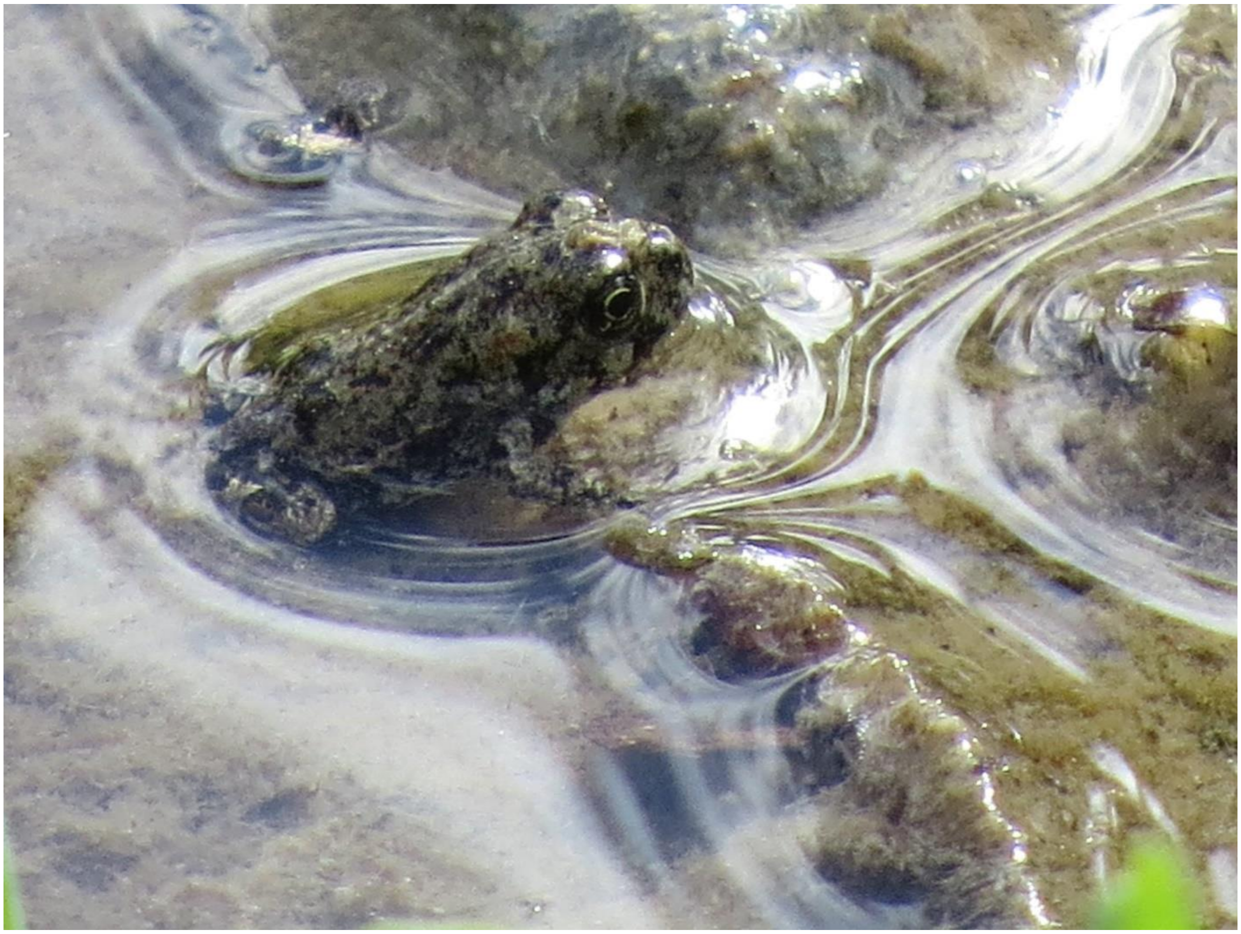
BEFORE THE SECRETARY OF THE INTERIOR



Juvenile Amargosa toad

EMERGENCY PETITION TO LIST THE AMARGOSA TOAD (*ANAXYRUS NELSONI*) AS A THREATENED OR ENDANGERED SPECIES UNDER THE ENDANGERED SPECIES ACT

CENTER FOR BIOLOGICAL DIVERSITY
May 29, 2024

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NOTICE OF PETITION

The Honorable Deb Haaland
U.S. Department of the Interior
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Dear Secretary Haaland,

Pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b); section 553(e) of the Administrative Procedure Act (APA), 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity hereby petitions the Secretary of the Interior, through the U.S. Fish and Wildlife Service ("FWS" or "Service"), to protect the Amargosa toad (*Anaxyrus nelsoni)* as a threatened or endangered species. FWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on FWS. Specifically, the Service must issue an initial finding as to 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). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* The petitioner also requests that critical habitat be designated for the Amargosa toad concurrently with the species being listed, pursuant to 16 U.S.C. § 1533(a)(3)(A) and 50 C.F.R. § 424.12.

Petitioner the Center for Biological Diversity ("Center") is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and the habitat and climate they need to survive through science, policy, law, and creative media. The Center is supported by more than 1.7 million members and online advocates throughout the country. The Center works to secure a future for all species, great and small, hovering on the brink of extinction. The Center submits this petition on its own behalf and on behalf of its members and staff with an interest in protecting the Amargosa toad and its habitat.

We are requesting that this petition be considered on an emergency basis as this rare endemic species is immediately threatened by a mining project currently in NEPA review, as well as six other mining projects in different stages of development. Under Section 4(a)(7) of the Endangered Species Act, the Service has the authority to promulgate an emergency listing rule for "any emergency posing a significant risk to the well-being of any species of fish or wildlife…" The Amargosa toad faces such an emergency and warrants immediate action.

Sincerely,

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I. EXECUTIVE SUMMARY

The Amargosa toad (*Anaxyrus nelsoni*) is a critically endangered species found only along an approximately 14 mile stretch of the Amargosa River and nearby interconnected tributary springs in Southern Nevada's Oasis Valley. The size of the toad population is small, with the number of toads possibly not exceeding about 2,000 individuals.

Two previous Endangered Species Act petitions in 1994 and 2008 were both denied by the US Fish and Wildlife Service, largely on the basis of ongoing community-led conservation efforts. Despite these efforts, the Amargosa toad's population continues to remain in a highly precarious state, and today faces a new existential threat, which did not exist when previous petitions were under evaluation.

The groundwater resources which sustain the Amargosa River, and the habitats that depend on it, are imminently threatened by 7 gold mining projects, including what is potentially the largest greenfield gold discovery in the US in more than a decade. Through dewatering and groundwater pumping for operational use, gold mining threatens to reduce the quantity of spring discharge in Oasis Valley, resulting in the loss and/or degradation of the toad's spring-fed habitat. Simulated cumulative pumping from several of these gold mines shows widespread drawdown along the length of the Amargosa River in Oasis Valley.

Other major threats include ongoing water abstraction and diversion impacts, non-native ungulate grazing, invasive species, off-road vehicles and climate change. This species urgently needs the protections afforded by the Endangered Species Act.

II. INTRODUCTION

Globally more than 40% of amphibian species are threatened with extinction (IPBES 2019, p. 26; IUCN 2021, p. 3), which is more than any other group of vertebrates. In the United States, the level of amphibian imperilment is similar, with reports that up to 42 percent of amphibian species are listed as threatened or declining (Stuart et al. 2004, Bradford 2005 and Grant et al. 2016, as cited in Keller et al. 2021, p. 255). Grant et al. 2016 estimate that the average amphibian species will be gone from half of the places where it now occurs in < 20 years (USGS 2021, p. 1). Despite being the most imperiled vertebrate group, however, Gratwicke et al. 2012 and Harris et al. 2012 estimate that 80-82% of at-risk amphibian species in the United States remain unlisted under the ESA (Walls et al. 2017, p. 156).

The Amargosa toad (*Anaxyrus nelsoni)* is a critically endangered (IUCN SSC Amphibian Specialist Group 2022, p. 1) member of the *Anaxyrus boreas* species complex (Gordon et al. 2020, p. 166). In the western United States, *A. boreas* populations have experienced declines across their large range and *A. boreas* occupancy is declining within the Great Basin due to habitat loss (Gordon et al. 2017, p. 36). All 6 members of the *A. boreas* complex endemic to the Great Basin are ranked as either imperiled or critically imperiled by NatureServe (NatureServe 2021a-f, p. 1).

The Amargosa toad is only found along a ~14 mile (mi) kilstretch of the Amargosa River and nearby interconnected tributary springs between approximately Springdale and Beatty in Oasis Valley, southern Nevada (Burroughs 1999, Lannoo et al. 2005, Green et al. 2014 as cited in IUCN SSC Amphibian Specialist Group. 2022; NDOW 2023a, p. 1-2). The size of the Amargosa toad population is small (USFWS 2010a, p. 42051), with the number of toads possibly not exceeding about 2000 individuals (Kegerries et al. 2019, p. 18-19).

The main threat to this species is gold mining. There are 7 gold mining projects surrounding Oasis Valley, including the North Bullfrog project which is currently undergoing National Environmental Policy Act (NEPA) analysis, and the Expanded Silicon Project, which has been described as the biggest greenfield gold discovery in the United States in recent decades. Dewatering and production pumping for these mining projects is modeled to cause significant and widespread drawdown of groundwater levels across Oasis Valley, potentially leading a decrease in spring discharge and a gradual loss or degradation of Amargosa toad habitat. Other major threats include ongoing water abstraction and diversion impacts, non-native ungulate grazing, invasive species, off-road vehicles (ORVs) and climate change.

Without adequate protection against gold mining and other threats, the Amargosa toad will join the more than dozen endemic species and subspecies that have already gone extinct in Nevada (NDNH 2006, p. 3).

III. NATURAL HISTORY

A. Taxonomy and Description

The Amargosa toad (*Anaxyrus nelsoni*) is a member of the Great Basin *A. boreas* complex, which includes the cosmopolitan *A. boreas* and the endemic *A. williamsi*, *A. canorus*, *A. monfontanus*, *A. nevadensis* and *A. exsul* (Gordon et al. 2020, p. 166) (**Figure 1**).

According to USFWS 2010a, p. 42041: *Stejneger (1893, cited in Lannoo 2005, p. 247) described the Amargosa toad as Bufo boreas nelsoni, a subspecies of the western toad (Bufo boreas). Savage (1959, pp. 251–254) was the first to refer to the Amargosa toad as Bufo nelsoni in accordance with the rules of the International Code of Zoological Nomenclature. Feder (1997, cited in Lannoo 2005, p. 428) diagnosed Bufo nelsoni by allozymic data and concluded that the Amargosa toad warrants species status. Mitochondrial DNA analyses by Goebel (1996, cited in*

Lannoo 2005, p. 429) are consistent with species status for the Amargosa toad. In 2002, Bufo nelsoni was listed as a full species in the Integrated Taxonomic Information System database compiled by the Smithsonian Institution, with the highest credibility rating by their Taxonomic Working Group (Lannoo 2005, p. 427). Frost et al. (2006) moved North American toads from Bufo to Anaxyrus (Tschudi 1845, cited in Frost et al. 2006, p. 363), which was accepted in 2008 by the Committee on Standard and Scientific Names (Committee; Crother 2008, pp. 2–4).

Adult male and female Amargosa toads typically have a snout-vent length of 1.6 to 2.7 inches (in) (42 to 68 millimeters (mm)) and 1.8 to 3.5 in (46 to 89 mm) respectively (Nevada Department of Wildlife 2000, p. A–2 as cited in USFWS 2010a, p. 42041). The dorsal body of the Amargosa toad has three paired rows of tubercles (wart-like skin projections) and black speckling or asymmetrical spots occur on the toad's back (**Figure 2**). Background coloration ranges from near black to brownish or pale yellow-brown or olive, and there can be considerable variation among individual toads in the same population. A light mid-dorsal stripe is present along the backbone. The color of the large, wart-like parotid glands located behind the eye is tawny to olive. The Amargosa toad's underside is whitish or pale olive, with scattered black spots that give the appearance of pants (USFWS 2010a, p. 42041).

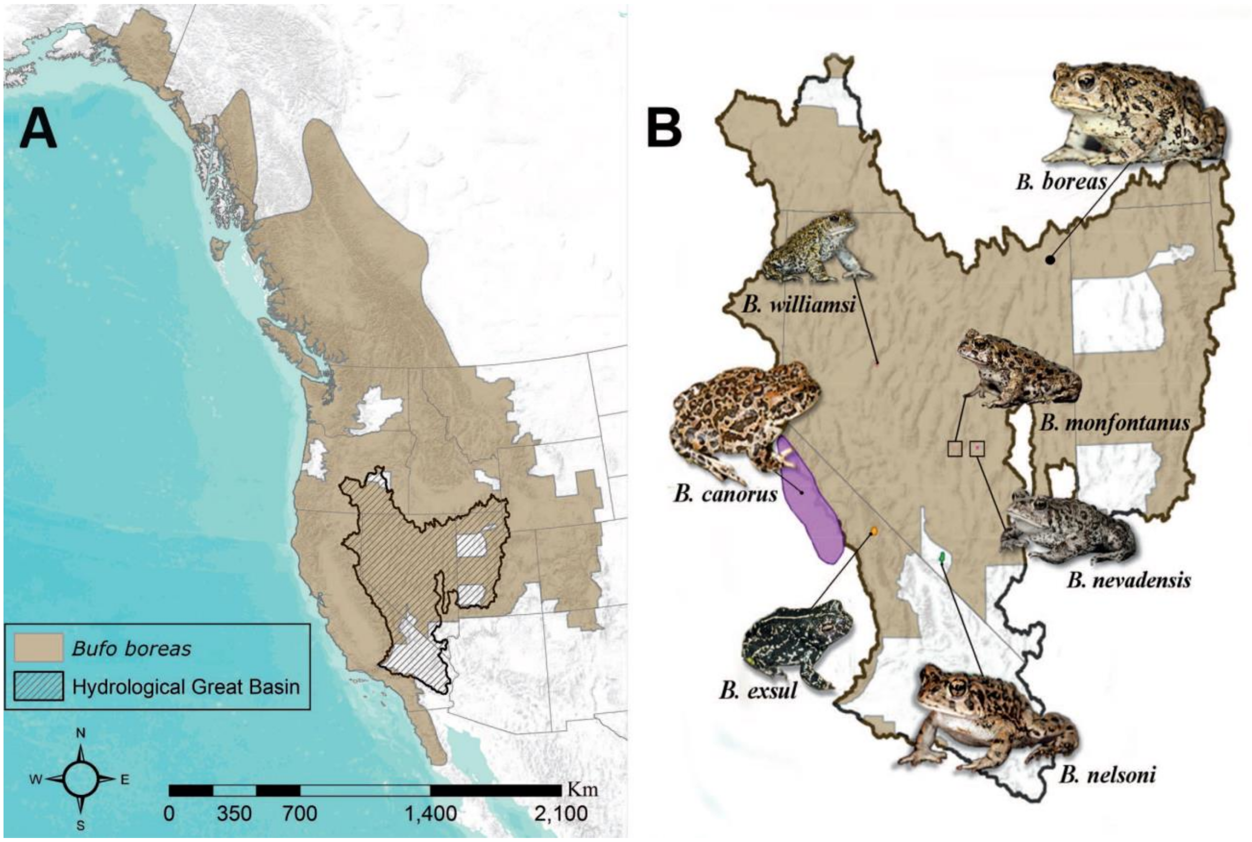

Figure 1. **Distribution of *Anaxyrus boreas* and Great Basin *A. boreas* species complex.** (A) *A. boreas* range-wide distribution (brown), with the hydrologic Great Basin (black outline and hash mark interior) within the western United States (Gordon et al. 2017). (B) *A. boreas* species complex members, including *A. nelsoni*, and their ranges within the hydrologic Great Basin. Spatial data for all toads is from IUCN (2015), except for *A. nevadensis, A.*

williamsi and *A. monfontanus*. Images were taken by M.R. Gordon except for *A. canorus*, with photo credit to G. Nafis. Image taken and legend adapted from Gordon et al. 2020, p. 176.

Figure 2. Adult Amargosa toad

B. Habitat and Ecology

For breeding and population recruitment to occur, the Amargosa toad needs open, ponded, or flowing water. It also requires riparian vegetative cover in an early to intermediate successional stage to form a partial canopy that provides shade with minimal emergent vegetation at the water's edges. Immature (metamorphs or toadlets) (**Figure 3**) and adult Amargosa toads also require areas they can use for shelter, including burrows, debris piles, spaces under logs or rocks, and areas of dense vegetation (USFWS 2010a, p. 42041 and NDOW 2000, p. A–2 cited therein). Another habitat requirement is adjacent vegetated uplands for nocturnal foraging. Dense vegetation and advanced successional stages of riparian vegetation appear to constrain habitat suitability and occupancy by all life stages, especially in the absence of open water (Ibid). Toads can occur abundantly in irrigated and disturbed areas (USFWS 2010a, p. 42041).

The breeding season for the Amargosa toad begins in mid-February and can last into July, with adults congregating at breeding sites. Over 6000 eggs may be produced in a single reproductive event (USFWS 2010a, p. 42021 and Altig 1987, p. 277 and Heinrich 1995, p. 2 cited therein). Tadpoles require relatively open water and over a long enough time period for metamorphosis and development into toadlets to occur (approximately 30 days). The entire breeding effort may fail due to early desiccation of wetlands and predation. Amargosa toads typically live 4-5 years but longevity can be as high as 17 years based on Nevada Department of Wildlife (NDOW)'s population monitoring program data (USFWS 2010a, p. 42041 and Hobbs 2010, p. 1 cited therein).

Amargosa toad prey items include insects (e.g. mosquitoes), spiders, scorpions and snails, while predators include various birds as well as well as badgers, bass and crayfish (Center for Biological Diversity 2008, p. 11).

Figure 3. Amargosa toad metamorph

C. Hydrogeology

Oasis Valley is situated in Nye County and is bounded on the west by the Bullfrog Hills, on the east by Bare Mountain and the mountains on the Nevada National Security site, on the south by the Beatty Narrows along the Amargosa River, and on the north by a low divide separating Oasis Valley from Sarcobatus Flat (Zdon 2021, p. 8).

The Amargosa River, which runs through Oasis Valley, originates at 1,200 m on Pahute Mesa, about 20 km north of Beatty in Nye County. The river flows primarily underground southward, westward, and then northward over 290 km and reaches its terminus near Badwater in Death Valley, Inyo County, California (Bleich 2021, p. 9) (**Figure 4**). Although ephemeral for much of its length, the Amargosa River channel includes portions in Oasis Valley that have permanent surface water due to numerous springs and seeps (NDOW 2000, p. A-1 and Soltz and Naiman 1978 cited therein). Many spring sources and seeps, some of which provide extensive wetted outflow systems, also occur in associated ephemeral tributary drainages. However, these only connect with the Amargosa River main channel during storm events or high precipitation years. Although upland benches and ephemeral river portions are typical of the surrounding transitional zone between Mojave desert scrub and Great Basin desert scrub ecotypes, Oasis Valley's permanently wetted channel and extensive springs and seeps complex represent a unique ecological situation (NDOW 2000, p. A-1).

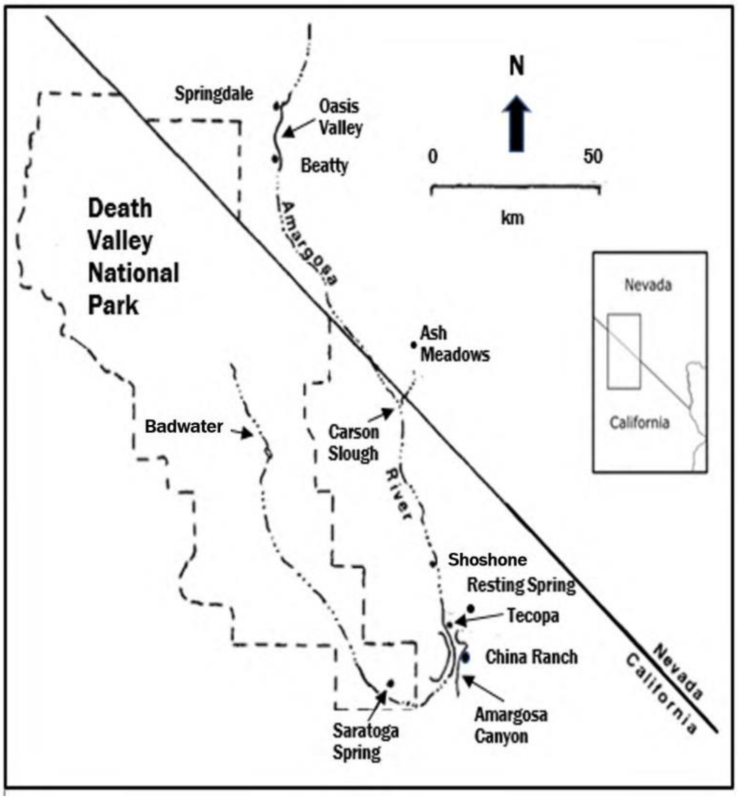

Figure 4. The Amargosa River. Sections that do not support perennial surface flows in the absence of substantial rainfall events are shown with a broken line, and sections normally supporting surface water are shown with a solid line (Bleich 2021, p. 9 and Williams et al. 1984 cited therein). Note: the actual Death Valley National Park boundary is larger than what is shown on the map, with the mapped version representing the former Death Valley National Monument boundary.

Oasis Valley is described in Jackson et al. 2021 as being part of the “Pahute Mesa-Oasis Valley Groundwater Basin (PMOV)” (**Figure 5**). About half of the basin’s recharge comes from the eastern Pahute Mesa Area and the rest comes primarily from other highland areas including Timber Mountain, Belted and Kawich Ranges, and Black Mountain (Jackson et al. 2021, p. 1). Recharge is predominantly due to diffuse percolation of water greater than 1000 years. The other (minor) recharge component is episodic pulses of modern water, seen as a rise in water levels between 3 months and 1 year after a wet winter (Ibid). Over 98% of natural groundwater flow in the PMOV basin is estimated to discharge from springs and seeps in Oasis Valley (Jackson et al. 2021, p. 52). Discharge is thought to be controlled by the general thinning of volcanic rocks toward Oasis Valley and their termination against siliciclastic rocks of low permeability cropping out near Oasis Valley. The siliclastic rocks prevent southward flow and force groundwater to rise through faults in the Oasis Valley area (Jackson et al. 2021, p. 52 and references therein). It is estimated that 5,900 acre-feet/year (afy) of groundwater is discharged in Oasis Valley through springs, or by diffuse upward flow into shallow alluvium with phreatophytes subsequently evaporating or transpiring the water. The remaining natural discharge in the PMOV basin is through subsurface outflow in alluvium from Oasis Valley to the Amargosa Desert and is estimated to be about 80 afy (Jackson et al. 2021, p. 52 and Reiner et al. 2002 cited therein). According to Jackson et al. (2021, p. 46), only minor amounts of surface and groundwater flow occur into and out of the PMOV basin.

However, there is uncertainty as to the amount of flow between Sarcobatus Flat and Oasis Valley. In the Death Valley regional groundwater flow system v. 2.0 model, the boundary between the two basins is not given an interbasin flow value, but the boundary is marked as having “high potential to transmit groundwater,” (Belcher et al. 2017, p. 36). In developing their hydrologic model for the North Bullfrog Mine, HydroGeoLogica found “interpolated groundwater elevation contours show a component of flow from the Sarcobatus Flat South groundwater basin into the north end of the Bullfrog Hills groundwater basin and Oasis Valley, from the Sarcobatus Flat North groundwater basin into the PMOV groundwater basin, and from the Bullfrog Hills groundwater basin into Oasis Valley,” (HydroGeoLogica 2023, p. 75; also p. 86). The water budget developed for the North Bullfrog Mine model shows interbasin flow from both North and South Sarcobatus Flat into Oasis Valley (Ibid, p. 87).

