CENTER for BIOLOGICAL DIVERSITY Because life is good.

July 24, 2017

Marci Todd
Acting State Director
Bureau of Land Management
1340 Financial Blvd
Reno, NV 89502-7147

Via Facsimile: 775-861-6711

RE: Center for Biological Diversity et al. Protest of the September 2017 Competitive Oil and Gas Lease Sale, Battle Mountain District - DOI-BLM-NV-B020-2017-0036-DNA

Dear Ms. Todd:

The Center for Biological Diversity, Great Basin Resource Watch, Progressive Alliance of Nevada, the Sierra Club Toiyabe Chapter, and Western Watersheds Project (collectively, "Protestors") hereby file, this Protest of the Bureau of Land Management's ("BLM") planned September, 2017 Competitive Oil and Gas Lease Sale and Environmental Assessment DOI-BLM-NV-B020-2017-0036-DNA, pursuant to 43 C.F.R. § 3120.1-3. We formally protest the inclusion of each three parcels, covering 3,680 acres in the Battle Mountain District Office. The "specific serial numbers" of the parcels protested are NV-17-09-001, NV-17-09-002, and NV-17-09-003.

PROTEST

I. Protesting Parties: Contact Information and Statement of Interests:

This Protest is filed on behalf of Protestors by their authorized representative:

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The Center for Biological Diversity is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental

law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over 1.3 million members and on-line activists, including those living in Nevada who have visited these public lands in the Battle Mountain District management area for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

Great Basin Resource Watch is a 501(c)(3) non-profit organization, founded in 1994 by a coalition of environmental, Native American and scientific community representatives. GBRW is a regional environmental justice organization dedicated to protecting the health and well being of the land, air, water, wildlife, and human communities of the Great Basin from the adverse effects of resource extraction and use. GBRW's headquarters are in Reno, Nevada. GBRW informs communities about mining impacts through reports and educational materials. We review mine proposals, permits and expansions in Nevada and California, and recommends policy solutions to reduce toxic emissions, protect our water resources and preserve human and wildlife habitat.

The Progressive Leadership Alliance of Nevada was founded in 1994 to bring together diverse and potentially competing organizations into one cohesive force for social and environmental justice in Nevada. Since 1994, the organization has grown from 12 original founding member groups to a current membership of over 30 organizations.

The Sierra Club was founded in 1892 and is the nation's oldest grassroots environmental organization. The Sierra Club is incorporated in California, and has more than 815,000 members nationwide and 5800 in Nevada, and is dedicated to the protection and preservation of the environment. The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments. The Sierra Club's Toiyabe Chapter has members who visit lands affected by the proposed lease sale. The Sierra Club has members that live in, work and use this area for recreation such as hiking, snowshoeing, cross-country skiing, climbing, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

Western Watersheds Project is a non-profit organization with more than 5,000 members and supporters. Our mission is to protect and restore western watersheds and wildlife through education, public policy initiatives and legal advocacy. Western Watersheds Project and its staff and members use and enjoy the public lands and their wildlife, cultural and natural resources for health, recreational, scientific, spiritual, educational, aesthetic, and other purposes. Western Watersheds Project also has a direct interest in mineral development that occurs in areas with sensitive wildlife populations and important wildlife habitat.

The mailing addresses for individual protestors are as follows:

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II. Statement of Reasons as to Why the Proposed Lease Sale Is Unlawful:

BLM's Determination of NEPA Adequacy ("DNA") and proposed decision to lease the three parcels listed above are substantively and procedurally flawed for numerous reasons, detailed below. Because the DNA asserts that the proposed lease does not require preparation of an Environmental Assessment ("EA") because the proposed parcels "are very near/adjacent to

one of the parcels (# 106) specifically considered in DOI-BLM-NV-B020-2017-0002-EA, have geographic and resource conditions that are sufficiently similar, and would be subject to the same stipulations and lease notices attached to that parcel," DNA at 2, we hereby incorporate by reference hereto our May 25, 2017 protest of BLM's June 12, 2017 Battle Mountain District lease sale, and the references cited therein.[1] The principal flaws in BLM's analysis and proposed action are as follows:

1. The use of a Determination of NEPA Adequacy to authorize leasing of the proposed parcels is illegal under the National Environmental Policy Act and BLM's regulations.

2. Substantial new information exists regarding wildlife resources within the area that would be affected by the proposed action, including the existence of a distinct, recently-described species of toad.

3. BLM has completely failed to engage in any site-specific analysis of the foreseeable consequences of leasing for a number of important physical and biological resources, including surface and ground water, wetlands, and native species including the newly-described Railroad Valley toad, the threatened Railroad Valley springfish, and the Great Basin spadefoot toad.

3. BLM's proposed action is arbitrary and capricious because of the unfounded assumption, given recent levels of interest in oil and gas exploration in the Railroad Valley, that development is unlikely to occur.

4. BLM has never, under decades-old resource management plans, evaluated the site-specific impacts of modern oil and gas development, including hydrologic fracturing, on non-mineral resources within the Battle Mountain District, including listed and sensitive species, big game, surface and ground waters and springs, and soils and steep slopes. BLM's "Resource Protection Alternative" added to the June 2017 leasing decision in the Final Environmental Assessment has never been subject to public comment or adequately disclosed and analyzed, and arbitrarily assumes, without analysis or documentation, that additional stipulations will avoid all impacts from resulting oil and gas development.

5. BLM's DNA, in violation of law, fails to comply with Section 7 of the Endangered Species Act, which requires that agencies insure that their actions will not jeopardize the continued existence of species listed under the Endangered Species Act. Despite the presence of listed species, BLM improperly and in violation of law attempts to postpone its consideration of oil and gas activities to the drilling stage.

6. BLM has both failed to consider the climate and greenhouse gas emission impacts of its oil and gas leasing decisions, and has arbitrarily rejected alternatives, including no leasing and no fracking alternatives, that would mitigate the adverse climate impacts of its actions.

[1] See Center for Biological Diversity et al. Protest of the June 2017 Competitive Oil and Gas Lease Sale, Battle Mountain District - DOI-BLM-NV-B020-2017-0002-EA (May 25, 2017) (Exh. A).

A. BLM's Refusal to Prepare an Environmental Impact Statement or Environmental Assessment Violates the National Environmental Policy Act and Its Implementing Regulations

BLM cannot cure the lack of any detailed, contemporary analysis of the results of new leasing in the Railroad Valley through a Determination of NEPA Adequacy. As discussed in detail in our prior protest, neither the two-decade old Tonopah RMP nor the June Lease Sale EA provide any clear or meaningful description of the water, soil, wildlife, and paleontological resources that may be affected by additional oil and gas drilling in the Battle Mountain district as a whole, nor in the Railroad Valley in particular. Reliance on the June 2016 EA is particularly inapplicable, as the single Railroad Valley parcel analyzed in that EA – Parcel 106 – represented the reinstatement of a previously-authorized lease, as well as 640 new acres.[2] The current proposed lease sale, however, involves some 3680 acres of wholly new leasing in the Railroad Valley – an area with both demonstrated potential for oil and gas in the form of an existing producing field, and, as discussed below, unique hydrologic and biological resources.

NEPA requires agencies to undertake thorough, site-specific environmental analysis at the earliest possible time and prior to any "irretrievable commitment of resources" so that the action can be shaped to account for environmental values. Pennaco Energy, Inc. v. United States DOI, 377 F.3d 1147, 1160 (10th Cir. 2004). Oil and gas leasing is an irretrievable commitment of resources. S. Utah Wilderness All. v. Norton, 457 F. Supp. 2d 1253, 1256 (D. Utah 2006). Thus, NEPA establishes "action-forcing" procedures that require agencies to take a "hard look," at "all foreseeable impacts of leasing" before leasing can proceed. Center for Biological Diversity v. United States DOI, 623 F.3d 633, 642 (9th Cir. 2010); N.M. ex rel. Richardson v. BLM, 565 F.3d 683, 717 (10th Cir. 2009). Chief among these procedures is the preparation of an environmental impact statement ("EIS"). Id. BLM, however, did not prepare an EIS, or even an Environmental Assessment to determine whether preparation of an EIS is required.

In order to determine whether a project's impacts may be "significant," an agency may first prepare an Environmental Assessment ("EA"). 40 C.F.R. §§ 1501.4, 1508.9. If the EA reveals that "the agency's action may have a significant effect upon the . . . environment, an EIS must be prepared." Nat'l Parks & Conservation Ass'n v. Babbitt, 241 F.3d 722, 730 (9th Cir. 2001) (internal quotations omitted). If the agency determines that no significant impacts are possible, it must still *adequately* explain its decision by supplying a "convincing statement of reasons" why the action's effects are insignificant. Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1212 (9th Cir. 1998) (emphasis added). However, BLM's EA and draft FONSI fail to provide any reasonable "convincing statement of reasons" for a finding of no significant impact. BLM moreover failed to include any analyses for site-specific impacts. BLM claims:

> The sale of parcels and issuance of oil and gas leases is strictly an administrative action. The act of offering, selling, and issuing federal oil and gas leases does not produce impacts to water quality and surface water. On-the-ground impacts would not occur until

[2] June 2016 EA at 15.

> a lessee applies for and receives approval to drill on the lease. The BLM cannot determine at the leasing stage whether or not a proposed parcel will actually be sold, or if it is sold and issued, whether or not the lease would be explored or developed. Consequently, the BLM cannot determine exactly where on a lease a well or wells may be drilled or what technology may be used to drill and produce wells, so the impacts listed below are derived from historical information and what might be proposed in the near future. Impacts of any future proposed exploration or development would be analyzed under additional site-specific, project-specific environmental analysis.[3]

BLM failed both of NEPA's "twin aims": not only did BLM fail to ensure that the agency takes a "hard look" at the environmental consequences of its proposed action, it also failed to make information on the environmental consequences available to the public, which may then offer its insight to assist the agency's decision-making through the comment process. See, e.g., Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 349 (1989). NEPA's procedural requirement is not merely a formality, but is there to allow the agencies and the public to understand the consequences of the proposed lease auction. Not only did BLM fail to provide an adequate environmental analysis of the foreseeable impacts of the proposed lease sale, but furthermore failed to provide the public adequate notice of either foreseeable environmental impacts, or the consequences of its newly-added "Additional Resource Protection Alternative".

BLM's deferral of site-specific analysis until the APD stage is unlawful under NEPA, its implementing regulations, and legal precedents. Courts have repeatedly rejected BLM's claim that it is not required to conduct any site-specific environmental review until after the parcels are leased and a proposal is submitted by industry. See, e.g., Center for Biological Diversity & Sierra Club v. BLM, 937 F. Supp. 2d 1140, 1158 (N.D. Cal. 2013) (". . . BLM asserts the now-familiar argument that there is no controversy because any degradation of the local environment from fracking should be discussed, if ever, when there is a site-specific proposal. But the Ninth Circuit has specifically disapproved of this as a reason for holding off on preparing an EIS."); and Conner v. Burford, 848 F.2d 1441, 1450 (9th Cir. 1988) ("The government's inability to fully ascertain the precise extent of the effects of mineral leasing ... is not, however, a justification for failing to estimate what those effects might be before irrevocably committing to the activity.").

BLM is required under NEPA to perform and disclose an analysis of environmental impacts of the 106 parcels offered for lease *before* there are any "irreversible and irretrievable commitments of resources." Center for Biological Diversity, 937 F. Supp. 2d at 1152 (citing Conner v. Burford, 848 F.2d 1441, 1446 (9th Cir. 1988) ("Our circuit has held that an EIS must be prepared *before* any irreversible and irretrievable commitment of resources.") (emphasis added). "[N]on-NSO leases, even if subject to substantial government regulation, do constitute an 'irretrievable commitment of resources.' As a result, unless the lease reserves to the agencies an '*absolute right* to deny exploitation of those resources,' the sale of [] non-NSO leases ... constitutes the go or no-go point where NEPA analysis becomes necessary." Id at 1152. In other words, the specific environmental effects of oil and gas leasing in the project area must be analyzed and disclosed now, at the leasing stage.

[3] Revised EA at 42.

Rather than perform the environmental review as required, BLM asserts that all significant impacts of the proposed action are covered by the environmental impact statements (EISs) for the 1997 Tonopah Resource Management Plan ("RMP"), and and defers the site-specific analysis until after the parcels are leased.[4] This is unlawful. BLM is required to analyze all foreseeable human health and safety risks, and seismic risks, posed by unconventional extraction techniques before leasing. BLM's analyses on these issues are outdated and/or cursory at best. In a case called Center for Biological Diversity & Sierra Club v. BLM, 937 F. Supp. 2d 1140, 1152 (N.D. Cal. 2013), BLM also attempted to defer NEPA analysis of hydraulic fracturing (hereinafter referred to as "fracking") on the parcels at issue until it received a site-specific proposal, because the exact scope and extent of drilling that would involve fracking was unknown. The district court held BLM's "unreasonable lack of consideration of how fracking could impact development of the disputed parcels went on to unreasonably distort BLM's assessment," and explained:

> "[T]he basic thrust" of NEPA is to require that agencies consider the range of possible environmental effects before resources are committed and the effects are fully known. "Reasonable forecasting and speculation is thus implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as 'crystal ball inquiry.'"

Center for Biological Diversity, 937 F. Supp. 2d at 1157 (citing City of Davis v. Coleman, 521 F.2d 661, 676 (9th Cir. 1975)).

