

**Amargosa Niterwort
(*Nitrophila mohavensis*)**

**Five-Year Review:
Summary and Evaluation**



Amargosa niterwort on salt encrusted mud flat, photo by Gina Glenne, USFWS

**U.S. Fish and Wildlife Service
Nevada Fish and Wildlife Office
Las Vegas, Nevada**

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FIVE-YEAR REVIEW

Species reviewed: Amargosa niterwort (*Nitrophila mohavensis*)

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FIVE-YEAR REVIEW
Amargosa niterwort (*Nitrophila mohavensis*)

I. GENERAL INFORMATION

I.A. Introduction

The Amargosa niterwort (*Nitrophila mohavensis*) is a small, 4-inch-tall, perennial herbaceous plant of the Chenopodiaceae (goosefoot family). It occurs in colonies of individuals linked by their large, rhizomatous roots. This species is limited to highly alkaline, moist, salt-encrusted clay soils within the southern portion of Carson Slough in Nevada and California. It occupies the most localized habitat of all plant species endemic to the Ash Meadows region of the Mojave Desert. Amargosa niterwort is sensitive to disturbance and does not reinvade sites where the salt crust overlying the soil has been disrupted (Service 1990).

I.B. Methodology used to complete the review

This five-year review includes an analysis of life history, research, and survey data available to the U.S. Fish and Wildlife Service (Service) in the Nevada Fish and Wildlife Office and Ventura Fish and Wildlife Office files, Ash Meadows National Wildlife Refuge (Refuge) files, and other available information in general scientific literature. Recent literature was weighted more heavily than older literature. This review was conducted by staff in the Nevada Fish and Wildlife Office in Las Vegas. No information from the public was received for the Amargosa niterwort following the Federal Register announcement for the five-year review.

I.C. Reviewers

Lead Region – Contact name(s) and phone numbers:

Region 8 (California and Nevada) – Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, (916) 414-6464

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Ventura Fish and Wildlife Office – Connie Rutherford (805) 644-1766

I.D. Background

I.D.1. FR Notice citation announcing initiation of this review:

July 7, 2005; 70 FR 39327-39329

November 3, 2005; 70 FR 66842 (extension of comment period)

I.D.2 Listing history
Original Listing

FR notice: October 13, 1983; 48 FR 46590-46598
Date listed: May 20, 1985; 50 FR 20777-20794
Entity listed: Species (*Nitrophila mohavensis*)
Classification: Endangered

I.D.3. Associated actions

Critical habitat was designated at the time of the original listing on May 20, 1985 (50 FR 20777-20794).

I.D.4. Review History

The status of the Amargosa niterwort has not been reviewed since the species was listed in 1985.

I.D.5. Species' Recovery Priority Number at start of review

8; as reported in the Service 2006 annual recovery data call.
A priority number 8 reflects a moderate degree of threat with a high potential for recovery as applied to a full species.

I.D.6. Recovery Plan or Outline

Name of plan: Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada
Date issued: September 28, 1990
Dates of previous revisions: N/A

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS?

No. The Endangered Species Act (Act) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing as a distinct population segment (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No

II.B.2. Adequacy of recovery criteria

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

Yes
 No

The Recovery Plan is 16 years old. The Recovery Plan combines recovery criteria for all seven listed plant species. It is ecosystem-based; therefore, delineating specific recovery objectives for each plant species is difficult. The Recovery Plan relies on future surveys, monitoring, and research to determine and set appropriate recovery objectives and delisting criteria for each species. Very little of this information has been collected; therefore, the Recovery Plan continues to remain conceptual regarding delisting criteria that were intended to be based on these data.

II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threats)?

Yes
 No

There is new information to consider regarding threats to the species because five occurrences have been recorded since the recovery plan was prepared.

II.B.3.

See discussion in II.B.2.a. The Ash Meadows Recovery Plan is ecosystem-based and is not specific to the five listing factors (A, present or threatened destruction, modification, or curtailment of the species' habitat or range; B, overutilization for commercial, recreational, scientific, or educational purposes; C, disease or predation; D, inadequacy of existing regulatory mechanisms; and E, other natural and manmade factors affecting its continued existence).. Table 1 includes the downlisting and delisting criteria that apply to Amargosa niterwort as described in the Ash Meadows Recovery Plan.

Table 1: Ash Meadows Recovery Plan Downlisting and Delisting Criteria for the Amargosa niterwort.

Downlisting Criteria

#	Criterion
1	All non-native animals and plant species must be eradicated from essential habitat.
2	Secure and protect the Ash Meadows aquifer so that all spring flows return to historic discharge rates and the water level in Devils Hole is maintained at a minimum level of 1.4 feet below the copper washer.
4	Essential habitat must be secure from detrimental human disturbance including mining, off-road vehicles, and introduction of non-native species.
6	Amargosa niterwort is present in all localities that it has occupied historically as identified in Appendix A, Table XV, of the Recovery Plan.

Delisting Criteria

#	Criterion
1	Criteria shown above for downlisting from endangered to threatened.
2	Secure, protect, and maintain in natural vegetation, corridors, and adjacent buffer areas for gene flow and dispersal of listed plant species within the essential habitat.
3	Native plant communities and aquatic communities have been reestablished to historic structure and composition within all essential habitat.
6	All of the listed plant species are present in all the sites that they have historically occupied as identified in Appendix A, Table XV, of the Recovery Plan, and within each critical habitat unit, the listed plant has a frequency value equal to or greater than the frequency value determined by Recovery Plan Task number 644 needed as an indicator of a self-sustaining plant species. Task number 644 requires that for each listed plant species, frequency data must be gathered from examples of vegetation that is unaltered, to quantify recovery objectives. Sampling method must be determined, including the size/shape of sampling units and the number of units needed to accurately estimate frequency values.