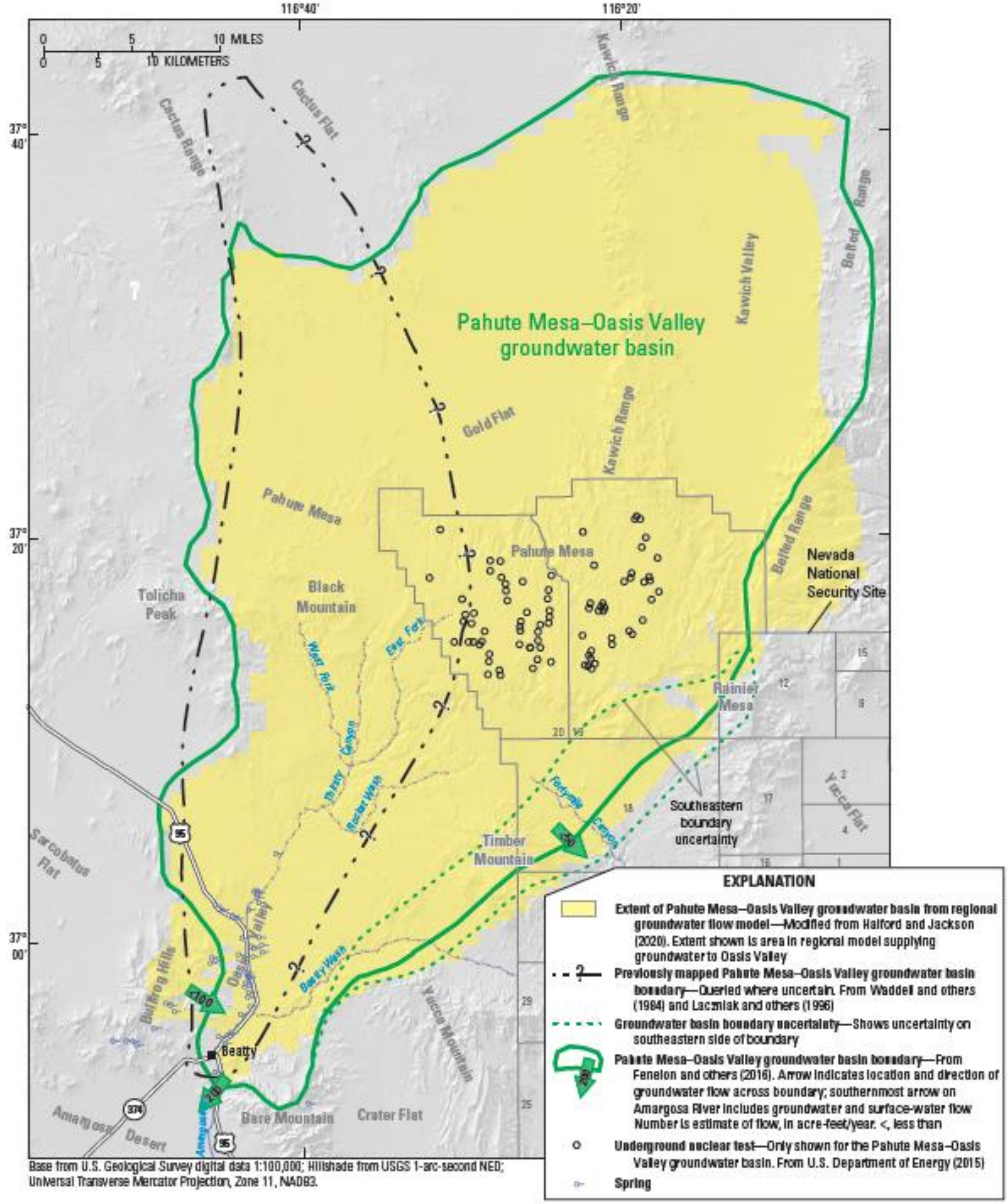

Figure 5. Pahute Mesa-Oasis Valley groundwater basin (Jackson et al., 2021, p. 47).

D. Associated Species of Interest

The Amargosa toad broadly co-occurs with the Oasis Valley springsnail (*Pyrgulopsis micrococcus*) and the Oasis Valley speckled dace (a distinct population of *Rhinichthys nevadensis nevadensis)*. Both are endemic to Oasis Valley and ranked as critically imperiled by NatureServe (NatureServe 1997, p. 1; NatureServe 2021g. p. 1). Other species that are reported to occur along the Amargosa River in Oasis Valley include the federally protected Southwestern willow flycatcher and yellow-billed cuckoo (BLM 2023a, p. 2), as well as an unidentified species of *Tryonia* (NDOW 2023a, entire).

IV. RANGE AND STATUS

A. Distribution

The Amargosa toad occurs within Oasis Valley, along an approximately 14-mile section of the Amargosa River and nearby spring systems, roughly between the towns of Springdale and Beatty. Oasis Valley is situated along U.S. Highway 95 between Bullfrog Hills and the Nevada Test Site (USFWS 2010a, p. 42041; NDOW 2023a, p. 1-2). The area occupied by the toad is small and isolated, with no known probable connections to other toads in the *A. boreas* complex. The closest western toad occurrence is located approximately 35 linear mi (56 km) away in Death Valley National Park, California (USFWS 2010a, p. 42041 and NDOW 2000, p. A-1 cited therein).

Figure 6 shows the Amargosa toad's potential habitat and movement corridors. Toads have been encountered at approximately the northern and southern end of the range (NDOW 2023a, *entire*) and various sites in between (see below).

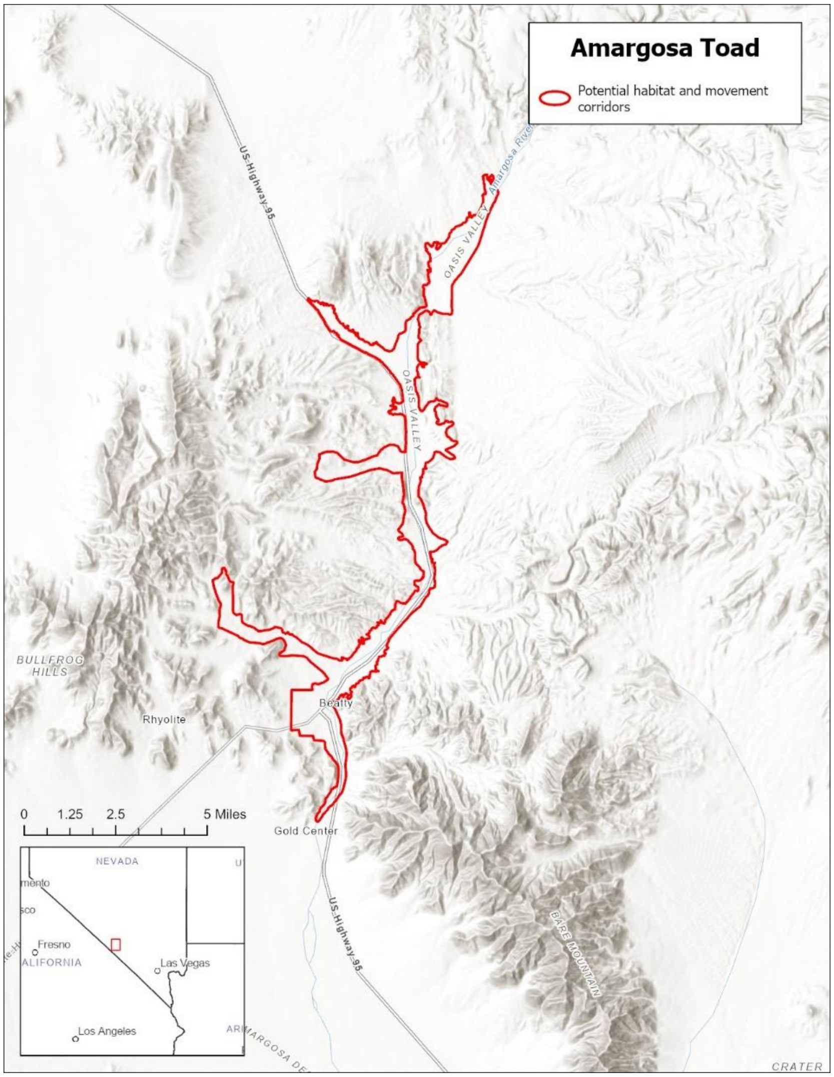

Figure 6. Amargosa toad potential habitat and movement corridors. Adapted from May 9, 2007 Amargosa Toad Working Group map provided by NDOW on July 20, 2023.

B. Population Monitoring

A long-term population monitoring program for the Amargosa toad was initiated by NDOW in 1998, using mark-recapture methods at 11 out of 18 sites known to be occupied by the Amargosa toad at the time. The 11 sites were grouped into 4 spatial areas known as Harlan-Keal, Amargosa River, Spicer/Mullin/Torrance; and Angel’s (USFWS 2010a, p. 42041-42042).

Harlan-Keal Group: consists of 4 sites known as Harlan-Keal, Trespass Seep, Wild Burro Seep, and Crystal Spring (USFWS 2010a, p. 42042). Harlan-Keal is a privately owned site with an irrigated garden area and pond. Trespass Seep is a low-flow spring on Bureau of Land Management (BLM) land (USFWS 2010a, p. 42042). No toads were observed at Trespass Seep on two separate survey occasions in June 2017[1] and the site is no longer monitored by NDOW. However, it has been modified for Amargosa toad habitat[2]. Wild Burro Seep, also on BLM land, includes a low-flow spring, an excavation with exposed groundwater and wet meadow (USFWS 2010a, p. 42042). A 12 acre (ac) (4.9 hectares (ha)) area around the seep was fenced in 1998 to exclude wild burros overusing the site. Toads were rare at Wild Burro Seep as of 2010 due to limited habitat, although creation and enhancement of toad habitat was being planned (USFWS 2010a, p. 42042 and STORM-OV, 2009c, pp. 1-6 cited therein). Surveys in June of 2017 found abundant fresh burro droppings, and 8 burros inside the fence exclosure, but no toads[3].

Crystal Spring is privately owned and consists of a spring, pond and outflow (USFWS 2010a, p. 42042). The spring is part of a cluster of springs known as the Crystal Spring Complex (DRI 2023, p. 38). A wild burro exclosure was built around Crystal Spring in 1995 to reduce trampling and overuse of the spring (USFWS 2010a, p. 42042), and habitat restoration is currently ongoing at the Complex (TNC 2024a, p. 4). However, clear evidence of impacts from anthropogenic disturbances including water abstraction, surface water diversion, and invasive species were recently observed throughout a relatively narrow (~50 m) stretch of groundwater dependent ecosystem (GDE) vegetation immediately surrounding and extending approximately 1,650 ft downgradient of Crystal Spring. Water abstraction-related impacts were also noted to be ongoing due to the continuing use of Crystal Spring as a source of domestic water (DRI 2023, p. 40).

Less than 0.25 mi southwest of Crystal Spring is Bryan (or Brian) Spring, also within the Crystal Spring Complex (DRI 2023, p. 4), and included in the Harlan-Keal group according to more recent records[4]. Surveys in 2017 found toads at the site[5]. However, recent field investigations in the area also found evidence of surface water diversion, invasive species and impacts from burro grazing (despite an apparently intact livestock exclusion fence) (DRI 2023, p. 44).

Amargosa River Group: consists of 3 monitored segments with riparian vegetation interspersed with flowing, open water, along a 2 mi (3.2-km), mostly perennial, section of the Amargosa River located from just north of the Stagecoach Casino and Hotel to the Narrows, south of Beatty (USFWS 2010a, p. 42042-42043). Most of the toad's habitat is located in this section, with land ownership a mix of private, local, and BLM (Ibid, p. 42043). The Nature Conservancy (TNC) also more recently purchased land in the Beatty Narrows area and has been conducting restoration work there since 2018. Restoration efforts include removal of invasive tamarisk, planting of native cottonwood and willows, restoring natural topography and partially excluding grazing (DRI 2023, p. 53). However, heavy summer grazing still occurs outside of the fenced

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[1] 3310 EDIT Amargosa Toad Surveys 6_13-28_17 ED.xlsx (BLM records obtained in response to the Center for Biological Diversity's Freedom of Information Act (FOIA) request, FOIA No. BLM-2024-000221)
[2] 20230829_North Bullfrog_EIS_Project_Water_Res.doc, p. 2 (FOIA No. BLM-2024-000221)
[3] 3310 EDIT Amargosa Toad Surveys 6_13-28_17 ED.xlsx (FOIA No. BLM-2024-000221)
[4] Ibid.
[5] Ibid.

area, and signs of anthropogenic disturbance are apparent on the BLM lands north of the TNC property, and include recent signs of grazing (Ibid, p. 55). There is additionally tamarisk throughout an approximately 2 km section of the River between the TNC property and Beatty, which may have previously been affected by mining operations and dewatering due to the excavation of a gravel pit for highway construction (Ibid, p. 55, 57). In the Stagecoach area, habitat modifications include a recently restored area of riparian GDE vegetation, the removal of raised berms to restore the natural channel and flood plain, and several efforts to plant native vegetation and remove invasive species (DRI 2023, p. 49). However, there is evidence of surface water diversion, water abstraction, grazing, and invasive species throughout the area, with other signs of anthropogenic disturbance including trash and refuse and small areas of head cut (Ibid, p. 51).

Spicer/Mullin/Torrance Group: consists of 3 private properties known as the Spicer site (320 ac; 129 ha), the Mullin site (80 ac; 32 ha), and Torrance Ranch (130 ac; 52 ha). These 3 sites are contiguous or in close proximity to each other, allowing for movement of the Amargosa toad. As of 2010, all three property owners were conservation partners with the Service and NDOW, and had taken part in Amargosa toad habitat improvements projects (USFWS 2010a, p. 42043). Torrance Ranch was purchased by TNC in 1999 to protect the Amargosa toad and to allow for experimental habitat management for the benefit of the toad (Ibid). Restoration work has included a prescribed burn, removal of invasive species, fencing to exclude cattle and burro grazing, restoration of natural topography, and planting of riparian trees (DRI 2023, p. 33). However, approximately 350 ft east of Torrance Ranch, is a site referred to by DRI 2023 as Torrance Ranch East, centered around an unnamed spring associated with the Goss spring complex. The ownership of the land is unclear but the spring system has been the subject of repeated but unsuccessful efforts to restore historically degraded Amargosa toad habitat, and the site has clear evidence of extensive grazing and numerous invasive species. Nearby compacted road surfaces and other features appear to also be causing several localized areas of active head cut (DRI 2023, p. 35, 37).

Angel's Site: consists of a single 296-ac (120-ha) location on private property. A spring-fed, cement lined pond with an outflow to a wetland pasture provides breeding and oviposition habitat for the Amargosa toad. However, the pond has dried up at least once in the past (2007), both crayfish and bullfrog have been reported from the site (USFWS 2010a, p. 42043), and no surveys have occurred since 2013 due to a change in property ownership (Kegerries et al. 2019, p. 9).

The long-term monitoring program for the Amargosa toad involves capture and marking of all juveniles and adults that measure at least 2 inches (50 mm) (USFWS 2010a, p. 42041). The 2009 population estimate for monitored sites is reported by USFWS (2010) as 1,623, a 13.6% decrease from the 1998-2008 average of 1,826 (USFWS 2010a, p. 42051 and Hobbs 2009, p. 1 cited therein). However, unsuitable weather conditions during 2007-2008 surveys may have caused below average toad activity, and habitat improvements and disturbance of aquatic systems at monitored sites are said to have led to increases in toad captures and reproduction (USFWS 2010a, p. 42041 and references therein). On p. 42051 of USFWS 2010a, the estimated rangewide total number of adult Amargosa toads is given as 2,500 to 4000.

In 2010, other sites besides those in the four monitored groups were known to be occupied or potentially occupied by Amargosa toads (USFWS 2010a, p. 42043 and references therein). One site was also known to be historic (USFWS 2010a, p. 42043). However, no population size estimates or trends had been made for these other sites and toads therein were not included in the 2010 range-wide population estimates (Ibid). Sites where toads were or may have been extant include (but are not limited to) Springdale, Parker Ranch, Coffer Ranch (described in more detail below) (USFWS 2010a, p. 42043 and references therein) and the Indian Springs Complex. The latter consists of Upper, Middle, and Lower Indian Springs, which includes 2 springs. Upper Indian Spring is the location of a municipal well providing water to Beatty, while Middle Indian Spring is mostly dry. Little if any toad habitat exists at either site (USFWS 2010a, p. 42043). Lower Indian Spring is nearly dry, although habitat restoration may have occurred since 2010. A livestock/burro exclosure of approximately 10 ac (4 ha) was built around the two springs in 1994. Based on Appendix A (see below), Amargosa toads continue to occur at the Indian Springs Complex. Another site is Revert Spring (303 ac; 123 ha), which is privately owned and an important source of water for Amargosa toad habitat in the river (Ibid).

Based on a recent analysis of NDOW's Amargosa toad database containing over 15,000 toad records from 1998 to 2017 (Kegerries et al. 2019, p. 2), toad encounters over this time period occurred on 7 group parcels throughout the Amargosa River Basin. These included the 4 group parcels described above as well as Parker Ranch, Springdale and Brackenbury Ranch (Ibid, p. 9) (**Figure 7**), which was Coffer Ranch at the time of writing of USFWS 2010a (NDOW 2017, p. 1). Brackenbury Ranch was subsequently acquired by TNC and became TNC 7J Ranch (NDOW 2023a, p. 1), and then The Gary and Lajetta Atwood Preserve. However, for consistency with other recent reports, we continue to use the name 7J Ranch (or "Upper" or "Lower" 7J ranch) in this petition.

Parker Ranch: covers 24 acres (212 ha) and was purchased by TNC in 2000 for the protection and restoration of unique biological resources, including Amargosa toad habitat. The site includes Ute Spring and is located approximately 4 mi (6.4 kilometers (km)) north of Beatty. Restoration efforts on the property centered around the construction of several ponds in 2003 to restore open water and aquatic habitat. What had previously been a single large man-made fishing pond was reconstructed into a series of smaller ponds with a network of engineered channels and swales extending downgradient towards the Amargosa River. Additional restoration work was also conducted by TNC in subsequent years. Grazing impacts and invasive species were recently observed on-site (DRI 2023, p. 45-46).

Springdale: this site provides around 1 acre (2.5 ha) of toad habitat and at the time of writing of USFWS 2010a, it had undergone habitat improvements such as the removal of salt cedar (USFWS 2010a, p. 42043). Toads were found at the site in 2017[6] and are very likely to still occur there[7]. The Springdale site was recently purchased by the mining company AngloGold Ashanti and will apparently be used for ecological and historical preservation (Pahrump Valley Times 2023a, p. 3). However, it seems reasonable to assume that, should the need arise, the company will use the site for its North Bullfrog mining operations located approximately 2 miles west (see below). Most importantly, as discussed below, AngloGold Ashanti has predicted that drawdown due to the North Bullfrog Project will be approximately 13 feet (ft) (4 meters (m)) at Springdale Spring (see below).

TNC 7J Ranch: this site covers 900 acres (364 ha) and occurs approximately at the northernmost edge of the Amargosa toad range (USFWS 2010a, p. 42043). At the Upper 7J Ranch, discharge from Suzie Kimball Spring was diverted into a pond constructed of native fill in the early 1900s. Annual discharge was approximately 1,090 afy prior to the impoundment, and less than 200 afy in the 1960s (DRI 2023, p. 26). Surface water flow was recently observed in the area immediately downgradient of the pond, and along two braided swales, but the rate of discharge was not reported. Following acquisition of the ranch by TNC in 2019, grazing practices have been modified but not eliminated. Invasive plants have also been removed but not eliminated (Ibid). At the Lower 7J Ranch surface features include (but not may be limited to) diffuse seepage and several springs with discrete discharge points. Invasive plants occur at the site (Ibid, p. 31). Surveys at TNC 7J Ranch in 2017 also found crayfish, gambusia and bass[8].

C. Population Status

According to Kegerries et al. 2019, the Amargosa toad population at all parcels combined remained relatively steady at approximately 2000 toads from 1998 to 2016 (**Figure 8**) (Kegerries et al. 2019, p. 18). However, only the Harlan-Keal, River Beatty, Angel's Ladies and Spicer/Mullin/Torrance parcels were surveyed from 1998 to 2013, with Parker Ranch, Springdale, and TNC 7J Ranch sampled only sporadically due to limited access (Kegerries et al., 2019, p. 9) (**Figure 9**). The population at the Harlan-Keal parcel also generally declined from 350 individuals in 1998 to 124 individuals in 2013 (Ibid, p. 20-21), and survey effort in general became less standardized after 2013 (Ibid, p. 18). It is additionally clear, based on the conditions at the various sites described above, that water abstraction and diversion, grazing, invasive

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[6] 3310 EDIT Amargosa Toad Surveys 6_13-28_17 ED.xlsx (FOIA No. BLM-2024-000221)
[7] North Bullfrog Emails.pdf, pages 335-337 (FOIA No. BLM-2024-000221)
[8] 3310 EDIT Amargosa Toad Surveys 6_13-28_17 ED.xlsx (FOIA No. BLM-2024-000221)

species and other anthropogenic disturbances remain a threat to the Amargosa toad despite conservation efforts. Even in the absence of emerging threats from gold mining, the Amargosa toad’s population is vulnerable to extinction.

For the period 2018-2022, there appears to be a lack of available monitoring reports and survey data. However, a 2023 report suggests nocturnal mark-recapture PIT tag surveys and visual encounter surveys were conducted in 2022 at the Amargosa River, in the Beatty Narrows area, and at TNC 7J Ranch and nearby adjacent springs on BLM land. Forty-two toads were encountered in total. The length of the Amargosa toad’s distribution was also revised from 10-12 miles to approximately 14 miles (NDOW 2023a, p. 1-2). Included in Appendix A is additionally a map showing survey data available from NDOW as of June 2023[9], which broadly matches the group parcels described above.

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[9] North Bullfrog Emails.pdf, p. 308 (FOIA No. BLM-2024-000221)

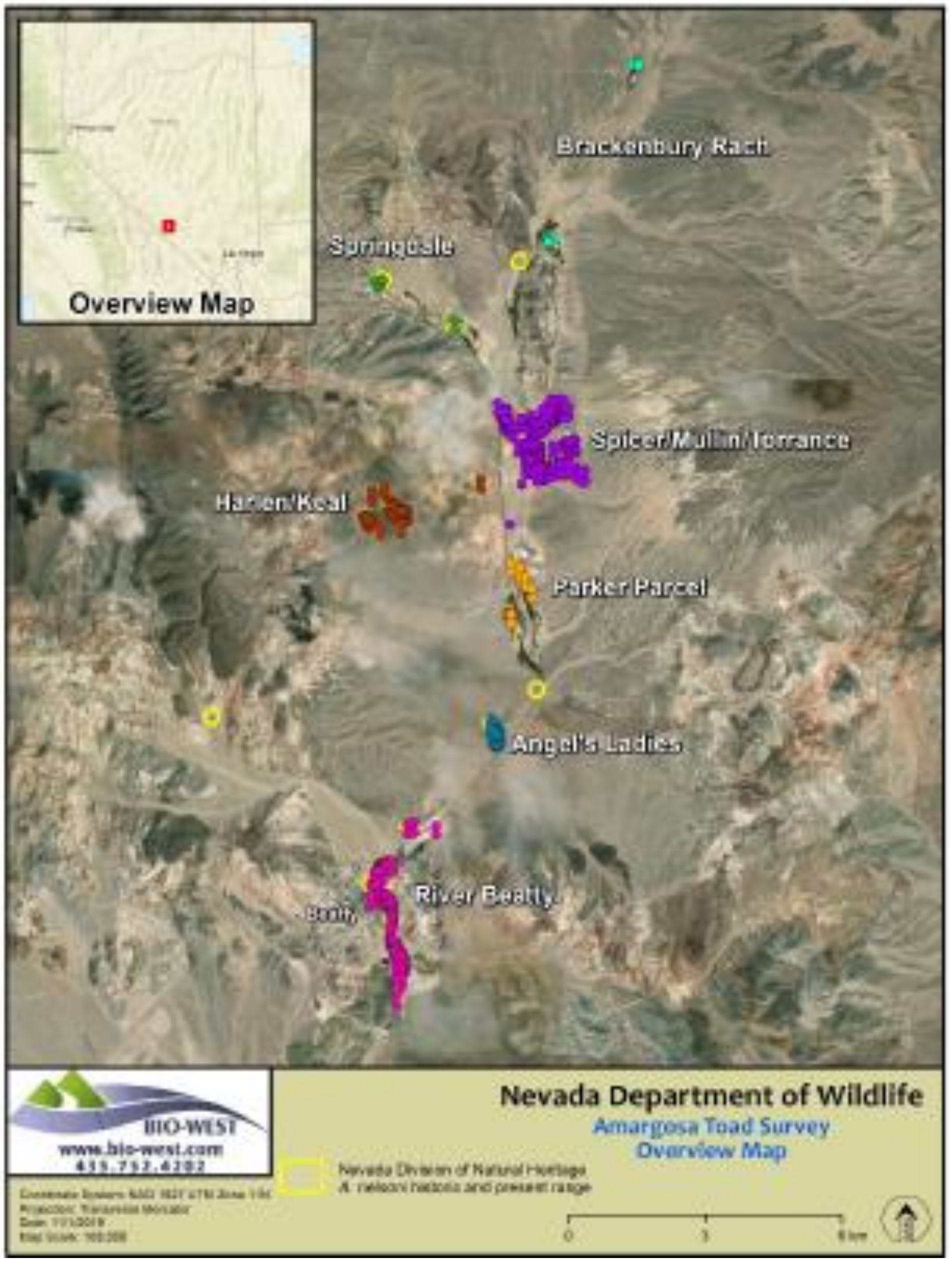

Figure 7. Amargosa toad encounter locations by group parcel in the Amargosa River Basin. The yellow polygons represent the Nevada Division of Natural Heritage (NDNH) present and historic toad distribution (Kegerries et al. 2019, p. 10).

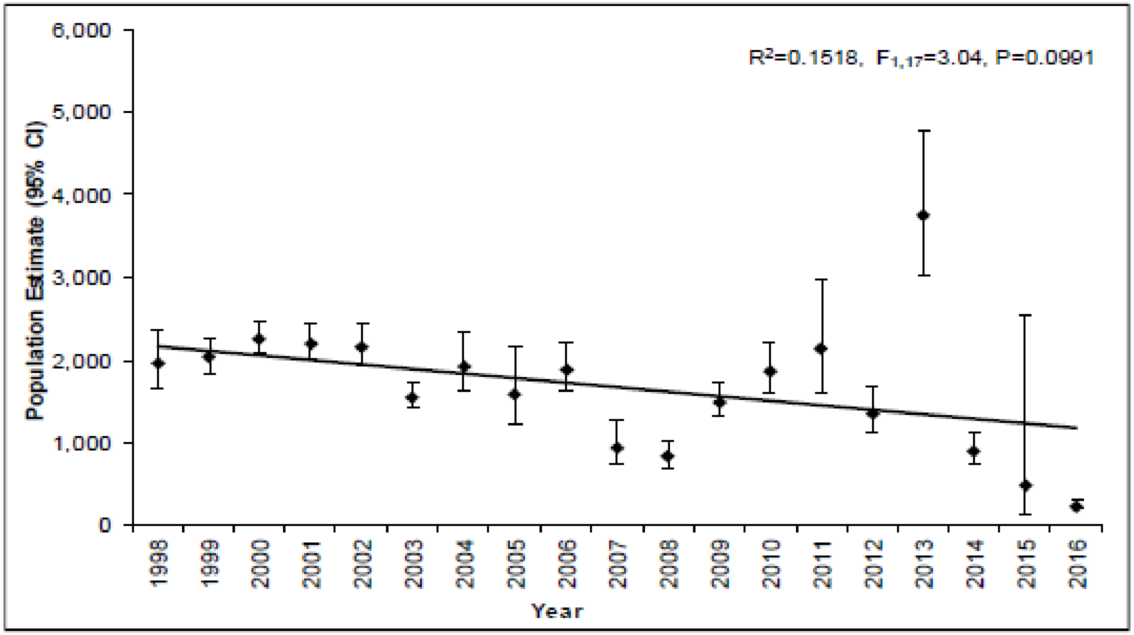

Figure 8. Amargosa toad robust design population model for all parcels combined from 1998 to 2016. Error bars depict the 95% confidence intervals (Kegerries et al. 2019, p. 19).

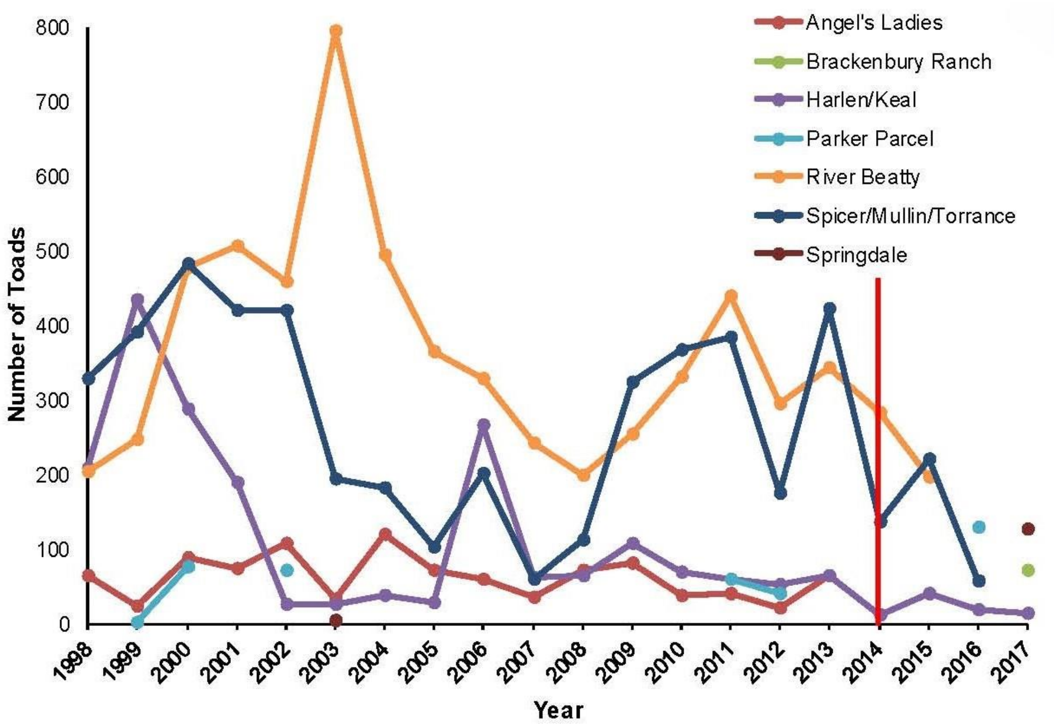

Figure 9. Amargosa toad encounters. Number of Amargosa toads encountered by year in the Amargosa River drainage, separated by group parcel. The Red line indicates a change in survey design after 2013 (adapted from Kegerries et al. 2019, p. 11).

V. THREATS

A. Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The alteration and/or elimination of Amargosa toad habitat has occurred primarily through human activities including alteration or diversion of springs and associated pools and outflows, agricultural and urban land development, and alteration of the Amargosa River channel and riparian corridor for flood control and by intense vehicle traffic. Fragmentation of existing habitats has occurred due to the construction of US Highway 95 through the channel of the Amargosa River (NDOW 2000, p. A-5). Partly as a result of human caused impacts, some reaches of the river have also become seasonally or perennially dewatered in most years (Ibid), likely leading to loss of toad habitat. Degradation of habitat has additionally occurred due to invasive nonnative plants (Ibid) and the presence of ungulates. These and other anthropogenic disturbances continue to threaten the Amargosa toad. However, the most immediate risk to the toad's survival is dewatering and groundwater pumping associated with multiple gold mining projects in the vicinity of the Amargosa River in Oasis Valley.

1. *Gold Mining*

There are currently seven gold mining projects around the Amargosa toad's habitat (**Figure 10**): Zacapa's South Bullfrog project, Augusta's Bullfrog and Reward projects, and AngloGold Ashanti's Expanded Silicon, North Bullfrog, Sterling and Mother Lode projects (Zacapa Resources 2023, p. 2-3). The Sterling project includes the Sterling, Daisy, Secret Pass and SNA deposits, the North Bullfrog project includes the Mayflower, Jolly Jane and Sierra Blanca Complex (not labelled) deposits, and the Bullfrog project includes the Bullfrog, Bonanza Mountain and Montgomery-Shoshone deposits. The red broken lines correspond to Zacapa's South Bullfrog project exploration targets. The Silicon project and Merlin deposit form part of what is now known as the Expanded Silicon project.

The approximate locations of the 7 projects (North Bullfrog, Bullfrog, South Bullfrog, Reward, Mother Lode, Sterling and Expanded Silicon) relative to the toad's range are shown in **Figure 11**. Open pit mining is anticipated to occur at most if not all projects, with devastating consequences for the Amargosa toad's scarce riparian habitat. The specifics of each project are described first, followed by a discussion of water resource impacts and other potential effects on the Amargosa toad.

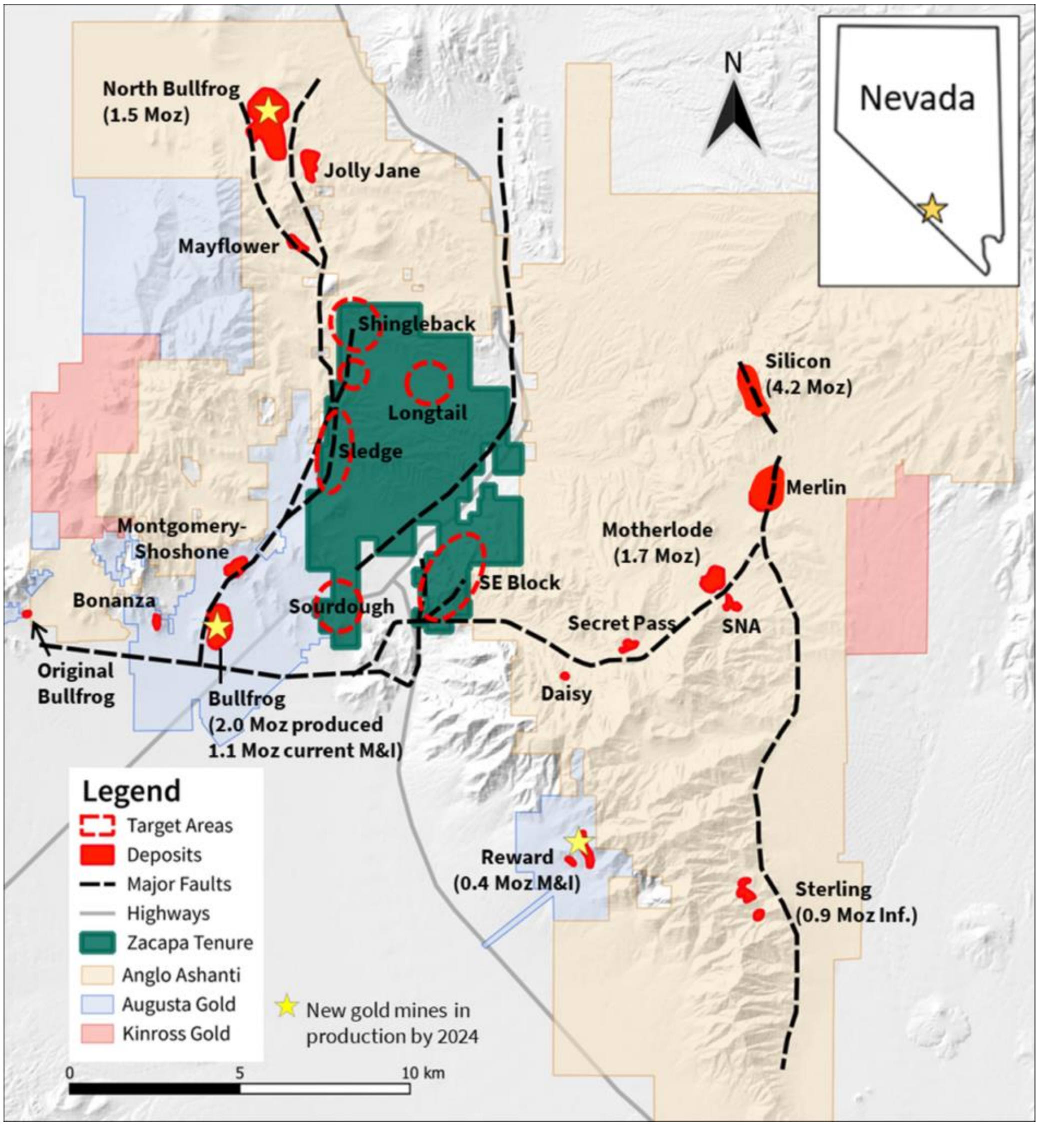

Figure 10. Gold mining projects in the Beatty district (Zacapa Resources 2023, p. 3)

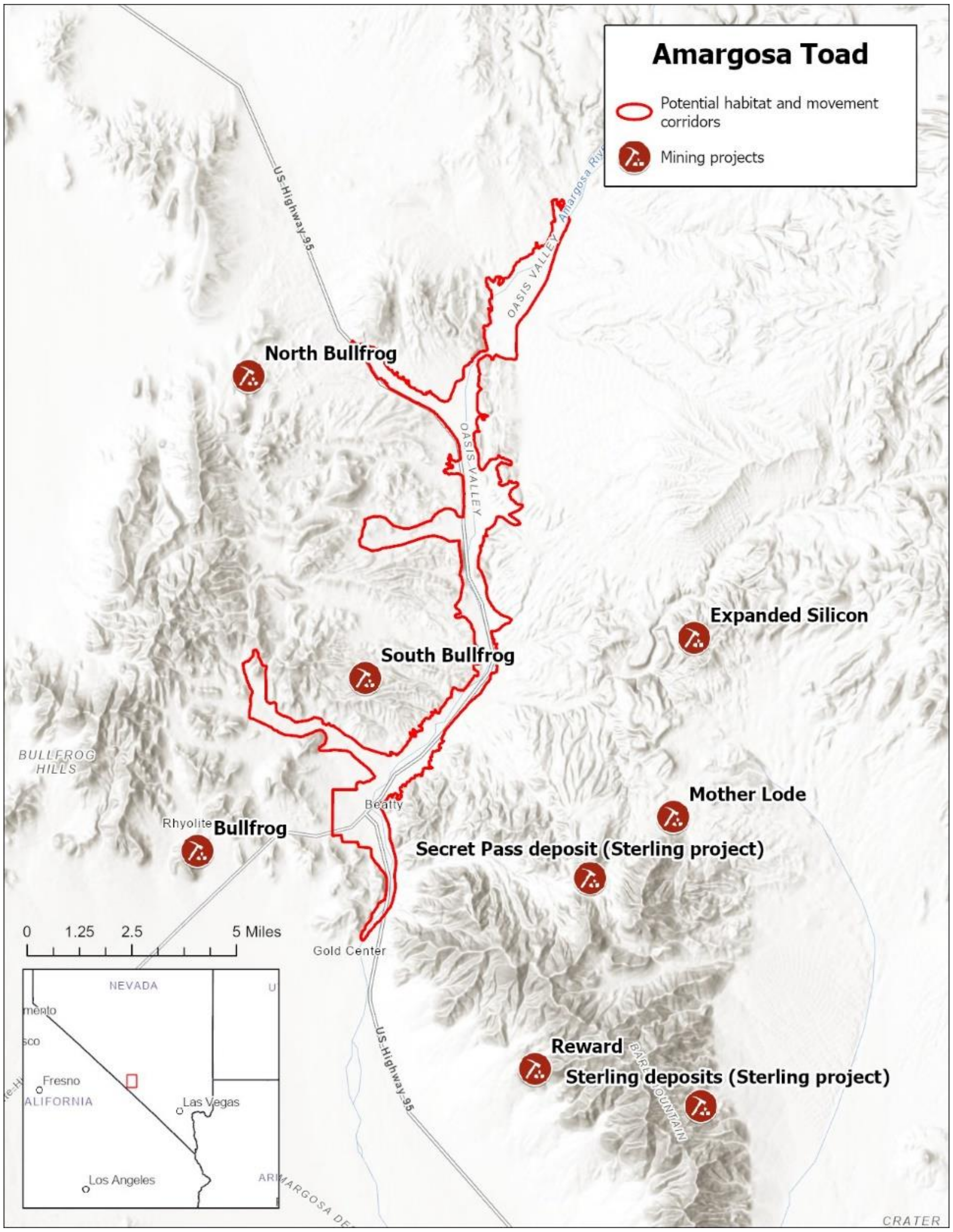

Figure 11. Map of Amargosa toad habitat and Beatty district gold mining projects. The location of the projects is approximate and based on the following sources: (a) North Bullfrog (AngloGold Ashanti 2022, p. 197); (b) South Bullfrog (Zacapa Resources 2021, p. 1); (c) Bullfrog (Augusta Gold 2022a, p. 159); (d) Expanded Silicon (AngloGold Ashanti 2022, p. 201, 203); (e) Mother Lode (AngloGold Ashanti 2022, p. 210); (f) Reward (Augusta Gold 2022a, p. 15, 159); (g) Sterling (AngloGold Ashanti 2022, p. 210). The Sterling project is represented as two separate projects, "Secret Pass deposit (Sterling project)" and "Sterling deposits (Sterling project)" as individual deposits are spread over a distance of approximately 10 km and it seems likely that more than one mine could be built.

South Bullfrog

The South Bullfrog project is a gold exploration project acquired by Zacapa Resources in 2020 through claim staking (Zacapa Resources 2023, p. 2, 4). The property is located on BLM land, directly adjacent to the western and northern town boundaries of Beatty, and is centered on

36°56’46” N, 116°45’33” W (Zacapa Resources 2021, p. 1; Zacapa Resources 2023, p. 6). It comprises 488 contiguous unpatented mining claims covering an area of almost 10,000 ha (Ibid; Zacapa Resources 2023, p. 2-3). The company completed the first phase of its initial exploration program in March 2022 (Zacapa Resources 2022, p. 3), and in February 2023, announced that it had received approval from the BLM for its Notice of Intent for proposed drilling activities at the project’s Longtail prospect. This together with a previously obtained permit for the Shingleback prospect was reported to complete permitting activities for an inaugural 3,000 meter drill program at the project (CNW Group 2023, p. 2). Little is known about prior exploration at the property but some has taken place (Ibid, p. 4).

Reward

The Reward project is an open-pit heap leach gold mining project acquired by Augusta Gold in 2022. Located 11.3 km (7 miles) south-southeast of Beatty (Augusta Gold 2022a, p. 2; Augusta Gold 2022b, p. 1; Augusta Gold 2023a, p. 4), at approximately 36°50’16” N, 116°42’02” W (Augusta Gold 2022a, p. 15, 159), the project encompasses 127 mining claims totaling approximately 944 ha, mostly on BLM land (Ibid, p. 3). There are two deposits (Good Hope and Gold Ace), as well as additional exploration targets (Augusta Gold 2023b, p. 10). The company recently claimed to have “all major federal and state permits in place, sufficient water rights for construction and operation, and existing power supply to the project site” (Augusta Gold 2023a, p. 2). The project’s feasibility study was said to be scheduled for completion in Q4/2023, with production planned for late 2024 (Ibid). Prior to the Reward project’s acquisition by Augusta Gold, historical exploration of the project had been completed by several other companies (Augusta Gold 2022a, p. 5).

Bullfrog

The Bullfrog project is another open pit heap leach gold mining project owned by Augusta Gold (Augusta Gold 2023b, p. 4), which began exploration in 2020 (Augusta Gold 2022c, p. 15). The project is located 4 miles west of Beatty (Augusta Gold 2022c, p. 11, 65), at approximately 36°53’53” N, 116°49’02” W (Augusta Gold 2022a, p. 159), and is anticipated to share infrastructure with the Reward project, located 7 miles away (Augusta Gold 2023b, p .4). The project includes three deposits: Bonanza Mountain, Bullfrog and Montgomery-Shoshone (Augusta Gold 2023b, p. 15), and two additional exploration targets, with drill plans in place for one of the targets (Ibid, p. 16, 18). According to the company, a mine plan of operation (POO) is expected for mid-2024 (Augusta Gold 2023a, p. 3-4). Historically, the Bullfrog project was open pit and underground mined from 1989-1999 (Augusta Gold 2022c, p. 24).

Silicon/Expanded Silicon

The Silicon project is an open-pit heap leach gold mining project acquired by AngloGold Ashanti in 2020. The project is located approximately 12 km east of Beatty, at approximately 36°57’26”N, 116°38’45”W, and currently comprises 950 mining claims on BLM lands

(AngloGold Ashanti 2022, p. 201, 203). A POO was submitted to BLM in 2019 (AngloGold Ashanti 2023a, p. 35) and a first-time mineral resource was reported for the Silicon deposit in 2021 (AngloGold Ashanti 2023b, p. 2). A prefeasibility study began in 2022 (AngloGold Ashanti 2023a, p. 36) but was rolled back to incorporate the Merlin deposit (also situated within the Silicon claim block), in a conceptual study for the so-called Expanded Silicon project (AngloGold Ashanti 2022, p. 205; AngloGold Ashanti 2023a, p. 36). Submission of a new mining POO is anticipated for late 2024 to early 2025 (AngloGold Ashanti 2023c, p. 20). In February 2024, it was reported that the Expanded Silicon project has a mineral resource of 13.3 million ounces, including a 9.1 million ounce inferred resource at Merlin. The latter is believed to represent the largest greenfield gold discovery in the US in more than a decade (Webb 2024, p. 3).

Project infrastructure for the Expanded Silicon Project (**Figure 12**) is anticipated to include 2 pits, a waste dump of around 16 km^2 and processing facilities, including a 3-stage crushed leach facility, run of mine ore leach extension and an adsorption desorption and recovery (ADR) plant. Support infrastructure will include a fresh water supply system (incl. pipeline and pump stations), an electrical energy supply system, new roads and road upgrades, maintenance facilities, as well as a pit dewatering system (AngloGold Ashanti 2023a, p. 30).

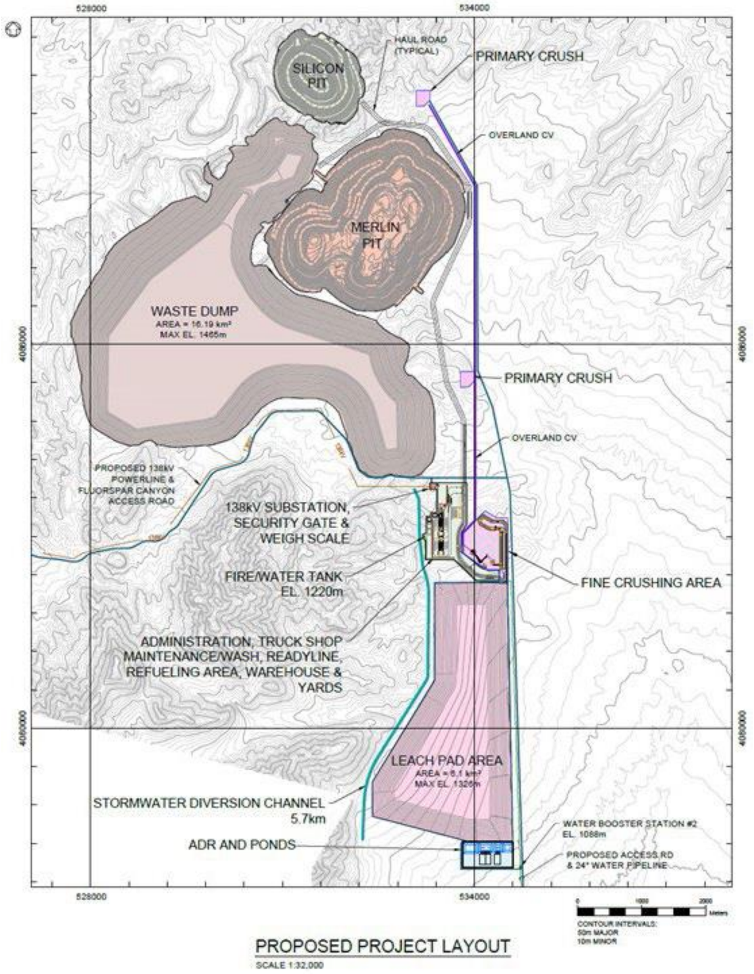

Figure 12. Proposed project layout for the Expanded Silicon project (AngloGold Ashanti 2023a, p. 30).

Mother Lode

The Mother Lode project is an open-pit gold mining project acquired by AngloGold Ashanti in 2022. The property is located approximately 10 km east of Beatty, at 36°54’27”N, 116°39’10”W, and comprises 13 mining claims. The project was mined from 1989 to 1991, with further exploration in later years. A mineral resource estimate was reported by Corvus Gold in 2020 (AngloGold Ashanti 2022, p. 208, 210, 212), and updated by AngloGold Ashanti in 2022 (Ibid, p. 209-208). The project area currently includes a reclaimed overburden facility and a small open pit. Future project infrastructure will include an expanded open pit, with mineralized material processed on a heap leach pad (HLP) or in a mill using agitated tank bio-oxidation and cyanidation. Access roads will be upgraded (Ibid, p. 209).

Sterling

The Sterling project is a past-producing open-pit and underground heap leach gold mine acquired by AngloGold Ashanti in 2022. The mine is currently in care and maintenance but has a valid mining permit with a permitted HLP expansion area (AngloGold Ashanti 2022, p. 214). The mine is located 14 km southeast of Beatty (Ibid, p. 194), at approximately 36°49’39”N, 116°38’36”W. The Sterling project also includes 3 deposits (Daisy, Secret Pass and SNA) suited to open-pit mining (Ibid, p. 214), located 6-9 km east of Beatty (Ibid, p. 194, 210), at approximately 36°53’26”N, 116°40’53”W. AngloGold Ashanti plans to process mineralized material from these deposits either on a HLP or in a mill (Ibid, p. 215). Both Daisy and Secret Pass were mined during the 1990’s (AngloGold Ashanti 2023c, p. 18). A mineral resource was inferred for the Daisy, Secret Pass and SNA deposits by AngloGold Ashanti in 2022 (AngloGold Ashanti 2022, p. 217).

North Bullfrog

The North Bullfrog project is an open-pit gold mining project acquired by AngloGold Ashanti in 2022 and the most advanced gold mining project in the vicinity of the Amargosa toad’s habitat. The project is located approximately 14 km northwest of Beatty, at 37°01’45”N, 116°47’59”W (AngloGold Ashanti 2022, p. 194-195, 197). The project area covers ~6,292 acres, with 5,396 acres (85%) on BLM land and 896 acres (15%) on private lands controlled by AngloGold Ashanti (EM Strategies 2023, p. 1). A first-time mineral resource was declared in 2022 (Ibid, p. 194) and the BLM is currently seeking public comment to inform its EIS for the project (DOI-BLM-NV-B020-2024-0019-EIS) (BLM 2024a, p. 2).

According to the POO, the project will include among other major components: three open pits: the Mayflower, the Jolly Jane, and the Sierra Blanca (with the Sierra Blanca Open pit comprised of the Sierra Blanca, Yellow Jacket and Savage Valley areas); four overburden storage areas; an ore-crushing and conveying system; a gravity mill with cyanide tank leaching; ore and growth media stockpiles; a power sub-station, solar field, and associated distribution system; a heap leach facility with solution channels, associated process solution tanks, and ponds; a water supply well-field and open pit dewatering system (wells, pipelines, and pipeline corridors); stormwater diversion channels and stormwater sediment basins; an ADR plant, refinery, and an assay laboratory; access and haul roads; continued surface exploration (EM Strategies 2023, p. 1-2). The proposed surface disturbance associated with the Project is 3,481.1 acres (Ibid, p. 9).

Approximately 238 million tons of heap leach ore and 227 million tons of overburden will be mined at the project site, for a total of 465 million tons of mined material (EM Strategies 2023, p. 2). Of the 238 million tons of ore, ten million tons will be processed in the gravity mill prior to recovery on the HLP, with the heap leach ore. Both ore and waste will be extracted from the open pits using conventional open pit mining methods (drilling, blasting, loading, and hauling). After recovery on the HLP, further processing will occur, including at the ADR plant (Ibid). The total mine life will be 20 years: approximately one year of “pre-mining” and construction, followed by 12 years of active open pit mining, followed by 2-3 years of active gold recovery on the HLP and mine reclamation activities, followed by 3-4 years of heap rinsing, reclamation and closure activities (Ibid, p. 42).

The annual mine water supply demand is estimated to range from 450 to 1,600 gallons per minute (gpm) (726 to 2581 afy) over a period of approximately 16 years to support mine construction, operations and closure (EM Strategies 2023, p. 31). The main demands will come from: the gravity mill, the ADR plant, the heap leach facility (HLF), construction for HLP expansions, the crushing and screening plant, mine facilities such as water for dust suppression, operational drilling water, a truck wash, fire water and potable water. However, most of the demand will be associated with make-up water supply to the HLF and associated processing (EM Strategies 2023, p. 32). The project's primary water supply will be the mine's dewatering operation, and specifically dewatering associated with the Sierra Blanca open pit (Ibid, p. 31). Open pit dewatering is required when a pit extends below the water table to keep the mine dry, and is typically achieved using in-pit pumps or vertical dewatering wells installed around the perimeter of the mine pit (Bozan et al., 2022, p. 1). At the Sierra Blanca pit, groundwater level is estimated at approximately 3,890 feet above mean sea level (amsl) pre-mining and 3,610 feet amsl post-mining – a difference of 280 feet (85 m). Dewatering is also planned at the Jolly Jane pit as mining is anticipated to reach 85 feet (26 m) below the pre-mining water table of 3,890 feet amsl (EM Strategies 2023, p. 14). The mine dewatering system is anticipated to include up to seven pit perimeter wells and one in-pit sump, with fewer pumping wells operating at the start of the open pit development. Peak groundwater dewatering is expected to occur during the final year of mining at the Sierra Blanca Open Pit at a pumping rate of around 820 gpm (1323 afy) (Ibid).

The other main source of water for the mine will be groundwater obtained through a proposed wellfield in the northwest corner of the project area, in the Sarcobatus Flat hydrographic basin (EM Strategies 2023, p. 31). The project straddles the boundary between Sarcobatus Flat hydrographic area (Basin 146) and Oasis Valley hydrographic area (Basin 228) (HydroGeologica 2021, p. 32). The six planned wells have individual pumping capacities between 250 and 400 gpm (403-645 afy) and AngloGold Ashanti is currently permitted to withdraw 1,277 afy from Basin 146 (EM Strategies 2023, p. 31). Additional mine water will also be supplied from meteoritic waters from ponds downstream of project facilities: (i) meteoric water accumulating within lined pond downstream of the crusher, stacker, and conveyor; (ii) meteoric water accumulating onto the heap leach or processing facilities (Ibid, p. 32).

Groundwater quantity impacts

The North Bullfrog project and other mining projects in Oasis Valley have the potential to impact groundwater availability in Amargosa toad habitat due to three main processes: 1) groundwater pumping, 2) pit lake development, and 3) diversion and/or collection of surface water.

Groundwater pumping

Gold mines require a significant amount of water for construction, operations and closure. The exact amount of water required largely depends on the processing method and the amount of material to be mined (University of Arizona 2024, p. 2), with water uses such as dust suppression common across mines. Another important factor is the extent of water reuse.

Based on our review of the gold mining projects near Beatty, most if not all will involve a heap leaching operation. Similar water use requirements as at the North Bullfrog project may therefore apply, per ton of material mined. Water at the various mines will also likely be supplied through a combination of production wells and dewatering wells (collectively “pumping wells”) as open pit mining is planned for most projects and a portion of the pits will likely extend below the water table.

With the onset of groundwater pumping, water levels around the mines will begin to decline, causing hydraulic gradients that induce radial flow towards the pumping wells. Cones of depression will develop around the wells and grow until the recharge rates are in balance with the pumping rates. The drawdown may intercept water that would otherwise be discharged at springs (Nye County 2004, p. 25) (**Figure 13**), or support groundwater dependent vegetation. Once the pumping ceases, water will continue to flow towards the wells but start to replenish the drawdown cones created by the pumping. The top of the cones will continue to expand even as the tip of the cones recover because gradients toward the wells are still required to drive the flows. Water levels at the wells initially recover quickly because there is little volume at the tip of the cones but in the long term, the remainder of the cones recover slowly because the flow gradients will have decreased so that fluxes toward the cones decrease (Myers 2011, p. 11). Thus, groundwater dependent ecosystems may continue to be affected by the mining projects long after mining has ceased.

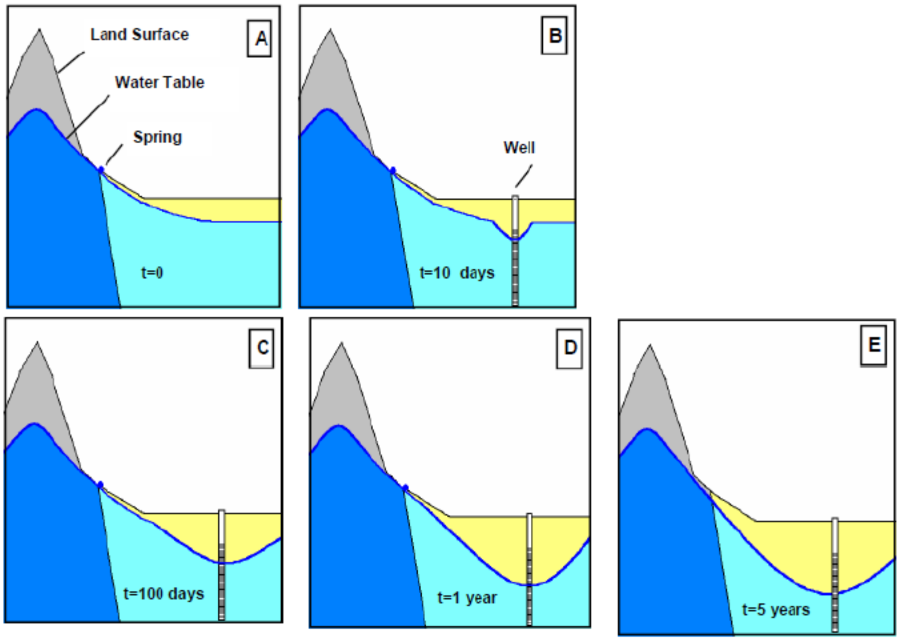

Figure 13. Impact of groundwater withdrawal on springs: (A) Natural hydrologic system is in balance; (B) Water levels are lowered in the vicinity of the pumping wells; (C) The area of decline expands outward from the pumping wells; (D) Wells' areas of influence reach groundwater feeding springs, causing a decline in discharge rates; (E) Springs dry up. Adapted from Nye County, 2004, p. 25.

To further illustrate the risk from groundwater pumping to the Amargosa toad's habitat, included in Appendix B is a hydrological analysis by Roux, Inc. This analysis is a preliminary conceptualization of the potential effects to groundwater-dependent ecosystems in the Beatty area from groundwater pumping associated with the North Bullfrog project and other gold mining projects in the Oasis Valley region. Included in the analysis are 4 of the 7 existing gold mining projects (including North Bullfrog)[10], and 3 different groundwater pumping scenarios with a pumping period of 15 years and an equally long recovery period. In the first scenario, with total pumping equal to 1,000 afy (i.e. less than half the maximum annual mine water supply demand at the North Bullfrog Project), >1 feet of drawdown is observed along the Amargosa River between approximately the town of Beatty and Parker Ranch, and around the Springdale site (Roux 2024, p. 4). In the second scenario, with total pumping equal to 2,500 afy (i.e. approximately equal to the maximum annual mine water supply demand at the North Bullfrog Project), drawdown in the Beatty area has increased to ≥ 10 feet, with drawdown of 1-10 feet further north (**Figure 14**). The footprint of the cone of depression continues to expand, primarily northeastward toward upper Oasis Valley hydrographic basin, after 15 years of recovery (Roux 2024, p. 5). For this scenario, it was also estimated that the integrated discharge to the Amargosa River in the Beatty area would be reduced by almost a fifth (17%) at the end of 15 years (Ibid, p. 7, 9). The third scenario assumes each mining project extracts 3,000 afy annually, resulting in a drawdown of 10-50 feet in the Beatty area and a more expansive cone of depression (Ibid, p.6).

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[10] For an explanation of the mining project selection for the analysis, see Roux 2024, p. 3 in Appendix B.

Residual drawdown in the amount of 10 feet or more also remains along significant reaches of the Amargosa River after 15 years of recovery (Ibid, p. 7).

The Roux memorandum is intended to be illustrative rather than definitive. The exact amount of water to be abstracted for future gold mines around Beatty is unknown, and the pumping amounts given in Scenarios 1 and 2 are very conservative. Additionally, the simulated groundwater extraction at the North Bullfrog Mine was assumed to be either 250 or 3000 afy (rather than ranging from 726 to 2581 afy, as prescribed in the POO) and to occur in Oasis Valley only (rather than Oasis Valley and Sarcobatus Flat[11]). So while not perfectly mirroring the mines as they are developing, it is clear from this analysis that the combined impact from multiple mining projects to springs and groundwater dependent ecosystems (shown on **Figure 15**, and figure 8 in the Roux analysis) will be substantial and will likely drawdown the River while degrading or eliminating Amargosa toad habitat.

Figure 4. Drawdown for Scenario 2 – Pumping 15 Years

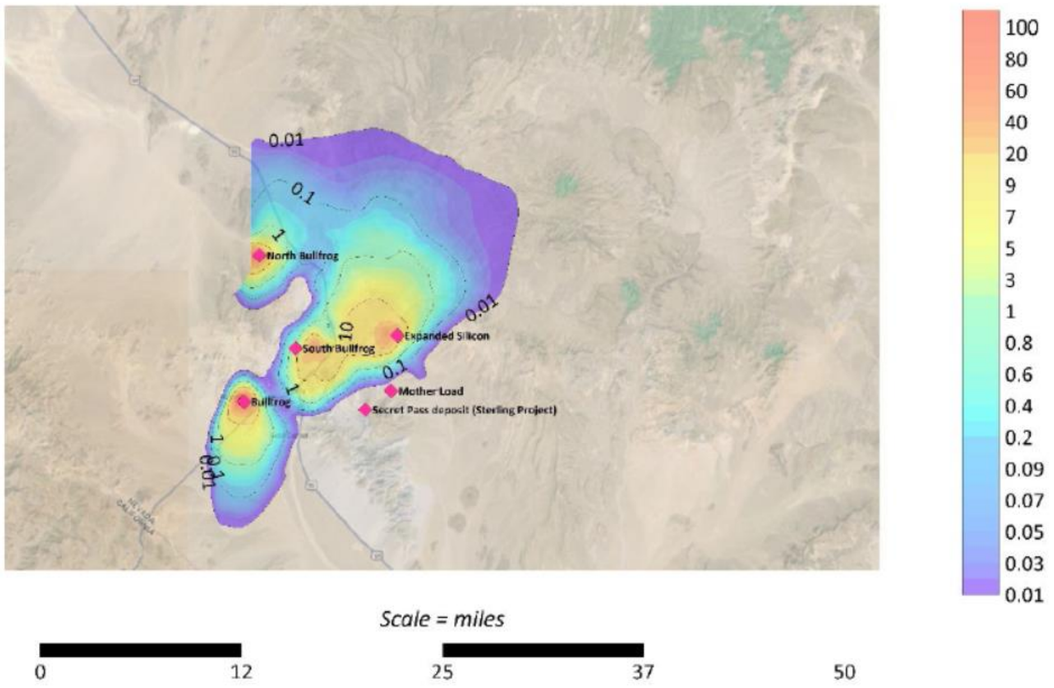

Figure 14. Drawdown scenario with 2,500 acre-feet of pumping. This is Scenario 2 from Roux 2024 (p. 5) (Appendix B) depicting cumulative drawdown in Oasis Valley due to pumping from four mines. Widespread drawdown of 5-10 feet is observable along the length of the Amargosa River. Actual pumping from these mines will be much higher.

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[11] The amount of interbasin flow from Sarcobatus Flat to Oasis Valley is uncertain, but pumping in Sarcobatus Flat could potentially significantly impact water levels in Oasis Valley. See discussion above in III(C).

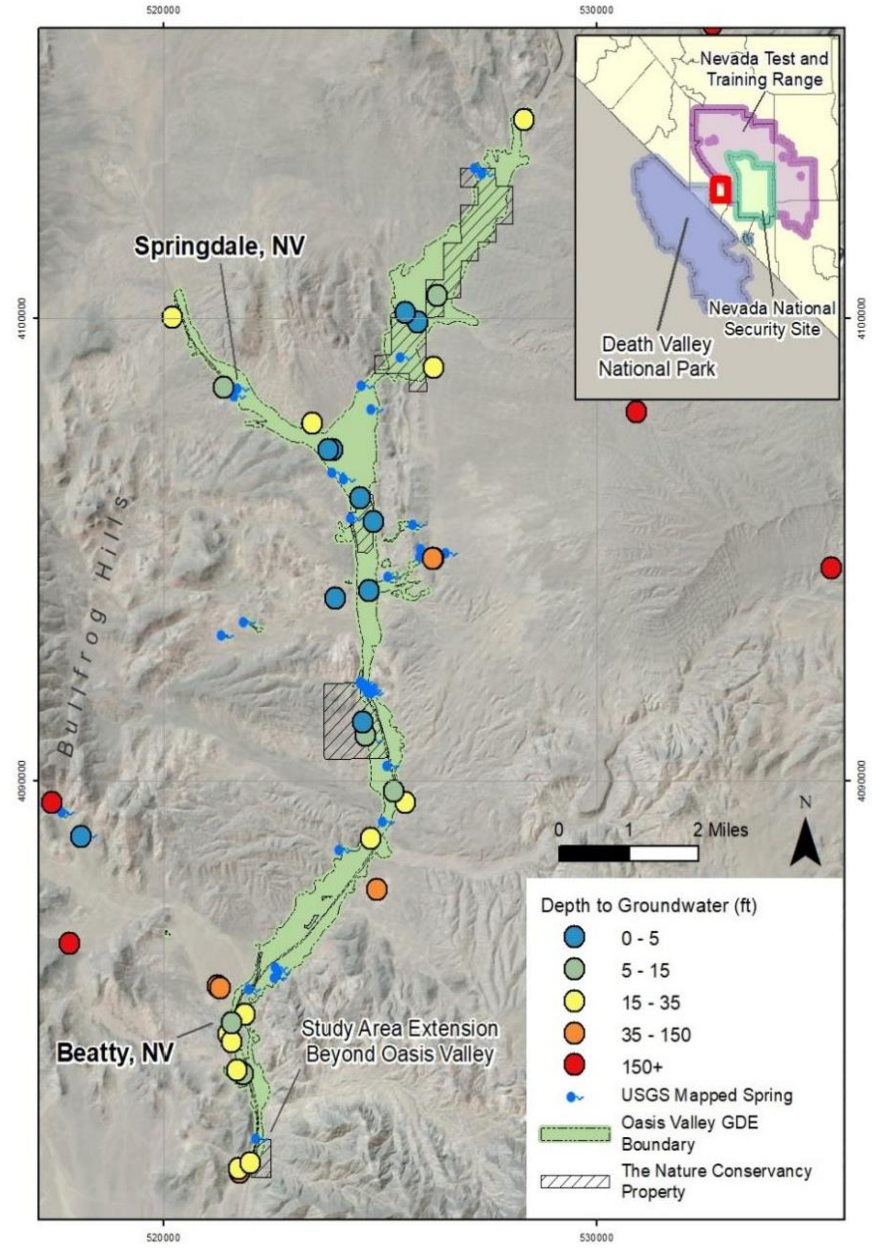

Figure 15. Overview of the extent of groundwater dependent ecosystems, wells with groundwater data (showing most recent depth to groundwater), springs, and TNC properties (DRI 2023, p. 7).

The risk to these resources from groundwater extraction associated with the North Bullfrog Project specifically is also apparent to some degree from AngloGold Ashanti's own hydrological modelling. The baseline hydrogeology report for the project (HydroGeoLogica 2023) describes the estimated changes in drain discharges (representing baseflow, spring flow, and evapotranspiration) due to pit dewatering and wellfield pumping. Discharge is reduced by 7%, or 408 afy, in the upper reach of the Amargosa River above the confluence with the unnamed drainage south of Springdale Spring (shown on **Figure 17**), and reduced by ~10%, or 28 afy, in the unnamed drainage south of Springdale Spring, upgradient from the confluence with the

Amargosa River (HydroGeoLogica 2023, p. 112-113). While the maximum extent of drawdown is only delineated for 10 ft (3 m) (Ibid, p. 114), the analyses also show that drawdown will be approximately 13 ft (4 m) at Springdale Spring (Ibid, p. 114), and approximately 3 ft (0.9 m) and 3.3 ft (1 m) at points along the Amargosa River, approximately 3 km (1.9 mi) and 4 km (2.5 mi) respectively, upstream from the confluence with the unnamed drainage south of Springdale Spring (Ibid, p. 114 and 655) (**Figures 18 and 19**). The Amargosa River locations approximately correspond to the Lower 7J Ranch. Approximately 1ft (0.3 m) of drawdown is estimated near Colson pond (Ibid, p. 114), which is located on the Upper 7J Ranch and contains Amargosa toads[12]. Even a small amount of drawdown may potentially dry up lower flowing springs or increase the amount of time a spring stays dry due to natural variability (Myers 2011, p. 7). As noted in Currell 2016a (p. 3):

> *It is quite possible for a spring (or a gaining stream) to experience minimal drawdown, but for the flow of water from the aquifer to the surface to decrease or even cease entirely. For this reason, by the time 20cm of drawdown has been noticed at the Doongmabulla Springs – which are located about 8 kilometres from the mine site – it is likely that the flow directions and water budget will have been fundamentally changed, and possible that the springs may ultimately cease to flow, as has occurred in many other parts of the Great Artesian Basin.*

Due to the Amargosa toad's rarity and dependence on springs and spring-fed habitat to fulfill its life history requirements (reproduction, recruitment, adult maintenance, and winter hibernacula) (NDOW 2022b, p. 323), even a small reduction in spring discharge could be catastrophic for the species. A smaller amount of spring habitat would support fewer individuals by offering fewer resources for the population (USFWS 2010b, p. 35404). A decrease in the amount of time wetlands hold water could also affect success at entire breeding sites (Wildlife Action Plan Team 2012, p. S-61). Moreover, the ability of eggs and tadpoles to withstand deviations in water quality may be limited (Wijethunga et al. 2016, p. 6994; Buxton and Sperry 2017, p. 27). Yet, if the amount of surface water decreases, temperatures and the concentrations of pollutants may increase while oxygen levels decrease (USFWS 2010b, p. 35405). Further, loss of spring habitat reduces opportunities for habitat niche partitioning and the ability of different species to coexist, particularly in the presence of non-native species (Ibid, p. 35405). Finally, further dewatering of the Amargosa River may reduce connectivity between otherwise isolated toad population segments, leading to inbreeding depression (NDOW 2000, p. A-5).

Even modest amounts of drawdown could dry up Amargosa toad habitats, especially over the long term. Capture is a term that refers to the loss of discharge from an aquifer, through surface expression or evapotranspiration, due to groundwater drawdown. While initial response to pumping occur through depletions to aquifer storage, over the long term, up to 85% of groundwater depletion expresses through capture of surface discharge (Konikow & Leake 2014,

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[12] North Bullfrog Emails.pdf, p. 364 (FOIA No. BLM-2024-000221)

p. 8). As pumping occurs, surface discharge and evapotranspiration are captured, resulting in the desiccation of moist soils and mortality of phreatophytic vegetation (Bredehoeft 2011, p. 809). Declines in groundwater levels of one foot would result in a linear reduction in evapotranspiration from phreatophytes (Bredehoeft and Durbin 2009, p. 4). During monitoring elsewhere in the Amargosa Basin, groundwater levels at a monitoring well in Chicago Valley decreased 1.6 feet over a 6 year period (Zdon 2020, p. 41), which coincided with the adjacent Twelvemile Spring going functionally dry (*Personal obsv.*, Donnelly, 2020).

There is the additional issue of groundwater flux as it pertains to pumping or dewatering. In some cases, groundwater monitoring for drawdown is not necessarily a good indicator of the propensity of a pumping scenario to contribute to capture (Currell 2016b, p. 620). There can be a delay between pumping and the impacts of such pumping as drawdown propagates through a system (Bredehoeft 2011, p. 810). After pumping commences and reductions in aquifer storage result, it creates a cone of depression which will induce flow of groundwater towards its bottom (Currell 2016b, p. 620). This will in turn draw water away from discharging at springs and wetlands, even when groundwater levels at those springs and wetlands have only decreased minimally (Ibid). “Only very minor drawdown need occur at this point for the flow direction to reverse, depriving springs or streams of flux,” (Ibid; **Figure 20**).

Proposed adaptive management measures to mitigate the harms of groundwater pumping on Amargosa toad habitat are unlikely to succeed in preventing groundwater drawdown and decreases in spring discharge. Groundwater drawdown can propagate slowly across the landscape, and there can be a significant delay between when pumping commences and when impacts of pumping materialize in nearby surface water sources (Barlow and Leake 2012, p. 73). It may take years for a drawdown signal to propagate to a spring or other surface water source; and due to this lag, even when adaptive management or other reasons cause pumping to decrease or cease, the drawdown can continue to increase as the cone of depression spreads outward (Bredehoeft 2011, p. 812). Even as pumping ceases, capture of surface discharge and evapotranspiration may persist “over a longer time period than the immediate (and often temporary) loss of storage,” (Currell 2016b, p. 620). Therefore, adaptive management regimes using triggers and other signals to manage pumping levels are unlikely to prevent degradation of Amargosa toad habitats due to groundwater pumping.

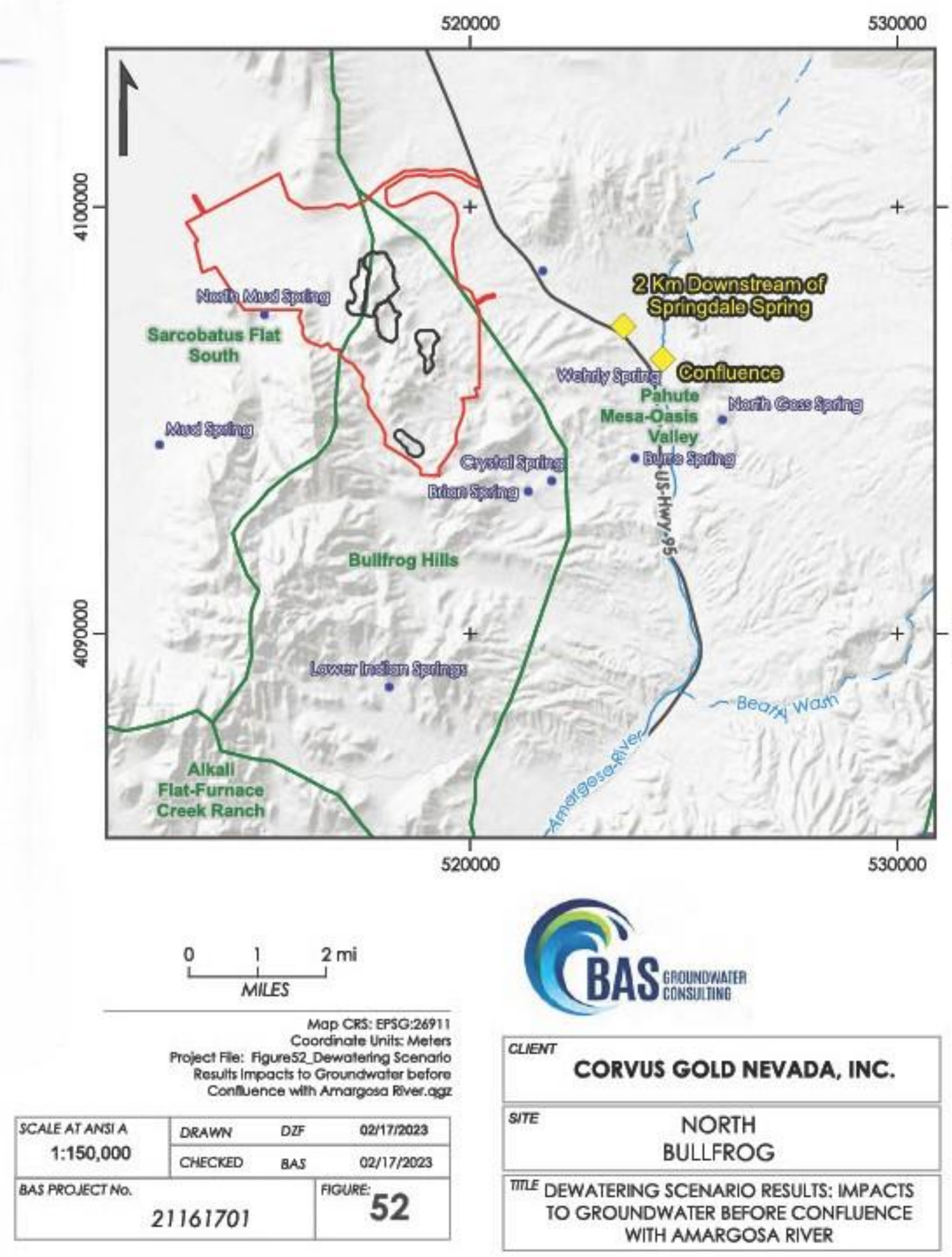

Figure 17. Map showing confluence ("confluence") of the Amargosa River with the unnamed drainage south of Springdale Spring (unlabelled blue dot). Adapted from HydroGeoLogica 2023, p. 654.

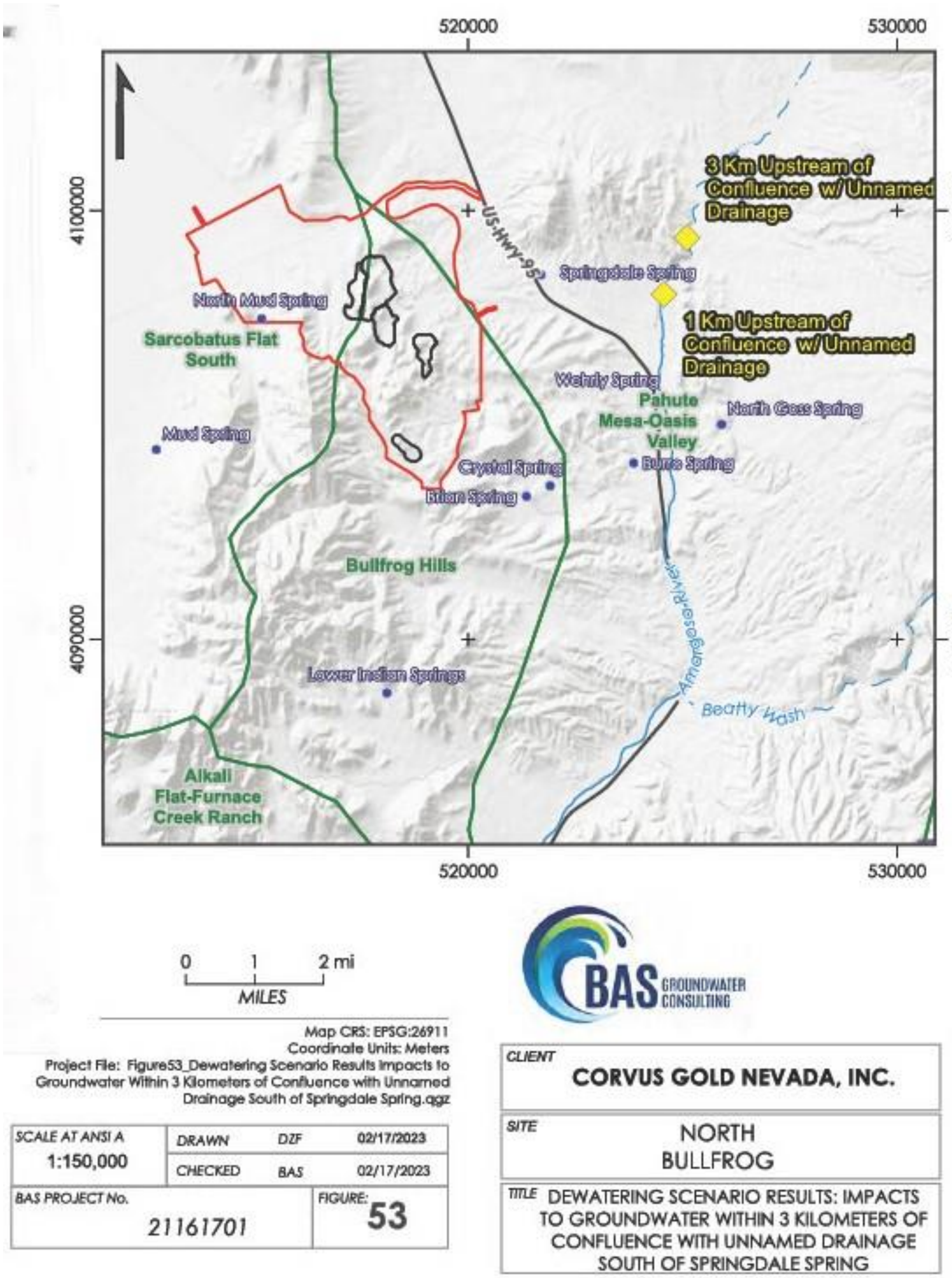

Figure 18. Location of the approximately 3 ft drawdown location along the Amargosa River 3 km upstream from the confluence with the unnamed drainage south of Springdale Spring. Adapted from HydroGeoLogica 2023, p. 655.

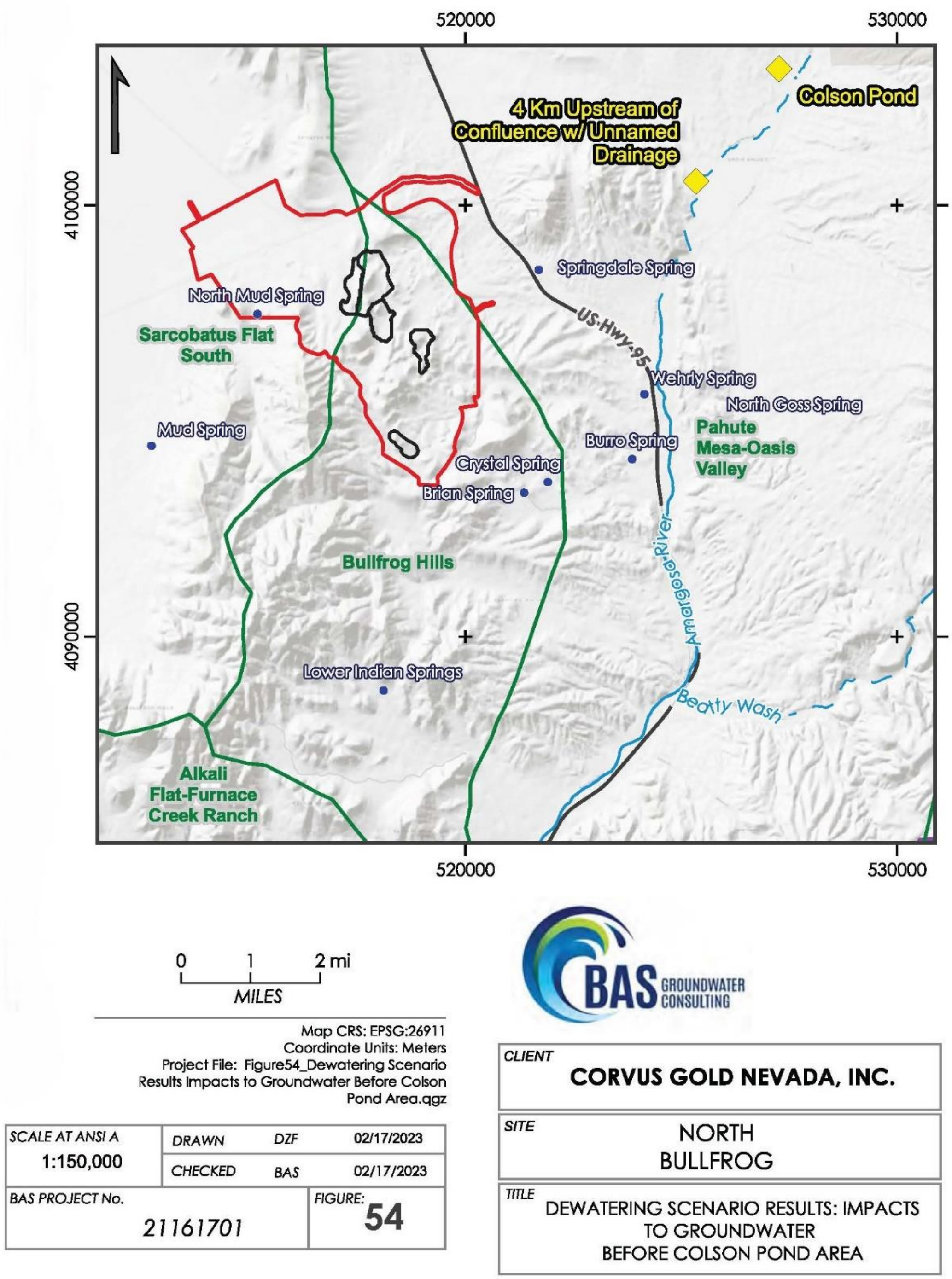

Figure 19. Location of the approximately 3.3 ft drawdown location along the Amargosa River 4 km upstream from the confluence with the unnamed drainage south of Springdale Spring. Also shown is Colson Pond. Adapted from HydroGeoLogica 2023, p. 656.

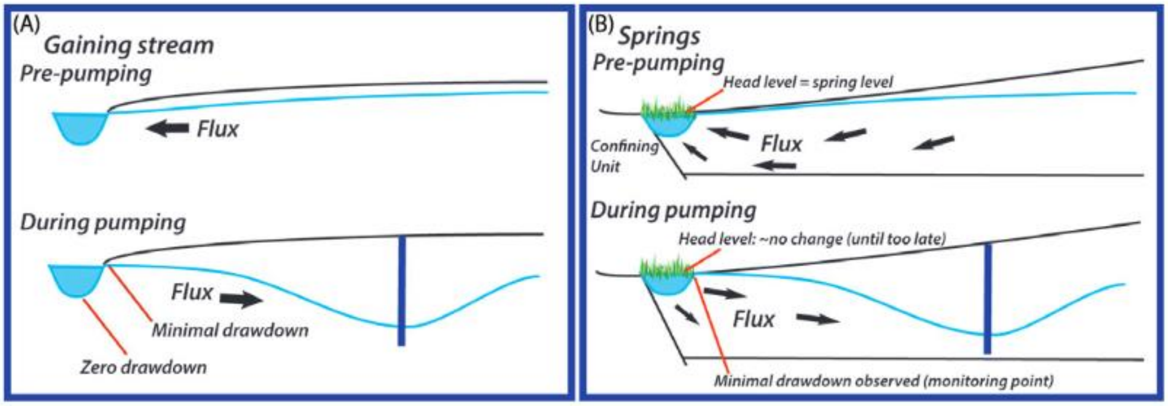

Figure 20. Conceptual model illustrating the impacts of groundwater pumping on flux as it pertains to (A) gaining streams and (B) springs. Pumping induces flow away from surface discharge and toward the cone of depression, even when groundwater levels at the source of discharge decrease minimally (Currell 2016b, p. 620).

Pit lake development

As discussed above, open pit mine dewatering is required when a mine's pit extends below the water table in order to keep the mine dry. Once the dewatering ceases, groundwater around the mine will start to recover and as this happens, the mine pit will fill with water, creating a pit lake (Bozan et al., 2022, p. 1822, 1825-1826). Because the volume of the pit below the water table was mostly rock prior to mining, the pit lake represents a substantial water deficit. Evaporation from the surface of the pit lake is another source of water loss (Myers 2014, p. 1). Whether or not a pit lake is backfilled, and the prevailing climate conditions, thus partly control the amount of water that is lost from the system, as well as the rate and extent of groundwater level recovery at the mine site (Bozan et al., 2022, p. 1826). Groundwater level recovery occurs until the net flux into the pit equals the evaporative loss from the pit lake (Ibid, p. 1826). In arid climates, evaporation can greatly exceed precipitation, causing unfilled mine pits to become terminal sinks for groundwater (Ibid). In the study by Bozan et al. 2022, equilibrium lake levels simulated for moderately transmissive aquifer conditions varied between 15–30 m below the premining groundwater table for net evaporation rates of 1,000 and 3,000 mm/year, respectively. The situation was exaggerated if less permeable aquifer conditions were assumed (Bozan et al., 2022, p. 1826, 1830). Based on technical comments submitted by Nevada's Bureau of Mining Regulation and Reclamation, net evaporation rates at mines in Nevada range between 508 mm/year and 1473 mm/year, although these are generally located at higher altitudes than the mining projects around Beatty (BMRR 2021, p. 1-3). For North Bullfrog, the project's hydrogeology baseline work plan (HydroGeoLogica 2021) estimates a net evaporation of 2261 mm/year, but the true figure is likely closer to 1702 mm/year (Ibid).

According to the North bullfrog project POO, dewatered pits at the project site will be backfilled with overburden material to eliminate the formation of pit lakes at closure and the associated evaporative water losses (EM Strategies 2023, p. 15). However, it is not all obvious that this mine closure option will be chosen at other proposed mines as shown by the 22 mining projects for which pit lake evaporation rates have been estimated and reported to NDEP (BMRR 2021, p. 3), or the 38 mines (44% of all mines in the state) in Nevada that are or are expected to become pit lakes according to recent reports (e.g. Nevada Independent 2023, p. 2). Backfilling of open pits can be cost-prohibitive, as exemplified by a recent mine expansion plan document for South Carolina's Haile gold mine which referred to the unfeasibility of backfilling two proposed pits due to cost (OceanaGold 2019 p. 9).

Surface water diversion and/or collection

Construction of mine facilities and roads, and diversion of surface (including meteoritic) water to protect mine infrastructure has the potential to change infiltration, and therefore groundwater flow, patterns. Consumption of surface water during mining operations also directly reduces the amount of water available to recharge aquifers.

Groundwater quality impacts

There are various mine components, described in more detail below, that can become a source of contamination to surface and/or groundwater due to leaks and spills. Among the chemicals that may be released are cyanide, heavy metals and sulfuric acid (Ibid, p. 5). The latter is formed when sulfide minerals present in the ore are exposed to air and water. The acid leaches minerals from the surrounding rock (Gestring and Hadder 2017, p. 5-6), forming a highly toxic solution.

1) Overburden storage areas. Overburden corresponds to all of the unwanted or low value material located between the surface and the targeted ore. It sometimes includes the first layer of soil and vegetation on the surface. Once removed, it is stored in heaps around the site, which can produce dust, and if dust is suppressed with watering, leachate (BTL Liners 2024a, b, p. 1). The latter may run off the waste rock pile, or percolate through the pile, infiltrating groundwater. Leachate may also be produced as a result of rain falling atop the overburden material.
2) Heap leach pads. These large, engineered structures are used to process lower grade ore using surface irrigation with a sodium cyanide solution. The latter infiltrates through the ore, picking up gold and other metals in the process (Gestring and Hadder 2017, p. 5).
3) Ponds and tanks used to collect, store and process solutions and mill tailings. Also liable to spills and leaks are pipelines and surface conveyors.
4) Trucks. The transport of chemicals to the mining site, and waste off-site is another potential source of contamination, as is the long-term storage of waste on-site. Spills associated with truck transport are particularly relevant in the case of the Bullfrog and Reward projects as these two projects are anticipated to share infrastructure but occur on opposite sides of the Amargosa river.

A final source of contamination is pit lakes formed by groundwater seeping back into open pits after mining ceases. Since most open pit gold mines occur in areas of high evaporation, the flow of water is typically into the open pit. However, if outflow occurs, the surrounding groundwater may be contaminated as the outflowing pit lake water is usually of poorer quality (Gestring and Hadder 2017, p. 6). The backfilling of open pits, although preferable from a groundwater recovery standpoint, also poses a risk to groundwater quality. Unlike in the presence of a pit lake, there will be no evaporation once the pit is backfilled, which means groundwater will flow into the backfill and out. As the groundwater infiltrates into the backfill, potential toxins can be leached and transported out of the pit, into surrounding groundwater (Great Basin Resource Watch 2023, p. 8).

There are numerous examples of leaks and spills associated with gold mines. Gestring and Hadder (2017) found that 27 out of the 27 (i.e. 100%) mining operations reviewed in their report (representing 93% of U.S. gold output in 2013) had experienced at least one pipeline spill or other accidental release, including cyanide solution, mine tailings, diesel fuel and ore concentrate (Gestring and Hadder 2017, p. 7-8). Meanwhile, 20 out of the 27 (i.e. 74%) mining operations were reported to have failed to capture or control contaminated mine seepage. The seepage of cyanide solution was one of the more common impacts (Ibid, p. 8). The potential for groundwater contamination depends in part on the local climate (Ibid), with the aridity of Oasis Valley (6 inches per year in the lowlands and 8-13 inches in higher elevation areas) (DRI 2023, p. 3) limiting vertical and horizontal flow of meteoritic water. However, ephemeral flows do still occur, and contaminated meteoritic water and/or mine chemicals may percolate into groundwater. At the North Bullfrog Project site, depth to groundwater is relatively deep, varying between less than 165 ft and more than 490 ft (HydroGeoLogica 2021, p. 21), which means that contamination of surface discharge may occur slowly, possibly after the mine has closed. Identifying failures prior to groundwater contamination can also be challenging, even in the presence of leak detection systems, as failures can and have occurred in parts of a mining facility that are unmonitored or difficult to monitor (Gestring and Hadder 2017, p. 8).

The effects of chemical contaminants’ release on amphibians may be lethal, sublethal, direct or indirect. Heavy metals and UV radiation may for example act synergistically with other environmental stressors to compromise the immune system of Western toads (*Anaxyrus boreas*), making them vulnerable to pathogens (Carey 1993 as cited in COSEWIC 2012, p. 48). Heavy metals including zinc, cadmium and copper can negatively impact amphibian growth, development and survival (Glooschenko et al. 1992, Brinkman 1998 as cited in COSEWIC 2012, p. 48). Recent research on Western toads living in arsenic (As) and antimony (Sb) contaminated wetlands found that although tadpoles completed metamorphosis, they accumulated among the highest concentrations of As and Sb ever reported for living vertebrates. Sublethal effects included delayed development and reduced size at metamorphosis (Dovick et al. 2020, p. 2). Rowe et al. (1996, 1998) found that coal ash caused increased incidence of oral deformities, increased metabolic rate and lowered larval survival of the American bullfrog, *Rana catesbeiana*, larvae. Coal ash has also been found to increase corticosterone and testosterone levels, and lower larval survival in the Southern toad, *Anaxyrus terrestris* (Rowe et al. 2001 as cited in AmphibiaWeb 2024, p. 3).

2. *Solar Energy Development*

The BLM recently identified areas open for utility-scale solar energy development as part of its Western Solar Plan amendment (NEPA number: DOI-BLM-HQ-3000-2023-0001-RMP-EIS). The preferred alternative, Alternative 3, includes opening up a significant amount of land in and near Oasis Valley, as shown in **Figure 21**, to utility-scale solar development. This includes lands directly adjacent to, and possibly within, Amargosa toad habitats.

Under the previous (2012) solar plan, BLM established the Amargosa Valley Solar Energy Zone (SEZ), intended to fast track solar development projects, as well as variance and exclusion lands. Variance lands were identified as lower priority lands generally appropriate for solar development (Clarke 2023, p. 2). The Amargosa Valley SEZ and solar energy project applications received by the BLM, in the Amargosa Valley area, as of June 1, 2022 (BLM 2022) are shown in **Figure 22**.

Large solar installations are a threat to the Amargosa toad as construction (primarily dust suppression) and operation consumes water, with recent reports linking drying of local wells to solar plants in California's Colorado Desert (Myskow 2023, *entire;* Wainwright 2023*, entire*). Recent solar plans for nearby Pahrump Valley cite requirements of 1,000 acre-feet or more for construction (Noble Solar 2022, p. 1-24; BLM 2020, p. 3-95). Future solar energy development is thus highly likely to increase pressure on the Death Valley Regional Flow System as a whole due to increased groundwater withdrawals, and may result in increased groundwater demand in Oasis Valley itself, exacerbating the impact of other groundwater uses on the Amargosa toad's habitat.

Inasmuch as the Western Solar Plan revision may result in solar development directly adjacent to Amargosa toad habitat, site-specific impacts must also be considered. Land clearing associated with solar development is also a concern as it may destroy toad habitat, increase sedimentation and promote invasion of exotic plants (Glicksman 2011, p. 114). Fencing around installations could potentially also reduce connectivity between Amargosa toad metapopulations. Road construction for access to the sites increase wildlife vehicle interactions and dust (Mulvaney 2017, p. 505). While much of the Amargosa toad's habitat is in areas with various protective statuses, this does not insulate them from the impacts of adjacent utility-scale solar development. "Proximity impacts result from the fragmentation and degradation of land near and between protected areas," due to solar development (Hernandez et al. 2015, p. 13581).

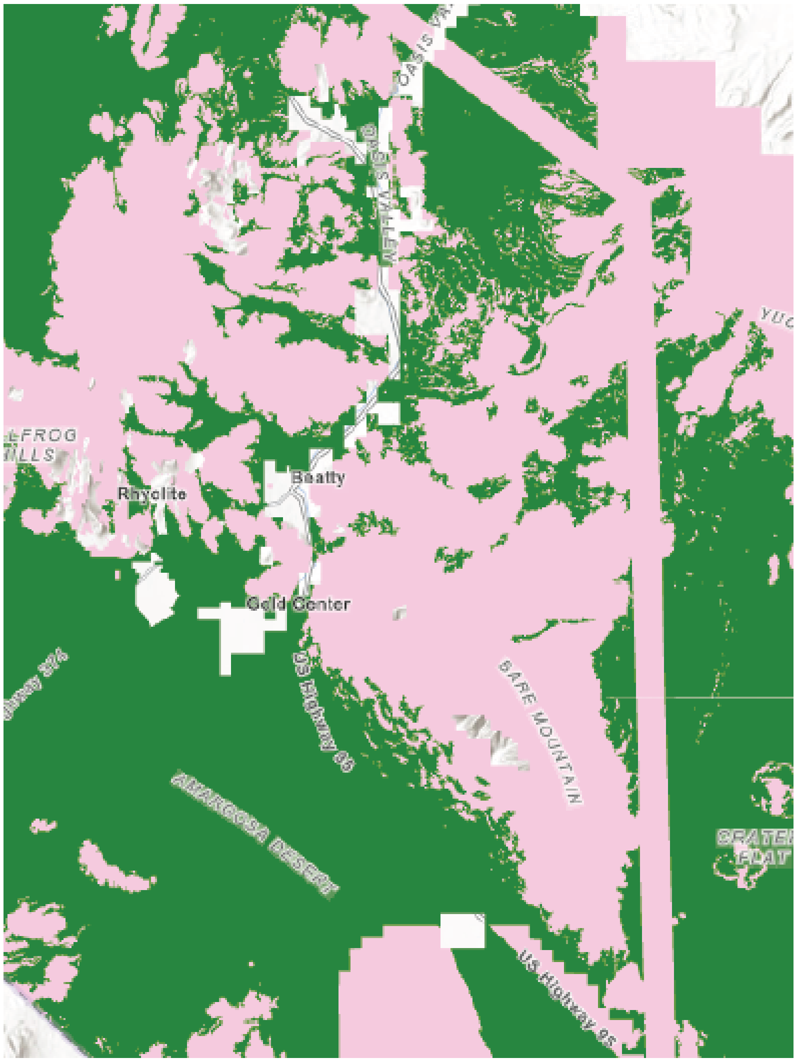

Figure 21. Alternative 3 of the Western Solar Plan Programmatic Environmental Impact Statement Revision is shown in forest green (Map from Center for Biological Diversity based on data from BLM 2024b).

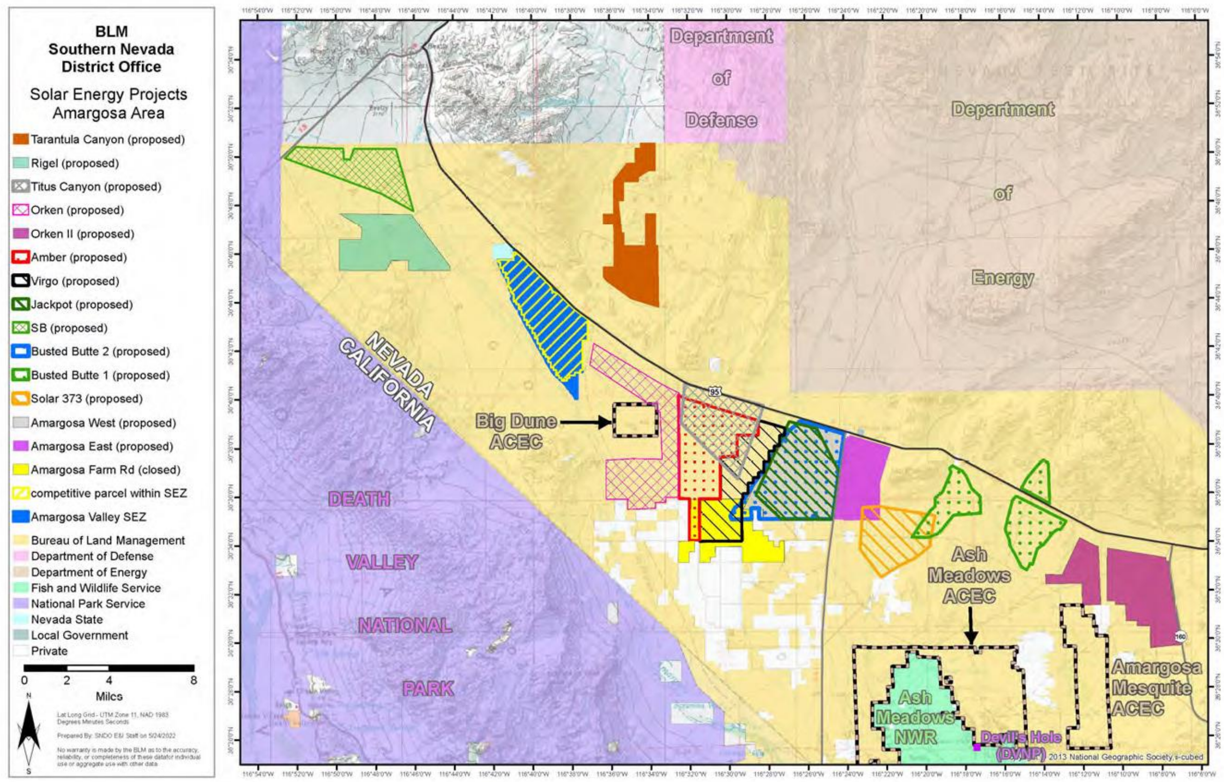

Figure 22. Solar energy projects in the Amargosa Valley area. The Ponderosa Solar application, received 6/2/2022, is not depicted (BLM 2022, p. 12).

3. *Wild Burros*

Wild burros are an invasive species in North America and invasive species are known to be one of the most widespread and serious threats to the integrity of native wildlife populations due to the habitat degradation they cause in native ecosystems (Wildlife Society 2014, p. 1). While light to moderate disturbance by wild burros may benefit the Amargosa toad by preventing the overgrowth of vegetation and keeping areas open (USFWS 2010a, p. 42047 and ATWG 2005 cited therein), intensive disturbance is likely to lead to significant habitat degradation. Large herbivores such as burros disturb landscapes by trampling soils and vegetation, selectively grazing palatable plants, and altering the distribution of nutrients in the ecosystem. Burros and horses ingest more forage per unit of body mass than any other large-bodied grazer in western North America (Wildlife Society 2014, p. 1-2). Research in the Great Basin has also found that areas with feral horses have fewer plant species and less grass, shrub, and overall plant cover than areas without, and more invasive plant species and weeds such as cheatgrass, which degrades wildlife habitat. Riparian and wetland areas may furthermore be impacted by burros through soil compaction and increased erosion (Ibid, p. 1), as well as decreased water quality and accelerated drying and loss of pool habitats during spring and summer months (NDOW 2000, p. A-5).

In addition to the aforementioned forms of habitat degradation, burros can trample all life stages of toads causing direct mortality and this effect is particularly a concern during key periods of the toad's life history such as breeding, egg-laying, maturation and emergence of toadlets (NDOW 2000, p. A-5). Burros may also destroy burrows used by the toads for shelter, or disturb the toads and disrupt their behavior (USFWS 2014a, p. 24291), and affect microclimatic conditions. In Targhee National Forest, thousands of boreal toad metamorphs were killed due to herding of sheep through a drying pond where the toads were concentrated; hundreds of toads perished due to trampling while hundreds more died afterward due to desiccation. The latter was caused by vegetation that had been used by the toads for cover getting trampled to the point that it no longer provided moist microhabitats (Keinath and McGee 2005, p. 38 and Bartelt 1998, 2000 cited therein).

In 2010, the Service argued that burro use of the toad's habitat was "light to moderate" (USFWS 2010a, p. 42047) and that the BLM manages the feral burro population and conducts gathers whenever the population numbers exceed the appropriate management level for the area, in accordance with the 2000 Amargosa Toad Conservation Agreement and Strategy (CAS) (Ibid). In 2000, there were just ~30 wild burros in the Bullfrog Herd Management Area (HMA) as a result of past removals, and it was indeed suggested that additional removal may occur if wild burros are determined to be negatively impacting Amargosa toads or their habitat (NDOW 2000, p. A-16). In 2012, the number of wild burros within and outside the HMA boundary was estimated to be 195 (although the real number was believed to be higher) (BLM 2012, p. 2), or approximately 214% of the high range of Appropriate Management Level (AML), 336% of the low range of AML (Ibid, p. 4-5) and 650% of the population size at the time of writing of the CAS. The BLM announced that it would implement phased burro gathers over the period 2012 through 2018 to 2022 to achieve a post-gather population in the HMA of 58 wild burros (Ibid, p. 3). It argued that without the prompt removal of the excess wild burros, "habitat for the sensitive Amargosa toad […] would continue to be impacted by the overpopulation of wild burros", and there would be "potential degradation or loss of Amargosa toad […] habitat as wild burros increasingly concentrate at riparian areas" (Ibid, p. 5). It further stated that many of the riparian areas within the HMA are critical habitat for the toad and that many of the riparian areas within the HMA that are accessible to wild burros have been degraded by heavy and concentrated use by wild burros (Ibid).

In 2019, the pre-gather population within and outside of the HMA was 828 (BLM 2019, p. 1), despite at least 3 previous gathers (BLM 2018, p. 1) since the BLM's decision to implement the Bullfrog HMA Wild Burro Gather Plan (BLM 2012, p. 1). The 2019 population count was 425% of that in 2012, 909% of the established AML of 58-91 (BLM 2019, p. 1) and 2760% of the burro population size in 2000. Thus, no overall reduction in burro population size was achieved in the lead up to the 2019 gather. The high number of burros was also noted by the BLM to have resulted in degradation of the landscape and negative impacts to other species sharing the habitat

(Ibid). The number of burros to be removed in 2019 was ~600, with the remaining ~282 burros set to remain in the HMA due to limited space in off-range holding facilities (Ibid). Two hundred eighty-two burros is still 144% of the population in 2012, 310% of the high range of AML and 940% of the population in 2000. The burro population is also reported to have continued to increase since 2018, and that the Beatty Town Advisory Board has requested another gather (Pahrump Valley Times 2023b, p. 1). Recent field investigations found burro grazing-related impacts at Brian Spring and Beatty Narrows (DRI 2023, p. 25, 44).

The BLM's Bullfrog HMA website suggests that the current AML is 55-91 burros and that it applies to just a portion of the HMA, with the decision to establish AML for the remainder of the HMA under appeal (BLM 2023b, p. 1). However, it is unclear how up-to-date this information is, and regardless, based on the information presented above, burros are not being managed in a manner consistent with Amargosa toad conservation.

4. *Livestock Grazing*

Livestock grazing is one of the most widespread land management practices in western North America and it has been associated with a wide range of negative impacts on habitat and vertebrate taxa, including amphibians (Fleischner 1994, p. 636; Knutson et al., 2004, p. 677; Schmutzer et al., 2008, p. 2622). Livestock grazing can increase soil compaction, decrease infiltration rates, increase runoff, decrease riparian vegetation, increase stream sedimentation and water temperature, contaminate water through excrement and promote invasive species, among other changes (Batchelor et al. 2015, p. 931; Kimball & Schiffman 2003 as cited in Filazzola et al. 2020; USFWS 2022, p. 72 and references therein). These changes are significant as even small deviations in water quantity and quality could potentially negatively impact the Amargosa toad. The loss of vegetation (and potentially the change in composition) may also affect the availability of prey items and the toad's ability to shelter from predators and the heat (NDOW 2023b, p. 3).

In addition to causing habitat degradation, livestock can trample toads and their burrows, and ingest toad eggs. An indirect effect of grazing can furthermore include the development of water tanks for livestock. In some cases, stock-tanks are used for stocking nonnative fish for fishing, or they may support other nonnative aquatic species such as bullfrogs or crayfish (USFWS 2022, p. 72-73), all of which increase the likelihood of negative interactions with the Amargosa toad. Another potential effect of livestock grazing is increased isolation and population fragmentation due to habitat degradation (USFWS 2014a, p. 24289).

The town of Beatty is co-located with BLM's Razorback grazing allotment, which according to PEER, was failing Land Health Standard Evaluations as of 2020, with livestock grazing a significant causal factor (PEER 2020, p. 1). Recent field investigations found livestock grazing impacts at both the Upper and Lower 7J Ranch, Torrance Ranch East, Brian Spring and Beatty Narrows (DRI 2023, p. 25).

5. *Off-Road Vehicles*

Amargosa toads are most affected by ORV activity during the breeding season, and during the egg and tadpole stages of development which are particularly vulnerable (USFWS 2010a, p. 42047). In 2010, ORVs were apparently only known to be a concern along the Amargosa River near the Stagecoach Hotel and Casino and education efforts were underway and forthcoming about the need to avoid ponded water/breeding pools during the breeding season. It was also suggested that ORV events near Crystal Spring were not a threat to the Amargosa toad due to the re-routing away from toad habitat (Ibid). However, ORV trails occur all around the Beatty area (Appendix C), riding outside of designated trails is a potential threat, and it is not at all clear that riders will indeed avoid toads (see Sopwith Motorsports 2013, p. 3-4). In addition to trampling toads, ORVs can cause soil compaction, which can reduce water infiltration, increase run-off, and cause severe erosion problems (Taylor, n.d., p. 3). ORVs also reduce vegetative cover, with a single vehicle pass capable of destroying or disrupting many types of plants, microfloral crusts and soils. Plants with shallow root systems often found in desert and arid regions are particularly vulnerable (Ibid, p. 4). The loss of vegetative cover increases susceptibility to erosion, reduces water penetration (Ibid), compromises the ability of Amargosa toads to find shelter, and potentially increases water temperature (Ibid, p. 5). ORVs are additionally a source of air pollution and can release gasoline and motor oil into soils and waters as a result of inefficient combustion and emissions (Havlick 2002 as cited Taylor, n.d., p. 2). Finally, based on changes documented in other taxonomic groups and Couch's spadefoot toad in response to disturbance, ORV activity could potentially cause important physiological and behavioral changes in the Amargosa toad (Taylor, n.d. p. 6-7 and references therein).

6. *Roads*

Maintenance activities along US highway 95 and highway surface runoff threaten the long-term viability of Amargosa toad populations adjacent to and in the road corridor (NDOW 2000, p. A-5). Use of heavy equipment may lead to direct mortality as well as soil compaction, while mowing may cause direct mortality as well as reduce cover availability, soil moisture and prey densities (Jochimsen et al. 2004, p. 29). Amphibians are also sensitive to the different toxic substances associated with road maintenance or emitted by vehicles capable of dissolving in fatty tissues, and to heavy metals that may accumulate in their bodies. Exposure to the compounds could affect reproduction and be lethal in the long-term (Jochimsen et al. 2004, p. 11 and Lodé 2000 cited therein). Surface runoff may lead to not only physiological impacts and habitat pollution, but also affect water levels in adjacent wetlands and consequently the suitability of this habitat for the toad's life history requirements (Jochimsen et al. 2004, p. 28 and Richter 1997 cited therein). Roads can furthermore cause invasion of roadside species (Jochimsen et al. 2004, p. 27), create physical or behavioral barriers to movement (Bouchard et al 2009 as cited in Cosentino et al. 2014, p. 36), and cause roadkill mortality when individuals do cross-over (Cosentino et al. 2014, p. 32 and references cited therein).

The combined outer limits of the many different ecological effects involving species, soil, and water that extend beyond the road surface describe a "road-effect zone" that may reach as far as 800 meters (Jochimsen et al. 2014, p. 27 and references cited therein). The vast majority of the overall habitat of the Amargosa toad occurs within 800 meters of Highway 95.

7. *Invasive Plants*

Nonnative invasive plant species such as Russian Olive and tamarisk have significantly altered riparian plant communities, directly impacting the Amargosa toad and other native species through increased transpiration and alteration of habitat structure (NDOW 2000, p. A-6). Efforts to remove nonnative invasive plants from the Amargosa River watershed have occurred since 2003 (USFWS 2010a, p. 42047) and are ongoing. However, recent field investigations found numerous invasive species in the Torrance Ranch East area (DRI 2023, p. 37), and invasive tamarisk at Beatty Narrows, despite repeated removal efforts (Ibid, p. 55). Invasive species were also observed at Parker Ranch, Brian Spring, the Upper 7J ranch and the Stagecoach area (Ibid, p. 26, 44, 45, 51). Efforts to control invasive plants are, moreover, likely to be hampered by threats such as reduced river flows and ORVs, which may act to promote the spread of invasives (University of California and California Exotic Pest Plant Council 1996, p. 2).

8. *Water abstraction and diversion*

As described in Section IV, Amargosa toad habitat (and potential habitat) continues to be impacted by surface water diversion and water abstraction. At Crystal Spring, DRI 2023 found clear evidence of impacts to the surrounding ecosystem from water abstraction and surface water diversion, and water abstraction-related impacts were noted to be ongoing due to the continuing use of Crystal Spring as a source of domestic water supply (DRI 2023, p. 40). At nearby Brian Spring, a French drain diverts water to a watering trough, and these man-made features were likely put in place to facilitate livestock water access, while excluding livestock from restored Amargosa toad habitat (DRI 2023, p. 44). In the Stagecoach area of the Amargosa river, there is evidence of surface water diversion and water abstraction (Ibid, p. 51). At Parker Ranch, a large fishing pond was reconstructed into a series of small ponds but water there is insufficient (Ibid, p. 45-46). At Upper 7J Ranch, surface water flows downgradient of the ponded spring, but the spring's discharge was an order of magnitude higher prior to the ponding (Ibid, p. 26).

Water abstraction is a threat to the Amargosa toad for the reasons outlined in section 1, including fewer population resources, inability to breed, inability to withstand deviations in water quality, reduced ability to coexist with other species (including nonnatives), and reduced connectivity. Surface water diversion is arguably less harmful than water abstraction but is also a significant threat as it degrades the natural habitat and hydrological regime which the toad is adapted to.

B. Disease or Predation

The amphibian disease chytridiomycosis, caused by the fungus *Batrachochytrium dendrobatidis,* (Bd) is a threat to the Amargosa toad. The disease has been linked to amphibian extirpations and declines, including declines among populations of the closely related *A. boreas* (Gordon et al. 2017, p. 136). A known vector for chytridiomycosis is the non-native North American bullfrog (*Rana catesbeiana*) (Ibid), which occurs at sites throughout Oasis Valley occupied by the toad and has indeed been shown to carry the fungus (USFWS 2010a, p. 42049). Another potential vector is the introduced red swamp crayfish (*Procambarus clarkii*) which also co-occurs with the Amargosa toad (Forrest et al. 2015, p. 922). Chytridiomycosis has been identified post-hoc as the cause of death in captive *Anaxyrus nelsoni*, but up until recently Bd was assumed to be constrained by the high ambient temperatures often present in Oasis Valley (Forrest et al. 2015, p. 918). Recent research reveals high levels of Bd infection in both bullfrogs and Amargosa toads during summer months, possibly explained by the more moderate body and water temperatures experienced by these amphibians (Ibid, p. 917). The data also suggest that the Amargosa toad can clear Bd infection, and due to lack of obvious symptoms may resist or tolerate the pathogen (Ibid). However, more subtle influences of the pathogen on overall survivorship or reproduction were not assessed. It is also possible that the Bd strain currently infecting the region is less virulent (Ibid, p. 922).

Predation of all life stages of the Amargosa toad by bullfrogs and nonnative crayfish is also a threat to the Amargosa toad at the metapopulation level (USFWS 2010a, p. 42049). The toad’s metapopulation structure can help ensure predator and prey are not present in all occupied patches all of the time (USFWS 2010a, p. 42029 and Simandle 2006 cited therein). However, other stresses such as diminishing water resources caused by groundwater pumping can limit the amount of habitat available for toads to escape to and colonize in response to threats. These other stresses can also increase local extinctions, limiting the toad’s ability to maintain its metapopulation structure. Other species that may grow to have a more substantial effect on the toad as a result of the cumulative effect of predation and other threats include mosquitofish and largemouth bass (see USFWS 2010a, p. 42049-42050). Bass are being reported from 7J Ranch (ATWG 2021a, p. 2) and from Bombo’s pond, near Beatty Narrows (NDOW 2024, p. 1-2). A fishing app known as Fishbrain also shows catches of nonnative species at Revert Springs and Beatty Springs along the Amargosa River (Fishbrain 2024a, p. 1; Fishbrain 2024b, p. 1).

C. Overutilization

Overutilization of the Amargosa toad for commercial, recreational, scientific or educational purposes is not known to be a factor.

D. Inadequacy of Existing Regulatory Mechanisms

1. *Federal Mechanisms*

National Environmental Policy Act
The National Environmental Policy Act provides some protection for the Amargosa toad. For activities undertaken, authorized, or funded by federal agencies, NEPA requires that the potential impacts of projects on the human environment be analyzed prior to implementation (42 U.S.C 4371 et seq.). If significant environmental effects are predicted to occur, the Federal agency must propose mitigations that could offset those effects (40 CFR 1502.16) (USFWS 2009a, p. 16). However, the law only requires agencies to disclose the impacts of their actions; it does not prohibit agencies from choosing alternatives that will negatively affect the Amargosa toad. Moreover, actions taken by private landowners or state agencies do not generally need to comply with NEPA since only projects with a Federal nexus (i.e. Federal funding, authorization or permitting) fall under NEPA (Ibid, p. 16).

Clean Water Act
The definition of jurisdictional waters, or the "Waters of the United States" (referred to as "WOTUS") has changed numerous times over the past decade based on Supreme Court rulings, U.S. Environmental Protection Agency (EPA) interpretations of law, and changing administrations. Under the definition of WOTUS promulgated by the Trump administration (the "Navigable Waters Protection Rule"), endorheic basins without perennial surface water connections to traditionally navigable waterways, such as Oasis Valley, were considered non-jurisdictional, and any water features within them were exempt from the Clean Water Act (CWA) (EPA 2020, p. 22251). A new definition took effect under the Biden administration in March 2023 (EPA 2023) and includes, among other water features, the following: interstate waters, certain tributaries to interstate waters, and wetlands adjacent to interstate waters (EPA 2023, p. 3005-3006). The EPA further notes "Interstate waters thus include waters that cross or form a part of State boundaries with other States and with other countries (Canada and Mexico). Examples of such waters include portions of the Amargosa River, which flows from Nevada into a dry playa in Death Valley, California, and the Great Dismal Swamp, a wetland which crosses the border between Virginia and North Carolina. The Amargosa River is not a traditional navigable water and does not otherwise flow to a traditional navigable water or the territorial seas, but under the agencies' pre-2015 regulations and the final rule, the portion of the Amargosa River that crosses the California/Nevada border is an interstate water. Tributaries to interstate waters like the Amargosa River and wetlands adjacent to interstate waters and their tributaries

are critical sources of life in desert climates." (EPA 2023, p 3072). However, whether or not the Amargosa River in Oasis Valley and associated wetlands would be considered jurisdictional under this latest rule is unclear. Moreover, while the USFWS can review permit applications under section 404 of the CWA, and provide recommendation for avoiding and minimizing impacts and implementing conservation measures for fish and wildlife resources, incorporation of these recommendations into permits is at discretion of the U.S. Army Corps of Engineers (USFWS 2014b, p. 51060).

2. *State Mechanisms*

The Amargosa toad is identified as a Species of Greatest Conservation Need in the Nevada Wildlife Action Plan (WAP) 2022 Revision (NDOW 2022a, p. 38). The WAP serves as a comprehensive, landscape level plan, identifying the species of greatest conservation need and the key habitats they rely on, with the intent to prevent wildlife species from becoming threatened or endangered. The WAP contains conservation actions to guide conservation of Nevada's key habitats and priority species, and many of these actions are strategies identified in other existing conservation plans. However, the WAP's recommended actions in no way represent a mandate or expectation for a given party to carry out or implement these actions (Ibid, p. 241). Conservation Agreements and Strategies identified in the WAP include the Amargosa toad CAS (Ibid, p. 7), described in more detail below.

The Amargosa toad is also included on the NDNH At-Risk Plant and Animal Tracking List (NDNH 2023, p. 20). This list directs NDNHs data acquisition priorities and provides up to date information on the status of these taxa. Taxa considered at-risk and actively inventoried by NDNH usually include federal or other Nevada agency status species, as well as those with global and/or state ranks 1-3, indicating some level of imperilment (Ibid, p. 1). The Amargosa toad has a global and state rank of 2 (imperiled) and is designated by the BLM and the state respectively as a Sensitive Species and a Protected Amphibian (NAC 503.075.2) (Ibid, pp. 20, 23-24). Fully protected species under state law are regulated by NRS 503.584 to 503.589 (inclusive), implemented through code in NAC 503. State protection is functionally a regulated take program, where the department must issue a permit to anyone wishing to "take" a state protected species. However, these state protections have never been used to prevent the destruction of protected species habitat. And indeed, these protections do not apply to actions undertaken by the federal government. For instance, despite the fact that the Moorman White River springfish (*Crenichthys baileyi thermophilus*) is on the list of fully protected species (NAC 503.065), BLM issued oil and gas leases within one mile of its habitat (BLM 2017, p. 10). State fully protected species status is inadequate to protect the Amargosa toad from federal actions which could impact its habitat, such as permitting of gold mines that could dry up springs the toad depends on for its survival.

The state of Nevada also cannot be relied on for safeguarding groundwater resources. First, the state's concept of "perennial yield" allows for the unmitigated destruction of all unallocated surface water resources. Perennial yield is notably not defined in statute, but a working definition is "[T]he maximum amount of groundwater that can be salvaged each year over the long term without depleting the groundwater reservoir. The perennial yield cannot be more than the natural recharge of the groundwater reservoir and is usually limited to the maximum amount of natural discharge." (Nevada Department of Conservation and Natural Resources n.d., p. 6). What this functionally means is that the state of Nevada makes available for appropriation an amount of water equivalent to that which is discharged within a basin through surface discharge and evapotranspiration through phreatophytic vegetation. As such, if a basin is fully appropriated and all of those water rights are being exercised, the long-term effect will be to cease all surface discharge and eliminate all phreatophytes (Bredehoeft & Durbin 2009, p. 4).

3. *Other Mechanisms*

The Amargosa Toad Working Group (ATWG) was established in 1996 to provide recommendations for the management and conservation of the Amargosa toad, and includes representatives of the Service, NDOW, TNC, BLM and other public and private stakeholders. The ATWG meets twice a year to present and exchange information on the toad, its habitat, ongoing habitat projects, potential threats, and to identify new conservation tasks (USFWS 2010a, p. 43043-42044). Many of the conservation actions implemented by the ATWG and its partners are due to commitments made in the CAS, completed in 2000. The goals of the CAS are to manage threats, maintain habitats, monitor populations, and test and evaluate habitat manipulations (USFWS 2010a, p. 42044).

At the time of writing of USFWS 2010a, progress had been made towards achieving CAS goals through monitoring and research, habitat protection and restoration, invasive vegetation removal, predator control, public education and outreach, and work with local community to achieve conservation such as an open space plan (USFWS 2010a, p. 42044). The ATWG was also in the process of updating the CAS, with the revised version anticipated to identify the conservation needs of the toad for the next 10 years and operate in a manner similar to the previous CAS (USFWS 2010a, p. 42044). Revision of the CAS was still in progress as of June 2023 but conservation efforts by the ATWG have continued to occur. A recent example is Amargosa toad habitat enhancement/restoration at Beatty Narrows (ATWG 2021a, p. 2; ATWG 2021b, p. 7).

Other examples of conservation efforts in the last ca. 10 years have included habitat restoration in the Stagecoach and Torrance Ranch areas (DRI 2023, p. 33, 49), habitat restoration at the Crystal Spring Complex (ongoing), amphibian disease (Bd) assessments (Wildlife Action Plan Team 2012, p. S-61; Forrest et al., 2015, *entire*), and management actions by private and public partners such as STORM-OV (Wildlife Action Plan Team 2012, p. S-62). 7J Ranch was also acquired by TNC in 2019, with conservation efforts including invasive species removal and modification of grazing practices.

Despite past and current conservation efforts, however, the habitat of the Amargosa toad continues to be impacted by grazing, invasive species and other human disturbances such as water diversion. Most importantly, the Amargosa toad needs water to survive, and existing efforts do not adequately protect the toad against the threat of declining groundwater levels due to gold mining.

E. Other Factors

1. Woodhouse's toad

Woodhouse's toad (*Anaxyrus woodhousii*) is a generalist bufonid occurring widely throughout the United States. It is highly successful at exploiting newly available habitat, and over the past century has used this ability to substantially expand its distribution in California and Nevada (Bleich 2021, p. 8 and references therein). Recently, *A. woodhousii* has been confirmed at multiple locations along the Amargosa River, and potentially within 100 km of Oasis Valley (Bleich 2021, p. 13).

Anaxyrus sp. are particularly vulnerable to congeneric hybridization, and interbreeding between *A. woodhousii* and ≥ 10 other bufonids has posed a conservation risk to several taxa (Bleich 2021, p. 12 and references therein). If *A. woodhousii* becomes sympatric with *A. nelsoni*, hybridization, the transmission of disease, behavioral modifications and competition will likely compromise the viability of the spatially restricted Amargosa toad (Bleich 2021, p. 12-13 and references therein). Northward dispersal of *A. woodhousii* and subsequent sympatry with *A. nelsoni* could result in an egregious and perhaps irreversible situation (Bleich 2021, p. 13).

2. Climate Change

The climate of Nevada is changing (State of Nevada Climate Initiative 2020, p. 1). Average temperatures have been increasing and 8 of the 10 warmest years since 1895 have occurred since 2000. In the near term, a warming of 4-6°F is projected throughout the state (Ibid, p. 5). Temperatures in excess of an ectotherm's critical thermal maximum or thermal optimum can impair fitness, limit activity or induce mortality (Greenberg and Palen 2021, p. 1-2). Increased temperatures will also lead to increased evaporative demand, and consequently increased drying of vegetation and soils (State of Nevada Climate Initiative 2020, p. 11). These water losses may exacerbate temperature effects (Greenberg and Palen 2021, p. 7), in addition to degrading the wetland habitat the toad needs for breeding, shelter and food.

Increasing air temperatures are also projected to lead to a longer growing season, with plants likely demanding more water overall (State of Nevada Climate Initiative, 2020, p. 15), and hence reducing the amount available to wildlife. Moreover, decreased surface-water resources generally means more groundwater withdrawal and more requests for water-well construction permits. Water development usually takes priority over aquatic habitats when the availability of water is limited by climatic conditions (USFWS 2014b, p. 51056).

Climate change may additionally increase the fire risk. Winter precipitation is projected to increase throughout Nevada and evaporative demand in both spring and summer is projected to increase by 5-15% in the near term. These conditions will likely lead to more vegetation and fuels growth followed by faster drying of vegetation, resulting in an increased fire risk (State of Nevada Climate Initiative, 2020, p. 18 and McEvoy et al 2020 cited therein). While some amount of burning may be beneficial for the toad due to a reduction in the emergent aquatic vegetation (USFWS 2010a, p. 42051), more severe burning may lead to direct mortality as well as loss of habitat.

Finally, according to Nevada’s 2012 WAP, models have predicted that for Oasis Valley and Amargosa River species in particular, there will be an increased potential for summer monsoonal precipitation patterns. While this could increase and extend base flow conditions for associated stream habitats, it may also increase the frequency of stochastic rain events with increased potential for flood events, channel scouring and channelization (Wildlife Action Plan Team 2012, p. 232). The negative effects of increased flooding on the Amargosa toad if realized could include displacement of individuals onto unsuitable habitat, destruction of habitat, and spread of non-native species, with potentially some offsetting through creation of new suitable habitat and facilitation of toad movement among different sites (USFWS 2010a, p. 42042). Due to modelling uncertainty, the authors of the WAP predicted that the net effects of climate change would be neutral through 2022 (Wildlife Action Plan Team 2012, p. 232). However, their assessment did not discuss in detail the impacts of precipitation-related threats, nor mention increasing evaporative demand or other potential threats associated with climate change. Over the past 30 years, the Mojave Desert climate has become hotter and drier, with longer periods of drought, and projections show that warming and drying will continue (TNC 2024b, p. 5).

3. *Stochastic events*

Stochasticity in the form of demographic, genetic, and environmental stochasticity, and catastrophic events (USFWS 2009b, p. 19), are another potential threat to the Amargosa toad.

Demographic stochasticity is the random survival and/or reproduction variability among individuals within a population. In small populations, reduced reproduction or die-offs of a certain age-class will significantly impact the whole population (Ibid).

Genetic stochasticity arises from the changes in gene frequencies due to the founder effect, random fixation, or inbreeding bottlenecks. Founder effect is the loss of genetic variation upon establishment of a new population by a very small number of individuals. Random fixation is when some portion of loci is fixed at a selectively unfavorable allele due to insufficient selection intensity for overcoming random genetic drift. The latter occurs when only a subset of alleles in the population is transmitted to the next generation, because only a fraction of all possible zygotes become breeding adults. A bottleneck refers to an evolutionary event characterized by a significant percentage of a population being killed or prevented from breeding. In small populations, these factors may lead to less genetic diversity being retained and greater chances of deleterious recessive genes being expressed. Loss of diversity could limit the species' adaptability to environmental changes and contribute to "inbreeding depression", which is the loss of reproductive fitness and vigor. Deleterious genes could reduce individuals' viability and reproductive success (USFWS 2009b, p. 19-20).

Environmental stochasticity is the seasonal variation in birth and death rates caused by weather, disease, competition, predation, or other factors external to the population. A low population year combined with drought or an external factor such as the introduction of the non-native Woodhouse's toad could be catastrophic for the Amargosa toad (USFWS 2009b, p. 19-20). Catastrophic events are an extreme form of environmental stochasticity and, although generally infrequent, can have disastrous effects on small populations, up to and including extinctions (Ibid).

The Amargosa toad is particularly vulnerable to catastrophic events as well as other threats due to not only its small population size but also its small range. The smaller the range, the greater the likelihood that multiple populations will be affected by the same threatening event and the greater the likelihood that insufficient habitat will remain to support a viable population. As noted in the Amargosa toad CAS (NDOW 2000), on p. A-4: "Species that are endemic to geographically small areas such as the Amargosa toad, are more vulnerable to certain threats than wide-ranging species. For, example the loss of one breeding site may be a substantial concern for the Amargosa toad whereas a similar loss would result in a negligible effect on the widely distributed and relatively abundant Pacific treefrog (*Psuedacris regilla*)".

VI. REQUEST FOR CRITICAL HABITAT DESIGNATION

The Center for Biological Diversity formally requests the Service designate critical habitat for the Amargosa toad concurrently with listing, as required by the ESA (16 U.S.C. 1533(a)(3A)). Critical habitat as defined by Section 3 of the ESA is: (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, 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) the specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species. 16 U.S.C. § 1532(5).

Critical habitat should include all existing habitat of the Amargosa toad and areas with potential for recovery and determined to be important to the survival and recovery of the species.

VII. CONCLUSION

The Amargosa toad is a narrowly endemic species occupying one 14 mile stretch of the Amargosa River. It has long faced threats such as trampling by non-native ungulates, invasive species, water abstraction and diversion leading to habitat degradation and destruction, ORVs, highways, and more. Twice previously, the Center and its predecessors have petitioned to protect this species under the Endangered Species Act. Twice, the Service has declined to list the species, largely on the basis of ongoing conservation efforts in Oasis Valley. While these efforts have had some successes, the Amargosa toad continues to remain in a highly precarious state and now faces a new existential threat.

Seven gold mining projects have been proposed encircling the toad's habitat in Oasis Valley, with most if not all anticipated to involve open pits. Groundwater pumping and dewatering for these gold mines could have severe impacts on the availability of groundwater to sustain the toad's habitat. Just one of these gold mines is under environmental review right now, and it will withdraw up to 2,500 afy from Oasis Valley and a likely connected aquifer in Sarcobatus Flat via dewatering and production pumping. This water consumption is modeled to cause significant declines on the Amargosa River and the toad habitats therein. Simulated pumping scenarios examining cumulative water withdrawals from the development of four mines show widespread drawdown across the Oasis Valley. This could spell extinction for the Amargosa toad.

Oasis Valley is set to become the epicenter of a vast new gold mining district, with over half a dozen gold mines putting tremendous stress on the delicate aquifer which sustains the Amargosa River. The Amargosa toad is entirely reliant on sustained discharge of groundwater for its life cycle. Despite well-intentioned conservation efforts by the local community and partners, the threat of groundwater drawdown due to gold mining poses an existential threat to the Amargosa toad. Only the Endangered Species Act can prevent its extinction.

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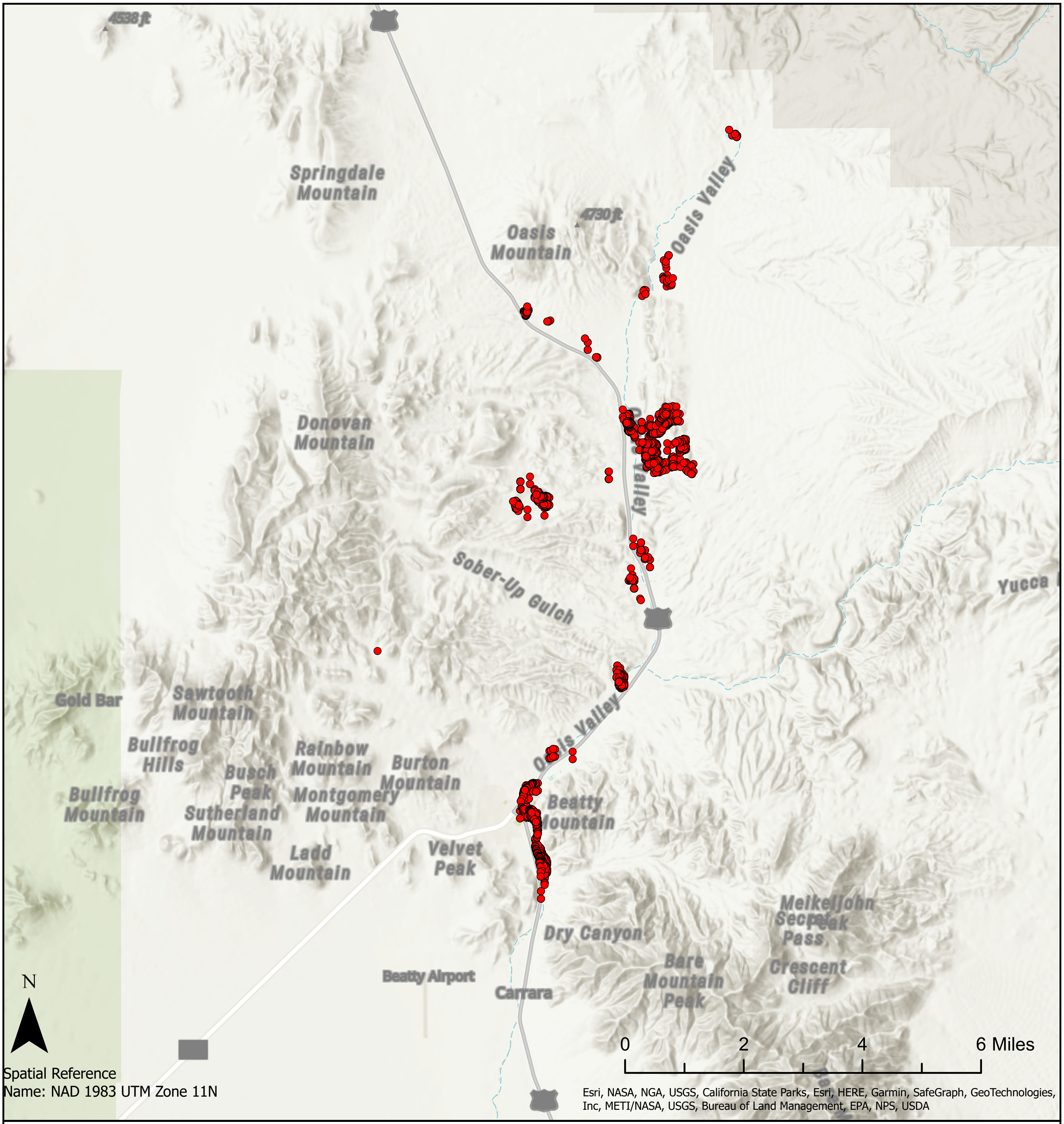
Appendix A



Spatial Reference
Name: NAD 1983 UTM Zone 11N

Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Legend

● Armargosa Toad

Armargosa Toad Occurrences In The Oasis Valley

June 16, 2023

Appendix B

ROUX

MEMORANDUM

Date: May 2, 2024

To: Mason Voehl - Amargosa Conservancy

From: Andy Zdon, P.G., CEG, C.Hg.

Subject: **Preliminary Review - Beatty Area Mine Dewatering**
Amargosa Desert, Oasis Valley and Crater Flat Hydrographic Basins, Nevada

Several proposed mining operations and their associated groundwater pumping projects are situated in the upper Amargosa watershed, specifically in the Amargosa Desert, Oasis Valley, and Crater Flat hydrographic basins. While these operations are in the development phase, the number of them, and the associated potential cumulative impacts on the Amargosa River and feeder springs has raised concerns. Pumping for dewatering and mine operations can have substantial effects on local hydrology, particularly in arid regions such as in the Beatty, Nevada area. On behalf of Amargosa Conservancy, Roux Associates, Inc. (Roux) has modeled multiple scenarios related to potential minerals extraction related groundwater pumping in the Beatty area. This, to obtain a preliminary conceptualization of potential effects to groundwater-dependent ecosystems in the area.

For the purposes of considering the perennial yield and existing underground (groundwater) rights, in this technical memorandum (memo), the Crater Flat, Oasis Valley, and Amargosa Valley hydrographic basins have been lumped with other basins (inclusive of basins #225 through #230) in the surrounding area. These other basins include Mercury Valley, Rock Valley, Fortymile-Jackass Flat, and Fortymile Buckboard Mesa, respectively. The combined estimated perennial yield of these basins is 24,000-acre feet per year (afy), while the committed groundwater rights represent 25,635 afy, indicating an over-allocated area (Nevada Department of Water Resources, 2024).

Numerous regional springs are present in the Oasis Valley basin, a spring is present (Specie Spring) approximately three miles west of the proposed pumping area in the Crater Flat Hydrographic Basin, and Amargosa Desert is the site of Ash Meadows National Wildlife Refuge and its numerous springs, and Devil's Hole. The Amargosa River has perennial flow in segments throughout the Oasis Valley basin.

BACKGROUND

The volume of groundwater in storage is an important aspect of the groundwater system. Changes in storage are identified in the field by changes in groundwater levels. A fundamental groundwater equation and the basis for evaluations of groundwater budgets (inflow vs. outflow estimates) is:

Inflow – Outflow = Change in Storage

When outflow exceeds inflow, there is a negative change of groundwater in storage and groundwater levels can be expected to decline. When inflow exceeds outflow, the reverse is true. When the system is in equilibrium, water levels will generally remain relatively constant despite short-term fluctuations. For the purposes of this evaluation we have evaluated changes to the system based on existing conditions. Long-term groundwater level declines are an indication that outflow is exceeding inflow for an extended period of time. It should also be noted that in many areas, the recovery of groundwater levels following groundwater being removed from storage can take longer than the period it took to decline, depending on the volume removed from storage, groundwater recharge, precipitation trends and the geology of the basin. As will be described further in this memorandum, this aspect of recovery is also observed in the analysis herein.

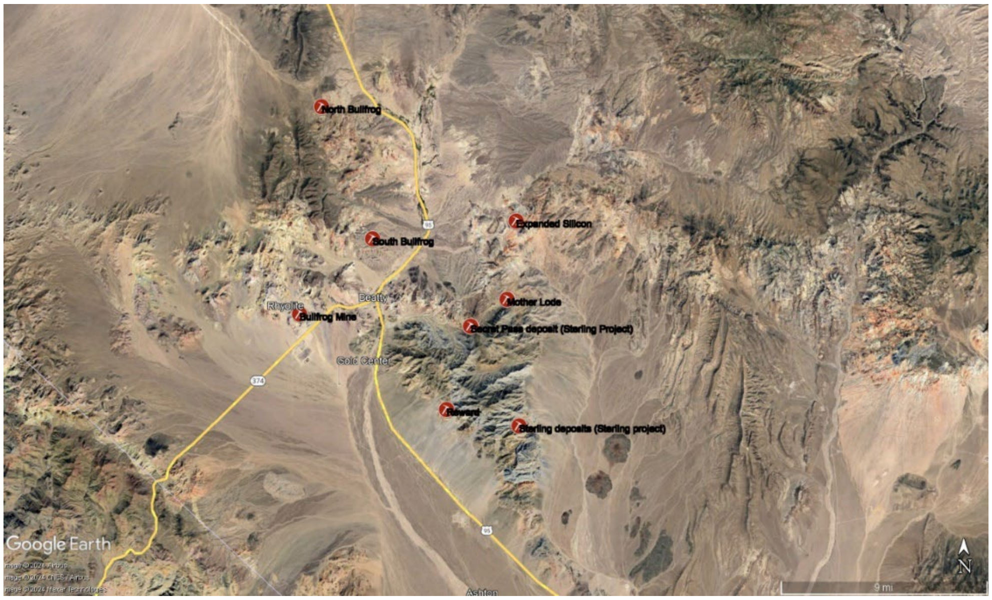
When a groundwater system is in equilibrium where inflow equals outflow, groundwater levels will be stable. Groundwater pumping would cause a disruption in this equilibrium, and recharge amounts and other biological/hydrologic conditions can change. More often, discharge amounts and patterns are impacted.

Regardless of the amount of groundwater pumped, there will always be groundwater drawdown (and the removal of water from storage) in the vicinity of pumping wells, a necessity to induce the flow of groundwater to said wells. For most groundwater systems, the change in storage in response to pumping is a transient phenomenon that occurs as the system readjusts to the pumping stress. The relative contributions of changes in storage, increases in recharge, and decreases in natural discharges evolve over time. If the system can come to a new equilibrium (i.e., a combination of increased recharge and/or decreased discharge), the storage decreases will stop, and inflow will again equal outflow with the changes to the inflow/outflow components described above.

APPROACH

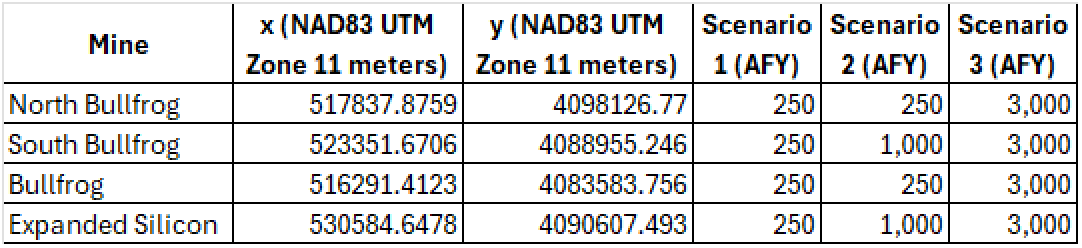
In order to evaluate the effects that pumping for dewatering and other operations from the several potential gold mines could have over an extended period of time, Roux used the U.S. Geological Survey's Death Valley Regional Flow System Model 3 (DV3) developed by Halford and Jackson (2020). The model currently provides the most robust tool for evaluating groundwater changes in the Amargosa Desert area. Given the construction of the DV3 model, the use of the model will provide results (e.g., drawdown) that are relative to existing conditions and water fluxes are not absolute values but changes from "predevelopment" conditions. The distribution of the proposed test mines are provided on Figure 1 below.

Figure 1. Distribution of Local Mines and Proposed Operations



Roux used the DV3 model as developed and made no structural changes to the model. All pumping was assumed to occur in Model Layer #2, as Model Layer #1 is absent in the area. Model Layer #2 is approximately 400 feet thick near the mine locations. Pumping was assumed to continue for 15 years, followed by 15 years of recovery for all scenarios. The selected test locations were assumed to be at the North and South Bullfrog Mines, Bullfrog Mine, and Expanded Silicon Mine (see Table 1 below). Model hydraulic conductivities near the Mother Load and Secret Pass mine locations were too low to support the minimum per-mine trial dewatering rate of 250 afy, so those locations were not simulated. Additionally, the Reward and Sterling deposit locations were not requested by Amargosa Conservancy to be included in this analysis.

