U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Lithobates onca

Common Name:

relict leopard Frog

Lead region:

Region 8 (California/Nevada Region)

Information current as of:

04/15/2012

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

> ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
>
> ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
>
> ___ Range is no longer a U.S. territory
>
> ___ Insufficient information exists on biological vulnerability and threats to support listing
>
> ___ Taxon mistakenly included in past notice of review
>
> ___ Taxon does not meet the definition of "species"
>
> ___ Taxon believed to be extinct
>
> ___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 05/09/2002

90-Day Positive:05/04/2004

12 Month Positive:05/04/2004

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current candidate notice of review (CNOR) (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Arizona, Nevada, Utah
- **US Counties**: Mohave, AZ, Clark, NV, Washington, UT
- **Countries**:Country information not available

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Arizona, Nevada
- **US Counties**: Mohave, AZ, Clark, NV
- **Countries**:Country information not available

Land Ownership:

National Park Service

Bureau of Land Management

Clark County, Nevada

Lead Region Contact:

ASST REG DIR -ES-OFFICE, Jeff Waters, 916-414-6724, Jeff_Waters@fws.gov

Lead Field Office Contact:

NV FISH AND WILDL OFC, Michael Burroughs, 702-515-5230, michael_burroughs@fws.gov

Biological Information

Species Description:

The relict leopard frog (Lithobates onca) (formerly in Rana) is a medium-sized frog (4.4–8.9 centimeters [1.7–3.5 inches] in length) in the family Ranidae (true frogs). Generally, the relict leopard frog is brown to grey on top with greenish brown spots that are often reduced or obscure on the front of the body (Figure 1). The colors underneath are white to yellow with occasional grey or brown mottling. The dorsolateral folds are indistinct and end well before the groin. A light line runs from below the eye, under the tympanum, to behind the angle of the mouth (Stebbins 2003, p. 238).

Figure 1. Relict leopard frog. NPS

Taxonomy:

Lithobates onca recently was removed from the large and predominantly Eurasian genus Rana by Frost et al. (2006, p. 369) and placed in the genus Lithobates, which was accepted in 2008 by the Committee on Standard and Scientific Names (Crother 2008, p. 7).

The taxonomy of the relict leopard frog has a controversial history centered on two major uncertainties. One long-debated uncertainty is whether or not relict leopard frogs and the Vegas Valley leopard frogs (L. fisheri)

represent distinct species or a taxonomic synonymy (Jaeger et al. 2001, p. 339). The latter taxon was considered extinct and described from a series of specimens collected in the Las Vegas Valley, Clark County, Nevada (Stejneger 1893, pp. 227–228). The other uncertainty is whether or not extant populations of leopard frogs within the Virgin River drainage, in the general range of relict leopard frogs, represent disjunct populations of lowland leopard frogs (L. yavapaiensis), a species described in 1984 (Platz and Frost 1984, pp. 940-941). Both of these historical uncertainties raised questions about the evolutionary distinctiveness of remnant populations within the Virgin River drainage and adjacent areas.

Jaeger et al. (2001, p. 339), based on molecular, genetic, and morphological evidence, concluded that the relict leopard frog is an evolutionarily significant unit (Moritz 1994, pp. 373–374), distinct from what appears to be a closely related taxon, the lowland leopard frog. The differences between relict leopard frogs and lowland leopard frogs are sufficient to distinguish them as separate species (Jaeger et al. 2001, p. 349).

In order to determine whether or not relict leopard frogs and Vegas Valley leopard frogs represent distinct species, Hekkala et al. (2011, pp 1379–1384) performed a broad comparison of mtDNA sequences from the entire collection of representative North American leopard frogs. While no differences in genetic base pairs were found between the Vegas Valley leopard frog and the Chiricahua leopard frog (L. chiricahuensis), there was a difference of four base pairs between the Vegas Valley Leopard frog and the relict leopard frog. Based on this study and according to nomenclatural priority, the northwestern lineage of the Chiricahua leopard frog is assigned to the Vegas Valley leopard frog. The results placed the Vegas Valley leopard frog within the taxon L. chiricahuensis, and as a distant relative of the relict leopard frog.

We have reviewed all available information on the taxonomy of the relict leopard frog and conclude that the species is a valid taxon.

Habitat/Life History:

As habitat generalists, relict leopard frogs historically occupied a variety of habitats including springs, streams, and wetlands characterized by clean, clear water with various depths, and cover such as submerged, emergent, and perimeter vegetation. Leopard frogs generally require shallow water with emergent vegetation for foraging and basking, and deeper water, root masses, undercut banks, and debris piles for cover and hibernacula (Relict Leopard Frog Conservation Team 2005, p. 23). Emergent or submergent vegetation also provide cover and oviposition (egg-deposition) substrate (Relict Leopard Frog Conservation Team 2005, p. 27). Breeding occurs February through April and November. A typical egg mass contains several hundred eggs. Observations suggest that adults prefer relatively open shorelines where dense vegetation is not dominant (Bradford et al. 2005, p. 568). Relict leopard frogs reach sexual maturity in 1 to 2 years. Juvenile and adult relict leopard frogs eat various invertebrates. Tadpoles consume algae and detritus. Longevity data are limited for the relict leopard frog; the northern leopard frog
(L. pipiens) is known to live at least 4 to 5 years.

Historical Range/Distribution:

The historical range of the relict leopard frog is not well documented (Bradford et al. 2005). Based on museum specimens, historical surveys and collections, field studies and observations, and literature, the known historical distribution for relict leopard frog includes 1) springs, streams, and wetlands within the Virgin River drainage downstream from the vicinity of Hurricane, Utah; 2) the Muddy River, Nevada; and 3) the Colorado River from its confluence with the Virgin River downstream to Black Canyon below Lake Mead, Nevada and Arizona (Bradford et al. 2004, pp. 218–219). Nevada areas represent historical localities with specimen records dating from 1936 at the Overton Arm area of Lake Mead and from 1955 at Black Canyon (Jaeger et al. 2001, p. 340). All historical localities are at or within a few kilometers of these three rivers. This apparent restriction in proximity to the three main rivers may be an artifact of historical

collecting activities. The relict leopard frog also may have occurred at lowland localities along the Colorado River, upstream from the confluence with the Virgin River, but no known specimens exist from this area (Relict Leopard Frog Conservation Team 2005, p. 22). The relict leopard frog was presumed extinct in the 1950s (Jennings 1988, p. 417).

In 1991, the relict leopard frog was rediscovered at seven sites in three relatively small areas: 1) near the Overton Arm of Lake Mead, Nevada; 2) Black Canyon near the Colorado River below Hoover Dam, in Nevada; and 3) Reber Spring near Littlefield, Arizona (Jaeger et al. 2001, p. 340). After the 1991 rediscovery of the species, sixty-four localities within the historic range of the relict leopard frog were surveyed. These surveys found relict leopard frogs only at the seven 1991 sites. Since 1991, the population at Corral Spring in the Overton Arm area was extirpated (Bradford et al. 2004, p.224). A second extirpation occurred at the Reber Spring site in 1998 (Bradford et al. 2004, p. 224).

Current Range Distribution:

The relict leopard frog occurs at seven natural and eight translocated or experimental sites (Table 1). The natural sites occur within two areas in Nevada: 1) near the Overton Arm area of Lake Mead and 2) Black Canyon below Lake Mead. These two areas encompass maximum linear extents of only 3.6 and 5.1 kilometers (km) (2.2 and 3.2 miles [mi]), respectively (Bradford et al. 2004, p. 225). Within the Overton Arm area, dispersal of relict leopard frogs may be possible between Blue Point and Rogers Springs, which are separated by a minimum of 1.6 km (1 mi).

The Relict Leopard Frog Conservation Team identified a Relict Leopard Frog Potential Management Zone which identifies natural sites and existing and potential future translocation sites (Figure 2). The most recent translocation sites are Perkins Pond, established in 2010, and Union Pass Spring, established in 2011. Perkins Pond is located on lands owned and managed by Clark County in coordination with the Relict Leopard Frog Conservation Team. Union Pass is the highest elevation site (approximately 3,800 feet) for relict leopard frogs, and occurs in the Black Mountains of Arizona on land managed by the BLM. Relict leopard frog populations may occur in other localized areas within the Potential Management Zone where habitat conditions are suitable. The Relict Leopard Frog Conservation Team estimates that the relict leopard frog occupies approximately 10–20 percent of its estimated historical distribution.

