AMPHIBIAN AND REPTILE SURVEYS

RESOLUTION COPPER MINING

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EXECUTIVE SUMMARY

Resolution Copper Mining, LLC (RCM) is currently in the prefeasibility phase of the development of a copper mine located near Superior, Pinal County, Arizona. In order to assist RCM in obtaining the necessary environmental permits, WestLand Resources, Inc. (WestLand) was retained by RCM to conduct baseline biological surveys and studies in the project area. The project area includes areas below the Apache Leap escarpment, Queen Creek Canyon, Oak Flat, Rancho Rio Creek, Devils Canyon, and Mineral Creek (the Study Area). Surveys reported here focus specifically on potential habitat for amphibians: the lentic habitats (ponds and stock tanks) and lotic habitats (ephemeral drainages and creeks) in the Oak Flat/East Plant Area, including portions of Devils Canyon south of U.S. Route 60 (US 60). The purpose of this project was to compile baseline data on amphibian and reptile species from surveys conducted for amphibians in 2011 and from previous surveys conducted in 2003 and 2004.

WestLand conducted presence/absence surveys for amphibians at 17 sites from May 10 through September 21, 2011 in the lentic and lotic systems within the Study Area. Field surveys for amphibians were conducted to coincide with their active season, when water temperatures are 57°F (14°C) or above. Water bodies were visited three times for evaluation. Survey locations in 2011 did not coincide with locations surveyed in 2004 except for four of 13 ponds that were surveyed in both years.

In 2011, five of 17 (28%) water bodies surveyed were occupied by at least one of three species of amphibians noted during surveys. Frogs and toads were only present in the creeks, while salamanders were only present in stock tanks. Tiger salamanders (*Ambystoma tigrinum*) were observed at Oak Creek Tank. Tiger salamanders were detected in 2010 and 2011 by Arizona Game & Fish Department (AGFD) at three additional stock tanks in the Study Area. By contrast, frogs and toads were present at all four creek locations: Devils Canyon, Rancho Rio Creek West and East, and Hackberry Creek. In 2004, five of 14 (36%) sites were occupied by two species of frogs and toads, but no salamanders were observed.

Amphibian species that were detected during the 2011 surveys were canyon tree frog (*Hyla arenicolor*), red-spotted toad (*Anaxyrus punctatus* [formerly *Bufo punctatus*]), and tiger salamander. Unidentified toad tadpoles (most likely red-spotted toads) were observed as well. These species were also detected in 2004 surveys.

The Chiricahua leopard frog (*Lithobates chiricahuensis*) has not been observed in any of these surveys. The lowland leopard frog (*Lithobates yavapaiensis*) was opportunistically observed in Devils Canyon by a WestLand biologist in September 2003 and during surveys in 2010 and 2011, AGFD detected this species in stock tanks east of the Study Area. This species was not detected in the Study Area during planned and incidental surveys by WestLand in 2004 and 2011 or during AGFD surveys in 2010 and 2011. Both leopard frog species require a reliable source of surface water, which has not been noted in the Study Area outside of Devils Canyon. Predatory species such as northern crayfish (*Orconectes virilis*) and tiger salamander, which have been associated with decreasing ranid populations in Arizona, were observed in both the creek and pond habitats in the Study Area.

Reptile observations were made during other biological surveys in 2003 and 2011. In 2004, focused nighttime sampling was performed by slowly driving and looking for reptiles on roads. Of the 21 species

of reptiles observed during surveys, the majority (13, 62%) were lizards. An additional two species of turtles were detected in a stock tank east of the Study Area by AGFD.

The lowland leopard frog observed opportunistically in Devils Canyon in September 2003 is the only US Forest Service Tonto National Forest (TNF) sensitive amphibian or reptile observed in the Study Area. No species of amphibians or reptiles federally listed under the Endangered Species Act as endangered, threatened, or candidate were observed during these studies.

1. INTRODUCTION

Resolution Copper Mining, LLC (RCM) is currently in the prefeasibility phase of the development of a copper mine located near Superior, Pinal County, Arizona (***Figure 1***). In order to assist RCM in obtaining the necessary environmental permits, WestLand Resources, Inc. (WestLand) was retained by RCM to conduct baseline biological studies in the project area. The project area includes areas below the Apache Leap escarpment, Queen Creek Canyon, Oak Flat, Rancho Rio Creek, Devils Canyon, and Mineral Creek (the Study Area). The goal of these surveys is to provide information regarding the biological and natural resource features in the vicinity of potential mine features. In this study, results from amphibian and reptile surveys conducted by WestLand as well as data from other reliable sources are reported.

The Study Area for this study focuses specifically on potential habitat for amphibians: the ponds, stock tanks, ephemeral drainages, and creeks in the Oak Flat/East Plant Area, including the area north of U.S. Route 60 (US 60), and in a portion of Devils Canyon (***Figures 2 & 3***).

WestLand has conducted amphibian and reptile surveys in the Study Area since 2003. The first objective of the surveys was to describe the amphibian species associated with potential habitat in the Study Area in order to compile a list of the amphibian species present and to collect data on the abundance of each species. The second objective was to describe the physical variables associated with the habitat in order to track seasonal changes in the water resources that support amphibians in the Study Area. The final objective was to compile a list of reptile species that have been observed in the Oak Flat/East Plant portion of the Study Area.

The goals of this report are: 1) to present the results of amphibian surveys conducted in 2011, 2) to incorporate the results of the amphibian surveys that were conducted in 2003 and 2004 (***Attachment 1 and 2***) as well as to incorporate surveys conducted by the Arizona Game & Fish Department (AGFD) in the Study Area (***Attachment 3***), and 3) to present a list of reptile species observed during surveys or opportunistically in the Study Area during several years of fieldwork. Also presented is information on the physical features of the ponds, stock tanks, and creeks where amphibian studies were conducted. This report does not include amphibian and reptile data collected from Mineral Creek, which will be presented in another report (WestLand 2012, in prep.).

1.1. STUDY AREA DESCRIPTION

The Study Area is situated east of Superior, Arizona. The Study Area is roughly bounded on the north by Queen Creek and US 60, on the east by Devils Canyon, on the south by Oak Creek, and on the west by the crest of Apache Leap. Elevations in the Study Area range from a minimum of approximately 3,000 ft (914 m) in Devils Canyon to a maximum of 4,822 ft (1,470 m) at the crest of Apache Leap. The Study Area includes private land, land administered by the Arizona State Land Department (State Land), and land administered by the US Forest Service Tonto National Forest (TNF) (***Figure 1***). Four vegetation types are found in the Study Area, including Arizona Upland Subdivision of Sonoran Desertscrub (Arizona Upland Desertscrub), Interior Chaparral, Madrean Evergreen Woodland, and Interior Riparian Deciduous Forest (***Figure 2***).

Sites of particular biological interest within the Study Area are riparian ecosystems. These include the spatially intermittent drainage of Devils Canyon, ephemeral drainages on Oak Flat, several ponds, reservoirs and stock tanks on Oak Flat, and creeks that flow from the Oak Flat/East Plant Mine Area into Devils Canyon. The amphibian surveys were conducted at lentic habitats (ponds and stock tanks) and lotic habitats (ephemeral drainages and creeks) of Oak Flat and segments of Devils Canyon (***Figure 2***). The following paragraphs provide specific descriptions of these areas.

The Oak Flat/East Plant Site Mine Area is roughly bounded on the north by US 60 and Queen Creek Canyon, on the east by the cliff top of Devils Canyon, on the south by Oak Creek, and on the west by the crest of Apache Leap. This area includes the TNF Oak Flat Campground. Parallel ridges and drainages trend toward the northeast from the Apache Leap ridgeline, becoming relatively level in the northeastern portion near Oak Flat. A subtle topographic divide separates these channels into those that drain north through Oak Flat to Queen Creek and those that drain east through Rancho Rio Creek and Hackberry Creek to Devils Canyon. The Oak Flat/East Plant Site Mine Area is dominated by Interior Chaparral vegetation, though elements of Madrean Evergreen Woodland are present at several ponds and reservoirs in the area (***Figure 2***).

Devils Canyon is a steeply walled north-south trending drainage located east of the Oak Flat/East Plant Site Mine Area (***Figure 2***). Surface water in the canyon is seasonally intermittent in the north and perennial in the south. Elevations within the northern segment of Devils Canyon surveyed for this study range from a maximum of approximately 4,000 ft (1,219 m) on a high ridge near the northern limit of the surveyed area to a minimum of roughly 3,420 ft (1,042 m) at the canyon bottom near the southern limit of the Study Area. Devils Canyon supports two groves of Interior Riparian Deciduous Forest, which include Arizona alder (*Alnus oblongifolia*), desert hackberry (*Celtis pallida*), Arizona sycamore (*Platanus wrightii*), and Fremont cottonwood (*Populus fremontii*).

2. METHODS

Amphibian surveys were conducted in Oak Flat/East Plant Mine Area and in Devils Canyon three times in May, July, and September (***Table 1***). Field surveys for amphibians were timed to coincide with their active season, when water temperatures are 57^{o}F (14^{o}C) or above. Water bodies were visited up to three times for evaluation. In 2003, amphibian surveys were conducted on April 16, May 14-16, May 30-31, and June 9-10 (***Attachment 1***). In 2004, a survey focusing on the Chiricahua leopard frog (*Lithobates chiricahuensis*) and the lowland leopard frog (*L. yavapaiensis*) was conducted from August 16-18, 2004 (***Attachment 2***).

Surveys followed the Visual Encounter Survey protocol developed by the US Fish & Wildlife Service (USFWS 2007). The site name, date, times of the beginning and end of the survey, UTM coordinates, observer names, water temperature, photo numbers, and general notes were recorded. The lotic systems of Rancho Rio Creek, Hackberry Creek, and Devils Canyon were surveyed by walking the drainages and making observations and recording data at each pool encountered until water in the reach ended. Dip nets were used to capture any adult amphibians, tadpoles, and other aquatic organisms that were present to confirm identification.

For lentic systems, a binocular survey was conducted before approaching the site. Once the visual assessment was completed, the perimeter of the site was surveyed. Dip nets and seine nets were used to capture any amphibians that were present along the banks as well as other aquatic organisms for identification. Depth of water in lentic systems was estimated during each visit.

Incidental observations of reptiles were recorded concurrently during the course of other biological studies in 2003, 2004, and 2011. Observations were made during daylight while walking to and from amphibian sample locations. Reptiles were routinely observed "sunning" themselves on rocks or open ground. Shelter sites, presence of scat, and other "sign" were also noted during these surveys. In 2004, nighttime surveys were performed by slowly driving and looking for reptiles along roads.

3. RESULTS AND DISCUSSION

3.1. SEASONAL COMPARISONS OF SELECTED SAMPLE SITES

Seventeen sites were surveyed in 2011. Fourteen sites were surveyed two or three times during the season and three sites were visited one time. Of the sites surveyed multiple times, nine of 14 (64%) were dry during at least one visit. Two sites, Oak Flat and Campsite Reservoir, were dry during each visit. Three lotic sites (Rancho Rio Creek East and West, and Hackberry Creek) had water during each visit in 2011, however, the number of pools along the creeks changed among visits, most likely due to intervening rainfall events.

Most of the lentic sites were distinctly drier in September than in May (***Table 1, Appendix A***). However, this seasonal pattern may not be typical for the area, since 2011 appeared to be dry year. Precipitation data from Shaft 9 near the Oak Flat Campground show that total rainfall for the year as of December 16, 2011 is 8.02 in, roughly half of the total rainfall for 2010 (18.77 in). Additionally, these data show that rainfall between July and September 2011 totaled 1.77 in, less than half of the rainfall for the same period in 2010 (3.94 in) (Weather Underground 2011).

Four ponds and stock tanks were surveyed in both 2004 and 2011 - Oak Flat Pond, Campsite Reservoir, Magma Mine Road Tank, and Magma Mine South Pond (***Table 1, Figure 2***). All of these sites had water when surveyed in 2004.

3.2. AMPHIBIAN SURVEYS

Frogs and toads observed during the 2004 and 2011 surveys were: canyon tree frogs (*Hyla arenicolor*), red-spotted toads (*Anaxyrus punctatus* [formerly *Bufo punctatus*]), and toad tadpoles that were assumed to be red-spotted toad larvae. Tiger salamanders (*Ambystoma tigrinum*) were also observed. No Chiricahua leopard frogs or lowland leopard frogs were observed during the 2004 or 2011 surveys. However, lowland leopard frogs were observed opportunistically in Devils Canyon in September 2003 (***Attachment 1***).

In 2011, five of the 17 creeks, tanks, and ponds surveyed (28%) were occupied by at least one of three species of amphibians noted during surveys. Oak Creek Tank was the only location (of the 13 tanks and ponds surveyed) in which amphibians were present. By contrast, amphibians were present at all four creek locations: Devils Canyon, Rancho Rio Creek West and East, and Hackberry Creek (***Table 1***). Frogs

and toads were only present in the creeks, while salamanders were only present in one pond. In 2004, five of the 14 sites (36%) WestLand visited were occupied by two species of amphibians (***Table 1***). During these surveys, frogs and toads were present in both creeks and ponds, but no salamanders were observed.

Four of the ponds visited in 2004 were revisited in 2011. Three of the ponds were dry during at least one survey in both years: Oak Flat Pond, Magma Mine South Pond and Magma Mine Road Tank. In 2004, frogs and toads were observed in one of the ponds, Campsite Reservoir; this location was dry when surveyed in 2011.

During surveys conducted in 2003, the same three amphibians were seen in several of the streams, drainages, and ponds. Survey results from 2003 are not included in ***Table 1***, since data were not quantified for all sample locations, but the results are summarized here. Tiger salamander larvae were seen in the Magma Mine South Pond, Drill Road Stock Tank, and Oak Flat Reservoir. Canyon tree frogs and red-spotted toads were seen in Drainage L (***Figure 2***), and canyon tree frogs were seen in several unidentified ponds and stock tanks. A lowland leopard frog was opportunistically observed in Devils Canyon during other surveys.

AGFD surveyed eight of the tanks within the Study Area during a study of the Devils Canyon drainage in 2010 and 2011 and located tiger salamanders at four tanks (***Table 1, Figure 2***). These tanks include Oak Creek Tank, in which WestLand detected tiger salamanders in 2011, and three other tanks in which WestLand did not detect amphibians. Neither WestLand nor AGFD detected amphibians in the remaining four tanks.

In the same study, AGFD detected tiger salamanders and lowland leopard frogs in stock tanks east of the Study Area (***Attachment 3***). Tiger salamanders were observed at six tanks and lowland leopard frogs were observed at three tanks.

3.2.1. Rancho Rio Creek East and West

Rancho Rio Creek is located southeast of Forest Road 315 in the Oak Flat/East Plant Mine Area. In May 2011, an approximately 330-yd (300-m) stretch of Rancho Rio Creek was surveyed for amphibians. Approximately 200-250 canyon tree frog tadpoles were observed. In July 2011, an approximately 770-yd (700-m) stretch of Rancho Rio Creek was surveyed for amphibians, which was approximately double the area of surface water compared to May. In July, there were 14 connected and unconnected pools along this stretch of the creek in which an estimated 150 canyon tree frog tadpoles were observed. In September 2011, the extent of surface water had contracted to 330 yd (300 m). No amphibians were observed during this visit.

3.2.2. Hackberry Creek

Hackberry Creek is located in the Oak Flat/East Plant Mine Area directly south of Rancho Rio Creek. Hackberry Creek was first visited in May 2011 and an approximately 660-yd (600-m) stretch of the creek was surveyed for amphibians. There were six unconnected pools along the survey route. An estimated 100 toad tadpoles were observed in these pools. No other amphibians were noted, but water boatmen (Hemiptera: Corixidae) and snails were noted in the pools. The next survey was conducted in September

2011. The extent of surface water had contracted to just 33 yd (30 m). Less than 10 toad tadpoles, presumably red-spotted toads, were present in the three small, unconnected pools.

3.2.3. Devils Canyon

The segment of Devils Canyon surveyed in this study is an intermittent stretch of creek immediately south of US 60. When this site was visited in September 2011, there were five unconnected pools along the survey route. One canyon tree frog was present in one of the pools along with water boatmen (Hemiptera: Corixidae) and northern crayfish (*Orconectes virilis*). The other pools contained water boatmen and backswimmers (Hemiptera: Notonectidae) but amphibians were not observed.

AGFD surveyed segments of Devils Canyon in 2009 and 2011 (***Attachment 4 and 3***). The 2009 survey was focused primarily on fish, but other fish surveys conducted by AGFD have reported opportunistic observations of amphibians (***Attachment 5***). AGFD did not report any observations of amphibians in Devils Canyon during either of these surveys.

3.3. REPTILE OBSERVATIONS

A total of 21 species of reptiles were observed in the Study Area during surveys conducted in 2003, 2004, and 2011 (***Table 2***). One turtle and six snake species were documented during these surveys. Lizards from five different families comprised the remaining observed reptile species. In 2011, three reptile species were observed: Sonoran mud turtle (*Kinosternon sonoriense*), black-necked garter snake (*Thamnophis cyrtopsis*), and Sonora whipsnake (*Masticophis bilineatus*). The latter two species had not been observed during previous surveys. During stock tank surveys in 2010 and 2011, AGFD detected a red-eared slider (*Trachemys scripta*) and spiny soft-shell turtle (*Apalone spinifera*) in one stock tank east of the Study Area (***Attachment 3***). Neither WestLand nor AGFD detected TNF sensitive reptile species or federally listed or candidate reptile species during these studies.

4. GENERAL DISCUSSION

The amphibian fauna of the Study Area appears to consist of three native species: canyon tree frog, red-spotted toad, lowland leopard frog, and the non-native tiger salamander. Frog and toad detections were limited to creeks and streams (lotic habitats); these taxa were not observed in ponds, stock tanks, and reservoirs (lentic habitats) during these surveys. Conversely, the tiger salamander has been observed only at stock tanks and was not observed in creeks and streams. No Chiricahua leopard frogs have been seen during WestLand surveys or those conducted by AGFD (***Attachment 3***). The lowland leopard frog, however, was opportunistically observed in Devils Canyon in September 2003 and AGFD has detected it in stock tanks east of the Study Area. This species was not detected in the Study Area during planned and incidental surveys by WestLand in 2004 and 2011 or AGFD surveys in 2010 and 2011 (***Attachment 3***). The lowland leopard frog is the only TNF sensitive amphibian that has been detected in the Study Area; no federally listed or candidate amphibians have been observed during these studies.

Reptile species are more diverse than amphibians in the Study Area, with 21 species observed. The majority of reptile species observed during survey efforts (13 of 21, 62%) surveys were lizards. Reptiles were detected during nighttime road surveys and by incidental observations during other studies. An

additional two species of turtles were detected in a stock tank east of the Study Area by AGFD (***Attachment 3***). Neither WestLand nor AGFD detected any TNF sensitive reptiles or federally listed or candidate reptiles in the Study Area.

The tiger salamander larvae that were observed at four tanks in 2011 may belong to either of two subspecies introduced to the area. The Arizona tiger salamander (*Ambystoma tigrinum nebulosum*) is native to high-elevation environments in Arizona and the barred tiger salamander (*A. t. mavortium*) is an invasive subspecies that is common in artificial ponds at low elevations (Collins 1981). In Arizona, the use of tiger salamander larvae as bait has led to the introduction of both subspecies into intermediate elevation environments, including the Study Area. This mixing of subspecies makes them difficult to identify in the larval stage (Brennan and Holycross 2006). In 2003, WestLand observed the native Arizona tiger salamander at Oak Flat Reservoir and Magma Mine South Pond (referred to as "Drill Road Stock Tank 3" in that report). However, since both taxa may occur in intermediate elevations, the identity of the subspecies of the larvae observed in 2011 is not certain.

5. REFERENCES

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TABLES

Table 1. Names and locations of the ponds and creeks surveyed in the Study Area[1].

Site Number	Site Name	Dates Visited	Surveyor	Pond/Pool Status[2]	Amphibians	Comments
1	Trail Tank	May 2011	AGFD	Water	Tiger Salamander	
		Sept 2011	WestLand	Water	None	Water was present. There were some backswimmers present in the tank.
2	West Pond FR 342	May 2011	AGFD	Water	Tiger Salamander	
		May 2011	WestLand	36-48 inches	None	Water was present. Snails, leeches, and water boatmen were present.
		July 2011	WestLand	24-36 inches	None	
		Sept 2011	WestLand	24 inches	None	
3	East Pond FR 342	May 2011	AGFD	Dry	None	
		May 2011	WestLand	Dry	None	Water was present in July and September. Snails, leeches, and water boatmen were present.
		July 2011	WestLand	24-36 inches	None	
		Sept 2011	WestLand	24 inches	None	
4	Devils Canyon	Sept 2011	WestLand	5 shallow pools	Canyon tree frog	Water was present. Crayfish, dragonflies, and water boatmen were present.
5	Oak Flat Pond	May 2011	WestLand	Dry	None	No water present in the May 2011 survey. In the July and September surveys the pond was 2-3 inches deep with some backswimmers present.
		July 2011	WestLand	2-3 inches	None	
		Sept 2011	WestLand	2-3 inches	None	
		Aug 2004	WestLand	Water	None	In 2004, water was turbid. Dragonflies present.
6	Oak Flat Reservoir	May 2011	WestLand	Dry	None	No water was present.
		July 2011	WestLand	Dry	None	
		Sept 2011	WestLand	Dry	None	
		Apr-Jun 2003	WestLand	Water	Tiger Salamander	

Table 1. Names and locations of the ponds and creeks surveyed in the Study Area[1].

Site Number	Site Name	Dates Visited	Surveyor	Pond/Pool Status[2]	Amphibians	Comments
7	Campsite Reservoir	May 2011	WestLand	Dry	None	No water was present in 2011.
		July 2011	WestLand	Dry	None	
		Sept 2011	WestLand	Dry	None	
		Aug 2004	WestLand	Water	30-50 Red-spotted toad tadpoles	Water was present in 2004.
8	Magma Mine North Pond 3	May 2011	WestLand	24-36 inches	None	Water was present during the May and July surveys. No water was present during the September survey.
		July 2011	WestLand	12-24 inches	None	
		Sept 2011	WestLand	Dry	None	
9	Magma Mine South Pond	May 2011	WestLand	24-36 inches	None	Water was present during the May and July surveys. No water was present during the September survey.
		July 2011	WestLand	12-24 inches	None	
		Sept 2011	WestLand	Dry	None	
		Aug 2004	WestLand	Water	None	Water was present. Algae, leeches, water boatmen/backswimmers, giant water bugs, dead crayfish, and blue heron.
10	Magma Mine Road Tank	May 2011	AGFD	Water	None	
		May 2011	WestLand	2-3 inches	None	Water levels were low during all three surveys. Some backswimmers and water boatmen were present.
		July 2011	WestLand	2-3 inches	None	
		Sept 2011	WestLand	1-2 inches	None	
		Aug 2004	WestLand	Water	None	Water was present. Water boatmen/backswimmers present. Tanks heavily impacted use by cattle.

Table 1. Names and locations of the ponds and creeks surveyed in the Study Area[1].

Site Number	Site Name	Dates Visited	Surveyor	Pond/Pool Status[2]	Amphibians	Comments
11	Rancho Rio Creek West	May 2011	WestLand	10 pools	Canyon tree frog tadpoles	Water was present. Backswimmers, water boatmen, and dragonflies were present.
		July 2011	WestLand	14 pools	Canyon tree frog tadpoles	
		Sept 2011	WestLand	10 pools	Canyon tree frog tadpoles	
12	Rancho Rio Creek East	May 2011	WestLand	5 pools	Canyon tree frog tadpoles	Water was present. Backswimmers, water boatmen, and dragonflies were present.
		July 2011	WestLand	3 pools	Canyon tree frog tadpoles	
		Sept 2011	WestLand	5 pools	Canyon tree frog tadpoles	
13	Hackberry Creek	May 2011	WestLand	6 pools	Unidentified toad tadpoles	Water was present. Backswimmers and water boatmen were present.
		Sept 2011	WestLand	2 pools	Unidentified toad tadpoles	
14	Hackberry Tank	May 2011	AGFD	Water	None	
		May 2011	WestLand	24-36 inches	None	Water was present. Backswimmers, water boatmen, and dragonfly larvae were present.
		Sept 2011	WestLand	12-24 inches	None	
15	Apache Leap Tank	May 2011	AGFD	Water	None	
		Sept 2011	WestLand	Dry	None	No water was present during WestLand's survey. There were snail shells in the bottom of the tank.
16	Mesquite Flat Tank	May 2011	AGFD	Water	Tiger salamander	
		May 2011	WestLand	12-24 inches	None	Water level was low during the May 2011 survey. No water was present during the September 2011 survey.
		Sept 2011	WestLand	Dry	None	

Table 1. Names and locations of the ponds and creeks surveyed in the Study Area[1].

