Status Review of Borax Lake Chub (*Gila boraxobius*)
Oregon Department of Fish and Wildlife
December 2020

Executive summary

The Borax Lake Chub are listed as a threatened species on the State List of Threatened and Endangered Species ("State List"; OAR 635-100-0125). The original listing occurred because Borax Lake Chub were listed as threatened under the Federal Endangered Species Act (ESA) at the time the State List was created (consistent with 635-100-0105(2)(a)). In 2017, Borax Lake Chub was reclassified on the State List from Endangered to Threatened and in June of 2020 they were found to be recovered and delisted from the federal ESA (85 FR 35574). Recovery actions for Borax Lake Chub were guided by the criteria in the Federal Recovery Plan (USFWS 1998). This review describes the current status of Borax Lake Chub relative to the State delisting criteria (OAR 635-100-0112).

Removing a species from the State List requires a public rulemaking and determinations by the Commission (OAR 635-100-0112). These decisions require an evaluation of the following state criteria to determine whether (OAR 635-100-0112(1)-(3) and 0105(6)):

1. The species is not, or is not likely to become within the foreseeable future, in danger of extinction throughout any significant portion of its range in this state, or is not at risk of becoming endangered throughout any significant portion of its range in this state;
2. That the natural reproductive potential of the species is not in danger of failure due to limited population numbers, disease, predation or other natural or human-related factors affecting its continued existence;
3. That most populations of the species are not undergoing imminent or active deterioration of their range or primary habitat;
4. That overutilization of the species or its habitat for commercial, recreational, scientific, or educational purposes is not occurring or is not likely to occur; and
5. That existing state or federal programs or regulations are adequate to protect the species and its habitat.

Based upon a review of the recovery actions that have been conducted and the best available scientific data, Borax Lake Chub meet the biological and non-biological criteria for delisting. Of particular note, population abundance is not limiting and recent land purchases, restrictions, and existing regulations are sufficient to protect the habitat supporting Borax Lake Chub against direct and indirect recreational or commercial impacts.

Introduction

The Borax Lake Chub (*Gila boraxobius*) is a species of the genus *Gila* (a widespread desert minnow) that only exists in (i.e., is endemic to) Borax Lake and some adjacent wetlands in the Alvord Basin in Harney County, Oregon (Williams and Bond 1980). Adults are typically 33 to 50 millimeters (1.3 to 2 inches) standard length, with a maximum recorded size of 93 millimeters (3.6 inches) standard length. Spawning can occur year-round, but primarily takes place in the fall and spring (Williams & Bond 1983, Scoppettone et al. 1995). Spawning occurs primarily in gravel, rock outcrop, and sand habitats, which comprise about

16% of the substrate in Borax Lake (Perkins et al. 1996). The Borax Lake Chub is an opportunistic omnivore (Williams & Williams 1980, Scoppettone et al. 1995).

Borax Lake is a natural, 4.1 hectare, geothermally-heated alkaline lake, which is perched 10 meters above the desert floor on borosilicate deposits. Spring inputs near the bottom of a deep vent, 32 meters (100 feet) below the surface, vary from 40-148°C (104-300°F). Surface water temperatures typically vary from 16-38°C (61-100°F), but fluctuations occur and temperatures occasionally exceed 38°C (100°F), and fish mortality events have occasionally been observed in conjunction with prolonged heat waves (Scoppettone et al. 1995). Water flows from Borax Lake into surrounding marshes, small pools, and Lower Borax Lake.

Although Borax Lake Chub are relatively abundant, they are naturally at increased risk of extinction because they are represented by a single population that occupies limited habitat with potential for exposure to temperatures above their thermal tolerance limits. Additionally, the shallow nature of the lake, its elevated location, and the potential for seismic disturbance mean the lake is potentially vulnerable to draining.