Downlisting criterion #1, the removal of all non-native animals and plant species from essential habitat, has been partially achieved (Factor E). While non native species are not currently a direct threat to the Amargosa niterwort, salt cedar (*Tamarix ramosissima*) is generally a problem in the Carson Slough and wetlands on the Refuge. The Refuge has recently prepared an Integrated Pest Management Plan (Service 2006a). This plan provides a framework for managing invasive species, including salt cedar. In addition, the Refuge recently secured funding for salt cedar removal activities. These activities have only recently been implemented and have not yet produced on-the-ground results.

The Bureau of Land Management (BLM) Las Vegas District has recently completed an Interagency Agreement with the Lake Mead National Recreation Area Exotic Plant Management Team for spot removal of non-native species within the Upper Carson Slough watershed. This work is ongoing.

Downlisting criterion #2, secure and protect the Ash Meadows aquifer so that all spring flows return to historic discharge rates and the water level in Devils Hole is maintained at a minimum level of 1.4 feet below the copper washer, has only partially been achieved (Factor A). See discussion in section II.C.2.a. Protecting a minimum water level in Devils Hole will protect Amargosa niterwort occurrences on the Refuge; however, it may not protect critical habitat and the Lower Carson Slough occurrence which depend in part on subsurface flows from the Amargosa Valley.

Downlisting criterion #4, securing essential habitat from detrimental human disturbance including mining, off-road vehicles, and introduction of non-native species, has been partially achieved (Factor A). See discussion under section II.C.2.a. Occurrences on the Refuge receive protection from off-road vehicles and surface mining on lands where the Service owns mineral rights. The Lower Carson Slough population receives limited protection from fencing installed on both sides of Ash Meadows Road. Active mining claims are present adjacent to the Lower Carson Slough population; this population could be indirectly affected by dewatering or other mining activities. Public minerals are available and minerals claims can be made on the Crystal Reservoir population; the economic incentive for these claims is unknown.

Downlisting criterion #6 has not been completed. Amargosa niterwort is not present in all localities that it has occupied historically as identified in Appendix A, Table XV.

Delisting is contingent on completion of the downlisting criteria described above. Delisting criterion #1, successful completion of the downlisting criteria, has not been completed. Criteria #2, 3 and 6 which address establishing corridors and re-establishing historical plant community structure are beginning to be addressed but have not been completed. The Refuge recently completed a Geomorphic and Biological Assessment for the Refuge (Service 2006b) which describes targets states for hydrologic and biologic functioning. The Refuge also recently completed an Integrated Pest Management Plan which outlines a strategy for managing weeds on the Refuge (Service 2006a). These efforts are just beginning and no tangible on-the-ground results have been achieved.

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

II.C.1.a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Population Abundance

When the species was listed in 1985, it was known from one location, the type locality, in Lower Carson Slough, approximately 3 miles northeast of Death Valley Junction, California, in sections 5, 6, 7 and 8, Township 25 North, Range 6 East (October 13, 1983; 48 FR 46590-46598). Since listing, five additional populations have been documented around the Refuge and at Tecopa, California. These populations are described in Table 2 and occurrences shown in Figure 1. During 2005 and 2006, the Amargosa niterwort was observed at five of the six locations. At the sixth location, the Refuge West Entrance site, biologists from the Service and U.S. Geological Survey (USGS) failed to locate the plant in a presence-absence survey on April 13, 2006. Pending more complete surveys, the status of the Refuge West Entrance population should be considered likely extirpated since it has not been observed since 1994. Accordingly, the species is currently known from two populations in California and three populations on the Refuge in Nevada.

Table 2: Known populations of Amargosa niterwort; prepared August 1, 2006, U.S. Fish and Wildlife Service

State	Population	Occurrence on Figure1	Year First Reported	Status, most recent observation	Occupied Habitat (acres)	Acreage Source
CA	Lower Carson Slough, CA (280,000 ramets, SERG 2004)	A	1953 by Roos and Roos (Type Locale)	Present (Caicco 2005)	10.1	Mapped (SERG 2004)
NV	Crystal Reservoir, Refuge (10,000 ramets, Glenne 1998)	B	Knight 1990	Present (Caicco 2005)	25-30	Estimated from Caicco (2005)
NV	Central Carson Slough 1 on Refuge boundary, NV (<50 ramets, Edwards 2006)	C	Observed by Sada 1984, reported in Knight & Clemmer (1987)	Present (Edwards 2006)	0.34	Mapped (Edwards 2006)
NV	Central Carson Slough 2 outside of Refuge (3,000-3,750 ramets, Edwards 2006)	D	Observed by Sada 1984, reported in Knight & Clemmer (1987)	Present (Edwards 2006)	20.78	Mapped (Edwards 2006)
NV	Refuge West Entrance, north and south of Spring Meadows Road (unknown ramets)	E	Observed by Love 1987, reported in Knight (1990)	Unknown, likely extirpated (last obs St George 1994); none observed in 2006	--	---
CA	Tecopa, CA (500-750 ramets, Edwards 2006)	Not shown	1963, 1987, cited in CNDDDB (2006)	Present (Edwards 2006)	0.01	Estimated (Edwards 2006)
	<i>Estimated total known occupied habitat</i>				56	

All population estimates for the Amargosa niterwort in our files report the number of observed ramets (above-ground stems), rather than describe the number of individuals. This is because determining an individual plant is difficult as the species reproduces

vegetatively via underground rhizomes along which multiple ramets can emerge. The most important Amargosa niterwort population is in the Lower Carson Slough. This population accounts for roughly 95 percent of the known distribution in terms of the density/number of ramets present. In terms of area occupied, it is the second largest, occupying less area than the Crystal Reservoir population. Recently, quantitative population estimates have been made for the Lower Carson Slough. A 2003 demographic sampling estimated 280,000 ramets present on 10.1 acres (SERG 2004). A similar sampling of other populations has not been completed. At this time only visual population estimates associated with occurrence data are available.