Site Number	Site Name	Dates Visited	Surveyor	Pond/Pool Status[2]	Amphibians	Comments
17	Oak Creek Tank	May 2011	AGFD	Water	Tiger salamander	
		May 2011	WestLand	24 inches	Tiger salamander larva	Water was present during the May 2011 survey. Tank was dry in the September 2011 survey.
		Sept 2011	WestLand	Dry	None	
18	Oak Flat Reservoir drainage	Aug 2004	WestLand	Water	Red-spotted toad tadpoles	Five small tadpoles. Boatmen/backswimmers, beetles, and leeches present.
19	Queen Creek	Aug 2004	WestLand	1.6 inches	None	Shallow water in tinajas from recent precipitation event.
20	Cattail Tank	Aug 2004	WestLand	Dry	None	
21	Drainage C	Aug 2004	WestLand	Water	Red-spotted toad tadpoles	200 tadpoles. Water boatmen/backswimmers, dragonflies, leeches and garter snake present.
22	Drainage E	Aug 2004	WestLand	Water	None	Boatmen/backswimmers, dragonflies present.
23	Drainage J	Aug 2004	WestLand	Water	Red-spotted toad tadpoles	100 + larvae. Giant water bugs, water boatmen/backswimmers and dragonflies present.
24	Drainage L	Aug 2004	WestLand	Water	Canyon tree frog and red-spotted toad tadpoles	12 + Canyon tree frog larvae, many red-spotted toad larvae. Giant water bugs, water boatmen/backswimmers, dragonflies, and garter snake present.
25	Drainage M	Aug 2004	WestLand	Water	None	No visual encounter survey form was completed in 2004.
26	Apache Leap Stock Pond	May 2011	AGFD	Water	None	
		Aug 2004	WestLand	Water	None	Water turbid with algae. Dragonflies and leeches present. Large snail die-off.

[1] – Dates are presented in reverse chronological order and surveyors are presented in alphabetical order.

[2] – Presence/absence of water or approximate depth when it was measured or estimated.

KEY

Water boatmen – Hemipetera: Notonectidae

Backswimmers – Hemiptera: Corixidae

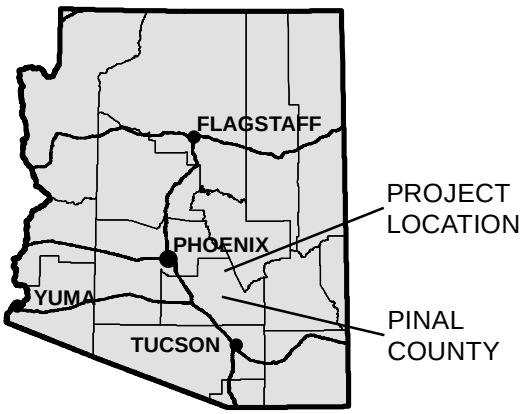
Giant waterbugs – Hemiptera: Belostomatidae

Crayfish – Decapoda: Cambaridae

Table 2. Reptile species observed in surveys by WestLand in 2003, 2004, and 2011.

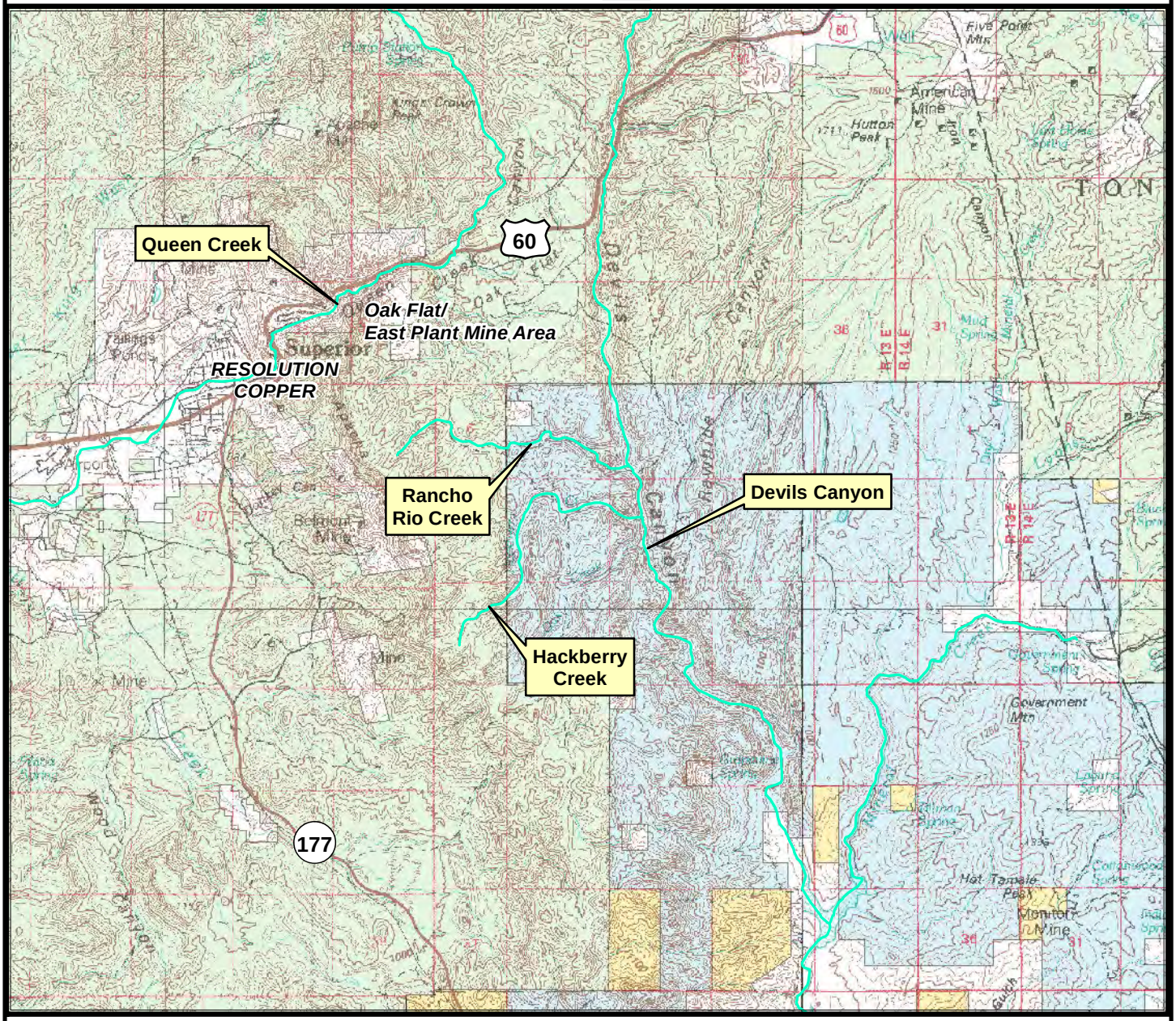
Common Name/Scientific Name		Family Name	2003	2004	2011
Sonoran mud turtle	*Kinosternon sonoriense*	Kinosternidae			X
Western banded gecko	*Coleonyx variegatus*	Geckkonidae		X	
Chuckwalla	*Sauromalus ater*	Iguanidae		X	
Eastern collared lizard	*Crotaphytus collaris*	Crotaphytidae	X	X	
Lesser earless lizard	*Holbrookia maculata*	Phrynosomatidae		X	
Greater earless lizard	*Cophosaurus texanus*	Phrynosomatidae	X		
Zebra-tailed lizard	*Callisaurus draconoides*	Phrynosomatidae	X		
Desert spiny lizard	*Sceloporus magister*	Phrynosomatidae	X		
Spiny lizard	*Sceloporus sp.*	Phrynosomatidae		X	
Side-blotched lizard	*Uta stansburiana*	Phrynosomatidae	X		
Tree lizard	*Urosaurus ornatus*	Phrynosomatidae	X		
Regal horned lizard	*Phrynosoma solare*	Phrynosomatidae	X		
Western whiptail	*Cnemidophorus tigris*	Teiidae	X		
Whiptail lizard	*Cnemidophorus sp.*	Teiidae		X	
Sonoran whipsnake	*Masticophos bilineatus*	Colubridae			X
Gopher snake	*Pituophis melanoleucus*	Colubridae	X	X	
Black-necked garter snake	*Thamnophis cyrtopsis*	Colubridae	X	X	X
Western diamondback rattlesnake	*Crotalus atrox*	Viperidae	X	X	
Black-tailed rattlesnake	*Crotalus molossus*	Viperidae		X	
Tiger rattlesnake	*Crotalus tigris*	Viperidae	X		
Arizona black rattlesnake	*Crotalus cerberus*	Viperidae		X	

FIGURES



SURFACE MANAGEMENT (BLM 2011)

- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)



Pinal County, Arizona,
Superior, Pinal Ranch, Teapot Mntn,
& Hot Tomale Peak USGS 7.5' Quadrangles

N

0 8,000 16,000 Feet

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RESOLUTION COPPER MINING
Amphibian and Reptile Surveys

VICINITY MAP
Figure 1

Path: M:\Projects\807.49\Amphibian_and_Reptile_Survey_Report\FIGURES_4_19_12\Fig2_2004_2011_Amphibian_Reptile_Survey_11X17_Quad.mxd

Legend

- Ephemeral Drainage
- Creek or Drainage
- 2004 Site Name
- 2011 Site Name
- AGFD Site Name (Crowder & Robinson 2011 Survey)

Vegetation Communities

- Arizona Upland Subdivision of Sonoran Desertscrub
- Madrean Evergreen Woodland
- Interior Chaparral
- Interior Riparian Deciduous Forest

2011 Site 1 Trail Tank
AGFD Trail Tank
AGFD Tanks 13A/B
2011 Site 2 West Pond FR342
2011 Site 3 East Pond FR342
AGFD Tanks 15
2011 Site 4 Devils Canyon US 60 Reach
2004 Site 18 Oak Flat Drainage
2004 Site 19 Queen Creek
2004 Site 5 Oak Flat Pond
2011 Site 5 Oak Flat Pond
2011 Site 6 Oak Flat Reservoir
2004 Site 24 Drainage L
2004 Site 7 Campsite Reservoir
2004 Site 20 Cattail Tank
2004 Site 23 Drainage J
2004 Site 25 Drainage M
2011 Site 7 Campsite Reservoir
2011 Site 8 Magma Mine North Pond
2004 Site 9 Magma Mine South Pond
2011 Site 9 Magma Mine South Pond
AGFD Tank 30
2004 Site 10 Magma Mine Road Tank
2011 Site 10 Magma Mine Road Tank
Highest Elevation = 4822'
2004 Site 21 Drainage C
AGFD Tank 27
2004 Site 26 Apache Leap Stock Pond
2004 Site 22 Drainage E
2011 Site 11 Rancho Rio Creek West
2011 Site 12 Rancho Rio Creek East
2011 Site 13 Hackberry Creek
AGFD Tank 8
2011 Site 14 Hackberry Tank
AGFD Apache Leap Tank
2011 Site 15 Apache Leap Tank
Lowest Elevation = 3420'
AGFDTank 11
2011 Site 16 Mesquite Flat Tank
AGFD Tank 9
2011 Site 17 Oak Creek Tank

Data Source for Vegetation Communities:
WestLand Resources-multiple field trips compared with Google Earth imagery to determine biotic communities. Based on Biotic Communities of the Southwest - Brown & Lowe (August 1980) classifications.

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Engineering and Environmental Consultants

0 1,000 2,000 Feet

N

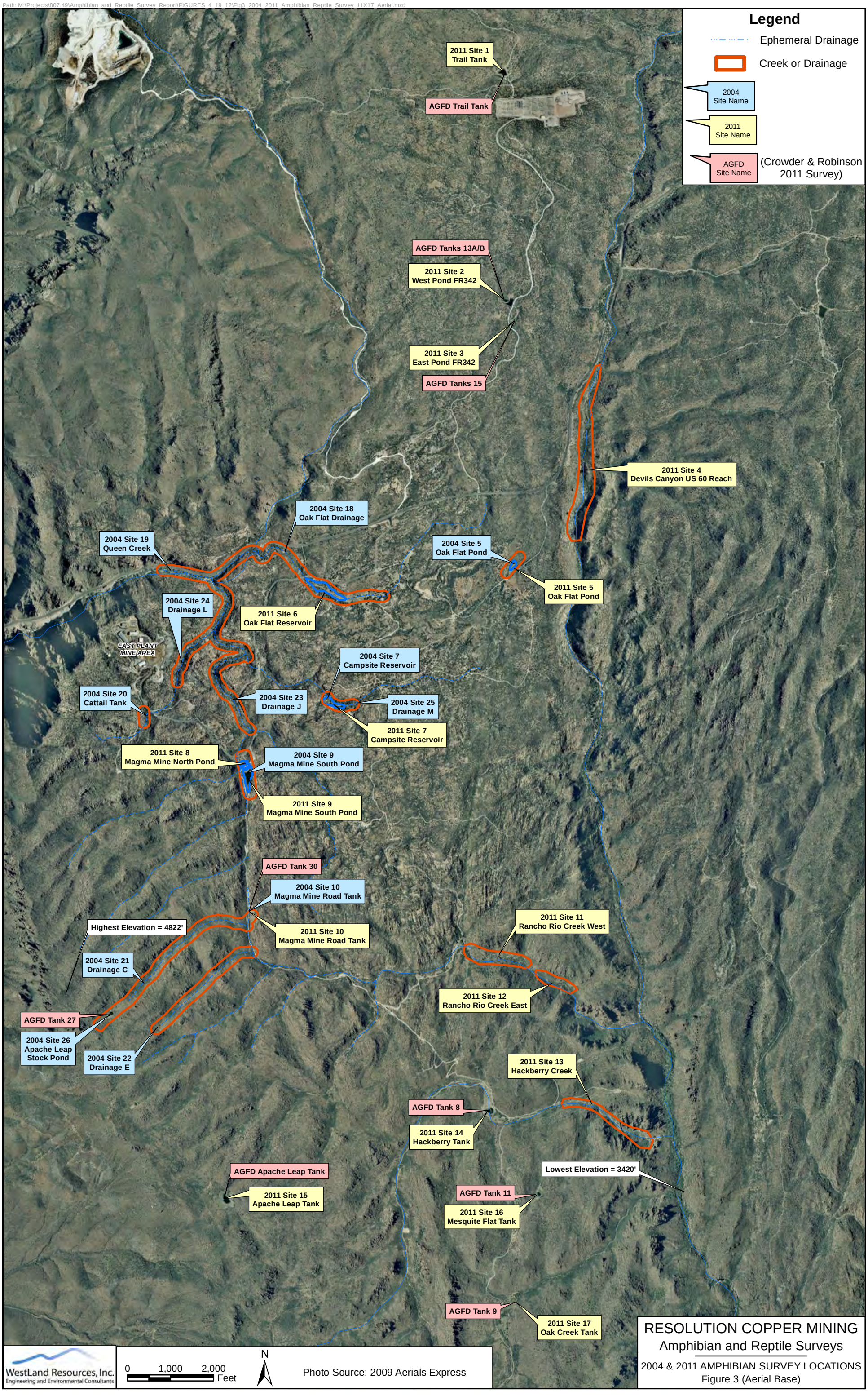
1:24000 USGS 7.5' Quadrangle Base Maps

RESOLUTION COPPER MINING

Amphibian and Reptile Surveys

2004 & 2011 AMPHIBIAN SURVEY LOCATIONS
Figure 2 (Quadrangle Base)

Path: M:\Projects\807.49\Amphibian_and_Reptile_Survey_Report\FIGURES_4_19_12\Fig3_2004_2011_Amphibian_Reptile_Survey_11X17_Aerial.mxd



APPENDIX A

PHOTOGRAPHS FROM MAY AND SEPTEMBER OF LOCATIONS SAMPLED IN 2011

Photo 1. East Pond - May 2011

Photo 2. East Pond – September 2011

Photo 3. West Pond – May 2011

Photo 4. West Pond – September 2011

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APPENDIX A.
Photographs from May and September of locations sampled in 2011

Photo 5. Dry Pond – July 2011

Photo 6. Dry Pond – September 2011

Photo 7. Magma Mine North Pond – May 2011

Photo 8. Magma Mine North Pond – September 2011

APPENDIX A.
Photographs from May and September of locations sampled in 2011

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Photo 9. Magma Mine South Pond– May 2011

Photo 10. Magma Mine South Pond– September 2011

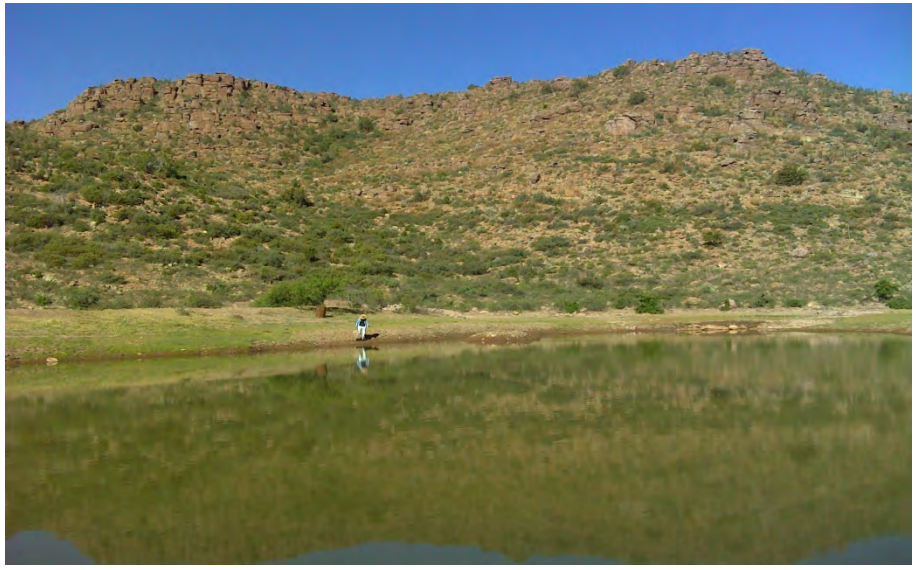

Photo 11. Hackberry Tank – May 2011

Photo 12. Hackberry Tank – September 2011

Photo 13. Mesquite Flat Tank– May 2011

Photo 14. Mesquite Flat Tank– September 2011

Photo 15. Rancho Rio Creek West – July 2011

Photo 16. Rancho Rio Creel West– September 2011

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APPENDIX A.
Photographs from May and September of locations sampled in 2011

Photo 17. Rancho Rio Creek East– July 2011

Photo 18. Rancho Rio Creek East– September 2011

Photo 19. Hackberry Creek– July 2011

Photo 20. Hackberry Creek– September 2011

ATTACHMENT 1

2004 BASELINE BIOLOGY AND LAND USE REPORT WESTLAND RESOURCES, INC.

BASELINE BIOLOGY
AND LAND USE REPORT

Prepared for:

Resolution Copper Company

2525 E. Arizona Biltmore Circle, Suite C-135
Phoenix, AZ 85016
(602) 956-0223

Prepared by:

WestLand Resources, Inc.
Engineering and Environmental Consultants
2343 E. Broadway Boulevard, Suite 202
Tucson, AZ 85719
(520) 206-9585

MARCH 2004
Job No. 807.03

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4.0 GENERAL WILDLIFE

As described in Section 3, two broad habitat types occur within the Resolution Parcel boundaries – Interior Chaparral (east of Apache Leap and the dominant biotic community in the project area) and Sonoran Desertscrub (west of Apache Leap). Brown (1994) provides an abbreviated list of the types of species expected to be found in Interior Chaparral (Table 4-1).

Table 4-1. Wildlife occurring in the Interior Chaparral habitat type (Brown 1994).

Common Name	Scientific Name	Common Name	Scientific Name
Mammals			
Cliff chipmunk	*Eutamias dorsalis*	Rock mouse	*Peromyscus difficilis*
White-throated woodrat	*Neotoma albigula*	White-footed mouse	*Peromyscus leucopus*
Mule deer	*Odocoileus hemionus*	Brush mouse	*Peromyscus boylii*
Eastern cottontail	*Sylvilagus floridanus holzeri*		
Birds			
Canyon wren	*Catherpes mexicanus*	Brown towhee	*Pipilo fuscus*
Rufous-sided towhee	*Pipilo erythrophthalmus*	Bushtit	*Psaltriparus minimus*
Crissal thrasher	*Toxostoma dorsale*	Black-chinned sparrow	*Spizella atrogularis*
Rufous-crowned sparrow	*Aimophila ruficeps*	Scrub jay	*Aphelocoma coerulescens*
Amphibians and Reptiles			
Glossy snake	*Arizona elegans*	Desert striped whipsnake	*Masticophis taeniatus*
Western rattlesnake	*Crotalus viridis*	Western fence lizard	*Sceloporus occidentalis*
Arizona alligator lizard	*Gerrhonotus kingi*	Eastern fence lizard	*S. undulatus*
Night snake	*Hypsiglena torquata*	Western blackhead snake	*Tantilla planiceps*
Sonora mountain kingsnake	*Lampropeltis pyromelana*	Sonoran lyre snake	*Trimorphodon biscutatus lambda*
Southwestern blind snake	*Leptotyphlops humilis*	Texas lyre snake	*Trimorphodon biscutatus vilkinsoni*
Sonora whipsnake	*Masticophis bilineatus*	Side-blotched lizard	*Uta stansburiana*
Arizona night lizard	*Xantusia arizonae*		

This species list does not provide a comprehensive species list for the project area. Given the wide variety of factors influencing wildlife species composition within a particular habitat type (e.g. habitat transitions, availability of water, etc.), additional analysis (including a literature review; field reconnaissance; and obtaining information from state and federal agencies, and local organizations) was utilized to determine those species with the potential to occur within the project area.

4.1. METHODS AND MAPPING CONVENTIONS

4.1.1. Mammals

Efforts to identify mammal species potentially occurring within the Resolution Parcel included:

1) review of relevant literature, 2) anecdotal observation during field reconnaissance, and 3) written and verbal correspondence with state and federal agencies, and local organizations. No species-specific mammal surveys were conducted for this assessment.

The following were contacted for information regarding potential mammal species within the Parcel: Arizona Game and Fish Department (AGFD); US Forest Service (USFS); US Fish & Wildlife Service (USFWS); and Boyce Thompson Arboretum. The AGFD provided harvest and survey data for various game species within relevant game management units. Additional harvest and survey data was provided by Ms. Amber Munig of AGFD on April 23, 2003 (Appendix B).

Additional information sources included an online search of the USFWS Fire Effects Information System (FEIS) database, a USFS general species account for Tonto National Forest, and a checklist of species provided by Boyce Thompson Arboretum, located approximately 11 km (6 miles) west of the Parcel. Finally, two bat survey reports completed by Bat Conservation International (BCI 1996 and 1997) within abandoned underground mine workings near Superior, Arizona were reviewed.

4.1.2. Reptiles and Amphibians

4.1.2.1. Amphibian Survey Methods

Amphibian surveys, in general, involved visual observation at surface water sources, capture, and in-hand identification. Focused field surveys for amphibians were scheduled to coincide with the active season for ranid frogs, which occurs from April through October, and/or during wet periods after spring runoff or rainfall, when ranid frogs are more visible (Sredl 1997).

In order to maximize the survey effort, surveys for amphibian species were conducted when water temperatures reached 14^{o}C or above, when the amphibians would be most active. Surveys for Chiricahua leopard frog and lowland leopard frog followed the General Visual Encounter Survey Method (VEM) protocol developed by the U.S. Fish and Wildlife Service (USFWS 2003b). The Chiracahua Leopard Frog VEM Form was used in collecting locality data, site and visit conditions, and herpetofauna observations for all known surface water features on the Resolution Parcel (Figure 7).

4.1.2.2. Reptile Survey Methods

Similar to amphibian surveys, surveys for reptiles involved visual observation and identification, and were completed in conjunction with other biological and resource surveys conducted as part of the baseline biological inventory. These surveys typically consisted of relatively wide-ranging walking transects through a variety of habitat types and geologic features. Reptile surveys were also conducted while traveling during field reconnaissance for other biological surveys. Reptiles are routinely observed “sunning” on rocks or open ground during early morning hours and moving across roads at night. Nighttime observation of roadways were used to supplement the walking transects and observations during other biological surveys.