In addition to natural risk factors, the thermal waters feeding Borax Lake face a potential threat from geothermal energy development. Proposals to drill wells near the lake prompted an emergency listing of this species as endangered in 1980. Other threats include modification of the fragile lake shoreline, which may easily be damaged by off-road vehicle use, and overgrazing by livestock.

Recovery Actions

A number of actions have been taken to safeguard the habitat for Borax Lake Chub following the federal listing action. These are outlined below.

- In 1982 the U.S. Fish and Wildlife Service (USFWS) designated critical habitat on 640 acres of land surrounding Borax Lake, including 320 acres of public lands and two 160 acre parcels of private land (USFWS 1982).

- In 1983, The Nature Conservancy (TNC) secured a 10-year lease to the two 160-acre parcels of private land surrounding and including Borax Lake and a “first right of refusal” for sale of the property and authority to manage the waters of Borax Lake. In 1993, TNC purchased the two 160- acre parcels of private land, bringing the entire critical habitat into public or conservation ownership. TNC ended water diversion from the lake for irrigation and livestock grazing within the critical habitat.

- In 1983, the U.S. Bureau of Land Management (BLM) designated 520 acres of public land surrounding Borax Lake as an Area of Critical Environmental Concern (ACEC) (BLM 2010). An ACEC is a conservation designation on certain lands managed by the BLM in the western United States, which requires protection of important riparian corridors, threatened and endangered species habitats, cultural and archeological resources, and unique scenic landscapes that the agency assesses as in need of special management attention.

- In 1991, Oregon Department of Fish and Wildlife (ODFW) acquired the water rights to Borax Lake for conservation purposes.

- In 2000, the US Congress passed the Steens Mountain Cooperative Management and Protection Act of 2000 (Steens Act) and BLM subsequently (2005) completed the Steens Mountain Cooperative Management and Protection Area (CMPA) Resource Management Plan (RMP). As a result, the BLM

has withdrawn the public lands in the Alvord Known Geothermal Resource Area (AKGRA) from mineral and geothermal exploration and development, except for 332 acres in the southwest corner of the AKGRA (BLM 2005).

- The entire area within critical habitat was closed to livestock grazing (BLM 2005). Note that this area was subsequently fenced to create an exclosure fully encompassing the critical habitat (see next bullet).

- In 2011, BLM and TNC completed a perimeter fence surrounding the designated critical habitat to exclude vehicles from the lake and in 2013 installed locks on these gates.

- The RMP provides additional protection of Borax Lake Chub critical habitat by directing BLM to pursue the establishment of a conservation agreement or other cooperative agreement to manage and protect the area for the conservation or recovery of the Borax Lake Chub, including closing the area to livestock grazing, off- road vehicle travel, and limiting or closing vehicle access.

- A cooperative management plan (CMP) between the BLM, ODFW, and USFWS was finalized in June of 2018.

In addition to these habitat actions, there has been significant coordination efforts among regulatory and land management parties, and intensive monitoring has occurred. To address future management needs, the BLM, ODFW, and the USFWS developed, and are implementing, the Borax Lake chub CMP (USFWS et al. 2018), and are committed to the continuing long-term management of this species. Numerous studies of the ecology and habitat of Borax Lake have been conducted (Salzer 1992; Scoppettone et al. 1995; Furnish et al. 2004; Scheerer et al. 2016). TNC conducted abundance estimates from 1986 through 1997. ODFW conducted abundance estimates from 2005 through 2019 (excluding 2013, 2014, and 2018), developed a survey protocol, and recommended a long-term monitoring strategy (Scheerer and Jacob 2005; Scheerer et al. 2012; Peterson et al. 2015; Bangs et al. 2020). ODFW also conducted surveys to monitor the condition of the lake's shoreline, outflow channels, and adjacent wetlands. Twelve photo points were established around the perimeter of the lake, temperatures were recorded, and disturbances were noted. To monitor the potential effects of future geothermal development that could occur within the aquifer that supplies water to Borax Lake, ODFW mapped the lake bathymetry and installed a water level logger in 2011. ODFW acquired data from 2011 through 2015, to acquire additional baseline data. A second water level logger was installed in 2016, but failed in 2018. The data collected from the loggers has helped to describe natural, seasonal variability in: 1) lake elevations, 2) the quantity and quality of habitat, and 3) the connectivity between the lake and adjacent wetlands. At present we have one water level logger installed, which we plan to operate into the foreseeable future. To date we have seen minimal fluctuations of the water level, with a maximum change of 0.1m observed from 2016 through 2018.