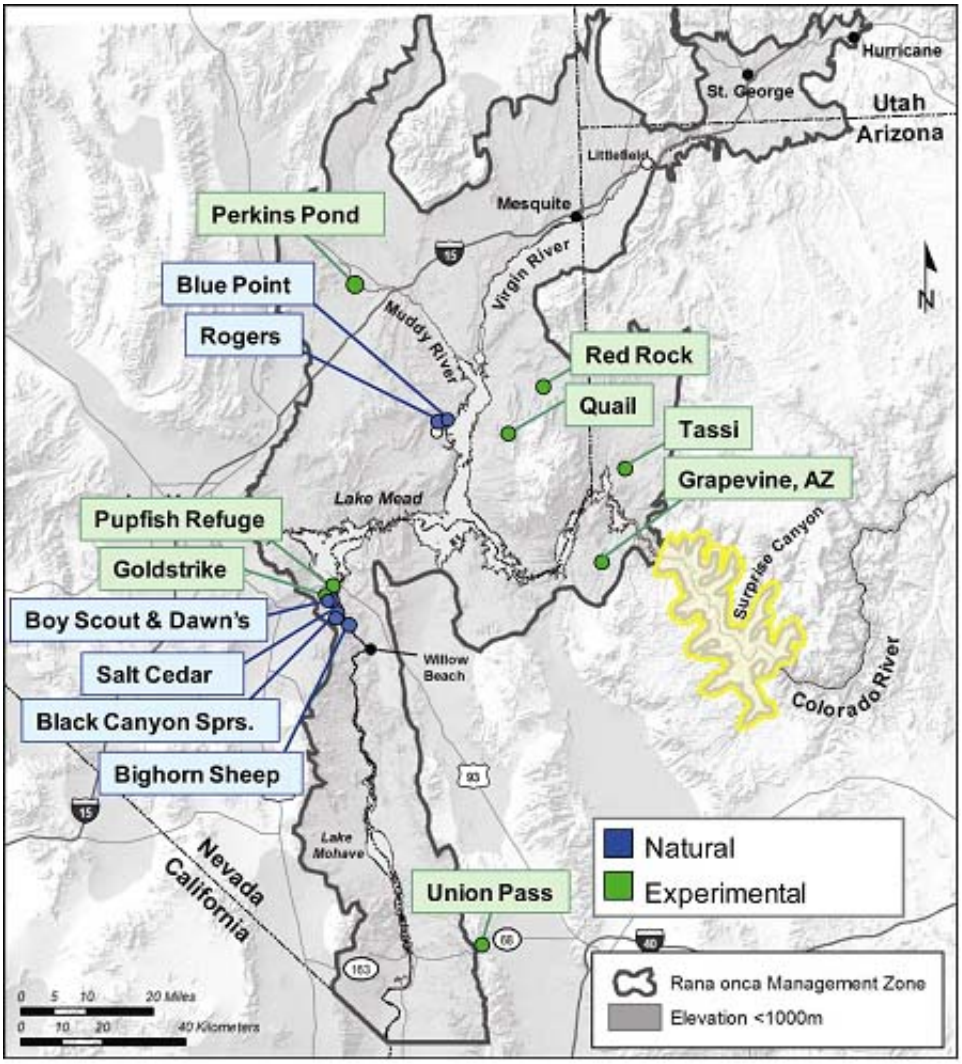


Figure 2. Locations of extant, natural populations of the relict leopard frog (in blue) and experimental translocation populations (in green). The relict leopard frog Potential Management Zone is indicated in the black line with the western Grand Canyon highlighted in yellow to denote that this area may not be a viable region for translocations because of the presence of related, lowland leopard frogs at Surprise Canyon. Figure provided by J. Jaeger, University of Nevada, Las Vegas.

Table 1. Highest counts of adult and juvenile relict leopard frogs from 2010–2011 visual encounter surveys (Jaeger 2011, p. 2).

Site	Spring 2010	Fall 2010	Spring 2011	Fall 2011
Natural Sites				
Bighorn Sheep Spring, NV	25	5	18	16
Boy Scout Canyon Spring, NV	23	20	23	46
Dawn's Canyon Spring, NV	4	3	8	5
Black Canyon Springs, NV	25	17	24	20
Salt Cedar Canyon Spring, NV	21	26	11	14
Blue Point Spring, NV	40	29	37	28
Rogers Spring, NV	1	2	6	3
Translocation Sites				
Gold Strike Canyon, NV	18	27	15	12
Grapevine Spring, AZ	132	101	148	72
Pupfish Refugium, NV	42	38	31	25
Quail Spring, NV	169	191	164	96
Red Rock Spring, NV	15	10	19	16
Tassi Spring, AZ	50	5	81	95
Perkins Pond, NV	introduced	17	0	2
Union Pass Spring, AZ	-	-	introduced	0
TOTALS	565	491	585	450

The best estimate on the amount of habitat available for relict leopard frogs is based on linear measurements made from remote images and data collected by Bradford et al. (2004). The linear distances of habitat at each current site are provided in Table 2. These distances do not reflect the quality or occupancy of relict leopard frog habitat along these systems, and for some sites the estimates include non-habitat areas. For example, only small fractions of Rogers Spring and Lower Blue Point represent currently occupied habitat, and much of these systems are of questionable habitat because of dense vegetation, tunneling of the water channel, and water quality issues at lower ends of the streams.

Table 2. Linear distances of relict leopard frog habitat (J. Jaeger, University of Nevada, Las Vegas).

Site Type	Site	Linear Distance (m)
Natural	Bighorn Sheep Spring	450
	Boy Scout Canyon	760
	Dawn's Canyon	240
	Black Canyon Springs	1500
	Salt Cedar Canyon Spring	360
	Upper Blue Point	575
	Lower Blue Point	2400
	Rogers Spring	3200
Translocation	Grapevine Canyon	1300
	Goldstrike Canyon	870
	Pupfish Refuge Spring	260
	Perkins Pond	275
	Quail Spring	100
	Red Rock Spring	730
	Tassi Spring	300

Population Estimates/Status:

General monitoring of populations has mostly involved counts from visual encounter surveys. These surveys,

however, are not intended to provide population estimates, but instead are used to assess the general status of populations over time. The only estimate of overall population size for the relict leopard frog was provided by Bradford et al. (2004, p. 224). This study estimated that 330 adult frogs occur in the Overton Arm area (Blue Point and Rogers Springs), and 747 adult frogs occur in the Black Canyon sites. Based on the maximum number of observations during 2010 surveys, the total number of juvenile and adult frogs ranges from 1,375 to 2,480 on natural and translocated sites (Jaeger 2011, p.1).

In 2011, the U.S. Fish and Wildlife Service (Service) provided funding to UNLV to develop population estimated based on visual encounter survey data. The Service anticipates initial results from the study in 2012.

Beginning in 2000, efforts to increase the number of relict leopard frogs and sites began by collecting portions of relict leopard frog egg masses and captive-rearing them to juvenile frogs at a facility on Lake Mead NRA headquarters in Boulder City, Nevada and the Service's Willow Beach Fish Hatchery, Arizona. Following selection of suitable translocation sites, captive-reared frogs are released at established translocation sites or natural sites to augment existing populations.

Translocation and population augmentation are continuing and have resulted in increases in frog numbers. In 2011, a total of 1,337 animals (1,049 late-stage tadpoles and 288 froglets) were translocated to three experimental sites and two natural sites. Counts of adult and juvenile frogs at sites in 2011 were similar to 2010 counts. Although population numbers have largely fluctuated, established translocation sites have contributed substantially to the overall numbers of frogs. Conversely, observations of frogs at natural sites remain relatively low. Habitat is improving at Bighorn Sheep Spring and Salt Cedar Spring following the decline in frog numbers that resulted from the floods in 2006. Habitat conditions at Rogers Spring remain relatively poor with dense vegetation covering most of the stream system. As vegetation increase, frog detectability decreases which may result in lower counts and under estimates of population size.