4.1.3. Birds

4.1.3.1. Raptor Survey Methods

The Parcel was surveyed for the presence of raptors on May 22 and 23, 2003 during the known raptor nesting/breeding season, with particular focus on areas containing appropriate nesting substrates such as cliff faces, rock outcrops, utility poles, and large trees. Survey methodology included linear transects, variable transects, and cliff surveys, all of which are described briefly below.

In general, linear transects are utilized in order to sample large areas in a relatively short period of time (Cooperrider et.al. 1986). Linear transects were conducted along Queen Creek and two tributary drainages near the western portion of Oak Flat. These narrow canyon bottoms contain riparian groves of sycamore, velvet ash, and Emory oaks that provide potential nest trees for raptors (Figure 9). Surveyors proceeded slowly on foot along transects, scanning the treetops with binoculars for evidence of raptors or their nests.

Variable transects were conducted in larger areas containing groves of cottonwoods, oaks, and other trees as well as in areas where steep topography and rock outcrops provided potential nest sites. Observers conducting variable transects moved through the survey areas in a meandering fashion, scanning all appropriate nest substrates with binoculars.

Cliff surveys were conducted on the face of Apache Leap from four fixed points located at intervals along the length of the cliff. Surveyors scanned the cliff face with the aid of binoculars and spotting scopes for a period of two hours. Observations took place during the early morning hours from ½ hour before sunrise until four hours after sunrise for three of the survey points. Surveys at the fourth fixed point were conducted in the late afternoon. Evidence of raptor habitation, including stick nests, whitewash, and observations of raptors themselves, was recorded on data forms. If raptors were present, behavioral observations were used to determine breeding status. Specific indicators of breeding activities include (Postupalsky 1974):

- Presence of a nest or eyrie[1]
- Young in nest
- Adult in nest in incubation posture
- Mating behavior
- Prey deliveries
- Nest maintenance
- Adult near nest

[1] The eyries of cliff nesting raptors can consist of a stick nest, scrape, ledge, or cavity.

4.1.3.2. Other Bird Survey Methods

With the exception of raptors, no species-specific surveys were conducted for birds in the Parcel. However, during general biological investigation work on the Parcel, WestLand biologists noted birds that were observed and/or heard within or near the Parcel.

4.2. RESULTS

4.2.1. Mammals

Mammals identified within the Parcel, either through direct observation or identification of scat or tracks, are listed in Table 4-2.

Table 4-2. Mammal species observed within the Parcel.

Common Name	Scientific Name
Black-tailed jack rabbit	*Lepus californicus eremicus*
Desert cottontail	*Sylvilagus audubonii*
Rock squirrel	*Spermophilus variegatus*
White-throated wood rat	*Neotoma albigula albigula*
Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Ringtail	*Bassariscus astutus arizonensis*
Coyote	*Canis latrans*
Gray fox	*Urocyon cinereoargenteus*
White-tailed deer	*Odocoileus virginianus couesi*

Because most of the mammal species which occur in Arizona are nocturnal or crepuscular, they are difficult to observe directly through field investigation. Based on the review of agency provided information and published literature, including review of spatial distribution and habitat requirements of Arizona mammal species, it was determined that the following species also have the potential to occur within the Parcel (Table 4-3).

Table 4-3. Mammal species that have potential to occur on the Parcel.

Common Name	Scientific Name	Common Name	Scientific Name
Desert shrew	*Notiosorex crawfordi crawfordi*	Porcupine	*Erethizon dorsatum*
California leaf-nosed Bat	*Macrotus californicus*	Mexican wood rat	*Neotoma mexicana*
Cave myotis	*Myotis velifer*	Harris' antelope squirrel	*Ammospermophilus harrisii*
California myotis	*Myotis californicus californicus*	Arizona pocket mouse	*Perognathus amplus amplus*
Western pipistrelle	*Pipistrellus hespurus hespurus*	Rock pocket mouse	*Perognathus intermedius intermedius*
Townsend's (or Western) big-eared bat	*Plecotus townsendii*	Merriam's kangaroo rat	*Dipodomys merriami merriami*
Mexican free-tailed bat	*Tadarida brasiliensis mexicana*	Brush mouse	*Peromyscus boylii rowleyi*
Western mastiff bat	*Eumops perotis*	Western harvest mouse	*Reithrodontomys megalotis*
Yuma myotis	*Myotis yumanensis*	Stephen's wood rat	*Neotoma stephensi*
Fringed myotis	*Myotis thysanodes thysanodes*	Deer mouse	*Peromyscus maniculatus sonoriensis*
Small-footed myotis	*Myotis ciliolabrum*	Porcupine	*Erethizon dorsatum*
Big brown bat	*Eptesicus fuscus*	Spotted skunk	*Spilogale putorius leucoparia*
Pallid bat	*Antrozous pallidus*	Striped skunk	*Mephitis mephitis*
Pocketed free-tailed bat	*Nyctinomus femorosaccus*	Hog-nosed skunk	*Conepatus mesoleucus venaticus*
Hoary bat	*Lasiurus cinereus*	Hooded skunk	*Mephitis macroura milleri*
Cliff chipmunk	*Eutamias dorsalis dorsalis*	Mountain lion	*Felis concolor*
Baileys' pocket mouse	*Perognathus baileyi baileyi*	Bobcat	*Felis rufus*
Desert pocket mouse	*Perognathus penicillatus pricei*	Kit fox	*Vulpes macrotis macrotis*
Cactus mouse	*Peromyscus eremicus eremicus*	Javelina	*Tayassu tajacu*
Southern grasshopper mouse	*Onychomys torridus*	Mule deer	*Odocoileus hemionus*

Particular attention was given to bat species, given the migratory habits of most bat species and the associated winter and summer ranges (Hoffmeister 1986). The BCI reports (BCI 1996 and 1997) identified four bat species near the Parcel during systematic surveys of abandoned mines in and near the Parcel. These include: the western big-eared bat (*Corynorhinus [Plecotus] townsendii*), big brown bat (*Eptesicus fuscus*), western pipistrelle (*Pipistrellus*

hesperus [hesperus]), and fringed myotis (*Myotis yumanensis*).

During field reconnaissance, unidentified bats were observed utilizing the Oak Flat Reservoir, feeding on mosquitoes or other small flying insects over the water's surface.

The Parcel is located within Game Management Units 24A and 24B, as designated by AGFD. Although the Parcel lies predominately within Unit 24A, due to irregular boundary designations, Unit 24B is more representative of the habitat type and species composition found within the Parcel. Game species data for Unit 24B, provided by AGFD. Note that the data provided below is for the entirety of Unit 24B, which comprises approximately 225,000 hectares (550,000 acres). The Parcel, as described previously, is approximately 1,225 hectares (3,025 acres) in size, or approximately 0.6 percent the size of Game Management Unit 24B.

- Black bear numbers tend to be low within the Unit and bear harvest was two (2) individuals for the 2002-2003 hunting season.
- Javelina occur throughout most of the Unit, with herd sizes averaging nine animals. Javelina harvest was 167 individuals for the 2002-2003 hunting season; survey for javelina during this period identified 83 animals.
- Mule deer are found throughout most of the Unit in areas that are generally below 4,500 feet in elevation. There has been a decline in mule deer numbers over the past ten years presumably due to inconsistent rainfall patterns. Mule deer harvest within the Unit was 73 individuals for the 2002-2003 hunting season; survey for mule deer during this period identified 147 animals.
- White-tailed deer may be found throughout most of the Unit, generally within brushier habitats above 3,500 feet in elevation. Habitat within the Parcel, particularly in the chaparral east of Apache Leap is consistent with that known to support white-tailed deer. White-tailed deer harvest within the Unit was 104 individuals for the 2002-2003 hunting season; survey for white-tailed deer during this period identified 66 animals.
- While mountain lion was not identified in the Hunting Report as a species found within the Unit, the lion harvest data identified five individuals taken for the 2002-2003 hunting season.

4.2.2. Reptiles and Amphibians

4.2.2.1. Amphibians Results

Within the Resolution Parcel, amphibian survey areas included portions of Queen Creek and several of its tributaries, as well as several scattered reservoirs, ponds, and stock tanks (Figure 7). Ranid frog survey of the Resolution Parcel occurred on April 16, May 14, 15, and 16; May 30 and 31; and June 9 and 10, 2003.

It should be noted that there are no confirmed perennial water sources within the Parcel. Queen Creek is an intermittent stream within the Parcel reach, and the remaining drainages are all ephemeral. All of the reservoirs, ponds, and stock tanks within the Parcel appear to be ephemeral as well, with the possible exception of the Oak Flat Reservoir. Additional discussion of surface water features within the project area is provided in Section 3.2.4.2 of this report.

At the time of field visits, the drainages within the Resolution Parcel contained isolated pools of water within tinajas. The stock tanks and small tinajas that maintained surface water through June were the features where most amphibian individuals were observed. Canyon tree frogs (larvae and adults) and a red spotted toad were noted within only one ephemeral drainage on the Parcel (Drainage L).

While no amphibians were noted within the reach of Queen Creek in the Parcel, tadpoles (including canyon tree frog larvae) were noted within the stream just west of the Parcel boundary. It is anticipated that amphibians occur within all reaches of Queen Creek where sufficient surface water or moisture is present.

Table 4-4 provides a list of amphibians that were noted during field reconnaissance of the Parcel.

Table 4-4. Amphibians noted during field reconnaissance of the Parcel.

Common Name	Scientific Name
Canyon tree frog	*Hyla arenicolor*
Tiger salamander	*Ambystoma tigrinum*
Red spotted toad	*Bufo punctatus*

Photo 4-1 shows an adult canyon tree frog.

Photo 4-1

Canyon tree frog larvae were also noted within Queen Creek just west of the Parcel boundary (Photo 4-2).

Photo 4-2

In general, canyon tree frogs were noted in areas that contained pools set in water-polished bedrock providing relatively safe haven from predators. No canyon tree frogs were observed within water features where tiger salamander larvae were present, presumably due to the fact that tiger salamander larvae predate upon amphibian egg masses and larvae.

Tiger salamander larvae were noted within the Drill Road Stock Pond and Oak Flat Reservoir. Different larval stages of tiger salamander were noted on April 16 (Photo 4-3), May 15 and 16, and May 30.

Photo 4-3

4.2.2.2. Reptiles Results

As described above, the Interior Chaparral habitat biotic community dominates the Resolution Parcel and the reptile relationships within chaparral are generally ill-defined (Brown 1994). Essentially, every habitat type within the Resolution Parcel can be utilized by reptiles, and the presence of the rock and boulder formations on the parcel provide numerous opportunities for reptile shelter.

Table 4-5 provides a list of reptiles that were noted during field reconnaissance of the Resolution Parcel.

Table 4-5. Reptiles noted during field reconnaissance of the Resolution Site.

Common Name	Scientific Name
Collared lizard	*Crotaphytus collaris*
Greater earless lizard	*Holbrookia texana*
Zebra-tailed lizard	*Callisaurus draconoides*
Desert spiny lizard	*Sceloporus magister*
Tree lizard	*Urosaurus sp.*
Side-blotched lizard	*Uta stansburiana*
Regal horned lizard	*Phrynosoma solare*
Western whiptail	*Cnemidophorus tigris*
Black-necked garter snake	*Thamnophis cyrtopsis*
Gopher snake	*Pituophis melanoleucus*
Western diamondback rattlesnake	*Crotalus atrox*
Tiger rattlesnake	*Crotalus tigris*

Photo 4-4 shows an adult breeding male collared lizard sunning.

Photo 4-4

Photo 4-5 shows a tree lizard sunning.

Photo 4-5

4.2.3. Birds

4.2.3.1. Raptor Results

Three active raptor nests were observed on the Parcel during the field survey. On May 22, 2003 a Cooper's hawk (*Accipiter cooperii*) nest was found in an Emory Oak located immediately downgradient of Dry Reservoir, near the Oak Flat Campground (Figure 9).

An adult male Cooper's hawk was observed low in the nest in an incubation or brooding posture, indicating that the nest contained either eggs or small fledglings. The presence of two fledglings was confirmed on a subsequent field visit completed on June 10, 2003.

On May 23, 2003 an active American peregrine falcon (*Falco peregrinus anatum*) was detected

on the face of Apache Leap (Figure 9) (Photo 4-6).

Photo 4-6

The adult peregrine was observed moving from perch to perch along the cliff face while at least two fledglings could be heard vocalizing from the vicinity of a large vertical fissure on the cliff face. At the end of the observation period, there was a series of strident vocalizations from the young indicating a prey delivery.

A single active Zone-tailed hawk (*Buteo albonotatus*) nest was observed in Queen Creek during riparian survey. Young from this nest were observed to have successfully fledged (being fully feathered and perched on branches well outside the nest) during 2003. In addition, two other active Zone-tailed hawk nests were observed in proximity to the Parcel in 2003 – one on Queen Creek downgradient of the Parcel and one within Devils Canyon.

Also observed adjacent to the Parcel were common blackhawks (*Buteogallus anthracinus*) within Devils Canyon. Individual blackhawks were observed on two separate occasions in June 2003; no nests or nesting behaviors were noted during these observations.

Numerous turkey vultures (*Cathartes aura*) were observed soaring along Apache Leap and throughout the Parcel in general. There is a well known turkey vulture communal roost located at the Boyce Thompson Arboretum where up to 100 individuals congregate nightly (Glinski 1998).

4.2.3.2. Other Bird Results

There are four different groups of bird species that are anticipated to occur or potentially occur on the Parcel: (1) resident birds, (2) riparian birds, (3) spring and fall migratory birds, and (4) occasional visitors. Anticipated species from each group are identified in Table 4-6.

Table 4-6. Bird species observed or anticipated to occur on the Parcel.

Group	Common Name	Scientific Name
Resident		
Chaparral	Rock wren	*Salpinctes obsoletus*
	Canyon wren	*Catherpes mexicanus*
	Rufous-crowned sparrow	*Aimophila ruficeps*
	Spotted (rufous-sided) towhee	*Pipilo maculatus*
	Canyon towhee	*Pipilo fuscus*
	Gambel's quail	*Callipepla gambelii*
	Morning dove	*Zenaida macroura*
	White-winged dove[1]	*Zenaida asiatica*
	Lesser nighthawk	*Chordeiles acutipennis*
Sonoran Desertscrub[2]	Verdin	*Auriparus flaviceps*
	Curve-billed thrasher	*Toxostoma curvirostre*

Table 4-6. Bird species observed or anticipated to occur on the Parcel.

Group	Common Name	Scientific Name
	Mockingbird	*Mimus polyglottos*
	Cactus wren	*Campylorhynchus brunneicapillus*
	Cardinal	*Cardinalis cardinalis*
	Phainopepla	*Phainopepla nitens*
	Gila woodpecker	*Melanerpes uropygialis*
	Greater roadrunner	*Geococcyx californianus*
Riparian	Black phoebe	*Sayornis nigricans*
	Lesser goldfinch	*Carduelis psaltria*
	Great blue heron	*Ardea herodias*
	Warblers[1]	Family Parulidae
	Flycatchers	Family Tyrannidae
	Bullock's oriole	*Icterus bullockii*
	Hooded oriole	*Icterus cucullatus*
	Violet-green swallows[1]	*Tachycineta thalassina*
	Cliff swallow[1]	*Petrochelidon pyrrhonota*
Spring and Fall Migrants	Migrant warblers, hummingbirds, flycatchers, buntings	
Occasional Visitors	Steller's jay	*Cyanocitta cristata*
	Mexican jay	*Aphelocoma ultramarina*
	Raven	*Corvus cryptoleucus*
	Acorn woodpecker	*Melanerpes formicivorus*
	Brown-headed cowbirds	*Molothrus ater*
	Bridled titmouse	*Baeolophus wollweberi*
	Oak titmouse	*Baeolophus inornatus*
	Blue-gray gnatcatcher	*Polioptila caerulea*
	Bewick's wren	*Thryomanes bewickii*
	Dark-eyed junco	*Junco hyemalis*
	Robin	*Turdus migratorius*
	Western bluebird	*Sialia mexicana*

[1]Occurring in summer.
[2]May be found within chaparral east of the Leap as well.

As described in Section 3.2.2, the Parcel is not an extraordinarily productive area (in terms of grass seeds, other herbaceous seeds, nuts, berries, and presumably insects) and the recent drought further depresses productivity. In addition, the wet areas are relatively open; more bird species would be anticipated to occur in these areas if stands of cattail, bulrush, etc. were found there.

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ATTACHMENT 2

2004 REPTILE AND AMPHIBIAN SURVEY: FEDERAL PARCEL, PINAL COUNTY, ARIZONA

WESTLAND RESOURCES, INC.

2004 REPTILE AND AMPHIBIAN SURVEY
Federal Parcel, Pinal County, Arizona

Prepared for:

Resolution Copper Company

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Prepared by:

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DECEMBER 2004
Job No. 807.09

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EXECUTIVE SUMMARY

WestLand Resources, Inc. (WestLand) was retained by Resolution Copper Company (Resolution) to conduct a reptile and amphibian survey on the approximately 1,224-hectare (3,025-acre) Federal Parcel (the Parcel). The Parcel is in the Tonto National Forest (TNF), east of the town of Superior, in Pinal County, Arizona.

Resolution proposes to obtain the Parcel by way of a land exchange. In support of this effort, WestLand has conducted ongoing biological resource investigations on the Parcel. The purpose of this survey was to provide baseline data regarding reptile and amphibian populations on the Parcel. This survey effort focused on the U.S. Fish & Wildlife Service (USFWS) threatened Chiricahua leopard frog (*Rana chiracahuensis*) and the U.S. Forest Service (USFS) Sensitive lowland leopard frog (*Rana yavapaiensis*).

Surveys were conducted on the Parcel from August 16 through 18, 2004. Only those portions of the Parcel known to support surface water were surveyed for amphibians. Survey for amphibians was conducted following the USFWS-recommended protocol for Chiricahua leopard frog. No Chiricahua leopard frogs or lowland leopard frogs were detected on the Parcel. Lowland leopard frogs had been previously noted off-site by a WestLand biologist along Devils Canyon, just east of the Parcel, in September 2003. Amphibians that were noted during this survey effort include red-spotted toad (*Bufo punctatus*) and canyon tree frog (*Hyla arenicolor*). The only other amphibian that was observed on the Parcel was introduced (to this area) Arizona tiger salamander (*Ambystoma tigrinum nebulosum*) which was observed in 2003 but not in 2004.

The habitats found within the Parcel would be considered marginal to poor for Chiricahua leopard frog and lowland leopard frog. These species require a reliable source of surface water, which has not been noted within the Parcel. Predatory species (i.e., crayfish and tiger salamander) that have been associated with decreasing ranid populations in Arizona occur within the on-site seasonal surface water features. The seasonal stock ponds on the Parcel are home primarily to the introduced Arizona tiger salamander (a known predator of ranid tadpoles), which apparently are stocked and seined each year and sold as bait. Although the Parcel occurs within the elevation range and potentially supports habitat for Chiricahua leopard frog, there are no known populations or historical records for Chiricahua leopard frog from Pinal County. Based upon the species-specific surveys that have been conducted to date and the current condition of aquatic habitats within the Parcel, we do not expect Chiricahua leopard frog or lowland leopard frog to occur on the Parcel.

Reptile surveys were conducted during field reconnaissance for other biological surveys. Nighttime surveys were also conducted for reptiles on the Parcel along roadways. Reptiles that were noted on the Parcel during these survey efforts include banded gecko (*Coleonyx variegatus*), Arizona black rattlesnake (*Crotalus viridis cerberus*), and black-necked garter snake (*Thamnophis cyrtopsis*). Essentially, every

habitat type within the Parcel can be utilized by reptiles, and the presence of the rock and boulder formations on the Parcel provide numerous opportunities for reptile shelter**.**

1. INTRODUCTION AND BACKGROUND

1.1 STATEMENT OF PURPOSE

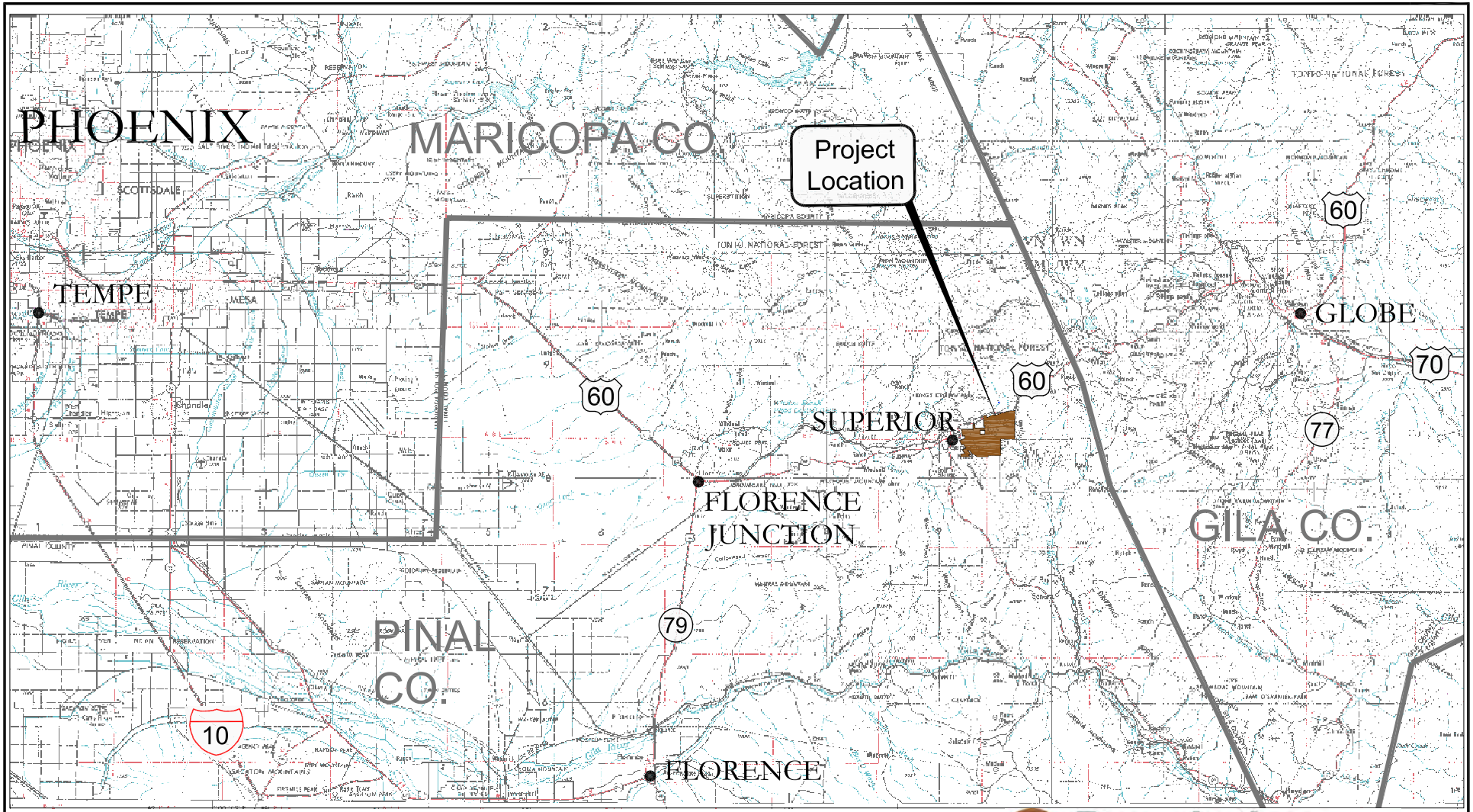
WestLand Resources, Inc. (WestLand) was retained by Resolution Copper Company (Resolution) to conduct a reptile and amphibian survey on the approximately 1,224-hectare (3,025-acre) Federal Parcel (the Parcel). The Parcel is in the Tonto National Forest, east of the town of Superior, in Pinal County, Arizona. The Parcel occupies a portion of Section 36, Township 1 South, Range 12 East; portions of Sections 1 and 2, Township 2 South, Range 12 East; portions of Sections 28, 29, 30, 31, and 32, and Section 33, Township 1 South, Range 13 East; and a portion of Section 6, Township 2 South, Range 13 East (Figure 1). This survey focused on the U.S. Fish & Wildlife Service (USFWS) threatened Chiricahua leopard frog (*Rana chiracahuensis*) and the U.S. Forest Service (USFS) Sensitive and Arizona Game and Fish Department (AGFD) Wildlife of Special Concern lowland leopard frog (*Rana yavapaiensis*) using the USFWS recommended survey protocol for the Chiricahua leopard frog.

