophic extinction and that fragmented habitat segments are potentially even more vulnerable to biodiversity loss than previously thought. Gibson 2013 at 1508.

VII. VALUE OF LISTING

Listing the Chub as "threatened" or "endangered" under the ESA is not only consistent with the relevant legal criteria, but is also necessary to prevent its extinction. The Chub is at risk due to the multiple and cumulative threats of habitat destruction and modification, predation from non-native species, and climate change. As described above, the current regulatory mechanisms are inadequate to protect the Chub, as they fail to specifically target Chub conservation.

Protection under the ESA will ensure that federal agencies investigate whether their future actions might negatively affect Chub populations and habitat. Additionally, federal protection under the ESA will restrict the actions of individual landowners that might negatively impact the Chub. Sixty-three percent of New Mexico's population resides within the Rio Grande watershed, and the population grew 19% between 1990 and 2000. NMDGF 2006 at 341. Most

[3] See, for examples, proposed rules for: Florida Bonneted Bat, Department of the Interior Fish and Wildlife Service, 77 Fed. Reg. 193 (Oct. 4, 2012); Spotless Crake, Department of Interior Fish and Wildlife Service, 77 Fed. Reg. 225 (proposed Nov. 21, 2012); Streaked Horned Lark, Department of Interior Fish and Wildlife Service, 78 Fed. Reg. 64 (April 3, 2013).

lands within the Rio Grande watershed are under federal ownership; however, 7% of the watershed is privately owned. *Id*. Finally, ESA listing would also allow for designation of critical habitat to protect the vital tributaries in the Upper Rio Grande in which the Chub continues to survive.

VIII. CONCLUSION AND REQUESTED DESIGNATION

For the reasons explained above, the Rio Grande Chub (*Gila pandora*) merits listing as an "endangered" or "threatened" species pursuant to the ESA. This listing action is warranted, given that the Chub has already been eliminated from a significant portion of its range and its population continues to decline. The Chub is threatened by human modification and destruction of its habitat, including fragmentation and low stream flow due to the presence of dams throughout the species' habitat. Predation and competition from non-native fish also negatively affect the Chub population. The ongoing effects of climate change and the biological vulnerability stemming from the Chub's isolated populations further the species' decline. Without the protection of the ESA, the Chub is in danger of extinction throughout all or a significant portion of its range. ESA listing would provide the essential protections that are necessary to ensure the Chub's survival.

WildEarth Guardians therefore respectfully petitions FWS to list the Rio Grande Chub as an "endangered" or "threatened" species under the ESA. The Chub qualifies for ESA listing, as it is threatened by four of the five listing factors: present and threatened destruction, modification and curtailment of habitat and range; disease and predation; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence.

Critical Habitat. Degradation of habitat is the biggest single threat to the Chub's survival. Because anthropogenic threats to the Chub's Upper Rio Grande habitat are a significant cause of the species' imperilment, WildEarth Guardians also requests that critical habitat be designated for this species concurrent with final ESA listing. Rees et al. 2005 at 9. The Forest Service has recognized that habitat protection in the Chub's remaining range is the most important tool to ensure the species' survival. *Id*. WildEarth Guardians requests that FWS designate the Chub's entire historic range—from the Rio Grande's headwaters in the San Juan Mountains, through New Mexico and into Texas—concurrent with final ESA listing. Designating this area critical habitat under the ESA would give the Chub its best chance of survival.

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