The size and extent of the Crystal Reservoir population is not well characterized, but it appears to be the second most important population with respect to the number of ramets present, containing roughly 3 percent of the known distribution. The population is larger in area than the Lower Carson Slough but it also contains a much lower density of plants. A 1998 Nevada Native Species Site Survey Report identified more than 10,000 ramets present (Glennie 1998). The extent of the population is not well characterized. The area mapped in 1998 was performed using a topographic map and encompassed roughly 187 acres; however, this mapping clearly includes unoccupied habitat and unsuitable habitat such as open water and freshwater marsh. A 2005 survey report recorded GPS locations for Amargosa niterwort within a 25-30 acre area (Caicco 2005). While this is not a perfect estimate, it is likely a better estimate of the population size than the 1998 mapping.

The remaining Amargosa niterwort populations combined make up roughly 2 percent of the known distribution of ramets. Two populations are mapped at the western Refuge boundary (described as Central Carson Slough 1 and 2 in Table 1). These populations were first mapped by Knight and Clemmer (1987). The site observation did not include population estimates. A visit by Glennie (1998) reported the Central Carson Slough 1 population to be approximately 700 ramets. A 2006 survey estimated 50 ramets in the same area (Edwards 2006). The Carson Slough 2 population was estimated to be between 3,000-3,750 ramets within two sites occupying 20.78 acres (Edwards 2006).

The Amargosa niterwort was first observed at Tecopa Hot Springs, California in 1963. This observation was submitted to the California Natural Diversity Database (CNDDDB) in 1987 (CNDDDB 2006). In 2005 and 2006 the presence of an extremely small Amargosa niterwort population was verified at this site (Edwards 2006).

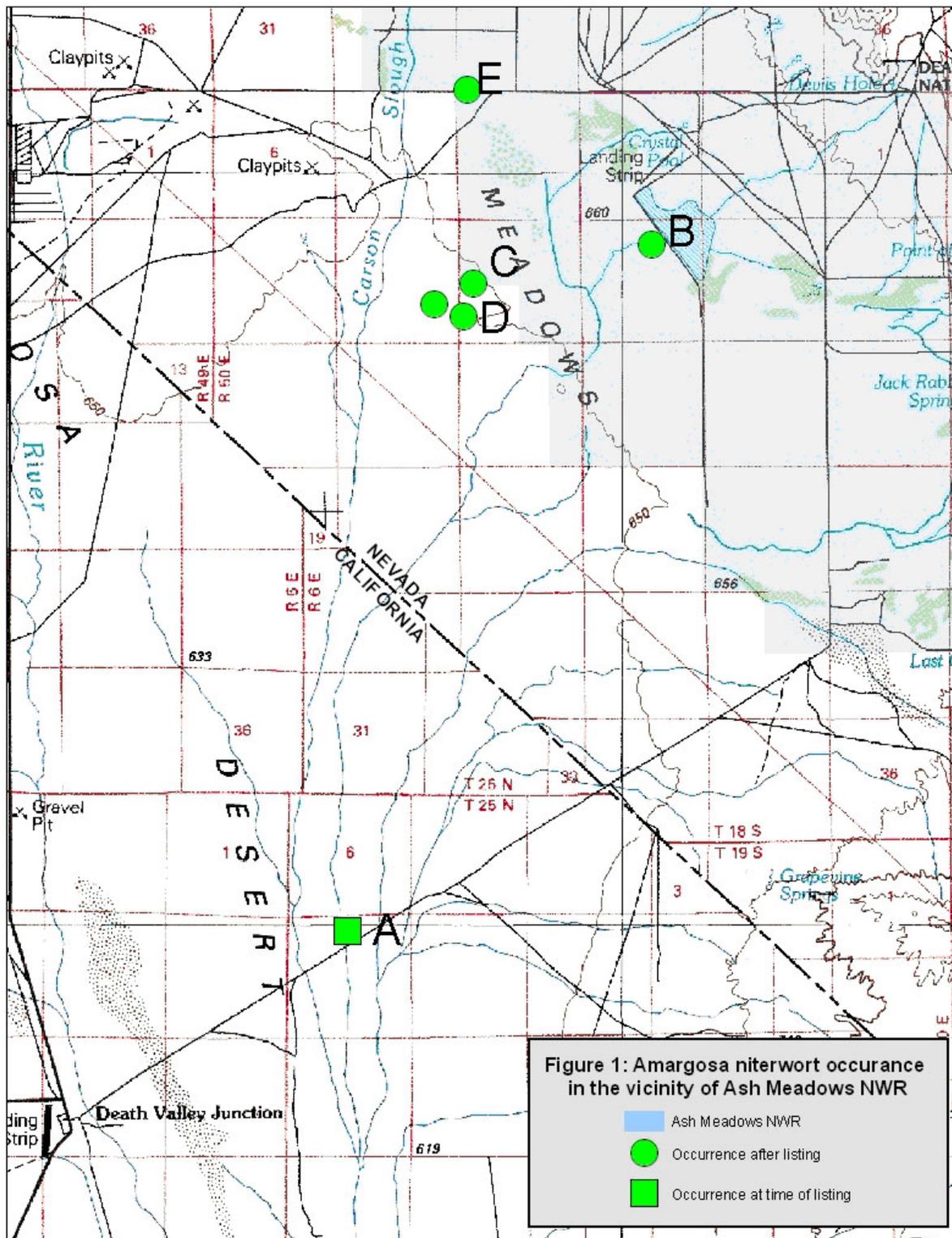


Figure 1: Location of Amargosa niterwort occurrences in the Ash Meadows vicinity. The type locality and only known occurrence at the time of listing is identified by the square. The Tecopa, California, population (not shown) is located approximately 40 miles to the south.