As the courts have made clear time and again, NEPA requires that "assessment of all 'reasonably foreseeable' impacts must occur at the earliest practicable point, and must take place before an 'irretrievable commitment of resources' is made." N.M. ex rel. Richardson v. BLM, 565 F.3d 683, 717-18 (10th Cir. 2009) (citing 42 U.S.C. § 4332(2)(C)(v)); compare with Center for Biological Diversity, 937 F. Supp. 2d at 1152 (N.D. Cal. 2013) ("Agencies are required to conduct this review at the 'earliest possible time' to allow for proper consideration of environmental values. . . A review should be prepared at a time when the decisionmakers 'retain a maximum range of options.'"). In Richardson, BLM argued there also that it was not required to conduct any site-specific environmental reviews until the issuance of an APD. The court looked to the Ninth and D.C. Circuits in concluding that "NEPA requires BLM to conduct site-specific analysis before the leasing stage." Richardson, 565 F.3d at 688. Richardson then offered a two-part test to determine whether NEPA has been satisfied: First we must ask whether the lease constitutes an "irretrievable commitment of resources." The Tenth Circuit, again citing to the Ninth and D.C. Circuits, concluded that issuing an oil and gas lease without an NSO stipulation constitutes such a commitment. Second, the agency must ask whether all "foreseeable impacts of leasing" have been taken into account before leasing can proceed. Id. Given the utter lack of any site-specific review of the present surface-occupancy-permitting parcels, for this lease sale, such impacts have not been taken into account.

B. Substantial New Information Exists Regarding Wildlife Resources Within The Area That Would Be Affected By The Proposed Action

[4] DNA at 1-2.

As described in detail in the attached letter from biologist Michelle Gordon,[5] scientists have recently documented a population of toads found only in the Railroad Valley of Nye County, Nevada. [6]

On July 20, the University of Nevada, Reno, announced the discovery of the Railroad Valley toad by Gordon and her colleague Dick Tracy.[7] The discovery represents the culmination of ten years of data collection, "shape" comparison, and DNA studies.[8] The Railroad Valley toad is found only in the Tonopah Basin, in the valley that would be affected by the three proposed lease parcels.

> The small isolated toad populations also have the smallest individuals compared to other western toads.The Dixie Valley species has the smallest body size among the region's complex of related species in the western United States, and can be further diagnosed from other toads in the complex by the large glands on its hind legs in addition to its distinctive coloration.
>
> The overall population numbers of the Dixie Valley toad are unknown, and the current range is severely restricted, suggesting that this species' population is likely very small and especially vulnerable to changes in environment.
>
> "The toads are perfectly concealed in the dense vegetation of their habitat," Gordon said. "You could easily miss seeing them during the day, making accurate counts difficult. But, during one trip at dusk, toads were everywhere, giving the impression that toads were locally abundant. And, without the water in this habitat, this toad species would completely disappear."[9]

Gordon, lead author on the scientific paper describing the Railroad Valley toad, and who conducted both morphological and molecular studies of the toads found in the Railroad Valley, writes:

> The results of our molecular and morphological analyses support that, like Dixie Valley, the toads in Railroad Valley represent another new species within the genus Bufo and are so rare that this newest species only occurs in spring fed wetland habitat within and around the Locke's Ranch area. The level of divergence detected in our genetic analyses of Railroad Valley indicate that these toads have been isolated longer than Dixie Valley (650KY) and exhibit a unique suite of morphological characteristics that distinguish this newest species from the broadly distributed Western toad (Bufo(Anaxyrus) boreas). Our species description detailing our analyses and description of the Railroad Valley toad is in final edits within our laboratory before we submit to Copeia for review and we

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[5] Letter from Michelle Gordon, M.Sc. (July 12, 2017) (attached as Exh. B)
[6] *See* Michelle Gordon, Three new bufonid (*Bufo (Anaxyrus)*) species discovered within the Great Basin and the consequences of taxonomic crypsis 50-70, M.Sci. Thesis (May 2017) (attached as Exh. C)
[7] Nevada Today, Rare Discovery of Three New Toad Species in Nevada's Great Basin by College of Science (july 20, 2017), https://www.unr.edu/nevada-today/news/2017/new-toad-species-discovered (attached as Exh. D)
[8] *Id.*
[9] *Id.*

hope to publish early next year. This is an exciting discovery, as these toads appear to have a unique phylogeographic connection outside the Great Basin. However, these toads face numerous challenges to persistence, partly due to critical dependence on the rare water that creates the necessary habitat for toads to forage and reproduce. The marshland areas produced by the springs near and in Locke's Ranch are small and isolated, but sustain not only these rare toads, but other unique aquatic fauna such the threatened Railroad Valley springfish (Crenichthys nevadae) and Great Basin spadefoot toad (Spea intermontana). However, Railroad Valley has a long history of gas and oil production and exploration. But consequences of such activities could result in mismanagement of resources within the valley or the overexploitation of rare water that result in habitat loss which would have profound impacts on the unique diversity within this valley, including the Railroad Valley toad.

There are multiple springs in Railroad Valley that could provide suitable toad habitat, but recent surveys have not yielded any sighting of this new species nor is there a historical record of collection for this toad among museums (MVZ, California Academy of Sciences). It appears that the Railroad Valley toad species is restricted to a severely small geographic range that is fragmented by desert sagebrush steppe, limiting dispersal of these toads from outside the moist vegetation of the marshy areas of the Locke's Ranch. And, similar to the scenario for Dixie Valley, the spring fed wetland habitat is highly susceptible to human influences and overexploitation that could lead to degradation or habitat loss that could result in the extinction of this new species before we have fully learned about this unique toad.[10]

The presence of a potentially distinct species of amphibian limited only to the Railroad Valley, and reliant on strictly limited areas of spring-fed wetland in the area, plainly represents "new information or circumstances." Although known occurrences of the newly-discovered toad are at Locke's Ranch, a wildlife preserve owned by the Nevada Department of Wildlife, located approximately 5 miles away from the DNA parcels, additional oil and gas leasing, drilling, and associated water use and other activity have the foreseeable likelihood of affecting the hydrology of the springs in and around Locke's Ranch.

In light of this information, BLM cannot "reasonably conclude that new information and new circumstances would not substantially change the analysis of the new proposed action."[11] Neither the 1997 Tonopah RMP EIS, the June Lease Sale EA, nor the DNA contain any acknowledgment or analysis of the presence of the Railroad Valley toad, nor the potential effects of additional drilling in the area on the spring-fed wetlands upon which it relies.

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[10] *Id.*
[11] DNA at 2.

C. BLM's DNA Violates NEPA By Failing to Disclose the Site-Specific Indirect and Cumulative Impacts of Its Proposed Action

BLM must take a hard look at the specific parcels that it is offering for oil and gas leasing, and the foreseeable impacts to the resources on these parcels. This includes disclosure of "the environment of the areas to be affected or created by the alternatives under consideration." 40 C.F.R. § 1502.15. Neither the DNA, nor the prior June Lease Sale EA, provide any detailed description of the Railroad Valley, a unique natural area containing significant marshes, threatened and sensitive fish, and unique amphibian species. BLM instead insists, however, on postponing any such analysis until it has already signed over drilling rights and is unable to preclude all surface disturbing activities to prevent critical environmental impacts that may arise after a proper NEPA analysis, asserting that "[e]xploration and/or development proposals will be further analyzed for direct, indirect and cumulative impacts at the time the proposals are submitted."[12] This is a violation of NEPA.

As the time for NEPA analysis was triggered by the proposal for the sale of the lease, BLM had to analyze whether its decision to open lands with unique and significant water and biological resources to development activities such as fracking might have significant environmental impact. Center for Biological Diversity & Sierra Club v. BLM, 937 F. Supp. 2d 1140, 1153 (N.D. Cal. 2013). If BLM finds based on the EA that the proposed actions will not significantly affect the environment, BLM can issue a finding of No Significant Impact ("FONSI") in lieu of the EIS. Id. However, in this case, BLM has not even prepared an EA, but rather, relies, in violation of its own regulations and manual, on a so-called "Determination of NEPA Adequacy."

NEPA regulations make no mention of Determinations of NEPA Adequacy – they are not NEPA documents, and cannot remedy failings in prior NEPA documents. BLM's Departmental Manual allows for their use when a proposed action is covered by existing NEPA analysis, and "there are no new circumstances, information, or unanticipated or unanalyzed environmental impacts that warrant new or supplemental analysis."[13] Here, not only is the prior NEPA analysis relied upon insufficient, but significant additional impacts are likely to occur on the additional three Railroad Valley parcels that have never been analyzed in any NEPA document.

In Center for Biological Diversity v. National Highway Traffic Safety Admin., 538 F.3d 1172 (9th Cir. 2008) the court took similar issues with the BLM's failure to explain why it chose not to prepare an EIS:

> Nowhere does the EA provide a 'statement of reasons' for a finding of no significant impact, much less a 'convincing statement of reasons.' For example, the EA discusses the amount of CO[2] emissions expected from the Rule, but does not discuss the potential impact of such emissions on climate change. In the "Affected Environment" section of the EA, NHTSA states that "[i]ncreasing concentrations of greenhouse gases are likely to accelerate the rate of climate change." The agency notes that "[t]he transportation sector

[12] DNA at 3.
[13] Department of the Interior Departmental Manual, Part 516, Section 11.6

> is a significant source of greenhouse gas (GHG) emissions, accounting for approximately 28 percent of all greenhouse gas emissions in the United States." From this, NHTSA jumps to the conclusion that "[c]oupled with the effects resulting from the 2003 light truck rule, the effects resulting from the agency's current action are expected to lessen the GHG impacts discussed above."

Id. at 1223 (internal citations omitted).

Similar to the National Highway Traffic Safety Admin case, the DNA (and June Lease Sale EA on which it relies) at issue here do not provide any clear or convincing statement of reasons for a finding of no significant impact. The June Sale EA discusses generally and vaguely the amount of surface disturbance that may result from leasing, the number of wells that might be drilled, the types of pollutants that may be emitted during development and production; but it does not discuss the potential impacts of any of these on the specific lands, waters, and species present within the areas proposed for leasing. The DNA, in turn, provides no information whatsoever regarding the resources that may be affected on the three additional Railroad Valley parcels. BLM cannot simply jump to the conclusion that its stipulations and proposed mitigation measures will lessen the potential impacts to the level of insignificance.

In evaluating the significance of the impact of the proposed action, the agency must consider both the context of the action as well as the intensity. The several contexts in which the significance of an action must be analyzed includes: "society as a whole (human, national), the affected region, the affected interests, and the locality." 40 C.F.R. § 1508.27. For site-specific actions, significance usually depends on the impact of the action on the locale, id., but in light of the recent Paris Agreement, it also depends on the impact on the world as a whole. Thus, to determine the significance of the action, BLM needed to look at not only the environmental impacts on the area to be leased, but also the analysis of the cumulative effects of oil and gas leasing on climate change.

Intensity is determined by scrutinizing the ten factors described in 40 C.F.R. § 1508.27:

> (1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
>
> (2) The degree to which the proposed action affects public health or safety.
>
> (3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
>
> (4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.
>
> (5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The presence of any *one* of these factors may be sufficient to require an EIS. Id. Several of these factors are implicated in this lease sale. The ones we highlight here in this comment letter are discussed in greater detail below. For one, there is a clear "controversy" regarding the nature of the drilling to occur on the leases and the potential impacts drilling would impose on air, water, soil, and wildlife resources among other things. A proposal is highly controversial when "substantial questions are raised as to whether a project... may cause significant degradation" of a resource. Northwest Envtl. Def. Ctr. v. Bonneville Power Admin., 117 F.3d 1520, 1536 (9th Cir. 1997). A substantial dispute may concern the "size, nature, or effect" of the action. Blue Mts. Biodiversity Project v. Blackwood, 161 F.3d 1208, 1212 (9th Cir. 1998).

Furthermore, BLM's estimates regarding surface disturbance is based on historic information from decades old RMPs which apparently do not take into account the recent sharp increase in leasing nominations and initial instances of fracking use in Nevada.[14] BLM should have considered in its EA the increased industry interest in Nevada oil and gas, and the potential for drilling levels to increase, should oil prices rise or well stimulation techniques change the production potential of Nevada hydrocarbon-bearing formations.

"[T]o prevail on a claim that the agency violated its statutory duty to prepare an EIS, a plaintiff need not show that significant effects will in fact occur. It is enough for the plaintiff to raise substantial questions whether a project may have a significant effect on the environment."

[14] See BLM Nevada, 2015 and 2016 Expressions of Interest, *available at* https://nflss.blm.gov/eoi/list; See also DeLong, Jeff, "Fracking Hits Home in Nevada," *Reno Gazette-Journal* (April 15, 2014).

Ctr. for Biological Diversity & Sierra Club v. BLM, 937 F. Supp. 2d 1140, 1154 (N.D. Cal. 2013). The significance of the impact of the proposed action depends on both the context of the action as well as the intensity. Id.

Numerous environmental harms may result from unconventional methods used by the industry to extract oil and gas, including hydraulic fracturing and horizontal drilling, as well as concerns relating to climate change. BLM has declined to look at these issues until it receives an APD proposal from the industry. As we have already explained above, this is unlawful. The impact of fracking alone raises substantial questions on whether the proposed project may have significant effects on the environment.

As discussed in our previous Protest of the June 2017 Lease Sale EA, BLM is required to prepare an Environmental Impact Statement ("EIS") or, at a minimum, take a hard look at site-specific impacts in its EA before coming to a decision as to whether an EIS is needed. Instead BLM continues to rely on "current resource and land use information and the management framework developed in the appropriate district or field office Resource Management Plans."[15] With the exception of last year's amendments for greater sage-grouse management, however, these "current" RMPs, with which these stipulations are in accordance, date from 1986 and 1997 respectively.

