



Herpetofaunal Habitat Quality Status of the Santa Cruz River Floodplains between Ajo Way and Silverlake Road, Tucson, Arizona

Prepared for

Pima County Regional Flood Control District
97 East Congress Street, 3rd Floor
Tucson, AZ 85701

Prepared by

RECON Environmental, Inc.
525 West Wetmore Road, Suite 111
Tucson, AZ 85705
P 520.325.9977 F 520.293.3051
RECON Number 4115B
January 31, 2007

Philip C. Rosen, Ph.D.
University of Arizona



TABLE OF CONTENTS

1.0	Introduction	1
2.0	Methods	4
3.0	Results	5
3.1	Amphibians	5
3.1.1	Mesquite Circle Pond	5
3.1.2	Tucson Diversion Channel	8
3.1.3	El Puente Lane and 34th Street	11
3.1.4	Floodplain Surface Northeast of Ajo Way and the Santa Cruz River	13
3.1.5	Cottonwood Lane Area between Ajo Way and 44th Street Alignment	16
3.1.6	Santa Cruz River Arroyo Bottom	16
3.1.7	Cottonwood Lane Area between Silverlake Road and River Arroyo	16
3.1.8	Silverlake Road Floodplain Fragment West of Cottonwood Lane	20
3.2	Lizards	20
3.2.1	Historic Santa Cruz Floodplain	20
3.2.2	Lizard Population Status along the West Branch	20
4.0	Summary	26
4.1	Amphibians	26
4.2	Lizards	27
5.0	Discussion	27
6.0	Recommendations	30
6.1	Amphibians	30
6.1.1	General Recommendations	30
6.1.2	Amphibian Habitat Design Considerations	32
6.1.3	Parcels Suitable for Amphibian Conservation	35
6.2	Reptiles	37

FIGURES

1:	Study Area	2
2:	Study Area from Silverlake Road on the North to Ajo Way on the South	3
3:	Lizard Abundance and Proportion of Giant Spotted Whiptails at West Branch, 2000–2006	24

TABLE OF CONTENTS (CONT.)

PHOTOGRAPHS

1:	Mesquite Circle Pond	6
2:	Tucson Diversion Channel Stream Cascading over Stabilizing Riprap	9
3:	Tucson Diversion Channel above the Cascade	10
4:	Rain Pool along El Puente Lane	12
5:	Wild Poinsettia, Mesquite, and Various Grasses at Santa Cruz Lane and 34 th Street	14
6:	Open Ground and One of Several Dispersed Stands of Mesquite characterizing the Environment of the Historic East Side Santa Cruz River Floodplain North of Ajo Way	15
7:	Mesquite Trees and Spadefoot Toad Breeding Pool along South Extension of Cottonwood Lane	17
8:	Characteristic Scene of the Santa Cruz River Arroyo Bottom between Ajo Way and Silverlake Road	18
9:	Santa Cruz River South of Silverlake Road	19
10:	South End of Swale-ditch Complex Southeast of Silverlake Road and Cottonwood Lane	21
11:	Floodplain Fragment on Silverlake Road West of Cottonwood Lane with Open Ground, Mesquite, Blue Paloverde, Palmer Amaranth, and Saltbush	22
12:	Homeless Persons' Establishment on the Santa Cruz River Arroyo Bottom near Tucson Diversion Channel	29

TABLES

1:	Special Interest Reptiles and Amphibians for which Surveys Were Conducted on the Santa Cruz River Bottomlands	3
2:	Lizards Observed At and Near the West Branch of the Santa Cruz River between Silverlake Road and 44th Street, Tucson	23

APPENDICES

A:	UTMs for Field Sites (WGS 1984 Datum)
B:	Field Notes (Rosen, Verbatim)
C:	Tabular Field Data

1.0 Introduction

Dr. Philip C. Rosen surveyed for amphibians and reptiles on the Santa Cruz River bottomlands (West Branch) during mid-to-late August 2006 in order to characterize the herpetofaunal habitat quality. The study area consisted of the Santa Cruz River bottomlands, east of Cottonwood Lane between Ajo Way and Silverlake Road in Pima County, Arizona (Figures 1 and 2).

This work was done at the request of the Pima County Regional Flood Control District in order to inform upcoming projects in the area. During previous projects, Dr. Rosen examined much of this area less thoroughly and had also monitored amphibians in the West Branch portion of the historic bottomlands. These pre-existing data are incorporated into the interpretations of results presented here for a more inclusive context.

For this project, Dr. Rosen also surveyed the east portion of the Santa Cruz River bottomlands for special interest lizards, thus supplementing earlier, ancillary observations. Nine time-constrained search (TCS)-based surveys for lizards were conducted along the West Branch. Extensive previous lizard observations for the West Branch are incorporated into this report, as are additional TCS surveys at the West Branch from 10 through 13 October 2006, which are beyond the scope of this project. The objectives of this project were to:

- Identify reptile and amphibian populations of interest and their habitat in the potential river park areas astride the Santa Cruz River;
- Contribute toward an understanding of how park, reserve, infrastructure, or urban development might impact and/or restore reptile and amphibian populations of interest and their habitat; and
- Record sensitive species populations that may be restricted to the West Branch within this study area.

The amphibian species of interest include all six summer breeding toads and toad-like frogs that occur at the West Branch and at certain other locations along Tucson's major riparian wash and river corridors (Table 1). The lizard species of interest include five species with limited distributions in the Tucson Basin, all of which have declined in some degree in former lowland strongholds along the Santa Cruz River and other major riparian corridors. These species are also listed in Table 1. In addition, Dr. Rosen surveyed for the southwestern black-headed snake (*Tantilla hobartsmithi*), which is also closely confined to major riparian areas in the Tucson Basin and has a stronghold at the West Branch.



Figure 1
Study Area

Numbers represent the discussed locations, stars are the photograph/figure locations.

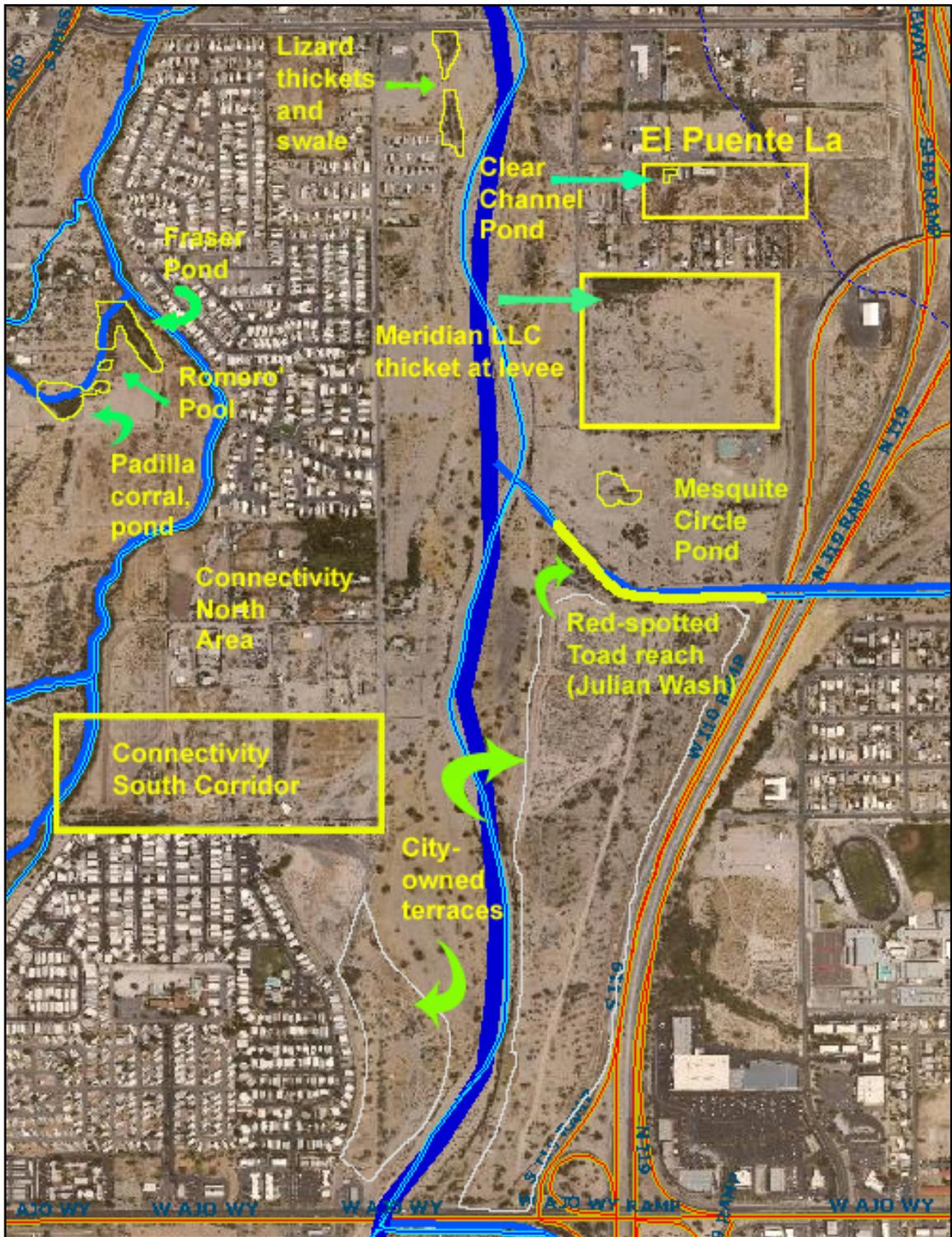


Figure 2
Study Area from Silverlake Road on the North to
Ajo Way on the South

Key features referred to in text are indicated.

TABLE 1
SPECIAL INTEREST REPTILES AND AMPHIBIANS FOR WHICH
SURVEYS WERE CONDUCTED ON THE SANTA CRUZ RIVER BOTTOMLANDS

Species	Common Name	Next Nearest Populations
Amphibians		
<i>Bufo alvarius</i>	Sonoran Desert toad	West Branch
<i>Bufo cognatus</i>	Great Plains toad	West Branch
<i>Bufo punctatus</i>	Red-spotted toad	West Branch
<i>Gastrophryne olivacea</i>	GreatPlains narrow-mouthed toad	West Branch
<i>Scaphiopus couchii</i>	Couch's spadefoot	Ubiquitous
<i>Spea multiplicata</i>	Mexican spadefoot	West Branch
Lizards		
<i>Aspidoscelis burti stictogramma</i>	Giant spotted whiptail	West Branch
<i>Aspidoscelis sonora</i>	Sonoran spotted whiptail	West Branch
<i>Sceloporus clarkii</i>	Clark's spiny lizard	West Branch *
<i>Sceloporus undulatus</i> <i>consobrinus</i>	southern plateau lizard	Downtown Tucson **
<i>Holbrookia maculata</i>	lesser earless lizard	Tucson Mountain Foothills

*Possibly extirpated at the West Branch; occurs in downtown Tucson

**Probably extirpated in Tucson; occurs along the Santa Cruz River in Tubac and at Tumacacori. Recent taxonomic proposal calls this taxon *Sceloporus cowlesi*, the southwestern fence lizard

2.0 Methods

The study area was visited several times. During daytime visits to survey for amphibians, ponds were dip-netted and/or visually assessed for tadpoles. In addition, debris items that could provide cover near aquatic breeding habitat were inspected for presence of amphibians. Survey locations were recorded with a Garmin 12 global positioning system (GPS) unit set to the WGS-1984 datum. Surveys previously conducted (as part of separate efforts) and incorporated into this report include auditory surveys conducted at night for frog and toad breeding choruses. Species were identified by their calls. These pre-existing data were incorporated into the interpretations of results presented in this report for a more inclusive context.

Lizard surveys were conducted during the warm part of morning or at mid-day by walking at an appropriate gait to see or hear lizards as they retreated. Binoculars (10X) were used with minimum focus at five feet when necessary to confirm identifications. Start–stop times were recorded along with breaks, other observations, or other various interruptions. All individual lizards were recorded by species and age/size class. Significant observations along with start and stop points were recorded as GPS

waypoints (Appendix A). Records were also kept as descriptive field notes (Appendix B) and in tabular format (Appendix C).

3.0 Results

3.1 Amphibians

3.1.1 Mesquite Circle Pond

Figure 1 –No.1

The highest amphibian diversity in the study area, excluding the West Branch, was found at Mesquite Circle Pond, which is a small impoundment south of the terminus of Santa Cruz Lane south of Silverlake Road (see Figure 2; Photograph 1). All six special-interest species (see Table 1) have been recorded breeding at or near this site during the past five years, although only four were confirmed breeding in this general area in 2006. Three species, Couch's spadefoot (*Scaphiopus couchii*; abundant), the Great Plains toad (*Bufo cognatus*; abundant), and the Great Plains narrow-mouthed toad (*Gastrophryne olivacea*; only two were heard calling) were found breeding in the pond in 2006. For the narrow-mouth toad, 2006 was the first ever recording east of the river in this part of Tucson.

Mesquite Circle Pond is the best remaining, known breeding site for the Great Plains toad in central Tucson; the only other important site is in a detention pond behind a supermarket at Silverbell Road and Speedway Boulevard, adjoining the Anklam and Silvercroft wash confluence.

The red-spotted toad (*Bufo punctatus*) probably does not breed at Mesquite Circle Pond, but breeds in numbers just to the south in the Tucson Diversion Channel (see below), and was found in 2006 utilizing terrestrial habitat around the Mesquite Circle Pond. The other two species, the Sonoran Desert toad (*Bufo alvarius* [aka Colorado River toad]) and Mexican spadefoot (*Spea multiplicata*) were found breeding at this area in 2002, prior to the disturbance associated with the Interstate 10/Interstate 19 freeway interchange construction and associated earth moving that damaged the breeding pools, which were immediately southeast of and adjoining the terminus of Santa Cruz Lane. In addition, a juvenile American bullfrog (*Rana catesbeiana*) was observed (auditory) at the pond. This invasive, non-native species would not be able to breed at a temporary pond site and must have arrived from another location.



