BEFORE THE SECRETARY OF THE INTERIOR

PETITION TO LIST THE RAILROAD VALLEY TOAD (*ANAXYRUS NEVADENSIS*) AS A THREATENED OR ENDANGERED SPECIES UNDER THE ENDANGERED SPECIES ACT

CENTER FOR BIOLOGICAL DIVERSITY
April 12, 2022

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NOTICE OF PETITION

The Honorable Deb Haaland
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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, Krista Kemppinen and Patrick Donnelly hereby petition the Secretary of the Interior, through the U.S. Fish and Wildlife Service ("FWS" or "Service"), to protect the Railroad Valley toad (*Anaxyrus nevadensis)* 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.*

Protecting the Railroad Valley toad under the ESA will serve to restore and maintain the health not only of this unique species, but the entire ecosystem and the other endemic species it contains.

The Center for Biological Diversity ("Center") is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has more than 1.7 million members and online activists throughout the United States. The Center and its members are concerned with the conservation of endangered species and the effective implementation of the Endangered Species Act.

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I. EXECUTIVE SUMMARY

The Railroad Valley toad (*Anaxyrus nevadensis*) is a critically imperiled, recently described species, endemic to Railroad Valley, Nye County, Nevada. It is only known to occur near and within one spring-fed wetland complex and has an estimated distribution of 1.8 km^2. The population size is unknown but is likely very small given the species' highly restricted, remote and isolated range, and past degradation of the spring systems it depends on. The most immediate risk to this rare species' survival is a proposed lithium production project, which threatens to reduce the quantity and quality of spring discharge, resulting in the loss and/or degradation of the toad's habitat. The Railroad Valley toad is also threatened by oil and gas development, livestock grazing, climate change, stochastic events, mining and to a lesser degree, non-native species and infrastructure. This species urgently needs the protections afforded by the ESA.

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 Railroad Valley toad (*Anaxyrus nevadensis*) is a recently described critically imperiled member of the *Anaxyrus boreas* species complex (Gordon et al. 2020, p. 181). 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 now either imperiled or critically imperiled (NatureServe 2021a-f, p. 1).

The Railroad Valley toad is endemic to Railroad Valley, Nye County, Nevada, and only known from near and within the spring-fed wetland areas of Lockes Ranch (Gordon et al. 2020, p. 176). The toad has an estimated distribution of 1.8 km^2 and its restricted range is remote and extremely isolated due to the cold desert habitat that surrounds the spring outflows critical to its survival (Ibid., p. 177-178). Due to these factors and past degradation of the springs and their outflows for irrigation and livestock watering (USFWS 2009a, p. 9-10, 13), it is assumed that this species' population is exceedingly small.

The main threats to this species are lithium production, oil and gas development, livestock grazing, climate change, stochastic events, mining, non-native species and infrastructure. Of greatest concern right now are 40 groundwater rights applications that are seeking to appropriate 112,000 acre-feet of water per year from Basin 173B, Railroad Valley – Northern Part, for a lithium brine extraction project. The proposed amount is more than the basin's perennial yield of 75,000 acre-feet per year, and there are already 31,852 acre-feet per year allocated (NDWR 2021, p. 1). Pumping 112,000 acre-feet per year therefore has the potential to substantially alter groundwater flow paths and reduce or dry up spring discharge at Lockes Ranch.

Without adequate protection against groundwater pumping and other threats, the Railroad Valley 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 Railroad Valley toad (*Anaxyrus nevadensis*) is a member of the Great Basin *A. boreas* complex (Blair 1972 as cited in Gordon et al. 2020, p. 173). However, up until recently, it was frequently misidentified as *A. boreas* due to its occurrence within the Western Toad's geographic range (Figure 1).

Gordon et al. 2020 showed that *Anaxyrus nevadensis* differs from *A. boreas* by a combination of restricted geographic distribution (Figure 1), genetic evidence, and morphological characters such as a smaller adult body size, a significantly, but modestly longer head with a relatively shorter snout, and well-separated, perceptibly short and narrow parotoid glands (Gordon et al. 2020, pp. 173-174).

The morphological characters of *A. nevadensis* are also distinct from other allied taxa within the *A. boreas* species complex (Gordon et al. 2020, p. 166). For example, although *A. nevadensis* is among the smallest terrestrial bufonids within the *A. boreas* species complex, it has a large head relative to the similarly small toads *A. exsul* and *A. monfontanus*. The toad also has well separated and severely reduced parotoid glands and longer femur than *A. exsul*, *A. monfontanus* and *A. williamsi* (Ibid., p. 174).

In addition to morphological shape differences, the dorsum of *A. nevadensis* differs from that of *A. exsul*, *A. monfontanus*, *A. nelsoni* and *A. williamsi* by its predominantly brown and gray tone, prominent warts and heavily creased skin. The venter *of A. nevadensis* resembles that of *A. exsul* and *A. williamsi*, with a belly and anterior sides of the limbs that are white with black mottling. Similarly to other members of the *A. boreas* species complex except *A. exsul*, the presence of a

dorsal stripe in *A. nevadensis* is extremely variable. Another highly variable characteristic in *B. nevadensis* is the presence of small, irregular tibial glands. As is common with most other bufonids, mature male *A. nevadensis* exhibit a secondary sexual characteristic in the form of distinct nuptial pads on the dorsal side of the first finger (Gordon et al. 2020, p. 174).

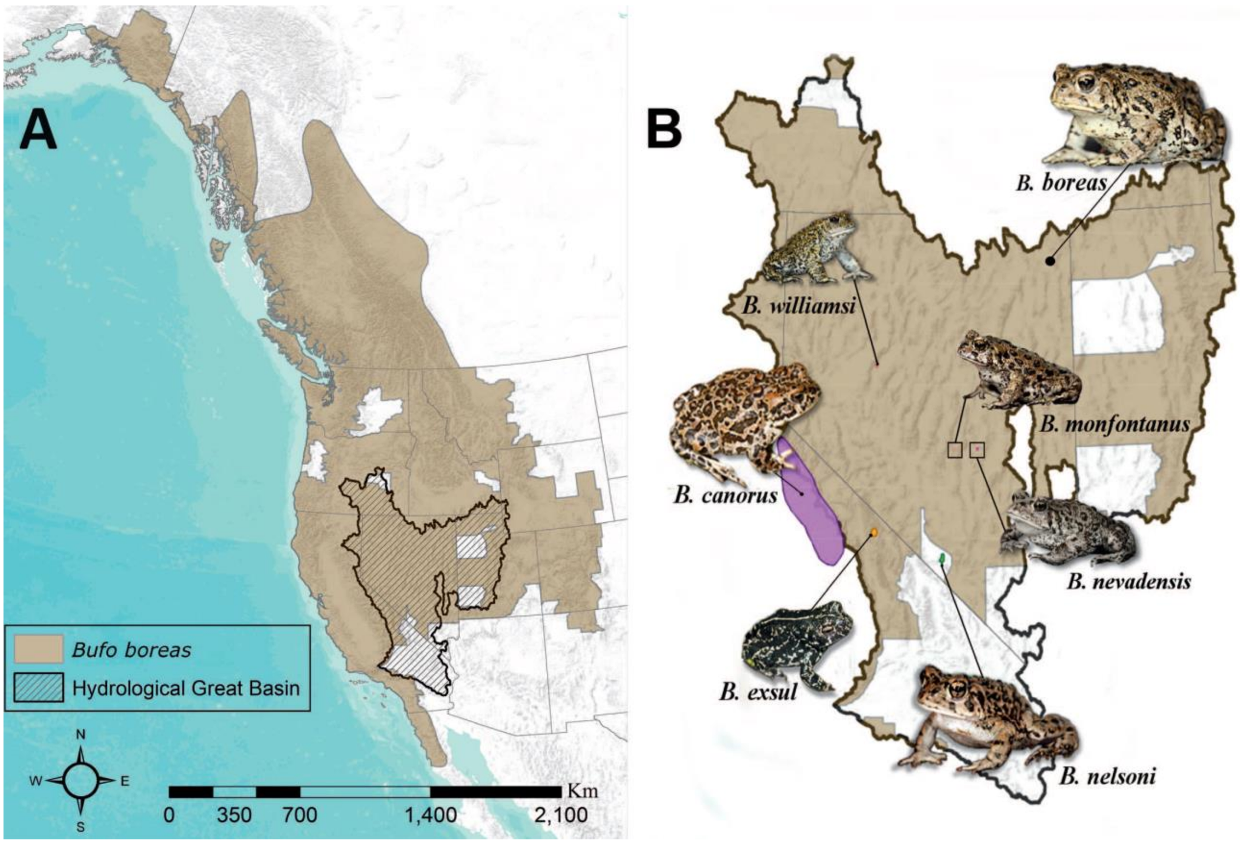

Figure 1. **Distribution of *A. boreas* and Great Basin *A. boreas* species complex.** (A) *A. boreas* range-wide distribution (brown), with the hydrologic Great Basin (black outline and hash mark interior) within the western United States (Gordon et al. 2017). (B) *A. boreas* species complex members, including *A. nevadensis,* 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.