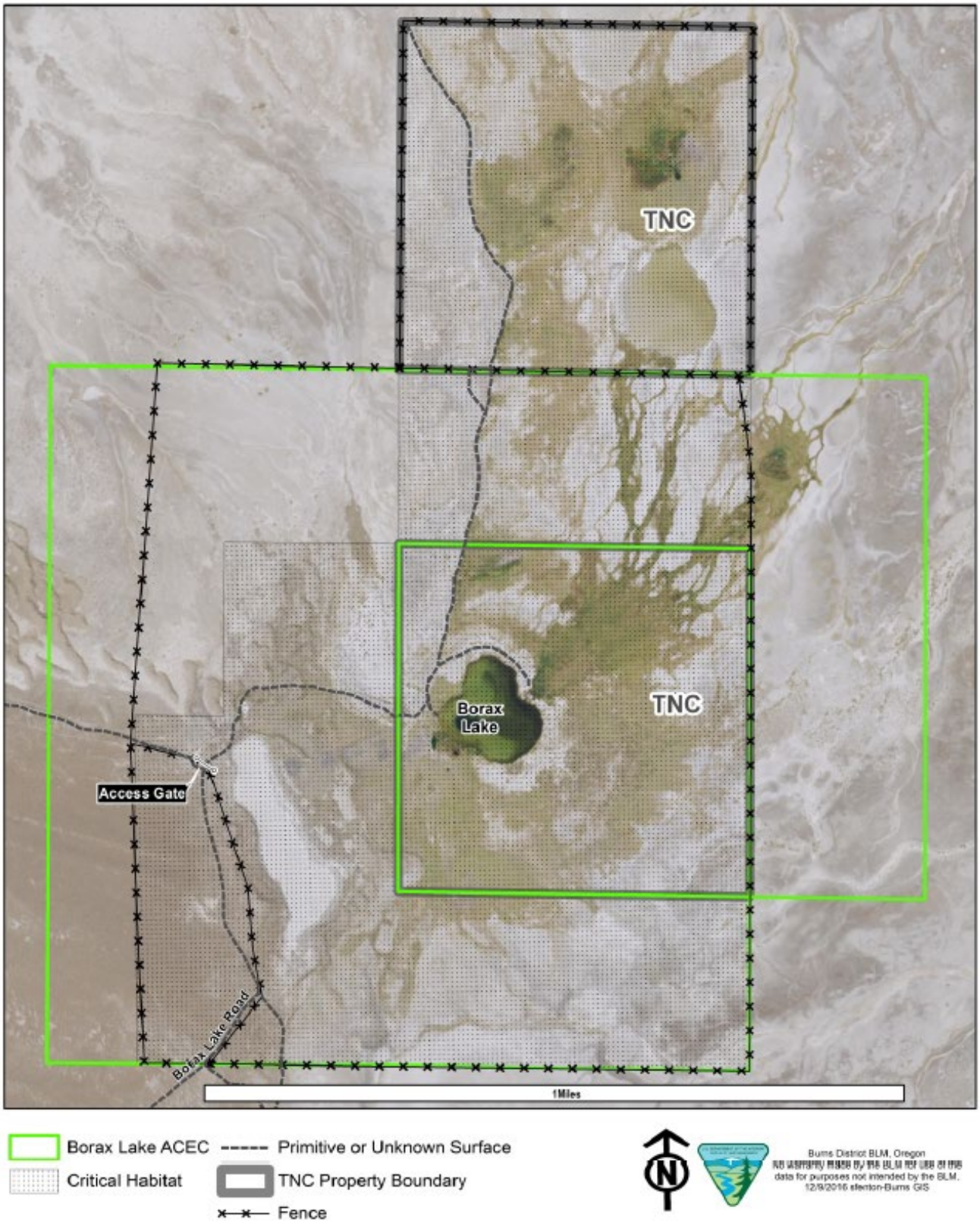

Figure 1. Critical habitat, Area of Critical Environmental Concern, and land ownership near and around Borax Lake. Map from BLM (2010).