Photograph 1 Mesquite Circle Pond

Looking southeasterly, between Tucson Diversion Channel (Julian Wash) and the south end of Santa Cruz Lane. The interstate highway interchange (Diversion Channel underpass) is in the background. All six of Tucson's summer-breeding frog and toad species have been found at or near this pond. The pond also supports large populations of predatory and filter-feeding invertebrates that eat mosquito larvae. The shallow lobe of the pond, where suitable water depth for tadpole development has been created by off-road vehicle ruts, is in the foreground; the deeper (ca. two-foot maximum) pool is visible among mesquite trees in the upper right.

Although the environs of this pond are mostly degraded in various ways, the breeding aggregations and success indicate the ease with which populations could be sustained or encouraged to expand in this region of the floodplain. This area may have the highest immediate potential for expanding amphibian conservation in Tucson because of the following characteristics:

1. Remoteness from people who might be most likely to complain about mosquitoes, etc.;
2. Soils suitable for amphibian burrowing and for holding water in catchments;
3. Proximity to sources of colonization and/or sources of exchange of migrants and genes;
4. Significant public ownership;
5. Potential inclusion in river park and Paseo de las Iglesias plans; and
6. Presence of excellent populations of tadpole shrimp and larval diving beetles (*Eretes stricticus*) and other species that actively consume mosquito larvae.

Several other small but interesting invertebrates were abundant at this pond, including temporary water dragonfly larvae and fairy shrimp. During the period of observation at Mesquite Circle Pond in 2006, no mosquito larvae were expected or observed. However, it is possible that a flush of floodwater mosquitoes might successfully mature at the first filling of the pond as this species would likely develop faster than any invertebrate predator which would consume or regulate them. Mexican spadefoot, the larvae of which actively eat mosquitoes, might be suitable as early mosquito control, since it may lay eggs immediately upon pond filling and hatch as relatively large, numerous, predaceous tadpoles. However, the use of Mexican spadefoot as a mosquito control method has never been studied or tested.

Of the study area locations, Mesquite Circle Pond has the best potential for temporary storage of translocated anurans or for establishment of populations of desirable species, especially the Mexican spadefoot, common in Tucson, and Great Plains narrow-mouthed toad, the rarest of Tucson's summer-breeding amphibians.

Tadpoles were salvaged from the following locations during summer 2006 and moved to Mesquite Circle Pond (as well as Ajo Detention Basin):

- **The Rillito River Ecological Restoration Project–Area 3** (at Columbus Boulevard). This area is scheduled for infrastructure refurbishment and ecological restoration, and construction will disturb existing amphibian populations.

- **Fraser Pond.** Many animals that were removed from Fraser Pond, as it approached desiccation that would have killed the tadpoles, to the West Branch were head-started by rearing them in outdoor containers through metamorphosis.
- **Pantano Wash and Cienega Creek.** Some tadpoles from Pantano Wash and Cienega Creek were also head-started.

These efforts will be detailed in a forthcoming report, but for this report it is noted that 373 narrow-mouthed toad tadpoles plus 44 metamorphs (total 417), 26 Mexican spadefoot metamorphs, 3 Great Plains toad metamorphs, and 1 Couch's spadefoot metamorph were released at Mesquite Circle Pond in late August and early September 2006. Prior to releasing metamorphs, transformed individuals of translocated, salvaged tadpoles that had grown well and appeared healthy were observed at Mesquite Circle Pond.

Mesquite Circle Pond demonstrates significantly how amphibian conservation could be incorporated successfully into the Santa Cruz River park and Paseo de las Iglesias projects. Even though the surrounding habitat is highly degraded, populations seem to be persisting. The pond could be replicated easily, habitat around it could be easily enhanced, and the pond's hydroperiod could likely be adjusted and even controlled by using the height of the levee or a removable retaining structure. Mesquite Circle Pond is a suitable area for study and monitoring of such opportunities, because it is removed from residences and businesses.

3.1.2 Tucson Diversion Channel

Figure 1 – No. 2

Tucson Diversion Channel is the debauchment of Julian Wash across and into the original east-side floodplain of the Santa Cruz River down to its confluence with the present river channel within the deep arroyo banks. A trapezoidal concrete channel passes under the interstate highway, then gives way to a stream that flows for several weeks during some summer monsoons and is stabilized by heavy riprap boulders that produce a rocky stream (Photographs 2 and 3).



Photograph 2
Tucson Diversion Channel Stream Cascading over Stabilizing Riprap

The stream is photographed as it reaches the level of the incised Santa Cruz River. Red-spotted toads are abundant and breed successfully throughout this environment, as they do at the few other mid-valley sites in Tucson Basin with rocky stream features.

Photograph taken on 8 August 2006.



Photograph 3
Tucson Diversion Channel above the Cascade

The interstate highway interchange is barely visible through the paloverde left of center on the horizon.

Photograph taken on 8 August 2006.

Red-spotted toad metamorphs were abundant at the Santa Cruz River confluence of this stream on 14 September 2005, and tadpoles were found abundant from near the river confluence to the upper rocky reach on 8 August 2006. It would appear that water is present continuously in this area for over 17-day stretches, since that is the minimum observed larval period for this species.

Red-spotted toads are abundant in mountain canyons surrounding Tucson, but are only known to occur mid-valley at five sites. One of these sites is in a similar setting along a much smaller drainage at Simpson Street, 1.63 mile north-northeast of the Tucson Diversion Channel locality. Three important conclusions can be drawn from these observations: (1) this usually montane species readily colonizes valley locations; (2) there is an apparently viable population of this species in the Tucson Diversion Channel that likely includes the Simpson Street Wash; and (3) man-made habitat that chances to resemble the rocky streams usually inhabited by this toad are also utilized by it in highly modified urban settings.

These observations explain the surprising, previously confusing appearance of small numbers of red-spotted toads in the West Branch area, especially along the south part of Cottonwood Lane, directly across the river from the Tucson Diversion Channel. Those observations in turn, extending back to the year 2001, confirm a viable population over several years and argue against the hypothesis that the observed West Branch animals are only temporarily present as migrants from a major population living in San Juan Wash (= Enchanted Hills Wash) in the Tucson Mountains.

The Tucson Diversion Channel may continue to support a diversity of various amphibians and other species as long as it is not simplified or repeatedly re-excavated or buried by heavy equipment. Its biodiversity might be enhanced by selective plantings of native trees and shrubs.

3.1.3 El Puente Lane and 34th Street

Figure 1 – No. 3 and 4

Many amphibians have been found both live and dead on Santa Cruz Lane south of Silverlake Road, especially Couch's spadefoots, Sonoran Desert toads, and Great Plains toads. Some of these live and breed in the small residential-industrial neighborhood in the northern three blocks of the area. A single narrow-mouthed toad was heard calling north of El Puente Lane in an unnamed mesquite (*Prosopis velutina*)-lined drainage ditch, along with several Couch's spadefoots.

A major aggregation of several thousand metamorph Couch's spadefoots was observed along El Puente Road at a rain pool in scrubby mesquite land (Photograph 4) owned, though apparently not utilized, by Clear Channel Communications at 0.20 mile southeast of



Photograph 4
Rain Pool along El Puente Lane

Scrubby mesquite supports a huge cohort of metamorphosed Couch's spadefoots.
An abundance of aquatic beetles of several kinds appeared to be present.
Photograph taken from El Puente Lane on 8 August 2006.

Silverlake and Santa Cruz Lane. The ground was covered by swarms of metamorphs over substantial areas.

Southeast of the corner of Santa Cruz Lane and 34th Street, an L-shaped levee retains runoff on a sizable parcel owned by Meridian Enterprises LLC, which is apparently not used except as a staging area during the Interstate 10/Interstate 19 interchange construction. Amphibians were not heard breeding onsite, which may have insufficiently deep waterpools or may have suffered too heavily from the heavy equipment and material staging. However, the effect of the levee on this small area indicates that rich vegetation may be restored on this original floodplain terrace rather easily (Photograph 5). This environment hosted a significant mosquito population: use of this form of habitat restoration would best be done away from residential areas.

In summary, the historic floodplain terrace east of the Santa Cruz River from the Tucson Diversion Channel to Silverlake Road retains significant amphibian populations and conservation potential despite decades of neglect and heavy disturbance. The three most critical components of any successful conservation in this area are (1) avoiding excessive road mortality, (2) capturing on-site runoff for vegetation enhancement and for a sufficient summer rainpool hydroperiod, and, of course, (3) maintaining open space.

3.1.4 Floodplain Surface Northeast of Ajo Way and the Santa Cruz River

Figure 1 – No. 5

In the floodplain surface north of Ajo Way, between Interstate 19 and the Santa Cruz River, arroyo is a major block of open space whose future is likely to determine whether viable wildlife populations can be maintained in this region of Tucson. It adjoins the Santa Cruz Lane region described in the preceding sections, as well as the presently incised river bottom, and is contiguous with the Cottonwood Lane-West Branch habitat area via the intervening arroyo bottom.

This area currently helps support populations of black-tailed jackrabbits (*Lepus californicus*) and zebra-tailed lizards, and has limited breeding by Couch's spadefoot. This level surface currently supports little or no successful amphibian breeding. Thus, it is currently a low-value habitat that nonetheless would play an important future role in a regional park system, assuming it is not used for commercial purposes. The most significant existing resources are stands of old mesquite (Photograph 6), which are currently scrubby and uninteresting, but would respond well to water supplementation and thus would anchor a developing park area or ecological restoration site. Since native mesquite is desirable in these settings, but becomes established and grows to large size slowly, stands of this kind should be recognized as having an important ecological value.



Photograph 5
Wild Poinsettia, Mesquite, and Various Grasses at
Santa Cruz Lane and 34th Street

This wild floodplain garden was created incidentally by a small levee. This is the largest stand of poinsettia seen by the author in Tucson.
Photograph taken on 8 August 2006.



Photograph 6
Open Ground and One of Several Dispersed Stands of Mesquite
characterizing the Environment of the Historic East Side Santa
Cruz River Floodplain North of Ajo Way

3.1.5 Cottonwood Lane Area between Ajo Way and 44th Street Alignment

Figure 1 – No. 6

Another area with open space potential, but currently of low wildlife habitat value is the historic west side floodplain surface north of Ajo Way (Photograph 7). While similar in most respects to the east side, it supports more amphibians, and there is successful breeding by Couch's spadefoot in off-road-vehicle-caused puddles. Amphibians also breed on the paved road surface and its margins. No amphibian calling has been heard in the privately owned gravel pit at the north end of this area.

3.1.6 Santa Cruz River Arroyo Bottom

Figure 1 – No. 7

The bottomlands of the Santa Cruz River in the area between Ajo Way and Silverlake Road are generally open, sandy, and dominated by salt cedar (*Tamarix* spp.), Bermuda grass (*Cynodon* spp.), a diversity of wildflowers and other desert ephemerals, and desert broom (*Baccharis sarothroides*) (Photographs 8 and 9). This area has generally low habitat value for most species and might prove difficult to restore, because its soils seem poorly suited to retaining surface flow or standing pools. It also tends to suffer severe flood scour within the constraining arroyo walls. (Further discussion of this complicated problem is beyond the scope of this report.) A few puddles were found in the edges of this environment that were marginally successful breeding sites for the Couch's spadefoot. Undoubtedly, all the amphibians present in the area utilize this site as a dispersal corridor and probably as an area for non-breeding activities such as foraging and aestivation. However, these activities have not been investigated.

3.1.7 Cottonwood Lane Area between Silverlake Road and River Arroyo

Figure 1 – No. 8

A largely degraded area of the west side historic floodplain between Cottonwood Lane and the arroyo extends about 0.8 mile south from Silverlake Road. A diversity of amphibians is found active along Cottonwood Lane, and there is sometimes substantial road mortality there. Well-watered properties owned by the Russell family on Cottonwood Lane provide an important support for declining bird, lizard, and amphibian populations in this part of Tucson.

The only significant amphibian breeding in this area occurs near the north end of this area, in swales northeast of the trailer homes along the east side of Cottonwood Lane



Photograph 7
Mesquite Trees and Spadefoot Toad Breeding Pool along
South Extension of Cottonwood Lane

Photograph taken on 12 August 2006.



Photograph 8
Characteristic Scene of the Santa Cruz River Arroyo Bottom
between Ajo Way and Silverlake Road

Photograph taken from near the 44th Street alignment on 12 August 2006.



Photograph 9
Santa Cruz River South of Silverlake Road

Site facing northeast across Palmer amaranth (*Amaranthus palmeri*) and mesquite toward vegetation dominated by saltcedar, desert broom, and perennial grasses.
Photograph taken on 12 August 2006.

(Photograph 10). Thus far, only Couch's spadefoot has been detected in this area and it is fairly abundant. The water is too ephemeral to support breeding by other species.

3.1.8 Silverlake Road Floodplain Fragment West of Cottonwood Lane

Figure 1 – No. 9

The open area west of Cottonwood Lane and Silverlake Road (Photograph 11) was investigated, but no sign of amphibians was detected. Breeding habitat is likely to be absent.

3.2 Lizards

3.2.1 Historic Santa Cruz Floodplain

Lizard surveys conducted at all the sites described above yielded desert species commonly found in arid major riparian settings throughout Tucson: western (tiger) whiptail (*Aspidoscelis tigris*), zebra-tailed lizard (*Callisaurus draconoides*), desert spiny lizard (*Sceloporus magister*), and tree lizard (*Urosaurus ornatus*). None of the special interest lizards (see Table 1) have been observed in these environments, and except for the swale in Photograph 10 and a mesic corner of the area depicted in Photograph 11, none are to be expected. Both of these areas yielded southwestern black-headed snakes and thus have some remaining riparian values, although they are small habitat areas compared to the West Branch and other contiguous habitats in the study area.

3.2.2 Lizard Population Status along the West Branch

TCS was conducted in the West Branch area on 19, 20, and 23 August and 11 through 13 October 2006. These efforts continued the monitoring ongoing since 2000 at the West Branch, and results are summarized in Table 2. During August and September 2006, TCS efforts from 2005 were repeated in the Rillito River system, which indicated that high lizard abundances have persisted despite severe drought followed by scour in the Rillito's 2006 record flooding. Along the Rillito River, while there are no giant spotted whiptails, both the Sonoran spotted whiptail and Clark's spiny lizard have approximately maintained 2005 abundance levels in 2006.