Population Trends

Currently, only inferences regarding Amargosa niterwort population trends can be made using anecdotal observations. Recovery tasks 4 and 6 of the Recovery Plan, which call for population monitoring, have not been fully implemented. Based on the available data, we believe the largest population in the Lower Carson Slough is declining. This population did not recover from development activities in the 1960s and 1970s (peat mining, water diversions, and groundwater pumping associated with large-scale farming in both the Refuge and Upper Carson Slough). John Roos, collector of the type specimen, observed in the mid-1990s that the Lower Carson Slough and Tecopa populations were considerably reduced from what he observed in the 1950s and 1960s; in fact, he had difficulty locating the populations (Roos and Roos 1995).

Based on anecdotal observations it also appears the geographic extent of the Lower Carson Slough population may be decreasing. In 1990, the full extent of the Lower Carson Slough population included an area that extended approximately 1 mile south of Ash Meadows Road (Knight 1990). A 2003 survey mapped the population only within 500 feet of the road (SERG 2004). Glenne (1998) mapped and estimated the Central Carson Slough 1 population at approximately 700 ramets. When the area was observed in 2005, the population was estimated at less than 50 ramets (Edwards 2006). This difference could be inflated due to observations noted at different times of the growing season. Glenne (1998) estimated the population at the peak of the growing season in August while Edwards (2006) estimated numbers very early in the growing season in April. Little or no data are available to suggest trends for the Amargosa niterwort populations at Tecopa and the Refuge West Entrance.

II.C.1.b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

There are no known problems with loss of genetic variation for this species. Amargosa niterwort reproduces both sexually and asexually. Research is needed to better understand how to best manage the genetic diversity of this species, as well as how many ramets constitute a single individual.

II.C.1.c. Taxonomic classification or changes in nomenclature:

The nomenclature or taxonomy of Amargosa niterwort has not changed since the species was listed.

II.C.1.d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

A number of new populations have been recorded since the species was listed in 1985. These are corrections to the historic range as described in the 1985 listing notice (50 FR 20777-20794). All known locations are associated with areas where water from the deep

carbonate aquifer reaches the surface. Most known occurrences are in the vicinity of the Refuge and Amargosa River watershed. The Tecopa population was first reported in 1963, but was missed in the 1985 listing notice. The two Central Carson Slough populations were discovered in late 1984 just after the final listing notice was prepared. The Refuge West Entrance and Crystal Reservoir populations were discovered a few years after that in 1990.

Water from the deep carbonate aquifer also emerges in Death Valley, California. In 1995, the National Park Service (NPS) completed a survey of the Saratoga Springs area of Death Valley; however, the Amargosa niterwort was not located (NPS 1995).

It is possible additional Amargosa niterwort populations could be discovered. These are likely to be small compared to the Lower Carson Slough population. Any new populations will likely be in the Ash Meadows vicinity. The most likely areas include a one-mile section of the Central Carson Slough from the Refuge boundary to the California-Nevada border and a two-mile stretch of the Lower Carson Slough, south of the mapped population at Ash Meadows Road, toward Alkali Flat and Eagle Mountain.

II.C.1.e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

The amount, distribution, and suitability of Amargosa niterwort habitat are dependent on both surface and subsurface hydrologic features (Reveal 1978). Surface flows within the Upper Carson Slough were altered and led to the first proposal to list the species in 1975 (July 1, 1975; FR 40 27824). Little is known regarding the subsurface flows in the Central and Lower Carson Slough that currently support the majority of the Amargosa niterwort. In a groundwater study of the Lower Carson Slough, Rowley (2003) determined that groundwater entering Lower Carson Slough comes from three, and perhaps four, flow paths within the Death Valley Flow system that includes both the Ash Meadows subbasin and/or the Alkali Flat/Furnace Creek Ranch subbasin (USGS 2002).

II.C.2. Five Factor Analysis (threats, conservation measures and regulatory mechanisms) –

II.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

The Amargosa niterwort currently faces three major threats under listing Factor A. One threat is an ecosystem-based alteration: habitat loss by changes in groundwater availability. Two threats are potential direct and indirect impacts to resulting from surface mining and raised construction of Ash Meadows Road.

Threats from Groundwater Development

At the time of listing the 1983 proposed rule described interruption of water supply to habitat as the major threat facing the species (October 13, 1983; 48 FR 43098-43105).

Currently, four out of the five known populations face this threat; only the Crystal Reservoir population on the Refuge is secure from this threat. Groundwater pumping is an incipient threat because the effects to the Amargosa niterwort are not likely to be immediately obvious and will cause a relatively slow population decline that could be masked by annual variations in precipitation. The Amargosa niterwort is dependent on saturated soils and a high groundwater table. Disruptions to the surface and subsurface hydrology are particularly important threats to the species.

Groundwater development and the threat it posed to the Devils Hole pupfish and its aquatic habitat in Devils Hole was a major factor that precipitated listing of the Ash Meadows endemic species, including the Amargosa niterwort. Devils Hole is a unique hydrologic feature; the visible water level is the highest point in the Ash Meadows hydrologic subbasin. Because of its importance, the water level in Devils Hole has been carefully monitored. Since 1988, levels in Devils Hole have steadily declined (NPS 2004) while groundwater monitoring wells lower on the Refuge remained stable (USGS 2005). Between 1988 and 2004, the level has dropped 2.76 inches at Devils Hole (NPS 2004). Based on the current trend, the U.S. Supreme Court-mandated minimum mean daily level for Devils Hole is estimated to be reached in 2045 (NPS 2004).

The Amargosa Valley is located approximately 10 miles northwest of the Refuge within the adjacent Alkali Flat/Furnace Creek hydrologic subbasin. The Lower Carson Slough population is within the same hydrologic subbasin. Groundwater pumping in the Amargosa Valley began to increase just as it was stopped on the Refuge. In 1987, groundwater pumping in the Amargosa Valley was estimated to be 1,877 million gallons per year (USGS 2005). In 2003, groundwater pumping was estimated to be 4,405 million gallons per year (USGS 2005). About 2,300 million gallons per year is believed to be the theoretical quantity that can be withdrawn without affecting water levels (USGS 2002). Groundwater is now being pumped from the Alkali Flat/Furnace Creek hydrologic subbasin at roughly two times the rate predicted to be sustainable (USGS 2005). Since 1992, most groundwater monitoring wells throughout the Amargosa Valley have shown a significant decline in water levels (USGS 2002).