Resolution proposes to obtain the Parcel by way of a land exchange. In support of this effort, WestLand has conducted ongoing biological resource investigations on the Parcel. The purpose of this survey was to provide baseline data with respect to reptile and amphibian populations on the Parcel and to identify the absence or presence of Chiricahua leopard frog and lowland leopard frog. Previous biological work conducted in Devils Canyon, immediately east of the Parcel, had identified the presence of lowland leopard frogs. Due to the similarity of habitat requirements of the two species, the possible presence of potentially suitable habitat on the Parcel, and the proximity of the Parcel to Devils Canyon, it was determined that survey of the Parcel would be appropriate.

1.2 DESCRIPTION, STATUS, RANGE, AND HABITAT

Ranids, also referred to as true frogs, may be distinguished from other frogs in Arizona by their ability to leap distances, relatively smooth skin, and well-developed webbing on their hind limbs. They often possess paired, glandular ridges (dorsolateral folds), which may be poorly defined, running along each side of the back (Sredl and Howland, undated). Currently, Arizona's ranid fauna include the Tarahumara frog (*Rana tarahumarae*) and six or seven species of leopard frog including the Chiricahua leopard frog and lowland leopard frog. Based on literature review of ranid range and habitat data, Chiricahua leopard frogs and lowland leopard frogs were initially considered to have potential to occur within the Parcel.

Ranids in Arizona are considered to be declining in numbers with the exception of an introduced species, the bullfrog (*Rana catesbeiana*), which out-competes and preys upon Arizona's native ranids. Other predators of ranid tadpoles include aquatic insects, native and non-native fish, garter snakes, crayfish, Arizona tiger salamander (*Ambystoma tigrinum nebulosum*), and wading birds. Predators of ranid juveniles and adults include native and non-native fish, garter snakes, raptors, and mammals. Also, a



Pinal County, Arizona
Mesa 1:250,000 USGS Map

0 6.5 13 KM

Approx. Scale 1" = 13 KILOMETERS

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Resolution Copper Company

2004 AMPHIBIAN SURVEY, FEDERAL PARCEL

VICINITY MAP
Figure 1

M:\projects\807.09\2004 REPTILE AND AMPHIBIAN SURVEY\ RS VICINITY REGIONAL.DWG

chytrid fungus has infected populations of ranids, causing mass die-offs and local extirpations (AGFD 2001a). Other threats to ranid populations include habitat alteration, destruction, and fragmentation (50 CFR 40790). The following paragraphs provide species accounts for the Chiricahua leopard frog and lowland leopard frog.

1.2.1 Chiricahua Leopard Frog

Description

Adult Chiricahua leopard frogs have snout-vent lengths that range from 5.0 to 13.5 cm (2.0 to 5.3 inches). This species is sexually dimorphic (male frogs are smaller than female frogs) and is stockier than other leopard frogs with a more rounded head and shorter limbs and slightly upturned eyes, resembling a bullfrog (Platz and Mecham, 1979). Key identifying features of the Chiricahua leopard frog are indicated in the adjacent photograph. The dorsolateral folds of this species are usually broken into short segments toward the rear and angled inward. This leopard frog has fairly rough skin (possessing many tubercles); dorsal spots are generally smaller and more numerous than in other leopard frogs. It's coloration can be described as greenish or brown with dull whiteish or yellowish below, usually with gray mottling on throat and sometimes chest. This species is yellow in the groin and on the lower abdomen. It possesses an upper lip stripe that is diffuse or absent (Stebbins, 1985).

Photograph of Chiracahua leopard frog. Note the broken and inset dorsolateral fold toward the rear and the upturned eyes.

Source: J. Eric Wallace and Heritage Fund

Status

In 1991, based on information indicating that Chiricahua leopard frog was recently extirpated from historical sites, the species was added to the list of Category 2 candidate species (candidate for listing under the Federal Endangered Species Act [ESA]). The species was elevated to a Category 1 candidate species when more information on its biological vulnerability was gained through research. In 1998 this species was petitioned for listing as endangered with designated critical habitat by Southwest Center for Biological Diversity. In 2000, a proposed rule for listing of Chiricahua leopard frog was published (65 FR 37343). The Chiricahua leopard frog was listed as threatened under the ESA in 2002 (50 CFR 40790). This listing was published with a special rule that replaces the ESA's general rules on prohibition of take for Chiricahua leopard frog. Under the special rule, take of Chiricahua leopard frog caused by use of or maintenance and operation of stock tanks for cattle located on private, State, or Tribal lands would be exempt from Section 9 of the ESA. There is no proposed or designated critical habitat listed for this species.

Range

The range of this species is divided into two areas: 1) northern montane populations occur along the southern edge of the Colorado Plateau in central and eastern Arizona and west-central New Mexico, and 2) southern populations occur in mountains and valleys south of the Gila River in southeastern Arizona and southwestern New Mexico, and extending into Mexico along the eastern slopes of the Sierra Madre Occidental (Sredl and Jennings, in press). Distribution of this species within this range is fragmented due to the arid nature of the region. Elevational distribution in northern populations is between 1,061 to 2,710 meters (3,500 to 8,900 feet) and in southern populations is between 1,061 to 2,012 meters (3,500 to 6,600 feet) (Sredl, 1997).

Most known northern Chiricahua leopard frog populations are in higher elevation headwaters of the Salt, Verde, and upper Gila Rivers, with the remaining in the Little Colorado Rover drainage. Most known southern Chiricahua leopard frog populations are in the San Simon, San Pedro, and Santa Cruz River drainages, while the remaining are in the headwaters of the Rio Concepcion and Rio Yaqui, which flow south into Mexico (AGFD, 2001a).

Historical records for Chiricahua leopard frog exist from Coconino, Yavapai, Navajo, Apache, Greenlee, Pima, Santa Cruz, Graham, and Cochise counties, Arizona; Catron, Socorro, Sierra, Grant, Hidalgo, and Luna counties, New Mexico; and Chihuahua, extreme northern Durango, and northern Sonora, Mexico (Sredl and Jennings, in press).

Habitat

This species is strictly aquatic; it's primary vegetation habitat type is oak, mixed oak, and pine woodlands. Other habitat types range into areas of chaparral, grassland, and desert. Natural aquatic systems preferred by this species include rocky streams with deep rock-bound pools, river overflow pools, oxbows, permanent springs, permanent pools in intermittent streams, and beaver ponds. Man-made aquatic systems include earthen stock tanks, livestock drinkers, irrigation sloughs, wells, mine adits, abandoned swimming pools, and ornamental backyard ponds (AGFD, 2001a). Known northern Chiricahua leopard frog sites are evenly split between natural lotic systems (streams) and lentic systems (i.e., ponds, stock tanks).

1.2.2 Lowland Leopard Frog

Photograph of Lowland leopard frog. Note the broken and inset dorsolateral fold and the vague upper lip stripe.
Source: J. Eric Wallace and Heritage Fund

Description

Adult lowland leopard frogs have a snout-vent length of 4.6 to 7.2 cm (1.8 to 2.8 inches) in males and 5.3 to 8.7 cm (2.1 to 3.4 inches) in females. Key identifying features of the lowland leopard frog are indicated in the adjacent photograph. The dorsolateral folds of this species are present and prominent. This species is tan, gray-brown, or light gray-green to green above and yellow below. The lowland leopard frog has a vague upper lip stripe and a dark spotting network on rear of thigh. Its yellow groin color often extends onto rear of belly and underside of legs.

Status

The lowland leopard frog is classified as USFS Sensitive and Wildlife of Special Concern in Arizona by the AGFD. This species is not afforded legal protection under the ESA.

Range

The current distribution of the lowland leopard frog is mainly in Arizona. This species' range is from the Colorado River near Yuma to west, central, and southeast Arizona south of the Mogollon Rim. Its elevation range in Arizona is 250 to 1,700 m (800 to 5,500 feet). Historically, this species' range extended throughout low elevation sites in the drainage of the lower Colorado River and its tributaries in Nevada, California, Arizona, New Mexico, northern Sonora, and extreme northeast Baja California, Mexico.

Habitat

Lowland leopard frogs are habitat generalists inhabiting and breeding in a variety of natural and man-made aquatic systems located in habitat ranging from desert grasslands to pinyon-juniper between 250 to 1,700 m (800 to 5,500 feet) (AGFD 2001b). They prefer natural river systems, permanent streams, and permanent pools in intermittent streams, springs, and cienegas; however, they can be found in stock ponds, irrigation canals, backyard ponds, and other similar water features throughout their range (AGFD 2001b). The presence of emergent vegetation is an important habitat feature that provides basking habitat, refuge, and forage opportunities for this species (New Mexico Game and Fish Department [NMGFD], 2003).

1.3 DESCRIPTION OF THE SURVEY AREA

The Parcel is located in the Pinal Mountains within the Central Highlands Province, a transition zone between the Colorado Plateau and the Basin and Range Provinces. Elevation within the Parcel varies from approximately 900 to 1,500 meters (3,000 to 5,000 feet) above mean sea level.

Over 90 percent of the area of the Parcel is covered by the Apache Leap tuff, the youngest consolidated geologic formation, which forms the cap of the Apache Leap escarpment on the western portion of the Parcel. Underlying units are volcanic and sedimentary rocks exposed at the foot of the Apache Leap escarpment. A late Tertiary/early Quaternary weakly consolidated gravel and conglomerate unit overlies the Apache Leap tuff in a small area on the eastern portion of the Parcel.

The soils associated with the Apache Leap tuff are classified as Lithic Torriorthents (Brown, 1994), and were formed as a residuum weathered from the tuff. These soils are shallow, gravelly, and strongly sloping to very steep soils and, consequently, are well drained.

The Parcel is dominated by plant species associated with Interior Chaparral (east of Apache Leap) and Sonoran Desertscrub biotic communities (west of Apache Leap), as described by Brown (1994). Relatively isolated patches of xeroriparian and mesoriparian vegetation are located throughout the Parcel around stock tanks and in association with ephemeral drainages, Rancho Rio Creek, and Queen Creek.

Surface water within the Parcel is limited to stock water impoundments, and snow melt and storm water flows in the ephemeral washes. Water also collects in boulder pools and tinajas in the drainage bottoms. The stock ponds and reservoirs contain water seasonally. There are no confirmed perennial water sources within the Parcel. One small segment of Queen Creek runs across a corner on the north side of the Parcel. This reach of Queen Creek, the Drill Road Stock Tank 3, and the Oak Flat Reservoir are intermittent in nature while all of the remaining reservoirs, ponds, and stock tanks within the Parcel are ephemeral. Additional information and descriptions of water features on the Parcel can be found in the *Baseline Biology and Land Use Report* (WestLand, 2003).

1.4 SUMMARY OF PREVIOUS SURVEYS CONDUCTED IN THE PARCEL VICINITY

WestLand prepared a *Baseline Biology and Land Use Report* (2003a) and a *Federal Lands Biological Assessment and Evaluation* (2003b) describing biological resources associated with the Parcel. In 2003, WestLand conducted ranid surveys of the parcel following USFWS-recommended survey protocols within portions of Queen Creek and several of its tributaries, as well as several scattered reservoirs, ponds, and stock tanks. Ranid frog surveys occurred on April 16; May 14, 15, and 16; May 30 and 31; and June 9 and 10, 2003. At the time of 2003 field visits, the drainages within the Parcel contained isolated pools of water within tinajas. The stock tanks and small tinajas that maintained surface water through June were the features where most amphibian individuals were observed. It is believed that

amphibians occur within all reaches of Queen Creek where sufficient surface water or moisture is present.

No leopard frogs were noted within the Parcel during previous survey efforts; however, lowland leopard frogs were noted by a WestLand biologist along Devils Canyon, just east of the Parcel in September 2003. Canyon tree frogs (larvae and adults) and a red spotted toad were noted within only one ephemeral drainage on the Parcel in 2003. Canyon tree frog larvae were also noted within Queen Creek just west of the Parcel boundary. In general, canyon tree frogs were noted in areas that contained pools set in water-polished bedrock providing relatively safe haven from predators.

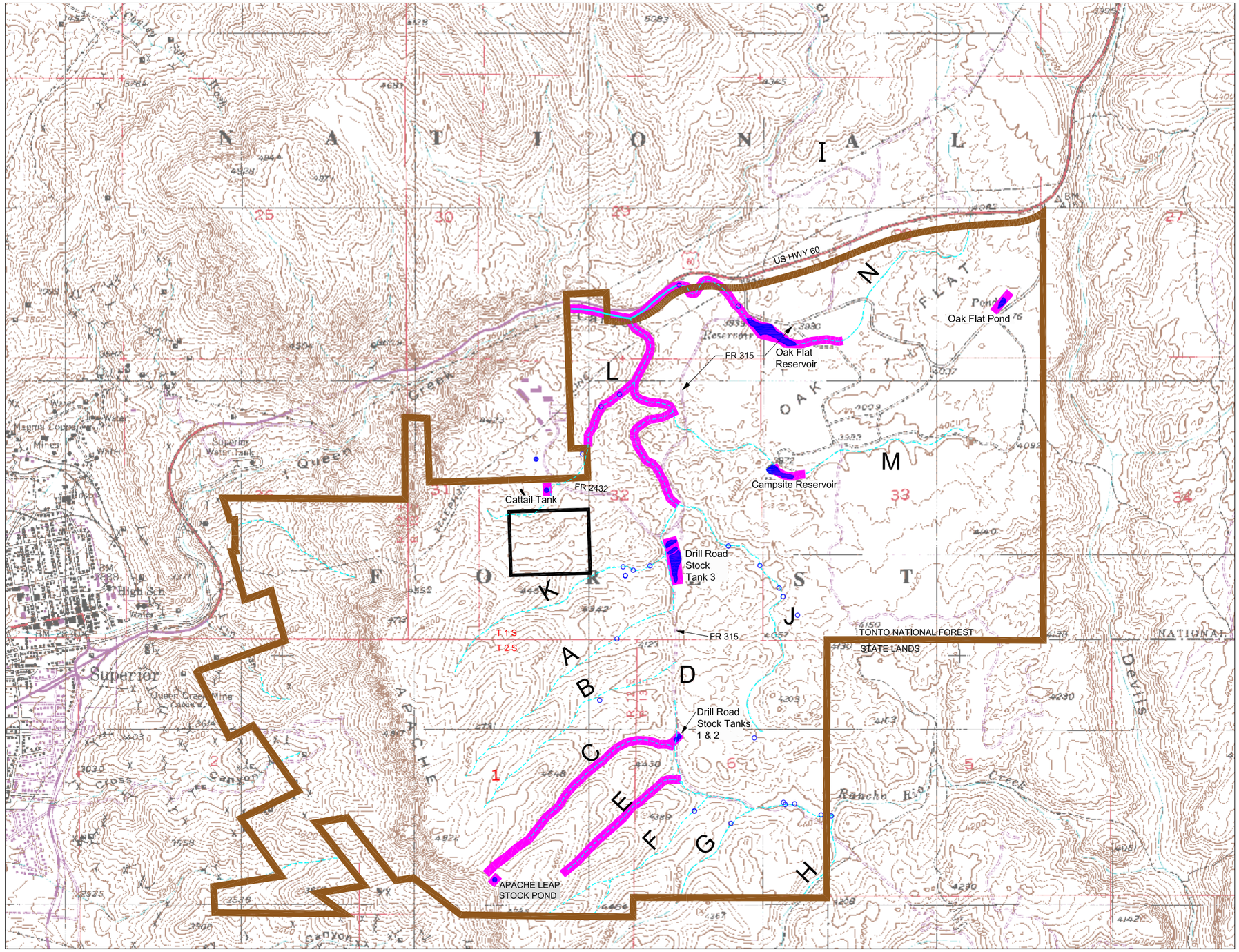
The seasonal stock ponds on the Parcel are home primarily to the introduced Arizona tiger salamander (*Ambystoma tigrinum nebulosum*, a known predator of ranid tadpoles), which apparently are stocked and seined each year and sold as bait. Tiger salamander larvae were noted within the Drill Road Stock Tank 3 and Oak Flat Reservoir. No canyon tree frogs were observed within water features where tiger salamander larvae were present, presumably due to the fact that tiger salamander larvae predate upon amphibian egg masses and larvae.

Reptiles that were noted during 2003 field reconnaissance of the Parcel include collared lizard (*Crotaphytus collaris*), greater earless lizard (*Holbrookia texana*), zebra-tailed lizard (*Callisaurus draconoides*), desert spiny lizard (*Sceloporus magister*), tree lizard (*Urosaurus* sp.), side-blotched lizard (*Uta stansburiana*), regal horned lizard (*Phrynosoma solare*), western whiptail (*Cnemidophorus tigris*), black-necked garter snake, gopher snake (*Pituophis melanoleucus*), western diamondback rattlesnake (*Crotalus atrox*), and tiger rattlesnake (*Crotalus tigris*).

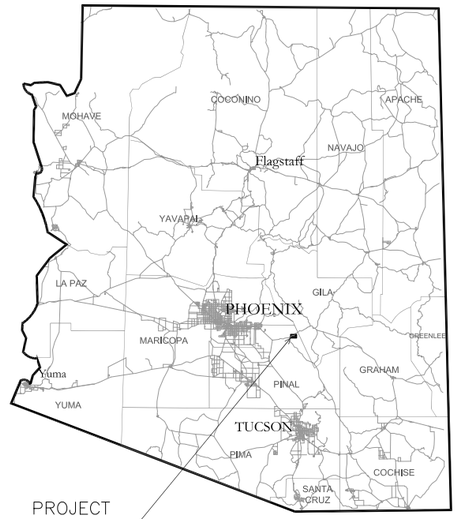
2. METHODS

Prior to conducting the 2004 fieldwork, WestLand conducted a review of available literature to obtain the most recent information about the Chiricahua leopard frog and lowland leopard frog habitat, life history, and known range in Arizona. Amphibian surveys, in general, involved visual observation at surface water sources, capture, and in-hand identification. Surveys for Chiricahua leopard frog and lowland leopard frog within the Parcel followed the Visual Encounter Survey protocol developed by the USFWS (USFWS, March 2003). The Chiricahua leopard frog Visual Encounter Survey form was used in collecting locality data, site and visit conditions, and herpetofauna observations for all known surface water features on the Parcel (Figure 2). Surface water features that were clearly too small or otherwise deemed unsuitable habitat were noted, and data collection forms were not filled out for these features. Field surveys for amphibians were scheduled and conducted to coincide with the active season for ranids and were conducted when water temperatures reached 14°C or above (per USFWS protocol).

Focused ranid surveys within the Parcel were conducted by two WestLand biologists along portions of Queen Creek, tributaries to Queen Creek, and the reservoirs and stock tanks that occur on the Parcel. Surveys were conducted on August 16 through 18, 2004. Figure 2 shows the surface water features where surveys were conducted in 2004.



CONTEXT MAP



N

LEGEND

- Parcel Boundary
- Private In-holding Boundary
- Ephemeral Drainage
- Intermittent Stream
- 2004 Amphibian Survey Areas
- Pond, Reservoir or Stock Tank
- Known Pool or Tinaja
- K — Drainage Identification
- FR — FOREST ROAD

0 300 600 M

Scale 1" = 600 Meters

Pinal County, Arizona
Superior, 1:24000 USGS Maps

Resolution Copper Company

2004 AMPHIBIAN SURVEY, FEDERAL PARCEL

2004 AMPHIBIAN SURVEY MAP

Figure 2

WestLand Resources Inc.
Engineering and Environmental Consultants
2343 E. Broadway Blvd. Suite 202
Tucson, Az 85719 (520) 206-9585

M:\PROJECTS\807.09\Reptile-Amphibian\2004-survey-areas.DWG 11-04

For lotic systems, surveys were conducted by walking the drainages in a zigzag fashion. A search was conducted surrounding any vegetation that was present along surface water, under rocks, downed branches, undercut banks, and any other places frogs might find cover. Dip nets were used to flush any frog that may be present and to catch specimens of tadpoles, aquatic organisms, and other fauna for proper identification.

For lentic systems, a search was conducted through binoculars before approaching the site. Once the visual assessment was completed, the perimeter of the site was surveyed. Dip nets were used to flush any frogs that might be present along the banks and to catch any other aquatic organisms.

Data that were collected at each site includes site name, UTM coordinates, elevation, date, observers, time of survey start and stop, time spent actively searching for herpetofauna, level of effort (i.e., partial or full coverage of the site), any voucher specimens taken, water class, water type, search methods, water pH, air and water temperature, habitat characteristics, weather conditions, land use, sign of potential predators, and any herpetofauna observations. The Visual Encounter Survey forms that were completed for the 2004 survey effort are included in Appendix A.

The on-site water features that were surveyed for the 2004 amphibian survey effort are highlighted in Figure 2 and include the following:

Lotic Systems	Lentic Systems
Drainage E	Oak Flat Pond
Drainage C	Cattail Tank
Lower portions of Drainage L	Drill Road Stock Tanks 1, 2, and 3
Lower portions of Drainage M	Campsite Reservoir
Queen Creek (on-site reach only)	Apache Leap Stock Pond
Lower portions of Drainage J	Oak Flat Reservoir

Similar to amphibian surveys, surveys for reptiles involved visual observation and identification, and were completed in conjunction with other biological surveys conducted as part of the baseline biological inventory. Reptile surveys were conducted contemporaneously with field reconnaissance for other biological surveys. Reptiles are routinely observed "sunning" on rocks or open ground during early morning hours and moving across roads at night.

3. RESULTS AND DISCUSSION

3.1 Site Conditions During 2004 Reptile and Amphibian Survey

At the time of 2004 field visits more surface water was noted within the lotic systems (the ephemeral drainages) on the Parcel and less surface water was noted within the lentic systems (stock ponds and reservoirs) on the Parcel than what had been noted in the 2003 survey effort, which was conducted earlier in the year. The 2003 survey effort preceded the "monsoon season" whereas the 2004 survey effort was conducted well into the monsoon season. The Oak Flat Pond, which was previously thought to hold

water year-round, held no surface water during the 2004 site visit. This observation may suggest that the summer monsoon contributes more surface water to the lotic systems and winter rains contribute more surface water to the lentic systems on the Parcel.

The Parcel and its vicinity received a significant amount of rain on the first afternoon and evening of survey, August 16, 2004 (this storm event contributed an estimated 4.0 centimeters [1.6 inches] of precipitation to the Superior area). The night of this storm event was spent driving along the roadways through the Parcel to note any reptiles or amphibians that may be active during this time. Four red-spotted toads and two canyon tree frogs were caught and identified along Forest Road 315 (FR 315) at this time. The toads and frogs were particularly plentiful along the road where it intersected Drainages L, K, and J (Figure 2). Other species noted included a banded gecko and jumping spiders.

3.2 Results of 2004 Reptile and Amphibian Survey

3.2.1 Amphibian Observations

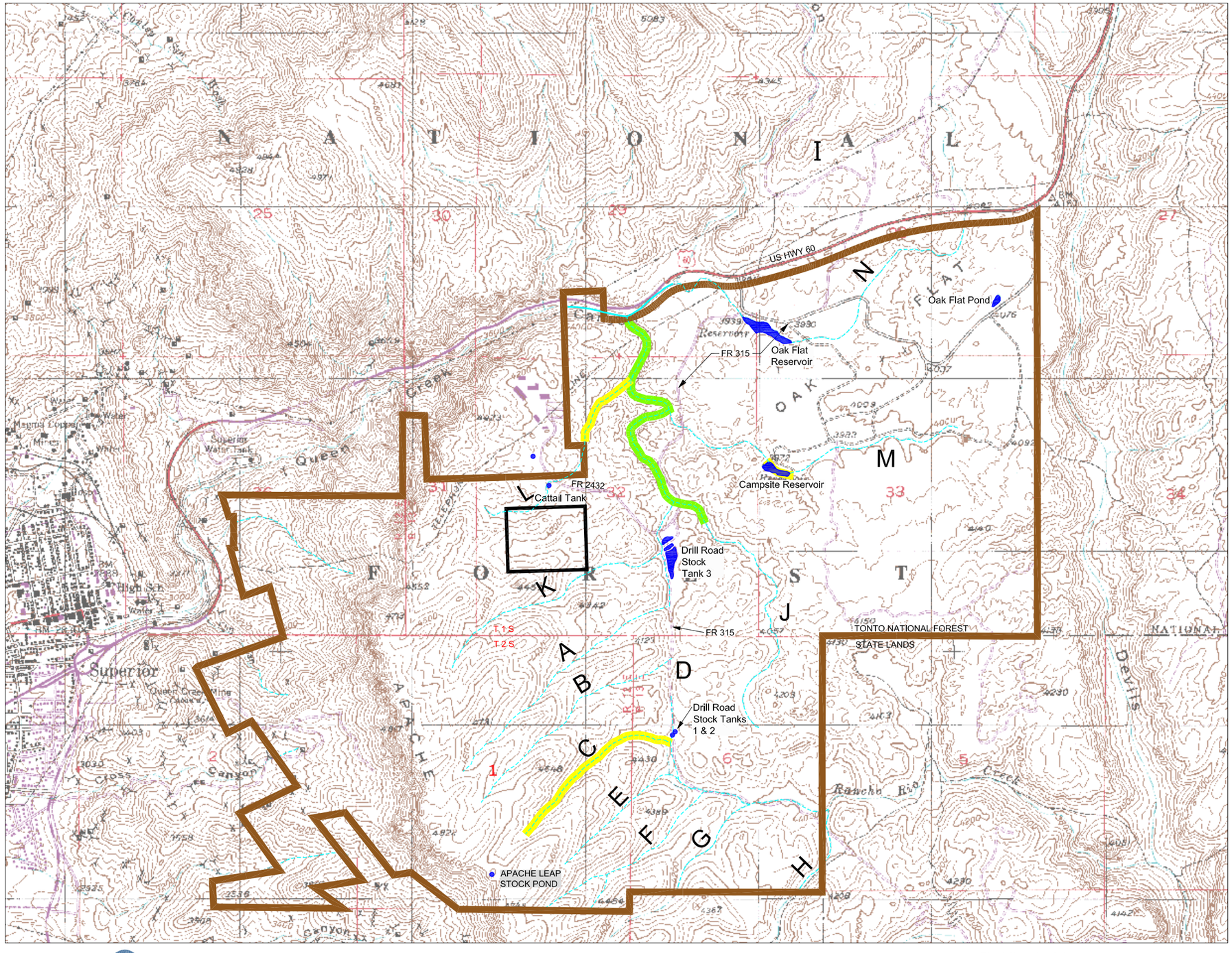
This section discusses findings of the 2004 amphibian survey by location. Visual Encounter Survey forms completed for the following surface water features are included in Appendix A. Selected photographs of the surface water features are included in Appendix B. Figure 3 shows surface water features surveyed and the distribution of red-spotted toads and canyon tree frogs that were observed during this survey effort.