With the exception of the September 2015 Nevada and Northeastern California Greater Sage-Grouse Record of Decision and Approved Resource Management Plan Amendment ("2015 GRSG RMP") which covers only issues relating to greater sage-grouse, the Tonopah RMP has not been revised in two decades, and therefore does not address the emergence of new and significant information, including but not limited to that relating to the new and dangerous extraction methods of fracking and horizontal drilling, or the increased seismic risks from such extraction methods. Specifically, BLM's reliance on the brief and extremely general "Hydraulic Fracturing White Paper" (Appendix E) fails to consider or analyze any of the site-specific impacts to springs, surface waters, shallow aquifers, or hydrologic and geological conditions specific to the lands and waters of the Battle Mountain District.

As BLM has not provided any environmental review of the parcels at issue or any site-specific analysis of the potential environmental impacts from the proposed action. BLM failed to take a hard look at the foreseeable impacts from the lease sale, oil and gas development, and the use of hydraulic fracking technologies. In particular, BLM failed to take a hard look at the potential impacts of the proposed action on water resources, air quality, climate change, human health and safety, seismicity, and sensitive species of plants and wildlife.

1. BLM does not Consider Potential Impacts to Water Resources in Proposed Sale Area

The June lease sale Environmental Analysis inadequately analyzes potential impacts to water resources and the plant and wildlife communities that rely on them. In the Environmental Assessment, BLM acknowledges the diverse array of water features located within parcels

[15] Revised June Lease Sale EA at 1.

proposed for leasing. This includes, but is not limited to, 34 springs and seeps, 3.9 miles of perennial streams, 674 acres of freshwater wetlands, and 13,044 acres of seasonally inundated playa. According to the EA, these are "the most productive and important ecosystems on the Battle Mountain District," containing "the majority of the [area's] biodiversity."[16] The September Lease Sale DNA, however, fails to provide any analysis whatsoever of the specific water resources, including the marshes of the Railroad Valley and the groundwater aquifers upon which they rely, that would be affected by expanded oil and gas drilling in the Railroad Valley.

a. The EA does not analyze impacts to water quantity

The DNA asserts that "Environmental concerns, interests, and resource values have changed little since the analysis documented in DOI-BLM-NV-B020-2017-0002-EA." That EA contains no disclosure or analysis of potential effects on water quantity. This is a critical deficiency in the DNA and EA's analysis of impacts, as the proposed lease areas are in arid environments, receiving something on the order of 5-6 inches of precipitation annually, per data cited in the June Lease Sale EA.

It is probable that any development of parcels proposed for lease in this sale would utilize hydraulic fracturing (HF). As such, it is incumbent upon BLM to analyze impacts to water quantity under the assumption that any development of the parcels would occur using HF.

An EPA study found that the volumes of water needed to successfully fracture rock to open up oil and gas resources vary widely: statewide median quantities utilized fell between 76,818 gallons (0.23 acre-feet) per well in California to 5,259,965 gallons (15.9 acre-feet) per well.[17] Without citations, the EA's own HF "white paper" puts forward ranges of 50,000 to 300,000 gallons (0.15 to 0.91 acre-feet) for shallow vertical wells, and 800,000 to 10,000,000 gallons (2.4 to 30.3 acre-feet) for deep tight sand gas horizontal or directionally drilled wells.

In addition to information about the quantities of water, an important piece of information in determining the impacts to water quantity is the number of anticipated wells. In this, the EA falls woefully short. The Reasonably Foreseeable Development (RFD) scenario is based exclusively on past development in Nevada, which has been miniscule compared to other Western States. It does not account for current or anticipated market trends, including the volatile price of oil. The RFD anticipates only 25 wells being developed in the Battle Mountain district. Should the price of oil spike, this number could dramatically increase, potentially numbering in the thousands of wells being developed across Nevada.

Given the variability in both estimates of water consumption per well and in the number of anticipated wells, there is great uncertainty in attempting to evaluate the impacts of the proposed lease sale on quantities of water. However, this does not relieve BLM from their legal obligation to evaluate such impacts. 40 CFR §1502.22 is known as the "uncertainty rule," and indicates that agencies must include information on uncertain impacts if such information "is

[16] DOI-BLM-NV-B020-2017-0002-EA, §3.2.4, p.41.
[17] U.S. EPA. Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/236F, 2016.

essential to a reasoned choice among alternatives, and the overall costs of obtaining it are not exorbitant." And indeed, these requirements are important for "impacts which have catastrophic consequences, even if their probability of occurrence is low."

The potential impacts to water quantity clearly meet this threshold. If hundreds or thousands of wells were developed, something that is not outside the realm of possibility should oil prices go back above $100 per barrel, and 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 from this lease sale 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. If the withdrawals are made from shallow alluvial aquifers, adjacent springs, wetlands, and other water features may dry up.[18] If the withdrawals are made from the deeper regional aquifer, effects may be far reaching and drying could occur tens of miles away. Additionally, due to connections between local and regional aquifers, intensive pumping of alluvial aquifers may eventually impact regional aquifers.[19]

Therefore, BLM has neglected its duty under NEPA to analyze the impacts of withdrawals for HF on water resources and their dependent ecosystems. Further, an adequate "hard look" at such impacts would include a very broad area of analysis based on a detailed hydrologic characterization of the regional aquifers potentially affected. As will be detailed below, dozens of endemic, endangered, or threatened species rely on water features potentially affected by pumping. Thus there are significant ramifications from neglecting to analyze impacts to water quantity.

b. The EA does not adequately analyze impacts to wildlife that depend on water features

Water features such as springs, seeps, perennial creeks, wetlands, inundated playas, and spring mounds are critical to the existence of Nevada's remarkable biodiversity. Dozens of species endemic to such water features have been discovered and described, and it is likely that there are many more which have yet to be discovered. In addition to endemic species, there are hundreds of other wildlife species which rely on water features to sustain life in such an arid environment.

BLM acknowledged the significance of potential impacts to water feature-dependent wildlife in the June Lease Sale Draft EA. "Several parcels are largely or entirely composed of wetland-riparian areas and playas that many wildlife species depend on. Oil and gas development could cause disproportionate and, in some cases, potentially irreversible habitat loss to these dependent species even with stipulated protection measures and BMPs."[20,21] Yet, despite the

[18] Deacon, J.E., A.E. Williams, C.D. Wilhams, and J.E. Williams. 2007. Fueling population growth in Las Vegas: How large-scale groundwater withdrawal could bum regional biodiversity. Bioscience 57(8): 688-698.
[19] U.S. Geological Survey Circular 1139. "Ground Water and Surface Water: A Single Resource." 1998.
[20] DOI-BLM-NV-B020-2017-0002-EA, DRAFT, §3.2.8, p.50.
[21] This statement was revised in the Final EA to read: "several parcels are largely or entirely composed of wetland-riparian areas and playas that many wildlife species depend on. Oil and gas development without proper engineering

clear possibility of significant impacts to water features from the proposed action, neither the DNA nor the EA upon which it relies contains any site-specific impacts groundwater, wetlands, or the wildlife which rely on those features. The following is a non-comprehensive list of wildlife who could be significantly impacted by the proposed action:

Springsnails

There are five species of springsnails which occur in the Railroad Valley: Big Warm Spring Pyrg (*Pyrgulopsis papillata*), Duckwater Pyrg (*P. aloba*), Duckwater Warm Springs Pyrg (*P. villacampae*), Lockes Pyrg (*Pyrgulopsis lockensis*), and the Southern Duckwater Pyrg (*P. anatina*). The Center for Biological Diversity petitioned the US Fish and Wildlife Service to protect these species under the Endangered Species Act in 2009. The Service declined to list these species, citing restoration of habitat and remaining unallocated groundwater in the basin as reasons.[22]

The Service used oversimplified reasoning in their determination. They simply subtracted the current usage from the perennial yield of the basin to come up with an amount of remaining unallocated groundwater. However, determining the potential for impacts to water features from groundwater pumping is not that simple. Groundwater can behave in paradoxical ways, and drawdown of aquifers can occur even if a basin is not overallocated. Groundwater pumping forms a wide "cone of depression" surrounding the point of diversion, reducing aquifer levels across the "area of influence," meaning the areal extent of the cone.[23] Thus while a basin may not be overallocated, any given pumping project can cause localized impacts across the area of influence.

Since the springsnails listed here occur in extremely isolated and singular habitats, generally just one spring, and since almost any impact to such springs would have the potential to wipe out these sensitive species, it is incumbent upon BLM to include an analysis of the potential impacts of groundwater withdrawals for HF in the Railroad Valley. This includes a detailed characterization of the aquifer and potential hydrologic connections between any area proposed for pumping and springs known to harbor springsnails.

Fish

The Great Basin is home to a wide array of fishes, many of which are endemic to specific habitats like springs. Like springsnails, these fishes are incredibly vulnerable to perturbations in their habitat. Thus it should come as no surprise that the majority of Nevada species protected under the Endangered Species Act are fishes.[24] There are several fishes which have the potential to be directly or indirectly affected by the proposed action. BLM needs to analyze the impacts to these species.

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controls, BMPs, and mitigation could cause disproportionate and, in some cases, potentially irreversible habitat loss to these dependent species." BLM did not provide a reason for changing the wording.

[22] FR 76 (177) at 56614.

[23] Basic Groundwater Hydrology. Heath, R.C. U.S. Geological Survey Water-Supply Paper 2220. 2004.

[24] Nevada Natural Heritage Program, "At Risk Plant and Animal Tracking List, January 2017."

The Railroad Valley springfish (*Crenichthys nevadae*) is federally listed as threatened, and occurs in just five or six springs in two localities in Railroad Valley. These springs were designated as critical habitat by Fish and Wildlife Service in 1986. Of particular concern with this fish is the Lockes Ranch spring complex, which lies approximately two miles from the three proposed parcels.

Groundwater pumping in such close proximity to the critical habitat of a threatened fish poses a dire threat to its continued occupancy of critical habitat. BLM needs to analyze the potential impacts of pumping in this area, and must do a Section 7 consultation with FWS. The Railroad Valley tui chub (*Siphateles bicolor ssp. 7*), a BLM sensitive species, also occurs in isolated springs in Railroad Valley, and analysis of impacts to it should be included. Although the June EA dismissed impacts to the Railroad Valley tui chub due to its assertion that Parcel 106 of that sale was two miles from occupied Railroad Valley tui chub habitat, the DNA fails to provide any analysis whatsoever of the proposed parcel's proximity to tui chub habitat

Birds

Numerous migratory birds utilize Nevada's springs, riparian areas, and phreatophytic vegetation for habitat. Notably, the federally endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and the federally threatened Yellow-billed cuckoo (*Coccyzus americanus*) both utilize phreatophytic and riparian vegetation in their migratory paths across Nevada. While their critical habitat and most occurrences have been in far southern Nevada, they have been documented to occur in the Great Basin as well.

Even small perturbations in groundwater levels can cause a loss of phreatophyte productivity, a reduction in phreatophyte cover, and ultimately a wholesale conversion to non-phreatophytic upland vegetative communities.[25] And in wetland areas, drawdown of the aquifer can result in decreased productivity and eventual type-conversion to shrubland. As such, BLM is obligated to examine the impacts of the proposed action to groundwater-dependent plant communities and the bird species which depend upon them for survival.

c. The Water Resources Stipulation (#NV-B-10-B-CSU) provides inadequate protection to critical water resources and the wildlife which depend on them.

Rather than deferring the tens of thousands of acres of proposed leases which have substantial conflict with water resources, BLM in its June lease sale elected to implement a new stipulation. Although we commend BLM's acknowledgment of its authority to consider and add lease stipulations at the leasing stage, the particular stipulation relied upon here would do little to protect water resources and the wildlife which depend on them.

Indeed, BLM seems to be mixing terms. While the ostensible point of the stipulation is to protect water resources, it provides only three mechanisms for protection: environmental review,

[25] Cooper, D.J., Sanderson, J.S., Stannard, D.I., Groeneveld, D.P. "Effects of long-term water table drawdown on evapotranspiration and vegetation in an arid region phreatophyte community." 2006. *Journal of Hydrology* 325.

engineering controls, and mitigation measures; and these only apply within 500 feet of wetland/riparian areas. Environmental review is simply that- an administrative action that provides no protection to resources in and of itself. Engineering controls and other mitigation measures do not actually provide protection for resources, but simply reduce the harm of the proposed action to the resources. These are very different, conceptually. With regard to groundwater pumping, a 500 foot buffer is not nearly enough. If a well requires millions of gallons of water to fracture, the cone of depression will extend well beyond such a buffer. Neither the June Lease Sale EA nor the September Lease Sale DNA provide any analysis of the foreseeable water demands of drilling operations in the Railroad Valley, nor the consequences to the area's groundwater aquifer and the springs and marshes supported by the aquifer.

d. BLM Has Failed to Analyze Impacts to Significant Paleontological Resources

In the June Lease Sale EA, BLM acknowledged that "The parcel in Railroad Valley has low to moderate potential for significant paleontological resources."[26] Despite the proposal to lease three additional but distinct parcels in the Railroad Valley, the DNA, however, makes no effort to disclose or analyze paleontological resources that could be adversely affected by resulting drilling activity.

