PROBABLE EFFECTS OF THE PROPOSED SNWA GROUNDWATER DEVELOPMENT IN SPRING VALLEY ON FISH AND SNAIL POPULATIONS

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INTRODUCTION

The Southern Nevada Water Authority (SNWA) proposes to pump 92,000 acre-feet per year of groundwater from Spring Valley, White Pine and Lincoln counties, Nevada. Dr. Tom Myers prepared a detailed report (Myers 2006) analyzing the effects of this proposed pumping on the ground water system, and implications of those effects for the surface waters. Elliott et al. (2006) identified areas in and near Great Basin National Park where surface waters are likely or potentially susceptible to groundwater withdrawals. Within Spring Valley some of the surface waters constitute critical parts of the world's remaining habitat for one species of springsnail and three fish species. Within Snake Valley some of the surface waters constitute the only world habitat for 2 species of springsnails as well as critical parts of the worlds remaining habitat for one species of springsnail and one kind of fish. These species, along with their Nevada Natural History Database rankings and other pertinent designations are shown in Table 1. This report examines the probable consequences of projected changes to surface waters in Spring and Snake Valleys on fish and snail populations.

SPRING AND SNAKE VALLEY SNAILS AND FISH

Figure 3 in Myers (2006) shows locations of some snail and all fish populations in Spring Valley referred to here. The Nevada Natural Heritage Database, on May 31, 2006, listed the bifid duct pyrg (*Pyrgulopsis peculiaris*), an endemic springsnail occurring in Spring Valley as an S1, G2 species (S1 = critically imperiled and especially vulnerable to extinction or extirpation within the State of Nevada due to extreme rarity, imminent threats, or other factors, G2 = globally imperiled due to rarity or other demonstrable factors). The species is known outside of Spring Valley only from Snake Valley and the lower portion of the Sevier River basin in Utah (Hershler and Sada 2002). Within Spring Valley the species occurs in Turnley Spring at Sacramento Pass (Hershler 1998).

A second springsnail (*Pyrgulopsis kolobensis*) is known from 11 springs in Spring Valley and 6 springs in Snake Valley (Hershler 1998). The species is also known to occur more widely in springs from extreme southeastern Idaho to southern Utah and east central Nevada (Hershler and Sada 2002). Like most species of the genus, *P. kolobensis* is nearly restricted to the area of the spring source and a short distance down the outflowing stream. While the species is widespread, recent work suggests the strong possibility that, upon further investigation, it will be found to consist of many closely related species. Because Spring and Snake valleys are hydrologically well isolated (Hershler and Sada 2002) this springsnail may actually represent one or more species endemic to each valley.

In Snake Valley, the Nevada Natural Heritage Database, on May 31, 2006 listed the bifid duct pyrg (*Pyrgulopsis peculiaris*) as an S1, G2 species and the longitudinal gland pyrg (*Pyrgulopsis anguina*) as an S1, G1 species (G1 = critically imperiled globally and especially vulnerable to extinction). The latter species is restricted to Big Spring, Clay Spring, and an unnamed spring north of Big Spring. In Snake Valley, both

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species are restricted to springs in the Big Springs Creek drainage within an area where, according to Elliott et al. (2006), surface-water resources likely are susceptible to ground-water withdrawals. A fourth species of springsnail, *Pyrgulopsis saxatilis,* is known only from Warm Springs in the Utah portion of Snake Valley.

Two species of springsnails are endemic to Snake Valley. Spring and Snake Valley share a species of springsnail that also occurs in the Sevier River drainage. A fourth species of springsnail is more widespread in Idaho, Nevada and Utah, but that species may actually represent several closely related forms, some of which may be unique to Spring and/or Snake valleys.

Spring Valley is devoid of naturally occurring native fish populations. However, in the late 1800's or early 1900's, but prior to 1938, the relict dace (*Relictus solitarius*) was introduced into Spring Valley, probably from Butte Valley. It has persisted in springs along the course of Spring Valley Creek (target 1 in Myers, 2006), at Stonehouse Springs (target 2 in Myers, 2006), and at springs on Keegan Ranch (target 3 in Myers, 2006) (Hubbs et al. 1974, personal communication Chris Crookshanks, NDOW, June 2006). The species was introduced into South Pond at Shoshone ponds in 1977 where it maintained a robust population through 2003, suffered a population decline in 2004, and recovered from that decline in 2005 (NDOW 2004, 2005).