The trend at the West Branch also indicates that despite the continuing drought, overall observed lizard abundance has roughly stabilized, remaining similar in 2005 and 2006 (Figure 3). However, while the giant spotted whiptail population survived the drought, its apparent decline continued apace (see Figure 14).



Photograph 10
South End of Swale-ditch Complex Southeast of Silverlake Road
and Cottonwood Lane

This view looks west-southwest toward trailer homes east of Cottonwood Lane.
Metamorph Couch's spadefoots were abundant in the grassy swale.
Photograph taken on 12 August 2006.



Photograph 11
Floodplain Fragment on Silverlake Road West of Cottonwood
Lane with Open Ground, Mesquite, Blue Paloverde,
Palmer Amaranth, and Saltbush

Photograph taken on 12 August 2006.

TABLE 2
LIZARDS OBSERVED AT AND NEAR THE WEST BRANCH OF THE SANTA CRUZ RIVER
BETWEEN SILVERLAKE ROAD AND 44TH STREET, TUCSON

Year	Tiger Whiptail	Sonoran Spotted Whiptail	Giant Spotted Whiptail	Tree Lizard	Desert Spiny Lizard	Clark's Spiny Lizard	Zebra-tailed Lizard	Regal Horned Lizard	Western Banded Gecko	Unidentified Lizards	Number of Lizards Observed
% of Total Observed Lizards											
2000	49.4	4.5	6.7	7.9	1.1	0.0	0.0	0.0	1.1	29.2	89
2001	29.8	16.7	6.1	5.3	1.8	0.9	1.8	0.0	0.0	37.7	114
2002	55.9	7.8	7.8	5.9	3.9	2.0	1.0	1.0	1.0	13.7	102
2003	35.4	6.2	5.3	5.3	2.7	0.0	9.7	0.0	1.8	33.6	113
2004	4.2	8.3	0.0	45.8	8.3	4.2	8.3	0.0	12.5	8.3	24
2005	37.8	10.6	4.3	8.5	3.7	0.5	1.1	1.1	2.1	30.3	188
2006	29.3	17.3	2.0	11.3	1.3	0.0	2.7	0.0	4.7	31.3	150
Overall	37.3	11.0	4.9	8.8	2.7	0.6	2.8	0.4	2.3	29.1	
Number Observed											
2000	44	4	6	7	1	0	0	0	1	26	89
2001	34	19	7	6	2	1	2	0	0	43	114
2002	57	8	8	6	4	2	1	1	1	14	102
2003	40	7	6	6	3	0	11	0	2	38	113
2004	1	2	0	11	2	1	2	0	3	2	24
2005	71	20	8	16	7	1	2	2	4	57	188
2006	44	26	3	17	2	0	4	0	7	47	150
Total	291	86	38	69	21	5	22	3	18	227	780

Source: Dr. P.C. Rosen

The giant spotted whiptail and Clark's spiny lizard were identified a century ago (1906) by Alexander Ruthven as characteristic lizards of the Santa Cruz River at Tucson. Their abundance here in the midst of the Sonoran Desert is expected to be related to mesic conditions along the river. Their decline is predictable based on current river conditions.

Both species appear to be diminishing in abundance at the West Branch, and Clark's spiny lizard was not detected there in 2006. Because of its occurrence in the Tucson Mountains, along the Cholla, and (presumably) San Juan washes on the bajada near the West Branch, and in downtown Tucson, its decline at the West Branch is not a major

**West Branch Lizards - Time-Constrained Search
(May - August)**

X - *A. burtti* (% of total)

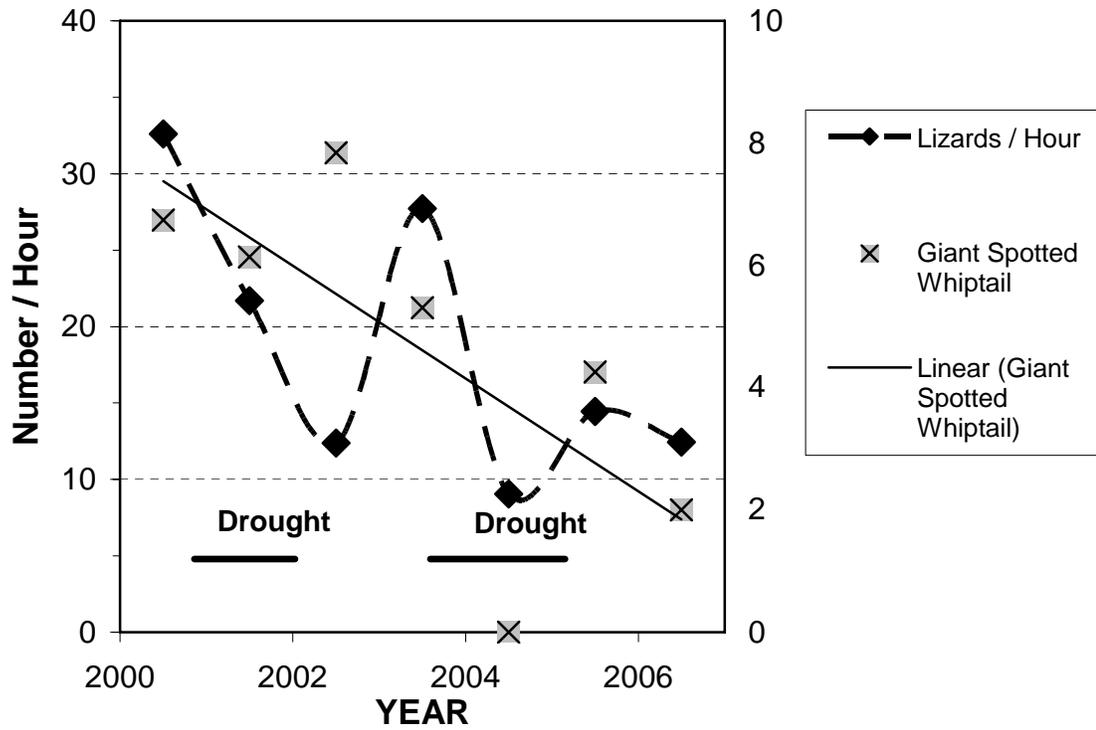


Figure 3
Lizard Abundance and Proportion of Giant Spotted Whiptails
at West Branch, 2000–2006

concern, although it is indicative of an overall problem. Further, the dense vegetation along the West Branch during monitoring in 2006 made it particularly difficult to see, approach, or identify the species of spiny lizards that were active in the bosque. Clark's spiny lizard probably still occurs at the West Branch, although it was not observed in 2006.

The giant spotted whiptail population at the West Branch is the only one known to remain in the Tucson Basin and one of a handful of lowland populations remaining in the United States. It also has a unique mitochondrial haplotype (i.e., unique genetics on the portion of DNA in the energy-producing organelle of the cell) compared to all others sampled in Arizona.

Two details from 2006 are worth mentioning. First, both female and male adult giant spotted whiptails were found in the reach of the West Branch where Pima County Regional Flood Control District initiated irrigation to support the bosque habitat, which is critical for this lizard species. Although this species has previously been seen in the same areas, it was previously more abundant elsewhere. This preliminary observation suggests that the watering should be continued.

Second, a hatchling giant spotted whiptail was found on 11 October 2006, close to the 44th Street alignment near the West Branch. This indicates that both males and females of the species—at least—persist, and that an “Allele Effect”, in which population density drops so low that reproduction fails, has not yet occurred. However, it is certainly apparent that this species population is near extinction.

4.0 Summary

4.1 Amphibians

Important amphibian breeding sites were identified near the local terminus of Santa Cruz Lane south of Silverlake Road, at a pond near the Tucson Water Company remediation facility and near to Tucson Diversion Channel. Six species of toads and toad-like frogs have been found attempting to breed in this area. A significant single-species breeding site was found to the north, at El Puente Lane, for Couch's spadefoot, the most widespread and abundant amphibian in Tucson.

Minor single-species breeding puddles, all also for Couch's spadefoot, were seen at numerous other sites in all sections of the historic floodplain terrace above the current arroyo of the Santa Cruz River between Ajo Way and Silverlake Road. These minor breeding sites play little role in contributing to local persistence of this species, except perhaps along the south leg of Cottonwood Lane, north of Ajo Way. Very minor breeding by Couch's spadefoot was found on the river's arroyo bottom, which reflects the general condition of the species throughout the Tucson basin for both the Santa Cruz River and, largely, the Rillito River.

Breeding sites south of Santa Cruz Lane at Mesquite Circle Pond and Tucson Diversion Channel are likely critical for the local persistence (in the West Branch area and, more generally, in central Tucson) of one species, the red-spotted toad (Channel), and important or critical for another, the Great Plains toad (Pond). The pond or its environs are also likely to play a role in determining the local persistence of the Mexican spadefoot, and could contribute significantly for two other species, the Sonoran Desert toad and Great Plains narrow-mouthed toad.

Couch's spadefoot can develop from egg to metamorph (toadlet) in 7.5 days and thus persist by using shallow, short-lived rain pools formed in smaller washes, abandoned minor diggings, and mud puddles deepened by vehicles in silty and clayey soils. Nothing short of intense road mortality or complete elimination of surface irregularities that hold standing water would likely eliminate this species, although it could be affected by other impacts.

All the amphibian species except for the red-spotted and Great Plains toads have stronger breeding aggregations at the West Branch than in the study area along the river east of the West Branch. However, the Mexican spadefoot, which is a significant consumer or mosquito larvae, is barely persisting at the West Branch and elsewhere in Tucson. Its future in Tucson would be significantly enhanced with the support of a population east of the river and other positive conservation efforts. The West Branch and adjoining parts of the Santa Cruz River constitutes the most important amphibian

breeding site in urban Tucson for all the species except for the red-spotted toad, which lives primarily in semi-arid canyons. Among the other five species, the Couch's spadefoot has its best urban populations at the West Branch, but is widely abundant also elsewhere along Tucson's major riparian corridors. The other four species could be extirpated, if their needs are ignored. The Santa Cruz River study reach near the West Branch is likely a key contributor to the persistence of amphibian species diversity at the West Branch and thus should be considered to be important for regional amphibian conservation.

4.2 Lizards

No special-interest lizards (see Table 1) were found in the study area, and populations of them are not to be expected without significant restoration or creation of thickets, bosques, or gallery forests. Lizards were abundant in the study area only in thickets west and southeast of the junction of Cottonwood Lane and Silverlake Road. The southwestern black-headed snake, another riparian-obligate species in Tucson, also occurred at these two areas. It and three special-interest lizards occur at the West Branch.

Monitoring for these special-interest species indicate that overall observed lizard abundance has stabilized at a moderate level following protracted drought, but results indicate that the most valuable local species population, the giant spotted whiptail, is in a steady decline. Another characteristic lizard of rich, mesic desert riparian areas, Clark's spiny lizard, may also be in local decline, but it still occurs along Tanque Verde Wash and upper Rillito River.

Three giant spotted whiptails were observed at the West Branch in 2006: two adults in the central part of the county-irrigated reach and a hatchling to the south, near the 44th Street alignment.

5.0 Discussion

The existing amphibian populations at Mesquite Circle Pond suffered declines during the past several years while construction was ongoing at the adjacent Interstate 10/Interstate 19 interchange. Additional damage occurred with extensive land disturbance to a large area immediately south of the Tucson Diversion Channel. If such activities continue, these populations will not persist. However, they are not irreplaceable and could be regenerated with habitat restoration from the West Branch or Ajo Detention Basin.

The Santa Cruz River bottom is inhabited by homeless persons who utilize most every well shaded spot (Photograph 12) both on the arroyo bottom and along the margins of the Tucson Diversion Channel. Homeless persons also inhabit the area of the Mesquite Circle Pond, where they may live in vehicles pulled temporarily into the mesquite scrub. The effect of this use on the amphibian populations is unknown.

Of more direct concern is the concept and outcome of potential infrastructure, ecological restoration, or commercial development that may occur astride the Santa Cruz River from Ajo Way to Silverlake Road and, indeed, north to 22nd Street. Amphibian populations persist in the Rio Nuevo area west of the Santa Cruz River, but are rapidly being extinguished by road mortality and elimination of breeding pools as that area is developed for commerce. The same could very well occur to the rest of the Santa Cruz River.

The results of this survey and broader observations in Tucson indicate that amphibian breeding occurs primarily on the floodplain terraces above the arroyo beds of the major urban riparian corridors. Little breeding occurs in the arroyo bottoms of either the Rillito or the Santa Cruz, but the surrounding riparian zones support many thousands of breeding frogs and toads. This suggests that preserving the fine soils of the historic floodplain surface of the Santa Cruz River will be more beneficial for amphibian diversity and abundance than widening the arroyo bottom and attempting to achieve ecological restoration there.

There are other approaches that could work, however. In Pantano Wash near Broadway, grade control structures create main-channel scour pools utilized by five of the amphibian species listed in Table 1, with minimal terrace habitat outside the soil cement banks. However, both the Rillito and Santa Cruz Rivers are larger, more powerfully scouring systems, and therefore it is not necessarily true that amphibian populations there, which currently breed on the old floodplain terraces above the arroyo bottom, would continue to persist in grade control structures analogous to those in Pantano. Although it should be feasible to engineer similar structures in these larger arroyos and thus create apparently suitable breeding pools, the great breadth of the arroyo-bottom strands and the high flood forces could present greater flood mortality risk for tadpoles and adult amphibians than in Pantano. The potential for habitat creation could be examined at flood control structures like those at Rillito east of Country Club and Santa Cruz River north of Silverlake Road, but so far significant populations have not been found at these sites. The Santa Cruz River arroyo between Silverlake Road and Ajo Way seems wide enough to support amphibians breeding sites and allow survival, but the soils may be too porous and the bosque too degraded.