Drainage E

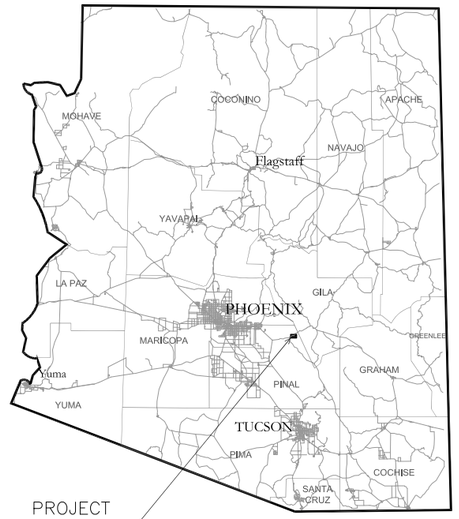
Drainage E is located southwest of the FR 315, east of Apache Leap, along the southern boundary of the Parcel (Figure 2). Most of this drainage was dry; however, it was holding some water in a few tinajas higher up near Apache Leap. More water was noted in 2004 than what had been noted during surveys completed the previous year in May. No herpetofauna were noted within Drainage E. Although no ranids were observed, a Visual Encounter Survey form was completed for this drainage and is included in Appendix A. Photograph 1 shows pooling along Drainage E looking downstream from just below Apache Leap.

Drainage C

Drainage C occurs downstream from the Apache Leap Stock Pond (Figure 2). This drainage supported sporadic pooling in tinajas during this site visit. A black-necked garter snake and numerous (200 plus) tadpoles (Photograph 2) were noted in one of these pools. No adult or juvenile frogs or toads were noted along this drainage. All the tadpoles appeared to be the same species, which was later identified as red-spotted toad. A Visual Encounter Survey form was completed for this drainage and is included in Appendix A.



CONTEXT MAP



LEGEND

- Parcel Boundary
- Private In-holding Boundary
- Ephemeral Drainage
- Intermittent Stream
- Known Canyon tree frog and Red-spotted toad distribution
- Known Red-spotted toad distribution
- Pond, Reservoir or Stock Tank
- K — Drainage Identification
- FR — FOREST ROAD

0 300 600 M

Scale 1" = 600 Meters

Pinal County, Arizona
Superior, 1:24000 USGS Maps

WestLand Resources Inc.
Engineering and Environmental Consultants
2343 E. Broadway Blvd. Suite 202
Tucson, Az 85719 (520) 206-9585

Resolution Copper Company

2004 AMPHIBIAN SURVEY, FEDERAL PARCEL

AMPHIBIAN DISTRIBUTION MAP

Figure 3

Oak Flat Reservoir Drainage

The Oak Flat Reservoir and associated drainage was surveyed from the drainage's confluence with Queen Creek to approximately 300 m (1,000 feet) upstream from the Oak Flat Reservoir (Figure 2). Photograph 3 shows the dry Oak Flat Reservoir. Photograph 4 shows red-spotted toad eggs and very small (approximately 4 cm [1.5 inches] long) tadpoles that were observed in the drainage downstream from the dry reservoir. A Visual Encounter Survey form was completed for this drainage and is included in Appendix A.

Queen Creek

A reach of Queen Creek that occurs west of the Parcel was surveyed in 2003 and found to support canyon tree frog tadpoles. Queen Creek within the Parcel was dry in the 2004 survey effort except for a few shallow pools, which were obviously a result of rain the previous night. No herpetofauna were noted. Photograph 5 was taken at the western Parcel boundary along Queen Creek looking upstream. Although no ranids were observed, a Visual Encounter Survey form was completed for this drainage and is included in Appendix A.

Drainage L

Drainage L is located south of Queen Creek east and southeast of the mining facilities along the north western boundary of the Parcel (Figure 2). Drainage L was surveyed in June 2003 and at that time supported canyon tree frogs and red-spotted toads. In 2004, we surveyed this drainage from Queen Creek to where the drainage intersects Oak Flat Reservoir. Again, in 2004, both red-spotted toad and canyon tree frog tadpoles were noted along Drainage L. Immediately upstream from Queen Creek there were pools containing red-spotted toad and canyon tree frog tadpoles. The canyon tree frog tadpoles had begun growing legs and were easily identified as canyon tree frog because of the yellow hindquarters and the toe pads. Photograph 6 was taken of the pools where canyon tree frog tadpoles were observed. Also, a black-necked garter snake (Photograph 7) was observed eating tadpoles in this area. Additionally, where this drainage and Drainage J cross FR 315, numerous red-spotted toads and canyon tree frogs were observed crossing the road during nighttime surveys on August 16, 2004, at which time it was raining steadily. At this time four red-spotted toads and two canyon tree frogs were captured and identified. Due to their stature and movement characteristics it was easily determined that the majority of the species hopping across the road were red-spotted toads. Two Visual Encounter Survey forms were completed for this drainage and are included in Appendix A.

Drainage M

Drainage M was surveyed from its confluence with Drainage L to its confluence with Drainage J (Figure 2). Significant pooling was noted along Drainage M just upstream from its confluence with Drainage L. No tadpoles were noted in these pools; they are deeper and cooler than those located in Drainage L. No Visual Encounter Survey form was completed for Drainage M.

Drainage J

Drainage J was surveyed from its confluence with Drainage M to where it intersects FR 315 (Figure 2). Shallow pooling occurs along this drainage just upstream from Drainage M but the drainage becomes dry approaching FR 315. The shallow pools occurring along this drainage supported red-spotted toad tadpoles (Photograph 8). As is the case with Drainage L, numerous red-spotted toads and a few canyon tree frogs were observed crossing FR 315 in the vicinity of this drainage. A Visual Encounter Survey form was completed for this drainage and is included in Appendix A.

Apache Leap Stock Pond

The Apache Leap Stock Pond is located immediately upstream from Drainage C along the Apache Leap in southwestern portion of the Parcel (Figure 2). The stock pond was not holding as much water as was noted in May 2003 and no herpetofauna were noted in our survey efforts. Photograph 9 shows the pond. There were many dead snails noted floating on the surface of the pond. No evidence to the possible cause of the snail die-off was noted. Although no ranids were observed, a Visual Encounter Survey form was completed for this pond and is included in Appendix A.

Cattail Tank

The Cattail Tank is located just south of FR 2432 immediately upstream of Drainage L (Figure 2). This tank was visited on August 16, 2004 and again on August 18, 2004 due to the rainfall event that occurred on the afternoon and evening of August 16, 2004. Photograph 10 shows the tank after the rainfall event. This tank held red-spotted toad tadpoles when it was visited in June 2003. No herpetofauna were noted in or around the tank in 2004. On August 18, the tank did support some surface water, probably as a result of the storm event, but no herpetofauna were noted in or around the tank. Two Visual Encounter Survey forms were completed for this tank and are included in Appendix A.

Drill Road Stock Tanks 1 and 2

Drill Road Stock Tanks 1and 2 (southern most tanks along FR 315) supported more water in 2003 than in 2004. Photographs 11 and 12 show Drill Road Stock Tanks 1 and 2, respectively. The banks of these tanks were heavily impacted from their use by cattle. No herpetofauna were noted during survey of these tanks. Although no ranids were encountered, a Visual Encounter Survey form was completed for each tank and are both included in Appendix A.

Drill Road Stock Tank 3

Drill Road Stock Tank 3 is the largest of the stock tanks along FR 315. In 2003 there were numerous Arizona tiger salamander noted in this tank as well as dead crayfish. This year, no Arizona tiger salamander were noted but there were numerous dead crayfish. Additionally, a great blue heron was noted foraging along the bank of the tank. Two surveys were conducted on this tank, on August 16 and on August 18, 2004. There was a light, intermittent rain during survey of this tank on August 16. This

tank was holding considerably less water than during site visits in 2003. No herpetofauna were noted in or around the tank. No photographs were taken of the tank. Although no ranids were encountered, two Visual Encounter Survey forms were completed for this tank and are included in Appendix A.

Oak Flat Pond

The Oak Flat Pond, which was completely dry during site visits in 2003, was holding surface water during the 2004 survey effort. Photograph 13 shows the pond. No herpetofauna were noted. Although no ranids were encountered, a Visual Encounter Survey form was completed for this pond and is included in Appendix A.

Campsite Reservoir

Campsite Reservoir is located along Drainage M just below Oak Flat Campground (Figure 2). This reservoir was dry during site visits in 2003; however, during the 2004 survey effort the reservoir supported surface water and red-spotted toad tadpoles (Photograph 14). A Visual Encounter Survey form was completed for the reservoir and is included in Appendix A.

3.2.2 Reptile Observations

In addition to the focused amphibian survey, opportunistic observation of reptiles were also conducted. Reptiles that were noted on the Parcel during the 2004 survey effort are listed in Table 1.

Table 1. Reptiles noted on Resolution Parcel in 2004.

Common Name	Scientific Name
banded gecko	*Coleonyx variegatus*
whiptail lizard species	*Cnemidophorus* sp.
Arizona black rattlesnake	*Crotalus viridis cerberus*
western diamondback rattlesnake	*Crotalus atrox*
black-tailed rattlesnake	*Crotalus molossus*
collared lizard	*Crotaphytus collaris*
lesser earless lizard	*Holbrookia maculata*
gopher snake	*Pituophis melanoleucus*
chuckwalla	*Sauromalus obesus*
spiney lizard	*Sceloporus* sp.
black-necked garter snake	*Thamnophis cyrtopsis*

4. CONCLUSIONS

Neither Chiricahua leopard frog nor lowland leopard frog were detected during focused survey of the Parcel in 2004. The habitats found within the Parcel would be considered marginal to poor for these

species. These species require a reliable source of surface water, which has not been noted within the Parcel. Predatory species (i.e., crayfish and tiger salamander) that have been associated with decreasing ranid populations in Arizona occur within the on-site surface water seasonal features. The seasonal stock ponds on the Parcel are home primarily to the introduced Arizona tiger salamander (a known predator of ranid tadpoles), which apparently are stocked and seined each year and sold as bait. Although the Parcel occurs within the elevation range and potentially supports habitat for the Chiricahua leopard frog, there are no known populations or historical records for Chiricahua leopard frog from Pinal County. Based upon the species-specific surveys that have been conducted to date and the current condition of aquatic habitats within the Parcel, we do not expect Chiricahua leopard frog or lowland leopard frog to occur on the Parcel.

Red-spotted toad and canyon tree frog occur throughout the Parcel within lotic systems where surface water is present. The known distribution of red-spotted toad and canyon tree frog throughout the Parcel is shown in Figure 3. Portions of the Parcel that were not surveyed but that likely also support these two amphibians include the reach of Drainage J southeast of FR 315 and Drainage K. No red-spotted toads or canyon tree frogs were noted in lentic systems.

The Interior Chaparral habitat biotic community dominates the Parcel and the reptile relationships within chaparral are generally ill-defined (Brown, 1994). Essentially, every habitat type within the Parcel can be utilized by reptiles, and the presence of the rock and boulder formations on the Parcel provide numerous opportunities for reptile shelter. As listed in Table 1, 11 reptile species were observed on the Parcel during the 2004 survey effort.

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APPENDIX A

CHIRICAHUA LEOPARD FROG VISUAL ENCOUNTER SURVEY DATA SHEETS

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unnamed Drainage E

SITE AT:

for use by central data repository only: NEW SITE Y N; NUM

*UTM ZONE: 11 (12) 13

*EASTING: 494570 | *NORTHING: 3682750 | *ELEV: 4240 m (ft)

*QUAD: Superior | *MIN: (7.5) 15 | *YEAR: 1981 | *COUNTY: AZ-PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y: 06/16/2004 | *START TIME: 1000 | *STOP TIME: 1200 | *SEARCH TIME: 30 min | *OBSERVERS: L. Barnes A. Bist

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | (Both Banks)

* VOUCHERS: Specimen Photo 00 Habitat Photo 01

Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: (Lentic) (Lotic)

*H_2O TYPE: Canal Plant outflow (Riverine) Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap (Hand exploration) Snorkel Boat Call playback Other

TDS: 110 ppm µs | pH: 6.2

REL. HUM. %

*T_{AIR}: 28.5 °C F

*T_{WATER}: 31.1 °C F

WATER CLARITY: (Extremely clear) Moderately clear Extremely heavily turbid

*LENTIC LENGTH: m | *LENTIC WIDTH: m | *LOTIC WIDTH: (0-2m) 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m (3-5 m) 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt (Sand) (Gravel) Cobble (Boulder) Bedrock

*WIND: < 1 mph (1-3 mph) 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	0	
SUBMERGED	0	
EMERGENT	0	
PERIMETER	40	Bermuda grass
CANOPY	30	mountain mahogany

*PREDATORS: (include scat and tracks)

Leeches (Boatmen) (Backswimmers) (Dragonflies)

Belostomatids Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: photo #1 looking downstream 494104; 3682405
no herpetofauna noted

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Locality Data

*SITE: unnamed Drainage C

SITE AT:

For use by central data repository only: NEW SITE Y N | NUM

*UTM ZONE: 11 12 13

*EASTING: 493994

*NORTHING: 3682935

*ELEV: 4135 m

*QUAD: Superior

*MIN: 7.5 15

*YEAR: 1981

*COUNTY: AZ---PINAL

DIRECTIONS: Apache Leap pond drainage

Site and Visit Conditions

*DATE: m m d d y y y y 08/16/2004

*START TIME: 1245

*STOP TIME: 1405

*SEARCH TIME: 5 min

*OBSERVERS: K Barnes, A Best

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | (Both Banks)

* VOUCHERS: Specimen Photo: 09 Habitat Photo: 03

Specimen(s): (Y) N Specimen #s: 1

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal Plant outflow (Riverine) Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: 100 ppm

pH: 8

REL. HUM. %

*T_{AIR}: 33 (C) F

*T_{WATER}: 34.8 (C) F

WATER CLARITY: Extremely clear (Moderately clear) Extremely heavily turbid

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: 0-2m (3-5m) 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m (3-5 m) 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt (Sand) (Gravel) Cobble (Boulder) Bedrock

*WIND: < 1 mph (1-3 mph) 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: 0-20% (21-40%) 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	0	
SUBMERGED	0	
EMERGENT	10	eleocharis sp.
PERIMETER	30	bermuda
CANOPY	0	

*PREDATORS: (include scat and tracks)

(Leeches) (Boatmen/Backswimmers) (Dragonflies)

Belostomatids Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles (Garter snakes) Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES:

493994; 3682751

photo 6, 7, 8 black-necked garter

photo 9 tadpoles

photo 10, 11, 12 pool

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
RANCAT	Uncertain (Certain)	Egg (Larvae) Juvenile Adult	200+	
BUFPUN	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: Reservoir Drainage

SITE AT:

For use by central data repository only: NEW SITE Y N; NUM

*UTM ZONE: 11 (12) 13

*EASTING: 4 9 4 8 1 4

*NORTHING: 3 6 8 5 5 1 0

*ELEV: 3872 (ft) m

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: AZ-PLNA

DIRECTIONS: ephemeral drainage b/t magma mine Reservoir and Queen Creek

Site and Visit Conditions

*DATE: m m d d y y y y: 08 18 2004

*START TIME: 1030

*STOP TIME: 1120

*SEARCH TIME: 20 min

*OBSERVERS: K. Barnes A. Best

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | (Both Banks)

* VOUCHERS: Specimen Photo ___ Habitat Photo ___ Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: Lentic (Lotic)

*H_2O TYPE: Canal Plant outflow (Riverine) Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap (Hand exploration) Snorkel Boat Call playback Other

TDS: 600 ppm pH: 7

REL. HUM: %

*T_{AIR}: 30.3 (C) F

*T_{WATER}: 24.4 (C) F

WATER CLARITY: (Extremely clear) Moderately clear Extremely heavily turbid

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt Sand Gravel (Cobble) (Boulder) (Bedrock)

*WIND: < 1 mph 1-3 mph (4-7 mph) 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING		
SUBMERGED		
EMERGENT		
PERIMETER		
CANOPY		

*PREDATORS: (include scat and tracks)

(Leeches) (Boatmen/Backswimmers) Dragonflies

Belostomatids (Beetles) Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES:

photo 42 dry magma mine Reservoir; photo 43 from drainage point

Continued on back (if needed)

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
BUPU	Uncertain (Certain)	(Egg) Larvae Juvenile Adult		
BUPU	Uncertain (Certain)	Egg (Larvae) Juvenile Adult	5	very small ~4cm long
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: Queen Creek

SITE AT:

For use by central data repository only: NEW SITE Y N NUM

*UTM ZONE: 11 (12) 13

*EASTING: 493958

*NORTHING: 3685410

*ELEV: ~3997 m ft

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: AZ-PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y 08 17 2004

*START TIME: 0850

*STOP TIME: 0945

*SEARCH TIME: 5 min

*OBSERVERS: L. Barnes, A. Best

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | (Both Banks)

* VOUCHERS: Specimen Photo 00 Habitat Photo 01

Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: Lentic (Lotic)

*H_2O TYPE: Canal Plant outflow (Riverine) Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip ne) Seine Trap (Hand exploration) Snorkel Boat Call playback Other

TDS: 100 ppm (H) S

pH: 6.8

REL. HUM: %

*T_{AIR}: 27.2 (C) F

*T_{WATER}: 23 (C) F

WATER CLARITY: Extremely clear (Moderately clear) Extremely heavily turbid

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: (0-2m) 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m (21-50 m) >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt Sand Gravel (Cobble) (Boulder) (Bedrock)

*WIND: (< 1 mph) 1-3 mph 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: (Y) N

VEGETATION	%	PROMINENT SPECIES
FLOATING	0	
SUBMERGED	0	
EMERGENT	0	
PERIMETER		Tobosa
CANOPY	30	cottonwood / sycamore

*PREDATORS: (include scat and tracks)

Leeches Boatmen/Backswimmers Dragonflies

Belostomatids Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: A few tinajas had water probably from last nights storm event (estimated 1.6")

photo #16 @ 493958; 3685410

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unnamed Drainage L

SITE AT:

For use by central data repository only: SW SITE Y N NUM

*UTM ZONE: 11 (12) 13

*EASTING: 493974

*NORTHING: 3684576

*ELEV: m ft

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: AZ-PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y

*START TIME: 1510

*STOP TIME: 1530

*SEARCH TIME: 5 min

*OBSERVERS: K Barnes A Bost

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | Both Banks

* VOUCHERS: Specimen Photo 00 Habitat Photo 01

Specimen(s): (Y) N Specimen #s: 2

*H_2O CLASS: Lentic Lotic

*H_2O TYPE: Canal Plant outflow (Riverine) Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: 60 µS

pH: 7

REL. HUM. %

*T_{AIR}: 30 °C F

*T_{WATER}: 36.0 °C F

WATER CLARITY: Extremely clear Moderately clear (Extremely heavily turbid)

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt Sand (Gravel) (Cobble) (Boulder) Bedrock

*WIND: < 1 mph 1-3 mph (4-7 mph) 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: 0-20% 21-40% (41-60%) 61-80% 81-100%

PRECIPITATION: None Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	15	algae
SUBMERGED	—	
EMERGENT	—	
PERIMETER	—	
CANOPY	5	EMORY OAK

*PREDATORS: (include scat and tracks)

Leeches (Boatmen/Backswimmers) (Dragonflies) (Belostomatids) Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: 493974; 3684576 — photo 15

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	(Uncertain) Certain	Egg (Larvae) Juvenile Adult	100+	493974; 3684516
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Locality Data

*SITE: unnamed Drainage L

SITE AT:

For use by central data repository only: NEW SITE Y N NUM

*UTM ZONE: 11 (12) 13

*EASTING: 494241

*NORTHING: 3685338

*ELEV: ~3905 m ft

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: AZ-PIMA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y: 08 17 2004

*START TIME: 1000

*STOP TIME: 1240

*SEARCH TIME: min

*OBSERVERS: K. Barnes, A. Best

*EFFORT: Total Perimeter / Partial Perimeter / Left Bank / Right Bank / (Both Banks) — meters

* VOUCHERS: Specimen Photo: ___ Habitat Photo: ___ Specimen(s): Y N Specimen #s:

*H_2O CLASS: Lentic (Lotic)

*H_2O TYPE: Canal Plant outflow Riverine Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap (Hand exploration) Snorkel Boat Call playback Other

TDS: 90 ppm pH: 6

REL. HUM. %

*T_{AIR}: 33.3 °C °F

*T_{WATER}: 24.0 °C °F

WATER CLARITY: Extremely clear (Moderately clear) Extremely heavily turbid

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt (Sand) Gravel Cobble (Boulder) Bedrock

*WIND: < 1 mph (1-3 mph) 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING		
SUBMERGED		
EMERGENT		
PERIMETER		
CANOPY		

*PREDATORS: (include scat and tracks)
Leeches (Boatmen/Backswimmers) (Dragonflies) (Belostomatids) Beetles Warm water fish
Cold water fish Tiger salamanders Bullfrogs
Mud turtles (Garter snakes) Wading birds
Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: pools begin @ confluence w/ Queen creek

photo #17 @ start point. photo 18 @ pool w/ canyon tree frog larva
photo #19 pools below tree frog (many tadpoles)

Continued on back? (Y)N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain (Certain)	Egg (Larvae) Juvenile Adult	12+	
	(Uncertain) Certain	Egg (Larvae) Juvenile Adult		suspected red-spotted toads
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unmarked Apache Cap Tank

SITE AT:

For use by central data repository only: NEW SITE Y N; NUM

*UTM ZONE: 11 (12) 13

*EASTING: 4 9 3 5 5 0

*NORTHING: 3 6 8 2 2 8 4

*ELEV: 4 5 6 5 0 m (ft)

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: PZ-PLNA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y: 08 16 2004

*START TIME: 1220

*STOP TIME: 1240

*SEARCH TIME: 15 min

*OBSERVERS: K. Barnes, A. Best

*EFFORT: (Total Perimeter) Partial Perimeter Left Bank Right Bank Both Banks; meters

* VOUCHERS: Specimen Photo 00 Habitat Photo 0_2; Specimen(s): Y (N); Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland (Stock tank) Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap (Hand exploration) Snorkel Boat Call playback Other

TDS: 120 ppm pH: 6

REL. HUM. %

*T_{AIR}: 31 (°C) °F

*T_{WATER}: 32 (°C) °F

WATER CLARITY: Extremely clear Moderately clear (Extremely heavily turbid)

*LENTIC LENGTH: 10 m

*LENTIC WIDTH: 5 m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m (6-10 m) 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph 1-3 mph (4-7 mph) 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: 0-20% (21-40%) 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	10	algae
SUBMERGED	—	
EMERGENT	—	
PERIMETER	—	
CANOPY	—	

*PREDATORS: (include scat and tracks)

(Leeches) Boatmen/Backswimmers (Dragonflies)