Federal Delisting

In June of 2020 Borax Lake Chub was removed from the Federal List of Endangered and Threatened Wildlife on the basis of recovery (85 FR 35574). The USFWS evaluated several criteria, as described in the species recovery plan, to determine that the species is no longer at risk of extinction now, or likely to become so in the future. All of the federal delisting criteria were met or addressed to allow for the federal delisting. The federal delisting criteria include the documentation of a viable, self-sustaining population of Borax Lake Chub, protections at the lake and surrounding habitats, and establishment of monitoring programs and regulations to protect the species and the habitat. The potential threat from climate change was also evaluated. The climate change review indicated that the future temperatures of the lake may be affected. However, the spatial variability in water temperatures within the lake and availability of thermal refuge habitats coupled with the species resiliency to temperature fluctuations and ability to rebound quickly from mortality events indicate climate change is not a current threat to the species.

Analysis of State List delisting requirements

State Criterion 1: The species is not, or is not likely to become within the foreseeable future, in danger of extinction throughout any significant portion of its range in this state, or is not at risk of becoming endangered throughout any significant portion of its range in this state

This Criterion has been met. The historical and current range of Borax Lake Chub is limited to Borax Lake (4.1 ha) and some adjacent wetlands. The population size of Borax Lake Chub varies substantially among years. The abundance estimates vary from a low of 1,242 to a high of 80,267 fish (Figure 2) (Bangs et al. 2020). Because Borax Lake Chub experience water temperatures that are at or near their thermal critical maximum (Williams and Bond 1983), Borax Lake Chub survival and recruitment are likely higher during years when lake temperatures are cooler (Scheerer et al. 2015). However, Borax Lake Chub may seek refuge from the warmest temperatures by moving to cooler available habitats in Borax Lake and the adjacent wetlands, which are variably connected by surface water. This behavioral thermoregulation was noted in July 1987 by Williams et al. (1989), when presumed high temperature induced mortality was observed and Borax Lake Chub congregated in cooler portions of the lake. Scheerer et al. (2015) speculate that the low Borax Lake Chub abundance observed in 2015 was a result of warmer than average summer temperatures in 2015 resulting in greater than average Borax Lake Chub mortality. The subsequent population estimates in 2017 and 2019 demonstrate the resiliency of Borax Lake Chub to recover quickly from mortality events. It is clear that Borax Lake Chub abundance varies considerably among years, and the population rebounds after low years. There is no apparent declining trend in abundance over the time period that it has been monitored. Borax Lake Chub are not likely to become in danger of extinction or endangered in the foreseeable future due to climate change because, consistent with the federal considerations mentioned above, the species exhibits a resistance to thermal fluctuations and the refuge habitat features of the lake should support the species into the future.