In 2011, three additional sites were assessed on BLM-managed land in the Gold Butte, Nevada area and determined suitable as translocation sites. BLM is in the process of establishing one or more of these sites as new translocation sites.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Water Diversions and Groundwater Development

Water diversions and groundwater development are continuing threats to relict leopard frogs, where historical populations have been extirpated, or their habitats are altered due to diversion of water from streams or wetlands for activities associated with livestock grazing, agriculture, urban development, and other uses (Jennings 1988, pp. 417.1–417.2; Jennings and Hayes 1994, p. 199). Because of legal water appropriations under Arizona, California, Nevada, and Utah water laws and land use practices on public, private, and tribal lands, water diversions continue to occur and are problematic for relict leopard frog conservation and management of occupied or historical leopard frog habitats.

Extant natural populations are restricted to perennial desert springs along the Virgin and Colorado river drainages. Substantial leopard frog habitat in the historical range of the relict leopard frog has been destroyed

or modified by activities such as spring capping, diversions and dam and reservoir construction. Aquifer overdrafting in areas that affect relict leopard frog habitat may be a significant threat because these aquifers may be limited in their ability to recharge.

Modifications have changed the amount and quality of habitat available for relict leopard frogs and also may have created habitat for and promoted introduction of nonnative predators, including the American bullfrog (L. catesbeiana); exotic aquarium fishes (e.g., mollies [Poecilla spp.] and cichlids [Cichlasoma spp.]); sport fishes including members of the Centrarchidae (bass, sunfish), Ictaluridae (catfish), and Salmonidae (trout) (Deacon et al. 1964, pp 385–386); and red swamp crayfish (Procambarus clarkii) (Jennings and Hayes 1994, p. 199). These species may directly prey on different life stages of the relict leopard frog, as well as compete for resources and further degrade the relict leopard frog's habitat.

Colorado River – The Colorado River system serves as a source of water divided among seven states for irrigation and domestic uses as well as for recreational activities, hydroelectric power, and environmental benefits. The Colorado River has undergone decades of alterations that have affected its ecosystems. These ecosystem alterations may have historically affected relict leopard frog populations through fragmentation of habitats and movement pathways; however, the extent of impacts is unknown. Construction of Hoover Dam potentially created a barrier in gene flow between the Northshore population (Rogers and Blue Point springs) and the five sites in Black Canyon as well as inundated existing habitat for the frogs. Coldwater releases from Hoover Dam could potentially impact dispersal activities among the frogs; however, relict leopard frogs have occurred downstream of Black Canyon at the Willow Beach National Fish Hatchery. These coldwater releases may have created a barrier against invasion by bullfrogs at Black Canyon which is beneficial to those populations of relict leopard frogs.

Reber Spring – The Littlefield, Arizona area was historically rural, but is becoming more urbanized. Potential future developments likely will consist of residential, commercial, and tourism interests, including golf courses. Although relict leopard frogs are extirpated from the site, future developments may impact relict leopard frog habitat if groundwater is used to the extent that spring outflow is reduced in the area.

Northshore Springs – Wetland habitat has been converted to agriculture or urban development near the Virgin and Muddy rivers in Utah, Arizona, and Nevada. Also, along the Virgin River, the hydrological regime has been substantially changed by upstream impoundments, diversions, and groundwater pumping. Habitat management actions, such as vegetation reductions, conducted at these sites in recent years have been short-lived with limited success.

Waters in this flow system are a combination of White River and Meadow Valley flow system water and local recharge from Hidden, Garnet, and California Wash, Lower Moapa Valley, and the Black Mountains area (Relict Leopard Frog Conservation Team 2005, pp. 35–36). The average monthly streamflow data for Rogers Spring for years 1985-2000 varies from 0.75 - 0.8 L/min and the average monthly streamflow date for Blue Point Springs for years 1998–2000 varies from 0.23–0.3 L/min (USGS 2001, in Relict Leopard Frog Conservation Team 2005, p. 36). This variable spring discharge illustrates the local recharge component of the "subregional" classification of these springs. This means that some undefined portion of the spring discharge is from local recharge, and some undefined portion is from the regional aquifer. Therefore, impacts resulting from aquifer development and drought are indistinguishable.

It is difficult to evaluate the impacts that groundwater development may have on these springs because of the uncertainty regarding both the regional component and the origin of the carbonate aquifer flow. Development in the Black Mountains area, Hidden, Garnet, and California Wash valleys had been limited until 1990 when various commercial enterprises were granted groundwater withdrawal permits (LVVWD 2001 in Relict Leopard Frog Conservation Team 2005, p. 36). Development in the California Wash Valley or the Lower Moapa Valley is more likely to impact Rogers and Blue Point springs because of the proximity of potential development to the springs. Groundwater is being pumped in Coyote Spring Valley and the Muddy River Springs area. In a 2006 Memorandum of Agreement, the Service, Moapa Valley Water District, Southern

Nevada Water District, and others agreed to develop a monitoring plan to assess impacts to the springs in the Muddy River area that may occur from groundwater pumping. This monitoring may help to anticipate future potential impacts to Rogers and Blue Point springs due to the regional component of their flow.

Black Canyon Springs – Black Canyon is located south of Hoover Dam along the Colorado River. Three springs in Black Canyon have extant populations of relict leopard frogs. The local recharge component of these springs originated from the Black and Eldorado mountains and the subregional groundwater source is from Eldorado Valley. However, the subregional source is somewhat uncertain due to limited sampling of the area.

The potential for further groundwater development in Eldorado Valley is limited; therefore, the potential to impact the springs from groundwater pumping is limited as well. Eldorado Valley is a closed basin (Relict Leopard Frog Conservation Team 2005, p. 36). This means that, except for potential temporary mining permits, the State Engineer will not issue additional permits in that basin. In addition to being a closed basin, water quality is another factor that hinders potential groundwater development of the basin. Eldorado Valley water quality is poor due to high salinities, thus making it an undesirable water source for human use, at least into the near future. As mentioned above, if Eldorado Valley is the subregional source of groundwater in Black Canyon, as it is believed to be, then the elevational gradient between the water table in Eldorado Valley and the springs in Black Canyon is such that a significant reduction in the water table would be required to impact the spring flows. If Eldorado Valley is not the subregional component, then groundwater development will have no impact on the springs in Black Canyon and should not impact the extant relict leopard frog population.

Changes in Plant Communities

The relevance of habitat heterogeneity to frogs within the aquatic and terrestrial environment is unknown but likely important. Shallow water with emergent and perimeter vegetation provides basking and foraging habitat, and deep water provides refuge from predators and potential hibernacula (Relict Leopard Frog Conservation Team 2005, p. 37). Thick patches of vegetation are important for cover and possibly prey production. At Blue Point and Rogers springs, relict leopard frogs make extensive use of thick Eleocharis clumps. However, uniformly dense vegetation growth and the resultant disappearance of varied habitat structure is a significant threat to relict leopard frog populations.

Without management of plant communities for the relict leopard frog, both native and nonnative plants can quickly form dense stands, eliminating open habitat and short, “understory” plant species used by the frogs. Native species of particular concern are cattails, common reedgrass, and sawgrass (Cladium spp.), which form tall, dense stands almost immediately upon colonizing an area, spread rapidly, and are resistant to disturbance. Cattail stalks trap large volumes of sediment in some systems (e.g., Sugarloaf Spring), further reducing pool and channel size. In addition to forming dense stands, aggressive nonnative species such as tamarisk (Tamarisk sp.) and tall whitetop (Lepidium latifolium) can irreversibly alter plant and insect communities, soil chemistry, water availability, and disturbance regimes.

Tall whitetop does not occur in springs occupied by the relict leopard frog, but occurs within the current range of the relict leopard frog and could become a threat. Tall whitetop is established and occurs sporadically in Las Vegas Wash. Tall whitetop does not occur in Lake Mead NRA.

Tamarisk is prevalent along the Virgin River and the shorelines of lakes Mead and Mohave, as well as in almost every untreated spring. Tamarisk has overgrown the type locality of the relict leopard frog, changing geomorphology, soil chemistry, and available habitat including surface water. The majority of tamarisk has been removed from Northshore springs, which are occupied by relict leopard frogs. These treatments will need to be maintained, but tamarisk is not a threat in the short term at these sites. Occupied Black Canyon springs contain substantial amounts of tamarisk. In the Black Canyon springs, tamarisk roots substantially reduce pool size by growing directly in the water and trapping sediment. Tamarisk also reduces the amount

of light available to forbs, which provide cover for relict leopard frogs, and each autumn fallen Tamarisk needles can entirely cover pools. While relict leopard frogs are thriving in Bighorn Sheep Spring, further encroachment and conversion to a tamarisk monoculture likely would be detrimental to the frogs. Current tamarisk management maintains open areas by pulling up sprouts and trimming branches.