In summary, although there is amphibian conservation potential worth investigating within the Rillito and Santa Cruz arroyos, the old floodplain surfaces (on the first terrace above the arroyo bottom strands) are where all the amphibian diversity is currently being supported. Therefore, restoration focused on the first terrace, along with maintenance of



Photograph 12
Homeless Persons' Establishment on the Santa Cruz River
Arroyo Bottom near Tucson Diversion Channel

These encampments occur throughout the study area where shade and privacy are available.

dispersal corridors, appears to be the most viable conservation strategy for amphibians and likely for reptiles as well. In the study reach, this implies that the best conservation strategy would focus on enhancements on the terraces east and west of the Santa Cruz River arroyo and maintaining suitable connectivity corridors across the river and between the river and the West Branch. In this context, current information indicates that widening the arroyo at the expense of the first terrace surfaces would be detrimental for amphibians and likely for many other species for which better habitat could be created on the terraces than in the arroyo.

Restoration activities in the river will tend to be undone by flooding, unless developing habitat is protected from the brunt of flood forces. If that is achieved on a local basis, shady, rich mature riparian woodland and forest might contribute to conservation of lizard biodiversity and could be utilized as foraging ground by amphibians. However, nothing is likely to be feasible within the incised arroyo in the study reach of the river that would enhance populations of lizard species listed in Table 1; these species require real bosque and gallery forest and must have stable areas that serve as refuges even when floods impact part of their habitat. For them, enhancement of habitat at the West Branch, and notably also within its surrounding neighborhoods, offers the most immediately feasible conservation opportunities, whereas restoration on the old floodplain terraces outside the arroyo appears to offer excellent medium- and possibly long-term opportunities. The same reasoning applies for aquatic species that might be restored, such as lowland leopard frogs (*Rana yavapaiensis*) and Gila topminnows (*Poeciliopsis occidentalis*), which are now established at residences adjoining the West Branch, as well as for other aquatic species that might be considered for restoration, such as other fishes, turtles, and gartersnakes.

6.0 Recommendations

6.1 Amphibians

6.1.1 General Recommendations

Conservation success is likely to be achieved by preservation of remaining open spaces and careful treatment of soils and remaining old trees on the historic floodplain surfaces surrounding the Santa Cruz River arroyo. Long, “laid-back” sloping banks and a widened river-arroyo channel are likely to provide little benefit for existing amphibian species and would come at the expense of floodplain terrace habitat with significant conservation and restoration potential. However, the current banks are so steep that they almost certainly severely impede amphibian dispersal between east and west terraces. Reducing these cut banks in some areas to a slope of about 30 degrees would probably be sufficient to

allow normal dispersal, although stabilizing them with rip-rap or soil cement rather than soil and vegetation might discourage the movement of smaller animals. Soil cement could be used in certain areas to deflect flood forces away from more natural soil banks, and dispersing animals would doubtless find their way past and around the less suitable hardened embankments. If the slight slopes and dense soils of the historic floodplain terraces could remain largely as they are, they would be conducive to the following conservation scenarios:

1. Capture local runoff in small ponds with intermediate hydroperiods (three to eight weeks, for example).
2. Capture sheet flow on the historic floodplain surface by avoiding incised washes and by judicious addition of levees and small water catchments.
3. Create rich riparian margins of entrenched washes like the Tucson Diversion Channel, avoiding the use of soil cement in these side drainages.
4. Divert flow from some of the entrenched washes onto the historic floodplain surfaces.
5. Create protected riparian outflows from the entrenched washes at their confluence with the Santa Cruz River.
6. Maintain continuous habitat corridors from the West Branch to the east side river floodplain.
7. Avoid heavy north–south vehicular traffic on the historic floodplain. Keep traffic flow at its margin, as exemplified by Mission Road, where road mortality of amphibians is practically non-existent despite the presence of large amphibian populations on the immediately adjoining floodplain.
8. Encourage neighborhoods on the floodplain to protect natural resources and enhance qualities of their properties beneficial to wildlife.

A number of properties seem especially suitable for purchase or dedication to conservation and park uses, notably all those on the east side historic floodplain from 34th Street to Ajo Way, and most of those on the west side historic floodplain from Silverlake Road to Ajo Way.

6.1.2 Amphibian Habitat Design Considerations

Although much remains to be learned about the facts of amphibian life in Tucson, enough observations of breeding biology (breeding site environments, adult-occupied habitat, and time-persistence of breeding water) are known to provide some working recommendations that could apply specifically to the study reach.

Two specific habitat considerations emerge: enriching bosque environments and enhancing breeding habitat. The summer-breeding amphibians in Tucson all appear to do well in a diversity of well-watered bosque types and do not apparently have stringent requirements for certain species of plants or for dense thickets. Ground-level productivity that would result from capturing sheet flow on or dispersing wash flows over level plains, where grasses and forbs would grow among small shrubs and mesquite, should suffice to create suitable feeding and hiding habitat for all six species. Examples of such suitable habitat are shown in Photographs 5 and 10, and additional examples can be found on many of the tobosa- and mixed-forb bottomlands at and southwest of the Pima County Fairgrounds, on the Fraser property at the West Branch and in the bosque south of San Xavier Road at the West Branch (visible from the road on the San Xavier District of the Tohono O'odham Nation). Similar productive wash-bank vegetation seen in parts of the Arroyo Chico near Highland and Santa Rita avenues offer more spatially constrained examples of vegetation and general moisture and humidity conditions suitable for adult and growing juvenile anurans of the locally occurring species.

Breeding habitat specifications can be given in a somewhat more preliminary way. Although certain parameters will be given, it remains unclear how exactly multiple species are able to coexist. It is certain that the hydroperiod (length of time water lasts without drying) determines whether a species can actually survive in a place or not. Although more detail will be provided in a separate report (the Swan Wetlands/Rillito Riparian amphibian salvage report, which is currently being prepared), some general guidelines can be summarized as follows. For Couch's Spadefoot, almost any pond, pool, or puddle that lasts for 10–12 days to a few months provides suitable habitat, and if shorter lived habitat is extremely prevalent it seems likely that Couch's Spadefoot could not only thrive, but compete strongly with other species, reducing biodiversity. This kind of less obvious process, or at least something like it, is likely to make the effect of hydroperiod on diversity less obvious and more complex than we currently understand. This means further research is needed for conservation.

That said, important design considerations can still be specified now. Red-spotted toads breed largely or entirely in rocky, flowing water like that found in canyon streams with few or no fish, and like that seen at Julian Wash (Tucson Diversion Channel) in the study reach. For this area, the Julian Wash is probably essential for the local persistence of this species, and water must remain for about 17 days, and often likely for 25 to 30 days, for reproduction to be successful. If more than one significant runoff event supplies water

to lower Julian Wash during a two-week period, the required hydroperiod may be achieved, even though a single event may be insufficient. The probabilities of two or more events have not been explored, but the principle should be clear. However, while this may apply well to a downstream reach like the Tucson Diversion Channel near the Santa Cruz River, where upstream areas with large imperviously paved surfaces yield abundant runoff to the lower reaches, sequential events refilling the breeding pools required by other species may be improbable. At present, Tucson Diversion Channel apparently provides adequate breeding habitat to support a substantial population of one toad species.

Pond-breeding species probably require a longer expected hydroperiod, because they are not likely to experience sufficient refilling to support tadpoles within a 2–3 week window. Current data indicate that the Mexican spadefoot tadpole requires 12–25 days to go through development and often lives in pools about 2–4 feet deep when full. The Great Plains toad can develop in as little as 17 days, but often requires longer. Optimal conditions include a hydroperiod of 17–30 days. This species also calls, and presumably would breed, during May and June in ponds with water but without predatory fish. It is widespread in Tucson, but there is some evidence that many of its breeding sites now have such reduced hydroperiods (or now have fish) that the adults are surviving for some years, while the population dwindles for lack of adequate breeding ponds. A somewhat different situation seems to characterize breeding of the large Sonoran Desert toad, although the details are only now becoming known from ongoing research and observational study. This species may require 30–45-day hydroperiods, in ponds 3–6 feet deep, and it often breeds in June before or just as the summer rains commence in fishless streams, pools, or ponds that retain water through the foresummer drought after wet winters. Sonoran Desert Toads also colonize newly established waters like fishponds, although the tadpoles probably cannot survive with fish. Excellent examples of suitable breeding habitat are found in larger stock ponds on the Santa Rita bajada in the Tucson Southlands and Santa Rita Experimental Range, at Buenos Aires National Wildlife Refuge, and even in the Black Wash Floodway pond near the Yaqui Pueblo. The Great Plains Narrow-mouthed toad appears to require about a 20–28 day hydroperiod, and near Tucson is most often found associated with richer environments with surrounding mesquite, grassy embankments, emergent aquatic vegetation, and submerged weeds such as Bermuda grass or other grasses. The subtle diversity of breeding characteristics of these four species suggests that one size will not fit all and that single ponds are not often likely to support them all.

A key model for how all four of these species might be supported is the West Branch area of the old Church Wash, the channel of which departs northward from the Church Wash Diversion at Mission Road about 0.4 mile south of 36th Street, passes in front of the Beryl Baker residence and across an arm of Pima County's mitigation property, and then onto the Padilla, Romero, and Fraser properties where it receives runoff from the west and supports the key amphibian breeding sites in the region. The Church Wash

Diversion was dug into the West Branch floodplain in the late 1980s to divert runoff from developments on the bajada west of Mission Road, and resulted in the desiccation and dieback of mesquite along the downstream Church Wash until additional inflow arrives on the Padilla property. The Padillas maintain a historic pond where this flow joins the Church Wash, and this pond apparently fills to a depth of about 3–4 feet with moderately strong rainfall events. There, large populations of Sonoran Desert toads and Great Plains narrow-mouthed toads breed successfully, and substantial numbers of Great Plains toads and Couch's spadefoot are also found breeding. The outflow of the pond is a shallow slough that supports huge numbers of breeding Couch's spadefoots, extending into a horse corral with a newer concrete curb that usually captures water that overflows the pond and slough. The pool in the corral supports many Couch's spadefoots, many of the few remaining Mexican spadefoots in the region, as well as a few Great Plains narrow-mouthed toads.

The current situation seems unstable. Prior to the concrete retaining structure at the Padilla's corral, and prior to the diversion of Church Wash, flow continued north into the mesquite on the Romero property where it filled a shallow circular pool, probably 18–24 inches deep surrounded by bosque and continued north into a large pool-pond complex in bosque adjoining the West Branch channel on the Fraser property. Large numbers of all five breeding species attempt to utilize these downstream pools, but they may now be a sink for all except the Couch's spadefoot, because the hydroperiod is too short, often less than two weeks, and the chance of refilling has been all but eliminated by the upstream diversion and water retention. While the Great Plains narrow-mouthed toad seems well adapted to the Padilla Pond and is persisting, the Mexican spadefoot appears to be in the process of being excluded by the loss of some aspect of the complex habitat, most likely the degradation of conditions in the intermediate-hydroperiod pools on the Romero and Fraser properties. The complexities recounted here suggest some recommendations that can apply to amphibian conservation at the West Branch, on the Santa Cruz floodplain terraces, and elsewhere, although we will have to manage adaptively as we learn more specifically how the community ecology of these animals works.

First, the Padilla Pond at about 3–4 feet deep, and filling at least partly readily from modest rainfall events (probably as little as 0.4 inches) offers a good model for breeding habitat that could be created in the Mesquite Circle Pond area. The existing levee could be modified by raising its lowest pond using the installation of an irrigation-type gate that could be set at different heights to achieve different full depths or to allow the pool to be drained, if mosquitoes or some other consideration required it.

Second, the shallower pools (mostly about 18–30 inches deep), seen in the Church Wash and elsewhere in the Tucson region, are likely to support additional species, especially Mexican spadefoots and, if they are set in relatively rich herbaceous areas with mesquite, the Great Plains narrow-mouthed toad. If these shallower ponds are likely

to get runoff often, their hydroperiod might be only 2–3 weeks and still support important breeding populations. A good example of where this might be accomplished in the study area is shown in Photograph 5, where pools could be created within the vegetation, where sheet flow from the large parcel would likely accomplish life sustaining refilling on a frequent basis.

Third, by accomplishing both of these restoration/enhancement projects in proximity to one another, it would be likely that complex and varied enough habitat would be created to sustain all five species for some years. Meanwhile, we would expect that a deeper understanding may emerge from research, and adaptive management could then be done if needed.

It is hoped that this discussion points toward the value of continuing research to establish the facts and dynamic theories needed for successful amphibian conservation in the region. For another species of interest, the remarkably attractive Sonoran green toad (*Bufo retiformis*), which may still remain near San Xavier and could be incorporated into the Tucson fauna, little is known of terrestrial habitat requirements or of breeding biology. This species is only available for study at a single known site, on the Palo Alto Ranch, except in Sonora and the Tohono O’odham Nation. Some of the research needed for urban conservation will have to occur in relatively natural settings outside the urban zone.

6.1.3 Parcels Suitable for Amphibian Conservation

From the standpoint of conservation actions that seem feasible and likely productive in the study reach, a few areas stand out in importance. A key feature involves connectivity between the West Branch and the Santa Cruz River. Two approaches seem likely to allow this connectivity to exist. First, purchase or easements could consolidate a corridor from the West Branch to the river immediately north of 44th Street via the Cesar Lopez property, the City of Tucson landfill, Parcel 11921031E, the four City of Tucson inactive landfill parcels just east of that, and the Chaffin property east of the landfill, along the river (Parcel 11918023B). Second, between these parcels and the trailer park subdivisions north of the Leon and Russell properties there remains a group of parcels with mostly older homes or open space that could be managed by a mix of purchase, easements, and neighborhood conservation initiatives. Along with the key issue of connectivity, these two areas could offer a site for a trail nexus between the river park and the West Branch. A more thorough and detailed consideration is needed there.