The relationship between groundwater declines in the Amargosa Valley and potential effects in Carson Slough is largely circumstantial, but compelling. Given the proximity and predicted flow paths, the Central and Lower Carson Slough populations of Amargosa niterwort likely receive water from both the Ash Meadows and Alkali Flat hydrologic subbasins (USGS 2002). Currently, we do not have quantitative data to determine whether significant population trends for the Amargosa niterwort exist. Informal observations suggest the largest population in the Lower Carson Slough may be declining (see Population and Demographic Trends). These data coincide with known changes in groundwater pumping. In a hydrologic assessment of the Lower Carson Slough population, Rowley (2003) suggests long-term vigilance of groundwater levels in monitoring wells will be required to ensure the viability of the Lower Carson Slough population.

The current reduced distribution of the Amargosa niterwort is the result of previous hydrologic changes to the Carson Slough. Population declines were first noted as a result of peat mining and agriculture that began in the 1960s. These activities ultimately prompted the first petition for listing (July 1, 1975; 40 FR 27823). At the time the species was proposed for listing in 1983, estimated water pumping at Ash Meadows by Preferred Equities Corporation would have exceeded the annual yield of the aquifer by 225 percent. Three years ago, groundwater pumping in the aquifer reached nearly 200 percent of the annual yield (USGS 2005).

The hydrology that supports the Tecopa population is largely unknown. The extent and immediacy of the threat of groundwater development is unknown. Like many areas in the region, Tecopa, California, is experiencing increases in private development. It already has a sizable seasonal population that spends the winter months in a recreational vehicle camp at Tecopa Hot Springs. Spring flows in the vicinity of the population have been observed to decrease during the winter months (Edwards 2006). Groundwater pumping during the tourist season may have an adverse effect on the Amargosa niterwort.

The hydrology that supports the Crystal Reservoir population is also poorly understood. The reservoir was built in the 1970s; the population, which is located at the base of the dam, was first reported in 1990. It is unclear whether or not the population existed prior to construction of the dam and reservoir. Surveys of Ash Meadows completed after the dam was built, did not locate the species (Beatley 1977). The saturated soils and seepage below the dam suggests that the Amargosa niterwort population is likely supported by the saturated soil and habitat created by water flows leaving the spillway and seeping under the dam. Changes in the level of outflow from Crystal Spring, as well as changes to Crystal Reservoir would likely have an effect on the population. Given the importance of this population, more information is needed to understand the hydrology in and around Crystal Reservoir.

Given our current understanding of Amargosa niterwort demographic and hydrologic trends at the Lower Carson Slough population, coupled with the rate of groundwater extraction in the Amargosa Valley, the relative magnitude and imminence of groundwater development are considered high.

Threats of Habitat Loss or Degradation from Surface Mining

In the 1985 final rule to list the species (50 FR 20777), BLM identified zeolite and potassium mining claims in the Ash Meadows vicinity as a potential threat to Ash Meadows species. Active mineral claims could cause direct loss of habitat, as well as indirect impacts to the species by diverting or draining water away from habitat during mining activities. Mineral entry on Federal lands is authorized by the Mining Act of 1872, and administered by the BLM. Under this program, surface disturbance and impacts to rare species that do not have federal protection are permissible as long as operations comply with all pertinent Federal and State laws.

Surface mining continues to directly and indirectly threaten the Lower Carson Slough population in California. Presently there are 46 active mining operations and claims located in and around the Lower Carson Slough, covering roughly 25 percent of designated critical habitat (BLM 2006). In addition, the Lower Carson Slough and vicinity are identified in the Northern and Eastern Mojave Desert Management Plan as an area of active mines with geothermal and saleable mineral potential (BLM 2002).

The four Amargosa niterwort populations on the Refuge are on BLM and Service lands with public minerals. In March 2000, the Service submitted a petition/application to the Las Vegas District BLM to withdraw from mineral entry 9,459.66 acres of public lands within the Refuge and the adjacent Ash Meadows Area of Critical Environmental Concern (ACEC) and transfer jurisdiction over the surface estate to the Service. BLM has not processed this petition/application. Currently, mining claims can be made within the Crystal Reservoir population on the Refuge.

Given the importance of the Lower Carson Slough and Crystal Reservoir populations and the threat posed by mineral claims on roughly 25 percent of the critical habitat, we conclude the magnitude of this threat is high. Currently, the economic viability of mineral extraction is unknown; therefore, we consider the imminence of this threat to be unknown.

Threat of Habitat Degradation from Ash Meadows Road

At the time of listing, Ash Meadow Road did not pose a threat to the Amargosa niterwort. In late 1999 and early 2000, the California Department of Transportation (Caltrans) improved Ash Meadows Road where it crosses the Lower Carson Slough and Amargosa niterwort habitat. Caltrans imported fill and raised the roadbed where it crosses the Lower Carson Slough and in doing so, impacted individual Amargosa niterwort plants. The raised roadbed now poses an indirect threat to the Amargosa niterwort population by altering sedimentation patterns in the Carson Slough during thunderstorms or rare high flow events. Several low-water crossings with drainage pipes are present under the highway; however, during unusually high-volume flows the pipes may be filled with sediment, causing the roadbed itself to act as a dam that retains sediment that could bury a portion of the Lower Carson Slough population (Service 1999). Given the importance of the Lower Carson Slough population, the magnitude of this threat is high. However, given the relative infrequency of flash floods, the overall magnitude and imminence of this threat is low.

II.C.2.b. Over-utilization for commercial, recreational, scientific, or educational purposes:

This factor is not relevant to the Amargosa niterwort.

II.C.2.c. Disease or predation:

This factor is not relevant to the Amargosa niterwort.