Habitat enhancement and improvements were accomplished in 2010 at Blue Point Spring, Quail Spring, and Perkins Pond; and Blue Point Spring, Bighorn Spring, and the Pupfish Refugium site in 2011. Future monitoring of frog populations and habitat conditions at these sites will inform the Relict Leopard Frog Conservation Team on the efficacy of these treatments.

Livestock Grazing and Wild Burros

Effects of livestock grazing on relict leopard frog populations may be positive and negative. While limited grazing may help to maintain open areas in spring systems, high levels of grazing can negatively impact amphibian habitat by removing bankside cover, increasing ambient ground and water temperatures, destroying bank structure (e.g., eliminating undercut banks), trampling egg masses, and adding high levels of organic wastes (Bradford et al 2004, p. 225).

Relict leopard frog populations in the Northshore area in the Lake Mead NRA may be affected by wild burros. Burros seasonally use water sources inhabited by frogs. During those periods, they intensively graze the shallow edges of pools. This use can result in the loss of vegetative cover in riparian and emergent zones, decreased water quality, direct impacts to habitat quality at spring outflow streams and along watercourses, and accelerated drying and loss of pool habitats during spring and summer months. Direct mortality of all life stages of frogs, due to trampling, also may occur and is of particular concern during key periods of the frog's life history such as during breeding, oviposition and development, and emergence of metamorphs. While burro activity may sometimes benefit leopard frogs by decreasing the density of vegetation, many species of emergent vegetation colonize deeper water where they are unaffected by burro grazing, and spread toward the shallow edges, filling the pool. For example, at Blue Point Spring, a previously favored area by relict leopard frogs, high levels of burro activity did not stop the spring's large, deep pool from becoming filled by dense vegetation.

Erosion and Scouring

Erosion and scouring appear to have both negative and positive consequences for relict leopard frogs. Northshore springs flow through soft, gypsum-based soils that are prone to erosion. As water downcuts, blocks of destabilized soil fall into the stream course, blocking flows. Small course shifts, due to collapse and subsequent re-routing, at times benefit the relict leopard frog by creating larger pools and new, open habitat. The dissolution of the gypsum is a potential threat to the relict leopard frog, which causes stream sections to suddenly shift underground resulting in rapid dewatering of large areas.

Black Canyon springs, in narrow, high gradient drainages, are subject to occasional scouring, as evidenced by boulders up to 2 meters in diameter that rest in the narrow canyons. Smaller flash flood events shifts gravel several times per year. While gravel shifts open habitat by burying
vegetation, gravel often can fill pools. Adult lowland leopard frogs are adept at escaping many flash floods, but larger floods may wash away entire cohorts of tadpoles.

Roads

Within Lake Mead NRA, a powerline access corridor runs through the Northshore area. While most public access is restricted by gates, graders conducting road maintenance at the Rogers Spring powerline crossing routinely push soil and debris into relict leopard frog habitat.

Agriculture

Groundwater pumping and surface diversion are consequences of most forms of agriculture. These practices deplete the local aquifer and can lead to subsequent decreases in the amount of available aquatic habitat for amphibians. In addition, surface soil disturbance can degrade water quality (e.g., change local surface water salinity). Agricultural pesticides used in the Muddy River Valley and Virgin River drainage may impact relict leopard frogs in and near those areas. Additionally, disruption of historical water regimes through construction of water impoundments and other water diversions may have impacted habitat available to relict leopard frogs. Within the Virgin River drainage, restrictions have been placed on the use of certain agricultural pesticides through the U.S. Environmental Protection Agency (USEPA) Endangered Species Protection Program.

Based on our evaluation of ongoing land uses described above, we conclude there is sufficient information to develop a proposed listing rule for this species due to the present or threatened destruction, modification, or curtailment of its habitat and range.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

Collection of relict leopard frogs is limited to controlled, low-level sampling for scientific purposes and collection for use in population restoration efforts. Arizona and Nevada regulate the collection of relict leopard frogs to those with a scientific collecting permit. Personal collection or possession of relict leopard frogs is prohibited under existing Nevada regulations for hobby possession of amphibians. Arizona Commission Order 41 specifies a closed season for relict leopard frogs in Arizona. In Utah, collection would be limited to scientific research. Arizona and Nevada regulations prohibit commercial collection or possession of relict leopard frogs for the amphibian and reptile pet trade. In addition to existing State regulations, collection or take of relict leopard frogs for scientific research from extant populations on NPS-administered lands requires additional review and permitting by Lake Mead NRA. NPS regulations prohibit commercial harvest, and personal collection consistent with State statutes and regulations.

The extent to which illegal collection occurs is unknown but considered a potential threat, especially at the Rogers and Blue Point springs sites on the Overton Arm. These sites receive a large number of visitors and are easily accessible to the public from Northshore Road on Lake Mead NRA.

We conclude there is not sufficient information to develop a proposed listing rule for this species due to overutilization for commercial, recreational, scientific, or educational purposes.

C. Disease or predation:

Exotic species, which are often implicated as serious predators and competitors of native ranid frogs in the western U.S. have become widely distributed along the Virgin, Muddy, and Colorado rivers. Included among these are the American bullfrog; exotic aquarium fishes (e.g., mollies and cichlids); sport fishes including members of the Centrarchidae (bass, sunfish), Ictaluridae (catfish), and Salmonidae (trout) (Deacon et al. 1964, pp 385-386); and red swamp crayfish (Jennings and Hayes 1994, p. 199). Bullfrogs eat frogs, including leopard frogs, snakes, lizards, birds, mammals, and invertebrates (Rosen and Schwalbe 1995, p.452). Bullfrogs also negatively affect native amphibians through competition for food and cover sites. Recreational access to springs and streams is the cause of a number of threats to the relict leopard frog. Recreational users deliberately introduce many nonnative species, including aquarium and sport fish, bullfrogs, turtles, and snails. The fish will initially feed on frog eggs and tadpoles. Once the tadpoles become too large for the fish to consume, they will then compete with the tadpoles for food (Goldstein 2007, p. 4). The frogs introduced to Perkins Pond beginning May 2010 are likely taken as prey by the abundant aquatic birds seen at the site.

At Rogers Spring, multi-colored aquarium gravel often can be found where unwanted aquatic pets have been freed. Feeding these exotic species is a favorite activity of many visitors at Rogers Spring. These introduced

species potentially predate all life stages of the relict leopard frog, including eggs and larvae. These introductions also may cause the spread of disease.

Chytridiomycosis (chytrid), caused by the pathogenic fungus Batrachochytrium dendrobatidis, is an emerging panzootic fungal disease in the U.S. and globally (Daszak et al. 2003, pp. 143–148; Blaustein et al. 2005, pp. 1464–1465). Clinical signs of amphibian chytrid and diagnosis are described by Daszak et al. (1999, p. 737) and include abnormal posture, lethargy, and loss of righting reflex. Gross lesions, which usually are not apparent, consist of abnormal epidermal sloughing and ulceration; hemorrhages in the skin, muscle, or eye; hyperemia of digital and ventrum skin; and congestion of viscera. Two theories exist regarding how chytrid contributes to amphibian death (Drew 2004, pp. 1–2). One theory suggests dehydration or suffocation since amphibians breathe, drink and maintain homeostasis largely through their skin. Another possibility is that chytrid releases a toxin which, in turn, kills the amphibian.

In spring 2010, the presence of chytrid fungus was documented in relict leopard frogs at Lower Blue Point. Testing for the presence of the fungus continued in 2011. Chytrid fungus was detected again in spring 2011 at Lower Blue Point Spring and in bullfrogs along the Muddy River; samples collected in July 2011 at Lower Blue Point Spring were all negative for the fungus. Understanding the distribution of this disease agent at relict leopard frog sites, and in the region, is a critical first step in understanding the potential impacts of this disease on populations. Plans for additional sampling are in place, but additional support will be necessary. Large sample sizes are needed to assess prevalence, or lack thereof, in any particular system with statistical assurance. Most importantly, a review of protocols to minimize the transport of this disease among sites is needed, and this review should extend to agency partners that have field crews conducting habitat work at spring sites.