D. BLM's proposed action is arbitrary and capricious because of the unfounded assumption that development is unlikely to occur

Reliance on the June lease sale EA is also arbitrary and capricious because of that document's assumption that only a small fraction of proposed leases will ever result in development. Looking at the history of oil and gas exploration and development throughout the entire Tonopah Field Office, the BLM concluded that "[t]he recent exploration and development history provides a basis for estimating a low development potential for oil and gas disturbance that might indirectly result from the June 2016 Competitive Oil and Gas Lease Sale."[27] By the June Lease Sale EA's own admission, however, this broad assumption of "low development potential" is not applicable to the Railroad Valley, where successful oil and gas production already exists. As BLM concedes, "it would be highly speculative to assume that production wells and additional oil fields would be developed within the [Tonopah Field Office] in areas other than Railroad Valley in the eastern part of the field office area, where the potential is moderate to high and where current well fields exist."[28] Given the existing field and moderate to high potential, it is false for BLM to assume that the foreseeable consequences of leasing within the Railroad Valley will be the same low ratio of successful wells as throughout the much larger Tonopah Field Office area analyzed in the June EA.

E. BLM's DNA Relies on an Alternative That Has Never Been Subject to Public Comment

In the Draft EA for its June Lease Sale, BLM recommended a "Partial Deferral Alternative" for approximately half of the affected area – including the single Railroad Valley parcel at issue - based on the fact that the Tonopah Resource Management Plan has last been

[26] June Lease Sale Final EA at 38.
[27] June Lease Sale Final EA at 20.
[28] *Id.* (emphasis added).

evaluated in 1997, and has never considered numerous significant developments (including hydraulic fracturing and potential effects on ground and surface waters):

> The Tonopah and Shoshone-Eureka RMPs, approved in 1986 and 1997 respectively, are scheduled to be replaced with a single updated RMP for the Battle Mountain District which would allow management to reflect the changing needs of the planning area. The process of developing the updated RMP was begun in 2010 and temporarily suspended while the GRSG Plan Amendment (see Section 1.3) was under development, to ensure that the RMP would be consistent with the extensive management direction it provides. The Battle Mountain District anticipates resuming the RMP update in 2017.

Draft June Lease Sale EA at 12. The Final June EA instead adopts as proposed alternative an "Additional Resource Protection Alternative": "Instead of deferring some parcels and parts of parcels from lease sale pending a future RMP update, new stipulations would be created and applied immediately to the same parcels (entire parcels) via this EA process. Additional parcels with important wildlife habitats would also have appropriate stipulations applied (Appendix C.2)." Revised EA at 2.

The last-minute addition of the "Additional Resource Protection Alternative," violates NEPA for two primary reasons. First, by adding an entirely new alternative at the last minute without and opportunity for public comment or agency decisionmaker consideration of such comment, it violates NEPA's requirement to involve the public at the earliest possible opportunity. Second the Final June EA contains no substantive or site-specific analysis of the degree to which the added stipulations will or will not actually be effective at reducing adverse impacts to the resources in question, including ground and surface waters, steep slopes, and wildlife habitat.

In addition, the use of a Determination of NEPA Adequacy for the current proposed lease sale, a decision with significant impacts distinct from those of the June lease sale, requires public comment. BLM's own NEPA Handbook states that, even where a Determination of NEPA Adequacy is used, "[i]n general, where the new proposed action has not already been discussed during the public involvement for the existing EA or EIS, some additional public involvement for the new proposed action will be necessary." BLM NEPA Handbook H-190-1. The three September Railroad Valley parcels were never disclosed to the public nor considered in connection with the June lease sale. In particular, BLM's failure to provide any opportunity for public input on this lease sale has deprived the agency of the ability to consider relevant significant new information, such as the discovery of the Railroad Valley toad. BLM cannot proceed with the lease sale without providing the public with a reasonable opportunity to comment on the decision.

F. BLM Has Failed to Consider Impacts to Endangered and Threatened Species and to Insure that Its Action Will Not Jeopardize their Continued Existence

BLM's must consult with the Fish and Wildlife Service prior to leasing to insure that its action does not jeopardize the continued existence, or adversely modify critical habitat, for the Railroad Valley Springfish (*Crenichthys nevadae*). The DNA and June EA on which its relies illegally forego any consideration or analysis of the effects of oil and gas drilling and

development on these affected species by deferring those required analyses to the permitting stage.

BLM's refusal to consult with the Fish and Wildlife Service regarding impacts to listed species including the Railroad Valley springfish prior to leasing violates Section 7 of the Endangered Species Act. The June EA reveals the presence of threatened, endangered, and sensitive species and their critical habitat within the areas proposed for leasing, but fails to provide any meaningful information regarding potential effects. The September DNA, in turn, fails to provide any analysis or disclosure whatsoever of the extent to which the Railroad Valley Springfish and its habitat may be affected by drilling on the proposed parcels, and resulting ground and surface water impacts. BLM must not only evaluate the indirect and cumulative effects on special status species under NEPA, it must also (a) consult with the Fish and Wildlife Service under Section 7 regarding the effects of oil and gas development and water use on listed species and critical habitat, and (b) evaluate the effects on sensitive species under its own sensitive species policy.

Congress enacted the Endangered Species Act (ESA) in 1973 to provide for the conservation of endangered and threatened fish, wildlife, plants and their natural habitats. 16 U.S.C § 1531, 1532. The ESA imposes substantive and procedural obligations on all federal agencies with regard to listed and proposed species and their critical habitats. *See id.* §§ 1536(a)(1), (a)(2) and (a)(4) and § 1538(a); 50 C.F.R. § 402. Under section 7 of the ESA, federal agencies must "insure that any action authorized, funded, or carried out by such agency ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined ... to be critical."16 U.S.C. § 1536(a)(2).

The definition of agency "action" is broad and includes "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies," including programmatic actions. 50 C.F.R. § 402.02. Likewise, the "action area" includes "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." *Id.*

The duties in ESA section 7 are only fulfilled by an agency's satisfaction of the consultation requirements that are set forth in the implementing regulations for section 7 of the ESA, and only after the agency lawfully complies with these requirements may an action that "may affect" a protected species go forward. *Pac. Rivers Council v. Thomas*, 30 F.3d 1050, 1055-57 (9th Cir. 1994). The action agency must initially prepare a biological assessment (BA) to "evaluate the potential effects of the proposed action" on listed species. 50 C.F.R. § 402.12. If the action agency concludes that the proposed action is "not likely to adversely affect" a listed species that occurs in the action area, the Service must concur in writing with this determination. *Id.* §§ 402.13(a) and 402.14(b). If the Service concurs in this determination, then formal consultation is not required. *Id.* § 402.13(a). If the Service's concurrence in a "not likely to adversely affect" finding is inconsistent with the best available data, however, any such concurrence must be set aside. *See id.* § 402.14(g)(8); 5 U.S.C. § 706(2). If the action agency concludes that an action is "likely to adversely affect" listed species or critical habitat, it must enter into "formal consultation" with the Service. 50 C.F.R. §§ 402.12(k), 402.14(a). The

threshold for triggering the formal consultation requirement is "very low"; indeed, "any possible effect ... triggers formal consultation requirements."[29]

Formal consultation commences with the action agency's written request for consultation and concludes with the Service's issuance of a "biological opinion." 50 C.F.R. § 402.02. The biological opinion states the Service's opinion as to whether the effects of the action are "likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat." *Id.* § 402.14(g)(4).[30] When conducting formal consultation, the Service and the action agency must evaluate the "effects of the action," including all direct and indirect effects of the proposed action, plus the effects of actions that are interrelated or interdependent, added to all existing environmental conditions – that is, the "environmental baseline." *Id.* §§ 402.14 and 402.02. The environmental baseline includes the past and present impacts of all Federal, state, and private actions and other human activities in the action area...."*Id.* The effects of the action must be considered together with "cumulative effects," which are "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." *Id.*

If the Service concludes in a biological opinion that jeopardy is likely to occur, it must prescribe "reasonable and prudent alternatives" to avoid jeopardy. *Id.* § 402.14(h)(3). If the Service concludes that a project is not likely to jeopardize listed species, it must nevertheless provide an incidental take statement (ITS) with the biological opinion, specifying the amount or extent of take that is incidental to the action (but which would otherwise be prohibited under Section 9 of the ESA), "reasonable and prudent measures" (RPMs) necessary or appropriate to minimize such take, and the "terms and conditions" that must be complied with by the action agency to implement any reasonable and prudent measures. 16 U.S.C. § 1536(b)(4); 50 C.F.R. § 402.14(i).

The ESA requires federal agencies to use the best scientific and commercial data available when consulting about whether federal actions will jeopardize listed species. *See* 16 U.S.C. § 1536(a)(2).Accordingly, an action agency must "provide the Service with the best scientific and commercial data available or which can be obtained during the consultation for an adequate review of the effects that an action may have upon listed species of critical habitat." 50 C.F.R. § 402.14(d). Likewise, "[i]n formulating its biological opinion...the Service will use the best scientific and commercial data available." *Id.* § 402.14(g)(8). However, if the action agency failed "to discuss information that would undercut the opinion's conclusions," the biological opinion is legally flawed, and the ITS will not insulate the agency from ESA Section 9 liability. *See Ctr. for Biological Diversity v. BLM*, 698 F.3d 1101, 1127-28 (9th Cir. 2012).

Section 7(d) of the ESA provides that once a federal agency initiates consultation on an action under the ESA, the agency, as well as any applicant for a federal permit, "shall not make any irreversible or irretrievable commitment of resources with respect to the agency action which

[29] *See* Interagency Cooperation Under the Endangered Species Act, 51 Fed. Reg. 19,926 (June 3 1996).
[30] To "jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." *Id.* § 402.02.

has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would not violate subsection (a)(2) of this section." 16 U.S.C. § 1536(d). The purpose of section 7(d) is to maintain the environmental status quo pending the completion of consultation. Section 7(d) prohibitions remain in effect throughout the consultation period and until the federal agency has satisfied its obligations under section 7(a)(2) that the action will not result in jeopardy to listed species or adverse modification of critical habitat.

BLM must use the existing available data to identify which sensitive species that are of critical concern with regards to the lands included in, or in immediate proximity to, the proposed sale parcels. BLM's EIS must disclose any potential direct, indirect or cumulative impacts to such species, including the lahontan cutthroat trout.

In addition, BLM must consult with the Service regarding the impacts of the lease sale on affected listed species, in compliance with its section 7 obligations under the ESA. To the extent that BLM relies on its section 7 programmatic consultations for the several management plans governing the lease sale, that reliance is not proper for any of the listed species affected by BLM's action. The potential for fracking and horizontal drilling and its associated impacts within the planning area constitutes "new information reveal[ing] effects of the [RMPs] that may affect listed species or critical habitat in a manner or to an extent not previously considered [in the prior section 7 programmatic consultations]." 50 CFR § 402.16(b). BLM must therefore reinitiate consultation on all of the planning documents for these areas. In any case, it must formally consult over the lease sale's potential adverse effects on listed species and consider the full scope of fracking and other drilling activities that could affect these species.

G. BLM Has Failed to Consider Climate Impacts or Analyze Reasonable Alternatives to Mitigate Those Impacts

As discussed in the Center's previous comment letters, as well as comments on the preliminary EA, BLM argues that it is required by law to "required by law to consider leasing of areas that have been nominated for lease if leasing is in conformance with the applicable BLM land use plan, in this case the Tonopah RMP (Tonopah Field Office), approved in 1997."[31] However, as BLM states and we agree, "[i]f there are known resource conflicts that cannot be addressed using a stipulation, then the parcel may be deferred until the known resource conflict is resolved." In this case, BLM has already demonstrated and exercised its authority to ban leasing by permanently removing from future lease sales several parcels due to resource conflicts.[32] In our comment letter we raised several more conflicts that require these parcels be deferred until such conflicts are resolved.

For one, and as we have already explained, climate change is a problem of global proportions resulting from the cumulative greenhouse gas emissions of countless individual sources. A comprehensive look at the impacts of fossil fuel extraction, and especially fracking, across all of the planning areas affected by the leases in updated RMPs is absolutely necessary.

[31] Final June Lease Sale EA at 8.
[32] Final June Lease Sale EA at 14.

BLM has *never* thoroughly considered the cumulative climate change impacts of *all* potential fossil fuel extraction and fracking (1) within each of the planning areas, (2) across the state, and (3) across all public lands. Proceeding with new leasing proposals *ad hoc* in the absence of a comprehensive plan that addresses climate change and fracking is premature and risks irreversible damage before the agency and public have had the opportunity to weigh the full costs of oil and gas and other fossil fuel extraction and consider necessary limits on such activities. Therefore BLM must defer all new leasing at least until the issue is adequately analyzed in a programmatic review of all U.S. fossil fuel leasing, or at least within amended RMPs. BLM's argument, in response to our comments, that a permanent cessation of leasing would require RMP amendment beyond the scope of the leasing decision ignores the established principle that agencies are obligated to consider all reasonable alternatives. Considering a no-leasing alternative would allow the agency to preserve the status quo and avoid irretrievable commitment of resources until such time as it can consider the regional and national impacts of fossil fuel leasing and undertake appropriate land use plan amendments or other actions.

III. Conclusion

The Railroad Valley is home to unique and significant hydrologic and biological resources, including spring-fed wetlands, a unique, and potentially endangered, species of toad found only in the Railroad Valley, and the threatened Railroad Valley springfish. The significant expansion of public land oil and gas leasing in the area poses significant threats to the area's marshlands, amphibians, and native fish. In light of these impacts, it is particularly egregious for BLM to assert that the impacts of leasing are fully disclosed and analyzed by a two-decade-old Resource Management Plan and a cursory, generalized Environmental Assessment that has never examined the specific impacts of nearly four thousand acres of new leasing in the Railroad Valley. As such, BLM should withdraw the proposed leases at least until such time as it has (a) prepared a legally adequate environmental review, (b) consulted with the Fish and Wildlife Service under Section 7 of the Endangered Species Act, and (c) has in place a valid Resource Management Plan that adequately addresses and mitigates the impacts of oil and gas development in the Battle Mountain District.