The key existing amphibian populations in the Santa Cruz floodplain study reach are in Parcel 11918002C, which is owned by the City of Tucson and includes the Mesquite Circle Pond and the lower Tucson Diversion Channel, and an unlabeled parcel between that one and Interstate 10. The south part of this parcel, and the adjoining City of Tucson parcel (Parcel 11918032B) to the south contain little good habitat now but must be

considered critical if an adequate fragment of habitat is to exist in this area. These southern areas could be restored along the lines described above in the preceding section for amphibians, lizards, and other species as part of a Paseo de las Iglesias effort. In addition, these parcels would be required for connectivity with the West Branch across the area described above in this section. As such, the City of Tucson is the key player in determining whether a viable conservation effort will be feasible along the river in this area. While some uses other than open space could be tolerable within a conservation framework, the problem of unsustainably heavy road mortality must be considered in addition to the need for suitable habitat and large enough blocks of habitat.

Intensifying development along Santa Cruz Lane south of Silverlake Road would significantly reduce the conservation potential of the area by increasing road mortality, which is already significant due to the new pavement extending 1/2 mile south from Silverlake Road. North of the Mesquite Circle Pond parcel, a large parcel (11811049G) owned by Meridian Enterprises LLC and recently used to stage the construction of the new interstate highway exchange, is the site of Photograph 5 and is large enough and well enough situated to rate as the highest priority private parcel for purchase for the conservation reasons discussed in this report. The site could readily be enhanced in several ways by encouraging the native forbs to expand, adding appropriate seed, planting native mesquite and other woody plants, and designing the sheet flow and water retention to support native plants and amphibian breeding. By acquiring this parcel, it would also be possible to regulate traffic to minimize amphibian road mortality on the south portion of Santa Cruz Lane here.

Although there are several residences crowded along the north edge of the Meridian property on 34th Street, the Meridian property opens to the northeast into Parcel 11811049D and adjoining parcels all owned by the State of Arizona (probably associated with the highway). Securing these as part of a conservation effort could allow the conservation project to proceed north to the other area currently supporting a high abundance, and some diversity of amphibians, along the eastern part of El Puente Lane. The property owned but apparently not intensively used at present by Clear Channel Communications (Parcel 11811022C) has a large shallow puddle-pool in scrubby mesquite that supports a large, successful population of Couch's spadefoots and many aquatic insects (see Photograph 4 and Section 4.1). Since this parcel may not be actively in use, it might be available for purchase. Between the Clear Channel parcel and the state-owned land near the highway are two parcels owned by Pablo Rodriguez (801 W. El Puente Lane; Parcels 11811022A and 11811021O) that appear vacant except for one or more homeless squatter camps. Thus, conservation efforts could be extended into this area. However, the Clear Channel parcel has a building that would likely increase its price.

To the north, between El Puente Lane and Silverlake Road, the land is mostly used by rough commercial operations, which entrain only low traffic, but which could very well be turned into a high-density development. If some or all the parcels discussed in this report were to be included in a conservation project, those parcels should be further evaluated. Of particular interest would be the Delia and Richard Gastelum properties astride the block of Santa Cruz Lane south of Silverlake Road.

6.2 Reptiles

The common desert species of lizards respond very well to the kind of restoration currently practiced along the Rillito River system. Very high abundances live among the native plant (brittlebush (*Encelia farinosa*), saltbush (*Atriplex* spp.), creosotebush (*Larrea tridentata*), blue paloverde (*Parkinsonia florida*), and mesquite along soil cement banks, and arroyo-side trails. However, riparian lizard or snake species are not found in these environments. These species are found in rich bosque, gallery forest, and neglected soil benches even within soil cement in places. Conservation of these generally interesting and attractive species, and the attendant biodiversity benefits will require a focus on sustaining more mesic riparian system and/or patches, either using natural processes or artificial irrigation.

It is significant to repeat that giant spotted whiptails, which require dense bosque-thicket type cover, and Clark's spiny lizards, which seem to require relatively mesic bosque and gallery woodland, have been found around well watered residences at the West Branch. Also, Clark's spiny lizard appears to be persisting in the northern part of downtown Tucson, beginning in the north courtyard of the art museum. Thus, conservation of these species is potentially feasible, but likely requires water. The most immediate task for them remains supporting the West Branch bosque with irrigation.

APPENDICES

APPENDIX A

APPENDIX A
UTMs FOR FIELD SITES (WGS 1984 DATUM)

Reference	Zone	Easting	Northing	Date	Description
Photograph 1	12S	501350	3561593	8/8/2006	Mesquite Circle Pond (S end SC La)
Photograph 2	12S	501279	3561534	8/8/2006	Tucson Diversion Channel riprap falls, 150 m E SCR
Photograph 3	12S	501573	3561431	8/8/2006	Tucson Diversion Channel above riprap falls
Photograph 4	12S	501469	3562268	8/8/2006	El Puente Road amphibian pool, E SC La
Photograph 5	12S	501331	3562025	8/8/2006	Poinsettia site at corner SC LA and 34th St
Photograph 6	12S	501155	3560824	8/12/2006	Tucson city property E of SCR and N of Ajo Way
Photograph 7	12S	500892	3560501	8/12/2006	Rut puddle near S Cottonwood La, N of Ajo Way
Photograph 8	12S	500872	3560922	8/12/2006	SCR bottom N Ajo Way, from N end Cottonwood La gravel pit
Photograph 9	12S	501040	3562345	8/23/2006	Open parcel W Cottonwood La along Silverlake
Photograph 10	12S	501042	3562420	8/23/2006	Swale SE Cottonwood La and Silverlake
Photograph 11	12S	501173	3562182	8/23/2006	SCR just S Silverlake
Photograph 12	12S	501232	3561333	8/12/2006	Homeless camp on SCR bottom S of Tucson Diversion Channel

APPENDIX B

**APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)**

8 August 2006 — Santa Cruz River bottom (E side) along Santa Cruz Lane

1220–1645: I started at 22nd Street and cut south through the neighborhood and found a big pool in a wash half-way to Silverlake Road at the Cross Cut Road (one can imagine what that refers to). There I found a good crop of 7–8 d-old *S. couchii* tadpoles, and mosquitoes flying but no larvae. Then I proceeded east the Santa Cruz, but found nothing in pools in the riverbed, crossing over to the south of Silverlake Road on foot, and finding the first wash channel dry.

- Then I went down Santa Cruz Lane from Silverlake, stopping at several sites.
- East of the S end of S.C. La I found a big puddle with a little aquatic beetle (*Eretes?*) activity, and netted a single two-centimeter beetle larva).
- Same spot, but S of the road to the Tucson Water remediation plant I found a shallow pool in the arroyo that, in ca. 2002 (see my notes) had a Salsola-dominated pool complex with BUAL, SPMU, BUCO, and SCCO. In this pool I got a few *Triops* (tadpole shrimp) and *S. couchii* tadpoles (6–8 d-old).
- Proceeding S around the Mesquite Circle Pond I found a road-rut puddle that had a few Fairy Shrimp and *S. couchii* tadpoles.
- At the Mesquite Circle Pond, water was 16" deep in the east end with mesquite, and there I found a good moderate abundance of *S. couchii* tadpoles (2 cm; old) and a small hoard of metamorphs under a board under a mesquite. Temperature here was 33-36 degC, with a major cool zone ca. 24 degC to the touch within 2 cm of the hard mud bottom. The larger, more shallow, less shaded northwest sector of the pond had a good moderate abundance of 1.5 cm (presumed 8 d-old) Great Plains Toad (*Bufo cognatus*) tadpoles. Here the water was much warmer (41 in shallow water, 40 in the deeper water. 38 on the muck surface where an animal could work in, and 36 3 cm into the muck. The toad tads were certainly tolerating 40 degC, or 104 degF body temperature, with a maximum depth of about 7-8". Throughout this pond arthropods were very abundant – Fairy Shrimp, Tadpole Shrimp, Beetle larvae (all about 1.5 – 2.25 cm long and of on kind, probably *Eretes*), plus a 1/4" dytiscids, and a 1/6" non-dytiscid diving beetle (in that order), plus I netted 1 *Eretes* (Charlie Brown beetle) and 1 *Belastoma* adult. No mosquitoes.
- I then checked the Tucson Diversion Channel, which had 2-4 age classes of *Bufo punctatus* tadpoles (larger ones in better still areas; I took a sample of about 8 to rear for ID check), distributed from 60 m above the S.C. River confluence all the way east

**APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)**

- to the concrete channel (which I didn't check). I also saw 1 *Eretes* and 1 *Belastoma* adult, and not much else except a bit of algae on the sand. Leaving, found a dried puddle adjoining the S. C. River bottom to the S of TD Channel with dead *S. couchii* tadpoles and at least a few live metamorphs.
- I then checked the rich area at the corner of S.C. La and 34th Street but no breeding habitat – top-notch stand of native *Poinsettia*.
 - Proceeded over to El Puente, where a mesquite scrub pool was chock full of *S. couchii* tadpoles (8-9 d-old, most with hind and front legs) and several size classes of those scary *Hydrophilis* water scavenger beetle larvae, plus a few of the two usual small diving beetles. On the mud in the mesquite there were massive herds of metamorph *S. couchii*, literally thousands together, as many or more than I've ever seen elsewhere, all less than 1 week post-metamorphosis. Most of the pool was 8" deep, but one site of 20".
 - I departed just as light rains, which became a major storm in the evening, became evident.

12 August 2006 — Santa Cruz River bottom (E and W sides) 29th – Ajo

1300–1630: I went back down Santa Cruz La to search for other tadpole species now that all *S. couchii* will be transformed and out of the water.

- **El Puente Lane mesquite scrub pool** had many metamorphs as before, but no tadpoles in the water, and many more beetles (including 1 *Eretes* seen) in evidence. Found a notonectid. No mosquitoes.
- **Mesquite Circle Pond** had common *B. cognatus* tadpoles (2+ cm long, early hind limb stage), and invertebrates as before with less dytiscid larvae and a few small *Hydrophilis* larvae seen, plus a few notonectids.
- Went **N of Ajo Way on COT land E of SCR**, and found good old, but now scrubby mesquite that might respond well to restorative park development with water. In this southern mesquite stand, I found an RV parked, and a vanishing puddle that should have been too small to invite the oviposition leading to the few, doomed (3 d-old size) *S. couchii* tadpoles I found; depth only 1.5 cm. Further north, just south of the Tucson Div Channel, the *S. couchii* pool had new 5-6 d-old tadpoles (possibly doomed), and many mosquitoes (ready to make it). Another puddle, on the margin of the SCR floodplain bottom had no tadpole evidence. I noted the open ground, weed

APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)

patch S of this, possibly suitable for heavy restoration work, and made a pan of photos. Two major squatter-homeless shanty setups are on the floodplain here. Overall, habitat quality here is not good.

- Went up **S Cottonwood La from Ajo Way**, and found a wheel-rut puddle pool with a moderate abundance of *S. couchii* tadpoles, and photographed gravel pit and SCR bottom. Went p the **old acequia N end of Chaffin property** and found it dry and dead.
- Went S on and E from Cottonwood La from Silverlake Road on the SCR original floodplain surface and found a puddle pool with 1 metamorphosing *S. couchii* tadpole and many mosquitoes about to eclose from the pupa stage. I also found a **swale in the old surface** with mesquite suitable for Giant Spotted Whiptails, and found a moderate abundance of *S. couchii* metamorphs. They could breed in this, most likely, but it doesn't look sufficient to support other species. Many mosquitoes attacked me in this swale.
- I proceeded to the **Fraser Pond adjoining West Branch** to calibrate the search for other species of anurans. There was a very high density of *Gastrophryne olivacea* (Great Plains Narrow-mouthed Toads; no hind leg yet, but about full size) in the green-topped water, and a few *B. alvarius* tadpoles (full size ranging from small hindleg to metamorphosing). Surrounding the water was an abundance of *B. alvarius* metamorphs. The water is about 13 days old, corresponding to the *Gastrophryne* developmental stage, but too early for the *B. alvarius* based on previous data. This, and the absence of breeding *B. alvarius* here or in the Padilla Pond 13 days ago suggests the *B. alvarius* may have come in with floodwaters, rather than developed with exceptional speed.

The Fraser Pond has been shrinking rapidly after filling for the first time 13 days ago, but not as fast as Judy Fraser expected. The deep N end is about 1m X 5m and up to 0.7m deep, but the rest is down to 25 cm or less, and in two parts about 3 X 4m and 6 X 18m. There was a severe mosquito attack on anyone in the area, but none in the water. There were a fair number of *Hydrophilis* beetle larvae, medium, small, and very small water beetles and one *Triops* (tadpole shrimp) detected. I collected some water (with a few incidental animals to check for mosquitoes, but found none.

The Fraser Fish Pond is doing well, the water having finally cleared this spring. There are about 10 huge Longfin Dace, and 1 or more normal-sized recruits, plus a fine abundance of Gila Topminnows. Note that I added about 100 small *Rana yavapaiensis* (Lowland Leopard Frog) tadpoles this spring, since Judy did not see

**APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)**

eggs or tadpoles from the ca. 5 survivors; she has now seen up to 8 metamorphs at once, and they have been seen up around the house as well as in the ponds. Beryl has reported numbers of metamorphs (from *in situ* breeding this spring), and recently a large dead tadpole – I also saw one dead in Cecil's home pond this past week) at her pond, but I have not visited there yet.

14 August 2006 — Fraser Pond at West Branch

Judy Fraser described pond function: the pond originally received inflow from Church Wash, but has slowly been regressing since that was diverted in ca. 1988. That flow was replaced by flow from an unnamed wash that enters near the south end of her property. The flow goes through the Padilla property, where it first fills the main pond, then the pools leading to their first horse corral (at the N property line), then the pool in the horse corral, then the pool in the mesquite adjoining their property line just to the N, then to the Fraser Pond.

This long path means the pond only fills once or twice per season at best, and if it fills completely it only lasts about 2 weeks. Therefore it produces a big crop of mosquitoes and is not sufficient to sustain good populations of mosquito-controlling arthropods such as tadpole shrimp and dytiscid beetles, which probably mainly come in from upstream. Also, the pond is generally not now long-lasting enough to sustain anurans other than *S. couchii*, although on occasion other species make it through due to two filling events or overflow of tadpoles from upstream (assumed).

Various solutions may be proposed, none very simple or cheap.

Although Judy added 1800 gallons of water on 8-13-06, that only went halfway to preventing complete drying. The isolated upper pool that was 6" deep on 12 August was dry, and there were 75 dead tadpoles (all *Gastrophryne*?) and several dead crustaceans. Another 1800 gallons is to be added today.

We went out and salvaged 365 *G. olivacea* tadpoles (50 to the inflow pool on Fraser's at Mission Road, 200 to Mesquite Circle Pond E of SCR, 100 to NW part Ajo Detention Basin, 15 to 4006 E Paseo Grande) and 25 *Bufo alvarius* tadpoles (and some possible *B. cognatus*) to Paseo Grande to be raised to determine species.

In doing so, netting yielded many small water beetles, some of their larvae, several adult *Eretes*, 1 large *Hydrophilis* larva, 5 *Belastoma* adults, 1 *Triops*, 3-4 fairy shrimp, that's about it. Flying mosquitoes were fierce, but none were wrigglers in the water. The light

APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)

rains and the chlorinated water have eliminated some of the green-granular algae film on the water surface.

Release sites look less favorable than the Fraser Pond. The **Mission Road Pool** is small and doesn't look very productive (saw 2 pre-metamorph *S. couchii* carnivorous). The **Mesquite Circle Pond** has some of the algae film, and good water, but its surroundings are more baked and barren (didn't net; water has dropped an inch or two; saw 1 pre-metamorph *S. couchii* carnivorous and heard 1 juv *R. catesbeiana*). **Ajo Detention Basin** is swamped with water and not very productive-looking right now, and there are lots of amphipods in the water; I saw no metamorphs hopping there, though the ground was moist. There was a modest outflow at ADB and a tiny trickle of inflow.

17 August 2006 — West Branch and Mesquite Circle Pond E SCR

1930–2100: Went with Julia, Sander, Cephias, and Beryl Baker to sample Triops, and found *Eretes* extremely abundant, along with the other things seen previously (this suggest the larvae were all *Eretes*), plus a good number of libellulid nymphs. Saw no *Gastrophryne*, but netted 8 *B. cognatus* larvae (3 frontleg, 5 large hindleg) and found 3 tail-stub metamorphs. Collected 28 *Triops* for Beryl's toad pool, and took a handful of *Eretes* and a couple of other predatory things, as she has many mosquito larvae there. I released 22 *Spea* there (5 from Valencia at Pantano, 17 from Columbus) and 14 (from Columbus) at Beryl's, where she also has some *Gastrophryne*, and where we saw an adult *B. cognatus*. At Beryl's USFWS Pond, *Poeciliopsis* were extremely abundant, and I counted 11 metamorph *R. yavapaiensis* and 3 large tadpoles.

19 August 2006 — West Branch

0904–1316: Conducted TCS on lizards from Church Wash parking south to main thicket on city land, north to S end of Fraser property, then over to Russell-Randolph property where I was able to do a circuit amidst the socializing. In addition to the reptiles and predators noted, saw 9 *S. tereticaudus* and 3 *Sylvilagus*, along with some interesting birds: a lesser goldfinch, and several yellowish warblers (with distinct white eye rings, one with a grayish head).

- At West Branch I found anuran larvae, which I thought were *B. cognatus*, but turned out to be *B. alvarius* (see 8-23-06) at Jesse's corral (just S of Ch Wash Div confluence) and in three pools at 44th ditch confluence. The pool at Jesse's was small and about 6" deep, and also had mosquito larvae, including some huge ones, and a couple of tadpole shrimp (*Triops longicaudatus*). Other pools, more shallow (to 2-4") were teeming with mosquito wrigglers. However, the deep pools (to 6-14") at

APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)

the 44th confluence were loaded with small beetles (dytiscids and hydrophilids, and possibly other families), *Eretes*, 2 cm libellulid nymphs, and with much effort I located 2 mosquito wrigglers. These pools also had a moderate abundance of *B. alvarius* tadpoles, and a single *Gastrophryne* tadpole was seen. I didn't spend much time or effort on this. Also in these pools I saw Lowland Leopard Frog juveniles (from Beryl's pond) and a small juvenile Checkered Garter Snake (*Thamnophis marcianus*, the first confirmed record, by photo). The Enchanted Hills/San Juan distributary floodplain pool S or Church Wash Diversion had 15 small juvenile LL Frogs, and on return trip I found an adult *B alvarius* active 50 m from it in the hot sun. The Freedom Road-end pool in WB had 2 juvenile Bullfrogs, presumably among many dispersing from Kennedy Park. Near Freedom Road-end Pool, I found a subadult male SW Blackheaded Snake (*Tantilla hobartsmithi*) under a shaded board; earlier I had found a young adult Long-nosed Snake (*Rhinocheilus lecontei* [bright lecontei phase]) under a board nr Jesse's. Overall the day was extremely productive of biodiversity.

- West Branch has had some significant flooding, no doubt on 29 July - 1 August. Water was nearly or just at bankfull. Flotsam came down the Enchanted Hills Wash leaving heavy deposits especially on the WB rim. In the channel large amounts of light debris are in trees and branches and strewn about, and some previous debris complexes are gone. The herbaceous cover is lush and over 100% coverage in most areas in the WB bosque proper and in well-watered parts of the floodplain. The un-watered Brophie floodplain is green but not tall nor with near 100% coverage, and it was much more lush in the year of the big overbank flood, 2002 I think. There is much leaf damage on many of the plant species, and insects are conspicuously abundant and diverse.
- I note there are many *Koeberlinia* plants on the City property along WB S of 44th Street alignment.
- The abundance of predators observed on these TCS is notable – roadrunners, cats, kestrels, etc. The lizards are markedly confined to very good escape cover. (Lizard and other data are in the lizard and anuran Excel files.)
- The only *C. burti* I found was near the north end of where I went, even with the Padilla property. It was a small, but full adult, in a mesquite thicket where I previously have seen this species and *S. clarkii*. Notably, the only other *C. burti* seen was also in the north half, though I have made considerable efforts (see also 8-23-06) to relocate those I saw down around 44th and further S in 2005. Perhaps the severe

**APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)**

desiccation evident in all the big mesquite S of the Church Wash Diversion confluence, and the county's watering of mesquite bosque N of the diversion have determined where the Giant Spotted Whiptail is persisting.

0904–1316 hr: Conducted TCS on lizards on Russell-Randolph property. Results of both are detailed in the Excel file, "Lizard TCS Tucson". Although I saw a juvenile *C. burti* in Jean Russell's stock-Oleander bed in spring 2006, now the watering is less and I saw few lizards.

20 August 2006 — West Branch

1238–1457: Conducted TCS on lizards from Fraser thicket S to the concrete pipe crossing and north to Silverlake Road, as detailed in the Excel file. Cardinals were prominent along this reach.

- During this effort I found *B. alvarius* and *S. couchii* metamorphs in wet spots in the WB bed downstream about halfway from Fraser's, but only *S. couchii* in the more arid and remote Bus Barn parcel in the Mission and Silverlake area. The N end of the BB parcel is particularly lush, especially close to WB, and I saw interesting plants there.
- The single *C. burti*, a small-medium adult, was in the bosque thicket on the E side, near an area where one was seen with Persons, Wright, and Bezy in 2003.
- From 1500-1645 hr I removed 223 more *Gastrophryne* tadpoles from the drying Fraser pond (she has been putting in about 1800 gallons/day starting 8-13-06 just to keep it from drying, and wants to discontinue after today, though she said she might give it one more shot). Took 73 frontleg and 150 hindleg or smaller *Gastrophryne* tadpoles, releasing all 73 + 100 at Mesquite Circle Pond and holding 50 tadpoles at home for Ajo Detention Basin.

23 August 2006 — Santa Cruz floodplain W of river near Silverlake Road

1130–1645: Conducted TCS in the small thicket line just W of the arroyo wall N right up to 29th. Many lizards, and a *Tantilla* under a big tree right S of 29th. The puddle that previously had many mosquitoes and a single tadpole supported only beetles this time.

Another TCS on the **floodplain parcel S of 29th and W of Cottonwood Lane**, with similar results all around – a snake, many lizards, a roadrunner, a cottontail, a rock squirrel, but also a small juv *Sceloporus magister*.

**APPENDIX B
FIELD NOTES (ROSEN, VERBATIM)
(continued)**

- Then I proceeded down Guadalajara Street and started a 3rd TCS at the 44th Street alignment ditch, repeating the area from Enchanted Hills confluence to through about half the City property. Lizard activity was poor, though I did finally find a *Sceloporus* (probably magister) and also a neonatal Zebra-tailed Lizard (*Callisaurus draconoides*). I saw a possible *C. burti*, in a debris area of the thicket where I previously saw them (2005).
- The shallow pools had all dried up, and one of the dragonfly pools at 44th was nearly dry – the several dozen 2 – 2 .5 cm nymphs concentrated in it may be doomed. However, the two other pools might hold up for them, and the tadpoles, which are now represented as abundant *B. alvarius* metamorphs, have apparently all transformed. I saw 4 Lowland Leopard Frogs, but down in the Freedom Rd-end Pool, heard 5 juvenile Bullfrogs squeak as they jumped. Saw another roadrunner.
- I then explored and reconnoitered briefly to the S, along **WB S of Ajo Way**, and along the **SCR W side floodplain surface down to Valencia**, seeing various predators (roadrunner, kestrel, and coyote) and finding a puddle pool with no mosquitoes, many small dytiscids, and a few fairy shrimp; metamorph *S. couchii* were abundant on the margin. Round-tailed Ground Squirrels are preternaturally abundant on the floodplain – no doubt a result of insufficient snakes, generally one of the planet's leading problems. The vegetation is poor once the WB to about ¼ mi S of Ajo is left behind, but there is considerable conservation potential, as the surface is OK and there may not be road mortality issues.

7 September 2006

Proceeded to **Mesquite Circle Pond** on the SCR old surface nr I10 – I19 interchange, and released 44 GAOL (Fraser), 4 SPMU (Vail), 3 BUCO (Vail), and 1 SCCO (carnivorous tad, Vail – all Pond 3 SE of Esmond), held and fed for 2 weeks) and found under cover 2 GAOL, 2 SCCO, and 1 BUPU (small juveniles 1-5 – 2 cm, growing well).

10–13 October 2006

Lizard TCS conducted at **West Branch**. Data are available in WayPt and LIZ TCS Excel files.

APPENDIX C

**APPENDIX C
TABULAR FIELD DATA**

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
RR1	12S	501040	3562345	8/23/2006 12:24	Roadrunner (1 ad) nr SCR S 29th	<i>Scaphiopus couchii</i>
STA1	12S	501042	3562420	8/23/2006 11:43	Start SCR lizard TCS	
TAHOF	12S	500785	3562532	8/23/2006 13:10	TAHO (1 lg ad F) under board, W SCR at 29th	<i>Tantilla hobartsmithi</i>
P01	12S	501232	3561333	8/12/2006 14:11	loc - photo set S of Tuc Div Chann	
COGPLS	12S	501350	3561593	8/8/2006 15:11	BUCO SCCO tads (abund) Mesq Circle Pond (SC La) w many inverts	<i>Bufo cognatus</i>
FALLS	12S	501279	3561534	8/8/2006 16:00	BUPU (tads common) riprap falls Tucson Div Chann 150 m E SCR	<i>Bufo punctatus</i>
PUNCUP	12S	501573	3561431	8/8/2006 16:00	BUPU (tads mod common) approx highest pt in stream Tuc Div Ch	<i>Bufo punctatus</i>
1000SC	12S	501469	3562268	8/8/2006 16:36	SCCO 10s of 1000s of metas off El Puente E SC La, hydrophilids	<i>Scaphiopus couchii</i>
POINST	12S	501331	3562025	8/8/2006 16:24	Poinsettia site (no breeding for anurans in SC La levee corner	
P02GEN	12S	501155	3560824	8/12/2006 14:15	Loc - approx photo LOC Tucson city SCR mesq N of Ajo Way	
RUTP	12S	500892	3560501	8/12/2006 14:23	SCCO - (mod common tads) rut puddle nr S Cttnwd La N of Ajo Way	<i>Scaphiopus couchii</i>
P0304	12S	500872	3560922	8/12/2006 14:30	Loc - approx photo LOC GRAVPIT SCR bottom N Ajo Way	
COUPH2	12S	501724	3562903	8/8/2006 13:54	SCCO (100s tads few metas) pool at Cross Cut Rd N of Silverlake	<i>Scaphiopus couchii</i>
ZIPSCR	12S	500986	3562812	8/8/2006 14:00	Zip - nothing in water in SC River just N of 29th St.	
ZSCR29	12S	501147	3562613	8/8/2006 14:22	Zip - nothing in water in SC River just N of 29th St.	
BEETL	12S	501371	3561752	8/8/2006 14:44	Beetle larva (Eretes?) in puddle SE SC La	<i>Eretes</i>
TSPCOU	12S	501372	3561739	8/8/2006 14:48	SCCO (few tads) Triops in shallow pool along Tuc Water Rd S SC La	<i>Scaphiopus couchii</i>
MSPCOU	12S	501387	3561558	8/8/2006 14:53	SCCO (few tads), Manatee-tail Fairy Shrimp in wheel rut puddle (S of SC la)	<i>Scaphiopus couchii</i>
COGPLS	12S	501350	3561593	8/8/2006 15:11	BUCO SCCO tads (abund) Mesq Circle Pond (SC La) w many inverts	<i>Scaphiopus couchii</i>
STREAM	12S	501221	3561582	8/8/2006 15:32	BUPU (tads mod common) lowest pt in stream Tuc Div Ch	<i>Bufo punctatus</i>
PUNC	12S	501366	3561431	8/8/2006 16:00	loc - falls in Tucson Diverson Channel nr Santa Cruz River	
SCLA chorus	12S	501426	3562401	8/8/2006 16:00	Santa Cruz La (S of 29th) chorus site in secondary wash - dry now	

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
COUDDL	12S	501248	3561426	8/8/2006 16:04	SCCO metas (few) dead tads (1000) puddle S Tuc Div Ch nr SCR	<i>Scaphiopus couchii</i>
MSQC	12S	501346	3561670	8/12/2006 13:16	BUCO (tads mod common) Mesq Circle Pond N Tuc Div Chann	<i>Bufo cognatus</i>
MNY	12S	501486	3562264	8/12/2006 13:41	SCCO (many metas) off El Puente E SC La, hydrophilids	<i>Scaphiopus couchii</i>
CDOOM	12S	501121	3560285	8/12/2006 13:54	SCCO (ca. 50 tds sm, unhelathy) shallow puddle Tucson city SCR mesq N of Ajo Way	<i>Scaphiopus couchii</i>
LUCKQQ	12S	501250	3561424	8/12/2006 14:05	SCCO (mod abund tads - 5-6 d-old, few meta) many mosquitoes - pool S Tuc Div Chann, nearly dry	<i>Scaphiopus couchii</i>
NONE	12S	501211	3561409	8/12/2006 14:06	Zip - puddle on SCR floodplain margin, no sign of tadpoles	
MSQ2	12S	500977	3562442	8/12/2006 14:51	SCCO (1 metamorphiing tad) in puddle pool w many mosquitoes NE Cttnwd La sector SCR	<i>Scaphiopus couchii</i>
LIZCMT	12S	501065	3562374	8/12/2006 14:56	SCCO (metas mod uncommon) in mesq-lizard swale NE Cttnwd La sector SCR	<i>Scaphiopus couchii</i>
DRY	12S	500728	3561160	8/12/2006 15:06	Zip - old growth mesq stand on WB area acequia, now dry and dead	
FRZ	12S	500362	3562003	8/12/2006 15:15	GAOL (tads v abund) BUAL (tads few metas abund) in Fraser Pond nr WB	<i>Bufo alvarius</i>
FRZ	12S	500362	3562003	8/12/2006 15:15	GAOL (tads v abund) BUAL (tads few metas abund) in Fraser Pond nr WB	<i>Gastrophryne olivacea</i>
REL50G	12S	500163	3561918	8/14/2006 16:42	Rel - 50 GAOL (lg tads fr Fraser Pond) at Mission Rd pool on Fraser property	<i>Gastrophryne olivacea</i>
REL50G	12S	500163	3561918	8/14/2006 16:42	SCCO (2 pre-met carnivorous morph seen) at Mission Rd pool on Fraser property	<i>Scaphiopus couchii</i>
RL200G	12S	501315	3561607	8/14/2006 16:56	Rel - 200 GAOL (lg tads fr Fraser Pond) at Mesq Circle Pond E SCR nr Tuc Div Chann	<i>Gastrophryne olivacea</i>
RL200G	12S	501315	3561607	8/14/2006 16:56	RACA (1 juv) SCCO (1 pre-met carnivorous morph seen) Mesq Circle ond nr SCR	<i>Rana catesbeiana</i>
RL200G	12S	501315	3561607	8/14/2006 16:56	RACA (1 juv) SCCO (1 pre-met carnivorous morph seen) Mesq Circle ond nr SCR	<i>Scaphiopus couchii</i>

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
COGMET	12S	501480	3561680	8/17/2006 19:45	BUCO (3 met, 3 front leg, 3 lg hindleg) Mesq Circle Pond nr SCR	<i>Bufo cognatus</i>
REL22	12S	501448	3561740	8/17/2006 20:00	Rel - SPMU (22: 5 fr Valencia, 17 fr Columb) at Mesq Circle Pond nr SCR and Tuc Div Chann	<i>Spea multiplicata</i>
REL14	12S	500189	3561512	8/17/2006 21:00	BUCO (1 ad) I Beryl Baker toad pool	<i>Bufo cognatus</i>
REL14	12S	500189	3561512	8/17/2006 21:00	RAYA (11 meta, 3 lg tad) in Beryl Baker USFWS pond	<i>Rana yavapaiensis</i>
REL14	12S	500189	3561512	8/17/2006 21:00	Rel - SPMU (14 fr Columb) at Beryl Baker Pond nr West Branch	<i>Spea multiplicata</i>
START1	12S	500117	3561439	8/19/2006 9:04	Start - lizard monitoring WB, at Ch Wash Div	
S01	12S	500293	3561457	8/19/2006 9:09	CNSO - ad Ch Wash Div	<i>Aspidoscelis sonora</i>
STU	12S	500371	3561486	8/19/2006 9:14	CNSO , CNTI, CNUNK WB Ch Wash Div	<i>Aspidoscelis sonora</i>
STU	12S	500371	3561486	8/19/2006 9:14	CNSO, CNTI, CNUNK WB Ch Wash Div	<i>Aspidoscelis</i> sp.
STU	12S	500371	3561486	8/19/2006 9:14	CNSO, CNTI , CNUNK WB Ch Wash Div	<i>Aspidoscelis tigris</i>
RAYA15	12S	500365	3561457	8/19/2006 9:22	RAYA (15 meta) WB-Ench Hills floodplain pool S Ch Wash Div	<i>Rana yavapaiensis</i>
S04	12S	500393	3561475	8/19/2006 9:24	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonora</i>
T02	12S	500412	3561459	8/19/2006 9:26	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
RHLE	12S	500400	3561414	8/19/2006 9:29	RHLE (ave ad) under board nr Jess's corrals, WB	<i>Rhinocheilus lecontei</i>
BTADS	12S	500391	3561367	8/19/2006 9:33	BUAL (origin ID as BUCO) tads, cat, Coopers Hawk WB pool nr Vbaker/Jesse corrals	<i>Bufo alvarius</i>
BTADS	12S	500391	3561367	8/19/2006 9:33	BUAL (origin ID as BUCO) tads, cat, Coopers Hawk WB pool nr Vbaker corrals	<i>Coopers Hawk</i>
BTADS	12S	500391	3561367	8/19/2006 9:33	BUAL (origin ID as BUCO) tads, cat , Coopers Hawk WB pool nr Vbaker corrals	<i>Felis cattus</i>
Uorn	12S	500391	3561367	8/19/2006 9:33	UROR (ad female) WB S Ch Wash Div	<i>Urosaurus orantus</i>
2RR	12S	500378	3561331	8/19/2006 9:43	Roadrunners (2) WB N Ench Hills confl	Roadrunner
TSDF	12S	500296	3560994	8/19/2006 9:58	RAYA (2 meta), THMA (1 sm juv), BUCO (tads common) GAOL (1 tad) many inverts WB pool at 44th	<i>Bufo cognatus</i>
TSDF	12S	500296	3560994	8/19/2006 9:58	RAYA (2 meta), THMA (1 sm juv), BUCO (tads common) GAOL (1 tad) many inverts WB pool at 44th	<i>Gastrophryne olivacea</i>

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
TSDf	12S	500296	3560994	8/19/2006 9:58	RAYA (2 meta), THMA (1 sm juv), BUCO (tads common) GAOL (1 tad) many inverts WB pool at 44th	<i>Rana yavapaiensis</i>
TSDf	12S	500296	3560994	8/19/2006 9:58	RAYA (2 meta), THMA (1 sm juv), BUCO (tads common) GAOL (1 tad) many inverts WB pool at 44th	<i>Thamnophis maricanus</i>
T03	12S	500307	3560991	8/19/2006 9:59	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
S05	12S	500343	3561091	8/19/2006 10:33	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonora</i>
T04U23	12S	500333	3561102	8/19/2006 10:37	CNTI ad UROR (ad, neon) WB lizard TCS	<i>Aspidoscelis tigris</i>
T04U23	12S	500333	3561102	8/19/2006 10:37	CNTI ad UROR (ad, neon) WB lizard TCS	<i>Urosaurus ornatus</i>
THU6	12S	500363	3561270	8/19/2006 10:46	CNTI (neon) CNUNK WB at Ench Hills Wash confl	<i>Aspidoscelis sp.</i>
THU6	12S	500363	3561270	8/19/2006 10:46	CNTI (neon) CNUNK WB at Ench Hills Wash confl	<i>Aspidoscelis tigris</i>
U07	12S	500309	3561399	8/19/2006 10:55	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
T06	12S	500256	3561286	8/19/2006 11:04	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
U08SUB	12S	500355	3561365	8/19/2006 11:08	CNUNK sub whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
T07	12S	500359	3561369	8/19/2006 11:09	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
S08	12S	500390	3561366	8/19/2006 11:12	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonora</i>
T08	12S	500402	3561413	8/19/2006 11:14	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
C01	12S	500405	3561343	8/19/2006 11:17	COVA (1 sub) under board nr Jesse's, nr WB	<i>Coleonyx variegatus</i>
S09	12S	500343	3561076	8/19/2006 11:28	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonora</i>
U910	12S	500333	3561054	8/19/2006 11:31	CNUNK 2 ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
U11	12S	500251	3560931	8/19/2006 11:36	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
U12	12S	500263	3560979	8/19/2006 11:37	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
U13	12S	500316	3561056	8/19/2006 11:41	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
S10	12S	500320	3561070	8/19/2006 11:42	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonora</i>
U14	12S	500338	3561088	8/19/2006 11:44	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
U15	12S	500339	3561089	8/19/2006 11:45	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis sp.</i>
S11	12S	500341	3561119	8/19/2006 11:46	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonora</i>

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
S1213	12S	500338	3561127	8/19/2006 11:47	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonorae</i>
U1213	12S	500319	3561100	8/19/2006 11:48	CNUNK 2 ad whiptail WB lizard TCS	<i>Aspidoscelis</i> sp.
T10	12S	500219	3560906	8/19/2006 11:56	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
TAHO	12S	500096	3560737	8/19/2006 12:07	TAHO (1 sm ad) under board, WB city propoerty S 44th	<i>Tantilla hobartsmithi</i>
T11	12S	500101	3560708	8/19/2006 12:15	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
T11	12S	500101	3560708	8/19/2006 12:18	RACA (1 juv heard jump into WB S of 44th)	<i>Rana catesbeiana</i>
U1617	12S	500275	3560977	8/19/2006 12:23	CNUNK 2 ad whiptail WB lizard TCS	<i>Aspidoscelis</i> sp.
UORN5	12S	500369	3561221	8/19/2006 12:32	UROR ad WB lizard TCS	<i>Urosaurus orantus</i>
S14	12S	500381	3561370	8/19/2006 12:37	CNSO - ad WB lizard TCS	<i>Aspidoscelis sonorae</i>
BUAL	12S	500364	3561430	8/19/2006 12:40	BUAL (1 ad) active on WB-Ench Hills floodplain	<i>Bufo alvarius</i>
T12	12S	500383	3561440	8/19/2006 12:41	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
T1315	12S	500458	3561540	8/19/2006 12:44	CNTI 3 ad WB lizard TCS	<i>Aspidoscelis tigris</i>
N-END	12S	500544	3561883	8/19/2006 12:56	Loc - N end of lizard TCS on this date	
T16	12S	500582	3561828	8/19/2006 12:58	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
B01U06	12S	500584	3561819	8/19/2006 12:59	CNBU (1 ad) UORN (ad) WB SE Padilla open flat	<i>Aspidoscelis stictogramma</i>
B01U06	12S	500584	3561819	8/19/2006 12:59	CNBU (1 ad) UORN (ad) WB SE Padilla open flat	<i>Urosaurus ornatus</i>
U18	12S	500582	3561724	8/19/2006 13:05	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis</i> sp.
T1718	12S	500573	3561694	8/19/2006 13:08	CNTI 2 ad WB lizard TCS	<i>Aspidoscelis tigris</i>
U19	12S	500576	3561631	8/19/2006 13:10	CNUNK ad whiptail WB lizard TCS	<i>Aspidoscelis</i> sp.
STOP	12S	500189	3561446	8/19/2006 13:16	Stop - lizard monitoring1 WB nr Ch Wash Div	
START2	12S	500897	3561433	8/19/2006 13:33	Start - lizard monitoring2 WB, at Jean Russell's driveway	
T201	12S	500892	3561452	8/19/2006 13:38	CNTI ad WB 2nd lizard TCS - Russell place	<i>Aspidoscelis tigris</i>
UROR21	12S	500786	3561528	8/19/2006 15:47	UROR (ad male) WB area on David Russell shed	<i>Urosaurus orantus</i>
T202	12S	500901	3561468	8/19/2006 16:09	CNTI ad WB 2nd lizard TCS - Russell place	<i>Aspidoscelis tigris</i>
STOP2	12S	500899	3561444	8/19/2006 16:09	Stop - lizard monitoring2 at Russell-Randolph property (- 2 hr)	

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
START	12S	500363	3562002	8/20/2006 12:38	Start - lizard monitoring WB, at Fraser thicket	
S-END	12S	500632	3561764	8/20/2006 12:53	Loc - S end of lizard TCS on this date	
U01	12S	500581	3561829	8/20/2006 13:03	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.
T01	12S	500581	3561889	8/20/2006 13:08	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
T02	12S	500559	3561908	8/20/2006 13:11	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
T03	12S	500538	3561935	8/20/2006 13:12	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
B01T04	12S	500456	3562022	8/20/2006 13:16	CNBU (1 ad) CNUNK WB N 1/3, E side	<i>Aspidoscelis</i> sp.
B01T04	12S	500456	3562022	8/20/2006 13:16	CNBU (1 ad) CNUNK WB N 1/3, E side	<i>Aspidoscelis stictogramma</i>
U02	12S	500400	3562176	8/20/2006 13:32	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.
T05UOR	12S	500413	3562296	8/20/2006 13:38	CNTI ad UROR (ad) WB lizard TCS	<i>Aspidoscelis tigris</i>
U03	12S	500420	3562316	8/20/2006 13:40	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.
T06	12S	500433	3562350	8/20/2006 13:42	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
T07	12S	500439	3562357	8/20/2006 13:44	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
U04	12S	500459	3562417	8/20/2006 13:47	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.
T08	12S	500461	3562423	8/20/2006 13:49	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
CAT	12S	500476	3562477	8/20/2006 13:51	Cat (domestic) along WB N 1/2	<i>Felis catus</i>
N-END	12S	500481	3562514	8/20/2006 13:54	Loc - N end of lizard TCS on this date	
T09	12S	500468	3562515	8/20/2006 13:55	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
HUMAN	12S	500468	3562516	8/20/2006 13:55	Human sleeping in WB bed in 29th St underpass cell	<i>Homo sapiens</i>
U05	12S	500449	3562497	8/20/2006 13:58	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.
U0607	12S	500441	3562480	8/20/2006 14:01	CNUNK 2 ad WB lizard TCS	<i>Aspidoscelis</i> sp.
COUMET	12S	500357	3562210	8/20/2006 14:16	SCCO (metas, abund on damp spot) N-most SCCO in WB	<i>Scaphiopus couchii</i>
COUALV	12S	500421	3562061	8/20/2006 14:23	SCCO BUAL (metas, abund on damp spot) N-most BUAL in WB	<i>Bufo alvarius</i>
COUALV	12S	500421	3562061	8/20/2006 14:23	SCCO BUAL (metas, abund on damp spot) N-most BUAL in WB	<i>Scaphiopus couchii</i>
U08	12S	500430	3562046	8/20/2006 14:26	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
U09	12S	500423	3562025	8/20/2006 14:30	CNUNK ad WB lizard TCS	<i>Aspidoscelis</i> sp.
RR-	12S	500423	3562025	8/20/2006 14:33	Roadrunner (1) WB nr Fraser Pond	Roadrunner
T10	12S	500475	3561977	8/20/2006 14:34	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
U1011	12S	500472	3561931	8/20/2006 14:37	CNUNK 2 ad WB lizard TCS	<i>Aspidoscelis</i> sp.
RAYA	12S	500411	3561987	8/20/2006 14:43	RAYA (1 lg juv) in Fraser Mesq Pond	<i>Rana yavapaiensis</i>
T11	12S	500470	3561934	8/20/2006 14:49	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
T12	12S	500408	3562003	8/20/2006 14:53	CNTI ad WB lizard TCS	<i>Aspidoscelis tigris</i>
STOP	12S	500363	3562001	8/20/2006 14:57	Stop - lizard monitoring WB, at Fraser thicket	
G73100	12S	501375	3561629	8/20/2006 16:57	Rel - GAOL (73 frontleg, 100 younger tads) fr Fraser Pond to Mesq Circle Pond	<i>Gastrophryne olivacea</i>
RELCOG	12S	506207	3560787	8/21/2006 19:51	Rel - BUCO (2 ad fr Columb) at KERP	<i>Bufo cognatus</i>
RELSGA	12S	506337	3560851	8/21/2006 20:05	Rel - SPMU (29), BUAL (12), GAOL (9), BUPU (2), SCCO (1) all meta at KERP	<i>Bufo alvarius</i>
RELSGA	12S	506337	3560851	8/21/2006 20:05	Rel - SPMU (29), BUAL (12), GAOL (9), BUPU (2), SCCO (1) all meta at KERP	<i>Bufo punctatus</i>
RELSGA	12S	506337	3560851	8/21/2006 20:05	Rel - SPMU (29), BUAL (12), GAOL (9), BUPU (2), SCCO (1) all meta at KERP	<i>Gastrophryne olivacea</i>
RELSGA	12S	506337	3560851	8/21/2006 20:05	Rel - SPMU (29), BUAL (12), GAOL (9), BUPU (2), SCCO (1) all meta at KERP	<i>Scaphiopus couchii</i>
RELSGA	12S	506337	3560851	8/21/2006 20:05	Rel - SPMU (29), BUAL (12), GAOL (9), BUPU (2), SCCO (1) all meta at KERP	<i>Spea multiplicata</i>
Z-BEET	12S	500976	3562442	8/23/2006 11:40	Zip - puddle SE Cttnd and 29th, w sm dytiscids, no tads or mosq	
C-MET	12S	501033	3562459	8/23/2006 11:45	SCCO	<i>Aspidoscelis</i> sp.
UR1	12S	501041	3562522	8/23/2006 11:50	UROR (1 ad) SCR 29th	<i>Aspidoscelis</i> sp.
TAHO	12S	501036	3562522	8/23/2006 11:53	TAHO (1 sm ad M) under board, just W SCR at 29th	<i>Aspidoscelis</i> sp.
U01	12S	501050	3562525	8/23/2006 11:55	CNUNK (1 ad) SCR 29th	<i>Aspidoscelis</i> sp.
U02	12S	501047	3562486	8/23/2006 11:58	CNUNK (1 ad) SCR 29th	<i>Aspidoscelis</i> sp.

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
T0104	12S	501041	3562478	8/23/2006 11:59	CNTI (3 ad 1 neon) SCR 29th	<i>Aspidoscelis</i> sp.
U0304	12S	501042	3562410	8/23/2006 12:02	CNUNK (1 ad) SCR 29th	<i>Aspidoscelis tigris</i>
U05	12S	501059	3562395	8/23/2006 12:05	CNUNK (1 ad) SCR 29th	<i>Aspidoscelis tigris</i>
T05	12S	501053	3562279	8/23/2006 12:08	CNTI (1 ad) SCR 29th	<i>Aspidoscelis tigris</i>
T06	12S	501052	3562239	8/23/2006 12:10	CNTI (1 ad) SCR 29th	<i>Aspidoscelis tigris</i>
UR2	12S	501064	3562349	8/23/2006 12:19	UROR (1 ad) SCR 29th	<i>Aspidoscelis tigris</i>
U06	12S	501044	3562336	8/23/2006 12:23	CNUNK (1 ad) SCR 29th	Roadrunner
T07	12S	501033	3562383	8/23/2006 12:31	CNTI (1 ad) SCR 29th	<i>Tantilla hobartsmithi</i>
T08	12S	501034	3562405	8/23/2006 12:32	CNTI (1 ad) SCR 29th	<i>Urosaurus orantus</i>
U07	12S	501037	3562400	8/23/2006 12:32	CNUNK (1 ad) SCR 29th	<i>Urosaurus orantus</i>
STP1	12S	501043	3562421	8/23/2006 12:33	Stop SCR lizard TCS	
STA2	12S	500783	3562534	8/23/2006 12:44	Start SCR lizard TCS	
T09	12S	500704	3562537	8/23/2006 12:46	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
T10	12S	500707	3562407	8/23/2006 12:49	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
RR2	12S	500699	3562417	8/23/2006 12:50	Roadrunner (1 ad) nr SCR S 29th	Roadrunner
T11	12S	500715	3562414	8/23/2006 12:51	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
T12	12S	500723	3562358	8/23/2006 12:56	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
T13	12S	500755	3562383	8/23/2006 12:59	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
T14	12S	500838	3562434	8/23/2006 13:03	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
T15	12S	500840	3562442	8/23/2006 13:04	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
MAGJ	12S	500777	3562505	8/23/2006 13:07	SCMA (1, sm juv) on mesq W SCR nr 29th	<i>Sceloporus magister</i>
STP2	12S	500789	3562534	8/23/2006 13:11	Stop SCR lizard TCS	
STA3	12S	500121	3560970	8/23/2006 13:34	Start WB lizard TCS	
S01	12S	500222	3560946	8/23/2006 13:41	CNSO (1 ad) 44th ditch W WB	<i>Aspidoscelis sonorae</i>
U08	12S	500268	3560925	8/23/2006 13:47	CNUNK (1 ad) WB nr 44th	<i>Aspidoscelis</i> sp.
2RAYA	12S	500277	3560945	8/23/2006 13:49	RAYA (2 juv) WB at 44th	<i>Rana yavapaiensis</i>

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
ALMETS	12S	500285	3560969	8/23/2006 13:51	BUAL (meta, abund) WB at 44th	<i>Bufo alvarius</i>
2RAYAS	12S	500298	3560991	8/23/2006 13:53	RAYA (2 juv) WB at 44th	<i>Rana yavapaiensis</i>
BUFFL	12S	500320	3561072	8/23/2006 14:01	Buffle Grass patch Ench Hills Wash floodplain	
U09BQ	12S	500344	3561173	8/23/2006 14:07	CNUNK (1 ad) WB nr 44th (poss burti)	<i>Aspidoscelis</i> sp.
RR3J	12S	500377	3561150	8/23/2006 14:14	Roadrunner (1 juv) WB N 44th	Roadrunner
UR3	12S	500340	3561053	8/23/2006 14:17	UROR (1 ad) WB 44th	<i>Urosaurus orantus</i>
SCELAD	12S	500349	3561191	8/23/2006 14:28	SCELsp (1 ad) on mesq WB N 44th	<i>Sceloporus</i> sp.
CD-N	12S	500339	3561230	8/23/2006 14:33	CADR (1 neon) Ench Hills Wash at WB	<i>Callisaurus draconoides</i>
C-METS	12S	500187	3560849	8/23/2006 14:47	SCCO	<i>Scaphiopus couchii</i>
T16	12S	500064	3560733	8/23/2006 14:53	CNTI (1 ad) SCR 29th W Cttnwd La	<i>Aspidoscelis tigris</i>
DFLY	12S	499947	3560665	8/23/2006 14:57	Loc - Dragonly Pool W Br nr 44th	
S-END	12S	499882	3560571	8/23/2006 15:02	Loc - S end WB lizard TCS	
5RACA	12S	500109	3560722	8/23/2006 15:09	RACA (2 juv) WB S 44th (Freedom Rd Pool)	<i>Rana catesbeiana</i>
UR4	12S	500104	3560953	8/23/2006 15:16	UROR (1 ad) WB 44th	<i>Urosaurus orantus</i>
STP3	12S	500113	3560961	8/23/2006 15:16	Stop WB lizard TCS	
WB-S	12S	499878	3559760	8/23/2006 15:33	Loc - south portion of good WB bosque, S of Ajo Way	
COYOTE	12S	500466	3558793	8/23/2006 15:52	Coyote nr SCR N of Irvington	<i>Canis latrans</i>
KESTR	12S	500506	3558255	8/23/2006 16:00	Kestrel W side SCR S Irvington	Kestrel
FSPCOU	12S	500505	3558071	8/23/2006 16:06	SCCO (meta, common) rd pool W side SCR S Irvington	<i>Scaphiopus couchii</i>
RR4	12S	500514	3557330	8/23/2006 16:09	Roadrunner (1 ad) nr SCR S Irvington	Roadrunner
RELGSC	12S	501354	3561663	9/7/2006 17:42	Rel - 44 GAOL (Fraser), 4 SPMU (Vail), 3 BUCO (Vail), and 1 SCCO (Vail), (all meta)	<i>Bufo cognatus</i>
RELGSC	12S	501354	3561663	9/7/2006 17:42	Rel - 44 GAOL (Fraser), 4 SPMU (Vail), 3 BUCO (Vail), and 1 SCCO (Vail), (all meta)	<i>Gastrophryne olivacea</i>
RELGSC	12S	501354	3561663	9/7/2006 17:42	Rel - 44 GAOL (Fraser), 4 SPMU (Vail), 3 BUCO (Vail), and 1	<i>Scaphiopus couchii</i>

APPENDIX C
TABULAR FIELD DATA
(continued)

WP ID	Zone	Easting	Northing	Date-Time	Notes	Species
RELGSC	12S	501354	3561663	9/7/2006 17:42	Rel - 44 GAOL (Fraser), 4 SPMU (Vail), 3 BUCO (Vail), and 1 SCCO (Vail), (all meta)	<i>Spea multiplicata</i>
WB-ST	12S	500112	3561443	10/11/2006 13:23	Start liz TCS WB at Ch W Div area	
TAHO	12S	500406	3561348	10/11/2006 13:49	BUAL (2 lg juv) under board (see TCS sheet for more info)	<i>Bufo alvarius</i>
TAHO	12S	500406	3561348	10/11/2006 13:49	BUCO (1 lg ad) under board (see TCS sheet for more info)	<i>Bufo cognatus</i>
TAHO	12S	500406	3561348	10/11/2006 13:49	TAHO (sm ad) (see TCS sheet for more info)	<i>Tantilla hobartsmithi</i>
CNBU	12S	500247	3560985	10/11/2006 14:11	CNBU (neo) under board nr WB N of 44th in flat nr x-rip	<i>Aspidoscelis stictogramma</i>
WB-END	12S	500107	3561445	10/11/2006 14:39	Stop liz TCS WB at Ch W Div area	
WB-S2	12S	500225	3561563	10/12/2006 11:48	Start liz TCS WB at Ch W Div area	
5SON	12S	500556	3561566	10/12/2006 12:20	CNSO (5 juv) in this area of central WB	<i>Aspidoscelis sonora</i>
COOPER	12S	500540	3561917	10/12/2006 12:57	Coopers Hawk along WB	Coopers Hawk
18RAYA	12S	500300	3561559	10/12/2006 13:36	RAYA (ad, sub) in Beryl Baker mud pool	<i>Rana yavapaiensis</i>
WB-E2	12S	500274	3561554	10/12/2006 13:38	Stop liz TCS WB at Ch W Div area	
22RAYA	12S	500269	3561551	10/12/2006 13:40	RAYA (ad, sub, juv) in Beryl Baker fish pond	<i>Rana yavapaiensis</i>
20RAYA	12S	500359	3561971	10/12/2006 13:58	RAYA (ad, sub, juv) in Judy Faser fish pond	<i>Rana yavapaiensis</i>
WB-S3	12S	500104	3560957	10/13/2006 11:51	Start liz TCS WB at 44th St alignment on Guadalupe	
TAHO2	12S	500129	3560959	10/13/2006 11:55	TAHO (sm ad) nr 44th ditch W of WB under concrete in x-rip	<i>Tantilla hobartsmithi</i>
TAHO3	12S	500117	3560956	10/13/2006 12:52	TAHO (neo) nr 44th ditch W of WB under concrete in x-rip	<i>Tantilla hobartsmithi</i>
TAHO4	12S	500117	3560956	10/13/2006 13:05	TAHO (neo) nr 44th ditch W of WB under concrete in x-rip	<i>Tantilla hobartsmithi</i>
WB-E3	12S	500117	3560954	10/13/2006 13:46	Stop liz TCS WB at 44th St alignment on Guadalupe	