Based on our evaluation of disease and predation described above, we conclude there is sufficient information to develop a proposed listing rule for this species.

D. The inadequacy of existing regulatory mechanisms:

State Regulations

Regulations administered by the Nevada Department of Wildlife (NDOW) afford the relict leopard frog some legal protections. The species is classified as protected under the Nevada Administrative Code (NAC) 503.075, which requires a permit to collect or possess individuals. Habitat protection for the relict leopard frog is provided by NAC 504.520, which prohibits alteration of a wetland or stream to the detriment of wildlife without a permit. Nevada Revised Statutes (NRS) 503.587 allows the Wildlife Commission to use its authority to manage land to carry out a program for conserving, protecting, restoring and propagating selected species of native fish, wildlife and other vertebrates and their habitat, which are threatened with extinction and destruction. Also, NRS 533.367 states that before a person may obtain a right to the use of water from a spring or water that has seeped to the surface of the ground, that person must ensure that wildlife which customarily uses the water will have access to it. However, the State Engineer, who oversees all water rights, may waive this requirement for a domestic use of water (NRS 533.367).

The Arizona Game and Fish Department (AGFD) also provide some legal protections to the relict leopard frog. The species is classified as Wildlife of Special Concern in the State, and Commission Order 41 of the AGFD regulations prohibits collection or hunting of relict leopard frogs, except under the authority of a special permit. Protection under Commission Order 41 provides protection to individual frogs, but not to habitat.

The Utah Division of Wildlife Resources (UDWR) also affords some legal protections to the relict leopard frog. The relict leopard frog is classified as a Sensitive Species in Utah. State of Utah Rule 657-3 prohibits the collection, importation, and possession of relict leopard frogs without a certificate of registration but

provides no protection of habitat.

National Park Service Organic Act

Legal protection is afforded to the relict leopard frog by the NPS at Lake Mead NRA under 36 CFR Part 2, which prohibits unauthorized possessing, destroying, injuring, defacing, removing, digging, or disturbing from its natural state any living or dead wildlife or fish, or the parts or products thereof. Extant populations of the relict leopard frog on NPS lands are afforded protection under the National Park Service Organic Act (16 USC 1, 2, 3 and 4).

Lacey Act

The Lacey Act (16 U.S.C. 3371 et seq.), as amended in 1982, provides some protection for the relict leopard frog. This legislation prohibits the import, export, sale, receipt, acquisition, purchase, and engagement in interstate or foreign commerce of any species taken, possessed, or sold in violation of any law, treaty, or regulation of the U.S., any Tribal law, or any law or regulation of any State. The relict leopard frog is not protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which regulates international trade.

National Environmental Policy Act (NEPA)

NEPA (42 U.S.C. 4371 et seq.) requires Federal agencies to describe a proposed action, consider alternatives, identify and disclose potential environmental impacts of each alternative, and involve the public in the decision making process. The release of documents is for disclosure, and NEPA does not require or guide mitigation for project impacts. Projects that are covered by certain "categorical exclusions" are exempt from NEPA biological evaluations. Both NPS and BLM comply with NEPA for actions requiring an environmental assessment, including many projects in or near relict leopard frog habitat. Federal agencies are not required to select the NEPA alternative having the least significant environmental impacts. A Federal agency may select an action that will adversely affect sensitive species provided that these effects were known and identified in a NEPA document.

Federal Land Policy Management Act of 1976 (FLPMA)

NPS and BLM are required to incorporate Federal, State, and local input into their management decisions through Federal law. The FLPMA (Public Law 94-579, 43 U.S.C. 1701) was written "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development and enhancement of the public lands; and for other purposes." Section 102(f) of the FLPMA states that "the Secretary [of the Interior] shall allow an opportunity for public involvement and by regulation shall establish procedures…to give Federal, State, and local governments and the public, adequate notice and opportunity to comment upon and participate in the formulation of plans and programs relating to the management of the public lands." Therefore, through management plans, NPS and BLM are responsible for including input from Federal, State, and local governments and the public. Additionally, Section 102(c) of the FLPMA states that the Secretary shall "give priority to the designation and protection of areas of critical environmental concern" in the development of plans for public lands. Although the BLM has a multiple-use mandate under the FLPMA, which allows for grazing, mining, and off-road vehicle use, the BLM also has the ability under the FLPMA to establish and implement special management areas such as Areas of Critical Environmental Concern (ACECs). ACECs can contain wilderness, research areas, etc., that can reduce or eliminate actions that adversely affect species of concern, including listed species.

Nationwide, enforcement of land use restrictions on Federal land is limited with only a few resource law enforcement officers (Gregory 2008, pp. 1–12). On BLM-managed lands under the jurisdiction of the Southern Nevada District Office outside of the Red Rock Canyon National Conservation Area, there is roughly one officer for every 370,200 acres. Several portions of the District (Moapa, Gold Butte, and Nye

County) only have one duty officer (BLM 2007, p. 1). The BLM's ability to enforce regulations in southern Nevada is not expected to improve in the near future.

Endangered Species Act of 1973, as amended (ESA)

Under the authority of section 10 of the ESA, the Service adopted policy and regulations for voluntary conservation of candidate species (Service 1999, pp. 32726–32736). Candidate Conservation Agreements (CCAs) are voluntary conservation agreements between the Service and one or more public or private parties. The Service works with its partners to identify threats to candidate species, plan the measures needed to address the threats and conserve these species, identify willing landowners, develop agreements, and design and implement conservation measures and monitor their effectiveness. Candidate Conservation Agreements with Assurances (CCAAs) expand on the success of traditional CCAs by providing non-Federal landowners with additional incentives for engaging in voluntary proactive conservation through assurances that limit future conservation obligations. One of the primary reasons for developing the CCAA program was to address landowner concerns about the potential regulatory implications of having a listed species on their land. The CCAA program specifically targets non-Federal landowners and provides them with the assurance that if they implement various conservation activities, they will not be subject to additional restrictions if the species becomes listed under the ESA. These assurances are only available to non-Federal entities for actions on non-Federal lands. A draft CCAA has been prepared by NDOW and the Service which should provide non-Federal and private landowners' incentives to consider their land as potential translocation sites for relict leopard frogs (see Conservation Measures Planned or Implemented section below).

Clean Water Act (CWA)

Under section 404, the U.S. Army Corps of Engineers (USACE) regulates the discharge of fill material into waters of the U.S., which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the USACE's criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the U.S. must be reviewed under the CWA, NEPA, and ESA. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

The USACE interprets "the waters of the U.S." expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, recent Supreme Court rulings have called into question this definition. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving "isolated" wetlands. Currently, USACE regulatory oversight of such wetlands (i.e., vernal pools) is in doubt because of their "isolated" nature. In response to the Supreme Court decision, the USACE and USEPA have released a memorandum providing guidelines for determining jurisdiction under the CWA. The guidelines provide for a case-by-case determination of a "significant nexus" standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007, pp. 4–11). The overall effect of the new permit guidelines on loss of isolated wetlands is not known at this time.

BLM Policies

As a Federal candidate species, populations of relict leopard frogs on BLM land are managed under the policies contained in their 6840 Manual, Release 6-125, revised as of December 12, 2008 (BLM 2008a). In accordance with BLM policy, candidate species are managed as sensitive species, defined as "species that require special management or considerations to avoid potential future listing" (BLM 2008b, Glossary, p. 5). The stated objective for sensitive species is to initiate proactive conservation measures that reduce or eliminate threats to minimize the likelihood of and need for listing (BLM 2008a, 6840.02). Conservation, as

it applies to BLM sensitive species, is defined as “the use of programs, plans, and management practices to reduce or eliminate threats affecting the status of the species, or improve the condition of the species’ habitat on BLM-administered lands” (BLM 2008a, Glossary, p. 2).