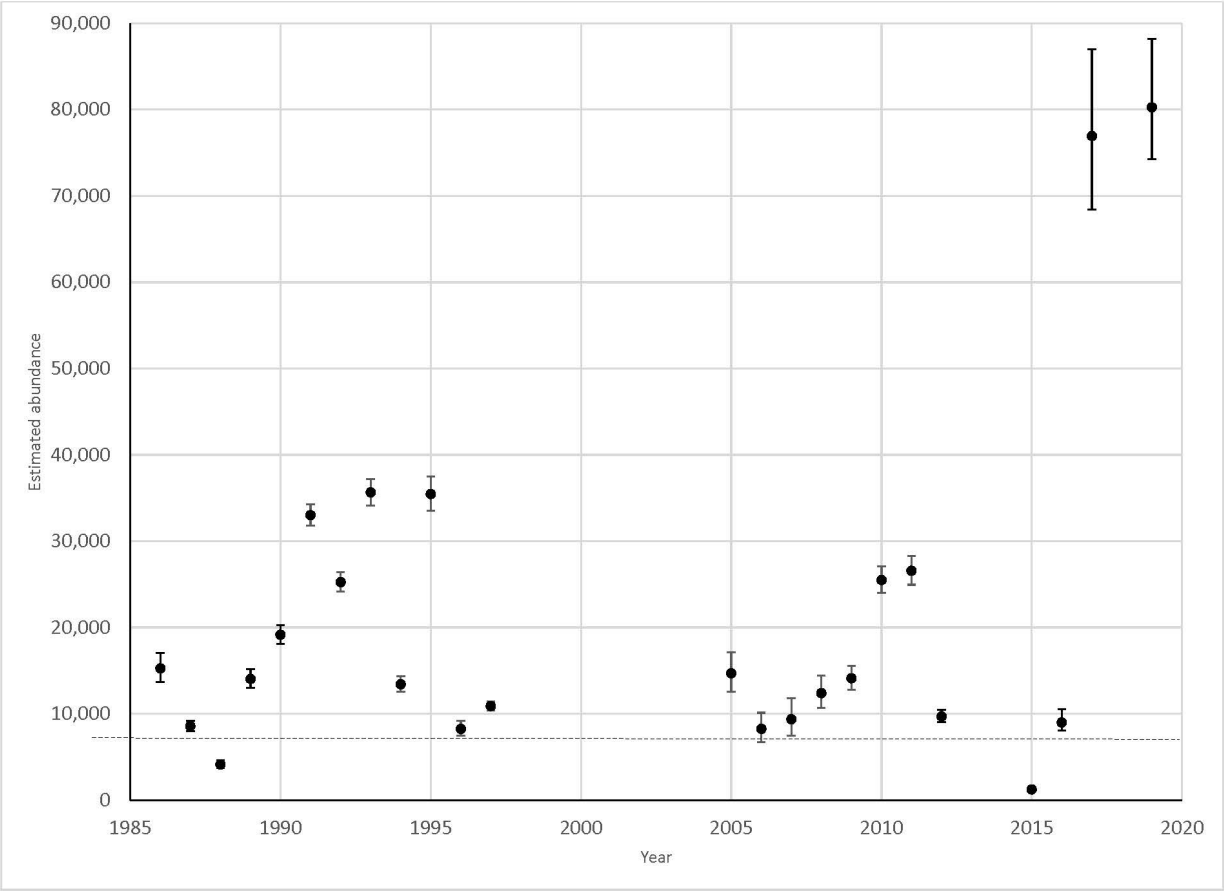

Figure 2. Borax Lake Chub estimated abundance (number of individual fish) from 1986 through 2019. Vertical bars represent 95% confidence intervals. From 1986 through 1990, only the perimeter of the lake was sampled. After 1990 the entire lake, wetland, wetland channel, and outflow channel were sampled. Different sampling methods were used during different time periods so estimates are not directly comparable across these time periods.

State Criterion 2: The natural reproductive potential of the species is not in danger of failure due to limited population numbers, disease, predation or other natural or human- related factors affecting its continued existence

This criterion has been met. The population numbers are variable among years, but as discussed in State Criterion 1 there is no evidence of limited numbers or declining population trends. Additionally, age-0 fish have been observed during surveys conducted by ODFW from 2005 through 2019 (Bangs et al. 2020), which is further conclusive evidence that reproduction is occurring. There is no evidence of disease, or predation, and no other factors have been observed or are thought to be a concern.