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Exhibits:

A Center for Biological Diversity et al. Protest of the June 2017 Competitive Oil and Gas Lease Sale, Battle Mountain District - DOI-BLM-NV-B020-2017-0002-EA (May 25, 2017)

B Letter from Michelle Gordon, M.Sc. (July 12, 2017)

C Michelle Gordon, Three new bufonid (*Bufo (Anaxyrus)*) species discovered within the Great Basin and the consequences of taxonomic crypsis 50-70, M.Sci. Thesis (May 2017)

D Nevada Today, Rare Discovery of Three New Toad Species in Nevada's Great Basin by College of Science (July 20, 2017), https://www.unr.edu/nevada-today/news/2017/new-toad-species-discovered

Exh. B

July 12, 2017

To Whom It May Concern:

My name is Michelle Gordon, a recent graduate from the University of Nevada, Reno and my thesis research included not only the recently described Dixie Valley toad (*Bufo* (*Anaxyrus*) *williamsi*) but also a population of toads found only in Railroad Valley, Nye County in Central Nevada. The results of our molecular and morphological analyses support that, like Dixie Valley, the toads in Railroad Valley represent another new species within the genus *Bufo* and are so rare that this newest species only occurs in spring fed wetland habitat within and around the Locke's Ranch area. The level of divergence detected in our genetic analyses of Railroad Valley indicate that these toads have been isolated longer than Dixie Valley (650KY) and exhibit a unique suite of morphological characteristics that distinguish this newest species from the broadly distributed Western toad (*Bufo*(*Anaxyrus*) *boreas*). Our species description detailing our analyses and description of the Railroad Valley toad is in final edits within our laboratory before we submit to Copeia for review and we hope to publish early next year. This is an exciting discovery, as these toads appear to have a unique phylogeographic connection outside the Great Basin. However, these toads face numerous challenges to persistence, partly due to critical dependence on the rare water that creates the necessary habitat for toads to forage and reproduce. The marshland areas produced by the springs near and in Locke's Ranch are small and isolated, but sustain not only these rare toads, but other unique aquatic fauna such the threatened Railroad Valley springfish (*Crenichthys nevadae*) and Great Basin spadefoot toad (*Spea intermontana*). However, Railroad Valley has a long history of gas and oil production and exploration. But consequences of such activities could result in mismanagement of resources within the valley or the overexploitation of rare water that result in habitat loss which would have profound impacts on the unique diversity within this valley, including the Railroad Valley toad.

There are multiple springs in Railroad Valley that could provide suitable toad habitat, but recent surveys have not yielded any sighting of this new species nor is there a historical record of collection for this toad among museums (MVZ, California Academy of Sciences). It appears that the Railroad Valley toad species is restricted to a severely small geographic range that is fragmented by desert sagebrush steppe, limiting dispersal of these toads from outside the moist vegetation of the marshy areas of the Locke's Ranch. And, similar to the scenario for Dixie Valley, the spring fed wetland habitat is highly susceptible to human influences and overexploitation that could lead to degradation or habitat loss that could result in the extinction of this new species before we have fully learned about this unique toad.

I would urge against proposed actions involving gas or oil exploration, extraction, and production in Railroad Valley due to the high level of uncertainty or lack of guarantee that proper protections will be in place to conserve and ensure the persistence of this new species and other unique flora and fauna of the region. The Railroad Valley toad occurs nowhere else and is restricted to one of the smallest geographic ranges known and we know so little about this toad. Yet, we are certain that this toad represents an irreplaceable piece in the bufonid legacy of the Great Basin and we should do much to protect and conserve this rare toad with well-informed management that requires more study and time.

Regards,

Michelle Gordon, MSc

Exh. C

University of Nevada, Reno

Three new bufonid (*Bufo* (*Anaxyrus*)) species discovered within the Great Basin and the consequences of taxonomic crypsis

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Biology

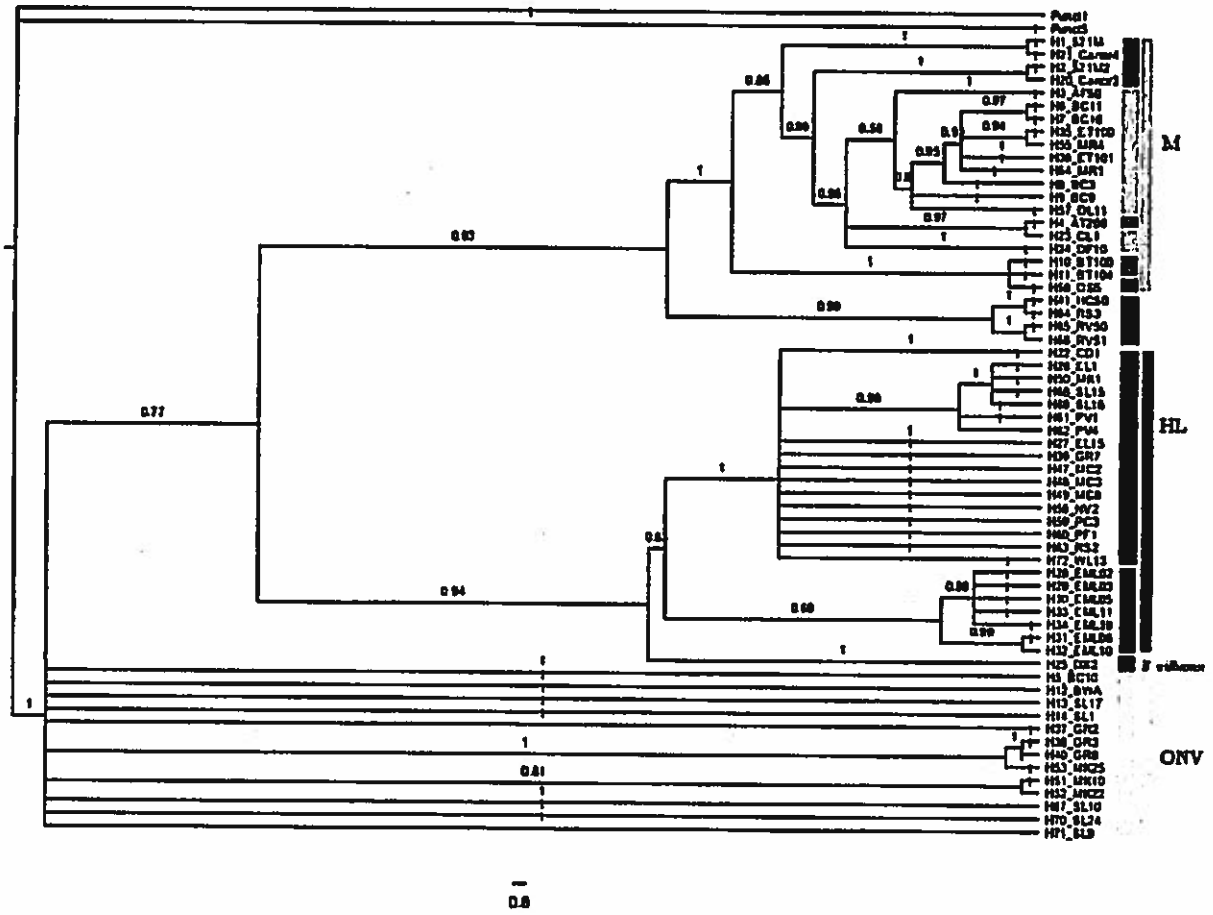
by

Michelle R. Gordon

Dr. C. Richard Tracy, Thesis Advisor

May, 2017

Figure S1.



CHAPTER 2: TWO NEW CRYPTIC ENDEMIC TOADS OF *BUFO* DISCOVERED IN CENTRAL NEVADA, WESTERN UNITED STATES (AMPHIBIA: BUFONIDAE: *BUFO (ANAXYRUS)*)

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Keywords: new species, *Bufo boreas*, *Bufo boreas* species complex, western toad, Railroad Valley, Hot Creek, *Bufo (Anaxyrus) nevadensis*, *Bufo (Anaxyrus) monfontanus*

ABSTRACT

We describe two new cryptic *Bufo* species within the subgenus *Anaxyrus* discovered in Central Nevada of the Western United States. Our analyses revealed that these two localized endemic toads are genetically divergent and morphologically distinct, yet were concealed under the range of the broadly distributed western toad (*Bufo boreas*), which occurs throughout Nevada. The newly discovered species are close in geographic proximity to each other (albeit, in different hydrological basins), but have evolved unique morphological characters that are distinct from each other and distinctive from all allied taxa within the *B. boreas* species complex. The delimiting of these two rare toads emphasizes the link between taxonomic crypsis and inadequate conservation as these newly described species are vulnerable to extinction due to severely restricted geographic ranges, unknown population sizes, and dependency on rare, fragile wetland habitat, which is a limited resource within Nevada, the primary state that makes up the arid Great Basin. These two endemics join the Great Basin *B. boreas* species complex as imperiled new members, and our study demonstrates that our knowledge of anuran diversity is incomplete and that new discoveries can still be made, even in unlikely settings.

INTRODUCTION

Amphibians are among the rarest vertebrates in the Great Basin desert, yet the western toad (*Bufo* (*Anaxyrus*) *boreas*) can be found throughout much of the region with a range that extends across the Western United States. The *B. boreas* species complex, which includes the cosmopolitan *B. boreas* (Baird and Girard 1852), plus four narrowly distributed endemics confined to the hydrologic Great Basin: *B. canorus* (Camp 1916), *B. exsul* (Myers 1942), *B. nelsoni* (Stejneger 1893), and the newly described *B. williamsi* (Gordon et al. 2017) are examples of the unique aquatic dependent taxa within this arid ecoregion. Previous analyses examining the genetic diversity and endemism within the *B. boreas* species complex have suggested that cryptic lineages are likely present within the western toad's broad geographic range, and that the current taxonomy does not accurately reflect *B. boreas* diversity (Stephens 2001), particularly around the Great Basin (Goebel 2005; Goebel et al. 2009). In our recent molecular examination of Great Basin *B. boreas* diversity, we confirmed the presence of cryptic species, such as *B. williamsi* and two other lineages described here, which were all concealed under the broad range of the western toad. Our extensive collection of morphological measurements of live toads allowed us to quantify significant features that further distinguish these new species from *B. boreas* and allied taxa within the regional *B. boreas* species complex. Here, we describe two new species, and highlight the consequence of taxonomic crypsis of undescribed species, which are constrained to extremely limited ranges, as these newest novel discoveries have the smallest known geographic distributions within the *B. boreas* species complex. And, like *B. williamsi* and *B. exsul*, are restricted to rare spring fed wetlands, a habitat within the Great Basin that is vulnerable to habitat loss and exploitation, warranting urgent conservation initiatives to protect and preserve these rare bufonids.

MATERIALS AND METHODS

Data collection and morphological analyses

We recorded morphological measurements from live adult toads from 19 populations within the hydrological Great Basin (Fig. 1A) including *Bufo boreas* (n = 289), *Bufo nelsoni* (n = 31), *Bufo exsul* (n = 30), *Bufo williamsi* (n = 76), plus individuals from both Hot Creek (n = 42) and Railroad Valley (n = 50) to comprise a large data set (n = 518). Fourteen morphological features were recorded and are as follows: snout– vent length (SVL; tip snout to posterior end of urostyle), head length (HL; tip of snout to occiput), head width (HW; at widest part of the head), snout length (SL; tip of snout to anterior corner of eye), inter-narial distance (IND; distance between nares), eye diameter (ED; at widest part of eye), inter-orbital space (IOD; shortest distance between medial margin of upper eyelids), tympanum diameter (TYM; at maximum width of tympanum), paratoid length (PL; horizontal length of parotoid gland) and width (PW; maximum width of parotoid), interparotoid distance (IPD; shortest distance between medial margin of parotoid glands), femur length (FL; distance between vent and knee), tibia length (TL; distance between knee and heel), hind foot length(FTL; distance from anterior margin of heel to distal end of the third toe). All morphological characteristics were measured using Mitutoyo digital calipers to a precision of 0.01mm. All individuals were measured by ETS with the exception of 13 individuals collected from Hot Creek and 19 individuals collected from Railroad Valley, which were measured by MRG, including the holotypes and paratypic series from each site. Digit length from hands and forelimbs were recorded by MRG. Sex was determined in the field, noting body size, behavior and secondary sex characteristics, such as the utilization of a release call and presence of nuptial pads on males as identifiers.

Individuals collected in May of 2015 from populations in Hot Creek Canyon, and the eastern neighboring basin, Railroad Valley, were selected to represent the holotypes and paratypic

series for both species and were euthanized and preserved following the guidelines under the Institutional Animal Care and Use Committee (IACUC) from University of Nevada (IACUC #00068). The tissue samples were extracted and preserved in 70% ethanol and specimens were fixed in 10% buffered formalin and transferred to 70% ethanol.