Belostomatids Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES:

large snail die-off; no herpetofauna observed

photo 4,5 - Habitat

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unmarked cattail tank

SITE AT:

For use by central data repository only: NEW SITE Y N NUM:

*UTM ZONE: 11 12 13

*EASTING: 493796

*NORTHING: 3684388

*ELEV: m ~4238 ft

*QUAD: Superior

*MIN: 7.5 15

*YEAR: 1981

*COUNTY: AZ --- PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: mm dd yyyy: 08 16 2004

*START TIME: 1435

*STOP TIME: 1450

*SEARCH TIME: 5 min

*OBSERVERS: K Barnes, A. Bust

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | Both Banks

* VOUCHERS: Specimen Photo __ __ Habitat Photo __ __

Specimen(s): Y N Specimen #s:

*H_2O CLASS: Lentic Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland Stock tank Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: Dip net Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: µs

pH:

REL. HUM. %

*T_{AIR} °C F

*T_{WATER} °C F

WATER CLARITY: Extremely clear Moderately clear Extremely heavily turbid

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph 1-3 mph 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: 0-20% 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: None Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: (Y) N

VEGETATION	%	PROMINENT SPECIES
FLOATING		
SUBMERGED		
EMERGENT		
PERIMETER		
CANOPY		

*PREDATORS: (include scat and tracks)

Leeches Boatmen/Backswimmers Dragonflies
Belostomatids Beetles Warm water fish
Cold water fish Tiger salamanders Bullfrogs
Mud turtles Garter snakes Wading birds
Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: dry stock tank (last year - red spotted toads)
photos 13, 14

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unnamed cattail tank *SITE AT:

For use by central data repository only: NEW SITE Y N NUM

*UTM ZONE: 11 (12) 13 *EASTING 493796 *NORTHING 3684383 *ELEV 4238 m (ft)

*QUAD: Superior *MIN: (7.5) 15 *YEAR: 1981 *COUNTY: AZ-PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y 08 18 2004 *START TIME: 0930 *STOP TIME: 0950 *SEARCH TIME: 5 min *OBSERVERS: K. Barnes, A. Bist

*EFFORT: (Total Perimeter) Partial Perimeter Left Bank Right Bank Both Banks meters

* VOUCHERS: Specimen Photo ___ Habitat Photo 02 Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland (Stock tank) Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: Dip net Seine Trap (Hand exploration) Snorkel Boat Call playback Other

TDS: 430 ppm pH: 6

REL. HUM. % *T_{AIR} 30.6 °C F *T_{WATER} 27.3 °C F

WATER CLARITY: Extremely clear (Moderately clear) Extremely heavily turbid

*LENTIC LENGTH: 12 m *LENTIC WIDTH: 10 m *LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m (11-20 m) 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph (1-3 mph) 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	0	
SUBMERGED	0	
EMERGENT	25	
PERIMETER	30	
CANOPY	0	

*PREDATORS: (include scat and tracks)

Leeches (Boatmen/Backswimmers) (Dragonflies)
Belostomatids Beetles Warm water fish
Cold water fish Tiger salamanders Bullfrogs
Mud turtles Garter snakes Wading birds
Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: dry 2 days ago; standing water is result of rain on 8/16 pm.

photo 90, 40 Habitat

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unmarked Drill Road Tank 1

SITE AT:

For use by central data repository only: NEW SITE Y N NUM

*UTM ZONE: 11 12 13

*EASTING: 4 9 4 5 0 9

*NORTHING: 3 6 8 2 9 4 2

*ELEV: 4136 m (ft)

*QUAD: Superior

*MIN: 7.5 15

*YEAR: 1981

*COUNTY: AZ---PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y: 08 17 2004

*START TIME: 1520

*STOP TIME: 1530

*SEARCH TIME: 5 min

*OBSERVERS:

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | Both Banks

* VOUCHERS: Specimen Photo ___ Habitat Photo 01

Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland (Stock tank) Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: 150 us

pH: 7

REL. HUM. %

*T_{AIR} 34,5 (C) F

*T_{WATER} 31,5 °C F

WATER CLARITY: Extremely clear Moderately clear (Extremely heavily turbid)

*LENTIC LENGTH: 8 m

*LENTIC WIDTH: 5 m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m (6-10 m) 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph (1-3 mph) 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	0	
SUBMERGED		
EMERGENT	0	
PERIMETER		
CANOPY	0	

*PREDATORS: (include scat and tracks)

Leeches Boatmen/Backswimmers (Dragonflies)
Belostomatids Beetles Warm water fish
Cold water fish Tiger salamanders Bullfrogs
Mud turtles Garter snakes Wading birds
Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: recently used tank; cattle sign

photo 35 Habitat Photo photos 37, 38, 39 Aquatic walk stick

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unmarked Drill Road Tank 2

SITE AT:

For use by central data repository only: NEW SITE Y N NUM

*UTM ZONE: 11 (12) 13

*EASTING: 4 9 4 5 1 0

*NORTHING: 3 6 8 0 0 0 5

*ELEV: 4136 m (ft)

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: AZ---PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y 08 17 2004

*START TIME: 1535

*STOP TIME: 1545

*SEARCH TIME: 5 min

*OBSERVERS:

*EFFORT: (Total Perimeter) Partial Perimeter Left Bank Right Bank Both Banks — meters

* VOUCHERS: Specimen Photo __ __ Habitat Photo 01 Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: Lentic Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland (Stock tank) Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: 110 µs

pH: 7

REL. HUM. %

*T_{AIR}: 34.5 °C F

*T_{WATER}: 35.1 °C F

WATER CLARITY: Extremely clear Moderately clear (Extremely heavily turbid)

*LENTIC LENGTH: 10 m

*LENTIC WIDTH: 10 m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): Mud/Silt Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph 1-3 mph 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: None Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y N

VEGETATION	%	PROMINENT SPECIES
FLOATING		
SUBMERGED		
EMERGENT	5	SEDGE
PERIMETER	5	BERMUDA GRASS & SEDGE
CANOPY		

*PREDATORS: (include scat and tracks)

Leeches (Boatmen/Backswimmers) Dragonflies

Belostomatids Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: RECENT USE BY CATTLE

photo 36 Habitat Photo

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unmarked Drill Road Leroy's STOCK Tank (#3)

SITE AT:

For use by central data repository only: NEW SITE? Y N NUM:

*UTM ZONE: 11 12 13

*EASTING: 494496

*NORTHING: 3683995

*ELEV: ~3493 m (ft)

*QUAD: Superior

*MIN: 7.5 15

*YEAR: 1981

*COUNTY: AZ--PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y: 08/16/2004

*START TIME: 1815

*STOP TIME: 1845

*SEARCH TIME: 20 min

*OBSERVERS: K Barnes, A. Bust

*EFFORT: (Total Perimeter) Partial Perimeter | Left Bank | Right Bank | Both Banks

meters

* VOUCHERS: Specimen Photo: 00 Habitat Photo: 0 0

Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal | Plant outflow | Riverine | Wetland | (Stock tank) | Lake | Reservoir | Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine | Trap | Hand exploration | Snorkel | Boat | Call playback | Other

TDS: 140 ppm

pH: 7

REL. HUM. %

*T_{AIR}: 20 (°C) F

*T_{WATER}: 27 (°C) F

WATER CLARITY: Extremely clear | Moderately clear | (Extremely heavily turbid)

*LENTIC LENGTH: m

*LENTIC WIDTH: m

*LOTIC WIDTH: 0-2m | 3-5m | 6-10m | 11-20m | 21-50m | 51-100m | >100m

*RIPARIAN WIDTH: 0-2 m | 3-5 m | 6-10 m | 11-20 m | 21-50 m | >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) | Sand | Gravel | Cobble | Boulder | Bedrock

*WIND: < 1 mph | (1-3 mph) | 4-7 mph | 8-12 mph | 13-18 mph | 19-24 mph | >24 mph

*CLOUD COVER: 0-20% | 21-40% | 41-60% | (61-80%) | 81-100%

PRECIPITATION: None | (Intermittent) | Steady & Light | Steady & Heavy | Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING		algae
SUBMERGED		
EMERGENT		
PERIMETER		
CANOPY		

*PREDATORS: (include scat and tracks)

(Leeches) | (Boatmen/Backswimmers) | Dragonflies

(Belostomatids) | Beetles | Warm water fish

Cold water fish | Tiger salamanders | Bullfrogs

Mud turtles | Garter snakes | (Wading birds)

Blackhawk | Mammals | (Crayfish)

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: many dead crayfish (great blue heron sighted at this site earlier today)
this tank is much smaller (holding less water than last year)

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Attachment 2: Chiricahua Leopard Frog Visual Encounter Survey

March 2003

Locality Data

*SITE: unnamed Lazy Drill Road STOCK TANK 3

SITE AT:

For use by central data repository only: NEW SITE Y N NUM:

*UTM ZONE: 11 (12) 13

*EASTING: 494498

*NORTHING: 3168395

*ELEV: ~3993 m ft

*QUAD: Superior

*MIN: (7.5) 15

*YEAR: 1981

*COUNTY: AZ--PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y 08 17 2004

*START TIME: 1550

*STOP TIME: 1610

*SEARCH TIME: 15 min

*OBSERVERS: K Barnes, A. Best

*EFFORT: Total Perimeter meters | Partial Perimeter | Left Bank | Right Bank | Both Banks

* VOUCHERS: Specimen Photo 00 Habitat Photo 00

Specimen(s): Y (N) Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland (Stock tank) Lake Reservoir Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: 140 ppm pH: 7

REL. HUM: %

*T_{AIR}: 30.1 °C (F)

*T_{WATER}: 25 °C (F)

WATER CLARITY: Extremely clear Moderately clear (Extremely heavily turbid)

*LENTIC LENGTH: 70 m

*LENTIC WIDTH: 25 m

*LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m 11-20 m 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph 1-3 mph (4-7 mph) 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: None Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y N

VEGETATION	%	PROMINENT SPECIES
FLOATING	60	algae
SUBMERGED	0	
EMERGENT	5	sedge
PERIMETER	85	sedge
CANOPY	0	

*PREDATORS: (include scat and tracks)

(Leeches) Boatmen/Backswimmers (Dragonflies)

Belostomatids Beetles Warm water fish

Cold water fish Tiger salamanders Bullfrogs

Mud turtles Garter snakes Wading birds

Blackhawk Mammals (Crayfish)

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES:

18 dead crayfish noted

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Locality Data

*SITE: unnamed Oak Flat Pond | SITE AT:

For use by central data repository only: NEW SITE Y N | NUM:

*UTM ZONE: 11 (12) 13 | *EASTING: 4961383 | *NORTHING: 3685427 | *ELEV: ~4109 ft m

*QUAD: Superior | *MIN: (7.5) 15 | *YEAR: 1981 | *COUNTY: AZ --- PINAL

DIRECTIONS:

Site and Visit Conditions

DATE: m m d d y y y y: 08 17 2004 | *START TIME: 1300 | *STOP TIME: 1320 | *SEARCH TIME: 10 min | *OBSERVERS: K Barnes, A-Best

EFFORT: (Total Perimeter) Partial Perimeter | Left Bank | Right Bank | Both Banks | meters

* VOUCHERS: Specimen Photo: 00 Habitat Photo: 02 Specimen(s): Y N Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal | Plant outflow | Riverine | Wetland | (Stock tank) | Lake | Reservoir | Small metal/concrete tanks or drinkers

SEARCH METHODS: (Dip net) Seine | Trap | Hand exploration | Snorkel | Boat | Call playback | Other

TDS: 30 ppm | pH: 7

REL. HUM. % | *T_{AIR}: 32.0 °C F | *T_{WATER}: 35.9 °C F

WATER CLARITY: Extremely clear | Moderately clear | (Extremely heavily turbid)

*LENTIC LENGTH: 50 m | *LENTIC WIDTH: 15 m

*LOTIC WIDTH: 0-2m | 3-5m | 6-10m | 11-20m | 21-50m | 51-100m | >100m

*RIPARIAN WIDTH: 0-2 m | 3-5 m | 6-10 m | 11-20 m | 21-50 m | >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) | Sand | Gravel | Cobble | Boulder | Bedrock

WIND: < 1 mph | 1-3 mph | (4-7 mph) | 8-12 mph | 13-18 mph | 19-24 mph | >24 mph

*CLOUD COVER: (0-20%) | 21-40% | 41-60% | 61-80% | 81-100%

PRECIPITATION: (None) | Intermittent | Steady & Light | Steady & Heavy | Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING	10	
SUBMERGED	0	
EMERGENT	40	Eleocharis sp.
PERIMETER	0	
CANOPY	0	

*PREDATORS: (include scat and tracks)
Leeches | Boatmen/Backswimmers | (Dragonflies)
Belostomatids | Beetles | Warm water fish
Cold water fish | Tiger salamanders | Bullfrogs
Mud turtles | Garter snakes | Wading birds
Blackhawk | Mammals | Crayfish

OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES: This pond was completely dry during survey last year. many rabbit pellets & deer scat noted photos 30, 31 Habitat photos

Continued on back? Y N

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

Locality Data

*SITE: unnamed campsite Reservoir | SITE AT:

For use by central data repository only: NEW SITE Y N | NUM

*UTM ZONE: 11 (12) 13 | *EASTING: 495060 | *NORTHING: 3684528 | *ELEV: 3936 (ft) m

*QUAD: Superior | *MIN: 7.5 (15) | *YEAR: 1981 | *COUNTY: AZ—PINA

DIRECTIONS:

Site and Visit Conditions

*DATE: m m d d y y y y 08/17/2004 | *START TIME: 1345 | *STOP TIME: | *SEARCH TIME: min | *OBSERVERS: C. Barnes, A. Best

*EFFORT: (Total Perimeter) Partial Perimeter | Left Bank | Right Bank | Both Banks | meters

* VOUCHERS: Specimen Photo: 01 Habitat Photo: 02 | Specimen(s): Y N | Specimen #s:

*H_2O CLASS: (Lentic) Lotic

*H_2O TYPE: Canal Plant outflow Riverine Wetland Stock tank Lake (Reservoir) Small metal/concrete tanks or drinkers

* SEARCH METHODS: (Dip net) Seine Trap Hand exploration Snorkel Boat Call playback Other

TDS: 40 ppm | pH: 6

REL. HUM: % | *T_{AIR}: 39.7 °C °F | *T_{WATER}: 37.0 °C °F

WATER CLARITY: Extremely clear (Moderately clear) Extremely heavily turbid

*LENTIC LENGTH: m | *LENTIC WIDTH: m | *LOTIC WIDTH: 0-2m 3-5m 6-10m 11-20m 21-50m 51-100m >100m

*RIPARIAN WIDTH: 0-2 m 3-5 m 6-10 m (1-20 m) 21-50 m >50 m

*PRIMARY SUBSTRATE (mark 1-3): (Mud/Silt) Sand Gravel Cobble Boulder Bedrock

*WIND: < 1 mph (1-3 mph) 4-7 mph 8-12 mph 13-18 mph 19-24 mph >24 mph

*CLOUD COVER: (0-20%) 21-40% 41-60% 61-80% 81-100%

PRECIPITATION: (None) Intermittent Steady & Light Steady & Heavy Snow/Sleet

DRY SITE: Y (N)

VEGETATION	%	PROMINENT SPECIES
FLOATING		
SUBMERGED		
EMERGENT		
PERIMETER		
CANOPY		

*PREDATORS: (include scat and tracks)
Leeches Boatmen/Backswimmers Dragonflies
Belostomatids Beetles Warm water fish
Cold water fish Tiger salamanders Bullfrogs
Mud turtles Garter snakes Wading birds
Blackhawk Mammals Crayfish

*OTHER ORGANISMS:

OTHER ORG. NOTES:

SITE / SURVEY NOTES:

photos 32 tadpoles photos 33, 34 Habitat ↑ @ reservoir then ↓ (Continued on back? Y N)

Herpetofauna Observations

*SPECIES	CERTAINTY	LIFE STAGE	#	NOTES
	Uncertain (Certain)	Egg (Larvae) Juvenile Adult	30-50	
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		
	Uncertain Certain	Egg Larvae Juvenile Adult		

APPENDIX B

PHOTOGRAPHIC DOCUMENTATION OF 2004 AMPHIBIAN SURVEY

Photo 1. View of Drainage E from Apache Leap looking downstream.

Photo 2. View of red-spotted toad tadpoles in pool along Drainage C.

WestLand Resources, Inc.
Engineering and Environmental Consultants
2343 E. Broadway Boulevard, Suite 202,Tucson, AZ 85719
520.206.9585 Fax 520.206.9518

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey

Photo 3. View of dry Oak Flat Reservoir.

Photo 4. View of amphibian egg masses (suspected red-spotted toad) in the Oak Flat Reservoir drainage.

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey
Sheet 2

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Engineering and Environmental Consultants
2343 E. Broadway Boulevard, Suite 202, Tucson, AZ 85719
520.206.9585 Fax 520.206.9518

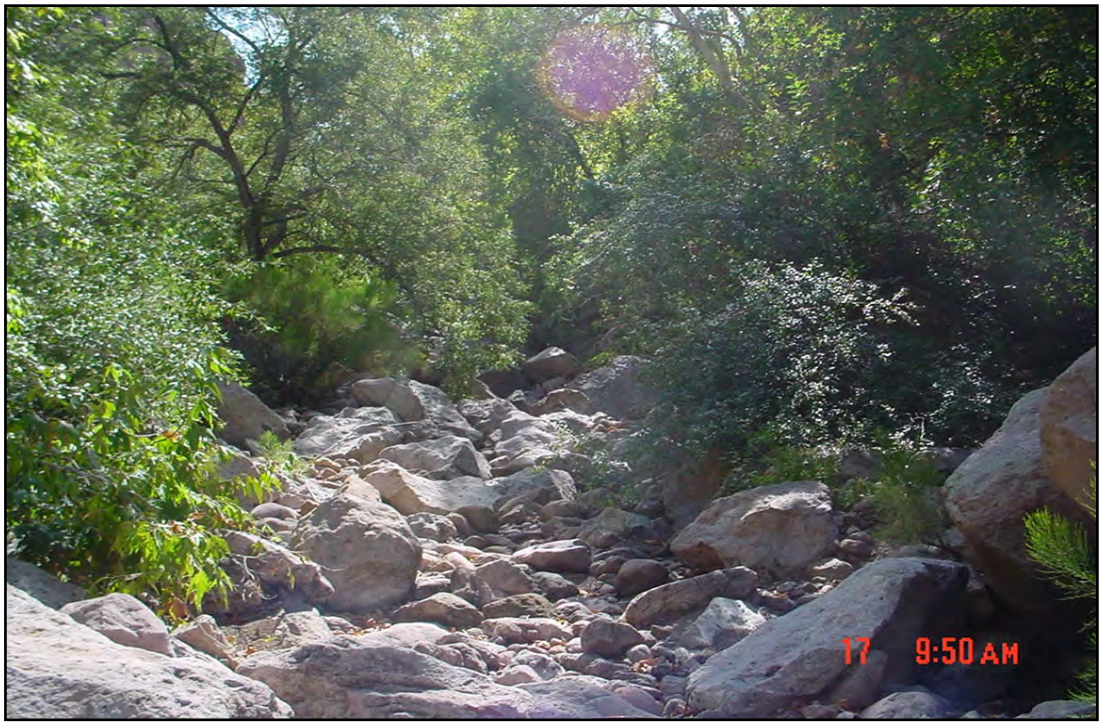

Photo 5. View of Queen Creek looking upstream from western Parcel boundary.

Photo 6. View of pools that support canyon tree frog and red-spotted toad tadpoles along Drainage L.

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520.206.9585 Fax 520.206.9518

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey
Sheet 3

Photo 7. Black-necked garter snake found eating tadpoles along Drainage L.

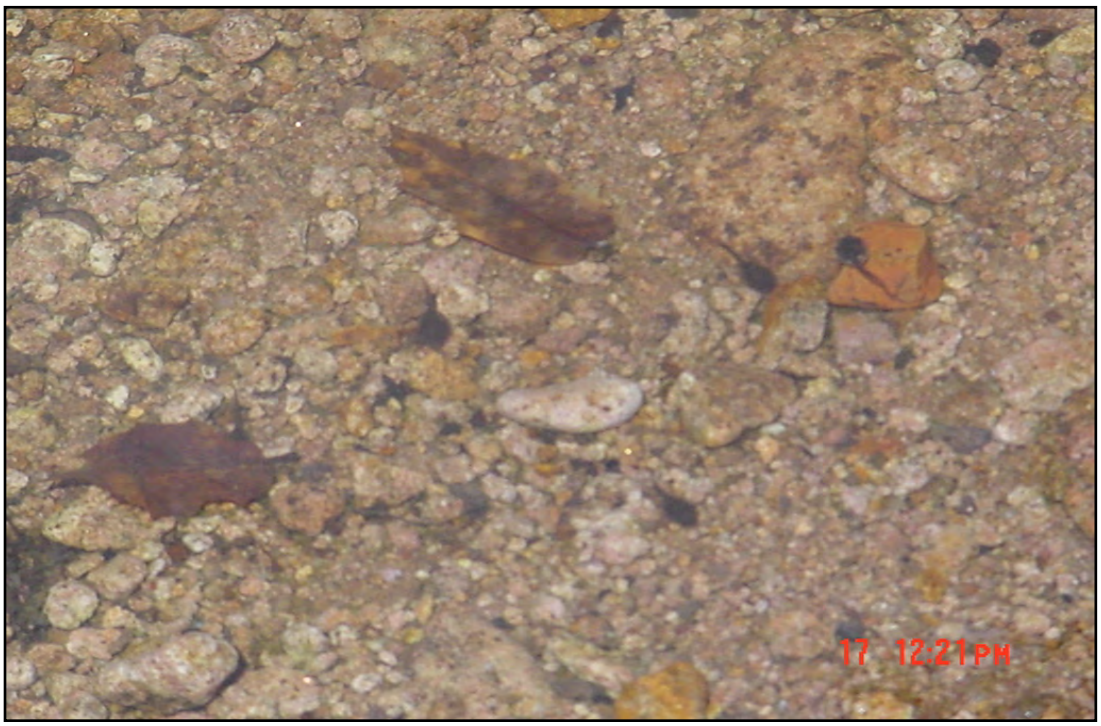

Photo 8. Red-spotted toad tadpoles in pool along Drainage J.

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Engineering and Environmental Consultants
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520.206.9585 Fax 520.206.9518

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey

Photo 9. Apache Leap Pond. Note the dead snails floating on water surface.

Photo 10. View of Cattail Tank after storm event. This tank was dry previous to rain event.

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Engineering and Environmental Consultants
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520.206.9585 Fax 520.206.9518

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey

Photo 11. View of Drill Road Stock Tank 1.

Photo 12. View of Drill Road Stock Tank 2.

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Engineering and Environmental Consultants
2343 E. Broadway Boulevard, Suite 202,Tucson, AZ 85719
520.206.9585 Fax 520.206.9518

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey
Sheet 6

Photo 13. View of Oak Flat Pond.

Photo 14. View of red-spotted toad tadpoles noted within the Campsite Reservoir.

WestLand Resources, Inc.
Engineering and Environmental Consultants
2343 E. Broadway Boulevard, Suite 202,Tucson, AZ 85719
520.206.9585 Fax 520.206.9518

Resolution Copper Company

Photo Documentation
of 2004 Amphibian Survey
Sheet 7

ATTACHMENT 3

DEVILS CANYON DRAINAGE STOCK TANK SURVEYS DURING 2010 AND 2011, ARIZONA GAME & FISH DEPARTMENT

Devils Canyon Drainage Stock Tank Surveys During 2010 and 2011

Clayton D. Crowder and Anthony T. Robinson
Arizona Game and Fish Department
5000 W. Carefree Hwy
Phoenix, AZ 85086

December 20, 2011

Arizona Game and Fish Department Mission

To conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs, and to provide wildlife resources and safe watercraft and off-highway vehicle recreation for the enjoyment, appreciation, and use by present and future generations.

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ACKNOWLEDGMENTS

The surveys conducted in the Devils Canyon and Mineral Creek drainages in 2010 and 2011 occurred with the assistance of multiple agency personnel and private citizens. These surveys were funded through an agreement with U.S. Fish and Wildlife Service as part of the Central Arizona Project (CAP) Gila River Basin Native Fishes Conservation Program. Involved in the 2010 surveys were individuals from Arizona Game and Fish Department (Tony Robinson, Clay Crowder, Natalie Robb, Danny Rodriguez, Steve Prager, Abi Medina and Kent Mosher). Additionally, the 2011 surveys included personnel from Arizona Game and Fish Department (Clay Crowder, Tony Robinson, Kent Mosher, Andrea Steffen and Kyle Yarush). Access to lower Devils Canyon was granted by ASARCO Ray Mine and escort provided by Ray Mine personnel (Keith Warren and Brian Munson), likewise access through Resolution Copper's JI Ranch was provided by the property caretakers.

Recommended Citation:

Crowder, C.D. and A.T. Robinson. 2011. Devils Canyon drainage stock tank surveys during 2010 and 2011. Arizona Game and Fish Department, Phoenix. 9pp.

INTRODUCTION

Gila chub *Gila intermedia* was federally listed as endangered with critical habitat in 2005 (Federal Register 2005). Upper Mineral Creek, the watershed immediately upstream of the ASARCO Ray Mine Big Box Dam, was designated as critical habitat for Gila chub at the time of listing. According to Robinson (2008a), Gila chub were last documented in upper Mineral Creek in 2000. Subsequent surveys completed in 2002, 2006 and 2008 were not able to document the presence of Gila chub, and the species is considered extirpated from upper Mineral Creek (Robinson 2008a).

Robinson (2008a) recommended repatriation of Gila chub in upper Mineral Creek, as well as additional surveys of the drainage; namely the ~650 meter reach of Mineral Creek below Big Box Dam and the ASARCO Ray Mine tunnel, and the Devils Canyon drainage, to ascertain the possibility of Gila chub existing outside the upper Mineral Creek reach (Robinson 2008a). Mineral Creek lineage chub would be the preferred lineage for repatriation of chub into upper Mineral Creek (Robinson 2008a). In 2008, Robinson (2008b) performed aerial helicopter surveys to identify perennial reaches and stock tanks within the Devils Canyon drainage.

In 2009, Arizona Game and Fish Department (AGFD) conducted fish surveys in Mineral Creek from Big Box Dam to ASARCO Ray Mine tunnel, in Devils Canyon and in Rawhide Canyon, a sub-drainage of Devils Canyon located approx. 2.65 km upstream of Devils Canyon and Mineral Creek confluence (Robinson et al. 2010). No Gila chub or other native fish were observed or captured during the surveys. However, nonnative Green sunfish *Lepomis cyanellus*, fathead minnow *Pimephales promelas* and mosquitofish *Gambusia affinis* were detected. These nonnative species were previously detected in Devils Canyon (Schwemm 2002; AGFD unpublished data) and Mineral Creek, below Big Box Dam (Andrews and King 1997). Robinson et al. (2010) suggested that nonnative fish species within Devils Canyon and lower Mineral Creek could have originated from: 1) upstream migration from the Gila River to Mineral Creek prior to the construction of the ASARCO Big Box Dam, 2) illegally stockings or 3) downstream migration into Devils Canyon from stock tanks within the watershed. Robinson (2008b) recommended that all tanks in the Devils Canyon drainage be surveyed prior to any renovation effort to restore Gila chub to the Devils Canyon, Big Box Dam reservoir and lower Mineral Creek.

The objective of the surveys conducted in 2010 and 2011 was to complete the inventory of perennial waters (streams reaches and tanks) in the Devils Canyon drainage to document the presence and distribution of Gila chub and other fish and aquatic vertebrate species within the drainage. The inventory was also done to identify source populations of nonnative fish (i.e. stock ponds). Fish distribution information is needed if Gila chub are repatriated to upper Mineral Creek and if the watershed above Big Box Dam is renovated and managed for native fishes (Robinson 2008a).

STUDY SITE

Devils Canyon is a tributary to Mineral Creek, which is a tributary to the Gila River in Pinal County Arizona. Devils Canyon joins Mineral Creek approximately 14 km upstream of the Mineral Creek and Gila River confluence, on the southwestern edge of the Pinal Mountains (Figure 1). Devils Canyon begins at an elevation of approximately 685 m and runs in a north-to-south direction, bisecting U.S. Highway 60 in the uppermost 5.6 km of the canyon. Devils

Canyon has five main sub-tributaries; the three minor tributaries entering Devils Canyon from the west are Rancho Rio Creek, Hackberry Creek and Oak Creek. The largest tributary, Rawhide Canyon, runs in a northeast-to-south direction. Rawhide Canyon's confluence with Devils Canyon lies approximately 10.8 km downstream of Devils Canyon and US Highway junction. Another tributary is Iron Canyon, which drains the Top of the World area and then parallels U.S. Highway 60 before meeting Devils Canyon. The Devils Canyon drainage covers an area of about 92.35 km^2. More than 20 tanks are known to occur throughout the drainage (Robinson 2008b).

METHODS

Stock Tank Surveys

Using a combination of data collected from Robinson's (2008b) aerial survey of Devils Canyon drainage (Figure 3), TOPO! 4® software and aerial images from Google Earth®, 29 stock tanks within Devils Canyon drainage were identified. An additional three tanks were discovered during the surveys. Personnel from AGFD surveyed the stock tanks on July 6-8, 2010 and May 3, 4 and 16, 2011. Three stock tanks were not visited, two of which (Iron Flat tank and an unnamed tank identified as Tank 32 within Table 1) were reported (Robert Johnston, local landowner, personal communication, May 17, 2011) to go dry during the year and have limited access because roads were behind deeded or locked gates. The third unvisited tank (Tank 23) had incorrect GPS coordinates so was not found, but was later determined to exist based on examination of satellite photographs.

Stock tanks were surveyed using bag seines (9 m wide, 1.2 m high with 6 mm mesh), and dip nets (Duraframe Dipnet® electro intermediate hex trap net, 37 cm wide at the base, 12 cm wide at the apex and 41 cm long with 3mm mesh and 1.5 m pole). Ropes (~approximately 45 m long each) were attached to the seine brails to facilitate pulling the seine across the tanks. The bag seine was pulled through each tank three times, each time through a different portion of the tank, unless the tank was 1) dry, 2) small enough to be surveyed by one or two seine hauls, or 3) too shallow or small in which case dip nets were used. Data recorded for each sampling effort included: site name, site location (GPS coordinates), date, time, participants, effort (length and width of area surveyed via bag seine or dip net sweep), area of tank (length and width of wetted area), species captured and number of individuals.

Stream Surveys

A 1 km reach of upper Rawhide Canyon was visually surveyed on May 3, 2011 because bedrock tinajas were observed in that reach by Robinson (2008b). Wetted reaches, which were pools, were visually inspected and seined or dip netted if enough water was present. In addition, a 1-km portion of Devils Canyon was surveyed on June 2, 2011. This reach was previously surveyed (Robinson et al. 2010), however an Audubon Arizona employee reported a 'chub-like' fish in the reach and verification of the report was needed. The one reach of Devils Canyon targeted was surveyed using Smith-Root model LR24 backpack electrofisher with one probe and rattail. Sections were shocked in an upstream direction and fish were captured using dip nets. Survey length and duration shocked was variable. Data recorded for each effort included: site name, site location, species captured, number of fish of each species captured and seconds electrofished.

Deeper pools were sampled with Promar® collapsible mini-hoop nets (0.85 m long, 0.3 m diameter circular hoops, with 9 mm mesh) baited with Gravy Train® dog food. Nets were set for a minimum of 2 hours during daylight. Data recorded for each trap included: date and time net was set and pulled, GPS location, species captured and numbers of individuals captured.

Physical Environment
Water quality parameters; pH, conductivity (µS), salinity (ppm), total dissolved solutes (mg/L) and water temperature (˚C), were measured using an EXTECH Instruments Inc. ExStik EC500 meter. Dissolved oxygen (mg/L) was measured using an EXTECH Instruments Inc. ExStik DO600 meter.

RESULTS

Stock Tank Surveys
Of the 31 stock tanks that were surveyed; only two (Headquarter tank and East Fork tank) had fish (Table 2). Mosquitofish were the only fish species captured in East Fork tank. Mosquitofish and bluegill *Lepomis macrochirus* were captured in Headquarter tank, with bluegill being more abundant; this is the first time that bluegill has been documented in Devils Canyon drainage. A slider, likely a red-eared slider *Trachemys scripta* and a large female spiny soft-shell turtle *Apalone spinifera* were also observed at Headquarter tank. Eleven of the stock tanks had tiger salamander *Ambystoma tigrinum* in varying stages of development (ie. egg, brachial larvae, adult). Two tanks had northern crayfish *Orconectes virilis*, three had lowland leopard frog *Rana yavapaiensis*, and one had black-necked gartersnake *Thamnophis cyrtopsis* (Table 1).

Stream Sampling
No Gila chub were in Devils Canyon. Green sunfish and northern crayfish were captured during electrofishing. Only Green sunfish were captured in the mini-hoop nets (Table 2). Both adult and juvenile Green sunfish were captured in the traps.

Very little water was found in Rawhide Canyon. Most water was in three relatively small (about 2, 4, and 6 m^2) tinaja pools; the larger tinajas observed by Robinson (2008b) were dry. No fish were observed (the water was clear in all pools found) or captured in dip net sweeps (the number of dip net sweeps was not recorded).

DISCUSSION

Only nonnative fishes were found during our survey of stock tanks and two stream segments in the Devils Canyon drainage. We did not capture green sunfish in any of the stock tanks, so cannot conclude that the stock tanks were sources of dispersal of the species into Devils Canyon and upper Mineral Creek. However as Robinson et al. (2010) discussed, perhaps these fish were illegally stocked in the stream system in the past or moved downstream from a stock tank where they were previously stocked but no longer persist. The three stock tanks that were not surveyed are not likely a source of nonnatives fishes because two of them (Iron Flat tank and Tank 32) are reported (Robert Johnston, personal communication, May 17, 2011) to annually go dry, and the third, Tank 23, is upstream of Tank 22 and Tank 22 was fishless. Arizona Game and Fish Department Region VI office did not have stocking records or copies of a Wildlife Holding Permit for Headquarter tank (Chris Cantrell, AGFD Region VI Fish Program Manager, personal communication, December 05, 2011). Likewise, AGFD could not locate any stocking records or Wildlife Holding Permits for tiger salamanders, which were found in nine stock tanks in the

Devils Canyon drainage, indicating that there has been illegal movement of aquatic species within the drainage.
Gila chub have not been found in any surveys in any Mineral Creek or Devils Canyon since 2000 (Robinson 2007; Robinson 2008a; Robinson et al. 2010). Some of the perennial stream sections in Devils Canyon (e.g., from Rio Rancho Creek down to Five Pools) have only been surveyed once, but in multiple surveys of the lowest section of Devils Canyon, Gila chub have never been captured. Therefore, Gila chub can probably be considered extirpated from the Mineral Creek drainage.

RECOMMENDATIONS

Efforts to reestablish Gila chub into upper Mineral Creek and in suitable portions of Devils Canyon should be continued. Following recommendations from Robinson et al. (2010), the three best choices of lineages to use would be Redfield Canyon, Hot Springs Canyon or Bonita Creek. If the entire Mineral Creek and Devils Canyon drainage above Big Box dam is to be managed for Gila chub and other native fish, then the stock tanks in the drainage containing nonnative fishes as well as the perennial portions of Devils Canyon and upper Mineral Creek (Big Box Dam to series of small natural water falls) and Big Box Dam reservoir should be renovated to prevent the reinvasion of nonnatives into the system.

Prior to the completion of the renovation, stock tanks within the Mineral Creek drainage should be surveyed and assessed for nonnative fish presence. Likewise, the three remaining stock tanks in Devils Canyon drainage should be surveyed to completely rule them out as potential sources of nonnative fishes. Headquarter tank could be further evaluated to determine if other nonnative fish (i.e., bullhead or catfish) are also present.

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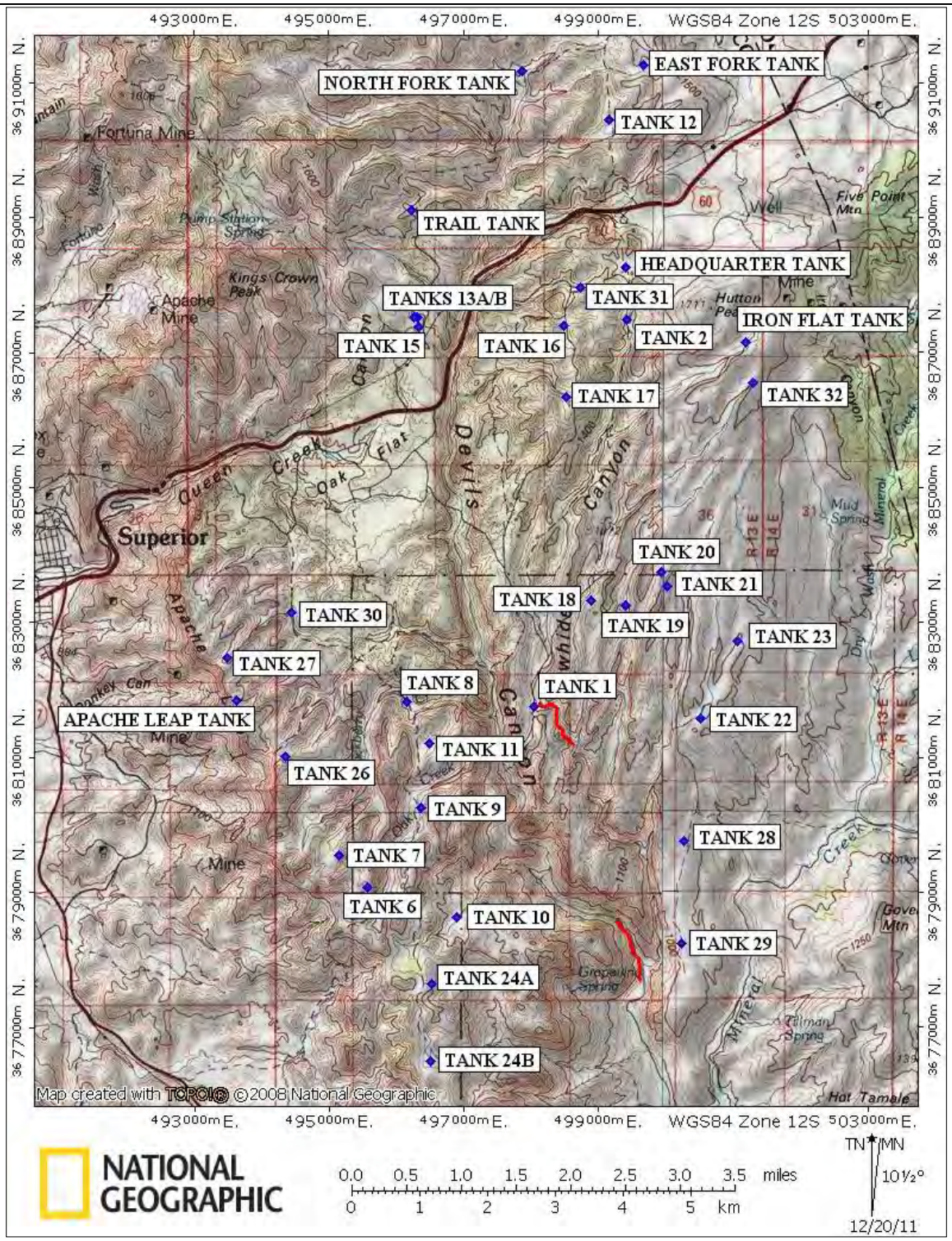

Figure 1. Map showing locations of stock tanks (blue triangles) in Devils Canyon drainage. The tanks were surveyed in 2010 and 2011. The red line located below Tank 1 in the central portion of the map is the 1 km portion of Rawhide Canyon that was surveyed on May 3, 2011. The red line in the lower right-hand portion of the map is the 1 km portion of Devils Canyon that was surveyed on June 2, 2011.

Figure 2. Photographs taken during Devils Canyon drainage stock tank surveys, 2010 and 2011. Top left: a large brachial larvae of tiger salamander. Top right: photo of Apache Trail tank, a typical stock tank. Bottom left: survey crew beginning a seine haul. Bottom right: bluegill, mosquitofish, and crayfish captured in a bag seine haul at Headquarter tank.

Table 1. Stock tank locations in Devils Canyon drainage, methods of survey, and species detected during 2010-2011. GPS coordinates are NAD83. Species codes are as follows: *Ambystoma tigrinum* AMTI, *Apalone spinifera* APSP, *Gambusia affinis* GAAF, *Lepomis macrochirus* LEMA, *Rana yavapaiensis* LIYA, *Orconectes virilis* ORVI, *Thamnophis cyrtopsis* THCY, *Trachemys scripta* TRSC.

Tank name	UTM Zone	UTM Easting	UTM Northing	Date visited	Gear/ comments	Species detected
Apache Leap tank	12S	493631	3681849	May 4, 2011	Bag seine	-
East Fork tank	12S	499668	3691252	May 16, 2011	Bag seine	GAAF, AMTI
Headquarter tank	12S	499403	3688286	May 17, 2011	Bag seine	LEMA, GAAF, ORVI, TRSC, APSP
Trail tank	12S	496227	3689116	May 3, 2011	Bag seine	AMTI
North Fork tank	12S	497862	3691181	May 16, 2011	Bag seine	-
Iron Flat tank	12S	501180	3687142	NA	Not surveyed	NA
Tank 1	12S	498048	3681746	May 3, 2011	Bag seine	-
Tank 2	12S	499420	3687490	May 4, 2011	Bag seine	-
Tank 6	12S	495572	3679069	May 4, 2011	Dipnet	-
Tank 7	12S	495145	3679552	May 4, 2011	Bag seine	-
Tank 8	12S	496149	3681830	May 4, 2011	Bag seine	-
Tank 9	12S	496371	3680246	May 4, 2011	Bag seine	AMTI
Tank 10	12S	496892	3678627	May 3, 2011	Dry	-
Tank 11	12S	496491	3681201	May 4, 2011	Bag seine	AMTI
Tank 12	12S	499160	3690444	May 16, 2011	Bag seine	AMTI
Tank 13A	12S	496304	3687523	May 3, 2011	Bag seine	AMTI
Tank 13B	12S	496258	3687512	May 3, 2011	Bag seine	AMTI
Tank 15	12S	496332	3687388	May 3, 2011	Dry	-
Tank 16	12S	498479	3687404	May 3, 2011	Bag seine	AMTI
Tank 17	12S	498512	3686340	May 3, 2011	Bag seine	AMTI, RAYA
Tank 18	12S	498891	3683325	July 6, 2010	Bag seine	AMTI
Tank 19	12S	499390	3683248	July 6, 2010	Bag seine	-
Tank 20	12S	499922	3683748	July 7, 2010	Dry	-
Tank 21	12S	500008	3683540	July 7, 2010	Bag seine	THCY
Tank 22	12S	500506	3681580	July 7, 2010	Bag seine	RAYA
Tank 23	12S	501051	3682713	NA	Not surveyed	NA
Tank 24A	12S	495145	3677638	July 6, 2010	Dry	-
Tank 24B	12S	496504	3676501	July 7, 2010	Dry	-
Tank 26	12S	494346	3681014	July 8, 2010	Bag seine	-
Tank 27	12S	493482	3682478	May 4, 2011	Bag seine	-
Tank 28	12S	500262	3679749	July 7, 2010	Bag seine	RAYA
Tank 29	12S	500229	3678238	July 7, 2010	Bag seine	-
Tank 30	12S	494440	3683152	May 4, 2011	Bag seine	-
Tank 31	12S	498734	3687969	May 4, 2011	Bag seine	ORVI, AMTI
Tank 32	12S	501289	3686552	NA	Not surveyed	NA

Table 2. Summary of fish captured and catch rates during the June 2, 2011 fish survey of Devils Canyon, Arizona, showing for each gear type: total number of individuals captured, number of sampling efforts, mean catch-per-unit-effort, and standard error of the mean catch rate. Catch rates for the electrofishing are the number of individuals (Ind) captured per minute electrofished and for trapping are the number of individuals captured per hour.

Gear type	Statistic	Green sunfish	Crayfish	Total
Electrofishing	#Individuals	137	1	138
	#Efforts	3	3	3
	Mean #Ind/min	22.05	-	22.05
	SE±	(6.23)	-	
Mini hoop	#Individuals	139	-	139
	#Efforts	6	6	6
	Mean #Ind/h	10.19	-	10.19
	SE±	(1.23)	-	(1.23)
Table Total	#Individuals	276	1	277

Table 3. Summary of results of the stock tanks containing fish and crayfish during the 2010 and 2011 stock tank in Devils Canyon drainage, Arizona.

Stock tank	Gear type	Statistic	Bluegill	Mosquitofish	Total Fish	Crayfish
East Fork tank	Bag seine	#Individuals	-	2094	2094	-
		#Efforts	-	3	3	
		Mean #Ind/m²	-	6.71	6.71	
		SE±	-	(1.23)	(1.23)	
Headquarter tank	Bag seine	#Individuals	2207	488	2695	45
		#Efforts	3	3	3	3
		Mean #Ind/m²	3.17	0.79	3.96	0.06
		SE±	(1.01)	(0.52)	(1.04)	(0.03)
Tank 31	Bag seine	#Individuals	-	-	-	1
		#Efforts	-	-	-	1

Table 4. Water quality characteristics measured in the two stock tanks that contained fish in Devils Canyon drainage, 2010-2011.

Site name	Date	Water temp. (C)	Dissolved oxygen (mg/L)	pH	Conductivity (μS)	Total dissolved solids (mg/L)	Salinity (ppm)
East Fork Tank	05/04/2011	21.9	5.57	7.33	83.5	81.8	58.8
Headquarter Tank	05/16/2011	22.8	11.18	8.45	66.1	47.8	31.8

ATTACHMENT 4

DEVILS CANYON AND MINERAL CREEK FISH SURVEYS DURING 2009, ARIZONA GAME & FISH DEPARTMENT

Devils Canyon and Mineral Creek Fish Surveys During 2009

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February 2010

Introduction

Gila chub *Gila intermedia* was listed as federally endangered with critical habitat in 2005 (Federal Register 2005). At the time of listing 29 populations in seven watersheds in the Gila River basin were considered extant. One of the extant populations was in Mineral Creek, tributary to the Gila River in Pinal County, Arizona. The Mineral Creek population was first documented in 1993 (Andrews and King 1997), but was last documented during 2000 (Robinson 2008a) even though four surveys in upper Mineral Creek (upstream of Big Box Dam) were completed between 2002 and 2008: two during 2002, one in 2006, and one in 2008. Gila chub are likely extirpated from upper Mineral Creek (Robinson 2008a). Robinson (2008a) recommended repatriating Gila chub to upper Mineral Creek, however expressed concern about stocking another lineage of Gila chub into the system if the species still occurred elsewhere in the watershed (e.g., Devils Canyon and the portion of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel). Mineral Creek watershed Gila chub, if they still exist, would be the preferred lineage to repatriate into upper Mineral Creek. Robinson (2008a) recommended surveying Devils Canyon and the portion of Mineral Creek between Big Box Dam and the tunnel to be more confident that Gila chub are extirpated from the Mineral Creek watershed. Gila chub have never been documented in Devils Canyon, a tributary to Mineral Creek, but only two fish surveys are known to have been done, both restricted to the lowest reach immediately above Big Box Dam Reservoir (Robinson 2008a). Gila chub were recorded from the portion of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel in a 1993 survey (Andrews and King 1997).

The objective of the surveys within the Mineral Creek watershed during 2009 were to document occurrence of Gila chub and other fish species within perennial waters in Devils Canyon and the portion of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel.