In March, 1972, 15 Pahrump poolfish (*Empetrichthys latos*) were transferred from Manse Spring in Pahrump Valley to the recently constructed pools at Shoshone ponds. A self-sustaining population survived there until 1974 when vandals turned off a valve controlling flow of water from the artesian well to the ponds. Modifications were made to the water supply system by BLM in an effort to prevent vandalism in the future, and poolfish were reintroduced in August 1976. In 1976 Manse Spring was no longer available as a source of supply for this endemic species because the spring had dried in summer 1975 as a consequence of groundwater pumping in Pahrump Valley. A second population established at Corn Creek Spring had also become severely depleted, apparently as a consequence of predation by introduced mosquitofish. Fortunately, sufficient numbers existed to be moved to holding facilities at Corn Creek and UNLV. Fish originating from stocks held at UNLV, were transferred to renovated facilities at Shoshone ponds in August 1976. They have maintained good populations in North Pond, Middle Pond, and Stock Tank to the present (FWS 1993, NDOW 2004, 2005).

One management objective of the Bureau of Land Management's Habitat Management Plan for the Shoshone Ponds area is development of a refuge for the Pahrump poolfish (FWS 1993). In support of that objective, the Bureau designated Shoshone ponds and the surrounding 1240 acres as the Shoshone Ponds Natural Area in 1970. In its proposal to change the status of Pahrump poolfish from endangered to threatened, the FWS (1993) noted that Shoshone ponds were located on public lands, and that water rights for support of the fish populations at the Shoshone ponds were held by Nevada Department of Wildlife. Because of the long-term viability of the poolfish population in Shoshone ponds, the fact that the Nevada Division of Wildlife Resources holds water rights at Shoshone Ponds for maintenance of Pahrump poolfish, and the BLM commitment to maintenance of the species at that location, the FWS included this population in their evaluation of Pahrump poolfish for reclassification from endangered to threatened status (FWS 1993). However, FWS decided against down-listing the species to threatened status, noting in their final ruling that "pressures exerted on the ground water system [in Spring Valley] to accommodate extensive population growth and development in southern Nevada could threaten the future existence of the poolfish." (FWS 2004).

Bonneville cutthroat trout (*Oncorhynchus clarkii utah*) occur in Spring Valley only in Ridge/Pine Creek on the Western slope of the South Snake Range. The species is thought to have expanded into Ridge Creek via the Osceola Ditch in the early part of the 20th century when it was built to connect Lehman Creek on the east slope to Ridge Creek on the west slope. The species further expanded into Pine Creek through a ditch built about 1937 to connect Ridge Creek to Pine Creek. Today the genetically pure BCT population in Pine/Ridge Creek is one of only 8 such populations in Nevada (Crookshanks 2004). In Snake Valley on the west slope of the North Snake Range, Bonneville cutthroat trout maintain populations in Smith Creek, Deadman Creek, Deep Canyon Creek, Hampton Creek, and Hendry's Creek. On the west slope of the South Snake Range, there are Bonneville cutthroat populations in Strawberry Creek, Mill Creek, South Fork of Baker Creek, Snake Creek, Big Wash, and South Fork of Big Wash (personal communication Chris Crookshanks, NDOW, June 21, 2006). While in most cases Bonneville cutthroat trout live in stream segments above those considered likely susceptible to groundwater withdrawal by Elliott et al. (2006), all would be adversely affected by reduced habitat quality within or in stream segments immediately below their range.

Bonneville cutthroat trout, relict dace, and Pahrump poolfish have maintained viable reproducing populations essentially since introduction and all are protected species under Nevada Revised Statutes 501. Under provisions of the Endangered Species Act, the Pahrump poolfish is listed as endangered, and the Bonneville cutthroat trout and relict dace are listed as species of concern. The Nevada Natural Heritage Database, on 31 May 2006 (Table 1), listed the three species as follows: Bonneville cutthroat trout -- S1, G4 T2 (critically imperiled in Nevada; globally secure but of long-term concern, subspecies imperiled globally); Pahrump poolfish -- S1, G1, T1 (critically imperiled in Nevada, globally, and as a subspecies); Relict Dace -- S2, S3, G2, G3 (imperiled or vulnerable in Nevada and globally).

EFFECTS OF THE PROPOSED PROJECT ON SNAILS AND FISH

Probable adverse effects of the proposed SNWA groundwater development project on sensitive snail and fish species in Spring and Snake valleys is summarized in Table 1. The report by Myers (2006) indicates that the proposed SNWA groundwater project will result in drawdown of the water table at Shoshone Ponds and Sacramento Pass within 20 years. The drawdown of the water table is likely to be severe enough to cause the artesian well at Shoshone ponds to quit flowing, and the springs at Sacramento Pass to fail. As a consequence, the three endangered Pahrump poolfish populations at Shoshone ponds, the imperiled relict dace population at Shoshone ponds, and the critically imperiled bifid duct pyrg population at Sacramento Pass are likely to disappear within 20 years of implementation of the proposed SNWA project. Imperiled relict dace populations at Keegan Ranch and Stonehouse Spring are likely to disappear 200-1000 years following initiation of pumping. The imperiled relict dace population in springs along Spring Valley Creek in the northern part of Spring Valley will probably be unaffected.

Critically imperiled Bonneville cutthroat trout populations in Pine/Ridge Creek and in creeks on the west slope of the South Snake Range may be adversely affected by reduced flows in stream reaches identified by Elliott et al. (2006) as an "area where surface-water resources likely are susceptible to ground-water withdrawals." Adverse effects would stem from both reductions in habitat quality in stream reaches occupied by Bonneville cutthroat, and from reductions in habitat quality in stream reaches at lower elevations unoccupied by Bonneville cutthroat. At the lower elevations the effect would occur primarily as a consequence of loss or population decline of aquatic insects. With fewer adult aquatic insects available to fly upstream to lay eggs following metamorphosis, densities of aquatic insects in the upstream reaches would decline. Crookshanks (2004) has shown that streams in the Snake Range without trout populations, or stream segments without trout populations have increased diversity and abundance of aquatic insects. That increased diversity and abundance provides an important source of aquatic insects for replenishment of populations reduced by trout predation.

The four species of the genus *Pyrgulopsis*, like other species in this genus, are restricted to spring sources of permanent springs and a very short distance downstream. These springs have been flowing constantly for millennia. In addition, each species typically exhibits very specific preferences for microhabitat characteristics such as substrate, velocity, depth, etc, and they partition available habitats according to those microhabitat preferences (Hershler 1998, Hershler and Sada 2002). This makes their populations especially sensitive to reduced spring discharge. In Spring Valley, the *Pyrgulopsis peculiaris* population in Turnley Spring, and 4 of the 7 populations of *Pyrgulopsis kolobensis* are likely to disappear within 20 years following initiation of groundwater development by SNWA. The remaining 3 populations will probably decline over the subsequent 200 years as spring discharge declines, becomes more variable, and ultimately ceases. In Snake Valley *Pyrgulopsis peculiaris* and *Pyrgulopsis anguina* are restricted to Big Springs and two nearby springs, all within an area identified by Elliott et al. (2006) as "likely susceptible to groundwater withdrawal." Reduction in spring discharge therefore may adversely affect the only habitat from which *Pyrgulopsis anguina* is known, and one of the few habitats occupied by *Pyrgulopsis peculiaris*. Warm Spring in the Utah portion of Snake Valley, the only known habitat of *Pyrgulopsis saxatilis*, may also be adversely affected by the proposed project. Other springs in Snake Valley occupied by *Pyrgulopsis kolobensis* could also be affected to the detriment of the springsnail populations occurring there.

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Table 1. Fish and Snail Species from Spring and Snake Valleys Potentially Susceptible to Adverse Effects as a Consequence of the Proposed SNWA Groundwater Development Project. Susceptibility estimates are based on the likely response of the species to conditions described in Myers (2006) or Elliott et al. (2006). Columns with headings < 20 and > 200 marked with an X identify populations at the indicated location which, based on information in Myers (2006) are likely to be adversely affected or entirely eliminated within 20 years, or following more than 200 years of groundwater withdrawal at the rate requested by SNWA. Columns with headings "likely" or "potentially" identify populations at the indicated location which, based on information in Elliott et al. (2006) live in areas considered to be likely susceptible, or potentially susceptible to adverse effects of groundwater withdrawal in Spring Valley at the rate requested by SNWA. For more specific information about location, refer to Table 2.

			State/Federal Rank		Susceptibility-Myers 06, Elliott et al. 06			
SPECIES	VALLEY	LOCATION	NNHP Rank	FWS	< 20 years	>200 years	likely	potentially
P. peculiaris	Spring	Turnley Spring	S1,G2		X			
P. kolobensis	Spring	Unnamed springs, east of Cleve Creek			X			
P. kolobensis	Spring	Unnamed springs, Stonehouse				X		
P. kolobensis	Spring	Unnamed springs, Minerva			X			
P. kolobensis	Spring	Unnamed springs, 1.6 km north of Minerva			X			
P. kolobensis	Spring	Unnamed springs, 3.2 km north of Minerva			X			
P. kolobensis	Spring	Unnamed spring				X		
P. kolobensis	Spring	Willow Spring				X		
O. clarkii utah	Spring	Ridge/Pine Creek	S1, G4, T2	SC			X	
R. solitarius	Spring	Spring Valley Creek	S2 S3, G2 G3	SC				
R. solitarius	Spring	Stonehouse Spring	S2 S3, G2 G3	SC		X		
R. solitarius	Spring	Keegan Ranch	S2 S3, G2 G3	SC		X		
R. solitarius	Spring	Shoshone South Pond	S2 S3, G2 G3	SC	X			
E. latos latos	Spring	Shoshone Middle & North Pond, Stock Tank	S1 G1 T1	E	X			
P. peculiaris	Snake	Big Spring	S1,G2				X	
P. anguina	Snake	Big Spring	S1,G1				X	
P. anguina	Snake	Unnamed springs north of Big Spring	S1,G1				X	
P. anguina	Snake	Clay Spring	S1,G1				X	
P. saxatilis	Snake	Warm Springs					X	
P. kolobensis	Snake	Unnamed spring tributary to Snake Creek					X	
P. kolobensis	Snake	Unnamed spring, south of Caine Spring						
P. kolobensis	Snake	Knoll Spring						
P. kolobensis	Snake	Twin Springs						
P. kolobensis	Snake	Cold Spring						
P. kolobensis	Snake	"Leland Harris" Springs						
O. clarkii utah	Snake	Smith Creek	S1, G4, T2	SC				
O. clarkii utah	Snake	Deadman Creek	S1, G4, T2	SC				
O. clarkii	Snake	Deep Canyon Creek	S1, G4, T2	SC				

utah						
O. clarkii utah	Snake	Hampton Creek	S1, G4, T2	SC		
O. clarkii utah	Snake	Hendry's Creek	S1, G4, T2	SC		
O. clarkii utah	Snake	Strawberry Creek	S1, G4, T2	SC	X	
O. clarkii utah	Snake	Mill Creek	S1, G4, T2	SC	X	
O. clarkii utah	Snake	South Fork Baker Creek	S1, G4, T2	SC		
O. clarkii utah	Snake	Snake Creek	S1, G4, T2	SC	X	X
O. clarkii utah	Snake	Big Wash	S1, G4, T2	SC	X	X
O. clarkii utah	Snake	South Fork Big Wash	S1, G4, T2	SC		X

Table 2. Geographic location designators for springs and streams in Spring and Snake valleys identified in Table 1. Location information for fish in Spring Valley (O. clarki utah, R. solitarius, and E. latos) is latitude and longitude. All other location information is as indicated in the respective column. Entries in the column headed location are somewhat abbreviated, but otherwise identical to those listed in the corresponding column in Table 1.