To characterize morphological differences among species, we used multivariate analysis of covariance (MANCOVA) and used SVL as the covariate in these analyses to account for body-size variability among species (Dahl and Peckarsky 2002; McCoy et al. 2006). This analysis results in least squares means generated from regressions for each size corrected variable against SVL which can identify subtle, but statistically significant differences in fine features examined in these toads. We also log transformed the raw dataset as an additional way to account for differences in allometry of measured toads and analyzed the scaled data set using MANCOVA to quantify morphological differences among the species (Lleonart et al. 2000). We used Tukey HSD post-hoc pairwise comparisons to identify significant character state differences among the species examined. A cross-validated discriminant function analysis (DFA) was used to evaluate the variation in multivariate space to identify variables that best discriminated among the species. Data collected from multiple measurers can result in inter-observer error due to variations in character assessment, particularly on the fine features of amphibian anatomy (Hayek et al. 2001). These errors can produce results that may bias biological interpretations from morphological analyses (Hayek et al. 2001). To avoid inter-observer biases, only measurements collected by ETS were used in the morphological analyses with the exception of the means table (Table 1) which includes combined raw, unadjusted measurements from ETS and MRG. All statistics were conducted using JMP Pro v. 10 (SAS, Cary, NC).

Genetics

Following the methods described in Gordon et al. (2017), tissue samples were collected from individuals identified as *B. boreas* (Fig.1B; n = 308), *B. nelsoni* (n = 32), *B. exsul* (n = 30),

B. williamsi (n = 7), and *B. canorus* (n = 32). The control region (CR) of the mitochondrial genome was selected due to the site's high rate of evolution ideal for intraspecific analyses (Avise et al. 1987), and because it has been used in previous phylogenetic studies evaluating *B. boreas* diversity (Stephens 2001; Goebel et al. 2009). PCR products were sequenced using ABI 3730 Sequencer and data were analyzed with Sequenchersoftware (Gene Codes, Ann Arbor, Michigan).The final alignment of the *B. boreas* species complex (CR 1622bp) was completed using ClustalW (Larkin et al. 2007) within Mega 7.0 (Kumar et al. 2015) resulting in 72 unique haplotypes included in further analyses. To examine pairwise genetic distances among sequences relative to haplotypes identified, a Jukes-Cantor model (Jukes and Cantor 1969) was applied in Mega 7.0 (Kumar et al. 2015).

Genetic analyses

Previous molecular studies support evidence of recent divergence of allied taxa within the *B. boreas* species complex (Graybeal 1993; Shaffer et al. 2000; Stephens 2001; Pauly et al. 2004; Goebel et al. 2009; Switzer et al. 2009). Due to the close ancestry of this species group, we constructed a TCS haplotype network in PopART to examine population level genealogy (Clement et al. 2002; Leigh and Bryant 2015). Phylogenetic hypotheses were tested using Bayesian inference (BI) in MrBayes v3.1.2 (Ronquist and Huelsenbeck 2003), and maximum likelihood (ML) phylogenies were constructed in Mega 7.0 (Kumar et al. 2015) to examine evolutionary relationships and comparative tree topologies between taxa of the *B. boreas* species complex. The program Tracer v1.6 (Rambaut et al. 2014) confirmed that analyses reached stationarity and trees were constructed using FigTree v1.4.2 (Rambaut 2014). *Bufo punctatus* was selected as our outgroup since this taxon was included in previous studies that examined the same molecular marker investigating the fine scale relationship of toads within the *B. boreas* species complex (Stephens 2001; Goebel et al. 2009). A condensed tree was constructed in Mega 7.0

(Kumar et al. 2015) for simplicity as the broader examination of *B. boreas* diversity is in progress.

To examine the relationship of *B. boreas* populations outside the Great Basin to the variant haplotypes for a broader geographic and historical context, sequences for the control region from Goebel et al. (2009) were downloaded from GenBank and added to the data set (Table 2) into Mega 7.0 (Kumar et al. 2015). To reconstruct the evolutionary history, 87 unique haplotypes were used in ML based on the Hasegawa-Kishino-Yano model (Hasegawa et al. 1985). All positions containing gaps and missing data were eliminated. There were a total of 628 positions in the final dataset using ML in Mega 7.0 (Kumar et al. 2015).

***Bufo (Anaxyrus) nevadensis*, new species**

Railroad Valley toad

(Figures 1, 2B, 3- 6; Tables 1, 3, 4)

Holotype. CAS 259272, adult female (Fig. 6, Table 1), collected from Locke's Preserve, Railroad Valley, Nye County, Nevada, United States (38°33'9.1"N, 115°46'12.8"W), on 5 May 2015 by M. R. Gordon.

Paratypes. UNR 7905, adult male; UNR 7906, adult female; UNR 7907, adult female; UNR 7908, adult male; UNR 7909, adult female; all individuals collected by M.R. Gordon, K. Guadalupe and C. Burg on 5 May 2015 within the identified home range in Railroad Valley (Fig. 2B).

Diagnosis

Bufo (*Anaxyrus*) *nevadensis* is a member of the Great Basin *B. boreas* complex (Blair 1972), but currently identified as *B. boreas* due to its occurrence within the western toad's geographic range, yet is distinct from *B. boreas* by a combination of morphological characters

(Fig. 3, Fig. 6., Table 1, 3), genetic evidence (Fig.4, Fig. 5, Table 4), and restricted geographic distribution (Fig. 2B). *Bufo nevadensis* is distinguished from *B. boreas* due to: its small adult body size (SVL is approximately 2 cm smaller than *B. boreas*; Table 1, 3); significantly, but modestly longer head with a relatively shorter snout; well separated, perceptibly short and narrow parotoid glands; significantly, but comparatively long legs, large hind feet (Fig. 6B); and distinctive mottling of venter (Fig. 6B, Fig. 6D).

Bufo nevadensis is among the smallest terrestrial bufonids within the *B. boreas* species complex (Table 1, 3). However, this new species exhibits a relatively large head unlike similarly small toads, *B. exsul* and *B. monfontanus*, with a significantly, but comparatively shorter snout distinctive from all species within the complex except *B. exsul* (Table 3). The well separated and severely reduced parotoid glands exhibited in *B. nevadensis* is divergent from all taxa within the *B. boreas* species complex and the shortened gland length distinguishes *B. nevadensis* from both *B. boreas* and *B. monfontanus*. *Bufo nevadensis* has statistically significant, relatively long legs; longer femur than exhibited in *B. exsul*, *B. monfontanus*, and *B. williamsi*, long tibial and hind feet which separate *B. nevadensis* from *B. monfontanus and B. williamsi* (Table 3). In addition to morphological shape differences, *B. nevadensis* displays a dominantly brown and gray toned dorsum with prominent warts and heavily creased skin, which differs from *B. exsul*, *B. monfontanus*, *B. williamsi* and *B. nelsoni*. The venter of *B. nevadensis* is similar to *B. exsul* and *B. williamsi*, exhibiting black mottling contrasted against a white background color on the anterior sides of the limbs and belly. The presence of a dorsal stripe is extremely variable among individuals of *B. nevadensis*, as is similar to the other members of the *B. boreas* species complex, with the exception of *B. exsul*. Small, irregular tibial glands may be present in individuals, but this characteristic is highly variable.

In mature *B. nevadensis* males, distinct nuptial pads develop on the dorsal side of the thumb, a typical secondary sexual characteristic exhibited among most bufonids. This species lacks an advertisement call, but emits a release call when males come in contact with one another which sound like the weeping of a chick and is similar among congeners of the *B. boreas* complex (Stebbins 2003).

Description of holotype

Body relatively small and robust (SVL = 62.5 mm); head wider (HW = 20.1 mm than long (HL = 17.2 mm; 85% head length to head width). Snout is subellipitical in dorsal view; snout profile moderately truncate in lateral view (SL = 7.49 mm; 1.5 times longer than eye diameter). Canthus rostralis distinct and cuneate. Loreal region slightly concave. Nostrils slightly protuberant, directed dorsolaterally and closer to anterior corner of eye than to snout. Internarial distance (IND = 3.57 mm) 75% of interorbital distance (IOD = 4.76 mm). Eyes well separated; interorbital space nearly equivalent to eye diameter (ED = 4.81 mm). Upper eyelids prominent in dorsal view; eyes slightly breach profile margin. Tympanum (TYM = 2.98 mm) distinct, subovoid, relatively small (52% of eye diameter). Supratympanic fold present. Parotoid glands weakly present viewed above; Parotoid glands narrow (PW = 3.74 mm), severely tapered at posterior corner of eye in lateral view. Parotoid glands 1.5 times longer (PL = 7.47 mm) than eye diameter; parallel, well separated (IPD = 12.28 mm). Forearms robust. Fingers unwebbed; relative length III > I > II > IV; tips rounded, subarticular tubercles moderate, accessory palmar tubercles small, round. Inner metacarpal tubercle distinct, round. Palmar tubercle prominent, elliptical. Hind limbs long; femur slightly longer (FL = 21.2 mm) than tibia (TL = 18.7 mm). Tibial glands irregular, scarcely defined, half the length of parotoid gland. Tarsal fold present; hind feet webbed proximally (FTL = 37.0 mm). Relative toe lengths IV > III > V > II > I; toe tips rounded. Subarticular tubercles faintly evident, small, round. Plantar tubercles numerous, small. Inner metatarsal tubercle pronounced, elevated, relatively large, elliptical. Outer metatarsal

tubercle distinct, ovoid. Skin warty on dorsum; primary warts elevated, irregular; finely granular skin between elevated warts from interorbital space increasing in coarseness toward posterior margin of dorsum at articulation with femur. Legs warty; tubercles small, moderate. Venter coarse, seat patch conspicuous.

Color in life

Dorsal ground color of holotype light brownish gray, flecked with dark brown, irregular spotting (Fig. 6A). Grayish face dappled with dark brown patches, upper eyelids finely speckled black. Smooth dark olive brown blotches along prefrontal to frontal area of head and interorbital space. Pupil black, horizontal with gold streaked iris. Brownish gray parotoid glands exhibit minor black to dark brown spotting. Cream colored dorsal stripe present, originating posteriorly at nares and terminating at the posterior margin of urostyle. Elevated, dark olive brown warts at interparotoid space, along dorsum; some warts exhibit a slight, black halo; olive streaking connects warts along midline bordering dorsal strip; dorsolaterally, olive to dark brown wart color is streaked against brownish gray background color. At the midaxillary line, black streaking contrasts against white background. Throat white with minor black spotting near lower lip. Venter is mottled black against white background color (Fig. 6B) In dorsal view, arms have minor dark olive banding and olive patches against light grayish brown ground color; hind legs exhibit dark olive brown banding and patches against light grayish brown ground color down to heavily dappled olive feet atop brownish gray background color. Along medial and ventral sides of legs, black spotting and patches occur against white ground color down to medial edge of feet, which appear dark gray on underside. In paratypes, background color ranges from light gray to light brownish gray; warts may be olive colored to olive brown and may be encircled by a narrow, black halo. Brown to dark brown spotting around the face; minor black spotting on throat and minor to heavy black mottling occur on venter.

Color in preservative

Color is similar to that in life (Fig. 6A, Fig. 6B) with some notable differences. Overall background color in the holotype appears gray (Fig. 6C). Along dorsum, dark brown warts are flattened and appear as heavy streaks against brownish gray background adjacent to the dorsal stripe. Marbling along the midaxillary line and venter less vibrant than in life and appear dark gray against a white ground color and seat patch is muted light gray (Fig. 6D).

Distribution

Bufo nevadensis is known only to occur near and within the spring fed wetland areas of Lockes Ranch (1460 m above sea level), a protected wildlife management area located in Railroad Valley, an east-central desert basin between the Pancake Range and Grand Range of Nye County, Nevada (Fig. 2B). The critical marshland habitat for this endemic toad are solely fed from Big, Reynolds and Hay Corral springs which results in a severely restricted range with an estimated distribution of 1.8 km^2. These outflows are remote and isolated, surrounded by cold desert habitat dominated by big sagebrush (*Artemisia tridentata* ssp. *tridentata*), greasewood (*Sarcobatus vermiculatus*), rubber rabbitbrush (*Ericameria nauseosa*) and saltbush (*Atriplex* spp.) with limited usable corridors for amphibian dispersal, which likely restricts this species' movement to other spring localities within Railroad Valley. *Bufo nevadensis* co-occurs with the federally-listed Threatened Railroad Valley springfish, *Crenichthys nevadae,* and *Spea intermontana* (Great Basin spade foot toad) and toads are typically found in shallow water or among the vegetation in the perimeter band that transitions from riparian to sagebrush steppe habitat.

Life history and behavior

Bufo nevadensis is confined to the spring fed wetland habitat within Lockes Ranch wildlife management area managed by the Nevada Department of Wildlife (NDOW). *Bufo nevadensis* is nocturnal, emerging at dusk and it can be found in shallow, marshy water or under

desert vegetation that borders the riparian areas. Characteristic of cold deserts, Railroad Valley experiences extreme fluctuations in day and nighttime temperatures as well as season-to-season variation. As is common for other members of the *B. boreas* complex, these toads likely retreat to burrows in the fall, not emerging until spring, when males begin to congregate in shallow water for breeding. Mature males, similar to other members of the *B. boreas* complex (with the singular exception of *B. canorus*), do not have an advertisement call, but emit a release call when males come in close contact with one another. Egg masses and tadpoles develop in still, shallow water amid the marshy vegetation of the wetland habitat.

The population size for this species is unknown; however, the extreme isolation and restricted range may indicate that the population numbers may be small. Little is known regarding the dispersal and non-breeding behavior of this rare toad.

Etymology

The species name is a derivative from the state of Nevada (U.S.A) where this rare toad occurs and pays homage to the unique biodiversity found in the desert landscape of its home state.

Suggested Common Name

We propose the common name "Railroad Valley toad for this species.

Remarks

Railroad Valley is a geothermally active area within the Range and Basin Province with significant opportunities for anthropogenic energy production, including extraction of its oil reservoirs (Liu et al. 1997) that continue to contribute to ongoing economic interests in the valley which are currently overseen by the Bureau of Land Management. Discovery of this rare new species should elicit high conservation concerns due to its severely restricted range and limitations to dispersal due to isolation and remoteness of the spring fed habitat upon which *B. nevadensis* is dependent. Any further human anthropogenic modifications of habitat that may

degrade this extremely important habitat would imperil this toad. However, with new species designation, conservation initiatives would provide a platform for ongoing policy and monitoring to allow this this endemic toad to persist.

***Bufo* (*Anaxyrus*) *monfontanus*, new species**

Hot Creek toad

(Figures 1, 2B, 3-5, 7; Tables 1, 3, 4)

Holotype. CAS 259273, adult male (Fig. 7, Table 1, 3), collected from Hot Creek Canyon, Nye County, Nevada, United States (38°32'19.32"N, 116°27'32.9"W), on 6 May 2015 by M. R. Gordon.

Paratypes. UNR 7910 (University of Nevada, Museum of Natural History), adult male; UNR 7911, adult male; UNR 7912, adult male; UNR 7913, adult male; UNR 7914, adult male; UNR 7915, adult male; UNR 7916, adult male; UNR 7917, adult male; all individuals collected from Hot Creek Canyon within the identified home range (Fig. 2B) on 6 May 2015 by M.R. Gordon

Diagnosis

Bufo (*Anaxyrus*) *monfontanus* **sp. nov** occurs within *B. boreas* range but is distinct from the Western toad by a combination of diagnostic morphological characters (Fig. 3, Fig. 7, Table 1, 3), genetic evidence (Fig. 4, Table 4), and restricted geographic distribution (Fig. 2B). *Bufo monfontanus* is distinguishable from *B. boreas* by: a small adult body size (SVL is 2 cm smaller than *B. boreas*; Table 1, 3); significantly, but modestly shorter head; perceptibly large, parotoid glands; significantly, but comparatively shorter legs with small hind feet; and weakly warted body (Fig. 7A).

Bufo monfontanus is among the smallest bufonids within the *B. boreas* species complex, and only larger than *B. williamsi* (Table 1, 3). *Bufo monfontanus* has a significant, but relatively

shorter head with a comparatively long snout, with a relative head width more comparable to larger-sized taxa *B. boreas* and *B. nelsoni* (Table 3). An important diagnostic feature among *B. monfontanus* is the presentation of well-defined, relatively-large parotoid glands, which distinguishes this small toad from all other small-sized toads within the *B. boreas* species complex (Table 3). *Bufo monfontanus* has shorter legs; significantly, but relatively the shortest femur and tibia of all taxa within the *B. boreas* species complex and relatively small feet distinct from both *B. boreas* and *B. nevadensis* (Table 3). The dorsal stripe is extremely variable among individuals of *B. monfontanus*; a characteristic typical among taxa within the *B. boreas* species complex with the exception of *B. exsul*. And, small, irregular tibial glands may be present among individuals of *B. monfontanus* as seen in both *B. nevadensis* and *B. williamsi*.

In adult *B. monfontanus* males, distinct nuptial pads develop on the dorsal side of the thumb which is a typical secondary sexual characteristic exhibited among most bufonids. And, akin to congeners of the *B. boreas* species complex, except *B. canorus*, males of this species emit a release call that sounds like a weeping chick (Stebbins 2003).

Description of holotype

Body small, robust (SVL = 59.6 mm); head wider (HW = 19.3 mm) than long (HL = 16.2 mm). Snout subovoid in dorsal view; snout rounded in lateral view, long (SL = 6.43 mm; 40 % of head length). Canthus rostralis distinct, concave, angular, sloping up to medial orbital margins. Loreal region slightly concave. Nostrils protuberant, directed dorsolaterally, closer to anterior corner of eye than end of snout. Internarial distance 75% of eye-to-naris distance (IND = 2.26 mm). Relatively moderate eyes well separated (ED = 4.44 mm; IOD = 3.81 mm); eyes do not breach snout profile in dorsal view. Tympanum distinct, oval, small (TYM = 2.48 mm; 53% of eye diameter). Supratympanic fold weakly present, flat. Parotoid glands longer (PL = 8.78 mm) than wide (PW = 5.27 mm; length nearly twice eye diameter). Glands elevated, slightly convergent at posterior ends in dorsal view. In lateral view, parotoid glands elongated

longitudinally from posterior corner of eye, oval, wider than the eye (1.4 times eye diameter). Inter-parotoid space large (IPD = 9.40 mm; 2.5 times interorbital distance). Forearms robust, smooth. Fingers unwebbed; relative lengths III > I > IV > II; nuptial pads present, raised on dorsal side of digit I; tips rounded, subarticular tubercles moderate, round; accessory palmar tubercles small, round. Inner metacarpal tubercle raised, prominent, round. Palmar tubercle distinct, large, subovoid, borders medial margin of inner metacarpal tubercle. Hind limbs long; femur longer (FL = 23.1 mm) than tibia (TL = 19.7 mm). Tibial gland weakly present in dorsal view and equivalent to the width of the parotoid gland. Tarsal fold present. Hind feet webbed proximally (FTL = 35.00 mm). Relative toe lengths IV > III > V > II > I; tips rounded. Subarticular tubercles distinct, small and round; plantar tubercles numerous, small. Inner metatarsal tubercle conspicuous, elevated, relatively large and elliptical. Outer metatarsal tubercle pronounced, ovoid. Longitudinally along dorsum, dorsal stripe weakly present, originating posterior to interorbital space, terminating at urostyle; irregular, elevated but scattered warts present, increasing in size from interorbital space to posterior margin of urostyle. Skin between warts nearly smooth; forearms smooth; hind legs exhibit minor warts, tibial gland scarcely present and irregular. Originating posterior to labial commissure, inferior to tympanum, dense, small tubercles occur along posterior axillary line, terminating near anterior articulation of femur. Venter coarse; seat patch granular and conspicuous.

Color in life

Dorsal background color is light olive gray with minor black flecks throughout dorsum; elevated brown warts encircled with a narrow, incomplete black halo (Fig. 7A). More pronounced black halos border brown warts laterally along posterior axillary line. Dorsal stripe present; fine line, light green, interrupted at parotoid region. Pupils horizontal; iris flecked gold. Parotoid glands are flecked with black, minute spots against olive gray. Thick brown stripe present, inferior to the eye, occurring from orbit anterior border down to upper lip margin; tubercles that

originate at labial commissure are buffy colored, transition to more olive colored spines moving laterally along body. Along midaxillary line, olive background color transitions to cream color with heavy black blotching. Throat clear, buffy colored. Venter nearly clear, buffy with minor black spots except at seat patch gray, which is coarse with fine white granules (Fig. 7B). Dorsally, arms exhibit little color variation from olive with some minor dark brown patches; legs have minor black stripes atop white background color along inner shank down to dorsal side of foot. In paratypes, dorsal stripe present or weakly present; dorsum ground color variable shades of olive; venter may exhibit minor black spotting against buffy ventral ground color. Parotoids directed parallel behind eyes or slightly convergent at posterior ends. Brown striping above lip and inferior to eyes may be weakly present.

Color in preservative

There are notable differences in preservation (Fig. 7C, Fig. 7D) when compared in life (Fig. 7A, Fig. 7B). The overall ground color of the preserved holotype is dark and gray. Dorsal stripe thin, white, broken at posterior edges of parotoid glands, continues to vent. The warts along the dorsum are flattened, dark gray, and similar in shade to the ground color and parotoid glands. Face is dark gray, striping inferior to eye is muted and tubercles posterior to labial commissure appear white. Arms are very smooth and dark. Nuptial pads are present and brown in preservative. Marbling along midaxillary line is black against a muted gray ground color. Venter is light gray overall; seat patch is muted in preservative. Tubercles on feet and hands are diminished and dark, tips appear brown.

Distribution

Bufo monfontanus is only found within the marshes fed by thermal spring outflows in Hot Creek Canyon (1859 m above sea level) in Hot Creek Range in Central Nevada. The narrow canyon is nestled between Box and Corral Canyons and runs east to west, and toads have only been found in the small Hot Creek stream fed by Upper Warm Springs. This locality is extremely

remote and isolated, and the spring flows through the canyon are interrupted, likely restricting toad dispersal from east to west, with few suitable corridors outside the canyon. The estimated range for *B. monfontanus* is extremely small at 1 km^2, as essential wetland habit is critically limited and isolated by cold desert habitat dominated by sagebrush steppe. The population size is unknown for this endemic toad, but is likely small and warrants further examination. *Bufo monfontanus* co-occurs with introduced *Crenichthys nevadae* (Railroad Valley springfish) near Upper Warm Springs and the introduced *Rana catesbeiana* (American bullfrog) can be found within the interior streams of the canyon.

Life history and behavior

Bufo monfontanus emerges only after dusk, exhibiting typical nocturnal behavior similar among taxa of the *B. boreas* species complex with the exception of *B. canorus*, which is diurnal. This species can be found in the marshy water or in the perimeter band that transition from riparian habitat to sagebrush steppe. Typical of congeners of the *B. boreas* species complex, *B. monfontanus* likely hibernates, using burrows. Little is known about the dispersal behavior of this toad. The high elevation and extreme temperatures, both daily and season-to-season variability, likely prohibit a long breeding season and further investigation through monitoring and annual surveys could provide insight into the life history strategy of this unique toad.

Etymology

The species name *monfontanus* (from the Latin "mons" for mountain and Latin "fons", a spring or fountain) is descriptive of the high-elevation spring habitat where this toad occurs and pays tribute to the nature of the rare spring habitat and the biodiversity relying on this important resource within the Nevada.

Common Name

We propose "Hot Creek toad" as the common name for this species as it only occurs in the small spring fed habitat within Hot Creek Canyon, Nevada, USA.

Remarks

This new toad species, similar to other taxa of the *B. boreas* species complex, represents another narrow endemic that is found only in small and fragile spring ecosystems of the Great Basin. This new species warrants high conservation concern and urgent initiatives to monitor, and to study how to preserve this new toad species. Especially troubling is that little is known about the population size, breeding and dispersal of this small toad species. Additionally, the predatory generalist, *Rana catesbeiana,* co-occurs within the spring fed stream system of Hot Creek Canyon, and this species is known to outcompete and prey upon much smaller anurans such as bufonids. *Rana catesbeiana* is also a known vector for potentially lethal anuran diseases, such as chytridiomycosis (Kats and Ferrer, 2003; Daszak et al., 2004), whose effects on the narrowly distributed *B. monfontanus* is unknown.

RESULTS

Morphological Evidence

There were significant differences for all 14 size-corrected morphological characters among *B. boreas*, *B. nelsoni*, *B. exsul*, *B. williamsi,* and newly characterized species, *B. nevadensis* and *B. monfontanus*. *Bufo nevadensis* is significantly smaller overall than larger bufonids *B. boreas* and *B. nelsoni* ($F_{3, 439} = 62.4, p < 0.0001$), yet it has a significant, but modestly larger head ($F_{6, 439} = 704.0, p < 0.0001$; $F_{6, 439} = 899.6, p < 0.0001$; Table 3) which is longer than similar body-sized congeners, *B. exsul*, *B. williamsi* and *B. monfontanus*, with moderate, well separated eyes ($F_{6, 439} = 290.1, p < 0.0001$). Significant differences were detected among species for snout length ($F_{6, 439} = 145.8, p < 0.0001$), and in pairwise comparisons recovered from Tukey HSD post-hoc tests (Table 3), *B. nevadensis* has a short snout, while perceptibly subtle, differs significantly from all other congeners examined in this study except *B. exsul*. The parotoid glands of *B. nevadensis* are significantly reduced; parotoid width is narrower than all congeners examined ($F_{6, 439} = 145.1, p < 0.0001$), and shorter in length than *B. boreas* and *B. monfontanus*

($F_{6, 439}$= 156.6, p < 0.0001; Table 3). Additionally, the small-sized *B. nevadensis* has significant, relatively long legs; the femur is comparatively longer than all other congeners with the exception of the larger toads *B. boreas* and *B. nelsoni* ($F_{6, 439}$= 741.2, p < 0.0001; Table 3), and tibial and foot length are longer than the similar-sized toads *B. williamsi* and *B. monfontanus* ($F_{6, 439}$= 770.8, p < 0.0001; $F_{6, 439}$= 392.3, p < 0.0001; Table 3).

Bufo monfontanus has a significantly smaller body size than the larger sized toads, *B. boreas* and *B. nelsoni* ($F_{5, 439}$= 62.4, p < 0.0001; Table 3), and outsizes only *B. williamsi* (Table 1, 3). This small toad has a wide head similar to *B. boreas* and *B. nevadensis*, but has the shortest relative head length of all species within the complex ($F_{6, 439}$= 899.6, p < 0.0001; Table 3), with moderate, well separated eyes ($F_{6, 439}$= 290.1, p < 0.0001; Table 3). Significant differences in parotoid width were detected among the species complex ($F_{6, 439}$= 145.1, p < 0.0001) and in pairwise comparisons in Tukey HSD post-hoc tests, *B. monfontanus* exhibits the longest parotoid gland which differs significantly, though the physical difference is modest, from all congeners of the complex except *B. boreas* ($F_{6, 439}$ = 156.6, p < 0.0001; Table 3). The large glands are comparatively closer together, which is significantly different from that presented in *B. boreas*, *B. nelsoni* and *B. nevadensis* ($F_{6, 439}$= 380.2, p < 0.0001; Table 3). The leg features of *B. monfontanus* are reduced with significant differences detected; while perceptibly subtle, *B. monfontanus* has relatively the shortest femur than all congeners of the complex ($F_{6, 439}$= 741.2, p < 0.0001; Table 3), shorter tibia differing from lengths observed in *B. boreas*, *B. nelsoni*, and the small toad, *B. nevadensis* ($F_{6, 439}$= 770.8, p < 0.0001; Table 3), and a small foot length distinct from *B. boreas* and *B. nevadensis* ($F_{6, 439}$= 392.3, p < 0.0001; Table 3).