Study Site

Mineral Creek is a tributary to the Gila River in Pinal County Arizona. Mineral Creek is impounded by Big Box Dam (constructed in 1971) just upstream of ASARCO Ray Mine. An approximately 650-m long reach of Mineral Creek exists from Big Box Dam to the tunnel entrance, after which the stream flows through the tunnel under the ASARCO Ray Mine (Figure 1). Immediately above Big Box Dam, the watershed divides into Devils Canyon to the west and Mineral Creek to the east (this portion of Mineral Creek is referred to as upper Mineral Creek). Devils Canyon is a mostly north-to-south oriented drainage and the northern upstream end crosses US Highway 60. Rawhide Canyon, a north-to-south oriented tributary, meets Devils Canyon approximately 3.1 km upstream from the confluence with Mineral Creek. Robinson (2008b) identified two perennial reaches in Devils Canyon during an aerial survey; the upper reach extended from the U.S. Highway 60 bridge downstream for approximately 2 km, and the lower reach extended from the Rancho Rio Creek confluence downstream for approximately 4 km, ending about 750 m downstream of an area known to canyoneering enthusiasts as Five Pools (five waterfalls with associated plunge pools). Robinson (2008b) also observed some water and riparian vegetation in a short portion of Rawhide Canyon from its mouth upstream approximately 500 m. We surveyed five reaches during 2009 (Figure 1): 1) Devils Canyon from the U.S. Highway 60 bridge to 2,350 m downstream on July 14, 2) Devils Canyon from Rancho Rio Creek to approximately 2,440 m downstream on April 15-16, 3) the plunge pools

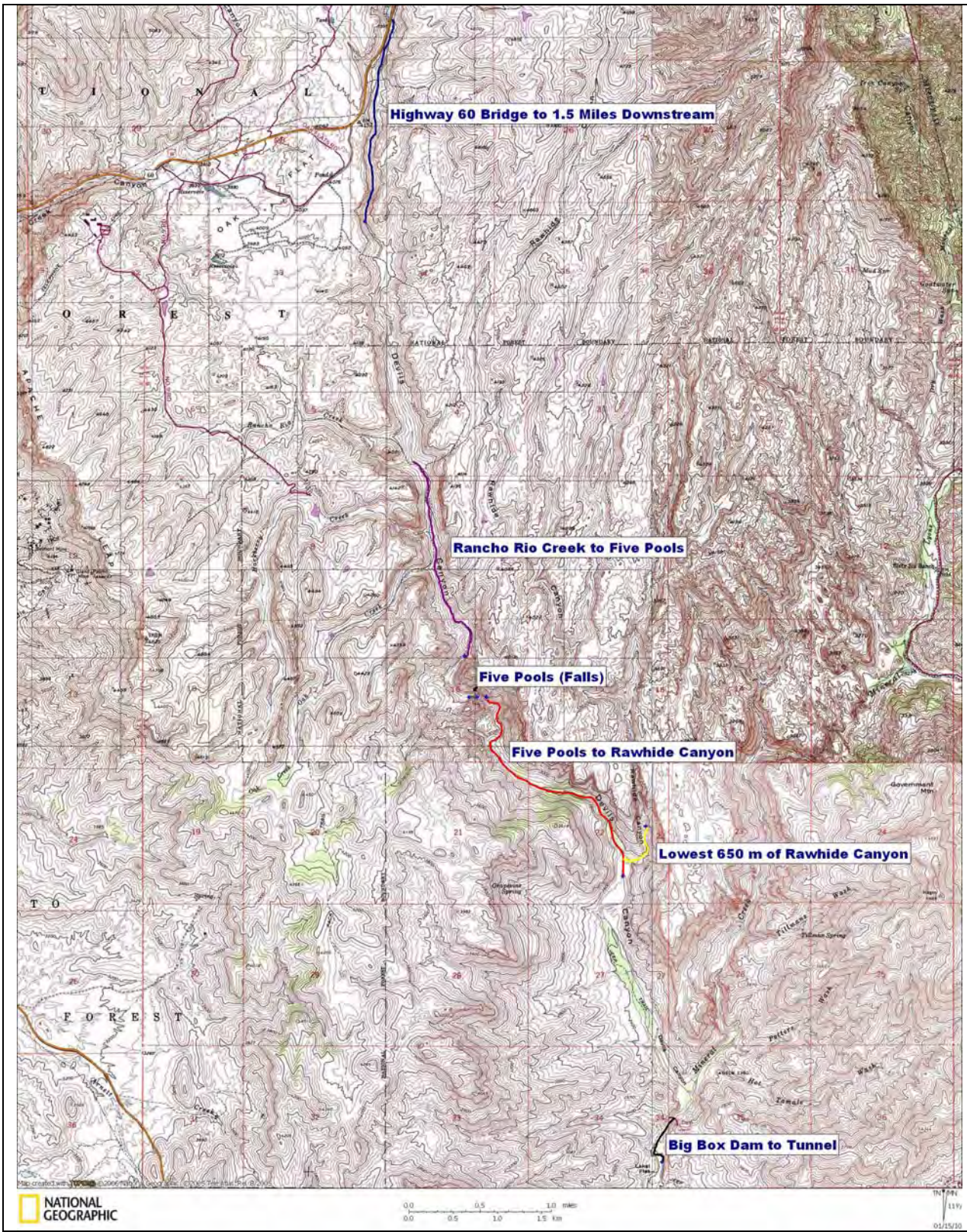


Figure 1. Map showing location of reaches sampled in Devils Canyon, Rawhide Canyon, and Mineral Creek during 2009 fish surveys.

below each of the five falls on April 16, 4) from approximately 50 m downstream of the lowest of the five falls downstream 3,070 m to about 175m past the confluence of Rawhide Canyon on August 3-4, and 5) Rawhide Canyon from its mouth upstream 650 m to a dry waterfall on August 3.

Seven fish species have been documented in Mineral Creek and its tributary Devils Canyon. Fish species reported in Devils Canyon include green sunfish *Lepomis cyanellus* and fathead minnow *Pimephales promelas* (Schwemm 2002; AGFD unpublished data). Fish species reported in Mineral Creek include native longfin dace *Agosia chrysogaster*, Gila chub *Gila intermedia*, and desert sucker *Catostomus clarki* and nonnatives fathead minnow, green sunfish, mosquitofish *Gambusia affinis*, and black bullhead *Ictalurus melas* (Andrews and King 1997).

Methods

Wadeable water within each reach was surveyed using a Smith-Root model LR24 backpack electrofisher with one probe and rattail. Stream sections were shocked during daylight hours moving in an upstream direction, and stunned fish were captured with dip nets (Duraframe Dipnet® electro intermediate hex trap net with 3 mm mesh and 5 ft long pole). Section length and duration shocked were variable, and were a result of where we stopped to process fish. Data recorded for each section included: date, GPS location, species captured and numbers, seconds electrofished, and length of section electrofished.

Deeper pools were surveyed with Promar collapsible mini-hoop nets (0.85 m long, 0.3 m diameter circular hoops, with 9 mm mesh) or Promar collapsible minnow traps (0.43 m long, 0.25 m wide, with 2 or 5 mm mesh) baited with Gravy Train® dog food. Nets were set in the afternoon and pulled the next morning when possible, or for a minimum of 2 hours during daylight. Dip nets (Duraframe Dipnet® electro intermediate hex trap net with 3 mm mesh and 5 ft long pole) were also used to survey deeper pools or areas where electrofishing or traps could not easily be used. Data recorded for each trap or dip net sweep included: date and time net was set and pulled, GPS location, species captured and numbers of individuals.

Four of the Five Pools were sampled after rappelling down to each; the second uppermost pool is small and was not sampled. In the first and third pools, an experimental monofilament gill net (green meanie 15.2 m long x 1.5 m wide, with 6 different mesh panes ranging from 19 to 46 mm) was set in the morning and pulled several hours later in the afternoon. Two mini hoop nets (Promar® collapsible 0.85 m long, 0.3 m diameter circular hoops, with 9 mm mesh) baited with Gravy Train® dog food were also set in the morning in the third pool and pulled several hours later in the afternoon. The fourth and fifth pools were surveyed by snorkeling; two people snorkeled through each for approximately 10 minutes.

Results

No Gila chub were captured in any of the five reaches surveyed. Three fish species, all of which are nonnative, were captured during the surveys: green sunfish, fathead minnow, and mosquitofish. In the section of Mineral Creek below Big Box Dam, green sunfish were by far the most abundant species, and the only other species captured was fathead minnow (Table 1). Green sunfish appeared to be more abundant in this section of Mineral Creek than in any of the Devils Canyon reaches surveyed (Tables 1 and 2). In Devils Canyon both green sunfish and

mosquitofish were captured, but mosquitofish were only captured in the upstream-most reach (Highway 60), whereas green sunfish were captured in all four reaches surveyed (Table 2). No fish were captured or observed in Rawhide Canyon. Crayfish were also captured in the Highway 60 and Rancho Rio to Five Pools reaches and two dead ones were observed in the reach between Five Pools and Rawhide Canyon (Table 2). Sonoran mud turtles *Kinosternon sornoriense* were observed all reaches except the Five Pools. A black-necked garter snake *Thamnophis cyrtopsis* was observed and captured in the Highway 60 reach of Devils Canyon.

Discussion

No Gila chub were captured or observed during our surveys, which lends evidence that they are not present in Devils Canyon and are no longer present in the section of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel. They were last captured in the section of Mineral Creek between Big Box Dam and the mine during 1993, but were captured just downstream of the old reservoir in Lakel Flat, which is now covered by the mine. Our survey in Mineral Creek was intensive, but within the uppermost portion immediately below Big Box Dam there was a large deep pool which could not be effectively sampled with the gear we had, so it is possible that Gila chub are present, but if so they are likely very rare, as there were many suitable looking pools downstream that were sampled but no chub were captured.

Gila chub have never been reported from Devils Canyon, but it seems likely that they could have occupied the lower reach from just downstream of Five Pools to the confluence with Mineral Creek as there are no natural waterfalls in this reach to prevent upstream movement during high flow periods, and the portion just downstream of Five Pools appears to be perennial. However, the section between Rawhide Canyon and the confluence with Mineral Creek appears to be ephemeral (Schwemm 2002, Cori Carveth, Arizona Game and Fish Department, personal communication), which may function as a fish barrier to some species. It also seems likely that Gila chub could have occupied the lowest reach of Rawhide Canyon for the same reasons. The five waterfalls that create the Five Pools however, are postulated to have been fish barriers for over ten thousand years, as we think they are basalt, and two of the falls are 15.2 vertical meters and two others 3.7 m, and one 3.0 m (Figure 2). If these five falls were fish barriers, then there should never have been any native fish captured upstream; results of our survey support this hypothesis and we only found records of one survey upstream (a vegetation survey; Jacobs and Flesch 2007) where only nonnative fish were observed. However, it seems likely that the upper portion of the stream was surveyed more times in the past given it's proximity to U.S. Highway 60 and the fact that it occurs on Forest Service and State Lands; records of any past surveys would help determine if the hypothesis is true or false. The dry waterfall in Rawhide Canyon about 650 m upstream of the confluence with Mineral Creek had a vertical drop of approximately 5-6 m and has thus also a likely been a fish barrier in at least the last few thousand or so years.

Only nonnative fishes were found during our survey of Devils Canyon and one section of Mineral Creek. Nonnative fish in the portion of Mineral Creek surveyed may have originated from the Gila River and migrated into Mineral Creek before the mine was developed, may have been purposely stocked, or may have migrated downstream from upstream stock tanks. Nonnative fish in the portion of Devils Canyon upstream of Five Pools likely originated from one of the many stock tanks in the upper portion of the Devils Canyon watershed (Robinson

2009b). Native fish were found in the 1990s within the portion of Mineral Creek that we surveyed, but are either now extirpated or are very rare.

Recommendations

Data from past surveys indicate that Gila chub are extirpated from upper Mineral Creek (upstream of Big Box Dam; Robinson 2009a), and data in this report and previous surveys indicates that they are not present in Devils Canyon. Therefore, we contend that Gila chub are extirpated from the Mineral Creek watershed upstream of Big Box Dam. They may also be extirpated from the portion of Mineral Creek downstream of Big Box Dam, as we did not capture any in the section between the dam and the ASARCO Ray Mine tunnel. It is possible, but seemingly unlikely, that they still exist, but are rare in this section of Mineral Creek, and we could conduct another survey in this section to be even more confident. Regardless, it is desirable to re-introduce Gila chub to upper Mineral Creek. Assuming they are extirpated from the entire Mineral Creek drainage, the preferable lineage to use for reintroduction would be one that is geographically close, as it would be assumed to be the most genetically similar. Based on an examination of Dowling et al. (2008), and considering genetics and geographic proximity we suggest that the three best choices of lineages to use are Redfield Canyon, Hot Springs Canyon, or Bonita Creek.

The portion of Devils Canyon from about 600 m upstream of Five Pools to the confluence of Rancho Rio Creek appears to be perennial, given the presence of mature riparian forest and presence of green sunfish. This reach had many deep pools (Figure 2) and abundant aquatic invertebrates which indicated that it would be suitable for Gila chub. Consideration should be given to renovating Devils Canyon upstream of Five Pools (including stock tanks) and repatriating native fishes including longfin dace, Gila chub, and desert sucker. Another approach that is more logistically complex and extensive would be to renovate the entire Mineral Creek watershed upstream of Big Box Dam, including Devils Canyon, Big Box Dam Lake and the lowest 1 km of upper Mineral Creek, and then stocking and managing for only native fish species upstream of the dam. Upper Mineral Creek upstream of the series of small waterfalls approximately 1450 m upstream of Big Box Dam Reservoir is free of nonnative fishes so would not need to be renovated.

Acknowledgements

These surveys were funded through and agreement with U.S. Fish and Wildlife Service as part of the Central Arizona Project (CAP) Gila River Basin Native Fishes Conservation Program. Various Arizona Game and Fish Department personnel people assisted with the fish surveys. Natalie Robb, Jeff Sorensen, Tony Robinson, Clay Crowder, and David Orabutt conducted the surveys in Devils Canyon between Rio Rancho Creek downstream to the bottom of Five Pools. Rawhide Canyon and the section of Devils Canyon between Rawhide Canyon and the Five Pools were surveyed by Clay Crowder, Antonio Lopez, Cassandra Smith, and Danny Rodriguez. The section of Devils Canyon near U.S. Highway 60 was surveyed by David Orabutt, Amberle Vasey, and Danny Rodriguez. The section of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel was surveyed by Tony Robinson, David Orabutt, and Clay Crowder; we were escorted by Keith Warren of ASARCO Ray Mine.

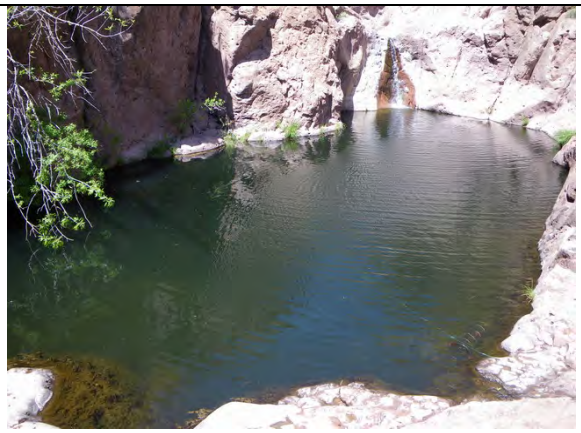
Table 1. Summary of results of the April 22, 2009 fish survey in Mineral Creek, ASARCO Ray Mine, Arizona, showing for each gear type total number of fish captured, the number of sampling efforts, mean catch-per-unit-effort and standard error of the mean catch rate. Catch rates for electrofishing are the number of individuals (Ind) captured per minute electrofished, and for minnow trapping are number of individuals captured per hour.

Gear type	Statistic	Green sunfish	Fathead minnow	Total
Electrofishing	# Individuals	596	4	600
	# Efforts	6	6	6
	Mean #Ind/min	16.88	0.15	17.03
	SE	(3.03)	(0.15)	(3.14)
Minnow Trapping	# Individuals	759	1	760
	# Efforts	21	21	21
	Mean #Ind/h	13.40	0.02	13.42
	SE	(4.17)	(0.02)	(4.17)
Table Total	# Individuals	1355	5	1360

Table 2. Summary of results of the 2009 fish survey of four reaches of Devils Canyon from the U.S. Highway 60 bridge downstream to Big Box Dam Reservoir. No fish were captured in the one reach of Rawhide Canyon (from mouth upstream 650 m) sampled.

Reach	Gear type	Statistic	Green Sunfish	Mosquitofish	Total Fish	Crayfish
Highway 60 to 1.5 miles downstream						
	Electrofisher	#Individuals	22	361	383	161
		#Efforts	8	8	8	8
		Mean #Ind/min	1.38	18.8	20.18	11.14
		SE	(1.37)	(12.71)	(12.49)	(4.52)
	Dip net	#Individuals	0	0	0	27
Rancho Rio Creek to Five Pools						
	Electrofisher	#Individuals	411		411	9
		#Efforts	9		9	9
		Mean #Ind/min	4.17		4.17	0.09
		SE	(0.67)		(0.67)	(0.05)
	Mini Hoop	#Individuals	215		215	7
		#Efforts	20		20	20
		Mean #Ind/h	0.55		0.55	0.02
		SE	(0.09)		(0.09)	(0.01)
Five Pools (falls)						
	Gill net	#Individuals	8		8	
		#Efforts	2		2	
		Mean	1.18		1.18	
		SE	(0.92)		(0.92)	
	Snorkel	#Individuals	11		11	
		#Efforts	4		4	
		Mean #Ind/min	16.18		16.18	
		SE	(16.18)		(16.18)	
	Mini hoop	#Individuals	10		10	
		#Efforts	2		2	
		Mean #Ind/h	1.52		1.52	
		SE	(1.52)		(1.52)	
Five Pools to Rawhide Canyon						
	Electrofisher	#Individuals	55		55	
		#Efforts	8		8	
		Mean #Ind/min	7.31		7.31	
		SE	(4.51)		(4.51)	

Reach	Gear type	Statistic	Green Sunfish	Mosquitofish	Total Fish	Crayfish
	Dip net	#Individuals	22		22	
		#Efforts	20		20	
		Mean #Ind/m^2	7.03		7.03	
		SE	(2.88)		(2.88)	
	Mini hoop net	#Individuals	110		110	2
		#Efforts	12		12	
		Mean #Ind/h	1.34		1.34	
		SE	(0.58)		(0.58)	

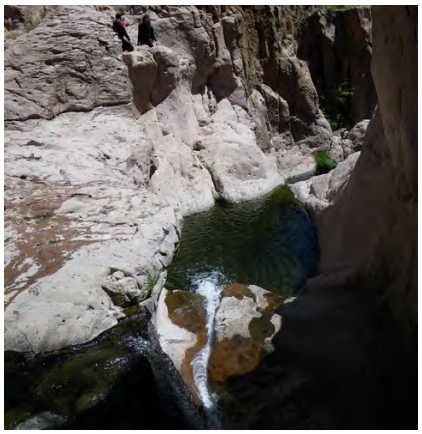
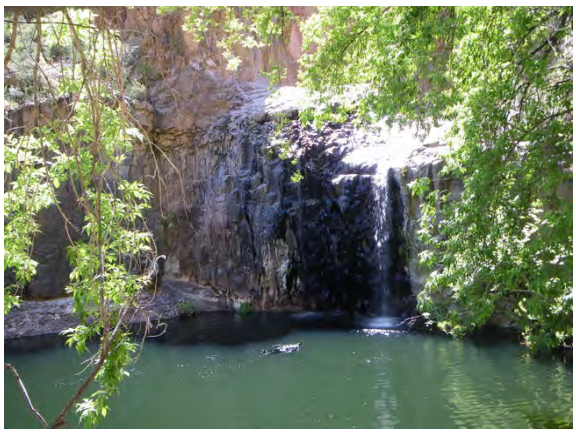




Figure 2. Photographs of Devils Canyon on April 17, 2008: *top left* shows Devils Canyon Creek near the confluence with Rio Rancho Creek. The rest of the photographs are of each of the Five Pools: *middle left* shows pool 1 (the uppermost pool), *bottom left* shows pool 2, *top right* shows pool 3, *middle right* shows pool 4, and *bottom right* shows pool 5 (lower most pool).

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ATTACHMENT 5

2006 Upper Mineral Creek Technical Report, Arizona Game & Fish Department

Upper Mineral Creek

On March 15-16, 2006 Bill Burger, Curt Gill, Natalie Robb, Cori Carveth and Craig Woods surveyed the upper section of Mineral Creek from the ASARCO Dam to the headwaters at Government Springs Ranch. This section of Mineral Creek was surveyed in 2000 and 2002. Gila chub, longfin dace and green sunfish were reported in 2000 however since then no fish have been observed in the upper section of Mineral Creek. Suitable physical habitat currently exists for native fish species however it is unclear whether high flows or some form of contamination caused the extirpation of fishes from this section of stream. Lowland leopard frogs, Sonoran mud turtles and a mixture of invertebrates were observed on this survey. We would recommend re-introducing longfin dace to the upper section of Mineral Creek to determine its suitability as habitat for native fish species.

Survey Results

Mineral Creek is a tributary to the Gila River in Pinal County, Arizona. Mineral Creek is a highly disturbed system. The headwaters of Mineral Creek have been heavily grazed and destroyed by fire. The stream is dammed above the ASARCO Mine and downstream flows are diverted around the mine, by way of a tunnel, for 1700 feet.

Surveys were conducted in two areas, from the ASARCO mine upstream to Tillmans Wash (~2.5 km) and from Government Springs Ranch downstream to Tillmans Wash (~2 km)

Upstream: 12S 0502659E 3679736N (Government Springs Ranch)
Midway: 12S 501230E 3677527N (Upstream of Tillmans Wash)
Downstream: 12S 0500656E 3675446N (Above reservoir)

Note: All UTM's are in NAD27.

Access: Moderate

Note: The drive to both locations is fairly easy. Permission is required in advance by way of letter to enter the mine site. Mine personnel must accompany visitors through the mine. Permission is also required for Government Springs Ranch (see file).

Elevation: 2540 ft or 770 m at midpoint

Dates/Time: 03-15-06 and 02-16-05

Personnel: B. Burger, N. Robb, C. Gill, C. Carveth (AZGFD) and C. Woods (USFS)

Habitat: The stream channel is canyonized for the large part of the flowing stream. Substrate consists of sand, gravel, large boulders and bedrock outcroppings. Flows were moderate although multiple large pools were present and many backwater areas have been formed by large boulders. Riparian vegetation was lush and canopy was moderate throughout most of the surveyed area. Watercress, duckweed, algae and other aquatic vegetation were well represented and provided abundant habitat within the stream.

Methods: Electrofishing, fine mesh dip nets or visual observation.

Note: We electrofished the lower section of the stream on March 15th.

Fish: None

Riparian Herps:
Lowland leopard frogs, *Rana Yavapaiensis (*Both adult and tadpole life stages were observed)
Sonoran mud turtles, *Kinosternon sonoriense sonoriense*

Aquatic Invertebrates:
Hemipterans, notonectidae and corixidae
Larval caddis flies, mayflies, and Diptera
Adult Tycos (check with Curtis on all these)

Crayfish: No crayfish were observed during this or past surveys.

Barrier: Maybe

Note: Large boulders currently provide barriers for upstream movement in several locations but may not be barriers at all flows.

Water Quality: Good (taken at 11am on March 15, 2006)
Temp: 16^0C
pH: 8.85

Land Use: This portion of Mineral Creek experiences minimal recreational use because of restricted access at both its upstream and downstream ends. Cattle are permitted to graze the upstream portion of the stream, and we saw sign of cattle at both ends of the creek. Due to a change in ownership of the Government Springs Ranch, the upper portion of the stream is currently less grazed than it had been under the prior permittee. The new permittee is working to develop a management strategy that hopefully will reduce the impact of cattle on the stream.

Recommendations:
Mineral Creek has been designated as critical habitat for Gila Chub, however, since 2002 Mineral Creek has been devoid of fish. Prior to 2002 longfin dace, Gila chub and green

sunfish were collected from this creek. The habitat within the creek consisted of deep pools with runs and riffles in between indicating good structure. Fallen trees and a diverse mixture of riparian species provide stabilization for adjacent banks. Despite extreme flooding last winter (landowner), most vegetation seemed stable with the exception of some large broken trees. Large boulders and channel morphology should provide backwater habitat for native fishes. Aquatic invertebrates were abundant and should provide a forage base for native fishes. The presence of sensitive aquatic invertebrates and lowland leopard frogs indicates good water quality.

It has been speculated that flooding within the canyon led to the disappearance of fishes from the stretch of Mineral Creek. We recommend re-stocking this section of Mineral Creek with longfin dace. If this species is successful, after two years we propose re-stocking Gila chub.

Mineral Creek has been designated as critical habitat for Gila Chub since November 2005. Surveys in 2000 documented longfin dace, Gila chub and green sunfish; however subsequent surveys in 2002, 2005, and our current survey have failed to document any fish in this creek. During our survey habitat within the creek consisted of deep pools with runs and riffles in between indicating good structure. Fallen trees and a diverse mixture of riparian species provide stabilization for adjacent banks. Despite the landowners report of high flows in 2005 most vegetation seemed stable with the exception of some large broken trees. Large boulders and channel morphology should provide backwater habitat for native fishes. Aquatic invertebrates were abundant and should provide a forage base for native fishes. The presence of sensitive aquatic invertebrates and lowland leopard frogs indicate that good water quality currently exists in this portion of the stream.

It has been speculated that flooding within the canyon may have led to the disappearance of fishes from this stretch of Mineral Creek since 2000, but other than the apparent disappearance of the fish, there is little evidence to support this contention. Currently the reason for the disappearance of the fish is unclear.

We recommend re-stocking this section of Mineral Creek with longfin dace. Depending on the success of this species we recommend re-evaluating Mineral Creek as habitat for the endangered Gila chub.