II.C.2.d. Inadequacy of existing regulatory mechanisms:

The final rule that included the Amargosa niterwort describes inadequacy of existing regulatory mechanisms as a significant threat to the Amargosa niterwort. Presently, no regulatory mechanisms have been developed to replace protection offered under the Act and inadequacy of regulatory mechanisms continues to be a significant threat to the species.

State protections

The Amargosa niterwort was listed as endangered under the California Endangered Species Act in 1979 and is protected by the California Environmental Quality Act (CEQA). The final rule discusses that the listing of the Amargosa niterwort by the State of California does not provide adequate protection against the most significant threat, interruption of the water supply to its habitat in Nevada.

The Amargosa niterwort was added to the Nevada Division of Forestry list of critically endangered plants under Nevada Revised Statute 527.270 in 1986. State listing in Nevada does not provide protection to the Lower Carson Slough population in California, which is approximately 95 percent of the distribution, or provide additional protection on Federal lands in Nevada.

Groundwater rights in Nevada are regulated by the State Engineer. The Service owns rights that support the Amargosa niterwort on the Refuge. However, it is not clear that the Lower Carson Slough population is supported by this source (see discussion under factor A). Further groundwater pumping in the Amargosa valley is now 200 percent beyond the recharge capacity of the aquifer (see discussion under Factor A). It is not clear that the hydrologic conditions needed to support the Amargosa niterwort populations both in California and Nevada will be protected under current regulatory mechanisms. In theory, the water rights owned by the Refuge are protected. However, in recent hearings, the National Park Service (Death Valley National Park) testified the number of water rights issued by the State of Nevada for the Amargosa Valley has grossly exceeded sustainable withdrawal levels and the resource is over-allocated (Baldino 2006).

Federal protections

The 1985 final rule recognized establishment of the Refuge did not provide any protection for the Amargosa niterwort (50 FR 20777-20794) because the only known population for the Amargosa niterwort was located in California. Presently, with the discovery of the Crystal Reservoir population, a small portion, roughly 5 percent, is now protected on the Refuge and within the adjacent BLM Area of Critical Environmental Concern.

Protection under the Act continues to be the most important regulatory mechanism for protecting the Amargosa niterwort because it is the only regulatory mechanism that spans both California and Nevada state jurisdictions and it is the only mechanism that is able to protect Amargosa niterwort habitat from mining and groundwater pumping in certain

situations. For this reason we conclude the magnitude of the threat posed by inadequate regulatory mechanisms is high. We consider this threat to be imminent because groundwater pumping is now at 200 percent above sustainable levels.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

At the time of listing, under listing Factor E, the Amargosa niterwort faced direct and indirect impacts associated with trampling by wild horses and off-highway-vehicle (OHV) activity. At the present these threats have been largely abated. Two new threats, habitat alteration by nonnative species and fire, and a potential catastrophic failure of Crystal Spring Dam exacerbated by the vulnerability of the species to stochastic events, were not discussed in the original listing. Only one of these, potential failure of Crystal Spring Dam, is considered a significant threat.

Trampling by wild horses and OHV activity

Trampling by wild horses and OHV activity were described as threats in the 1985 listing. On the Refuge, threats from wild horses and OHV activity have been reduced by fencing installed in the mid-1990s. The Lower Carson Slough population was fenced in 2001 to protect it from OHV activity as mitigation for a lawsuit brought against BLM by the Center for Biological Diversity in 2000 (BLM 2000). As a result of this lawsuit, BLM was required to fence along Ash Meadows road to protect the Amargosa niterwort and the threatened Ash Meadows gumplant (*Grindelia fraxino-pratensis*) in the Lower Carson Slough, as well as initiate a water study of the Lower Carson Slough (this study was completed by Rowley in 2003). As of 2005, the fence along the road largely remains intact, with only one section near the Nevada border downed.

Amargosa niterwort populations on the Refuge are relatively well protected; however, the Crystal Reservoir population was impacted by illegal OHV activity in the early 2000s. The effects of OHV activity on this population were scattered over a 0.5 acre area, but were less than 0.01 acre in total. The Tecopa population appears to be at the highest risk to damage from OHV activity. The area is unfenced and tire tracks have been observed going through the small Amargosa niterwort population (Edwards 2006). Given the fencing that has been installed to protect the lower Carson Slough population and the Refuge, which together compose roughly 98 percent of the known distribution, we consider the magnitude and threat posed by trampling by wild horses and OHV activity to be low and non-imminent.

Invasive Species and Fire

Invasive species were described as a threat in the rule to list the species in 1985. Amargosa niterwort habitat consists of barren, salt-encrusted mudflats with little to no vegetation. With the exception of salt cedar (*Tamarix* sp.), most invasive species present at Ash Meadows lack the special adaptations needed to survive in Amargosa niterwort habitat. Salt cedar is known to be a significant threat to wetlands in the vicinity (Service 2006a). However, salt cedar does not currently appear to be establishing in Amargosa

niterwort habitat in either the Lower Carson Slough or below Crystal Reservoir (Service 2006a). Neither the Refuge nor BLM has an active program to remove salt cedar in or near occupied habitat. Fire has recently been identified as a threat to other Ash Meadows endemic plant species due to the increase in non-native species that would carry a fire (e.g., Ash meadows gumplant 5-year review, Service 2007); however, given the sparse cover and open structure of Amargosa niterwort habitat, fire is not expected to pose a significant threat. Given the available information, we conclude the threats posed by non-native species and fire are low and non-imminent.

Failure of Crystal Spring Dam

While not discussed in the original listing, species with small populations, like the Amargosa niterwort, have an inherent increased risk of extinction through natural catastrophes, e.g, unpredictable flooding, drought events (Giplin and Soule 1986). Despite an increase in number of known occurrences for the species, natural catastrophes continue to pose a high risk to the Amargosa niterwort because the lower Carson Slough and Crystal Reservoir populations together compose approximately 98 percent of the known distribution. These two populations are within the same watershed and would both be affected by a catastrophic failure of Crystal Spring Dam or a catastrophic flash flood event in the watershed.

Seepage under Crystal Spring Dam suggests that the dam could be showing signs of weakening. Both the State of Nevada and the Service have identified problems with the dam. A Safety Evaluation of Existing Dams (SEED) assessment by the Service ranked the overall safety of the dam as “fair” (Service 2005). This classification was chosen in part because of seepage at the downstream toe. This classification also recognizes that infrequent hydrologic and/or seismic events would probably result in a dam safety deficiency. Stochastic events in the area include earthquakes and flash floods. The SEED report classifies Crystal Spring Dam as a low hazard and therefore a low priority for the Service’s maintenance and repair funding. The low safety hazard rating reflects the fact that there is not an imminent risk to public safety since there is no human habitation or other structures in the area that would be affected by a breach. The SEED analysis does not consider sensitive, threatened, or endangered plant or animal species in hazard classifications (Service 2005). The State of Nevada is requiring the Service to develop an Emergency Action Plan for Crystal Spring Dam because of potential property damage and public safety concerns from flooding. This suggests that the State of Nevada considers the dam to be a significant or high hazard dam (Service 2005).

A breach of the reservoir would affect the area immediately below the dam, Lower Crystal Marsh, as well as the Lower Carson Slough at Ash Meadows Road (Service 2005). Given the severity of a potential impact, the magnitude of this threat is considered high. However, given the infrequent nature of catastrophic flash flooding and earthquakes in the vicinity that could cause the failure of Crystal Spring Dam, and the absence of human habitation or structures, we consider the imminence of this threat to be low. Nonetheless, Amargosa niterwort habitat occurs in low-lying areas susceptible to flooding. The Amargosa niterwort population in the Lower Carson Slough has likely

survived previous flash floods. However, because the Lower Carson Slough population is now smaller than it was in the 1950s and 1960s, when it was described as extensive, it is less protected against stochastic events such as flash flooding. Further compounding potential impacts from a flash flood event are the hydrologic modifications at Ash Meadows Road (see discussion under Factor A). Given the severity of a potential impact, the magnitude of this threat is considered high. However, given the infrequent nature of catastrophic flash flooding in the vicinity, the imminence of this threat is low.

II.D. Synthesis

Section 3 of the Act defines an “endangered species” as any species that is in danger of extinction throughout all or a significant portion of its range. The discovery of new populations on and near the Refuge expands the known distribution (area occupied) of the *Amargosa niterwort* by approximately 5 percent. The very restricted distribution of the *Amargosa niterwort*, with roughly 95 percent of the population in a single 10-acre population in the Lower Carson Slough, makes the species particularly vulnerable to threats. Many of the threats to the species described in the original listing still remain. The threat of loss of habitat from groundwater extraction and vulnerability to stochastic events has the highest magnitude. The threat posed by wild horses and OHV activity has been largely abated and is considered to have a lower magnitude. New threats have been identified, including hydrologic changes associated with Ash Meadows Road and a potential failure of Crystal Spring Dam.

At the time of listing, loss of habitat by groundwater extraction and development at Ash Meadows were the largest threats to the *Amargosa niterwort*. Based on this status review, loss of habitat from groundwater development continues to be the most significant threat to the species. The importance of hydrology for the *Amargosa niterwort* is reflected in downlisting criterion 2 (protection of the Ash Meadows aquifer). Establishment of the Refuge and the purchase of water rights were believed to have abated this threat. However, it may be important to reevaluate downlisting criterion 2. At the time of listing, it was assumed that the *Amargosa niterwort* population in the Lower Carson Slough was supported by surface and subsurface flows from Ash Meadows. If this were the case, we would expect the Lower Carson Slough population to remain stable and increase as groundwater pumping stopped on the Refuge. Based on recent mapping, the southern edge of lower Carson Slough population appears to have moved north approximately one mile between 1990 and 2004, decreasing the total area mapped for the population.

Unfortunately, beyond mapping, no quantitative demographic or trend monitoring data have been collected (Recovery Plan tasks under 4 and 6). Additionally, the relationship between groundwater extraction and water availability in the Lower Carson Slough is poorly understood. In 1990, groundwater pumping exceeded the sustainable yield of the Alkali Flat/Furnace Creek hydrologic subbasin in which the Lower Carson Slough population is located. In 2003, groundwater pumping was 200 percent of the sustainable yield. Loss of hydrologic functioning will likely continue to manifest slowly. Water

levels in Devils Hole are being monitored and should provide an indication of the state of the Ash Meadows aquifer. Given our understanding of the population distribution of this species, and our understanding of the groundwater dynamics that support the species, the magnitude and imminence of this threat are considered high. This situation could become extreme in the near future if current groundwater pumping is not returned to a sustainable level.

Other threats discussed in the original listing include: loss of habitat from mining, OHV activity, grazing by wild horses, and invasive species. Mining remains a potential threat. This threat has an unknown magnitude because the economic incentives for expanding mining of the minerals in the area are unknown. Other than protection under the Act, there are no other regulatory mechanisms to protect the species from mining. Both before and after listing, BLM established ACECs to protect the Amargosa niterwort in Nevada. However, these designations provide only partial protection for the Amargosa niterwort since existing mineral claims can still be activated in an ACEC. Unless there is a Congressional action to prevent it, active mining claims cannot be withdrawn; only new claims in an ACEC can be denied. In Nevada, mineral claims have been withdrawn from the Ash Meadows ACEC through an amendment to the Southern Nevada Public Lands Management Act, but this protection expires in 2007. BLM plans to make a petition/application to continue this protection. In California, mineral claims have not been withdrawn and one active mining claim is immediately adjacent to critical habitat in the lower Carson Slough. Withdrawal of mineral claims and the purchase of mineral rights both in the Refuge and Amargosa niterwort critical habitat has not been completed (Recovery Plan tasks 1-1-1 and 1-2-1).

Fencing the Refuge has reduced wild horse and OHV impacts. Fencing the Refuge has also indirectly benefited the Lower Carson Slough population by curtailing cross-country OHV travel through the area. Fencing along Ash Meadows Road by BLM has directly reduced OHV impacts to the Lower Carson Slough population, but disrepair of the fence in Nevada could threaten progress. Salt cedar is known to be a significant threat to wetlands in the vicinity. This concern is manifested in downlisting criterion 1. However, salt cedar does not currently appear to be a problem in either the Lower Carson Slough or below Crystal Reservoir areas. The Refuge has an active program to remove salt cedar.

The most important new threat identified in this review is increased vulnerability of the Lower Carson Slough population to flash flooding as compounded by the hydrologic modifications associated with Ash Meadows Road. It is not clear what effect the new raised road will have on the Lower Carson Slough population as no assessments of this risk have been completed. During a high flow event, it is likely the new raised road could act as a berm, causing sediment to bury an unknown extent of this important population of Amargosa niterwort.

A second new threat identified in this review is the potential failure of Crystal Spring Dam from a catastrophic flash flood or earthquake. Failure of the dam would affect both the Lower Carson Slough and Crystal Reservoir populations. These populations

combined make up 98 percent of the known Amargosa niterwort distribution and population. The SEED classification for the Crystal Spring Dam recognizes infrequent hydrologic and/or seismic events would probably result in a dam safety deficiency. Given the severity of a potential impact, the magnitude of this threat is considered high. However, given the infrequent nature of catastrophic flash flooding and earthquakes in the vicinity that could cause the failure of Crystal Spring Dam, the imminence of this threat is low.

The Amargosa niterwort occurs within an extremely restricted range containing roughly 56 acres of occupied habitat. Roughly 98 percent of the population and distribution occurs at two sites. Loss of either the Crystal Reservoir or Lower Carson Slough population would be significant. Flash flooding, a failure of Crystal Reservoir and/or groundwater extraction all pose significant risks to both populations; therefore, we conclude the Amargosa niterwort continues to meet the definition of “endangered” as defined in Section 3 of the Act.

III. RESULTS

III.A. Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

III.B. New Recovery Priority Number: No change

The Amargosa niterwort is currently assigned a listing priority number of 8. In determining the listing priority number, both the degree of threats and potential for recovery are considered. A number 8 reflects a moderate degree of threat with a high potential for recovery as applied to a full species.

Under Service guidance, a moderate degree of threat “means the species will not face extinction if recovery is temporarily held off, although there is continual population decline or threat to its habitat” (48 FR 43098-43105, September 21, 1983). A high degree of threat indicates “extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction.” The information presented in this review does not support the conclusion that the Amargosa niterwort is experiencing a rapid population decline or habitat destruction. A low degree of threat means the species “is rare, or is facing a population decline which may be a short-term, self-correcting fluctuation, or the impacts of threats of the species’ habitat are not fully known.” The information presented in this review suggests the population decline facing the Amargosa niterwort is a long-term trend likely associated with changes in groundwater availability. Based on our understanding of the threats and population trends for the Amargosa niterwort as detailed previously, we conclude the species is best described as facing a

moderate degree of threat. However, if groundwater extraction is not addressed in the near future this threat could become high.

Under Service guidelines, recovery potential is classified as either high or low. A high potential for recovery means the biological and ecological limiting factors are well understood, threats to the species' existence are well understood and easily alleviated, and intensive management is not needed. In species with a low recovery potential, the biological and ecological limiting factors are poorly understood, the threats to the species existence are poorly understood or pervasive and difficult to alleviate, and the degree of management needed is intensive with uncertain probability, or success of techniques unknown or still experimental. Little is known regarding the life history and horticultural propagation of the Amargosa niterwort. However, based on similar wetland species that reproduce vegetatively, there is no reason to believe that the species will require special or intensive management to facilitate recovery beyond reestablishing habitat and possibly reintroducing propagules. Due to these reasons and those detailed previously, we conclude the Amargosa niterwort is best described as having a high recovery potential.

III.C. Reclassification Recommendation: N/A

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

For the Amargosa niterwort, implementing population monitoring and investigating the factors that affect recovery are crucial (as described in tasks 4 and 6 in the Recovery Plan). Determining population trends for this species as described in the Recovery Plan is imperative and should be the first priority and should be performed over the next five years. Groundwater pumping will likely continue to increase in the Amargosa Valley. Documenting population trends will be paramount to identify any changes associated with such pumping. Before monitoring surveys are implemented, a long-term population monitoring plan for the Amargosa niterwort should be prepared to ensure that the necessary statistical rigor is included. Permanent plot markers were placed as part of the mapping and sampling plots set up during a demographic study by San Diego State University (SERG 2004). These plots offer a unique opportunity to gather quantitative population trend data for the species. This study should be incorporated into the long-term population monitoring plan.

Additional research into the hydrology of the Central and Lower Carson Slough as it relates to the Ash Meadows and Alkali Flat/Furnace Creek hydrologic subbasins is needed. This should be the second priority for this species. Additional groundwater monitoring wells should be installed in the Central and Lower Carson Slough as part of the research.

Limiting potential flash flood or failure of Crystal Spring Dam impacts to the Lower Carson Slough population is critical. To accomplish this, modifications to Ash Meadows Road should be pursued to restore the natural hydrology that supports the Amargosa niterwort. Additionally, the repair, modification or removal of Crystal Spring Dam

should be studied and implemented. These actions should be the third priority for this species.

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U.S. FISH AND WILDLIFE SERVICE
FIVE-YEAR REVIEW of *Nitrophila mohavensis*

Current Classification Endangered
Recommendation resulting from the Five-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number N/A

Review Conducted By Fred Edwards, Nevada Fish and Wildlife Las Vegas Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date 12-31-07

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve  Date 11/10/08

Cooperating Field Supervisor, Fish and Wildlife Service

Concur Do Not Concur

Signature _____ Date _____