Clark County Multiple Species Habitat Conservation Plan (MSHCP)

The MSHCP provides for conservation of the relict leopard frog and 77 other species and their habitats throughout Clark County (Regional Environmental Consultants 2000). The incidental take permit issued to Clark County for the MSHCP exempts take of listed species on up to 145,000 acres of non-Federal land over a 30-year period. Disturbance fees collected from developers fund conservation actions for the covered species on Federally-managed land to offset impacts from development on non-Federal land in Clark County. Conservation actions include public information and education, research, inventory and monitoring, protective measures, and habitat restoration and enhancement. Specifically, the permit requires Clark County to participate with the Federal land management agencies in the development of conservation management plans for certain areas or covered species, including desert riparian habitats, such as the Muddy and Virgin rivers, Meadow Valley Wash, and low elevation springs, which contain amphibians and aquatic snails. The MSHCP has funded a project to monitor populations, acquire and manage habitat, and determine temperature preferences of relict leopard frogs.

Summary of Regulatory Mechanisms

Regulatory mechanisms exist for all natural and translocated populations of the relict leopard frog. State laws in Nevada, Arizona, and Utah and the Lacey Act provide protection to relict leopard frogs mostly through regulations that prohibit collection and, to a lesser degree, their habitat. All extant natural populations of the relict leopard frog occur within the Lake Mead NRA, which is managed by the NPS. As stated above, NPS regulations offer protection to the relict frog and its habitat, through regulations that prohibit possession, injury, removal, or disturbance of relict leopard frogs and transport and release of nonnative predators. NPS and BLM policy requires that management activities do not lead to a trend to list candidate species as threatened or endangered. NEPA and FLPMA allow the public opportunities to comment on proposed Federal actions including those that may involve relict leopard frogs. CCAA developed under section 10 of the ESA may afford some protection or conservation to the relict leopard frog and its habitat. Protection under the Clean Water Act is uncertain but may result in mitigation of adverse effects.

Based on our evaluation of regulatory mechanisms described above, we conclude there is not sufficient information to develop a proposed listing rule for this species.

E. Other natural or manmade factors affecting its continued existence:

Small Population Size

The low numbers of individuals within each population, some of which may not be viable, further threatens the relict leopard frog. Amphibians are thought to have a metapopulation structure consisting of groups of individuals inhabiting a system of habitat patches connected by migration across contiguous habitat. Populations that occur in isolated patches may be extirpated by stochastic events such that recolonization may not occur due to the distance of separation and absence of contiguous habitat (Marsh and Trenham 2001, p. 41).

The threat of low numbers of individuals is being minimized through collection of eggs from wild and captively-held individuals, and head-starting the tadpoles to metamorphosis. Froglets from this effort are considered for translocation with the goal of augmenting existing populations and establishing new, self-sustaining populations within the historical range of the species. In 2010, the Relict Leopard Frog Conservation Team evaluated and approved Stewart Ranch as a new translocation site. In addition, three new

sites were evaluated in 2011 and new sites were established at Perkins Pond (2010) and Union Pass Spring (2011). Populations of frogs at Quail Spring, Rogers Spring, and Lower Blue Point Spring were augmented with captive-reared frogs in 2011.

Air Pollution

Air pollution has been implicated as a cause of amphibian population declines in the U.S. through acidification of water bodies from both point and non-point sources, and pesticide exposure. In the western U.S., however, the predominance of evidence indicates that this effect from non-point sources is not currently manifested, even in waters with low acid neutralizing capacity (Bradford et al. 1994, pp. 155–161).

Extant populations of the relict leopard frog do not occur downwind from large centers of industry, metropolitan development on the scale of the eastern U.S., agriculture, or smelters. Thus, it is unlikely that air pollution is a major stressor on relict leopard frog populations. Agricultural pesticides used in the Muddy River valley and Virgin River drainage may impact relict leopard frogs in and near those areas, especially the Northshore populations at the Lake Mead NRA located near these agricultural areas. Within the Virgin River drainage, restrictions have been placed on the use of certain agricultural pesticides through the USEPA Endangered Species Protection Program.

Wildfire

The effects of natural and uncontrolled human caused wildland fires, as well as human controlled burns, on native amphibian populations in the southwest are poorly known and depend on local conditions (Relict Leopard Frog Conservation Team 2005, p. 41). Increased peak flows and sedimentation loads and ash flow following major precipitation events or during spring runoff after a hot burn are the primary threats to aquatic systems and species (DeBano et al. 1996, in Relict Leopard Frog Conservation Team 2005, p. 41). These events can move all life stages of amphibians and fish down drainage, destroy amphibian eggs, and decrease available habitat. Smoke diffusion into water and ash flow can result in high levels of phosphorus and nitrogen that may be toxic to frogs. However, fire may benefit aquatic species in some systems by providing the disturbance of riparian vegetation necessary to keep succession from eliminating the aquatic system.

Visitors sometimes cause fires at Blue Point and Rogers springs. Palm tree fires have occurred as a result of visitors launching fireworks into palm frond skirts. Although fires temporarily clear thick vegetation, it regrows quickly and possibly in densities greater than present prior to burning.

Climate Change

The Intergovernmental Panel on Climate Change (IPCC) has high confidence in predictions that extreme weather events, warmer temperatures, and regional drought are likely to increase in the northern hemisphere as a result of climate change (IPCC 2007, pp. 15–16). Climate models show the southwestern U.S. has transitioned into a more arid climate of drought that is predicted to continue into the next century (Seager et al. 2007, p. 1181). In the past 60 years, the frequency of storms with extreme precipitation has increased in Nevada by 29 percent (Madsen and Figdor 2007, p. 37). Increasing summer and winter temperatures and decreasing precipitation regionally greater than current global models could adversely affect relict leopard frogs by causing reduced spring flow and surface water, habitat loss, and altering fire frequencies.

Changes in local southern Nevada climatic patterns cannot be definitively tied to global climate change; however, they appear to be consistent with IPCC-predicted patterns of extreme precipitation, warmer than average temperatures, and drought. Information on specific effects from climate change to the relict leopard frog and to individual habitats and aquatic systems is not available, and effects are difficult to predict and likely to vary from site to site over time. Ongoing management of the matrix of habitats that support the relict

leopard frog reduces the potential threat of climate change. In the absence of active management, several spring sites may become degraded; however, larger spring sites are expected to maintain their function to provide the ecological needs for the species.

Floods

Major flood events have occurred in the Black Canyon area with short-term adverse effects to relict leopard frog habitat; however, relict leopard frogs continue to occur in the river and may benefit from the disturbance created by such events. Although floods may result in short-term adverse effects to the relict leopard frog, the disturbance created by flooding events may scour dense emergent vegetation and create and increase open water pools that are preferred by the species.

Ultraviolet-B (UV-B) Radiation

Increases in UV-B radiation from depletion of stratospheric ozone have been suggested as a possible threat to amphibian populations (Blaustein et al. 1997, pp. 13735–13736). In amphibians, ambient levels of UV-B can result in impaired growth, slowed development, malformations, altered behavior and mortality. UV-B also can interact with other environmental stressors to amplify these negative effects on individuals (Searle et al. 2010, p. 237).

UV-B mainly decreases egg survivorship and increases deformities in developing metamorphs (Blaustein et al. 1997, pp. 13735–13736). Although relict leopard frogs and their eggs are exposed to UV-B, no adverse effects have been observed during population monitoring activities that suggests that UV-B is a threat.

Based on our evaluation of other natural or manmade factors affecting its continued existence described above, we conclude there is sufficient information to develop a proposed listing rule for this species.

Conservation Measures Planned or Implemented :

The NPS, in cooperation with various other Federal, State, and local partners, including the Service, developed a Conservation Agreement and Strategy, which is intended to improve the status of the relict leopard frog through management actions and protection. The Conservation Agreement and Strategy was finalized in 2005 and conservation actions are being implemented by partners. The effort to develop the plan began in March 2001 with the formation of a group of biologists and resource managers, now referred to as the Relict Leopard Frog Conservation Team. Conservation actions identified Conservation Agreement and Strategy include captive rearing tadpoles for translocation and refugium populations, habitat and natural history studies, habitat enhancement, population and habitat monitoring, and translocation. Annual work plans and reports of activities are prepared by the Relict Leopard Frog Conservation Team. Ongoing and future management and conservation activities will proceed under the direction of the Relict Leopard Frog Conservation Team.