State Criterion 3: Most populations of the species are not undergoing imminent or active deterioration of their range or primary habitat

This Criterion has been met. Borax Lake Chub consist of a single known population in Borax Lake and some adjacent wetlands, and there has been no reduction in the range or primary habitat in the past 35 years since the species has been monitored. In contrast, the primary habitat has been protected and restored as outlined in the recovery actions above.

State Criterion 4: Overutilization of the species or its habitat for commercial, recreational, scientific or educational purposes is not occurring or is not likely to occur.

This Criterion has been met. Borax Lake Chub are a non-game species, they are not allowed to be commercially or recreationally harvested, and sportfish regulations specifically prohibit catch-and-release angling for them. Outside of population monitoring, no other scientific or educational utilization occurs. In addition, the habitat for Borax Lake Chub is protected from commercial use. Land has been secured through public (i.e., BLM) and private (i.e., TNC) entities and is currently managed to protect Borax Lake Chub. See 'Recovery Actions' (this document) for more details. The designated critical habitat is fenced, gated, and locked to restrict vehicular and other unauthorized access such as livestock grazing. Access to Borax Lake is restricted to foot traffic.

State Criterion 5: Existing state or federal programs or regulations are adequate to protect the species and its habitat.

This Criterion has been met. Protections and mechanisms are in place for the species and habitat. A primary future threat for Borax Lake Chub is related to potential off-site geothermal energy development that may have a hydraulic connection to the lake through the aquifer. Development of the habitat and surrounding geothermal resource is adequately protected. With acquisition of Borax Lake by TNC, surface waters on their land cannot be appropriated. Additionally, ODFW obtained the water rights to Borax Lake in 1991 for conservation purposes.

Although surface water appropriations have been protected, there is a possibility that additional groundwater use on private land outside of the critical habitat area may affect Borax Lake. The primary potential groundwater use in this area would be for geothermal energy development, which initially triggered federal ESA listing of Borax Lake Chub in 1980 and 1982. There are no current or known efforts to develop geothermal energy in this area. There are approximately 2,000 acres of private lands within a 3-mile radius of Borax Lake. The relationship between groundwater extraction and the Borax Lake ecosystem has not been thoroughly assessed because groundwater connections are complex and variable in this dynamic fault-controlled geothermal system (Fairley and Hinds 2004). Detailed studies would be needed to provide a better understanding of the relationship between fault mechanics and groundwater hydrology. If a geothermal energy project were initiated, there are regulatory mechanisms in place that allow for consideration of the unique nature of Borax Lake Chub. Protections under these and other

regulatory mechanisms are not dependent on designation under the State List, especially given that Borax Lake Chub will be placed on the Sensitive Species List (OAR 635-100-0040) if they are removed from the State List of Threatened and Endangered Species. If in the unlikely chance that geothermal development is proposed, then ODFW could respond with an emergency/temporary listing (OAR 635-100-0115; the USFWS could also do this for the federal ESA, as was done with the original listing). The potential threat of geothermal energy development on private lands within the AKGRA and the adequacy of existing regulatory protections are discussed more fully in Attachment 1.

Conclusion

Borax Lake Chub were emergency listed as endangered under the federal ESA in 1980 because of a potential threat from geothermal energy development. Since listing, a number of recovery actions have been implemented to protect and enhance the habitat across the range of Borax Lake Chub. The historical range of Borax Lake Chub is currently intact and the land is owned and managed by TNC in cooperation with ODFW, BLM, and USFWS. The land surrounding the range of Borax Lake Chub is owned and managed by BLM in cooperation with TNC, ODFW, and USFWS; this land is also designated as an Area of Critical Environmental Concern. Borax Lake Chub abundance is variable among years, natural reproduction is occurring, and the species and its habitat are not subject to overuse for commercial, recreational, or scientific, or educational purposes. State delisting criteria all appear to be met. In addition, "warning" systems are in place if future threats of geothermal development (see Attachment 1) or climate change-driven thermal impacts (monitoring per the CMP) occur.

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