SPECIES	VALLEY	LOCATION	GPS Zone	Northing	Easting	Township	Range	Quarter Section	State	Reference
P. peculiaris	Spring	Turnley Spring	11	4337854	728759	15N	68E	SW 16	NV	Hershler 1998, NNHP
P. kolobensis	Spring	springs east of Cleve Creek	11	4342371	719114	16N	67E	SW 32	NV	Hershler 1998
P. kolobensis	Spring	springs at Stonehouse	11	4406265	710704	22N	66E	SW 17	NV	Hershler 1998
P. kolobensis	Spring	Unnamed springs, Minerva	11	4300810	726139	11N	67E	SE 12	NV	Hershler 1998
P. kolobensis	Spring	spgs 1.6 km N of Minerva	11	4302262	725489	11N	67E	SW 1	NV	Hershler 1998
P. kolobensis	Spring	Spgs, 3.2 km N of Minerva	11	4304730	725311	12N	67E	NW 36	NV	Hershler 1998
P. kolobensis	Spring	Unnamed spring	11	4412437	708680	23N	66E	SW 30	NV	Hershler 1998
P. kolobensis	Spring	Willow Spring	11	4396998	713863	21N	67E	NW 15	NV	Hershler 1998
O. clarkii utah	Spring	Ridge/Pine Creek	385937N	1142132W					NV	NNHP
R. solitarius	Spring	Spring Valley Creek	394919N	1143322W					NV	NNHP
R. solitarius	Spring	Stonehouse Spring	394657N	1143224W					NV	NNHP
R. solitarius	Spring	Keegan Ranch	392633N	1142942W					NV	NNHP
R. solitarius	Spring	Shoshone South Pond	385615N	1142454W					NV	NNHP
E. latos latos	Spring	Shsh Pnd M, N, & S T	385615N	1142454W					NV	NNHP
P. peculiaris	Snake	Big Spring	11	4287088	749495	10N	70E	NE 33	NV	Hershler 1998, NNHP
P. anguina	Snake	Big Spring	11	4287088	749495	10N	70E	NE 33	NV	Hershler 1998, NNHP
P. anguina	Snake	spgs north of Big Spring	11	4289299	750246	10N	70E	SW 22	NV	Hershler 1998, NNHP
P. anguina	Snake	Clay Spring	12	4305865	740343	22S	19W	NW 33	UT	Hershler 1998, NNHP
P. saxatilis	Snake	Warm Springs	11	4371817	754968	15S	19W	SW 31	UT	Hershler 1998
P. kolobensis	Snake	spg trib to Snake Creek	11	4311226	747485	12N	70E	NW 17	NV	Hershler 1998
P. kolobensis	Snake	spg, S of Caine Spring	11	4335575	754924	15N	71E	NW 31	NV	Hershler 1998
P. kolobensis	Snake	Knoll Spring	12	4348130	752162	18S	18W	NE15	UT	Hershler 1998
P. kolobensis	Snake	Twin Springs	12	4365261	753551	16S	18W	SW 22	UT	Hershler 1998
P. kolobensis	Snake	Cold Spring	12	4371234	745690	16S	19W	NW 2	UT	Hershler 1998
P. kolobensis	Snake	"Leland Harris" Springs	11	4382268	757116	14S	18W	NE 32	UT	Hershler 1998
O. clarkii utah	Snake	Smith Creek							NV	NNHP
O. clarkii utah	Snake	Deadman Creek							NV	NNHP
O. clarkii utah	Snake	Deep Canyon Creek							NV	NNHP
O. clarkii utah	Snake	Hampton Creek							NV	NNHP
O. clarkii utah	Snake	Hendry's Creek							NV	NNHP
O. clarkii utah	Snake	Strawberry Creek							NV	NNHP
O. clarkii utah	Snake	Mill Creek							NV	NNHP

O. clarkii utah	Snake	S Fork Baker Creek	NV	NNHP
O. clarkii utah	Snake	Snake Creek	NV	NNHP
O. clarkii utah	Snake	Big Wash	NV	NNHP
O. clarkii utah	Snake	South Fork Big Wash	NV	NNHP

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