Below are the tasks in the 2011 Work Plan and their status:

Tasks Completed in 2011

• Augment translocation sites: Quail Spring, Perkins Pond, and Union Pass Spring. (In addition, two natural sites were augmented- Rogers Spring and Lower Blue Point Spring).
• Monitor all translocated populations: Pupfish Refuge Spring, Goldstrike Canyon Spring, Grapevine Spring, Red Rock Spring, Quail Spring, Tassi Spring, and Union Pass Spring.
• Monitor all natural populations: Bighorn Sheep Spring, Blue Point Spring, Rogers Spring, Boy Scout Canyon Spring, Salt Cedar Spring, Black Canyon Spring and Dawn’s Canyon Spring.

• Small-scale enhancement and habitat restoration at Lower Blue Point Spring, Bighorn Spring, and Pupfish Refugium.
• Manage database of natural, transplanted, and assessments of potential translocation sites.
• Continue implementation of the Clark County MSHCP projects: Relict Leopard Frog Monitoring and Management Project; and Relict Leopard Frog Conservation, along with the associated UNLV agreement.
• Investigate additional grant funding or matching funds options through NDOW. Funding secured through 2014.
• Continue assessment of chytrid status in relict leopard frogs. Samples taken at Lower Blue Point and Muddy River (bullfrogs).
• Complete clearance for Union Pass Spring, Arizona for translocation. Frogs released in April 2012.
• Assess springs not previously visited on surveys in Gold Butte. Three sites assessed and determined suitable.
• Continue Pupfish Refugium Spring non-native to native vegetation replacement. Saltcedar removed, replaced with natives.
• Develop implementation plan for Perkins Pond.

Tasks Near Completion

• Complete the programmatic CCAA for relict leopard frogs on private land in Nevada. (draft provided to the Service)

Tasks in Progress

• Work with the Nevada Division of State Parks to develop an agreement and move forward with the establishment a refuge site at Spring Mountain Ranch State Park. (dependent upon completion of the CCAA)
• Continue the engineering, design and construction of refuge ponds at Las Vegas Springs Preserve for the relict leopard frog. Bids accepted and work to be initiated in 2012.
• Identify and resolve obstacles precluding the use of the water pumping station as an artificial refuge for relict leopard frogs. (dependent upon completion of the CCAA)
• Continue follow up on Pakoon Springs as a potential site for translocation of relict leopard frogs, including eradication of potential amphibian predators and competitors.
• Follow up with UDWR in Washington County about getting involved with relict leopard frog conservation activities.
• Coordinate with land managers to assess the possibility of Warm Springs Natural Area as a future translocation site. (dependent upon completion of the CCAA)

Summary of Threats :

Regarding Factor A – The present or threatened destruction, modification, or curtailment of its habitat or range. The primary threats to the relict leopard frog include alteration, loss, and degradation of aquatic habitat due to water developments and impoundments and the presence of nonnative vegetation at all sites. Changes in plant communities that result in dense growth and the prevalence of tamarisk reduce the capability of all sites to support relict leopard frogs. Overgrazing by livestock and burros; erosion and scouring; roads (Rogers Spring); agriculture resulting in increase groundwater use; wildfire; and floods are other important threats. Although water developments are ongoing, no effects have been documented on relict leopard frog populations and their habitat. Habitat threats continued in 2011–2012 but the numbers of individuals and sites occupied by the frog are increasing through captive-rearing and translocation.

Regarding Factor B – Overutilization for commercial, recreational, scientific, or educational purposes. Collection of relict leopard frogs is limited to low-level sampling for scientific purposes and an unknown level of unauthorized collection by the public.

Regarding Factor C – Disease or predation. The presence of chytrid fungus in relict leopard frogs at Lower Blue Point Spring in 2011 and 2011 warrants further evaluation of the threat of disease to the species. Monitoring should occur to determine the prevalence of chytrid in relict leopard frog populations and disease in individuals. Bullfrogs, crayfish, nonnative fishes, and aquatic birds are important relict leopard frog predators, and widely distributed across the range of the relict leopard frog.

Regarding Factor D – The inadequacy of existing regulatory mechanism. The relict leopard frog is protected by Nevada, Arizona, and Utah; BLM; and NPS. Limited protection, conservation, and mitigation may occur through the ESA and Clean Water Act. BLM and NPS law enforcement provides limited protection on Federal lands. The status of the relict leopard frog as a candidate will ensure that the species is included in NEPA planning for Federal projects; however, NEPA is a primarily a disclosure process and impacts to species still may occur. Development of a CCAA in Nevada should further conservation of the species on non-Federal land.

Regarding Factor E – Other natural or manmade factors affecting its continued existence. The size of natural and translocated populations is small and therefore vulnerable to stochastic events, such as floods and wildfire. Air pollution is unlikely a major threat to the relict leopard frog. Climate change that results in reduced spring flow, habitat loss, and increased prevalence of wildfire would adversely affect relict leopard frog populations. Effects of UV-B radiation on the relict leopard frog are unknown.

We reviewed and evaluated the five listing factors with regard to the status of the relict leopard frog. The Service considers a candidate species to be one for which we have on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened, but for which preparation and publication of a proposed rule is precluded by higher priority listing actions. Based upon the information in our files, we find that there is sufficient information with regard to Factors A, C, and E to conclude that the relict leopard frog meets the definition of a candidate. We find that the relict leopard frog is warranted for listing throughout all of its range and, therefore, it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

RECOMMENDED CONSERVATION MEASURES

We recommend the following conservation measures to remove or reduce threats to the relict leopard frog. Refer to the Conservation Agreement and Strategy for additional information on these measures.

1. Remove or substantially minimize threats, including invasive species, to extant populations and occupied habitats.
2. Enhance existing habitat and create new habitats where feasible.
3. Establish additional populations of relict leopard frogs in existing or created habitats.
4. Manage relict leopard frogs and their habitats to ensure persistence in diverse aquatic ecosystems and facilitate processes that promote self-sustaining populations.
5. Monitor relict leopard frog populations and conduct more sampling for chytrid fungus at all sites; determine relationship between presence of chytrid fungus and disease in relict leopard frogs.

6. Investigate the conservation biology of the relict leopard frog and use the results of such investigations to better assess and meet the goals and objectives of the Conservation Agreement and Strategy.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	**Imminent**	Monotypic genus	7
		Species	**8**
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

The magnitude of threats to the relict leopard frog is moderate to low. This determination is based on its low population numbers, limited distribution, and the presence of nonnative predators. The relict leopard frogs face one or more threats which are ongoing and may be long-term in duration. The threat of disease is unknown at this time because no documented mortality of diseased individuals has been reported. However, in 2010 and 2011, chytrid fungus was documented at Lower Blue Point, and further investigations are necessary to determine the magnitude of this threat. No frog populations are currently threatened by any major anthropogenic activity that would reduce the numbers and distribution of any given population. We determined that the magnitude of threats to the relict leopard frog is similar to the 2005 level when the Conservation Agreement and Strategy was finalized, indicating threats are moderate to low to the species.

Imminence :

The relict leopard frog is facing a combination of imminent and non-imminent threats. We considered the contribution and potential effects of each threat to the overall status of the relict leopard frog. We determined that imminent best describes the overall combined threats facing this species.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

The immediate loss of relict leopard frogs and their current occupied habitat is unlikely. The Conservation Agreement and Strategy and CCAA provide a strategy for conservation. We will monitor the effectiveness of these agreements and willingness of the participants to continue implementation.

Description of Monitoring:

Professional amphibian biologists and resource specialists, representing academia and land and resource management agencies, are members of the Relict Leopard Frog Conservation Team. The team monitors the status of the relict leopard frog and progress of conservation efforts. The team meets in Boulder City, Nevada a minimum of twice per year. Since April 2011, the Relict Leopard Frog Conservation Team met twice (May and December 2011). Monitoring of natural and translocated populations continues and involves at least three visits to each known site occupied by relict leopard frogs. Amphibian biologists most familiar with ranids in the southwestern U.S. believe this level of monitoring is appropriate given the biology of the species and threats. Survey information is used to determine and document population viability, evaluate and document population trends, and assess the success or failure of management activities. Extant populations are monitored following protocols established in the Conservation Agreement and Strategy.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Arizona,Nevada

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

As participating representatives on the Relict Leopard Frog Conservation Team, biologists from the NDOW, AGFD, and UDWR developed the agreement and strategy during 2004–2005. UDWR continues to support the conservation efforts but has decided to limit their involvement with the team due to funding constraints and other higher priorities.