B. Biology

Anaxyrus nevadensis is a nocturnal species that emerges at dusk. It likely retreats to burrows in the fall and emerges in the spring when males begin to congregate in shallow water for breeding. Mature males do not have an advertisement call but emit a release call when coming into contact with other males. Egg masses and tadpoles develop in still, shallow water, amid the marshy vegetation of the wetland habitat where the toad occurs (see next section). More research is needed on this species' dispersal and non-breeding behaviour (Gordon et al. 2020, pp. 174, 177-178).

C. Habitat

The Railroad Valley toad is found in Railroad Valley, a cold desert basin that experiences extreme diurnal and seasonal temperature variations. The toad occurs near and within wetland areas fed by three thermal springs. Individuals can be found in shallow water or among the vegetation in the perimeter band transitioning from riparian to sagebrush steppe habitat. The spring outflows are remote and isolated, surrounded by cold desert habitat of predominantly Big Sagebrush (*Artemisia tridentata ssp. tridentata*), Greasewood (*Sarcobatus vermiculatus*), Rubber Rabbitbrush (*Ericameria nauseosa*), and saltbush (*Atriplex spp*.). Usable corridors for the species' dispersal are limited which likely restricts its movement to other spring localities within Railroad Valley (Gordon et al. 2020, pp. 176-178).

D. Hydrogeology

The warm springs that support the Railroad Valley toad habitat are located within the Railroad Valley North hydrographic basin (173B) (Myers 2020, p. 1). This north to south trending basin lies within an overall flow system roughly defined by carbonate rocks overlain by alluvial or basin fill material. Carbonate rock dominates the mountain ranges east and likely provides a north-south passage for groundwater flow. Volcanics dominate west of the valley. Warm springs such as the ones that the Railroad Valley toad depends on likely serve as discharge points for the carbonate aquifers as these are generally found where the basin boundaries coincide with faults among the carbonate rock (Ibid., p. 4-5).

E. Associated Species of Interest

The Railroad Valley toad co-occurs with the Great Basin Spadefoot (*Spea intermontana*) and the federally listed threatened Railroad Valley springfish (*Crenichthys nevadae*) (Gordon et al. 2020, p. 177). Lockes Ranch is also home to the Lockes pyrg (*Pyrgulopsis lockensis*), a critically imperiled springsnail endemic to Railroad Valley and included on the Nevada Division of Natural Heritage At-Risk Plant and Animal Tracking List (NDNH 2021, p. 12). In addition, the critically imperiled Railroad Valley Skipper (*Hesperia uncas fulvapalla*) has been documented near Lockes Ranch and its distribution is thought to be restricted to the same hydrographic basin as the Railroad Valley toad. Thus, it may benefit from efforts to protect the toad's habitat (USFWS 1996, p. 5; USFWS 2011, p. 61544-61545). Other species that may also benefit indirectly include the imperiled Jones globemallow (*Sphaeralcea caespitosa*), which has a variety (*Sphaeralcea caespitosa var. williamsiae*) endemic to Nye County. The plant has been documented in several locations at or near Lockes Ranch (USFWS 1996, p. 4-5; NatureServe 2022, p. 3). Another species is the Railroad Valley tui chub (*Siphateles bicolor ssp. 7*), the only other native fish in Railroad Valley (USFWS 1996, p. 4), and a critically imperiled subspecies classified as a Sensitive Fish (503.067) by the State of Nevada and a Sensitive Species by the Bureau of Land Management (BLM) (NDNH 2021, p. 19, 24). The tui chub is known from

springs that include those within 3 miles of the points of diversion for the aforementioned 40 water rights applications for lithium production (see section V(A.2) for more details).

IV. RANGE AND STATUS

The geographic range for *Anaxyrus nevadensis* is among the smallest known for taxa in the *A. boreas* species complex (Gordon et al., 2020, p. 181). This species is found in Railroad Valley, an east-central desert basin located between Pancake Range and Grant Range of Nye County, Nevada. It is only known to occur near and within the spring-fed wetland areas of Lockes Ranch. The toad's critical marshland habitat depends on outflows from just three springs (Big, Reynolds, and Hay Corral) (see Figure 2), which results in a severely restricted range with an estimated distribution of 1.8 km^2 (Ibid., p. 176-177). The size of the Railroad Valley toad population is unknown but is likely small due to its highly restricted range and the remoteness and extreme isolation of the spring outflows, which likely restricts dispersal to other spring localities (Ibid., p. 177-178) (see section III(C)). In addition, although the sampling strategy precludes robust inference about occupancy, few adult or larval toads were detected in Railroad Valley during a recent survey (Halstead et al. 2019, p. 25). Finally, past and ongoing degradation of the toad habitat, described in more detail below, has almost certainly resulted in population declines. Lockes Ranch was historically used for raising cattle and Big, Reynolds, and Hay Corral springs and their outflows were manipulated over time to facilitate irrigation of the meadows (USFWS 2009a, p. 13). Hay Corral Spring was also excavated in 2002 to divert water for livestock watering (*Id*.), and some damage is likely to have occurred at the springs from trampling and grazing by cattle. Whether currently open to grazing or not, the areas continue to be badly trampled by cattle, including wetland areas where *A. nevadensis* likely lives.

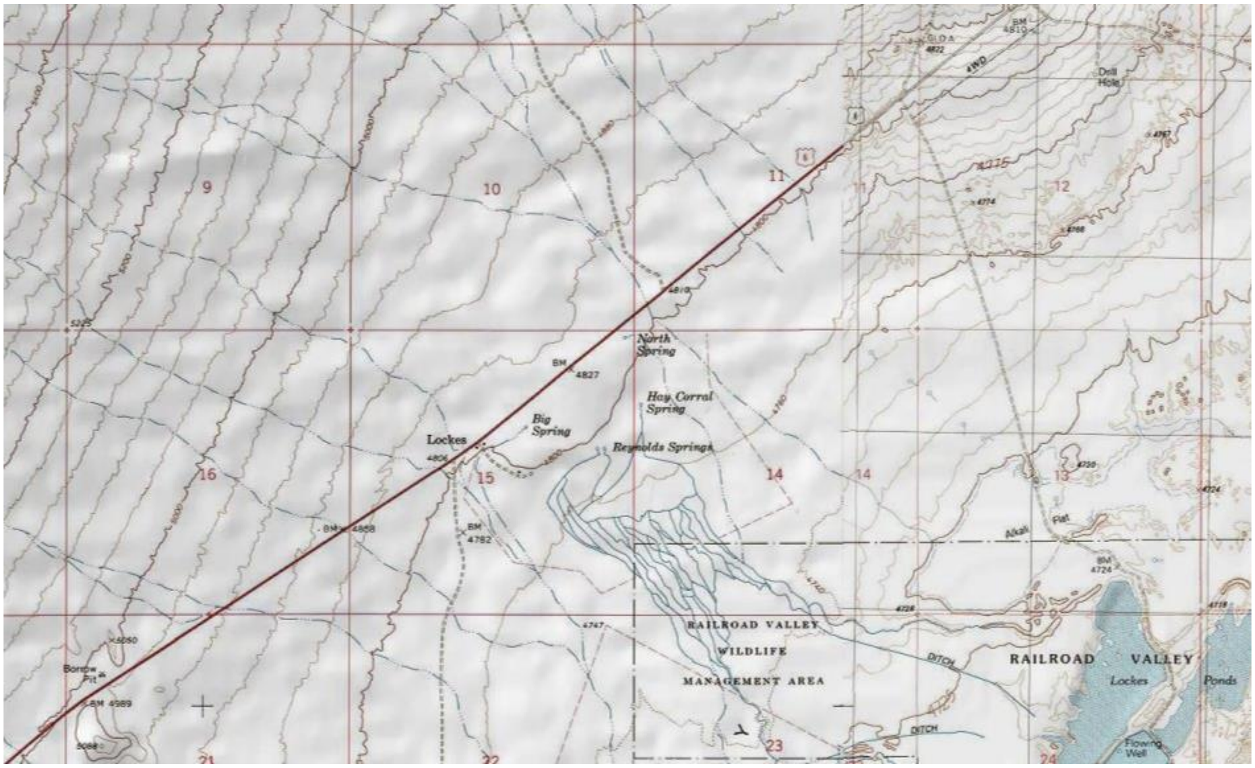

Figure 2. The three springs (Big, Reynolds and Hay Corral) feeding the toad's critical marshland habitat. U.S. Fish and Wildlife Service | Copyright © National Geographic Society, i-cubed. Map created using the Service's online mapper, available at: https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77 (accessed January 2022).

V. THREATS

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

Historically, the main threats to the Railroad Valley toad were habitat loss and degradation due to water diversions, groundwater pumping and livestock grazing (USFWS 1986, p. 10857-10858; USFWS 2009a, p. 13). All four spring systems at Lockes Ranch were dramatically altered by human activities and extinction of the toad was likely only narrowly avoided due to listing of the Railroad Valley springfish in 1986. The land and water rights to the former ranch were purchased by the Department of Wildlife (NDOW) and habitat restoration occurred for the benefit of the fish (USFWS 2009a, p. 19; USFWS 2021, p. 8). However, despite these efforts, the toad faces major threats from large-scale groundwater pumping for lithium production, oil and gas development and livestock grazing. Other more minor, habitat-based threats are mining, non-native vegetation and infrastructure.

1. *Oil and gas extraction and hydraulic fracturing*

Railroad Valley is a geothermally active area with significant opportunities for anthropogenic energy production that are the subject of ongoing economic interests overseen by the Bureau of Land Management (Gordon et al. 2020, p. 178). Approximately 40,650 acres in oil and gas leases were authorized by the BLM Tonopah field office from July 1, 2011 to January 1, 2021 (USFWS 2021, p. 8). The amount of oil produced between ca. 1954 and 2016 was approximately 47 million barrels, exceeding the amount produced in any other basin-valley in Nevada (Bortz, 2016, p. 1, 30).

Shown in Figure 3 are the currently active BLM oil and gas leases in the vicinity of Lockes Ranch. Development of these oil and gas resources can involve hydraulic fracturing ("fracking") (see section a), a production method which enables enhanced access to oil and natural gas in shale formations (EPA 2021a, p. 2-3). In 2013, the State of Nevada Commission on Mineral Resources (within Nevada's Division of Minerals) approved a hydraulic fracturing permit located within Railroad Valley, about 10 miles from Lockes Ranch (State of Nevada Commission on Mineral Resources 2012, *entire*).

As will be described in more detail in section b-d, hydraulic fracturing poses a risk to the survival of the Railroad Valley toad due to the potential for impacts to groundwater discharge at Lockes Ranch, both in terms of water quantity and quality.

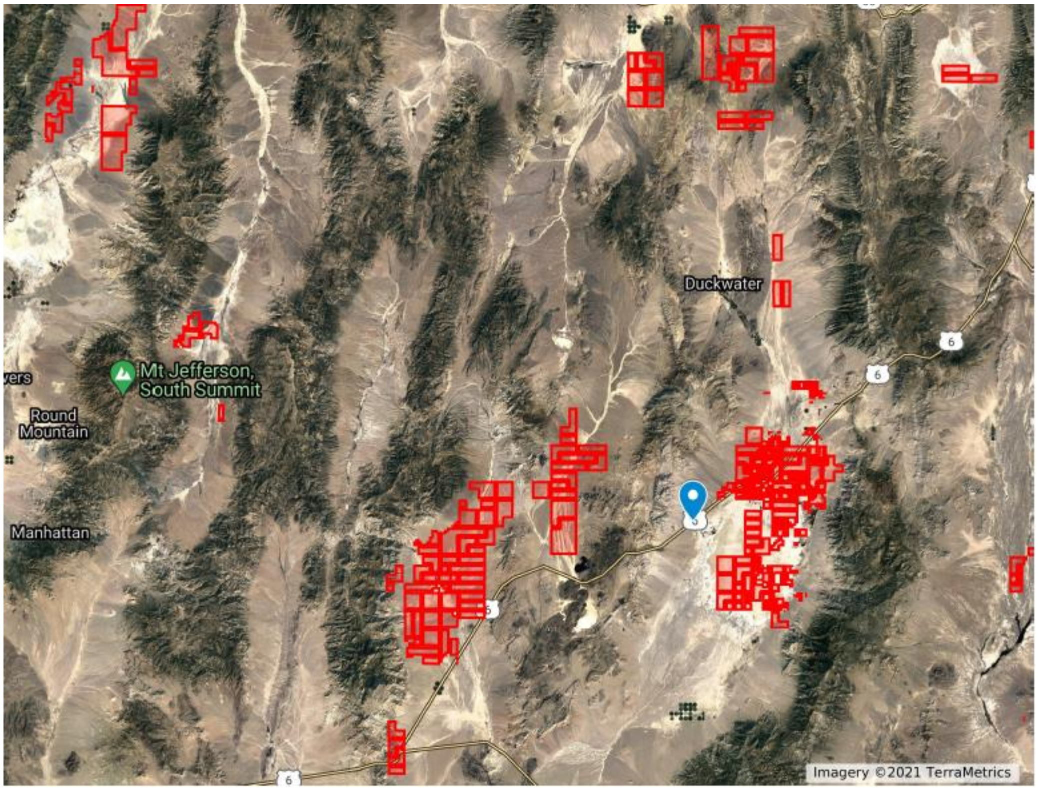

Figure 3. **Oil and gas leases**. Actively held oil and gas leases in the vicinity of Lockes Ranch (blue pin), authorized as of 10/15/2021. Map created from LR-2000 data using Google MyMaps.

a. Hydraulic fracturing

Hydraulic fracturing is an unconventional oil and gas production technique which involves fracturing rock formations to stimulate the flow of natural gas and oil and increase the recoverable volumes. Drilled wells may extend vertically hundreds to thousands of feet below the land surface and may include horizontal or directional sections that are thousands of feet long. Fractures are produced by injecting large quantities of fluids at high pressure into target rock formations via wellbores. The fluids are usually a mix of water, chemical additives and proppant (sand, ceramic pellets or other small incompressible particles) that open and enlarge fractures within the rock formation. The fractures can reach distances of several hundred feet from the wellbore and are held open by the proppants (EPA 2021b, p. 1). Once the injection process ends, the internal pressure of the rock will drive the fluid back to the surface through the wellbore. This fluid is called "flowback" or "produced water" and may contain the injected chemicals as well as naturally occurring materials such as brines, metals, radionuclides, and hydrocarbons. The flowback and produced water is often injected underground for disposal, but in some areas it may be treated and reused, or discharged to surface water after processing by a wastewater treatment facility (Ibid., p. 1-2).

b. Impacts to Groundwater quantity

Water withdrawals for fractured wells on the actively held oil and gas lease parcels near Lockes Ranch have the potential to significantly impact groundwater quantity and therefore spring discharge. The median volume of water used per well, by state, for hydraulic fracturing as reported in FracFocus 1.0 ranged between 76,818 and 5,259,965 gallons for the period January 2011 to February 2013 (EPA 2016, p. ES-12 to ES-13). According to a recent BLM Hydraulic Fracturing White Paper, the range of volumes that may generally be used to fracture wells in Nevada is ~50,000 to 300,000 gallons for shallow vertical wells, and ~800,000 to 10 million gallons for deep tight sand gas horizontal or directionally drilled wells (BLM 2017, p. 128). These higher end estimates are particularly concerning when considering the number of wells that could potentially be developed. Hundreds or thousands of wells is not outside the realm of possibility should oil prices go back above $100 per barrel. If those wells each required the high-end estimate of 10,000,000 gallons (30.3 acre-feet) to fracture, total water withdrawals for fractured wells could reach into the billions of gallons (tens of thousands of acre-feet).

Withdrawals on the level of tens of thousands of acre-feet have the potential to radically alter the hydrologic regime in the areas where such withdrawals are made (Deacon et al. 2007, p. 693). Figure 4 conceptualizes how the springs at Lockes Ranch may be affected by groundwater withdrawals: (a) in the near term, valley-fill aquifer wells create a localized cone of depression while wells in the carbonate aquifer produce artesian flow; (b) in the mid-term, the water table in the valley fill aquifer decreases substantially and local springs supported by this shallow aquifer fail. The deep water table also decreases, leading to a loss of artesian pressure and a decline of the regional springs supported by this deep aquifer. In addition, the reduced pressure causes groundwater from adjacent basins to flow downgradient towards it; (c) in the long-term, both the shallow and deep aquifers within the basin subjected to groundwater pumping reach a new steady state. The downhill groundwater gradient towards the sites of withdrawal leads to a decline of water tables and failure of local and regional springs in adjacent basins (Deacon et al. 2007, p. 694).

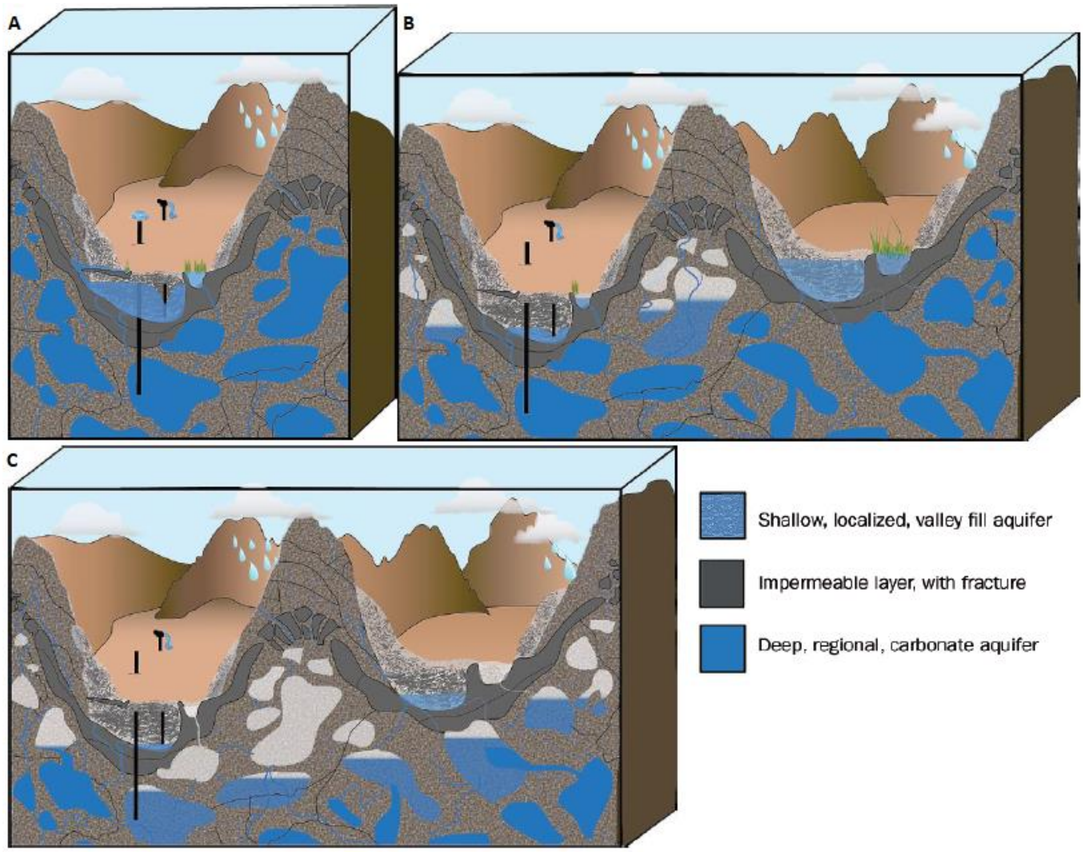

Figure 4. Conceptual diagram of the effects of groundwater withdrawal on the variously integrated valley-fill and deep carbonate aquifers in Nevada. (Adapted from Deacon et al., 2007, p. 694).

The Railroad Valley toad relies on dependable spring flows. A smaller spring-fed wetland habitat would support fewer individuals due to the reduced availability of population resources (USFWS 2010, p. 35404). An adequate amount of standing water is also required by the toad for breeding and for egg masses and tadpoles to develop (Gordon et al. 2020, p. 178), which means that a decline in spring discharge could compromise the ability of the toad to reproduce. A change in the length or timing of wetland inundation may also impact the toad's reproductive success (Gonzales et al. 2004 as cited in Guzy et al. 2006, p. 276 and Brooks 2004 as cited in Walls et al. 2013, p. 346). 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, as the amount of surface water decreases, temperatures and the concentrations of pollutants may increase while oxygen levels decrease (USFWS 2010, p. 35405).

Further, loss of spring-fed habitat reduces opportunities for habitat niche partitioning and the ability of different species to coexist, particularly in the presence of non-native species (USFWS 2010, p. 35405). North American bullfrogs (*Rana catesbeiana*) would most likely be a threat to the Railroad Valley toad if introduced to Lockes Ranch as they are known to prey upon other amphibians and be a vector for diseases such as chytridiomycosis (Gordon et al. 2017, p. 136) (see below).

c. Impacts to Groundwater Quality

Fracking poses significant risks to groundwater quality as it typically involves the injection of tens of thousands of gallons of chemicals (EPA 2016, p. 3-22), the production of wastewater, and there are multiple pathways for contamination.

As described above, fracturing fluids are usually a mix of water, chemical additives and proppant. Produced waters can contain large quantities of total dissolved solids, salts, metals and naturally occurring radioactive materials. Flowback waters may contain similar constituents as well as fracturing fluid additives such as surfactants and hydrocarbons (Brittingham et al. 2014, p. 11039). If groundwater contamination were to occur, it would be very difficult, if not impossible, to restore the original quality of the water. Contaminated groundwater can in turn affect the quality of surface water at discharge areas such as the thermal springs where the Railroad Valley toad occurs (EPA, n.d., p. 3).

Groundwater contamination below the surface can occur in a number of ways (NRDC 2012, p. 2). An oil or gas well is constructed with casing, which consists of layers of steel pipe that are completely or partially cemented into the surrounding rock and to each other. The casing and the cement protect groundwater resources from the gas, oil, and fluids in the rock. However, improperly constructed and/or maintained oil or gas wells can allow migration of oil, gas, formation water, drilling fluid, or fracking fluid, leading to contamination of groundwater (*Id.*). Pathways for fluid movement in a cemented well can develop over time, including during hydraulic fracturing. In particular, degradation of casing and cement can occur due to exposure to corrosive chemicals, formation stresses, and operational stresses such as pressure and temperature changes during hydraulic fracturing (EPA 2016, p. ES-29 to ES-30).

There are documented examples of mechanical integrity problems in hydraulically fractured oil and gas production wells. In Bainbridge Township, Ohio, hydraulic fracturing of an inadequately cemented gas well contributed to the contamination of local drinking water resources. In North Dakota, near Killdeer, an inner string of casing burst during hydraulic fracturing of an oil well, which led to a release of hydraulic fracturing fluids and formation fluids that impacted a groundwater resource (EPA 2016, p. ES-30).

Another way in which fracking can impact groundwater quality is via improper plugging of an oil or gas well, which can also allow migration of frack fluid or other contaminants into groundwater (NRDC 2012, p. 2). Yet another pathway is the growth of out-of-zone fractures, where fractures extend further than intended. The fracture can reach other geologic formations including groundwater aquifers. Some geologic formations are also extensively naturally faulted and fractured, which may cause induced fractures to connect to these natural fracture networks (*Id.*).

Finally, groundwater may become contaminated through spills and leaks at the surface. Fluids, chemicals, proppants and wastewater are stored on the surface in tanks or pits, and improper storage can lead to leaks or spills. In 2007, in Kentucky, pits containing flowback fluids overflowed, changing the pH and electrical conductivity of Acorn Fork Creek. Leaks or spills can also occur due to human error, broken valves, pipes or pipelines (EPA 2016, ES-35; NRDC 2012, p. 2). In 2015, in North Dakota, approximately 2.9 million gallons of produced water spilled from a broken pipeline. The spilled fluid reached Blacktail Creek, elevating its chloride concentration and electrical conductivity. Elevated levels of both were also found downstream in the Little Muddy River and the Missouri River (EPA 2016, p. ES-35). Another risk is leaks or spills during the transport of fluids (NRDC 2012, p. 2), waste (EPA 2016, p. ES-35), or chemicals (EPA 2016, p. 5-31, 5-32). A U.S. GAO study found that up to 1,365 truckloads can be required just for the drilling and fracturing of a single well pad (GAO 2012, p. 33), while the New York Department of Conservation estimated the number of "heavy truck" trips to be about 3,950 per horizontal well (including unloaded and loaded trucks) (New York Department of Environmental Conservation 2015, p. 6-306). Illegal dumping of fracking waste is also a risk. In 2013, for example, it was discovered by Ohio authorities that thousands of gallons of fracking wastewater had been dumped into the Mahoning River by a drilling waste operator into the Mahoning River (Ridlington and Rumpler, 2013, p. 22).

2. *Lithium production*

Lithium is important for the renewable energy transition since it is required for battery storage of energy. However, in order to ensure that lithium production does not exacerbate the biodiversity crisis, production systems need to minimize water consumption, maximize recycling and be sited so as to minimize impacts on species.

Currently, two-thirds of the global production of lithium is extracted from brine (i.e. highly saline solutions), a method that involves the evaporation on average of half a million litres of brine per ton of lithium carbonate (Flexer et al. 2018, p. 1188, 1190). Brines can either be found directly on the earth surface or deep under salt lakes or salt flats, in very dry regions that allow salts to persist. Figure 5a provides a general schematic representation for the technology currently used for lithium brine extraction. The brine is pumped from underneath the salt lake into a series of large open air shallow evaporation ponds. The lithium brine is concentrated by solar evaporation and wind, and subsequently recovered. This technology is generally known as the evaporitic technology (Ibid., p. 1190), and can involve evaporation of up to 95% of the original brine water. Mining companies also have separate wells for freshwater used in the different steps of the extraction/purification process (Ibid., p. 1194).

In addition to the evaporitic technology, new, much more energy intensive, methodologies have been developed that propose a certain chemical/physico-chemical method for capturing lithium.

These are often referred to as direct lithium extraction (DLE). The by-product is lithium deprived spent brine rather than salt mixtures (waste) (Figure 5b) and it has been suggested that the large volumes of lithium deprived brine would be reinjected back to the underground aquifers (Flexer et al. 2018, p. 1191, 1198-1199). At the time of writing of Flexer et al. 2018, however, there were no known examples of reinjection of large volumes of brine or any other fluid in salt lakes. Yet, it is likely that residual brines (likely no more than 5% of the originally extracted volume) were sometimes being reinjected back into salars upon lithium recovery using evaporitic technology. It is also very likely that at least a fraction of the spent brine produced by FMC in Argentina using solar/wind evaporation and ion exchange columns was being reinjected (Ibid., p. 1199). Reinjection of spent lithium brine into the subsurface runs the risk of contaminating groundwater aquifers and springs as their surface expressions.

In addition to lithium extraction from brines, lithium can also be extracted from hardrock or clays, but this requires a range of hydrometallurgical processes. Exploitation is usually mineral-specific due to considerable variation in chemical composition and other properties (Flexer et al. 2018, p. 1190). To extract the lithium, however, an open pit mine must be created, which leaves scars in the landscape. A large amount of water is also required, albeit less than with lithium brine extraction, and CO_2 is released in large quantities (Early, 2020, p. 3).

Most of the raw material used domestically in the United States is extracted in Latin America or Australia and processed in Asia. Nevada's Clayton Valley, just 200 km to the west-southwest of Railroad Valley, is home to the only large-scale lithium (brine) production facility in the United States, in operation since the 1960s (Ameriwest Lithium 2022, p. 2; Penn and Lipton, 2021, p. 2). Brine is pumped from multiple aquifer systems to an extensive pond system where it is concentrated by solar evaporation. The evaporation ponds span approximately 4,150 acres and hold up to several billion gallons of brine (Zampirro, n.d., p. 271).

In the past couple of years, however, there has been a drastic increase in lithium exploration in Nevada. As of January 24, 2022, there were an estimated 12,291 active, filed, and submitted placer claims in Nevada (Nevada Division of Minerals Open Data Site 2022, p. 1). Moreover, according to Ameriwest Lithium, Railroad Valley is potentially one of the best lithium resources globally. It is twice the size of nearby Clayton Valley and comparable in size to the Salinas Grandes salt flat in Argentina (Ameriwest Lithium 2022, p. 6). As of November 20, 2017, Lithion Energy Corporation had 495 placer claims spanning around 10,000 acres (Newsfile 2017, p. 1). In June 2020, American Battery Metals Corp was reported to have 1300 claims spanning 26,000 acres on BLM land. It was also reported to have done extensive geophysics and drilling, that it would continue to do more intensive land surveys and drilling, and that it had an extraction business (Rimes 2020, p. 1). In December 2021, Ameriwest's Railroad Valley exploration project included 462 placer claims spanning 9,097 acres (Ameriwest Lithium 2021, p. 4). As of March 2022, it appears that 318 new claims have since been acquired, increasing the size of the Railroad Valley property to 15,300 acres – an increase of almost 70% in just a few

months (Ameriwest Lithium, 2022, p. 2). Of most immediate concern, however, are the proposed new water rights applications by 3PL Operating Inc. for the purposes of lithium brine extraction in Railroad Valley-Northern Part (USFWS 2021, p. 14).

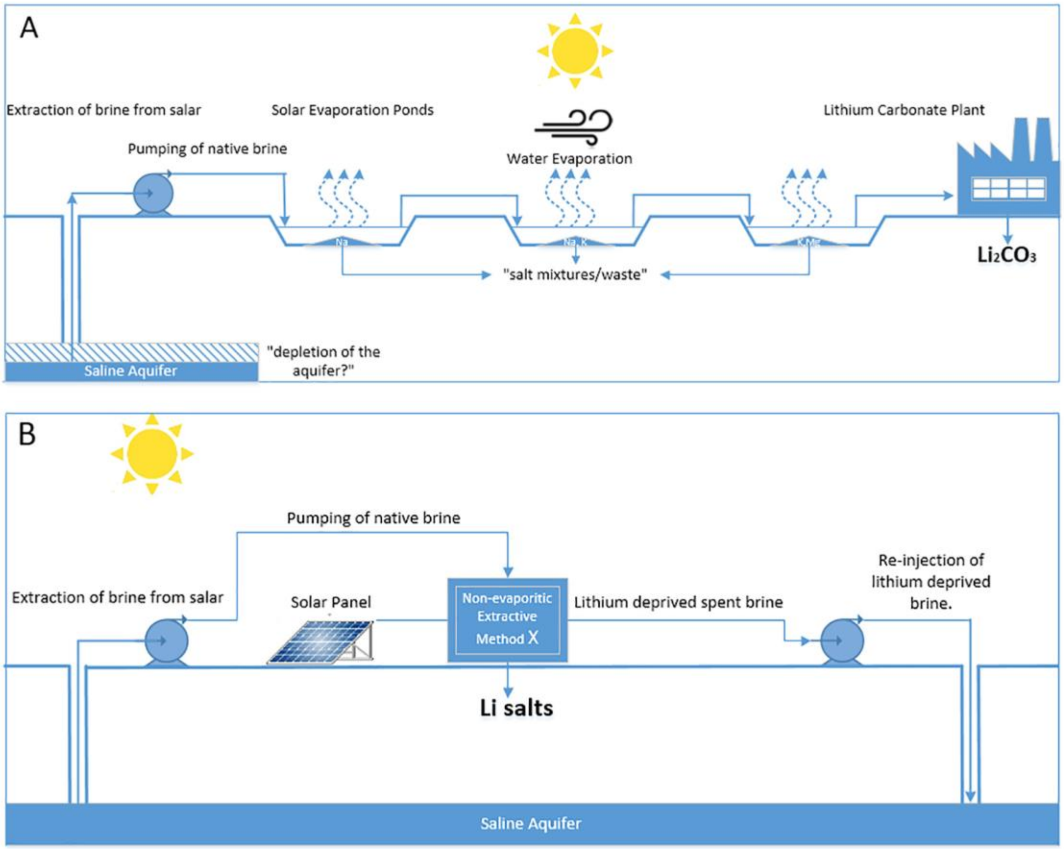

Figure 5. Schematic representation of 2 different approaches to lithium extraction and processing. A-Current evaporitic technology; and B-So-called direct lithium extraction (DLE), or lithium capture through chemical/physico-chemical methods combined with reinjection of large volumes of lithium deprived brine back to the underground aquifers. Adapted from Flexer et al. 2018, p. 1191.

The Railroad Valley lithium brine extraction project

Forty new water rights applications (Nevada Division of Water Resources application numbers 90712-90751, inclusive) were recently submitted by 3PL Operating Inc. for DLE lithium brine extraction over approximately 56 square miles beneath and southwest of the playa of northern Railroad Valley (Figure 6) (USFWS 2021, p. 14). The lithium processing methods to be used are unknown, but all water not consumed within the lithium processing circuit is claimed to be destined for reinjection to the playa aquifer via a network of wells (BLM 2021, p. 2). The proposed lithium brine extraction and reinjection may negatively impact water quantity and quality at Lockes Ranch, as outlined in the Service's protest of the applications (USFWS 2021, p. 15-16):

1) A significant amount of groundwater will be extracted near Lockes Ranch

The Lockes Ranch thermal springs are about 7 miles (or more) from the location of the proposed groundwater (brine) extraction / injection wells. Collectively, the applications are estimated to yield a net extraction rate (i.e. rate of pumping minus rate of injection) of about 18,500 acre-feet per year or 11,500 gallons per minute (gpm). Moreover, the maximum possible net extraction rate within the overall wellfield at any particular point in time may significantly exceed the anticipated annual average of 18,500 afy (or 11,500 gpm). Based on diversion rates of 3.9 cubic feet per second and 40 proposed points of diversion, the upper limit is 156 cubic feet or approximately 70,000 gpm.

2) Evidence suggests that a hydraulic connection exists between the thermal springs at Lockes Ranch and the proposed points of diversion

The hydrogeology of the area appears to be consistent with Lockes Ranch thermal spring water originating from the lower (regional) carbonate rock aquifer. In addition, water quality data from the USGS NWIS data base shows the spring water originating from the underlying (likely regional) carbonate-rock aquifer, and likely mixing with shallower alluvial groundwater. Based on USGS 2021 data, lithium concentrations in spring discharges at Lockes Ranch are indicative of bicarbonate type groundwater mixing with groundwater in contact with a source of lithium, probably volcanic materials. There is a therefore a hydraulic connection between the thermal springs at Lockes Ranch and the lithium containing geologic unit.

Furthermore, based on lithologic data, volcanic materials are found at a depth of about 800 to 1000 feet below ground surface (bgs) near Lockes Ranch thermal springs. The volcanic materials in turn overlie the regional carbonate-rock aquifer at a depth of about 1,300 to 1500 ft bgs in the area. This suggests that the regional carbonate-rock aquifer is relatively shallow where the thermal springs are found and is overlain by even more shallow volcanic materials that likely provide the lithium discharging from the springs. The same volcanic materials also appear to extend eastward beneath the playa of Northern Railroad Valley, but at depths of 4,400 to 6,500 ft bgs near the points of diversion. The total depth of the proposed project wells is conversely around 2,500 feet. Thus, the target brine pool likely lies above the bulk of the volcanics existing beneath the playa and from which the lithium in the brine pool appears to originate.

3) Post-processed brine will be reinjected using some subset of the proposed points of diversion, which may result in changes in water quality at the springs.

In addition to the aforementioned factors, there is uncertainty in regard to the discharge response curves of springs at Lockes Ranch to reductions in the rate of groundwater pumping. There will likely be (1) a lag between the maximum impact and the stopping of pumping; and (2) a

maximum impact which exceeds the impact when pumping is stopped. Thus, monitoring changes in spring discharge and water quality at Lockes Ranch to avert adverse effects would likely be ineffective (USFWS 2021, p. 17; Bredehoeft and Durbin 2009, p. 6-7). As discussed in section 1, the Railroad Valley toad is highly sensitive to changes in spring discharge as it needs sufficient standing water and wetland habitat to breed and survive. The impact of water quality degradation on toad development in particular is also a significant concern.

In addition to the Service’s assessment that the proposed lithium production project could substantially degrade thermal springs at Lockes Ranch (USFWS 2021, p. 17), there are documented examples of the negative impacts of lithium production on the environment. In Clayton Valley, it is estimated that water levels will take decades to recover from the impact of the groundwater withdrawals for mineral concentration by evaporation and that the loss of groundwater storage will never be regained (Esmeralda County, Nevada 2012, p. 43). In the “Lithium Triangle” of Bolivia, Argentina and Chile, lithium production has led to negative changes in water quality, vegetation structure, and the distribution of local flora and fauna, affecting local populations through decreases in agricultural productivity and traditional job losses (Romero et al. 2012, Babidge and Bolados 2018 and Liu et al 2019 as cited in Gutiérrez et al. 2022, p. 2). Moreover, within the Salar de Atacama in Chile, evidence was recently found of a negative correlation between lithium production and the abundance of two endemic globally threatened Flamingo species. Counts of the James’s flamingo (*Phoenicoparrus jamesi*) and the Andean flamingo (*Phoenicoparrus andinus*) decreased by around 10 and 12% respectively in just 11 years. These declines were likely caused by the effects of increasing mining pond area on the amount of surface water in the salar, as well as increases in disturbances such as noise and vehicular traffic from industrial activities (Gutiérrez et al. 2022, p. 7-8).

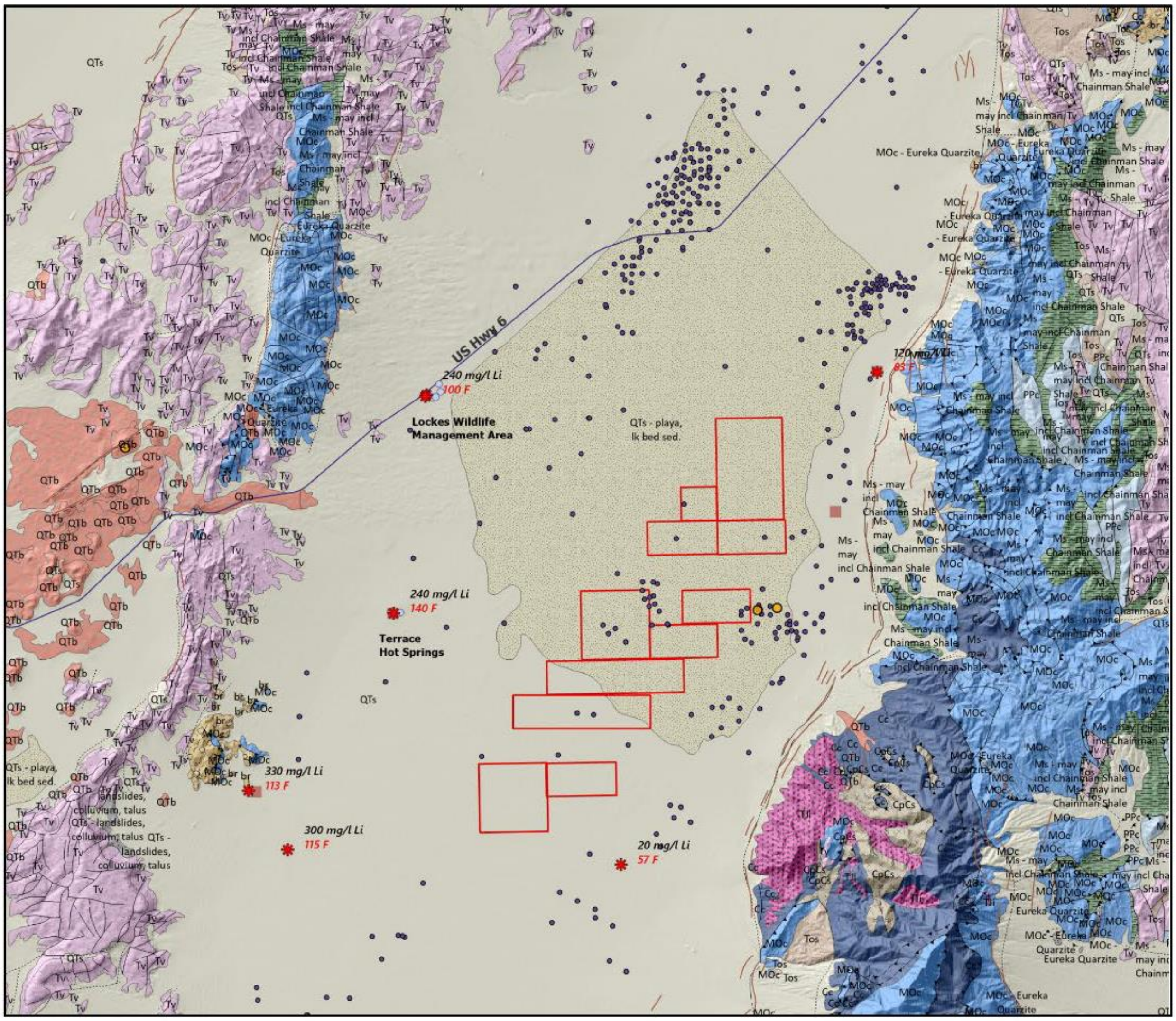

Figure 6. Location of the thermal springs in Lockes Ranch relative to the location of the proposed points of diversion (red rectangles). Red and black measurements denote water temperature and lithium concentration data respectively. Adapted from USFWS 2021, p. 19.

3. *Livestock grazing*

Livestock grazing is occurring at and adjacent to the springs at Lockes Ranch. As of May 2021, significant impacts were observed to the alkali wetlands and bulrush marshes at Reynolds Spring and Hay Corral Spring. Cows were also observed throughout Lockes Ranch in March 2022.

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). Grazing can negatively affect riparian and aquatic systems

through changes in hydrologic functioning, nutrient cycling, and herbaceous biomass productivity, soil compaction, vegetation removal, and nutrient redistribution (Filazzola et al., 2020, p. 7).

Grazing is a known threat to the Yosemite toad, also within the *A. boreas* species complex. The U.S. Fish and Wildlife Service identified livestock grazing as a prevalent threat to the Yosemite toad (*Anaxyrus canorus*) and a potential limiting factor in its range-wide population recovery (USFWS 2014a, p. 24291). Similarly to the Railroad Valley toad, the Yosemite toad relies on very shallow, ephemeral water in meadow and pool habitats as opposed to deeper lakes and streams, which means that both species may be sensitive to even minor habitat changes. Grazing can lead to more rapid erosion and gullying of meadows, which causes siltation and accelerated succession of meadows. Grazing can cause erosion by disturbing the ground, degrading vegetation cover, and destroying peat layers in meadows, causing a drop in the groundwater table and summer flows. This habitat degradation can in turn affect the viability of Yosemite toad populations given their reliance on the meadow and pool habitats for breeding, rearing, and adult survival. Moreover, loss of connectivity of habitats exacerbates isolation and population fragmentation (Ibid, p. 24289.). Livestock may also destroy burrows used by the toads for shelter and hibernation, or disturb the toads and disrupt their behavior (Ibid., p. 24291).

Grazing is also a potential threat to the black toad (*Anaxyrus exsul*), endemic to Deep Springs Valley (California Department of Fish and Wildlife 2022, p. 1-2, 5), and the boreal toad (*Anaxyrus boreas boreas*). Bartelt (1998, 2000) observed significant mortality of boreal toads in Targhee National Forest due to livestock activity. 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 (Bartelt 1998, 2000 as cited in Keinath and McGee 2005, p. 38).

4. *Infrastructure*

The current access road into Lockes Ranch creates disturbance to the open-water habitat area of Big Spring (USFWS 2021, p. 10) and is therefore a potential threat to the Railroad Valley toad. The service has recommended abandoning and reclaiming this road (*Id*.).

5. *Mining*

The historic silver mining district of Silverton, located approximately 5 miles west of Lockes Ranch, is experiencing an uptick in exploration activity. Silver Hammer Mining Corp. has launched a drilling project to explore for silver of sufficient quantity to reopen mining operations

at Silverton (Silver Hammer, 2022, p. 1-2). Should mining restart at Silverton, it could pose a threat to the water at Lockes Ranch, and thus the Railroad Valley toad, if open-pit mining went below the water table. Mining beneath the water table requires dewatering, to prevent the pit from flooding, which can cause drawdown in local and regional aquifers (Myers, 2015, p. 2), potentially affecting groundwater dependent ecosystems like those at Lockes Ranch.

B. Disease or Predation

The amphibian disease chytridiomycosis, caused by the fungus Batrachochytrium dendrobatidis, (Bd) is a potential threat to the Railroad Valley toad. The disease has been linked to amphibian extirpations and declines, including declines among populations of the closely related *A. boreas*. A known vector for chytridiomycosis is the non-native North American bullfrog (Gordon et al. 2017, p. 136). Introduction of the bullfrog, which is frequently transplanted by humans into new areas (Keinath and McGee 2005, p. 40) and an incredibly fecund species (Kamoroff et al. 2020, p. 618), could result in the disease being spread to Railroad Valley toads. As described in the recent emergency listing rule for the closely related Dixie Valley toad (*A. williamsi*), thermal spring waters may provide some protection against chytrid fungus but catastrophic effects to the species may occur if the water temperature decreases (USFWS 2022, p. 20, 35, 41-42). Within the Railroad Valley toad habitat, the water temperature may decrease due to the potential mixing of groundwaters with different physical properties during the lithium and oil and gas production processes (section A1-2). Bullfrogs are also thought to frequently compete with other amphibians, and prey on native amphibians (Kats and Ferrer 2003, p. 100). The Railroad Valley toad is much smaller than the bullfrog (Gordon et al. 2020, p. 168; AmphibiaWeb 2021, p. 1) and is therefore likely vulnerable to predation.

C. Overutilization

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

D. Inadequacy of Existing Regulatory measures

<u>Federal protections</u>

National Environmental Policy Act
The National Environmental Policy Act (NEPA) provides some protection for the Railroad Valley 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 Railroad Valley toad. The lithium placer claims and oil and gas leases in the vicinity of the Railroad Valley toad habitat are a case in point. 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 (USFWS 2009a, p. 16).

Clean Water Act
The Railroad Valley toad is known from spring-fed wetland areas (Gordon et al. 2020, p. 176), and section 404 of the Clean Water Act regulates fill in wetlands that meet certain jurisdictional requirements. Fill activities meeting those requirements require a section 404 permit. The US Fish and Wildlife Service can review permit applications and give recommendations to avoid and minimize impacts and implement measures to conserve fish and wildlife resources. Any other actions within the Railroad Valley toad habitat that have the potential to impact United States waters would also be reviewed under the Act (USFWS 2009a, p. 16).

However, whether or not Service recommendations are incorporated into section 404 permits is at the discretion of the U.S. Army Corps of Engineers. In addition, not all activities that occur in wetlands involve fill and not all wetlands are "jurisdictional." (USFWS 2014b, p. 51060). 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, 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 Railroad Valley, are considered non-jurisdictional, and any water features within them are exempt from the Clean Water Act (EPA 2020, p. 22251). This was repealed under the current administration, which is currently developing a new rule. The vagaries of the applicability of the Clean Water Act mean that it is inadequate to the task of protecting the Railroad Valley toad's habitat.