Table 1. Simulated Groundwater Extraction Points



Mine	x (NAD83 UTM Zone 11 meters)	y (NAD83 UTM Zone 11 meters)	Scenario 1 (AFY)	Scenario 2 (AFY)	Scenario 3 (AFY)
North Bullfrog	517837.8759	4098126.77	250	250	3,000
South Bullfrog	523351.6706	4088955.246	250	1,000	3,000
Bullfrog	516291.4123	4083583.756	250	250	3,000
Expanded Silicon	530584.6478	4090607.493	250	1,000	3,000

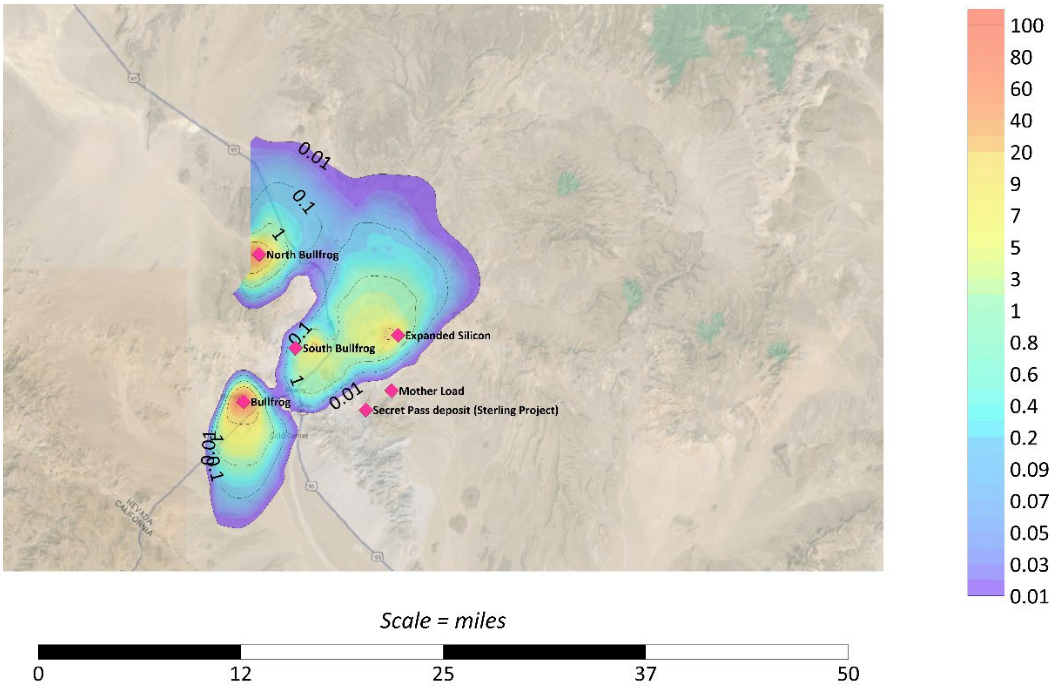
At the four remaining locations (North and South Bullfrog, Bullfrog, and Expanded Silicon), Roux assumed a trial dewatering depth to about 100 feet. This is important for reconciling the pumping rates with the model hydraulic conductivities in the context of the current grid spacing. In general, at the four remaining mine testing locations, transmissivities are too low to support even a 250 afy pumping rate when modeled as points in the x-y plane (i.e., as individual wells). Instead, the coarse grid spacing (in some cases up to about 5,000 feet on the side in the east-west direction), when used with a single well placed within these cells, implies a sort of dewatering drainage system across the finite-sized grid cell. This conceptualization should still produce a reasonable model of the groundwater head perturbation away from the pumped grid cell. Of note is that the North Bullfrog Mine location is close to the edge of the model and hence grid boundary effects may be present.

The dewatering simulations of the North Bullfrog Mine and Bullfrog Mine locations were able to result in the 100 feet of dewatering with about 250 afy of discharge (this is for both Scenarios 1 and 2, attached). For the South Bullfrog Mine and Expanded Silicon Mine locations, Roux moved the pumping location by one grid cell (see white arrows on grid-vs-log hydraulic conductivity figure) into more permeable material to allow evaluation of a higher pumping rate (1,000 afy each, as opposed to 250 afy each). Scenarios 2 and 1 refer to these variations, respectively. Scenario 3 was added as a maximum discharge rate scenario.

DRAWDOWN AND RECOVERY

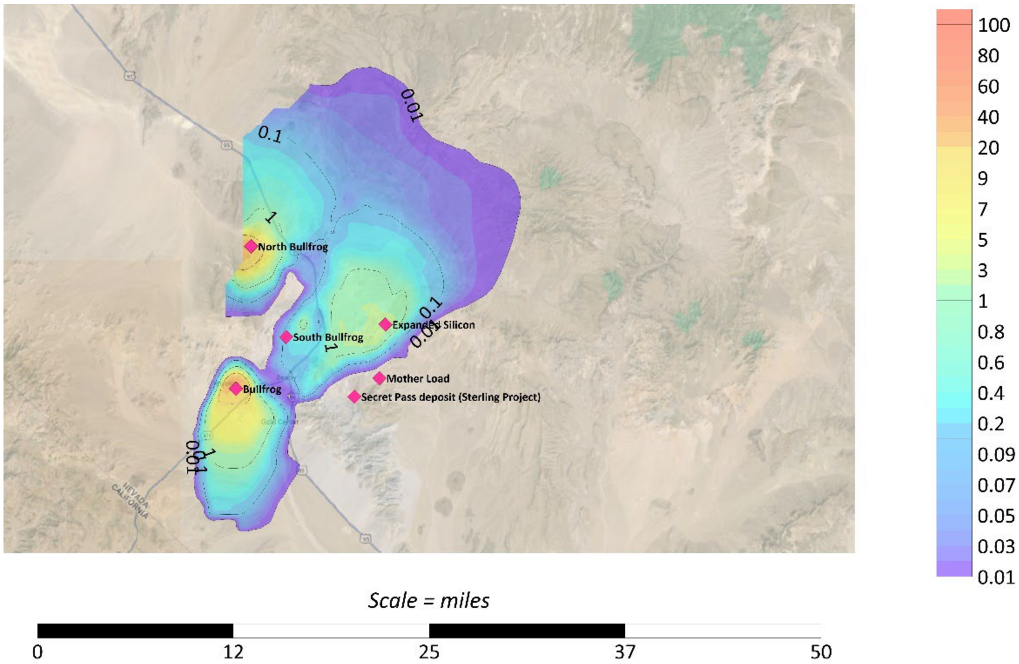
As estimated by DV3, the drawdown from the combined pumping are presented in the figures below (Figures 2 through 7). Scenario 1, which assumed a minimal pumping of 250 afy for 15 years from the four test mine locations, resulted in a cone of depression as presented in Figure 2. As seen on Figure 2, the four individual cones of depression coalesce into a regional cone that extends into the northern Amargosa Desert hydrographic basin on the south and into the Sarcobatus Flat hydrographic basin to the northwest (beyond the model grid). The cone of depression is cut off at the model grid boundary.

Figure 2 – Drawdown for Scenario 1 – Pumping 15 Years



Following 15 years of recovery at the Scenario 1 pumping rates, residual drawdown is shown on Figure 3 below.

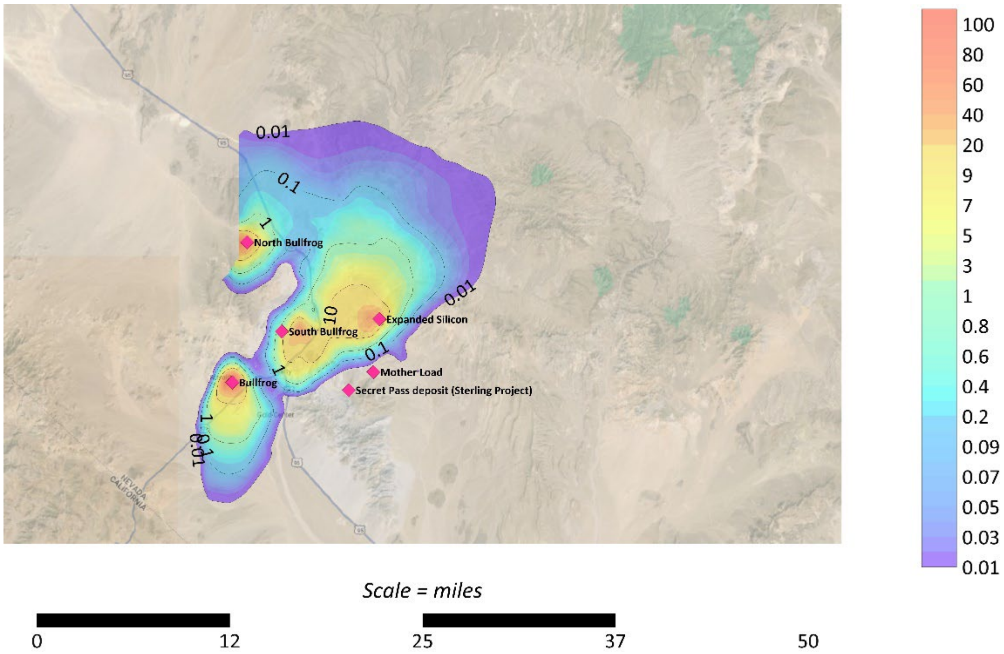
Figure 3. Residual Drawdown following 15 years of Recovery for Scenario 1 (



As can be seen, following 15 years of recovery, although varying degrees of drawdown recovery are observed, the footprint of the regional cone of depression continues to expand, primarily northeastward toward upper the Oasis Valley hydrographic basin. This is a common relationship for groundwater recovery following pumping projects in arid and semi-arid terrains.

Scenario 2, which assumed a pumping of 250 afy for 15 years from the North Bullfrog and Bullfrog Mines, and 1,000 afy for 15 years from the South Bullfrog and Expanded Silicon Mines. As seen on Figure 4, the four individual cones of depression coalesce into a regional cone that is more expansive and of greater magnitude of drawdown than that seen for Scenario 1.

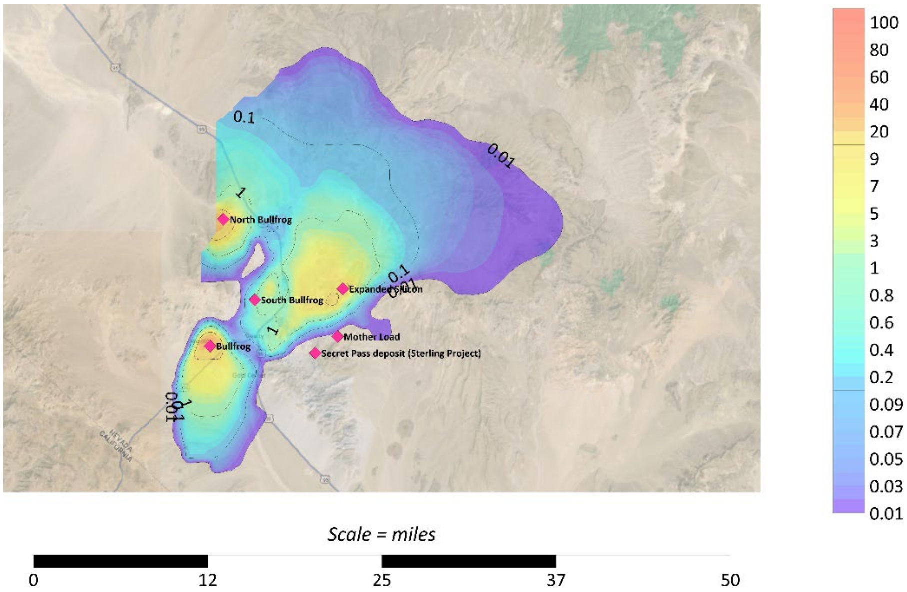
Figure 4. Drawdown for Scenario 2 – Pumping 15 Years



Approximately 80 to 100 feet of drawdown occurs around each of the test location extraction points, and drawdowns of more than 10 feet can be observed along the course of the Amargosa River in the Oasis Valley hydrographic basin. More on the ramification of flow in the Amargosa River will be discussed later in this memo, in the Discussion Section below.

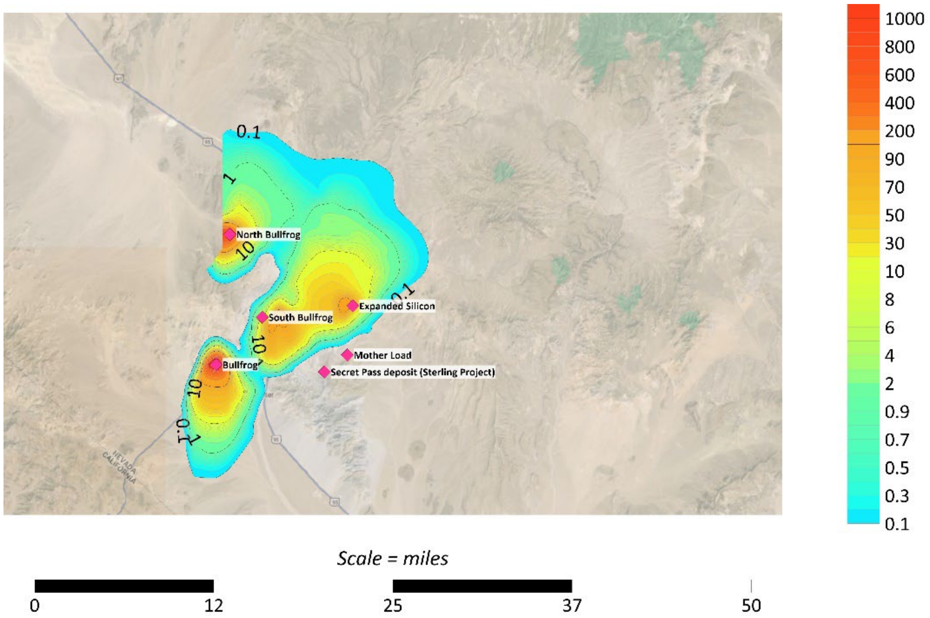
Following 15 years of recovery after Scenario 2 pumping, similar to Scenario 1 (although varying degrees of drawdown recovery is observed), the footprint of the regional cone of depression continues to expand, primarily northeastward toward upper Oasis Valley hydrographic basin.

Figure 5. Residual drawdown after 15 years of recovery – Scenario 2



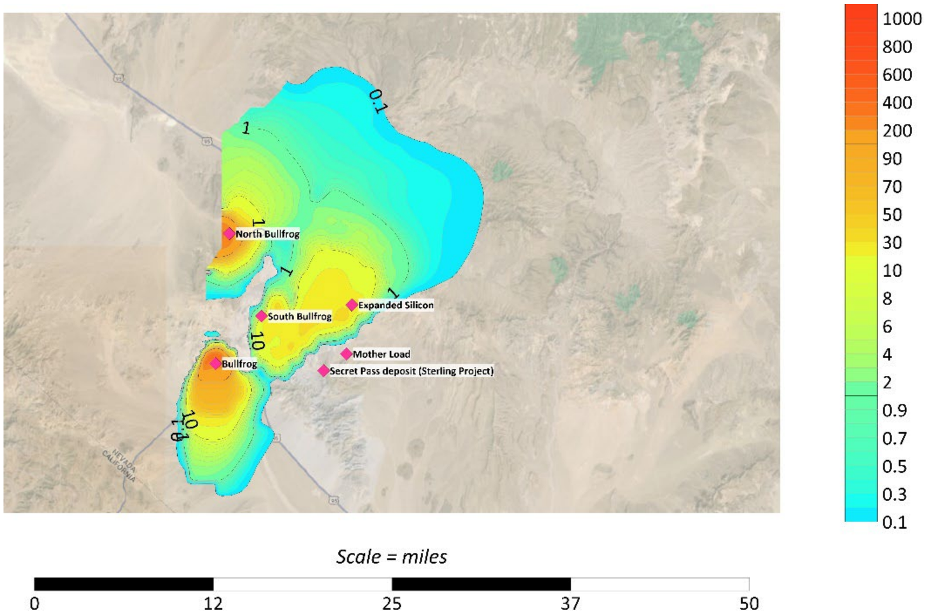
For Scenario 3, Roux assumed a larger scale of pumping with 3,000 afy of discharge from each of the four extraction test locations for 15 years. As would be expected, the drawdown associated with this scenario is substantially greater than for Scenarios 1 and 2 (Figure 6). In this case, 10 to 50 feet of drawdown is simulated along the Amargosa River corridor between the South Bullfrog and Expanded Silicon Mines. The regional cone of depression is more expansive and of substantially greater magnitude in this scenario, as would be expected. Note that the minimum contour is different than in the figures for Scenarios 1 and 2.

Figure 6. Drawdown for Scenario 3 – Pumping 15 Years



Following 15 years of recovery after Scenario 3 pumping, the footprint of the regional cone of depression continues to expand (although varying degrees of drawdown recovery is observed), primarily northeastward toward upper the Oasis Valley hydrographic basin. Also, 10 feet or more of residual drawdown remains along significant reaches of the Amargosa River.

Figure 7. Residual Drawdown following 15 Years of Recovery – Scenario 3



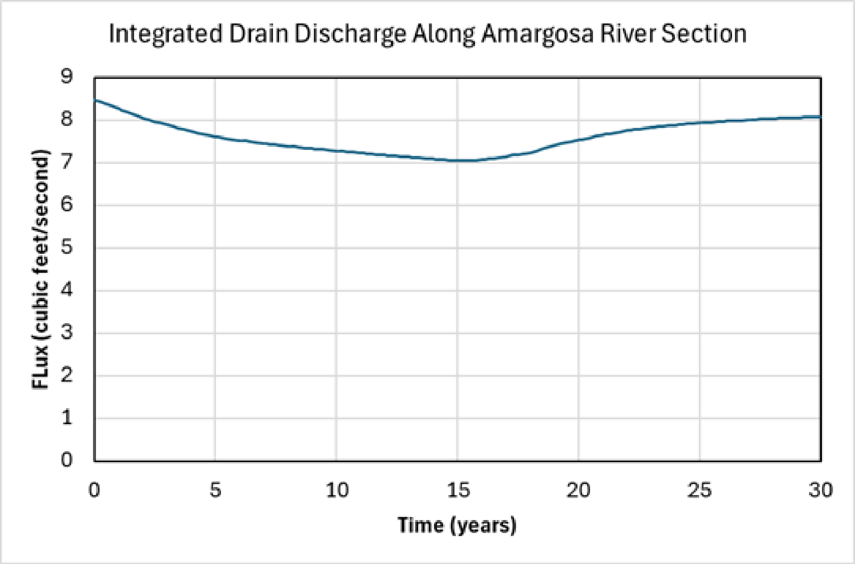
DISCUSSION

The principal concern related to the potential groundwater extraction pumping projects, due to existing and planned mining operations in the Beatty area, are impacts to springs and particularly the “gaining” reaches of the Amargosa River. As observed in each of the scenarios, groundwater drawdown is observed throughout much of Oasis Valley hydrographic basin, with substantial drawdown observed along the trace of the Amargosa River. This indicates that reductions in spring flow and Amargosa River flow would likely be substantial under these scenarios, affecting the extent of surface water along the Amargosa River, and reducing spring flows. Locations of springs in the area of the cone of depression are presented on the following page (Figure 8).

In order to consider the Oasis Valley hydrograph basin and the Amargosa River in a more granular fashion, Roux developed the following graph (Figure 9), which illustrates the discharge via the drain package from cells lining the Amargosa River in the Beatty area for Scenario 2. Roux converted the drain discharges into cubic feet per second (cfs) as it makes it easier to consider stream flow. The discharges are not flow rates in the Amargosa River, but rather the total flux through the drain cells lining the part of the river from the narrows below Beatty, and upstream.

Figure 8. Study Area Springs and Wells

Figure 9. Integrated Drain Discharge – Scenario 2



As can be seen, the flux decreases over the 15-year pumping period, with recovery (but not full recovery) during the 15 years after pumping ceases. This represents about a 17% reduction in the integrated discharge to the Amargosa River at the end of 15 years. The specific fate of where that lost water would have gone otherwise (e.g., riparian evapotranspiration, downstream flow) is not able to be determined, although the water is most likely resulting in reductions of both evapotranspiration and underflow toward Amargosa Desert hydrographic basin.

The drawdown figures (Figures 2 through 7) provided in the memo also indicate that the bedrock narrows along the Amargosa River below Beatty appear to limit drawdown extending southward into the Amargosa Valley, as a result of pumping from the North and South Bullfrog Mines and Expanded Silicon Mine test locations. This results in considerable risk to both springs and the Amargosa River within the Oasis Valley hydrographic basin, particularly as it relates to the continued expansion of the regional cone of depression after pumping ceases. As shown in the figures, the expansion of the regional cone of depression over time, including during recovery is generally northeast and east from the Amargosa River, the direction of many springs (Figure 8). Once pumping ceases, the extent to which the regional cone of depression expands and its magnitude is not controllable, it may continue to affect these ecological resources for decades longer than the amount of time the pumping (i.e., groundwater discharge) occurred.

REFERENCES

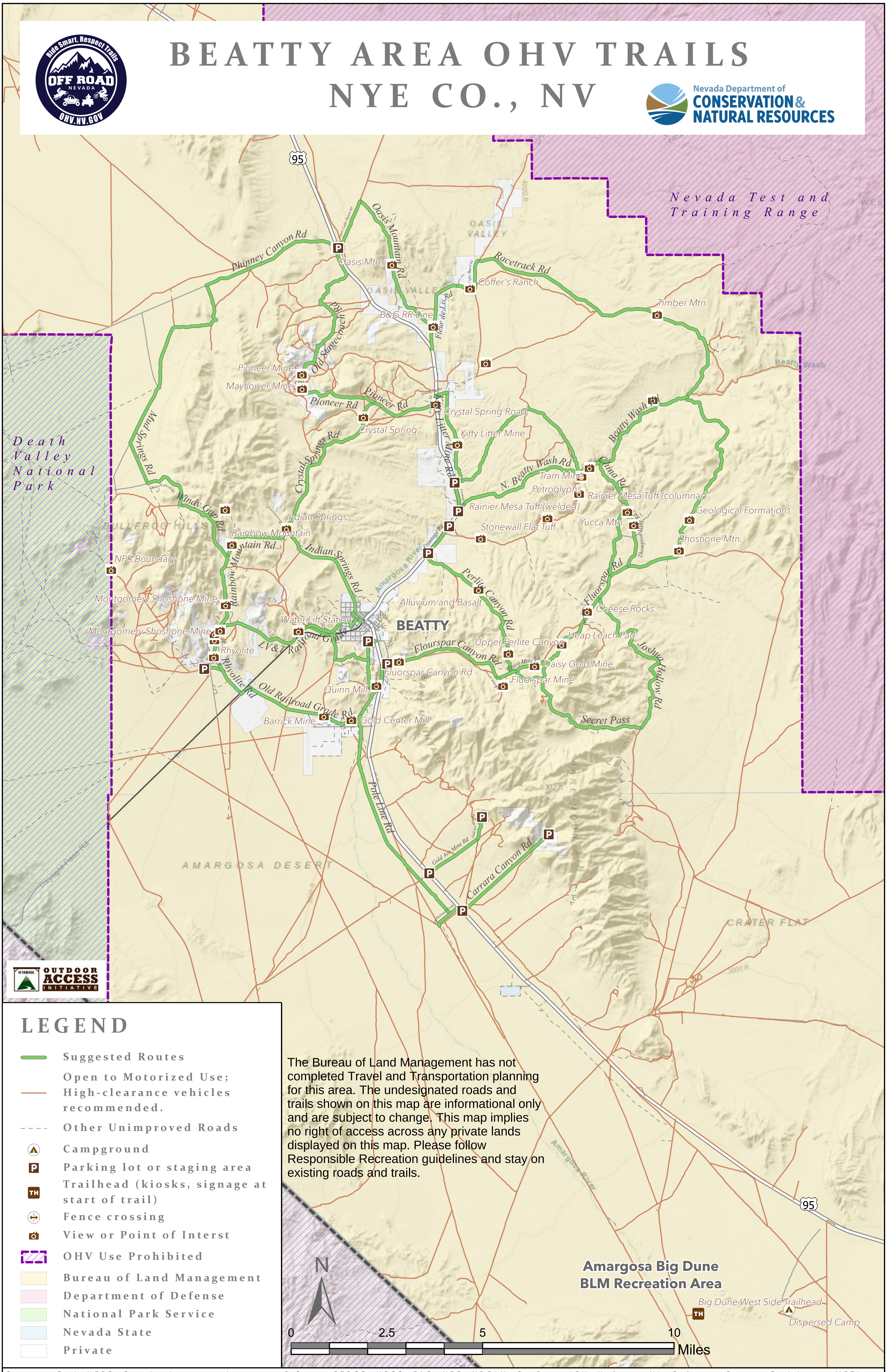
Halford, K.J., and Jackson, T.R., 2020, Groundwater characterization and effects of pumping in the Death Valley regional groundwater flow system, Nevada, and California, with special reference to Devils Hole: U.S. Geological Survey Professional Paper 1863, 178 p., https://doi.org/10.3133/pp1863

Nevada Department of Water Resources, 2024. Amargosa Desert Hydrographic Area Summary https://water.nv.gov/DisplayHydrographicGeneralReport.aspx?basin=230

Appendix C

Betty area off-highway vehicle trails (Off Road Nevada and Nevada Department of Conservation and Natural Resources 2023, *entire*).

BEATTY AREA OHV TRAILS
NYE CO., NV



LEGEND

- 🟩 Suggested Routes
- — Open to Motorized Use; High-clearance vehicles recommended.
- - - - Other Unimproved Roads
- ▲ Campground
- P Parking lot or staging area
- TH Trailhead (kiosks, signage at start of trail)
- ↔ Fence crossing
- 📷 View or Point of Interst
- ▨ OHV Use Prohibited
- ▢ Bureau of Land Management
- ▢ Department of Defense
- ▢ National Park Service
- ▢ Nevada State
- ▢ Private

The Bureau of Land Management has not completed Travel and Transportation planning for this area. The undesignated roads and trails shown on this map are informational only and are subject to change. This map implies no right of access across any private lands displayed on this map. Please follow Responsible Recreation guidelines and stay on existing roads and trails.

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community, Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community