In multivariate morpho-space using DFA, significant differences were detected among species ($F_{70, 323}$ = 3.40, p < 0.0001; Fig. 3). The DFA correctly classified 83.7 % of predicted species with some morphological overlap detected among *B. exsul*, *B. boreas*, *B. nelsoni* and *B.*

nevadensis. Little morphological overlap was detected with *B. monfontanus*. Canonical 1 explained 61 % of the variation with head width loading most heavily, while canonical 2 accounted for 17 % of the variation with parotoid length loading more heavily than other characters.

To assess sexual dimorphism in *B. monfontanus* (females = 16, males = 13) and *B. nevadensis* (females = 28, males = 3), intraspecific analyses showed significant differences in SVL only in *B. monfontanus* ($F_{1, 28} = 5.4, p < 0.03$), with females significantly larger than males ($p < 0.05$ for *B. monfontanus*). Additionally, *B. monfontanus* males have relatively longer legs than do females ($F_{2, 28} = 12.7, p < 0.0001$ for femur length; $F_{2, 28} = 24.1, p < 0.0001$ for tibial length; $F_{2, 28} = 19.0, p < 0.0001$ for foot length). While sexual dimorphism was not detected in SVL of *B. nevadensis* ($F_{1, 30} = 1.2$, p = 0.28), males did have relatively longer feet ($F_{2, 30} = 8.4, p < 0.001$). The unadjusted data collected for the four species examined for all fourteen characters are presented in Table 1.

Genetic evidence and phylogenetic relationships

Similar to findings presented by Gordon et al. (2017), the combined analyses for the control region of the mitochondrial genome examined in the *B. boreas* species complex study supported the existence of divergent lineages of undefined toad populations within the Great Basin, warranting inspection of cryptic populations occurring in Central Nevada and described herein. The TCS haplotype network and phylogenetic reconstructions support four major clades that correspond relatively to geographical regions within the hydrological Great Basin and defined as Western Great Basin (W), Humboldt-Lahontan (HL), Mojave (S), and Eastern Great Basin (E) (Fig. 1B, Fig. 4, Sup. Fig. 1, Sup. Fig. 2). The haplotype network highlights the divergent lineages of *B. nevadensis* and *B. monfontanus* from each other and to all *B. boreas* within the hydrological Great Basin (Fig. 4A) and illustrates the regional divide in diversity among populations of *B. boreas* and related taxa within the species complex (Fig. 1B, Fig. 4). All

phylogenies resulted in minor topological differences, but all supported the divergence of the Eastern clade, which includes newly described species *B. nevadensis* and *B. monfontanus* forming terminal taxa, and which are distinct from all congeners of the *B. boreas* species complex (Fig. 4B, Fig. 5, Sup. Fig. 1, Sup. Fig. 2). The evolutionary reconstruction generated using maximum likelihood supports the Eastern clade as basal to Great Basin clades (Fig. 4B) but differs from Bayesian analyses that resulted in the Eastern clade as sister to the Mojave clade, which includes *B. nelsoni*, *B. exsul*, as well as lineages of both *B. boreas* and *B. canorus* (Sup Fig. 1). In all combined analyses, *B. boreas* has less divergent populations in the Western Great Basin and Humboldt-Lahontan clades, and both *B. boreas* and *B. canorus* appear to be polyphyletic or paraphyletic with lineages that occur in the Humboldt-Lahontan and Mojave clades, a result consistent with previous studies (Graybeal 1993; Goebel 1996; Shaffer et al. 2000; Stephens 2001; Goebel et al. 2009; Switzer et al. 2009; Gordon et al. 2017).

Assessment of nucleotide diversity evaluating genetic distances for both *B. nevadensis* and *B. monfontanus* uncovered higher percentages of differentiation than other congeneric taxa within the *B. boreas* species complex (Table 4). *Bufo nevadensis* average genetic distance compared to *B. boreas* is 3.5 % and *B. monfontanus* is 3.2 %, and despite their seemingly close relative proximity (Fig. 1, Fig. 2B), these two species are highly differentiated from each other at 2.0 % divergence (Table 5).

Comparing *B. nevadensis* and *B. monfontanus* to *B. boreas* populations outside of the Great Basin, we used maximum likelihood to test evolutionary hypotheses which yielded support for the new species' divergence and illustrates close ancestry with *boreas* populations in Utah and Colorado (Fig. 5, Sup. Fig. 2). *Bufo nevadensis* forms a terminal clade and is basal to populations of boreal toads near the northwestern Utah border and Colorado (Table 2, Fig. 5, Sup. Fig. 2) and nucleotide diversity of this species to *boreas* was 1.7 %. *Bufo monfontanus* forms a terminal end,

and represents a divergent lineage, but shares a haplotype for this marker with one toad from the northwestern corner of Utah in Box Elder County (Fig. 5, Sup. Fig. 2) with an average genetic distance of 1.3 %. Additional molecular markers may provide greater insight into the fine scale relationships of these newly described species and taxa of the *B. boreas* species complex.

DISCUSSION

Our combined genetic and comparative morphological evidence strongly support recognizing two newly described toads, *B. nevadensis* and *B. monfontanus*, increasing the diversity of the Great Basin *B. boreas* complex to seven species. The taxonomic nomenclature within the Nearctic genus *Bufo* remains unstable, so we recommend that these novel endemics retain *Bufo* increasing the Nearctic subgenus *Anaxyrus* to 25 total species (Frost 2015; Pauly et al. 2009). These new species are morphologically distinct (Table 1) and genetically differentiated (Fig. 4) from the broadly distributed *B. boreas*, as well as to each other, adding to the intricate phylogeographic story of the *B. boreas* complex of the arid Great Basin. *Bufo nevadensis* and *B. monfontanus* are seemingly close in geographic proximity, separated by approximately 61 km of mountainous desert landscape, yet both have evolved unique phenotypic traits that are nearly opposite of each other in some respects. *Bufo nevadensis*, found only a small locality within Railroad Valley, Nye County, Nevada, is overall squat and warty, but with dramatically diminished parotoid glands (Fig. 6A, Fig. 6C) while the relatively high elevation toad, *B. monfontanus* of Hot Creek Canyon, Nye County, Nevada, which is nestled in the mountains of Hot Creek Range, exhibits relatively large, close-set parotoid glands and a weakly warted, comparatively slender body (Fig. 7A, Fig. 6C). Additionally, sexual dimorphism was only detected for *B. monfontanus*. And, while MANCOVA analyses are robust to uneven sample sizes, further analysis of a larger sample of *B. nevadensis* males may uncover sexual variation among *B. nevadensis*. The life histories for both of these newly named species warrants serious attention as the population numbers are unknown, and the geographic ranges for these species are among the

smallest known among the taxa of the *B. boreas* species complex. Breeding and reproduction timing have been documented in *B. nevadensis*, but not in *B. monfontanus*. However, this may be due to phenological differences in the species due to extreme dissimilarities in temperature and weather experienced by the mountain-inhabiting *B. monfontanus*. These parameters may limit the reproductive window, akin to the environmental restrictions experienced by *B. canorus* (Karlstrom 1962), a narrowly distributed high elevation relative found only in the Sierra Nevada Mountains (Fig. 2B). Despite a strong difference in habitat elevation, both *B. nevadensis* and *B. monfontanus* rely on rare spring fed wetlands, a habitat that is often a small and isolated aquatic resource within the State of Nevada, a region that comprises much of the interior of the arid Great Basin desert (Sada and Vinyard 2002). Although scarce, these riparian habitats are important hubs supporting widespread biodiversity and are often identified as sites rich in endemism, demonstrated by the high taxonomic diversity of spring fish (Hubbs and Miller 1948; Hewitt 1996, 2000; Smith et al. 2002; Finger and May 2015), spring snails (Hershler and Sada 2002; Sada and Vinyard 2002), riparian insects (Shepard 1992a) and toads (Wang 2009; Gordon et al. 2017). While new species within the region have been recognized, undetected and cryptic diversity is still likely within the region as many of these aquatic resources are difficult to detect, severely isolated (Shepard 1993), and rarely studied.

The Great Basin *B. boreas* species complex presents an ideal vehicle for evolutionary study demonstrated by the recent discoveries of cryptic species *B. williamsi* (Gordon et al. 2017) and the two new species described here. While neither species are sympatric with *B. boreas*, these divergent lineages represent new evolutionary trajectories from a common ancestor shared with the western toad, which is supported by molecular evidence (Fig. 4, Table 5) and emphasized by the variations exhibited in morphology by the region's toad species (Fig. 2B). The Great Basin desert may appear to be an unlikely setting for new bufonid species, as amphibians are among the rarest animals to occur within this region. However, the occurrence of this species complex,

whose localized endemics are confined to extremely restricted ranges within this exceptionally dry ecoregion, continues to spur study examining range wide *B. boreas* diversity to gain insight into the evolutionary relationships among these close relative toads (Graybeal 1993; Stephens 2001; Goebel 2005; Goebel et al. 2009; Switzer et al. 2009). An interesting result from our molecular study suggests that *B. nevadensis* and *B. monfontanus* are more closely related to western toads in Colorado (*B. nevadensis*) and Utah (*B. monfontanus*). In Goebel et al. (2009), genetic analyses suggested that there were divergent *B. boreas* lineages uncovered in the phylogenetic analyses from both states, but morphology was not investigated. Research examining the historic hydrological connections into Railroad Valley suggests a connection from the now disjunct White River to the Colorado River, which may have provided the corridors necessary for toad dispersal into the southern Great Basin (Noles 2009). This may provide some explanation for the high level of divergence exhibited in *B. nevadensis* and *B. monfontanus* to Great Basin *boreas* and allied taxa (Table 5), and elucidate the genetic link to western toads outside the region. Additional study is required to advance our understanding of the fine scale relationships among the toads within this species complex and work to identify cryptic taxa that may still remain undetected under the broad range of the western toad.

As species are fundamental to biological study, accurate taxonomy is critical for proper evaluation of diversity and conservation implementation (Bickford et al. 2007). *Bufo nevadensis* and *B. monfontanus* represent novel species concealed within a widely, distributed nominal species (Bickford et al. 2007). These species went undetected until our recent molecular study and demonstrates the increased risk of extinction for cryptic species that are rare due to inadequately resolved taxonomy. With the exception of widely distributed *B. boreas*, the congeneric taxa of the *boreas* species complex are currently Threatened (IUCN 2016) and themselves restricted to extremely small ranges (Fig. 2B). Both *B. nevadensis* and *B. monfontanus* inhabit severely small geographic distributions and join this complex as critically

imperiled new members of the *B. boreas* species complex. This study exposes the link between taxonomic crypsis and high extinction risk, which can have profound consequences to the preservation of biodiversity due to inaccurate taxonomy that may result in improper conservation initiatives. Inadequate conservation can result in serious ramifications, which further endanger these rare, endemic toads reliant on rare, isolated, and fragile wetland habitat open to mismanagement. Unknown population sizes, limited knowledge of life histories and small geographic ranges further emphasize the increased risk of extinction for both these newly discovered bufonids. Moreover, these new toad species reveal that our knowledge of North American anuran diversity remains incomplete (Bickford et al. 2007; Crawford et al. 2010) and taxonomic crypsis among frogs poses an important challenge in preservation of anuran diversity and conservation for a class experiencing global declines and extinctions (Collins and Storfer 2003; Corn 2005; Crawford et al. 2010; Lanoo 2012; Köhler et al. 2015). Delimiting both *B. nevadensis* and *B. monfontanus* is the first step in refining our knowledge of the diversity within the *B. boreas* species complex, enriching our understanding of bufonid evolution within the Great Basin, and will be the necessary first step in launching critical conservation initiatives to protect these vulnerable, rare toads.

ACKNOWLEDGEMENTS

We would like to extend our gratitude to US Fish and Wildlife Service (especially Todd Gilmore); the Biological Resources Research Center, and the Department of Biology of the University of Nevada Reno for providing funding for this research. Further thanks are extended for the invaluable field support from Dr. Sarah Snyder and Molly Betchel, plus field assistance from Kevin Guadalupe and Chris Burg of Nevada Department of Wildlife (NDOW #223071); laboratory support from Dr. Franziska Sandmeier and Dr. Bridgette Hagerty; Molly Stephens for bufonid tissues used to develop DNA markers, assistance in phylogenetic reconstruction from Joshua Hallas, Dr. Mo Beck, and Dr. Matthew Forister; and, aid from Pete Noles and Erich

Purpur on map development and design. We extend thanks to Dr. Chris Feldman for his help in preservation of the holotype and the paratype series. Additional thanks to Jens Vindum for assistance with the deposition of the valuable specimens into the Herpetology Department of the California Academy of Sciences. We were grateful for thoughtful reviews and attention to detail on early drafts from Chava Weitzman.