Endangered Species Act
A "critical habitat" designation is required for species listed under the ESA when "prudent and determinable". Federal agencies are in turn required to avoid "destruction" or "adverse modification" of designated critical habitat (USFWS 2017, p.1). Critical habitat has been designated for the Railroad Valley springfish (Figure 9) but the extent of overlap with the Railroad Valley toad habitat is unknown as no population estimate or surveys have been conducted to determine the entire range extent of the toad (NatureServe 2021a, p. 3). Critical habitat for the toad may also need to include areas not currently occupied by the toad to enable reintroductions (USFWS 2017, p. 1).

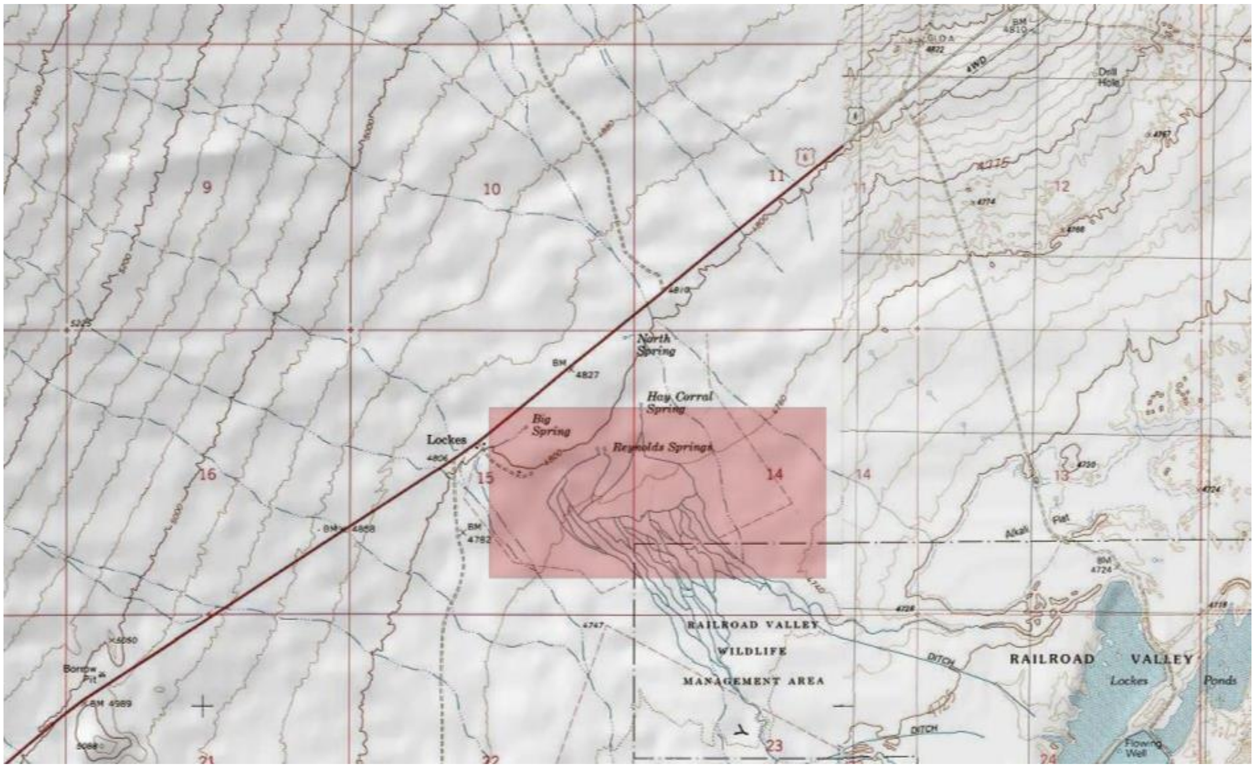

Figure 9. Critical habitat for the Railroad Valley springfish at Lockes Ranch. U.S. Fish and Wildlife Service | Copyright © National Geographic Society, i-cubed. Map created using the Service's online mapper, available at: https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77 (accessed January 2022).

State protections

The Railroad Valley toad is included on the Nevada Division of Natural Heritage (NDNH) At-Risk Plant and Animal Tracking List due to its critically imperiled rank at the global and state-level. This list directs NDNHs data acquisition priorities and provides up to date information on the status of these taxa. This is not, however a protective designation. No other designation or protection (NAC 503) is provided by the state (NDNH 2021, p. 1, 19, 24). The Nevada Department of Wildlife has proposed adding the species to the list of fully protected species (Board of Wildlife Commissioners 2021, p. 13). 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 has 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 Railroad Valley toad from federal actions which could impact its habitat.
Protections are additionally provided to the spring habitats at Lockes Ranch through ownership by NDOW of the land and water rights since 2005 (USFWS 2009a, p. 19; USFWS 2021, p. 7). Lockes Ranch is managed as a State Wildlife Management Area (WMA) by NDOW (NatureServe 2021a, p. 3) and is also known to the Service as Lockes WMA (USFWS 2021, p. 1). Lockes Ranch was purchased specifically for the recovery of the Railroad Valley springfish and other associated endemic species. The railroad valley recovery implementation team worked collaboratively to implement a habitat restoration and management plan, and in 2008 the four springs systems were restored to historical conditions (USFWS 2009a, p. 19). These and other recovery actions undertaken for the Railroad Valley springfish may indirectly benefit the Railroad Valley toad. However, the acquisition of Lockes Ranch by NDOW does not protect against groundwater development in the valley and adjacent valleys, which could decrease or eliminate groundwater on which these spring systems depend (USFWS 2021, p. 7).

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.

E. Other factors

1. Non-native vegetation

Non-native Russian Olive (*Elaeagnus angustifolia*) trees occur at Lockes Ranch and are a potential threat to the Railroad Valley toad habitat due to their ability to choke out native plants and alter the natural hydrology of riparian systems. Springs and outflows have so far benefitted from removal of Russian Olive and other vegetation management actions (USFWS 2021, p. 8).

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 while in the longer-term, a warming of 10-12°F is projected in most of central and northern Nevada under a high-emissions scenario (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. With increasing temperatures, less precipitation is predicted to fall as snow in Nevada. This trend, combined with a tendency for snowpacks to melt earlier due to the warming winters, is projected to decrease the amount of water in April snowpacks (when snow melt usually begins to replenish streams and rivers) by 30-50% by 2100 in most basins in the state. Less water in April snowpacks, less precipitation falling as snow and earlier precipitation runoff may in turn leave wetland habitats drier by the time summer arrives (State of Nevada Climate Initiative 2020, p. 13-14). A drier summer habitat could negatively impact toad maturation (Bison et al. 2021, p. 2-3).

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).

Finally, changes in climate can increase fire risk through changes in drying and warming. Winter precipitation is projected to increase, which can lead to more vegetation and fuels growth, while increasing spring and summer evaporative demand can increase wildlife risk by faster drying of vegetation (State of Nevada Climate Initiative, 2020, p. 18).

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 Railroad Valley 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 (*Id*.).

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. The combination of drought and a low population year could result in extinction. The environmental stochastic event can also have a human origin (USFWS 2009b, p. 20) such as the introduction of the non-native American bullfrog.

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 (USFWS, 2009b, p. 20). Moreover, it is fairly likely that droughts will become more frequent and intense in the future as a result of climate change (State of Nevada Climate Initiative 2020, p. 10).

Finally, the Railroad Valley toad is particularly vulnerable to stochastic events due to not only its small population size but also because it has extremely limited, if any, ability to colonize new areas in response to disturbances. As described in previous sections, the outflows of Big, Reynolds and Hay Corral springs are remote and isolated, with limited usable corridors for amphibian dispersal (Gordon et al. 2020, p. 177).

VI. REQUEST FOR CRITICAL HABITAT DESIGNATION

The Center for Biological Diversity formally requests the Service designate critical habitat for the Railroad Valley 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 Railroad Valley toad and areas with potential for recovery and determined to be important to the survival and recovery of the species. The toad population is restricted to one site and must be allowed to expand to other locations to prevent against stochastic events, and other threats, wiping out the entire population.

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