Literature Cited:

Blaustein, A.R., J.M. Kiesecker, D.P. Chivers, and R.G. Anthony. 1997. Ambient UV-B radiation causes deformities in amphibian embryos. Proceedings of the National Academy of Sciences of the United States of America 94:13735-13737.

Blaustein, A.R., and L.K. Belden. 2005. Ultraviolet radiation. Pages 87-88 in M. Lannoo (editor), amphibian declines, the conservation status of United States species. University of California Press, Berkeley, California.

Bureau of Land Management (BLM). 2007. Personnel communication from Gayle Marrs-Smith to Fred Edwards, U.S. Fish and Wildlife Service, on April 12, 2007. 1 p.

Bureau of Land Management (BLM). 2008a. 6840 Manual, Release 6-125. Washington Office, Washington, D.C. 24 sheets.

Bureau of Land Management (BLM). 2008b. Administrative Draft Final Environmental Impact Statement – Toquop Energy Project. Ely Field Office, Ely, Nevada. Various pagination.

Bradford, D.F., M.S. Gordon, D.F. Johnson, R.D. Andrews, and W.B. Jennings. 1994. Acidic deposition as

an unlikely cause for amphibian population declines in the Sierra Nevada, California. Biological Conservation 69: 155-161.

Bradford, D.F., J.R. Jaeger, and R.D. Jennings. 2004. Population status and distribution of a decimated amphibian, the relict leopard frog (Rana onca). The Southwestern Naturalist 49(2):218-228.

Bradford, D.F., J.R. Jaeger, and R.D. Jennings. 2005. Species account of the relict leopard frog (Rana onca). Pages 567-568 in M. Lannoo (editor), amphibian declines, the conservation status of United States species. University of California Press, Berkeley, California.

Crother, B. 2008. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. Sixth edition. 84 pp.

Daszak, P., L. Berger, A.A. Cunningham, A.D. Hyatt, D.E. Green, and R. Speare. 1999. Emerging infectious diseases and amphibian population declines. Emerging Infectious Diseases 5:735-748.

Daszak, P., A.A. Cunningham, and A.D. Hyatt. 2003. Infectious disease and amphibian population declines. Diversity and Distributions 9:141-150.

Deacon, J.E., C. Hubbs and B.J. Zahuranec. 1964. Some effects of introduced fishes on the native fish fauna of southern Nevada. Copeia 1964:384-388.

Drew, A.J. 2004. An investigation of climatic and geographic factors on the growth and spread of chytrid fungus on amphibian populations in Australia. Master's thesis, Texas Tech University, Lubbock, Texas. 60 pp.

Frost, D. R., T. Grant, J. Faivovich, R. H. Bain, A. Haas, C.F.B. Haddad, R.O. De Sa, A. Channing, M. Wilkinson, S.C. Donnellan, C.J. Raxworthy, J.A. Campbell, B.L. Blotto, P. Moler, R.C. Drewes, R.A. Nussbaum, J.D. Lynch, D.M. Green, and W.C. Wheeler. 2006. The amphibian tree of life. Bulletin of the American Museum of Natural History No. 297. New York, N.Y. 370 pp.

Goldstein, J.A. 2007. The effect of temperature on development and behavior of relict leopard frog tadpoles (Rana onca). Master's thesis, University of Nevada, Las Vegas. Summer 2007. 56 pp.

Hekkala, E.R., R.A. Saumure, J.R. Jaeger, H.W. Herrmann, M.R. Sredl, D.F. Bradford, D. Drabeck, and M.L. Blum. 2011. Resurrecting an extinct species: archival DNA, taxonomy, and conservation of the Vegas Valley leopard frog. Conservation Genetics 12:1379–1385.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: the physical science basis summary for policymakers. Contribution of the Working Group I to the fourth assessment report of the Intergovernmental Panel on Climate Change.
February 5, 2007. 18 pp.

Jaeger, J.R., B.R. Riddle, R.D. Jennings, and D.F. Bradford. 2001. Rediscovering Rana onca: Evidence for phylogenetically distinct leopard frogs from the border region of Nevada, Utah, and Arizona. Copeia 2001:339-354.

Jaeger, J.R. and J.G. Barnes. 2010. Annual report: relict leopard frog monitoring and management. January through December 2010. Unpublished report prepared for the Relict Leopard Frog Conservation Team. 14 pp.

Jennings, M.R. 1988. Rana onca Cope, relict leopard frog. Catalogue of American amphibians and reptiles

417:1-2.

Jennings, M.R., and M.P. Hayes. 1994. Decline of native ranid frogs in the desert southwest. Pages 183-211 in P.R. Brown and J.W. Wright (eds.) Herpetology of the North American Deserts, Southwestern Herpetologists Society, Special Publication. No 5.

Jennings, R.D., B.R. Riddle, and D.F. Bradford. 1995. Rediscovery of Rana onca, the relict leopard frog, in southern Nevada with comments on the systematic relationships of some southwestern leopard frogs (Rana pipiens complex) and the status of populations along the Virgin River. Report prepared for Arizona Game and Fish Dept., U.S. Bureau of Land Management, Las Vegas Valley Water District, U.S. National Park Service, and Southwest Parks and Monuments Association. 71 pp.

Madsen, T. and E. Figdor. 2007. When it rains it pours global warming and the rising frequency of extreme precipitation in the United States. Environment America Research and Policy Center. December 2007. 47 pp.

Marsh D.M. and P.C. Trenham. 2001. Metapopulation dynamics and amphibian conservation. Conservation Biology (1)15:40-49.

Moritz C. 1994. Defining ‘evolutionarily significant units’ for conservation. Trends Ecological Evolution 9: 373-375.

Olah-Hemmings, V. et al. 2009. Phylogeography of declining relict and lowland leopard frogs in the desert Southwest of North America. Journal of Zoology 280:343–354.

Platz, J.E. and J.S. Frost. 1984. Rana yavapaiensis, a new species of leopard frog (Rana pipiens complex). Copeia (4): 940-948.

Regional Environmental Consultants. 2000. Clark County multiple species habitat conservation plan. Prepared for Clark County, 500 Grand Central Parkway, Las Vegas, Nevada 89155.

Relict Leopard Frog Conservation Team. 2005. Conservation agreement and rangewide conservation assessment and strategy for the relict leopard frog (Rana onca). July 2005. 164 pp.

Rosen, P.C. and C.R. Schwalbe. 1995. Bullfrogs: introduced predators in southwestern wetlands. Pages 542-544 in E.T. LaRoe, G.S Farris, C.E. Puckett, P.D. Doran, and M.J Mac, editors. Our living resources. U.S. Department of the Interior - National Biological Service, Washington, DC.

Seager, R. et al. 2007. Model predictions of an imminent transition to a more arid climate in southwestern North America. Science 316:1181-1184.

Searle C.L., L.K. Belden, B.A. Bancroft, B.A. Han, L.M. Biga, A.R. Blaustein. 2010. Experimental examination of the effects of ultraviolet-B radiation in combination with other stressors in frog larvae. Oecologia 162:237-245.

Stebbins, Robert C. 2003. A field guide to western reptiles and amphibians, third edition. 544 pp.

Stejneger, L. 1893. Annotated list of the reptiles and batrachians collected by the Death Valley Expedition in 1891, with descriptions of new species. North American Fauna (7): 159-228.

U.S. Fish and Wildlife Service (Service). 1999. Announcement of final policy for candidate conservation agreements with assurances. Federal Register 64:32726-32736. June 17, 1999.

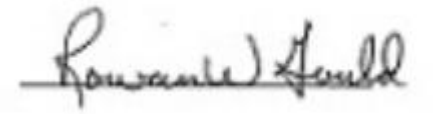
Vredenburg, V.T., and B.D. Wake. 2007. Global declines of amphibians. Encyclopedia of Biodiversity

2007:1-9.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  05/30/2012
Date

Concur:  11/06/2012
Date

Did not concur: _____ _____
Date

Director's Remarks: