2011 BAT SPECIES SURVEY

RESOLUTION COPPER MINING

Prepared for:

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Attachment 1. Bat Conservation International. 1997. A report on a bat survey of abandoned underground mine workings at BHP Copper – Superior Operations, with recommendations for bat conservation.
Attachment 2. WestLand Resources, Inc. 2004. Bat Survey of Federal Parcel, Pinal County, Arizona.

EXECUTIVE SUMMARY

Resolution Copper Mining LLC (RCM) is currently conducting pre-feasibility studies for the development of a copper mine and associated facilities near Superior, Pinal County, Arizona. WestLand Resources, Inc. (WestLand) has been conducting various baseline biological surveys to support planning and anticipated permitting efforts. As part of this effort, WestLand conducted bat surveys in the project vicinity. Surveys reported here focus specifically on potential habitat for bats including selected locations: in Devils Canyon, along Queen Creek Canyon, around Oak Flat/East Plant and vicinity, and portions of Apache Leap and vicinity (the Study Area). The purpose of this project was to compile baseline data on bat species from surveys conducted in 2011 and previous surveys conducted in the vicinity in 1996, 2001, 2002, and 2004.

WestLand conducted presence/absence surveys for bats in June and July 2011. Field surveys were scheduled to coincide with peak bat activity and reproductive period. A combination of passive and active monitoring techniques was used to evaluate bat use throughout the Study Area to reduce potential bias in species detection between survey methods. Passive sampling surveys were used throughout the Study Area by placing acoustic detectors at 26 locations. Active surveys were conducted using mist netting at seven water sources within the Study Area and vicinity and through visual inspections of 21 inactive mine features and two mine features along Apache Leap and vicinity were mist netted for bat use.

Fifteen bat species were detected within the Study Area and vicinity. Two additional species, the southwestern myotis (*Myotis auriculus*) and long-legged myotis (*Myotis volans*), are possibly present but are currently unconfirmed based on limited number of acoustic call recordings, therefore not meeting our criteria for species identification. No federally endangered, threatened, or candidate species were detected during any surveys of the Study Area. However, seven species (two of which were detected during previous assessments) are US Fish & Wildlife Service (USFWS) species of concern but are afforded no legal protection. Two species are considered wildlife species of concern for Arizona Game & Fish Department (AGFD). Five are considered sensitive species by the Tonto National Forest.

Surveys established the continued use of the area by pallid bats (*Antrozous pallidus*) and big brown bats (*Eptesicus fuscus*). Western small-footed myotis (*Myotis ciliolabrum*) detected during surveys in 2004 was not identified in this survey. Four new species were confirmed in the area including the silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), and big free-tailed bat (*Nyctinomops macrotis*). Greater western mastiff bat (*Eumops perotis*) and California leaf-nosed bat (*Macrotis californicus*), species previously captured in mist nets by AGFD in 2001 and 2002, were acoustically identified in this study. Additionally, WestLand observed pale Townsend's big-eared bats (*Corynorhinus townsendii*) in this survey and Bat Conservation International observed fringed myotis (*Myotis thysanodes*) in inactive mines in 1996.

KEY FINDINGS

- Fifteen bat species were identified through active and passive sampling methods.
- Four species were detected that had not been documented previously in the area. These include the silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), and big free-tailed bat (*Nyctinomops macrotis*).
- No federally endangered, threatened, or candidate species were detected during any surveys of the Study Area and immediate vicinity.
- Seven species (two of which were detected during previous assessments), the greater western mastiff bat (*Eumops perotis*), California leaf-nosed bat (*Macrotis californicus*), pale Townsend's big-eared bat (*Corynorhinus townsendii*), western small-footed bat (*Myotis ciliolabrum*), fringed myotis (*Myotis thysanodes*), cave myotis (*Myotis velifer*), and Yuma myotis (*Myotis yumanensis*), are USFWS species of concern but are afforded no legal protection.
- Two species, the California leaf-nosed bat (*Macrotis californicus*) and western red bat (*Lasiurus blossevillii*), are considered a wildlife species of concern for AGFD. Five species, the greater western mastiff bat (*Eumops perotis*), pocketed free-tailed bat (*Nyctinomops femorosaccus*), California leaf-nosed bat (*Macrotis californicus*), pale Townsend's big-eared bat (*Corynorhinus townsendii*), and western red bat (*Lasiurus blossevillii*), are considered sensitive by TNF.
- Bats were detected in all survey areas.
- Species in breeding condition were detected in all survey areas. The reproductive species observed include: pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), California myotis (*Myotis californicus*), cave myotis (*Myotis velifer*), Yuma myotis (*Myotis yumanensis*), canyon bat (*Parastrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*).
- Two additional species not previously documented in the area, the southwestern myotis (*Myotis auriculus*) and long-legged myotis (*Myotis volans*), may be present but are unconfirmed based on the limited number of acoustic calls recorded, therefore not meeting our criteria for species identification.

1. INTRODUCTION

Resolution Copper Mining LLC (RCM) is currently conducting pre-feasibility studies for the development of a copper mine and associated facilities near Superior, Pinal County, Arizona (***Figure 1***). WestLand Resources, Inc. (WestLand) has been conducting various baseline biological surveys in the area of proposed activities to support planning and anticipated permitting efforts. As part of this effort, WestLand conducted bat surveys in the area.

Surveys reported here focus specifically on potential habitat for bats including selected locations: in Devils Canyon, along Queen Creek Canyon, around Oak Flat/East Plant and vicinity, and portions of Apache Leap and vicinity (the Study Area) (***Figure 2***). Specific survey locations were selected to represent vegetation communities within the area and some locations had surface water although surveys were also conducted in dry locations. This report provides a list of the bats observed as well as a discussion of results from field surveys. These findings are compared to those from previous surveys conducted along Apache Leap in 1996 by Bat Conservation International (BCI) (***Attachment 1***), and at Boyce Thompson Arboretum approximately five miles west of the town of Superior in 2001 and 2002 by Arizona Game & Fish Department (AGFD) (Tim Snow, pers. comm.), and in the area by WestLand surveys in 2004 (***Attachment 2***).

1.1 AREA DESCRIPTION

The Study Area is situated in the Pinal Mountains immediately east of Superior, Arizona (***Figure 1***). This includes private land, areas administered by the Arizona State Land Department (State Land), and property administered by the Tonto National Forest (TNF) (***Figure 1***). Four vegetation types are found in the Study Area, including the Arizona Upland Subdivision of Sonoran Desertscrub (Arizona Upland Desertscrub), Interior Chaparral, Madrean Evergreen Woodland, and Interior Riparian Deciduous Forest (***Figure 2***). The western boundary of the Study Area is the Old Pinal town site located roughly one mile west of the town of Superior while the eastern boundary lies along Devils Canyon. The northern boundary runs north of US Route 60 (US 60) where it crosses Devils Canyon while the southern boundary is just south of Pacific Canyon. The topographic relief across the Study Area spans roughly 1,600 ft (488 m) of elevation, from a low of 2,500 ft (762 m) near the Old Pinal town site to a high of 4,100 ft (1,250 m) at a high point on Oak Flat. The Study Area was split into four areas each of which had different vegetation communities and topographic relief for comparison because of their possible diversity as bat habitats. These areas include: 1) Apache Leap and vicinity, 2) Queen Creek Canyon, 3) Oak Flat/East Plant and vicinity, and 4) Devils Canyon (***Figure 3***). General descriptions of each area are provided below.

1.1.1 Apache Leap and Vicinity

Vegetation: Interior Chaparral dominates areas above Apache Leap while below, very steep headwaters of ephemeral channels drain west through Arizona Upland Desertscrub toward Superior and Queen Creek (***Figure 2)***. There are three recognized vegetation series within this subdivision: the jojoba-mixed scrub, creosote bush-mixed scrub, and paloverde-cacti-mixed scrub series (Brown 1994). The latter series is the most extensive within the subdivision, and vegetation immediately west of Apache Leap is consistent with this series.

Topography: The Apache Leap formation rises abruptly to the east of the town of Superior (***Figures 2 and 3***). These west-facing cliffs attain a maximum height of approximately 600 ft (180 m) and extend for approximately six mi (10 km) in a north-south direction.

Inactive Mine Features: The vertical cliff faces and inactive underground mines (approx. 330 in total) along the leap provide roosting sites for crevice- and cave-roosting bats. These mine features are fitted with bat compatible gates or are permanently sealed to entry.

Water: No surface water is available in this portion of the Study Area.

1.1.2 Queen Creek Canyon

Vegetation: Within this steep-walled canyon, Queen Creek flows ephemerally and supports a stand of Interior Riparian Deciduous Forest in the canyon bottom. Arizona sycamores (*Platanus wrightii*) grow along the upper reaches, and mature Fremont cottonwoods (*Populus fremontii*) are present in the lower portion of the canyon (below the effluent tank located west of Superior near Old Pinal town site) (***Figure* 2**). Outside of the riparian zone of the canyon, Arizona Upland Desertscrub is present at lower elevations and Madrean Evergreen Woodland and Interior Chaparral vegetative communities are present at higher elevations.

Topography: Queen Creek Canyon, an east-west trending canyon paralleled by US 60, runs from Oak Flat/East Plant west to the town of Superior (***Figures 2*** and ***3***). This canyon descends from about 3,800 ft (1,160 m) in elevation near Oak Flat/East Plant to approximately 3,000 ft (910 m) in Superior.

Inactive Mine Features: No inactive features are available in this portion of the Study Area.

Water: The release of treated water (sewer plant effluent) near the Old Pinal town site provides a source of relatively permanent water. Overall, Queen Creek flows ephemerally.

1.1.3 Oak Flat/East Plant Site and Vicinity

Vegetation: This area is largely dominated by Interior Chaparral vegetation, although elements of Madrean Evergreen Woodlands are also present (***Figure 2***). Two oak species, Arizona white oak (*Quercus arizonica*) and Emory oak (*Quercus emoryi*), dominate the canopy layer. Understory layers in this region generally include chaparral-associated species, such as pointleaf manzanita (*Arctostaphylos pungens*), catclaw mimosa (*Mimosa aculeaticarpa* var. *biuncifera*), scrub oak (*Quercus turbinella*), and skunkbush (*Rhus trilobata*).

Topography: Oak Flat/East Plant is a contiguous area bounded on the north by US 60 and Queen Creek Canyon, on the east by Devils Canyon, on the south by Rancho Rio Creek, and on the west by the crest of Apache Leap (***Figures 2*** and ***3***). The area consists primarily of low rolling hills, shallow washes, and has numerous boulders and hoodoos.

Inactive Mine Features: No inactive features are available in this portion of the Study Area.

Water: Several ponds, creeks, and small reservoirs are located throughout this portion of the Study Area.

1.1.4 Devils Canyon

Vegetation: A well-developed hydroriparian zone of Interior Riparian Deciduous Forest extends south from the confluence of Rancho Rio Creek for about 2 mi (3.2 km) (***Figure 2***). Riparian vegetation in Devils Canyon is dominated by stands of Arizona alder (*Alnus oblongifolia*), scattered sycamore, and velvet ash (*Fraxinus velutina*). The understory is dominated by button willow (*Cephalanthus occidentalis*). In the lower reaches of Devils Canyon, alders give way to stands of Goodding willow (*Salix gooddingii*) and a few scattered Fremont cottonwoods.

Topography: Devils Canyon is a steeply walled north-south oriented drainage located east of Oak Flat/East Plant (***Figures 2 and 3***). The cliffs attain a maximum height of approximately 400 ft (120 m). Cliff faces occur intermittently along both sides of this drainage from its confluence with Rancho Rio Creek downstream for approximately 6 mi (10 km).

Inactive Mine Features: No inactive features occur in this portion of the Study Area.

Water: Surface water in the canyon is seasonally intermittent in the north and perennial in the south.

1.2 PREVIOUS SURVEYS WITHIN THE STUDY AREA AND VICINITY

WestLand prepared a *Baseline Biology and Land Use Report* (WestLand 2003a) and a *Biological Assessment and Evaluation* (WestLand 2003b) describing the Study Area's overall biological resources. In 2004, WestLand conducted bat surveys on portions of Oak Flat/East Plant and Apache Leap (***Attachment 2***). Three bat species were captured during mist netting surveys at drill road stock tank and an inactive mine. The three species include: pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), and western small-footed myotis (*Myotis ciliolabrum*) (***Table 2***). AGFD conducted mist netting surveys at Boyce Thompson Arboretum, located approximately 7 mi (11 km) west of the Study Area on US 60 within the Queen Creek watershed in September 2001 and June 2002 (Tim Snow, pers. Comm.). During these surveys, AGFD captured 11 bat species. These 11 species include: Greater western mastiff bat (*Eumops perotis*), pocketed free-tailed bat (*Nyctinomops femorosaccus*), Mexican free-tailed bat (*Tadarida brasiliensis*), California leaf-nosed bat (*Macrotus californicus*), pallid bat (*Antrozous pallidus*), pale Townsend's big-eared bat (*Corynorhinus townsendii*), big-brown bat (*Eptesicus fuscus*), California myotis (*Myotis californicus*), cave myotis (*Myotis velifer*), Yuma myotis (*Myotis yumanensis*), and canyon bat (*Parastrellus hesperus*) (***Table 2***). It is important to note that the environmental conditions occurring at Boyce Thompson Arboretum are not representative of most of the Study Area because it has large exotic trees, year-round standing water, and is at the lower elevation range (approx. 2,400 ft [732 m]) than most of the Study Area.

Bat Conservation International performed internal and external inspections of inactive mines along Apache Leap in 1996 (***Attachment 1***). They surveyed approximately 100 mines (of the nearly 330 mines in the area) within Pacific, Belmont, and Donkey canyons and near the town of Superior. BCI detected four species of bats during mine surveys (***Table 2***). They determined that 23 percent of the inactive mines along Apache Leap provided potential roosting habitat for bats.

2. METHODS

WestLand sampled for bat species occurring in the Study Area using three techniques: 1) visual inspections (active sampling) of inactive mine features to look for roosting bats, 2) acoustic surveys (passive sampling) using ultrasonic recorders to record bat calls as they fly/forage, and 3) mist netting (active sampling) of permanent water sources to capture bats. These survey methods were utilized to provide comprehensive evaluation of species presence within the Study Area by minimizing potential bias among sampling methods and to increase the number of areas surveyed simultaneously. Research comparing bat survey techniques shows that the use of multiple methods, specifically acoustic and netting in combination, provide a reliable representation of local bat communities (Kuenzi and Morrison 1998, Flaquer et al. 2007). For example, many acoustic detectors have difficulty detecting low intensity ultrasonic bat calls typical of bats that forage in areas with dense vegetation therefore relying on this method alone may bias the results towards species that have high intensity calls, (i.e. those species that forage in open areas) (Neuweiler 1990, Schnitzler and Kalko 2001). Fortunately, ultrasonic echolocation calls are fairly species specific, allowing for the inventory of bats over large areas simultaneously using multiple acoustic detectors. In contrast, mist netting likely favors the capture of species that fly lower in the environment and require relatively small open surface areas to drink while in flight. Larger bat species that require large open surface areas to drink while in flight and are less likely to be captured due to logistic difficulties in mist netting over large water sites. In addition, these methods complement each other because acoustic monitoring allows for evaluation of wet and dry areas across a landscape while mist netting is situated over water sources.

Before initiating bat surveys, maps were prepared of the Study Area, locations and general descriptions of inactive mines along Apache Leap were obtained, and an initial reconnaissance investigation was made to assist with survey site selection. Inactive mine features chosen for inspection were selected based on general descriptions and findings in ***Attachment 1***. Mine features described as being deeper than 100 ft (30 m), possessing multiple openings, and/or occurring in areas of bat activity as described in ***Attachment 1*** were selected for evaluation. Inactive mine features that were described as shallow (less than 100 ft [30 m]) or simple (having a single opening) were not selected for survey. WestLand evaluated at total of 21 (roughly six percent of the total mines) in Cross, Donkey, Belmont, and Pacific canyons as well as in the vicinity of RCM workings (only seven were internally surveyed due to safety and access issues) (***Figure 3***). Every inactive mine feature on our list that was accessible to internal entry was internally evaluated while the inaccessible features were inspected externally.

Acoustic and mist netting survey locations were chosen to provide a representative sample of vegetation communities and topographic relief within the Study Area. In addition, sampling locations for acoustic and mist netting surveys were positioned to provide sufficient spacing to minimize overlapping observations each night. Further evaluation of sampling sites were made in the field during initial reconnaissance investigations and focused on areas where bats may concentrate (around water, landscape features, etc.). Acoustic sampling areas were situated near surface water and/or along canyons and washes in which bats may travel. A total of 26 separate locations (12 of which were sampled on two dates) were acoustically sampled using four to seven detectors placed throughout the landscape, and seven locations were mist netted. WestLand conducted mist netting surveys on eight nights at seven locations (locations

1, 2, 3, 10, 13, 19, and 24), and conducted acoustic surveys on eight nights at 26 locations (***Table 1*****;** ***Figure*** **3**).

Surveys in 2011 were conducted over three periods between June and July to coincide with peak bat activity and breeding periods for bats within the region. The first surveys (reconnaissance and visual inspection of inactive mines) were conducted on June 6, 7, 8, and 9, the second surveys (acoustic and mist netting) were conducted on June 17, 18, 19, and 20, and the third surveys (acoustic and mist netting) were conducted on July 9, 10, 11, and 12. Sampling dates were randomly assigned to survey locations to reduce duplicate observations each night.

2.1 VISUAL INSPECTIONS OF INACTIVE UNDERGROUND MINE FEATURES

2.1.1 Internal Survey

An experienced biologist (with appropriate safety gear) entered mine workings when access was available while additional crew members remained outside for safety reasons. Evaluation at each mine consisted of documenting overall shape of internal mine features, determining evidence of bat use (guano, urine, splatter, and/or culled insect parts), observing presence of roosting bats, and evaluating suitability as potential bat habitat. When possible, roosting bats were identified to species. Not all inactive mine features evaluated were internally surveyed due to lack internal access or safety concerns.

2.1.2 External Survey

External surveys were conducted when entry into mine features was impossible due to lack of access or safety concerns. Evaluations at each mine feature consisted of documenting bat sign (guano, urine splatter, and/or culled insect parts) in the mine portal or the presence of moving air which suggests the presence of additional openings.

2.2 ACOUSTIC SURVEYS

Acoustic surveys were conducted by sampling for bats with AnaBat II™ (Titley Scientific, Columbia, MO, USA) and Song Meter SM2BAT (Wildlife Acoustics, Inc., Concord, ME, USA) ultrasonic bat detectors remotely placed throughout the Study Area each survey night. These detectors record high frequency sounds and translate them into visual representations of each call for species identification. AnaBat II™ detectors record bat calls and process the signals using frequency division allowing calls to be saved onto compact flash cards for downloading and analysis. SM2BAT records calls in broad band that can be observed in either frequency division or time expansion. Detectors were calibrated using 'Bat Chirp' board (http://www.Tony@NevadaBat.com) and all units were set at the same detection sensitivity level to maintain consistency among detectors.

The acoustic detector systems were programmed to make continuous recordings of ultrasonic echolocation calls given by bats within typically over 98 ft (30 m) distance of the microphone depending on detector sensitivity level, environmental structural arrangement, weather, species call frequency, etc. Between four and seven ultrasonic detectors were placed at sample locations to passively record bat calls from sunset to sunrise each survey night. Acoustic detectors were secured in waterproof containers and

microphones were elevated 6.5 ft (2 m) and 45° angle to a plexi-glass plate (***Photos 5 and 20*** in ***Appendix A***). This configuration improves call sequence quality and reduces the number of unusable call fragments. Acoustic detectors were positioned on rock ledges that overlooked potential flight paths and foraging areas. Call data files were then downloaded onto a laptop after each survey and were later analyzed in the office.

Bat calls were defined as an individual vocalization by a bat and a call sequence as any series of two or more individual calls. Bat calls were identified to species whenever possible. Those calls not readily identifiable due to similarities in call morphology frequency and shape of output were assigned to the analogous groups of call morphologies (sonic guilds) rather than to an individual species. Presumably, species in such groups are members of the same genus. The accepted criterion is a minimum of five good species-identifiable calls within a recorded sequence (before the call can be assigned to an individual species) (Sherwin et al. 2000). As applied in other studies, the following five morphologically similar call groups were utilized when recordings are fragmented or not clear enough for positive identification: 1) canyon bat (*Parastrellus hesperus*) and western red bat (*Lasiurus blossevilli*); 2) 50 kilohertz myotis; 3) 40 kilohertz myotis; 4) pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and Mexican free-tailed bat (*Tadarida brasiliensis*); and 5) pocketed free-tailed bat (*Nyctinomops femorosaccus*), big-free tailed bat (*Nyctinomops macrotis*), and greater western mastiff bat (*Eumops perotis*) (Gannon et al. 2003). Any unidentified recordings were compared to credible call libraries developed for southern Arizona by the Southwestern Museum of Biology and identified when possible.

2.3 MIST NETTING SURVEYS

Mist netting was used to allow for hands-on identification of bats and for evaluation of age and reproductive status of individuals of captured animals. Nets were placed over ponds or stream channels to capture bats that were foraging and/or drinking over water. At mine features, nets were stretched across mine openings to capture bats exiting or entering underground roosts. Shaft 2 (location 1) and Shaft 5 (location 2), active mine features, were the only mine features mist netted during this survey effort to determine bat use prior to closure. Very fine (38 millimeter polyester mesh) nylon nets (Avinet, Dryden, N.Y.) that are 8.5 ft (2.6 m) in height and varying length (8.5 ft [2.6 m], 19.7 ft [6 m], 29.5 ft [9 m, 39.4 ft [12 m], 59.1 ft [18 m]) were used as need to span water features or active mine sites.

Mist netting surveys were conducted beginning at sunset and continued for several hours. A trained biologist routinely monitored the nets throughout the active capture period. Once captured, bats were identified to species, sexed, aged, evaluated for reproductive status, measured, weighed, assessed for overall condition, and released within the capture area. Reproductive conditions fell into the following four categories: 1) non-reproductive (NR) showing no signs of breeding, 2) reproductive (R) males displaying swollen testicles or blackened epididymis, 3) pregnant (P) with females showing extended abdomen, 4) lactating (L) females showing signs of breast feeding with swollen nipples, dried nipples, and/or hair missing around the nipple area. Bats that were pregnant were freed without full processing to reduce stress on the animal. Animals were aged by placing wings over a light source to look for amount of light passing through the epiphyses (round end of a long bone) (Brunet-Rossinni and Wilkinson 2009). Age of captured animals fell into two categories: adults (A) with fully fused epiphyses (minimal light

passing through), and subadults (SA) possessing un-fused epiphyses (a lot of light passing through) and are therefore young of the year. USFWS white-nose syndrome decontamination protocol was followed by cleaning all measuring equipment with disinfectant and use of disposable gloves between bats (USFWS 2011).

3. RESULTS

Through these efforts a total of 113 bats were captured during 15.5 hrs of active mist netting and nearly 14,000 ultrasonic bat calls were recorded in 331 hrs of acoustic sampling. Ten bat species were captured during mist net surveys (an unknown myotis was not included in this total because it was one of two similar looking species already accounted for in these efforts) and five additional species were acoustically identified (***Table 2***). As a result, a total of 15 bat species were identified during these surveys. Through this and previous survey efforts, 17 bats species have been detected in the Study Area and vicinity (including the four new confirmed species in 2011 and two species observed in previous surveys but not observed in 2011).

In 2011, four new species in the Study Area and vicinity were detected including the silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), and big-free tailed bat (*Nyctinomops macrotis*) (***Table 2***). Two additional species, the southwestern myotis (*Myotis auriculus*) and long-legged myotis (*Myotis volans*), have been tentatively acoustically identified to the area based on a limited number of calls recorded but there were too few calls to confirm these species based on our identification criterion. The greater western mastiff bat (*Eumops perotis*) and California leaf-nosed bat (*Macrotis californicus*) that were captured in mist nets by AGFD in 2001 and 2002 were only acoustically identified in 2011 (***Table 2***). Additionally, BCI observed fringed myotis (*Myotis thysanodes*) in inactive mines in 1996 (***Attachment 1***) and WestLand mist netted western small-footed myotis (*Myotis ciliolabrum*) in 2004 (***Attachment 2***), neither of which was detected in 2011 (***Table 2***).

No federally endangered, threatened, or candidate species were detected during any surveys of the Study Area and vicinity (***Table 3***). However, seven species (two of which were detected during previous assessments) are USFWS species of concern but are currently afforded no legal protection. Two species (one of which was detected during previous assessments) are wildlife species of concern for AGFD, and five are forest sensitive species on Tonto National Forest (***Table 3***). General information for each bat species is provided in ***Appendix B***. Representative acoustic call recordings for selected species are provided in ***Appendix C***.

3.1 APACHE LEAP AND VICINITY SURVEY AREA

Visual Inspection: Inactive underground mine features in Cross, Donkey, Belmont, and Pacific canyons, as well as within the vicinity of the town of Superior were inspected (***Figure 3***). We visually inspected 21 inactive mine features (seven were internally surveyed and 14 were not internally inspected due to lack of access and/or safety concerns). Two bat species were observed using inactive mine features during visual inspections in the Apache Leap Survey Area (***Table 4***). Pale Townsend's big-eared bats (*Corynorhinus townsendii*) were visually observed roosting inside four of the seven internally surveyed inactive mine

features (although not all areas within each mine feature were inspected due to safety concerns and/or inaccessibility). No bats were visually observed by external inspection of the 14 inactive mine features surveyed.

Acoustic Survey: One species, California myotis (*Myotis californicus*), was acoustically identified near Shaft 2 (***Table 4***).

Mist Netting: Two lactating cave myotis (*Myotis velifer*) were identified by mist netting at Shaft 2 (location 1) (***Table 5; Figures 2 and 3***). Mist netting surveys at Shaft 5 (location 2) resulted in the capture of one male pale Townsend's big-eared bat (*Corynorhinus townsendii*) exiting the mine features (***Table 5; Figure 3***). Overall, bat activity was low in Shafts 2 and 5 with few bats attempting to enter and exit the mine feature.

Total Species: In total, three species, (pale Townsend's big-eared bat [*Corynorhinus townsendii*], Cave myotis [*Myotis velifer*] and California myotis [*Myotis californicus*]), were documented from Apache Leap and vicinity (***Table 4***). Cave myotis (*Myotis velifer*) was the only species found in reproductive condition (***Table 5***). No federally protected (endangered, threatened, or candidate) species were visually observed, captured or acoustically identified on Apache Leap (***Table 3***). BCI detected three additional species using inactive mine features through visual inspection (internal surveys) of roughly 100 locations (***Attachment 1***), although only one species, the fringed myotis (*Myotis thysanodes*), was not detected in the area during this survey (***Table 3***).

3.2 DEVILS CANYON SURVEY AREA

Visual Inspection: No inspections of inactive mine features were conducted.

Acoustic Survey: Acoustic surveys conducted at seven locations (locations 3 through 9) both above and within the canyon (***Figure 3***). It was second highest in acoustic surveys with six species (greater western mastiff bat [*Eumops perotis*], Mexican free-tailed bat [*Tadarida brasiliensis*], pale Townsend's big-eared bat [*Corynorhinus townsendii*], cave myotis [*Myotis velifer*], and Yuma myotis [*Myotis yumanensis*]), recorded in addition to mist-netted species (***Table 4; Appendix D***). In addition, three species (silver-haired bat [*Lasionycteris noctivagans*], southwest myotis [*Myotis auriculus*] and long-legged myotis [*Myotis volans*]), were tentatively acoustically identified but these identifications are unconfirmed due the limited number of calls recorded therefore not meeting our criterion for species identification (***Table 4***).

Mist Netting: Mist netting was conducted over one pond (location 3) in Devils Canyon (***Figures 2 and 3***). This location had the highest number of mist-netted species with six bat species (pocketed free-tailed bat [*Nyctinomops femorosaccus*], pallid bat [*Antrozous pallidus*], big-brown bat [*Eptesicus fuscus*], western red bat [*Lasiurus blossevillii*], California myotis [*Myotis californicus*], and canyon bat [*Parastrellus hesperus*]) captured (***Table 4***). Three species, the big-brown bat (*Eptesicus fuscus*), California myotis (*Macrotis californicus*), and canyon bat (*Parastrellus hesperus*), were found in reproductive condition (***Table 5***).

Total Species: No federally protected (endangered, threatened, or candidate) species were captured or acoustically identified in Devils Canyon (***Table 3***). One mist-netted species, the western red bat (*Lasiurus*

blossevillii), is a wildlife of special concern by AGFD and forest sensitive on TNF. Two acoustically identified species, the pale Townsend's big-eared bat (*Corynorhinus townsendii*), and greater western mastiff bat (*Eumpos perotis*), are considered species of concern by USFWS and forest sensitive on TNF, and two additional acoustically identified species, the cave myotis (*Myotis velifer*), and Yuma myotis (*Myotis yumanensis*), are considered species of concern by USFWS (***Tables 3 and 4***).

3.3 OAK FLAT/EAST PLANT AND VICINITY SURVEY AREA

Visual Inspection: No inspections of inactive mine features were conducted.

Acoustic Survey: Acoustic surveys were conducted at 13 locations (locations 10-23) throughout the area (***Figures 2*** and ***3***). This area had the highest number of bat species detected in acoustic surveys with nine species (greater western mastiff bat [*Eumops perotis*], pocketed free-tailed bat [*Nyctinomops femorosaccus*], California leaf-nosed bat [*Macrotus californicus*], pallid bat [*Antrozous pallidus*], pale Townsend's big-eared bat [*Corynorhinus townsendii*], western red bat [*Lasiurus blosevillii*], hoary bat [*Lasiurus cinereus*], silver-haired bat [*Lasionycteris noctivagans*], and Yuma myotis [*Myotis yumanensis*]) recorded in addition to mist-netted species (***Table 3; Appendix D***). In addition, two species (southwestern myotis [*Myotis auriculus*], and long-legged myotis [*Myotis volans*]) were tentatively acoustically identified but these identifications are unconfirmed due to limited number of calls recorded therefore not meeting our criterion for species identification (***Table 4***).

Mist Netting: Mist netting was conducted over three water sources (locations 10, 13, and 19) (***Figures 2 and 3***). Oak Flat/East Plant and vicinity had the second highest number of mist-netted species with five bat species (Mexican free-tailed bat [*Tadarida brasiliensis*], big brown bat [*Eptesicus fuscus*], California myotis [*Myotis californicus*], cave myotis [*Myotis velifer*], and canyon bat [*Parastrellus hesperus*]) captured (***Table 3***).

Total Species: No federally protected (endangered, threatened, or candidate) species were captured or acoustically identified in Oak Flat/East Plant and vicinity (***Table 3***). One mist-netted species, the cave myotis (*Myotis velifer*), and three acoustically identified species (pale Townsend's big-eared bat [*Corynorhinus townsendii*], greater western mastiff bat [*Eumops perotis*], and Yuma myotis [*Myotis yumanensis*]) are considered species of concern by USFWS (***Tables 3 and 4***). In addition, Townsend's big-eared bats and greater western mastiff bats are considered sensitive on TNF. Three species, the big-brown bat (*Eptesicus fuscus*), cave myotis (*Myotis velifer*), and Mexican free-tailed bat (*Tadarida brasiliensis*), were found in reproductive condition (***Table 5***).

3.4 QUEEN CREEK CANYON

Visual Inspection: No inspections of inactive mine features were conducted.

Acoustic Survey: Acoustic surveys were conducted at three locations (locations 24 through 26) along the canyon (***Figures 2 and 3***). This location had the third highest number of bat species detected in acoustic surveys with seven species (greater western mastiff bat [*Eumops perotis*], pocketed free-tailed bat [*Nyctinomops femorosaccus*], big free-tailed bat [*Nyctinomops macrotis*], Mexican free-tailed bat [*Tadarida brasiliensis*], western red bat [*Lasiurus blosevillii*], silver-haired bat [*Lasionycteris*

noctivagans], and canyon bat [*Parastrellus hesperus*]) in addition to mist-netted species (***Table 4; Appendix D***).

Mist Netting: Mist netting was conducted over one water source (location 24) (***Figures 2 and 3***). Queen Creek Canyon had the third highest number of mist-netted species with four bat species (pallid bat [*Antrozous pallidus*], big brown bat [*Eptesicus fuscus*], cave myotis [*Myotis velifer*], and Yuma myotis [*Myotis yumanensis*]) captured (***Table 4; Appendix C***).

Total Species: No federally protected (endangered, threatened, or candidate) species were captured or acoustically identified in Queen Creek Canyon (***Table 3***). Two of the mist-netted species, the cave myotis (*Myotis velifer*) and Yuma myotis (*Myotis yumanensis*), and one acoustically identified species, the greater western mastiff bat (*Eumops perotis*), are considered species of concern by USFWS. The greater western mastiff bat is also considered sensitive on TNF. Five species, the pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), cave myotis (*Myotis velifer*), Yuma myotis (*Myotis yumanensis*), and canyon bat (*Parastrellus hesperus*), were found in reproductive condition (***Table 5***).

3.5 AGE AND REPRODUCTIVE STATUS

Adults were detected throughout the Study Area. Only one sub-adult was captured in the Oak Flat/East Plant and vicinity (***Table 5***). Bats in breeding condition were detected in all four sample locations of the Study Area (***Table 5***). Species observed in reproductive condition include: pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), California myotis (*Myotis californicus*), cave myotis (*Myotis velifer*), Yuma myotis (*Myotis yumanensis*), canyon bat (*Parastrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*) (***Table 5***).

3.6 ROOST TYPE

Bat species that utilize a variety of roost types were detected in the Study Area (***Table 6***). Three primary roost structures found within the Study Area include crevices in cliffs, caverns (caves or underground mines), and decaying or live trees. A variety of species utilize these roost types with some being generalists while others are more specialized (***Table 6***). Species specific details are provided in ***Appendix B***.

4. DISCUSSION

The purpose of this study was to expand the extent and scope of the bat surveys in the area by conducting inspections of inactive mine features, performing acoustic surveys of numerous locations, and mist-netting primarily over open water features and also at entrances to active mines. Surveys were conducted in previously unsurveyed areas including Queen Creek, Devils Canyon and throughout much of Oak Flat/East Plant area. Combining the use of mist netting and visual inspections of inactive underground mines and acoustic sampling reduced bias towards detection of specific species and allowed for evaluations of bat use of a variety of habitats and topographic formations. The study resulted in the documentation of the presence of 15 bat species, 10 species that were captured in mist nets or visually observed roosting in inactive underground mines and five species that were acoustically identified. Two additional species, the southwestern myotis (*Myotis auriculus*) and long-legged myotis (*Myotis volans*),

have been tentatively identified acoustically but cannot yet be confirmed because of the limited number of acoustic call recordings therefore not meeting our criterion for species identification.

No federally endangered, threatened, or candidate species were detected within the Study Area and vicinity. However, seven species (two of which were detected during previous assessments) are species of concern by the USFWS but are afforded no legal protection (USFWS 2012a; 2012b) (***Table 3***). Two more species (one of which was detected during previous assessments) are wildlife species of concern by the State of Arizona (AGFD 2012), and five species are considered sensitive by the Forest Service (TNF 2011) (***Table 3***).

This bat survey has established the continued use of the area by pallid bats (*Antrozous pallidus*) and big brown bats (*Eptesicus fuscus*) that were detected during WestLand surveys in 2004, however, western small-footed myotis (*Myotis ciliolabrum*) was not identified, which was identified during 2004 surveys (***Attachment 2***). Four new species were confirmed in the area, including the silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), and big free-tailed bat (*Nyctinomops macrotis*). Greater western mastiff bat (*Eumops perotis*) and California leaf-nosed bat (*Macrotis californicus*) were acoustically identified. These two species were mist netted at by AGFD Boyce Thompson Arboretum in 2001 and 2002 (Tim Snow pers. comm.; ***Attachment 1***). Additionally, BCI observed fringed myotis (*Myotis thysanodes*) in inactive mines in 1996 and this species was also detected in this study (***Attachment 1***).

The Study Area appears to provide a variety of suitable roosting habitats based on the detection of crevice roosting, cavern roosting, and tree roosting bat species (***Table 6; Appendix B***). In addition, numerous open water sources, both artificial and natural, are available throughout the Study Area providing foraging habitat for resident bats. Only one sub-adult was netted in Oak Flat/East Plant area. Our surveys occurred in June and early July when sub-adults would have just begun to fly, therefore, making less likely to have captured many sub-adults during mist netting surveys. Seven species including pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), California myoits (*Myotis californicus*), cave myotis (*Myotis velifer*), Yuma myotis (*Myotis yumanensis*), canyon bat (*Parastrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*) were exhibiting signs of reproduction, suggesting maternity colonies are within or near the Study Area.

5. REFERENCES

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TABLES

Table 1. Bat surveys for 2011 field evaluations within Study Area.

Survey Area	Number of Mist Net Locations	Number of Acoustic Sampling Locations	Number of Visual Surveys of Inactive Mine Features	
			External	Internal
Apache Leap and vicinity	2	2	14	7
Queen Creek Canyon	1	3	0	0
Oak Flat/East Plant and vicinity	1	8	0	0
Devils Canyon	3	13	0	0
TOTALS	**7**	**26**	**14**	**7**

Table 2. Bat species observed within the Study Area and vicinity

Bat Species	WestLand 2011	WestLand 2004	AGFD 2001 and 2002	BCI 1996
Molossidae				
Greater western mastiff bat (*Eumops perotis*)	A	--	N	--
Pocketed free-tailed bat (*Nyctinomops femorosaccus*)	A, N	--	N	--
Big free-tailed bat (*Nyctinomops macrotis*)	A	--	--	--
Mexican free-tailed bat (*Tadarida brasiliensis*)	A, N	--	N	--
Phyllostomidae				
California leaf-nosed bat (*Macrotis californicus*)	A	--	N	--
Vespertilionidae				
Pallid bat (*Antrozous pallidus*)	A, N	N	N	--
Pale Townsend's big-eared bat (*Corynorhinus townsendii*)	A, N, V	--	N	V
Big brown bat (*Eptesicus fuscus*)	A, N	N	N	V
Silver-haired bat (*Lasionycteris noctivagans*)	A	--	--	--
Western red bat (*Lasiurus blossevillii*)	A, N	--	--	--
Hoary bat (*Lasiurus cinereus*)	A	--	--	--
Southwestern myotis *(Myotis auriculus*)	A[1]	--	--	--
California myotis (*Myotis californicus*)	A, N	--	N	--
Western small-footed myotis (*Myotis ciliolabrum*)	--	N	--	--

Table 2. Bat species observed within the Study Area and vicinity

Bat Species	WestLand 2011	WestLand 2004	AGFD 2001 and 2002	BCI 1996
unknown myotis (*M. ciliolabrum/californicus*)	N	--	--	--
Fringed myotis (*Myotis thysanodes*)	--	--	--	V
Cave myotis (*Myotis velifer*)	A, N	--	N	--
Long-legged myotis (*Myotis volans*)	A[1]	--	--	--
Yuma myotis (*Myotis yumanensis*)	A, N	--	N	--
Canyon bat (*Parastrellus hesperus*)	A, N	--	N	V
Total Bat Species Detected	**15[2] + 2 unconfirmed[1]**	**3**	**11**	**4**

A=acoustic detection, **N**=netted using mist net, and **V**= visually observed using mine features.

Note: Survey effort varied between years with limited internal mine surveys, widespread acoustic monitoring, and multiple netting locations employed in 2011. WestLand 2004 netted one stock tank and one mine feature. Arizona Game and Fish (AGFD) mist netted at Boyce Thompson Arboretum outside of CAA. Bat Conservation International (BCI) conducted internal surveys of approximately 100 mine features along Apache Leap.

[1]Unconfirmed identification because the limited number of acoustic calls recorded did not satisfy our identification criterion. These species include the southwestern myoits (*Myotis auriculus*) and long-legged myotis (*Myotis volans*).

[2]Does not include unknown myotis (*Myotis ciliolabrum* or *M. californicus*) category which could be one of two species that are similar in appearance and can be difficult to distinguish in the field.

Table 3. Current status of bat species detected in the Study Area and vicinity (USFWS 2012a, USFWS 2012b, AGFD 2012, TNF 2004). Species were detected in 2011 unless otherwise specified.

Bat Species	Status		
	USFWS	**AGFD**	**TNF**
Molossidae			
Greater western mastiff bat (*Eumops perotis*)	SC	--	S
Pocketed free-tailed bat (*Nyctinomops femorosaccus*)	--	--	S
Big free-tailed bat (*Nyctinomops macrotis*)	--	--	--
Mexican free-tailed bat (*Tadarida brasiliensis*)	--	--	--
Phyllostomidae			
California leaf-nosed bat (*Macrotis californicus*) [Detected in 2001 and 2002 by AGFD]	SC	WSC	S
Vespertilionidae			
Pallid bat (*Antrozous pallidus*)	--	--	--
Pale Townsend's big-eared bat (*Corynorhinus townsendii*)	SC	--	S
Big brown bat (*Eptesicus fuscus*)	--	--	--
Silver-haired bat (*Lasionycteris noctivagans*)	--	--	--
Western red bat (*Lasiurus blossevillii*)	--	WSC	S
Hoary bat (*Lasiurus cinereus*)	--	--	--
Southwestern myotis (*Myotis auriculus*)[1]	--	--	--
California myotis (*Myotis californicus*)	--	--	--
Western small-footed myotis (*Myotis ciliolabrum*) [Detected in 2004 by WestLand]	SC	--	--
Fringed myotis (*Myotis thysanodes*) [Detected in 1996 by BCI]	SC	--	--
Cave myotis (*Myotis velifer*)	SC	--	--
Long-legged myotis (*Myotis volans*)[1]	--	--	--
Yuma myotis (*Myotis yumanensis*)	SC	--	--
Canyon bat (*Parastrellus hesperus*)	--	--	--

SC=Species of Concern (no legal protection), **WSC**=Wildlife of Special Concern, and **S**=Sensitive.

[1]Unconfirmed identification because the limited number of acoustic calls recorded did not satisfy our identification criterion.

Table 4. Bat species identified during mist-netting or visual inspection of mine features and acoustic recordings in the Study Area and vicinity in 2011. A sub-set of sampling locations was surveyed multiple times.

Survey Area (number of sample locations)	**Active Sampling: Mist Netting or Visual Inspection of Inactive Mine Features**	**Passive Sampling: Acoustically Identified** (in addition to calls of captured animals)
Apache Leap (2)	**Vespertilionidae** Pale Townsend's big-eared bat (*Corynorhinus townsendii*) Cave myotis (*Myotis velifer*)	**Vespertilionidae** California myotis (*Myotis californicus*)
Devils Canyon (7)	**Molossidae** Pocketed free-tailed bat (*Nyctinomops femorosaccus*) **Vespertilionidae** Pallid bat (*Antrozous pallidus*) Big brown bat (*Eptesicus fuscus*) Western red bat (*Lasiurus blossevillii*) California myotis (*Myotis californicus*) Canyon bat (*Parastrellus hesperus*)	**Molossidae** Greater western mastiff bat (*Eumops perotis*) Big free-tailed bat (*Nyctinomops macrotis*) Mexican free-tailed bat (*Tadarida brasiliensis*) **Vespertilionidae** Pale Townsend's big-eared bat (*Corynorhinus townsendii*) Cave myotis (*Myotis velifer*) Yuma myotis (*Myotis yumanensis*) **Unconfirmed**[2] Silver-haired bat (*Lasionycteris noctivagans*) Southwestern myotis (*Myotis auriculus*) Long-legged myotis (*Myotis volans*)
Oak Flat/East Plant and vicinity (14)	**Molossidae** Mexican free-tailed bat (*Tadarida brasiliensis*) **Vespertilionidae** Big brown bat (*Eptesicus fuscus*) California myotis (*Myotis californicus*) Cave myotis (*Myotis velifer*) Canyon bat (*Parastrellus hesperus*)	**Molossidae** Greater western mastiff bat (*Eumops perotis*) Pocketed free-tailed bat (*Nyctinomops femorosaccus*) **Phyllostomidae** California leaf-nosed bat (*Macrotus californicus*) **Vespertilionidae** Pallid bat(*Antrozous pallidus*) Pale Townsend's big-eared bat (*Corynorhinus townsendii*) Western red bat (*Lasiurus blosevillii*) Hoary bat (*Lasiurus cinereus*) Silver-haired bat (*Lasionycteris noctivagans*) Yuma myotis (*Yuma myotis*) **Unconfirmed**[2] Southwestern myotis (*Myotis auriculus*) Long-legged myotis (*Myotis volans*)

Queen Creek (3)	**Vespertilionidae** Pallid bat (*Antrozous pallidus*) Big brown bat (*Eptesicus fuscus*) Cave myotis (*Myotis velifer*) Yuma myotis (*Myotis yumanensis*)	**Molossidae** Greater western mastiff bat (*Eumops perotis*) Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Big free-tailed bat (*Nyctinomops macrotis*) Mexican free-tailed bat (*Tadarida brasiliensis*) **Vespertilionidae** Western red bat (*Lasiurus blosevillii*) Silver-haired bat (*Lasionycteris noctivagans*) Canyon bat (*Parastrellus hesperus*)
2011 TOTAL	**10 bat species**	**15 bat species and 2 unconfirmed[2]**

[1]Total includes species captured in mist nets because acoustic calls were also recorded for these species.
[2]Unconfirmed acoustic identification because a limited number of calls were recorded that did not satisfy our identification criterion and the two *Myotis* species cannot be distinguished acoutsically.
Note: Acoustic calls for myotis species sonic guilds that range around 40 kHz and 50 kHz are not included in totals because these species in these groups have analogous vocalization calls that cannot be identified to species.

Table 5. Species, age, and reproductive status of bats observed at each segment within the Study Area and vicinity. Reproductive status is unknown for species detected acoustically or captured during previous surveys.

Bat Species	Location (Study Area segments)	Acoustic and/or Previous Surveys	Sex[1]		Age	Reproductive Status			
			M	F		NR (F/ M)	R (M)	P (F)	L (F)
Molossidae									
Greater western mastiff bat (*Eumops perotis*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek	X							
	Boyce Thompson	X							
Pocketed free-tailed bat (*Nyctinomops femorosaccus*)	Apache Leap								
	Devils Canyon	X	2	0	A	X	--	--	--
	Oak Flat/East Plant	X							
	Queen Creek	X							
	Boyce Thompson	X							
Big free-tailed bat (*Nyctinomops macrotis*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek	X							
	Boyce Thompson								
Mexican free-tailed bat (*Tadarida brasiliensis*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X	8	1	A	X	--	--	X
	Queen Creek	X							
	Boyce Thompson	X							
Phyllostomidae									
California leaf-nosed bat (*Macrotis californicus*)	Apache Leap								
	Devils Canyon								
	Oak Flat/East Plant	X							
	Queen Creek								
	Boyce Thompson	X							
Vespertilionidae									
Pallid bat (*Antrozous pallidus*)	Apache Leap								
	Devils Canyon	X	3	0	A	X	--	--	--
	Oak Flat/East Plant	X	3	0	A	X	--	--	--
	Queen Creek	X	0	1	A	--	--	--	X
	Boyce Thompson	X							
Pale Townsend's big-eared bat (*Corynorhinus townsendii*)	Apache Leap	X	2	2	A	X			
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek								
	Boyce Thompson	X							
Big brown bat (*Eptesicus fuscus*)	Apache Leap	X							
	Devils Canyon	X	1	3	A	X	--	X	--
	Oak Flat/East Plant	X	6	16	A	X	--	X	X
	Queen Creek	X	2	3	A	X	--	X	X
	Boyce Thompson	X							

Table 5. Species, age, and reproductive status of bats observed at each segment within the Study Area and vicinity. Reproductive status is unknown for species detected acoustically or captured during previous surveys.

Bat Species	Location (Study Area segments)	Acoustic and/or Previous Surveys	Sex[1]		Age	Reproductive Status			
			M	F		NR (F/ M)	R (M)	P (F)	L (F)
Silver-haired (*Lasionycteris noctivagans*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek	X							
	Boyce Thompson								
Western red bat (*Lasiurus blossevillii*)	Apache Leap								
	Devils Canyon	X	1	0	A	X	--	--	--
	Oak Flat/East Plant	X							
	Queen Creek								
	Boyce Thompson								
Southwestern myotis[1] (*Myotis auriculus*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek								
	Boyce Thompson								
California myotis (*Myotis californicus*)	Apache Leap								
	Devils Canyon	X	0	1	A	--	--	X	--
	Oak Flat/East Plant	X	1	0	S	X	--	--	--
	Queen Creek								
	Boyce Thompson	X							
Hoary bat (*Lasiurus cinereus*)	Apache Leap								
	Devils Canyon								
	Oak Flat/East Plant	X							
	Queen Creek								
	Boyce Thompson								
Unknown myotis (*M. ciliolabrum/californicus*)	Apache Leap								
	Devils Canyon	X	0	1	A	--	--	X	--
	Oak Flat/East Plant								
	Queen Creek								
	Boyce Thompson								
Fringed myotis (*Myotis thysanodes*) [Detected in 1996 by BCI]	Apache Leap	X							
	Devils Canyon								
	Oak Flat/East Plant								
	Queen Creek								
	Boyce Thompson								
Cave myotis (*Myotis velifer*)	Apache Leap	X	0	2	A	--	--	--	X
	Devils Canyon								
	Oak Flat/East Plant	X	0	1	A	X	--	--	X
	Queen Creek	X	9	9	A	X	--	X	X
	Boyce Thompson	X							
Long-legged myotis[2] (*Myotis volans*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek								
	Boyce Thompson								

Table 5. Species, age, and reproductive status of bats observed at each segment within the Study Area and vicinity. Reproductive status is unknown for species detected acoustically or captured during previous surveys.

Bat Species	Location (Study Area segments)	Acoustic and/or Previous Surveys	Sex[1]		Age	Reproductive Status			
			M	F		NR (F/ M)	R (M)	P (F)	L (F)
Yuma myotis (*Myotis yumanensis*)	Apache Leap								
	Devils Canyon	X							
	Oak Flat/East Plant	X							
	Queen Creek	X	0	4	A	--	--	X	X
	Boyce Thompson	X							
Canyon bat (*Parastrellus hesperus*)	Apache Leap	X							
	Devils Canyon	X	2	2	A	X	--	X	--
	Oak Flat/East Plant	X	7	12	A	X	--	X	X
	Queen Creek	X							
	Boyce Thompson	X							

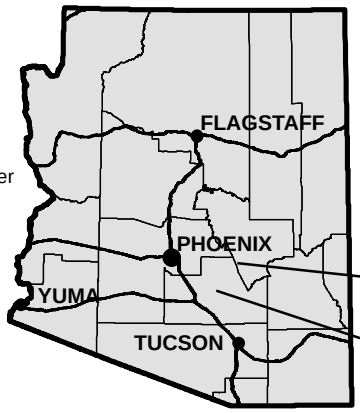
A=adult, **S**=sub-adult (young of the year), **NR**=non-reproductive, **R**=reproductive, **P**=pregnant, and **L**=lactating.
X indicates that status was confirmed; -- indicates that the category did not apply.
[1]Some individuals were released or escaped before processing and are not included in these totals.
[2]Unconfirmed acoustic identification because a limited number of acoustic calls were recorded that did not satisfy our identification criterion.

Table 6. Roost preference of bat species detected in 2011 field evaluations within Study Area and vicinity. Some species will utilize multiple roost types.

Crevice	Cavern (caves or underground mines)	Tree
Greater western mastiff bat (*Eumops perotis*)	Mexican free-tailed bat (*Tadarida brasiliensis*)	Silver-haired bat (*Lasionycteris noctivagans*)
Pocketed free-tailed bat (*Nyctinomops femorosaccus*)	California leaf-nosed bat (*Macrotis californicus*)	Western red bat (*Lasiurus blossevillii*)
Big free-tailed bat (*Nyctinomops macrotis*)	Pallid bat (*Antrozous pallidus*)	Hoary bat (*Lasiurus cinereus*)
Pallid bat (*Antrozous pallidus*)	Pale Townsend's big-eared bat (*Corynorhinus townsendii*)	Western small-footed myotis (*Myotis ciliolabrum*)
California myotis (*Myotis californicus*)	Big brown bat (*Eptesicus fuscus*)	Fringed myotis (*Myotis thysanodes*)
Western small-footed myotis (*Myotis ciliolabrum*)	California myotis (*Myotis californicus*)	
Fringed myotis (*Myotis thysanodes*)	Fringed myotis (*Myotis thysanodes*)	
Yuma myotis (*Myotis yumanensis*)	Cave myotis (*Myotis velifer*)	
Canyon bat (*Parastrellus hesperus*)	Yuma myotis (*Myotis yumanensis*)	
	Canyon bat (*Parastrellus hesperus*)	

FIGURES

ARIZONA



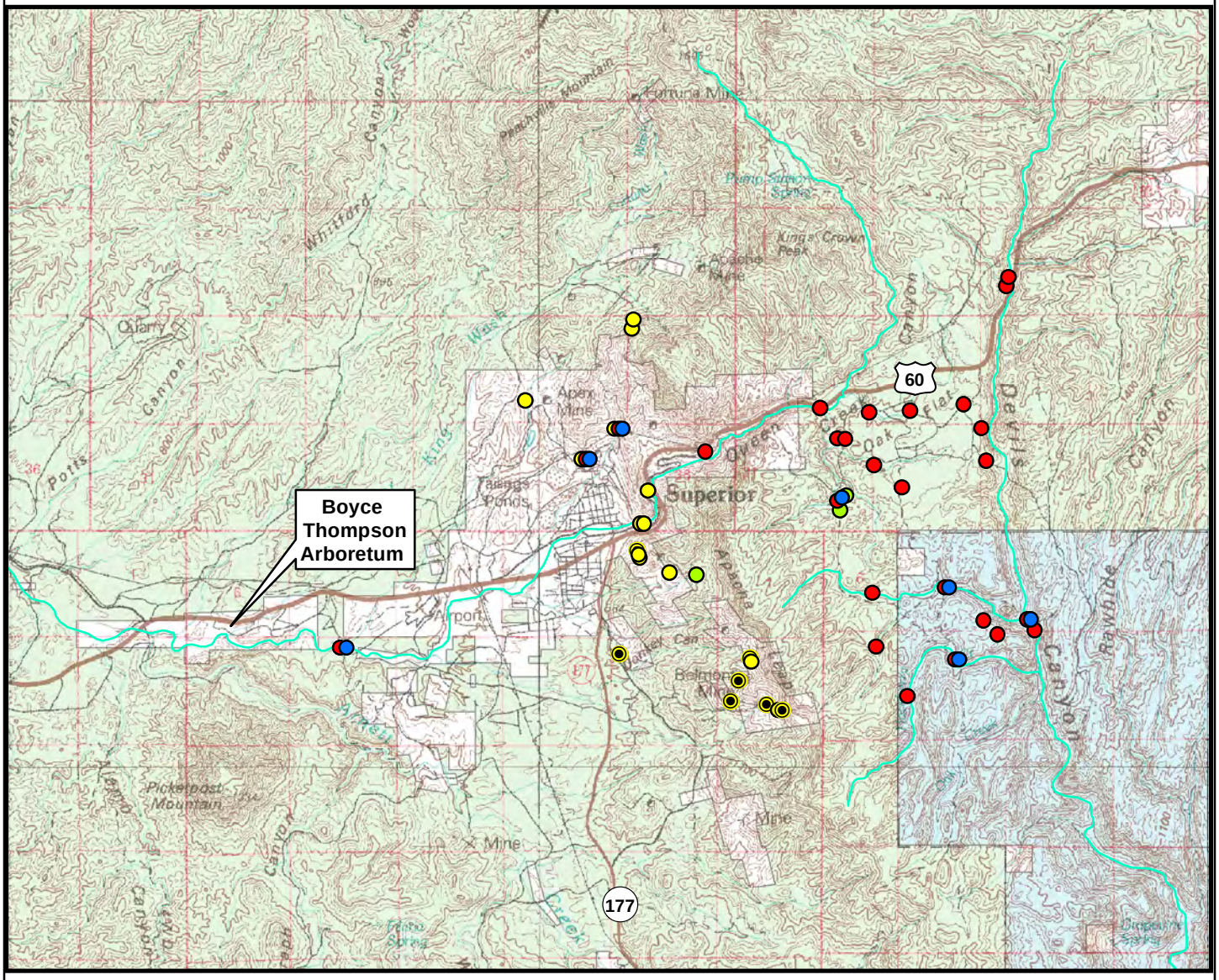
Legend

- Mist Netting Locations 2011 (7)
- Acoustical Sampling Locations 2011 (26) & Number
- Mist Netting Locations 2004

Visual Surveys of Inactive Mines (20)

- External (13)
- Internal (7)

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



Pinal County, Arizona,
1:100,000 Globe & Mesa USGS Quadrangles

N

0 1.5 3 Miles

WestLand Resources, Inc.
Engineering and Environmental Consultants

RESOLUTION COPPER MINING
2011 Bat Species Surveys

VICINITY MAP
Figure 1

M:\Projects\807.53\2011 BAT SPECIES SURVEY\2011_Figures\Figures_Revised_3_22_2012\B&L-WRI vegcomm.dwg

Map Base - 1:24000 USGS Quadrangles

N

0 1500' 3000' Feet

WestLand Resources, Inc.
Engineering and Environmental Consultants

LEGEND

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

- Mist Netting Locations 2011 (7)
- 2 Acoustical Sampling Locations 2011 (26) & Number
- Mist Netting Locations 2004
- Visual Surveys of Inactive Mines- External (13)
- Visual Surveys of Inactive Mines- Internal (7)

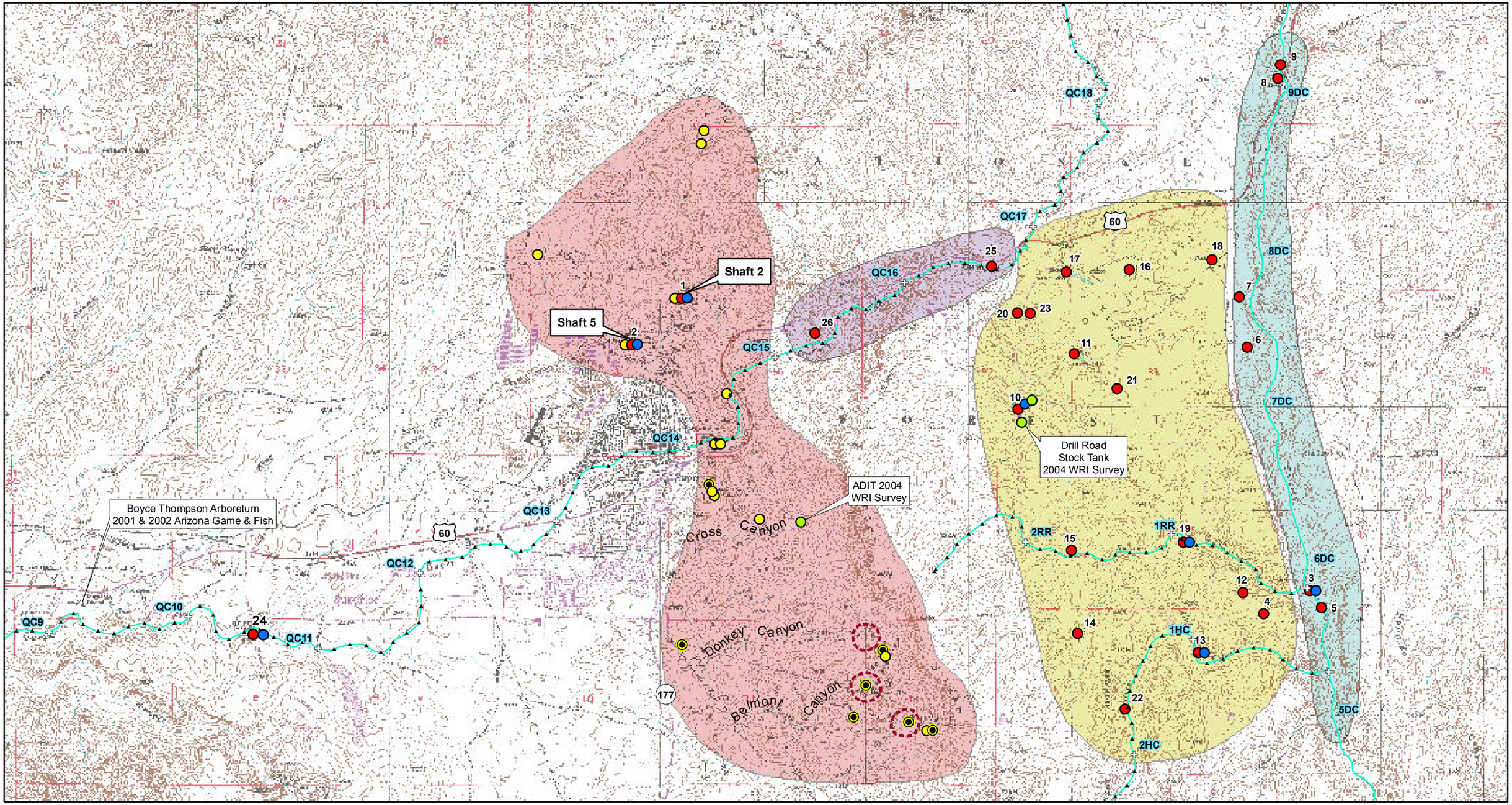
Data Source: WestLand Resources-multiple field trips compared with Google Earth imagery to determine biotic communities. Based on Biotic Communities of the Southwest - Brown & Lowe (August 1980) classifications.

RESOLUTION COPPER MINING
2011 Bat Species Surveys

VEGETATION COMMUNITIES IN STUDY AREA

Figure 2

Path: M:\Projects\807.53\2011 BAT SPECIES SURVEY\2011_Figures\Figures_Revised_3_22_2012\Fig3_Sample_Locations_Study_Areas.mxd



Map Base - 1:24000 USGS Quadrangles

Legend

- Mist Netting Locations 2011 (7)
- Acoustical Sampling Locations 2011 (26) & Number
- Mist Netting Locations 2004

Visual Surveys of Inactive Mines (20)

- External (13)
- Internal (7)

Note: Overlapping dots are separated for clarity.

- BCI 1996 Previous Survey
- 5DC Stream Miles Along Creeks (Tenth Mile Increment Indicted by ▲)
- DC Devils Canyon
- HC Hackberry Creek
- RR Rancho Rio Creek
- QC Queen Creek (from Whitlow Dam)
- Oak Flat / East Plant Area
- Apache Leap Area
- Devils Canyon Area
- Queen Creek Canyon Area

N

0 3,000 6,000 Feet

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RESOLUTION COPPER MINING
2011 Bat Species Surveys

SAMPLE LOCATIONS & STUDY AREAS
Figure 3

APPENDIX A

REPRESENTATIVE FIELD PHOTOS OF SAMPLE 1 LOCATIONS AND BAT SPECIES CAPTURED

APPENDIX A. REPRESENTATIVE FIELD PHOTOS OF SAMPLE LOCATIONS AND BATS CAPTURED WITHIN STUDY AREA AND VICINITY IN 2011

Photo 1. View of two stacked 6 m nets over Queen Creek Canyon in cottonwood gallery downstream of the Superior Wastewater Treatment Plant (sample location 24).

Photo 2. Photograph of a Yuma myotis (*Myotis yumanensis*) captured on 17 June 2011 along Queen Creek Canyon (sample location 24).

Photo 3. View of an old wing injury on a cave myotis (*Myotis velifer*) captured along Queen Creek Canyon on 17 June 2011 (sample location 24). A number of the cave myotis captured at this site had scaly skin and mottling on the wings from an unknown source.

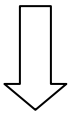

Photo 4. View of a myotis being weighed using a spring Pesola® scale.

Photo 5. View of the acoustic sample site at Drill Tank in Oak Flat/East Plant area (sample location 10). The bat detector is housed in a waterproof container and the microphone is elevated to reduce insect noise.

Photo 6. Two views of Dry Tank #1 in Oak Flat/East Plant area (sample location 11). This tank was dry throughout the study but the dense vegetation is evidence that at times it has standing water.

Photo 7. View of the acoustic sample site in Upper Devils Canyon (sample location 6). The slopes have arid interior chaparral vegetation but the floor of the canyon has a mixture of deciduous riparian vegetation.

Photo 8. View of the sample site at the confluence of Queen Creek Canyon and the Shaft 9 drainage, next to US 60 (sample location 25).

Photo 9. Photograph of a big brown bat (*Eptesicus fuscus*) captured along Queen Creek Canyon on 17 June 2011 (sample location 24).

Photo 10. Photograph of a cave myotis (*Myotis velifer*) captured along Queen Creek Canyon on 17 June 2011 (sample location 24).

Photo 11. Bat detector deployed at the horizontal entrance of Shaft 5 on Apache Leap and vicinity (sample location 2) (detector within the red circle). Bat calls were recorded and a night of mist netting determined that a single male pale Townsend's big-eared bat (*Corynorhinus townsedii*) was using the site to day-roost.

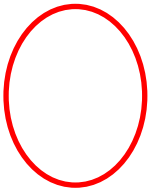

Photo 11. Pallid bat (*Antrozous pallidus*) captured along Devils Canyon on 18 June 2011 (sample location 3). The second photograph is of an ectoparasitic fly (Nycteribiidae) often found on pallid bats.

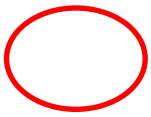

Photo 12. Large pool in Devils Canyon with a mist net across the bat flyway (sample location 3).

Photo 13. View of acoustic sample site in Upper Rancho Rio Canyon in Oak Flat/East Plant area. An acoustic detector was used to sample here on 12 July 2011 (sample location 19).

Photo 14. Photograph of a California myotis (*Myotis californicus*) captured at the pool in Devils Canyon on 18 June 2011 (sample location 3).

Photo 15. Photograph of a western red (*Lasiurus blossevillii*) bat captured at the pool in Devils Canyon on 18 June 2011 (sample location 3).

Photo 16. Photograph of a pocketed free-tailed bat (*Nyctinomops femorosaccus*) captured in Devils Canyon on 18 June 2011 (sample location 3).

Photo 17. Photograph of a canyon bat (*Parastrellus hesperus*) captured in Devils Canyon on 18 June 2011 (sample location 3).

Photo 18. View of acoustic sample site in dry tank near Oak Flat Campground in Oak Flat/East Plant area. This tank was dry during the study (sample location 16).

Photo 19. View of acoustic sample site along Queen Creek Canyon set under the bridge along US 60 (sample location 9).

Photo 20. View of acoustic sample site overlooking the earthen cattle tank in Hackberry Canyon in Oak Flat/East Plant area (sample location 13).

Photo 21. Photograph of either *Myotis ciliolabrum* or *M. californicus* capotes at Devils Canyon on 18 June 2011 (sample location 3). These two species cannot be identified in the field.

Photo 22. Photograph of healed wing tear on a canyon bat (*Parastrellus hesperus*) captured at Rancho Rio Creek in Oak Flat/East Plant area (sample location 19).

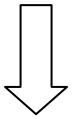

Photo 23. View of the net site along Rancho Rio Creek in Oak Flat/East Plant area with the net deployed over a pool and a bat detector recording bat calls in the area during mist netting (sample location 19).

Photo 24. Pale Townsend's big-eared bat (*Corynorhinus townsendii*) captured exiting Shaft 5 in Apache Leap and vicinity area at sunset on 20 June 2011 (sample location 2).

Photo 25. An ectoparasitic fly (Streblidae) on the pale Townsend's big-eared bat (*Corynorhinus townsendii*) in Apache Leap and vicinity (sample location 2). These ectoparasites are often found on bats.

Photo 26. View of acoustic sample site overlooking the Shaft 9 canyon in Oak Flat/East Plant area (sample location 23).

Photo 27. View of acoustic sample site in Devils Canyon (sample location 5).

Photo 28. Photograph of a cave myotis (*Myotis velifer*) captured along Rancho Rio Creek in Oak Flat/East Plant area (sample location 19).

Photo 29. Photograph of a lactating canyon bat (*Parastrellus hesperus*) captured along Rancho Rio Creek in Oak Flat/East Plant area (sample location 19). The tissue around the mammary gland shows milk and evidence of recent nursing.

Photo 30. Two photos of a male Mexican free-tailed bat (*Tadarida brasilliensis*) captured along Rancho Rio Creek in Oak Flat/East Plant area (sample location 19). The photo on the left shows the gular gland, which male Mexican free-tailed bats use to scent mark their territory during mating.

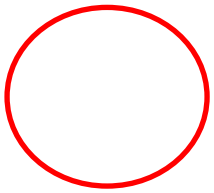

Photo 31. View of the acoustic sampling site in Upper Hackberry Canyon in Oak Flat/East Plant area (sample location 22).

Photo 32. Acoustic sample site within Oak Flat/East Plant area (sample location 21).

Photo 33. A cave myotis (*Myotis velifer*) captured at Queen Creek Canyon below the Superior Wastewater Treatment Plant in summer molt (sample location 24). It is common to see bats molting in summer.

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Photo 34. View of the acoustic sampling site in Oak Flat Campground in Oak Flat/East Plant area (sample location 16).

Photo 35. View looking into the abandoned road tunnel in Queen Creek Canyon where Mexican free-tailed bats (*Tadarida brasilliensis*) use crevices to day-roost.

APPENDIX B

DESCRIPTION OF BAT SPECIES DETECTED IN THE STUDY AREA AND VICINITY

APPENDIX B. DESCRIPTION OF BATS DETECTED IN STUDY AREA AND VICINITY IN 2011

MOLOSSIDAE FAMILY

Greater western mastiff bat (*Eumops perotis*)

The greater western mastiff bat is the largest bat in North America weighing between 2.12 – 2.47 oz (60 – 70 g) and having a wingspan of 21 - 23 in (53 – 58 cm) (Adams 2003). This bat utilizes lower and upper Sonoran Desertscrub habitats near cliffy areas with an abundance of crevices (Hoffmeister 1986, AGFD 2011). This species is typically found at low elevations (WBWG 2005). Detections occur in a variety of habitats: Lower Colorado Desertscrub (25%), Arizona Upland (41.7%), Mojave Desertscrub (16.7%), and oak-pine woodlands (16.7%) (Hoffmeister 1986).

Roosts are typically found in crevices greater than 2 in (5.08 cm) wide and deeper than 1 ft (0.3 m), with preferred depths greater than 10 ft (3.05 m) (AGFD 2011). Crevices are often located in rugged canyons (AGFD 2011). Occupied crevices usually have a 10 ft (3.05 m) fall to allow the bat to drop into flight (AGFD 2011). Colony size can range from as few as two bats to 100 individuals (AGFD 2011). Bats frequently move between roosts which may be temperature related, but could also be a response to disturbance (AGFD 2011).

Pocketed free-tailed bat (*Nyctinomops femorosaccus*)

The pocketed free-tailed bat is a small-to-medium sized bat weighing between 0.88 – 1.06 oz (25 - 30 g) (Adams 2003). This bat utilizes rocky arid and rugged landscapes with high cliffs (Adams 2003). They have been known to forage in Sonoran Desertscrub, Ponderosa pine forests, and Douglas-fir forests (Adams 2003). Detections occur in a variety of habitats: Arizona Upland Desertscrub (55.6%), oak-pine woodland (22.2%), plains and desert grassland (11.1%), and Interior Chaparral (11.1%) (Hoffmeister 1986, Biota Information System of New Mexico [BISON-M]. 2011).

Roosts are typically found in crevices in high cliff walls (Adams 2003, AGFD 2011). This species is also known to roost in human structures (Hoffmeister 1986, Adams 2003, AGFD 2011) and occasionally in tree cavities (Adams 2003). These bats are very noisy while in the roost (AGFD 2011).

Big free-tailed bat (*Nyctinomops macrotis*)

The big-free tailed bat is a medium-sized bat weighing 0.88 – 1.06 oz (25 – 30 g) and having a wingspan of 17-18 in (42 – 46 cm) (Adams 2003). This bat utilizes a variety of habitats including Sonoran Desertscrub, ponderosa pine forests and Douglas fir forest (Hoffmeister 1986, Adams 2003). They are unable to hibernate so they migrate south in the winter (AGFD 2011).

Roosts are typically found in crevices and fissures in high cliff walls (Hoffmeister 1986, AGFD 2001). This species is also known to roost in human structures and occasionally in tree cavities (Adams 2003). A nursery colony in Texas was found in a 6 in (15.2 cm) crevice located in a cliff 40 ft (12.2 m) above a talus slope (Hoffmeister 1986).

Mexican free-tailed bat (*Tadarida brasiliensis*)

The Mexican free-tailed bat is a medium-sized bat weighing between 0.39 - 0.53 oz (11 – 15 g) and having a wingspan of 12 - 14 in (30 – 35 cm) (Adams 2003). The Mexican free-tailed bat primarily utilizes lowland habitats but can also be found in the highlands (AGFD 2011). They migrate southward to the Lower Sonoran and Upper Sonoran life zones in winter (AGFD 2001).

Roosts are typically found in caves, inactive mines, and bridges within desertscrub communities (Hoffmeister 1986). They do not hibernate in Arizona (Hoffmeister 1986). This species forms large colonies reaching sometimes in the millions (Hoffmeister 1986, Adams 2003).

Phyllostomidae Family

California leaf-nosed bat (*Macrotis californicus*)

The California leaf-nosed bat is a medium-sized bat weighing around 0.21 – 0.63 oz (6 - 18 g) and having a wingspan of 13-15 in (33 – 38 cm) (Adams 2003). This bat utilizes Sonoran Desert scrublands and is occasionally found in Great Basin and Chihuahuan desertscrub (AGFD 2011). They occupy the same desertscrub habitat year round (Hoffmeister 1986, AGFD 2011).

This bat roosts in colonies located in caves and inactive mines during the day (Hoffmeister 1986, AGFD 2011, Adams 2003). Bats roost in areas within the mine that are within about 80 ft (24 m) of the opening and in large areas with abundant flying space (AGFD 2011). This species is intolerant of cold temperatures and therefore selects roosts that are above ambient temperatures, usually above 26.7ºC (80 ºF) (AGFD 2011). This species does not hibernate, does not use torpor (lowering the body temperature to that of its surroundings), and is not known to migrate (Hoffmeister 1986, AGFD 2011). This bat is sensitive to roost disturbance (AGFD 2011).

Vespertilionidae Family

Pallid bat (*Antrozous pallidus*)

The Pallid bat is a large-sized bat weighing around 0.46 – 1.02 oz (13 – 29 g) and having a wingspan of 14 - 15 in (36 – 39 cm) (Wilson and Ruff 1999, AGFD 2011). In Arizona, these bats are found throughout the state though they are more common in the southern portions of Arizona during the winter months (Hoffmeister 1986). In the Mogollon Rim they are found more frequently in xeric and scrub grassland habitat (45.2%), followed by deciduous woodland-evergreens (37.4%), and evergreen forests (17.4%) (Hoffmeister 1986). They are typically found at elevations below 8,000 ft (2,440 m) (AGFD 2011).

This bat roosts in crevices, buildings, and occasionally in caves, mines, and hollows of decaying trees (AGFD 2011). In Arizona, this species has been found to roost in separate roosts during the day and night (Wilson and Ruff 1999). Most colonies area made up of 25 to 125 individuals (Hoffmeister 1986). During the cold season, these bats occupy narrow crevices and cluster together, while conversely in the warm season, they will utilize larger domed and are more spread out in the roost (Hoffmeister 1986).

Pale Townsend's big-eared bat (*Corynorhinus townsendii*)

The pale Townsend's big-eared bat is a medium-sized bat weighing around 0.28 – 0.49 oz (8 – 14 g) and having a wingspan of 12 - 13 in (30 – 34 cm) (Adams 2003, AGFD 2011). In Arizona, these bats are found in desertscrub, pinion-juniper woodlands, oak woodlands, and coniferous forests (Adams 2003, AGFD 2011). They forage for small moths and often glean prey from vegetation while in flight (Adams 2003, AGFD 2011).

This species is a cavern obligate, requiring caves or inactive mines for all life stages (Adams 2003). This bat roosts communally in small colonies located in caves or inactive mines as day roosts, and occasionally night roosts in buildings (Adams 2003, AGFD 2011). Cavern habitat used as roosts during the warm months are typically different than those used during hibernation (AGFD 2011). Maternity roost locations usually occur in open ceilings within a cave/mine near the dim light zones and often have high air movement through multiple openings (AGFD 2011). Maternity colonies frequently switch between several locations (Adams 2003). Hibernation roost temperatures are usually around 54 ºF (12 ºC) (AGFD 2011). This bat is sensitive to roost disturbance (AGFD 2011).

Big Brown bat (*Eptesicus fuscus*)

The big brown bat is a large-sized bat weighing approximately 0.39 – 0.81 oz (11 – 23 g) and having a wingspan of 12.6 - 13.8 in (32 – 35 cm) (Wilson and Ruff 1999). The big brown bat utilizes Ponderosa pine forests, pinyon-juniper woodlands, the lower edge of the spruce-fir forests, and the Lower Sonoran habitats (AGFD 2011).

This bat roosts in inactive mines, caves, buildings, bridges, and hollow trees (Hoffmeister 1986, AGFD 2011). Big-brown bats do not tolerate hot roosts with temperatures exceeding 90 - 95°F (32 - 35°C) (Wilson and Ruff 1999, AGFD 2011). They roost in small colonies of typically less than 40 individuals (Hoffmeister 1986).

Silver-haired bat (*Lasionycteris noctivagans*)

The silver-haired bat is a medium-sized bat weighing around 0.28 – 0.39 oz (8 - 11 g) and having a wingspan of 11 -13 in (27 – 32 cm) (Adams 2003). This bat utilizes broad-leaf riparian and coniferous woodlands in close proximity to ponds and streams (AGFD 2011). They are thought to be migratory in parts of their range but may be active year-round in southern Arizona (Adams 2003). This bat is found in higher elevations in the summer and lower elevations in the winter (Hoffmeister 1986).

This bat roosts under the loose bark of trees and occasionally in man-made structures (Adams 2003). Roosts typically are over 33 ft (10 m) above the ground (AGFD 2011). Silver-haired bats usually roost alone or in small groups of two to six individuals (AGFD 2011). They hibernate in trees, buildings, crevices, or similar structures (AGFD 2011).

Western red bat (*Lasiurus blossevillii*)

The western red bat is a medium-sized bat weighing around 0.25 – 0.53 oz (7 – 15 g) and having a wingspan of 11.4 - 13.0 in (29.0 - 33.2 cm) (AGFD 2011). This bat utilizes broad-leaf deciduous riparian areas and woodlands for roosting and foraging (Hoffmeister 1986, Adams 2003, AGFD 2011).

This bat roosts singly in the foliage of large trees and shrubs in areas near water (Adams 2003, AGFD 2011). Roost sites are typically in large cottonwood trees, and they usually forage in areas containing cottonwoods, sycamore, oaks, and walnuts (Adams 2003). They have been known to roost in fruit tree orchards and may also occasionally roost in saguaro boots (hardened cavities in saguaros created by woodpeckers) (AGFD 2011). This bat is believed to be migratory (Adams 2003).

Hoary bat (*Lasiurus cinereus*)

The hoary bat is a large-sized bat weighing between 0.88 – 1.06 oz (25 – 30 g) and having a wingspan of 13 - 16 in (34 - 41cm) (Adams 2003). This bat utilizes coniferous and deciduous forests and woodlands, including desert habitats, riparian forests, and juniper scrub (AGFD 2011). They migrate south for the winter and are one of the most widely distributed bat species in America (Adams 2003).

This bat roosts singly typically within the foliage of large trees (Adams 2003). Roost sites are found 10 - 16 ft (3 - 5 m) above the ground in trees located at the edge of clearings (AGFD 2003).

California myotis (*Myotis californicus*)

The California myotis is a small bat weighing between 0.10 – 0.21 oz (3 – 5 g) and having a wingspan of 9 - 10 in (22 – 26 cm) (Adams 2003). This bat is found close to water (Adams 2003). In Arizona, they are found in brushy, grassy, or desert landscapes and do not use ponderosa or spruce-fir forests (Hoffmeister 1986). They forage from desertscrub up to the oak woodlands and along the edge of conifers (Adams 2003).

Roosts are typically found in cracks and crevices of canyon walls, and occasionally in caves or inactive mines (Hoffmeister 1986). They can also be found in hollow trees, under loose bark, and in buildings (Adams 2003). In the winter, this bat hibernates in caves and inactive mines (Adams 2003).

Western small-footed myotis (*Myotis ciliolabrum*)

The western small-footed myotis is a small bat weighing between 0.14 – 0.21 oz (4 – 6 g) and having a wingspan of 8 - 10 in (21 – 25 cm) (Adams 2003, AGFD 2011). This bat utilizes a variety of habitats including: oak-juniper woodlands, chaparral, riparian areas, deserts, and montane coniferous forests (Hoffmeister 1986, Adams 2003, AGFD 2011). In Arizona, these bats have been detected from the hottest deserts to the edge of the oak belt (Hoffmeister 1986).

Roosts in the summer are typically found in crevices, cracks, snags, holes, under rocks, hollow trees, under bark, and in buildings (AGFD 2011). In the winter, these bats are found in caves and/or inactive mines (AGFD 2011). This bat has also been observed roosting in an inactive swallow's nest (Adams 2003). These bats tolerate colder and drier hibernacula than other small bats and they tend to be solitary hibernators (Adams 2003, AGFD 2011). Hibernation roosts are typically located within the summer range (NatureServe 2011).

Fringed myotis (*Myotis thysanodes*)

The fringed myotis is a small bat weighing between 0.18 – 0.25 oz (5 – 7 g) and having a wingspan of 10 - 12 in (26 - 30 cm) (Adams 2003). The fringed myotis utilizes oak-pinyon woodlands though it is also found in fir-pine forests (Adams 2003, AGFD 2011). In southern Arizona, this species occurs mostly in

oak woodlands but also uses habitat ranging from lowland chaparral to Ponderosa pine forests (Hoffmeister 1986, Adams 2003).

Roosts are typically found in caves, inactive mines, cliff faces, dead or dying trees, snags, and buildings (Adams 2003, AGFD 2011). These bats may use lower elevation caves and inactive mines for hibernation sites (AGFD 2011). This species roosts in a variety of trees suggesting the structural characteristics (i.e. height, decay stage) are the primary reason for tree selection (WBWG 2005).

Cave myotis (*Myotis velifer*)

The cave myotis is a large myotis species weighing between 0.42 – 0.53 oz (12 – 15 g) and having a wingspan of 11 - 13 in (28 – 33 cm) (Adams 2003). These bats utilize desertscrub habitat containing creosotebush (*Larrea tridentata*), palo verde (*Parkinsonia* sp.), brittlebush (*Encelia* sp.), and a variety of cacti (Hoffmeister 1986, AGFD 2011, WBWG 2005) and are also occasionally found in pine-oak communities (AGFD 2011). Throughout their range, they have been found in desert floodplains, rocky canyon lands, and cave country (Adams 2003). Colonies in Arizona appear to have large home ranges, with one roost near Tucson covering 625 square mi (1,619 square km) and another by Picacho Peak of 360 square miles (932 square km) (Hayward 1970, Hoffmeister 1986, AGFD 2011).

Roosts are typically found in caves and inactive mines, though they have been observed in tunnels, under bridges, buildings, and occasionally in cliff or barn swallow nests (AGFD 2011, Adams 2003). This species appears to be highly dependent on the availability of open mines (Snow et al. 1993). Individuals are typically found roosting near the entrance of mines that can be as short as 30.5 m (100 ft) (Hoffmeister 1986). In Arizona, they are able to tolerate high temperatures and low humidity with one roost having temperatures of 98.6 °F (37 °C) and 23% relative humidity in July (AGFD 2011). Hibernation roosts are typically wet and located above 6,000 ft (1,829 m) (Hayward 1970, Hoffmeister 1986, AGFD 2011); for example, February roost temperatures were around 46.4 - 51.8 °F (8 - 11 °C) and relative humidity above 55% and frequently near 100% (Hoffmeister 1986, AGFD 2011). Some individuals migrate south for the winter while others remain in hibernation roosts (Hoffmeister 1986, AGFD 2011).

Yuma myotis (*Myotis yumanensis*)

The Yuma myotis is a small-sized bat weighing between 0.14 – 0.25 oz (4 – 7 g)and having a wingspan of 9 - 10 in (22 – 26 cm) (Adams 2003, AGFD 2011). The Yuma myotis utilizes areas with open water almost regardless of the surrounding habitat (Hoffmeister 1986, Adams 2003, AGFD 2011). They typically roost in close proximity to open water (Adams 2003, AGFD 2011). These bats have been found in upland and lowland habitats, desertscrub, forests, moist pinyon-juniper woodlands and riparian areas (AGFD 2011). The bats are more closely associated with water than any other North American bat (Barbour and Davis 1969). They are poor at concentrating urine (a method of retaining water) and as a result are frequently observed drinking water (AGFD 2011).

Roosts are typically found in crevices in cliff walls (Hoffmeister 1986, Adams 2003, AGFD 2011). This species is also known to roost in caves, inactive mines, buildings, bridges, (Adams 2003, AGFD 2011) and inactive cliff swallow nests (Hoffmeister 1986, Adams 2003). These bats frequently hang in tight clusters while roosting (AGFD 2011).

Canyon bat (*Parastrellus hesperus*)

The canyon bat is a small-sized bat weighing between 0.11 – 0.21 oz (3 – 6 g) and having a wingspan of 7 - 9 in (19 – 23 cm) (Adams 2003). The canyon bat utilizes a variety of desert habitats including rocky canyons, greasewood flats, creosote flats and lowlands (Adams 2003, AGFD 2011). In Arizona, this species forages along stream beds, canyons, and water holes and they rarely venture far from rocky areas (Adams 2003).

Roosts are typically found in crevices though they also use boulders, animal burrows, inactive mines, and occasionally buildings (Adams 2003). These bats form small colonies of less than 12 individuals (Adams 2003).

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APPENDIX C

REPRESENTATIVE ACOUSTIC GRAPHS OF BAT CALLS

APPENDIX C. REPRESENTATIVE ACOUSTIC CALLS RECORDED IN THE STUDY AREA IN 2011.

Exhibit 1. Search call of a Mexican free-tailed bat (*Tadarida brasiliensis*) recorded over Drill Tank in Oak Flat/East Plant area (sample location 10) on 06/17/11.

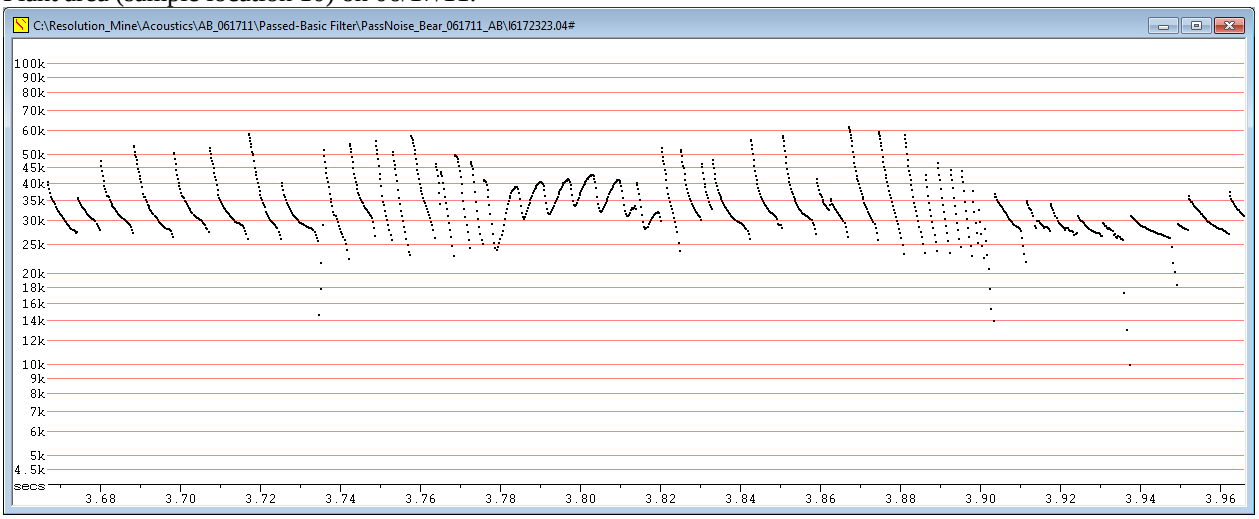


Exhibit 2. Call of a greater western mastiff bat (*Eumops perotis*) recorded in the Oak Flat/East Plant area (sample location 21) on 7/10/11.

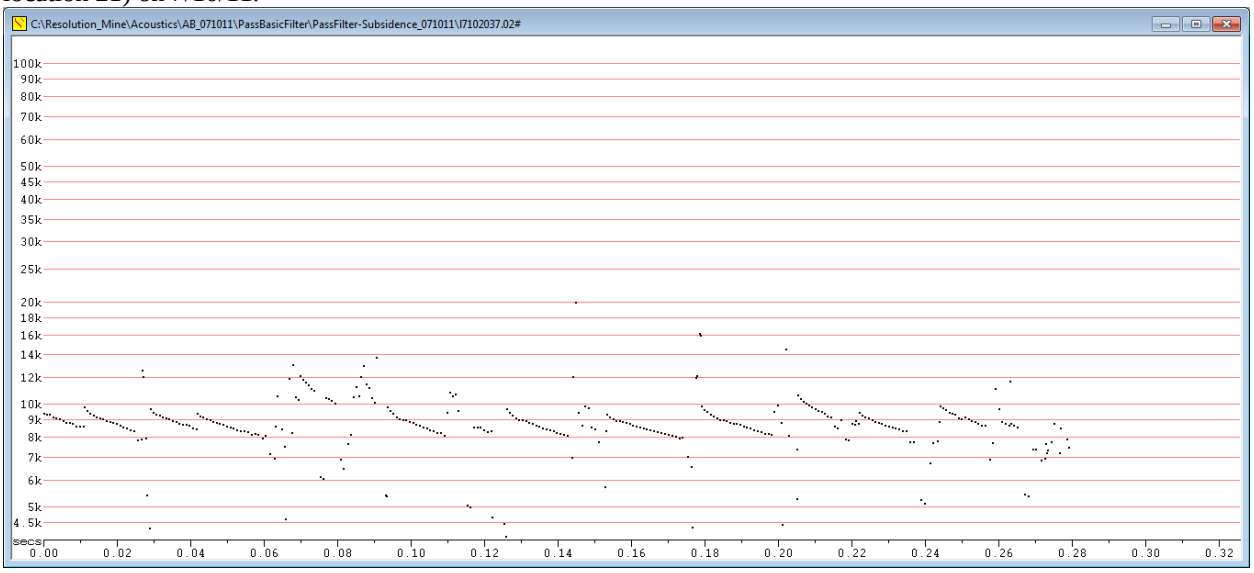


Exhibit 3. Search phase call sequence of a big free-tailed bat (*Nyctinomops macrotis*) recorded over the confluence of Queen Creek Canyon and drainage below Shaft 9 (sample location 25) on 07/09/11.

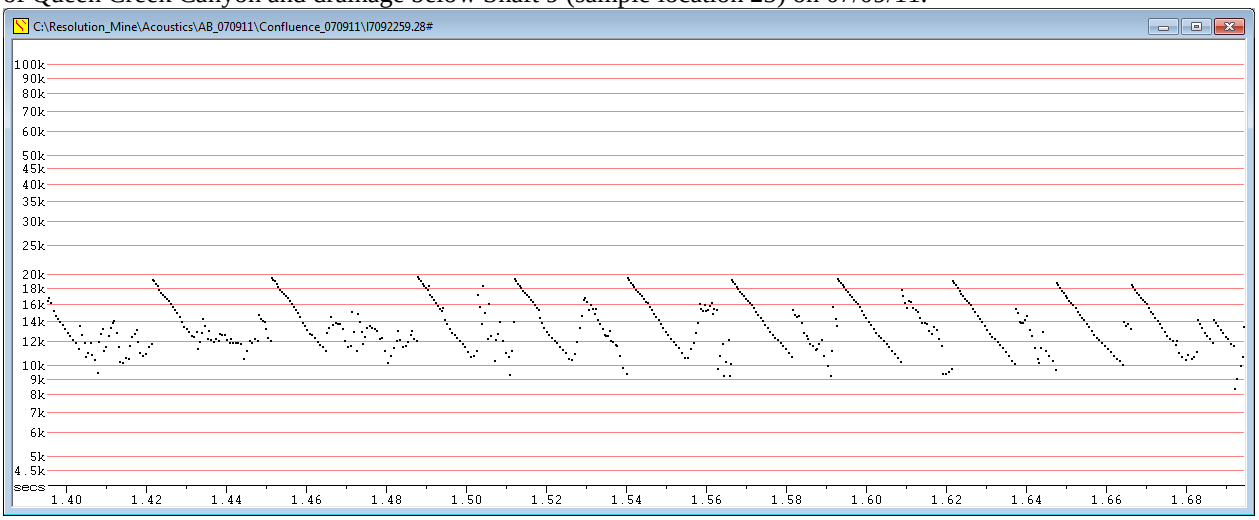


Exhibit 4. Search phase call sequence of a pocketed free-tailed bat (*Nyctinomops femorosaccus*) with a feeding buzz recorded over Dry Tank in Oak Flat/East Plant area (sample location 11) on 06/17/11.

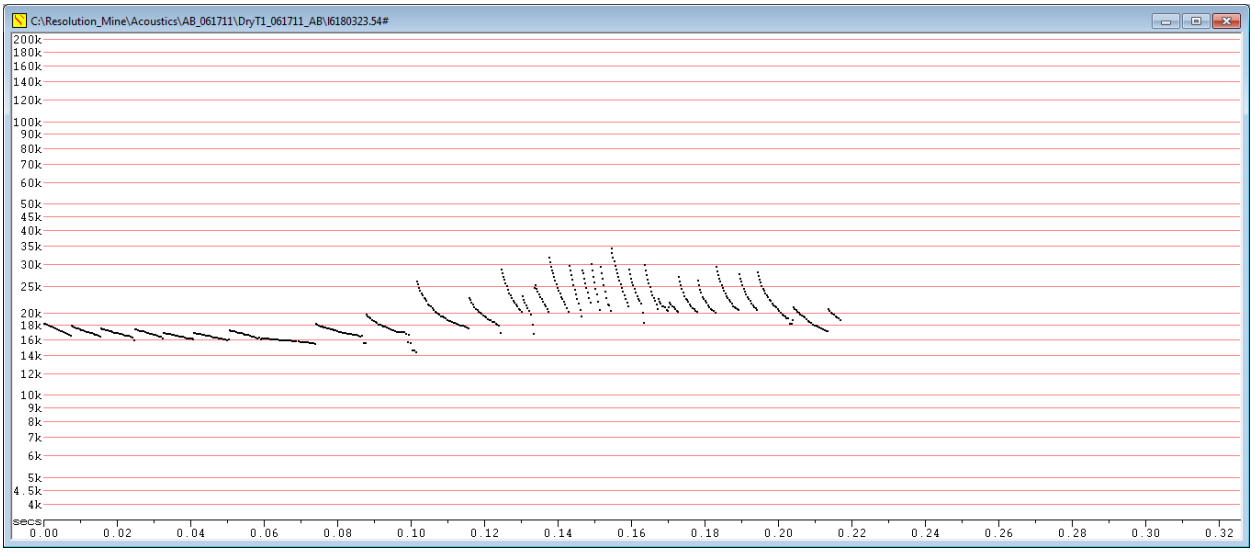


Exhibit 5. Call of a western red bat (*Lasiurus blossevillii*) recorded along the upper reach of Shaft 9 drainage in Queen Creek Canyon near the Magma Mine Road (sample location 23).

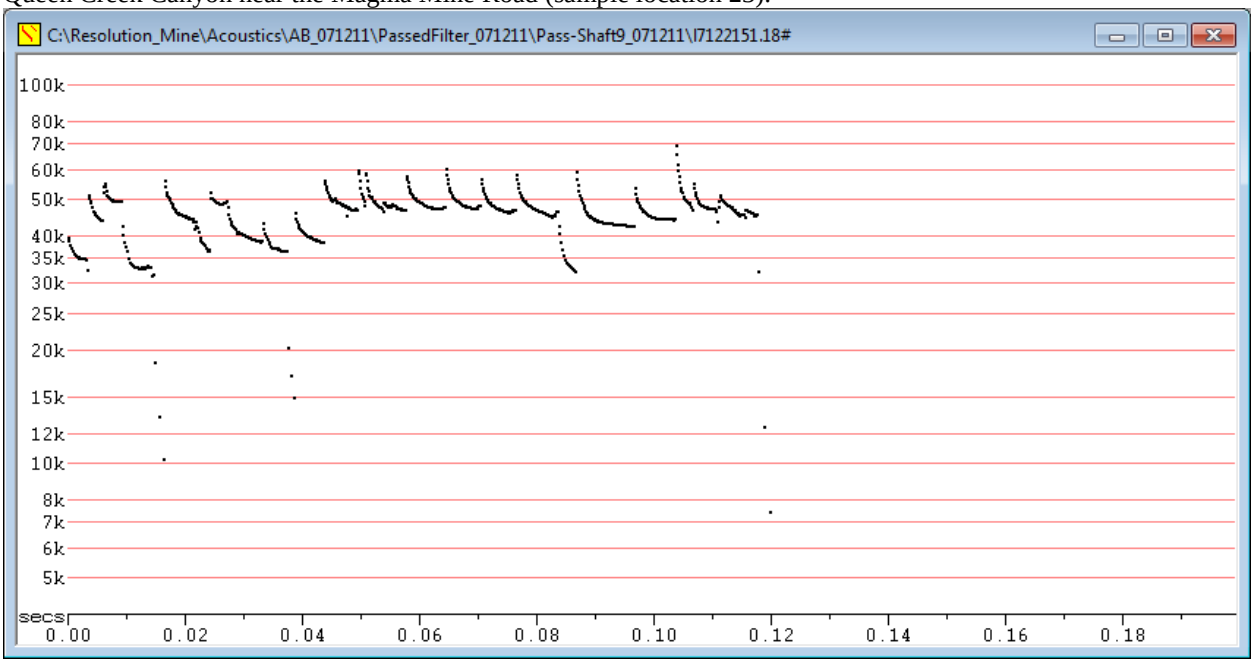


Exhibit 6. Calls of a cave myotis (*Myotis velifer*) recorded from Upper Devils Canyon (sample location 6) on 7/11/11. The slope plot on the right shows how these bats use broadband frequency calls of short duration during foraging to clarify prey locations in cluttered environments.

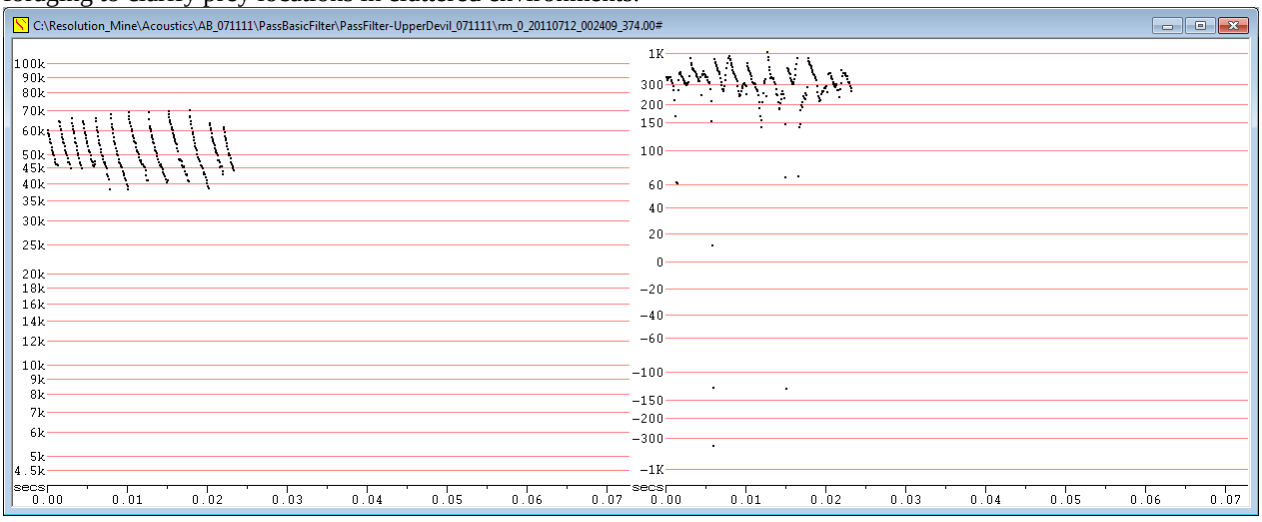


Exhibit 7. Search phase call sequence and social call (middle of sequence) of a pallid bat (*Antrozous pallidus*) recorded over Queen Creek Canyon (sample location 24) on 06/17/11.

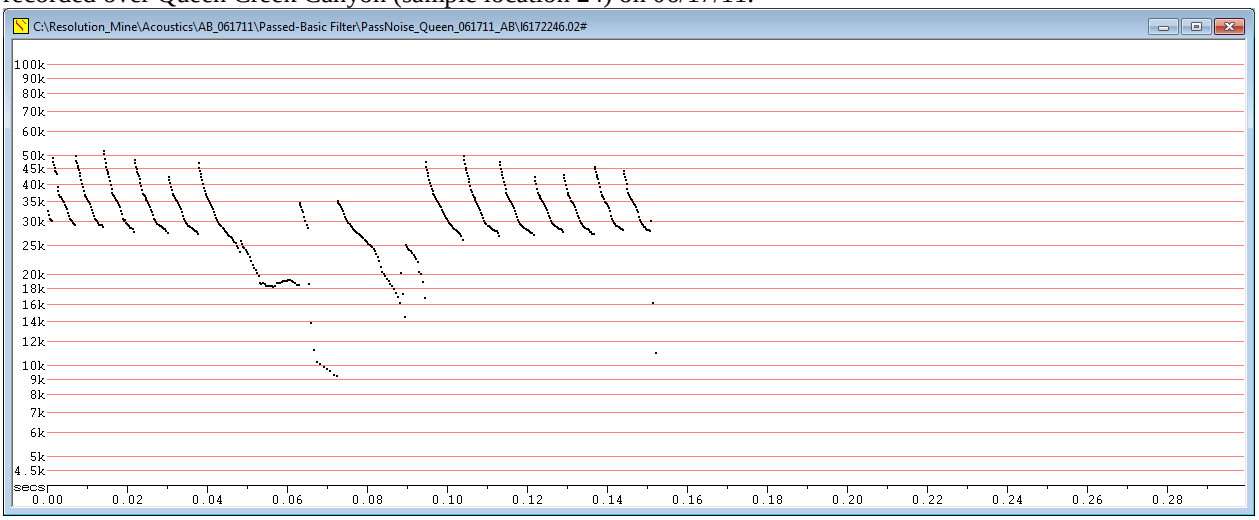


Exhibit 8. Search phase call sequence of a big brown bat (*Eptesicus fuscus*) with a feeding buzz (middle right) recorded over Dry Tank in Oak Flat/East Plant area (sample location 11) on 06/17/11.

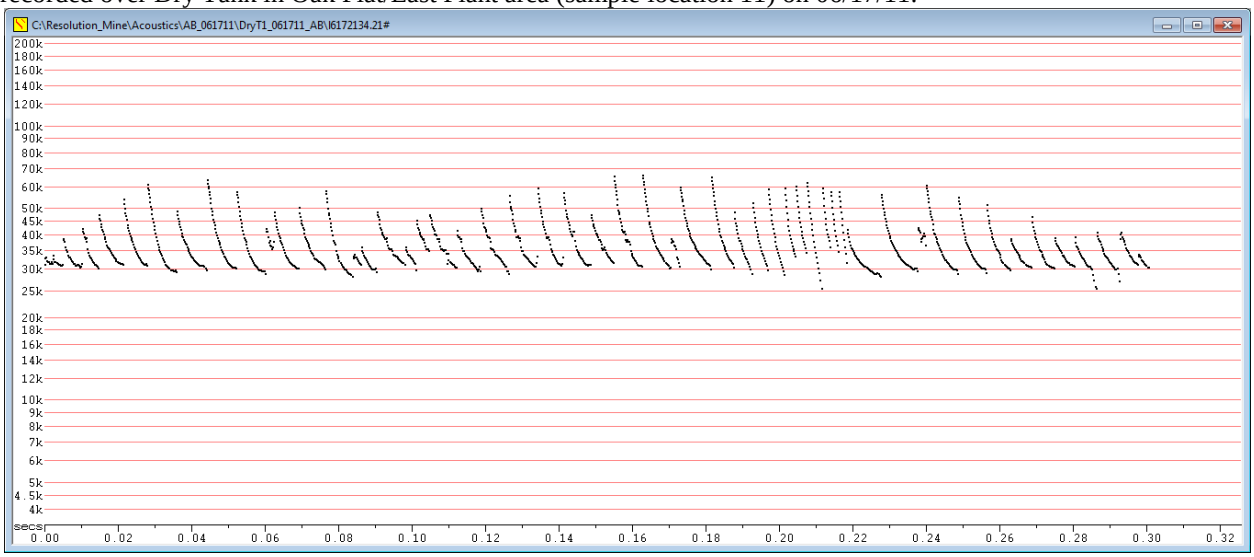


Exhibit 9. Acoustically identified search phase call sequence of a canyon bat (*Parastrellus hesperus*) with a feeding buzz (right) recorded over Dry Tank in Oak Flat/East Plant area (sample location 11) on 06/17/11.

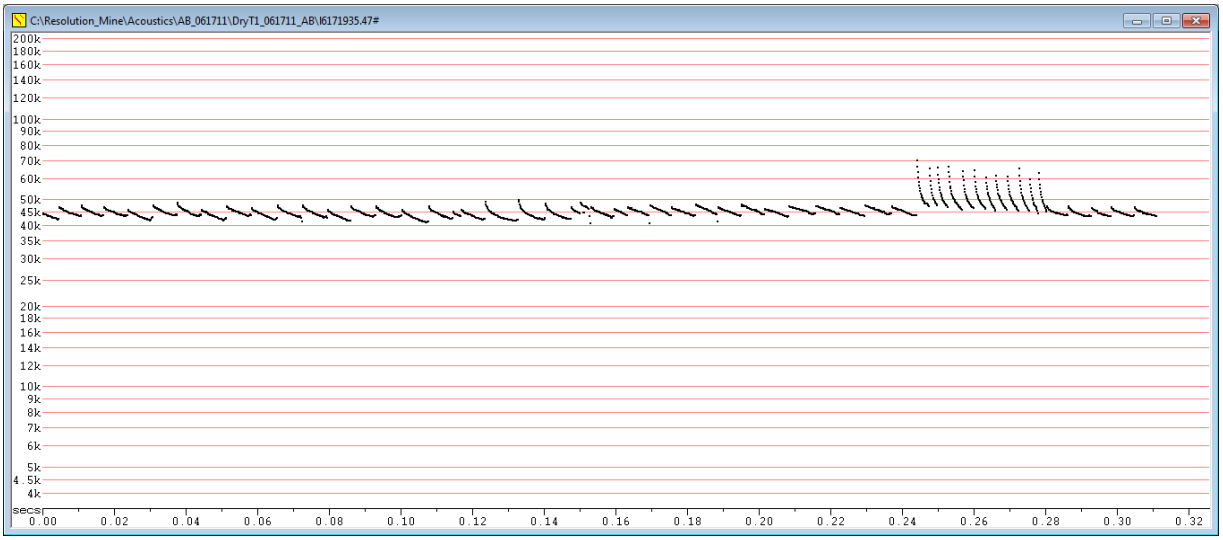
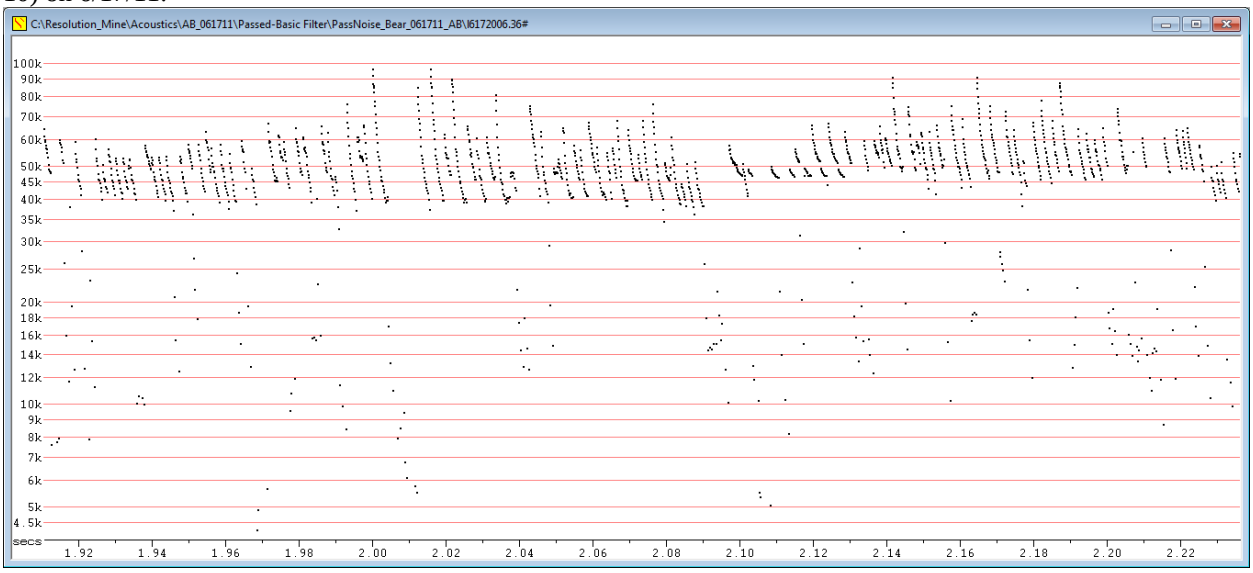


Exhibit 10. Calls of 40 kHz Myotis species recorded over Drill Tank in Oak Flat/East Plant area (sample location 10) on 6/17/11.



APPENDIX D

SUMMARY OF SPECIES ACOUSTICALLY IDENTIFIED

APPENDIX D. SUMMARY OF BAT SPECIES IDENTIFIED THROUGH MIST NETTING AND VISUAL INSPECTION OF MINE FEATURES (ACTIVE DETECTION) AND ACOUSTIC SURVEYS (PASSIVE DETECTION) CONDUCTED IN THE STUDY AREA IN 2011.

Site Number	Sample Location Description	Sample Date (Month/Day)	Active Detection	Passive Detection	Bat Species Identified
Apache Leap					
1	**Shaft 2**	7/11	✓	--	Vespertilionidae Cave myotis (*Myotis velifer*)
2	**Shaft 5:** horizontal and decline	6/17 6/20	✓	✓	Vespertilionidae Pale Townsend's big-eared bat (*Corynorhinus townsendii*)
Devils Canyon					
3	**Devils Canyon netting site:** Dense riparian vegetation and permanent water along Devils Canyon at the base of the trail from the rim.	6/18			Molossidae Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Pallid bat (*Antrozous pallidus*) Pale Townsend's big-eared bat (*Corynorhinus townsendii*) Big brown bat (*Eptesicus fuscus*) Western red bat (*Lasiurus blossevillii*) California myotis (*Myotis californicus*) Cave myotis (*Myotis velifer*) Canyon bat (*Parastrellus hesperus*)
			✓	✓	
			--	✓	
			✓	--	
			--	✓	
			✓	✓	
			✓	✓	
			✓	✓	
			--	✓	
			✓	✓	
4	**Devils Canyon parking:** Parking area to access Devils Canyon within interior chaparral with rocks and crevices and no surface water.	6/18 7/11			Molossidae Greater western mastiff bat (*Eumpos perotis*) Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Big free-tailed bat (*Nyctinomops macrotis*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Pallid bat (*Antrozous pallidus*) Pale Townsend's big-eared bat (*Corynorhinus townsendii*) Big brown bat (*Eptesicus fuscus*) Western red bat (*Lasiurus blossevillii*) Cave myotis (*Myotis velifer*) Canyon bat (*Parastrellus hesperus*)
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
5	**Lower Devils Canyon:** Dense riparian vegetation and permanent water in Devils Canyon downstream of the trail from the rim.	7/10 7/11			Molossidae Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Big brown bat (*Eptesicus fuscus*) Silver haired bat (*Lasionycteris noctivagans*) Cave myotis (*Myotis velifer*) Yuma myotis (*Myotis yumanensis*) Canyon bat (*Parastrellus hesperus*)
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
6 & 7	**Upper Devils Canyon (chaparral)** (2 sites): Overlook to upper Devils Canyon in interior chaparral vegetation with rock cliffs, view in the distance of canyon bottom with deciduous riparian vegetation.	6/17 7/11			Molossidae Greater western mastiff bat (*Eumpos perotis*) Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Big brown bat (*Eptesicus fuscus*) Western red bat (*Lasiurus blossevillii*) Silver-haired bat (*Lasionycteris noctivagans*) Southwestern myotis (*Myotis auriculus*) Cave myotis (*Myotis velifer*) Long-legged myotis (*Myotis volans*) Yuma myotis (*Myotis yumanensis*) Canyon bat (*Parastrelus hesperus*)
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	unconfirmed	
			--	unconfirmed	
			--	✓	
			--	unconfirmed	
			--	✓	
			--	✓	
8 & 9	**Upper Devils Canyon (deciduous)** (2 sites): Along upper Devils Canyon north of SR 60, located in dense deciduous riparian vegetation. Creek was flowing during July surveys.	6/18 7/11			Molossidae Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Big brown bat (*Eptesicus fuscus*) Southwestern myotis (*Myotis auriculus*) Cave myotis (*Myotis velifer*) Yuma myotis (*Myotis yumanensis*) Canyon bat (*Parastrelus hesperus*)
			--	✓	
			--	✓	
			--	✓	
			--	unconfirmed	
			--	✓	
			--	✓	
			--	✓	
Oak Flat/East Plant and vicinity					
10	**Drill tank:** Large earthen cattle tank with a few deciduous trees within interior chaparral located along No. 9 Road.	6/16 7/10 7/12			Molossidae Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Pallid bat (*Antrozous pallidus*) Big brown bat (*Eptesicus fuscus*) Hoary bat (*Lasiurus cinereus*) Silver-haired bat (*Lasionycteris noctivagans*) California myotis (*Myotis californicus*) Cave myotis (*Myotis velifer*) Yuma myotis (*Myotis yumanensis*) Canyon bat (*Parastrellus hesperus*)
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
			--	✓	
11	**Dry tank:** Large dry earthen reservoir behind a rock dam with large deciduous. Likely holds water during wetter periods.	6/17 7/12			Molossidae Pocketed free-tailed bat (*Nyctinomops femorosaccus*) Mexican free-tailed bat (*Tadarida brasiliensis*) Vespertilionidae Big brown bat (*Eptesicus fuscus*) Canyon bat (*Parastrellus hesperus*)
			--	✓	
			--	✓	
			--	✓	
			--	✓	

APPENDIX D. SUMMARY OF BAT SPECIES IDENTIFIED THROUGH MIST NETTING AND VISUAL INSPECTION OF MINE FEATURES (ACTIVE DETECTION) AND ACOUSTIC SURVEYS (PASSIVE DETECTION) CONDUCTED IN THE STUDY AREA IN 2011.

Site Number	Sample Location Description	Sample Date (Month/Day)	Active Detection	Passive Detection	Bat Species Identified
12	**Hackberry Canyon saddle:** Area overlooking Hackberry Creek arid interior chaparral landscape with rock pillars and crevices.	7/12			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	unconfirmed	Long-legged myotis (*Myotis volans*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
13	**Hackberry Creek tank:** Large earthen tank in a landscape of interior chaparral - permanent water with aquatic plants.	6/18 7/09 7/12			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	unconfirmed	Pallid bat (*Antrozous pallidus*)
			✓	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Western red bat (*Lasiurus blossevillii*)
			--	✓	Hoary bat (*Lasiurus cinereus*)
			--	unconfirmed	Silver-haired bat (*Lasionycteris noctivagans*)
			--	✓	Cave myotis (*Myotis velifer*)
			✓	✓	Canyon bat (*Parastrellus hesperus*)
14	**Upper Rancho Rio Creek:** Arid interior chaparral canyon with rock pillars and crevices.	7/10			Molossidae
			--	✓	Pocketed free-tailed bat(*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Western red bat (*Lasiurus blossevillii*)
			--	✓	Cave myotis (*Myotis velifer*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
15	**Middle Rancho Rio :** Arid interior chaparral landscape with rock pillars and crevices.	7/12			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Big free-tailed bat (*Nyctinomops macrotis*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Cave myotis (*Myotis velifer*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
16	**Oak Flat Campground:** Area in large trees surrounded by interior chaparral, small creek through campground that flows during wet periods.	7/11			Molossidae
			--	✓	Greater western mastiff bat (*Eumpos perotis*)
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
17	**Oak tank:** Large dry earthen tank behind a rock dam with large deciduous trees and likely holds water on wet years.	6/18 7/12			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Phyllostomidae
			--	✓	California leaf-nosed bat (*Macrotus californicus*)
					Vespertilionidae
			--	✓	Pallid bat (*Antrozous pallidus*)
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Canyon bat (*Parastrelus hesperus*)
18	**Power line pool:** Temporary pool during wet periods next to major power line on Oak Flat Road within interior chaparral.	7/12			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
19	**Rancho Rio Canyon netting site:** Riparian vegetation and permanent water within interior chaparral vegetation with cliffs and crevices.	6/19 7/10			Molossidae
			--	✓	Greater western mastiff bat (*Eumpos perotis*)
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			✓	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Phyllostomidae
			--	✓	California leaf-nosed bat (*Macrtous californicus*)
					Vespertilionidae
			--	✓	Pallid bat (*Antrozous pallidus*)
			--	unconfirmed	Pale Townsend's big-eared bat (*Corynorhinus townsendii*)
			✓	✓	Big brown bat (*Eptesicus fuscus*)
			--	unconfirmed	Southwestern myotis (*Myotis auriculus*)
			✓	--	California myotis (*Myotis californicus*)
			✓	✓	Cave myotis (*Myotis velifer*)
			--	✓	Yuma myotis (*Myotis yumanensis*)
			✓	✓	Canyon bat (*Parastrellus hesperus*)
20	**Shaft 9 canyon:** Interior chaparral with cliffs overlooking a canyon floor with deciduous riparian vegetation - directly below Shafts 9 & 10.	6/20 7/09 7/12			Molossidae
			--	✓	Greater western mastiff bat (*Eumops perotis*)
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Pale Townsend's big-eared bat (*Corynorhinus townsendii*)
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Western red bat (*Lasiurus blossevillii*)
			--	✓	Canyon bat (*Parastrellus hesperus*)

APPENDIX D. SUMMARY OF BAT SPECIES IDENTIFIED THROUGH MIST NETTING AND VISUAL INSPECTION OF MINE FEATURES (ACTIVE DETECTION) AND ACOUSTIC SURVEYS (PASSIVE DETECTION) CONDUCTED IN THE STUDY AREA IN 2011.

Site Number	Sample Location Description	Sample Date (Month/Day)	Active Detection	Passive Detection	Bat Species Identified
21	**Oak Flat area:** Arid interior chaparral landscape next to a small temporary pool that has water after monsoon storm.	7/10			Molossidae
			--	✓	Greater western mastiff bat (*Eumpos perotis*)
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Cave myotis (*Myotis velifer*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
22	**Upper Hackberry Creek:** Arid interior chaparral canyon with rock pillars and crevices.	7/10			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat(*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Cave myotis (*Myotis velifer*)
			--	✓	Yuma myotis (*Myotis yumanensis*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
23	**Upper Shaft 9 canyon:** Arid interior chaparral canyon with rock pillars and crevices.	7/12			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Big free-tailed bat (*Nyctinomops macrotis)*
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Western red bat (*Lasiurus blossevillii*)
			--	✓	Cave myotis (*Myotis velifer*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
Queen Creek					
24	**Effluent cottonwood gallery:** Dense riparian vegetation with cottonwood gallery and permanent water released from the Superior wastewater treatment plant.	6/19 6/20			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			✓	✓	Pallid bat (*Antrozous pallidus*)
			✓	✓	Big brown bat (*Eptesicus fuscus*)
			✓	✓	Cave myotis (*Myotis velifer*)
			✓	✓	Yuma myotis (*Myotis yumanensis*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
25	**Queen Creek/Shaft 9 confluence:** Canyon floor with deciduous riparian vegetation surrounded by rock pillars and crevices.	6/17 7/09			Molossidae
			--	✓	Greater western mastiff bat (*Eumops perotis*)
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Big free-tailed bat (*Nyctinomops macrotis*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Pallid bat (*Antrozous pallidus*)
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Silver-haired bat (*Lasionycteris noctivagans*)
			--	✓	Cave myotis (*Myotis velifer*)
			--	✓	Canyon bat (*Parastrellus hesperus*)
26	**Old tunnel:** Adjacent to Queen Creek with riparian deciduous vegetation at the mouth of the abandoned US60 tunnel with ceiling crevices.	7/11			Molossidae
			--	✓	Pocketed free-tailed bat (*Nyctinomops femorosaccus*)
			--	✓	Mexican free-tailed bat (*Tadarida brasiliensis*)
					Vespertilionidae
			--	✓	Big brown bat (*Eptesicus fuscus*)
			--	✓	Western red bat (*Lasiurus blossevillii*)
			--	✓	Canyon bat (*Parastrellus hesperus*)

ATTACHMENT 1

BAT CONSERVATION INTERNATIONAL, 1997

Citation #1340

To: Jeff Parker
Environmental Division Coordinator
BHP Copper
7400 North Oracle, Suite 200
Tucson, AZ 85704

From: Dan Taylor & Sheryl Ducummon
North American Bats and Mines Project
Bat Conservation International
P.O. Box 162603
Austin, TX 78716

A REPORT ON A BAT SURVEY OF ABANDONED UNDERGROUND MINE WORKINGS AT BHP COPPER--SUPERIOR OPERATIONS, WITH RECOMMENDATIONS FOR BAT CONSERVATION

Date of Survey, September 23 to 26, 1996

INTRODUCTION

According to the contracted agreement (letter to Jeff Parker dated August 19, 1996), biologists Dan Taylor and Sheryl Ducummon from Bat Conservation International (BCI) visited BHP's Superior Copper Mine from September 23 to 26, 1996. We agreed to conduct bat surveys on approximately 200 old mine workings, evaluate the workings for bat use and habitat potential, recommend sites suitable for protection, and provide technical assistance for the design and construction of bat-compatible closures, where appropriate. Upon arrival to the Superior Copper Mine, we consulted with Reclamation and Salvage Group Leader, Randy Marsing, and prioritized our survey efforts. Randy requested that we first concentrate on high priority areas and sites slated for immediate closure. For aid in locating inactive mine workings we used BHP Superior Operations Ancillary Properties Evaluation (Dennis Karkos, Mine Planner/Coordinator); this report indicates that more than 330 old mine workings are present on the Superior Mine Property. Identification numbers correspond to those assigned in Dennis Karkos' report.

During the survey period of September 23 to 26, 1996 approximately 100 inactive mine workings were evaluated. Surveys occurred in the following high priority drainages: Grand Pacific Group--approximately 11 mine working surveyed; Belmont Canyon Group--approximately 38 mine workings surveyed; and Donkey Canyon Group--approximately 46 mine workings surveyed. In addition, four other priority sites were surveyed: a ventilation shaft (#32) near the #1 Shaft, a series of adits in an open stope (#100, 101, and 102), and an additional adit (#107) along old highway 60. Within the Pacific, Belmont Canyon, and Donkey Canyon Groups all inactive mine workings visible to the surveyors were evaluated. We feel confident all old mine workings in these drainages that are extensive enough to provide bat habitat and/or are a liability risk have been surveyed.

SURVEY RESULTS

Survey techniques included daytime internal visits of mines safe enough to enter and nighttime external surveys of unsafe and/or complex mine workings. Daytime surveys consisted of visual searches for bats or bat sign such as guano or staining on the rib and back. External surveys entailed counting emerging bats with night vision scopes, recording high frequency bat vocalizations on acoustic bat detectors, capturing emerging bats with nets or traps. Approximately 175 person hours of field time were spent on the survey effort (this figure does not include many hours of prep and pre-field time or travel time for surveyors).

The following bat species were detected within inactive mines during the survey period:

Western big-eared bat	*Corynorhinus townsendii*
Big brown bat	*Eptesicus fuscus*
Western pipistrelle	*Pipistrellus hesperus*
Fringed myotis	*Myotis thysanodes*

BHP's Superior Mine may also provide habitat for other bat species not detected during this survey effort including:

California leaf-nosed bat	*Macrotus californicus*
Pallid bat	*Antrozous pallidus*
California myotis	*Myotis californicus*
Cave myotis	*Myotis velifer*
Yuma myotis	*Myotis yumanensis*

From all inactive mines surveyed to date at BHP's Superior Operations, the following information on mine workings used by bats can be summarized:

Percentage	Potential for Bat Habitat	Examples
46 %	provided no habitat for bats	completely collapsed adits, shafts or declines; prospect diggings
31 %	marginal to no bat habitat, no sign of bat use	short adits (≤ 50 feet), shafts, or declines
9 %	some bat sign evident, occasional use probable	deeper (> 50 feet) adits, shafts, declines
8 %	bats were present, frequent use probable	deeper and/or more complex adits and shafts
6 %	bats were present, high probability of significant bat use	more complex workings with inter-connecting adits, shafts, and/or declines; good airflow

Twenty three percent of inactive workings at the Superior Copper Mine had good to excellent potential as bat habitat, 77 percent had no potential to very marginal potential as bat habitat. Survey results showed that each drainage had two to four old workings that were significant bat habitat.

Specific recommendations for all sites surveyed are detailed in the next section.

RECOMMENDATIONS

Permanently closing inactive mine workings for the protection of human safety is of great concern at BHP's Superior Copper Mine. From a bat conservation perspective, two considerations should be made before any permanent closures are implemented: (a) the identification and protection of adequate high quality bat habitat such that bats may still inhabit the area; and (b) the safe exclusion of bats (and other wildlife) from other mines before closure at non-critical seasons--such as hibernation or maternity.

(A) Identification and protection of adequate high quality bat habitat:

Occupied sites or sites with excellent potential often consisted of two or more interconnected workings. These sites are listed below and should receive protection to assure an adequate amount of high quality bat habitat remains in each drainage.

Drainage/Group	Identification Number	Type
Grand Pacific Group	273	Main adit
	278	Adit/stope (connected to #273?)
Belmont Canyon Group	234	Adit with extensive workings
	238	Shaft (connected to #239)
	239	Adit with winze or shaft within
Donkey Canyon Group	221	Adit with other internal workings
	222	Shaft (connected to #223)
	223	Open workings on a vein
	225	Shaft (connected to #223?)
Additionally Surveyed Sites	100	Adit (connecting to # and #)
	101	Adit
	102	Open workings/stope
	107	Adit

All old mine workings identified for protection have been painted with the words "gate," "vent," or "gate or vent" at the portal. Adits (marked "gate" at portal) should be closed with bat-compatible grates that protect people from hazardous situations, but still allow safe bat access. Shafts (marked "vent") should be closed with bat-compatible grates, or other closures that address human safety issues and sustain airflow. Airflow is often important in maintaining the proper internal mine temperatures required by bats. Open workings or stopes (marked "gate or vent") should be closed with bat grates if possible, or if not feasible, they should be closed such that air flow is not disrupted. Bats occupying other nearby (approximate 2 mile radius) workings, if excluded before permanent closures, may move to these alternate protected sites.

Information on the importance of airflow and bat-compatible grate designs can be found in *Bats and Mines*, (Tuttle and Taylor, 1994). This document (pp. 19 to 20) recommends that wherever possible the minimum distance between vertical gate supports should be 24 inches (anything less may restrict

bat movement) and the maximum spacing to ensure adequate strength should be 4 to 10 feet. This spacing will depend upon the design and strength of materials used.

The widest vertical and horizontal spacings are always preferred by bats, but in no case should human safety be compromised. Horizontal members should be spaced no more than 5-3/4 inches, especially near heavily populated areas or recreation areas where small, unsupervised children could attempt to gain entry. Smaller distances can severely restrict bat movement and larger distances may enable unauthorized human entry. Gates constructed of 4 x 4 x 3/8-inch angle iron, reinforced by smaller angle iron stiffeners, have been successfully used to protect bats in caves and mines throughout North America. Additional bat-compatible grate design information can be found in Appendix A.

Shafts or stopes marked "vent" may be more difficult or costly to close with bat-compatible grates (due to unstable sites and large or irregular openings). These sites should be closed to human entry, but in a way that airflow is maintained. Suggestions for these closures include bat-compatible grates (above), cable netting (refer to Appendix B), and chain-link or other fencing. In the Upper Donkey Canyon group, a dangerous "ant-lion trap" shaft has been recommended for vent closure but may be difficult to close with traditional methods. This shaft may be important for maintaining airflow to lower workings. Large irregularly shaped boulders could be placed in this opening to address liability concerns but still permit some airflow.

Surveys at the following abandoned mine sites located bats present, sign of bat use, or potential for suitable habitat: Grand Pacific Group = 274 and 283; Belmont Canyon Group = 232, 254, 257, 258, and 259; Donkey Canyon Group = 193, 194, 195, 219, 227, 286, and 289. Bat-compatible gates are recommended for these sites, if possible. If bat-compatible gates are not feasible, bat exclusions are particularly important at these sites prior to permanent closure.

(B) Excluding Bats:

Several abandoned mine workings identified in Dennis Karkos' Report were surveyed and determined to be unsuitable habitat for bats. These sites are: Grand Pacific Group = 276; Belmont Canyon Group = 240 to 242, 245, 247, 250, 251, 253, 255, 256, 260 to 262, 265 to 271 and 288; Donkey Canyon Group = 192, 200 to 205, 209 to 212, 214 to 216, 218, 220, 224, 229, 230, 284, 290 to 292, 297, and 298. These abandoned workings are completely collapsed adits, shafts, or declines, or prospect diggings thus provide no suitable habitat for bats and little to no liability risk.

Excepting these unsuitable old mine workings, all remaining workings could harbor bats, even though surveys did not indicate bat presence or sign. These sites may be important to bats at times outside of the survey period (such as migratory stopover sites or mating chambers), and should still be given consideration prior to permanent closures. For these sites, the following recommendations are made:

1) Schedule bat exclusions and mine closures when the fewest bats are suspected to be using the mine. Two periods to be cautious of are maternity (late spring/summer) and hibernation seasons (late fall/winter). The best time for bat exclusions and mine closures is in April or in September-October to avoid these sensitive periods.

2) Mine portals can be covered with one inch chicken wire (preferably one hour after sunset so day roosting bats can easily exit for night feeding).

Exclusions using chicken wire allow bats trapped in the mine to squeeze through the wire mesh and escape, yet bats appear unwilling to squeeze back into the mine on subsequent nights. Chicken wire can be molded to provide and awning effect so bats inside the mine detect a window, yet bats approaching from outside the mine perceive a barrier. (During awning construction, do not leave sharp cut edges thus averting injury to bats.) Chicken wire can also exclude other wildlife species such as javelina, woodrats, rodents, and snakes. Chicken wire is durable and cannot be incorporated into woodrat and other rodent nests like other exclusion materials (such as soft netting, tarps, or fish seine).

3) Not all bats exit their day roosts every night, especially if they are disturbed or have detected the presence of a large predator (ie. humans) near the mine. For this reason, chicken wire exclusions should be in place for several days before permanent mine closures.

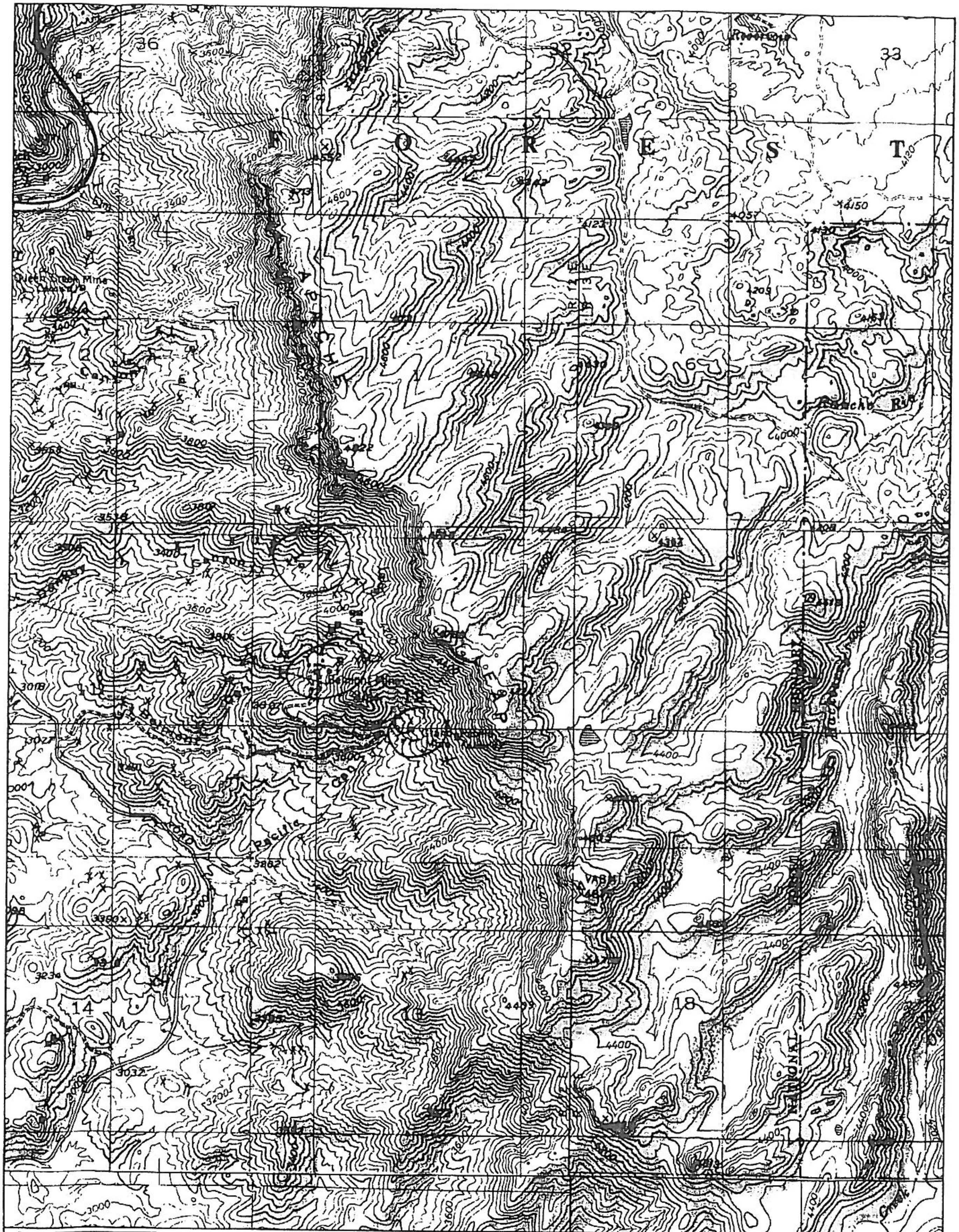
4) For short adits and old workings that are safe to enter, internal surveys prior to exclusion would be desirable. These surveys could determine whether bats or other wildlife were present, and the success of the exclusion before permanent closure.

5) Mines often have multiple entrances. Mines with known or suspected multiple entrances should be systematically closed. All known entrances can be excluded with chicken wire, but the bats may continue to use an unknown "back door." Closing suspected connecting entrances on subsequent days will allow escape for all bats using more complex mines.

6) If the covered mine is not permanently sealed within a few weeks of installing the chicken wire mesh, checking to be sure that openings do not erode open and restore bat access will be necessary periodically. Repeat above steps if this should occur.

In summary, almost one hundred old mine workings were surveyed for bats at BHP-Copper's Superior Operations. At least one significant abandoned mine bat roost was located in each drainage surveyed. Several sites were also identified as having some use by bats, or having potential for bat use. Based on our findings from the three major drainages surveyed, it is highly likely that additional significant bat populations exists in the other old workings on BHP's Superior property. We therefore recommend that these other workings also be surveyed for bats prior to closure.

BCI commends BHP for their commitment to excellence in mining environmental management and looks forward to cooperating with BHP-Copper on future bat conservation efforts.



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Scale 1 : 25,000
1" = 2080 ft

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ATTACHMENT 2

WESTLAND RESOURCES, INC. 2004 BAT SURVEY OF FEDERAL PARCEL, PINAL COUNTY ARIZONA

2004 BAT SURVEY
Federal Parcel, Pinal County, Arizona

Prepared for:

Resolution Copper Company

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Prepared by:

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DECEMBER 2004
Job No. 807.09

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EXECUTIVE SUMMARY

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

Resolution proposes to obtain the Parcel by way of a land exchange. In support of this effort, WestLand has been conducting baseline resource investigations on the Parcel. The purpose of this survey was to determine which bat species could be confirmed present on the Parcel.

This report includes a compellation of mist netting results from on-site surveys, comprehensive literature investigation, and data provided by the Arizona Game and Fish Department. In total it has been determined that 17 different species of bats have the potential to occur on the Parcel. Of the 17 potentially present species, three bat species were captured on the Parcel during mist netting efforts in July 2004.

The three species collected are:

- *Antrozous pallidus* (pallid bat),
- *Eptesicus fuscus* (big brown bat), and
- *Myotis ciliolabrum* (small-footed myotis).

None of these species are afforded special legal protection under any state or federal program.

1. INTRODUCTION AND BACKGROUND

1.1 STATEMENT OF PURPOSE

WestLand Resources, Inc. (WestLand) was retained by Resolution Copper Company (Resolution) to conduct a survey for bats on the approximately 1,224-hectare (3,025-acre) Federal Parcel (the Parcel). The Parcel is in the Tonto National Forest east of the town of Superior in Pinal County, Arizona. The Parcel occupies a portion of Section 36, Township 1 South, Range 12 East; portions of Sections 1 and 2, Township 2 South, Range 12 East; portions of Sections 28, 29, 30, 31, and 32, and Section 33, Township 1 South, Range 13 East; and a portion of Section 6, Township 2 South, Range 13 East (Figure 1). The Parcel is currently public land, managed by the US Forest Service.

Resolution proposes to obtain the Parcel by way of a land exchange. In support of this effort, WestLand has been conducting baseline resource investigations on the Parcel. The purpose of this survey was to determine which species of bats could be confirmed present on the Parcel, in accordance with established survey protocols and procedures.

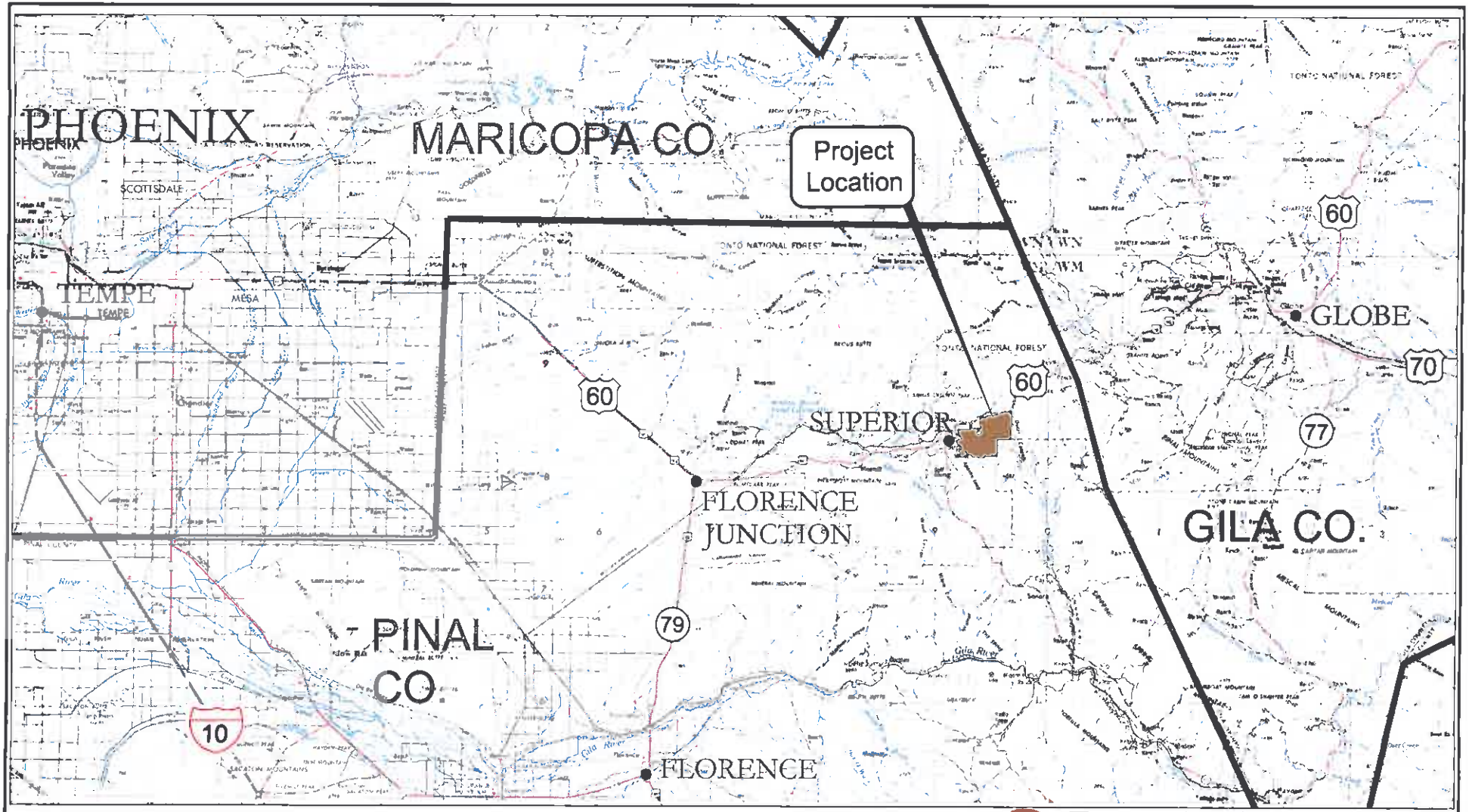
1.2 SITE DESCRIPTION

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

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

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

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



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

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Approx. Scale 1" = 13 KILOMETERS

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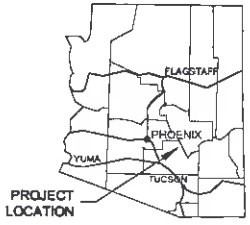

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Resolution Copper Company

BAT INVESTIGATION REPORT, FEDERAL PARCEL

VICINITY MAP
Figure 1

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1.3 SUMMARY OF PREVIOUS SURVEYS CONDUCTED IN THE PARCEL VICINITY

WestLand prepared a *Baseline Biology and Land Use Report* (2003a) and a *Federal Lands Biological Assessment and Evaluation* (2003b) describing biological resources associated with the Parcel. The biological baseline work included a review of bat species identified as anticipated to occur or as having potential to occur on the Parcel. The results of this initial effort produced a list of 17 bat species potentially present (Table 1). Of those 17 bat species, five are identified as being "special status" species.

Specifically, the special status of these species includes a designation as:

- Listed as a Threatened or Endangered, or as candidate or proposed for such listing by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA),
- U.S. Forest Service (USFS) Sensitive species (a list maintained by each National Forest), and/or
- Wildlife of Special Concern (WSC) in Arizona (a list maintained by Arizona Game and Fish Department [AGFD]).

The five special status species with some potential to occur on the Parcel are the California leaf-nosed bat (*Macrotus californicus*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), Allen's big-eared bat (*Idionycteris phyllotis*), spotted bat (*Euderma maculatum*), and the Townsend's (or Western) big-eared bat (*Plecotus townsendii*). It is important to note that the lesser long-nosed bat, spotted bat, and Allen's big-eared bat were all identified as having very remote potential for occurring on the Parcel.

Table 1. Bat Species Potentially Occurring On The Parcel

Common Name	Scientific Name	Status
California leaf-nosed Bat	*Macrotus californicus*	WSC (AGFD)
Cave myotis	*Myotis velifer*	None
California myotis	*Myotis californicus californicus*	None
Western pipistrelle	*Pipistrellus hespurus hespurus*	None
Pale Townsend's (or Western) big-eared bat	*Corynorhinus townsendii pallescens*	None
Mexican free-tailed bat	*Tadarida brasiliensis mexicana*	None
Western mastiff bat	*Eumops perotis*	None
Yuma myotis	*Myotis yumanensis*	None
Fringed myotis	*Myotis thysanodes thysanodes*	None
Small-footed myotis	*Myotis ciliolabrum*	None
Big brown bat	*Eptesicus fuscus*	None
Pallid bat	*Antrozous pallidus*	None
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	None
Hoary bat	*Lasiurus cinereus*	None

Table 1. Bat Species Potentially Occurring On The Parcel

Common Name	Scientific Name	Status
Allen's big-eared bat	*Idionycteris phyllotis*	None
Spotted bat	*Euderma maculatum*	WSC (AGFD)
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Endangered (USFWS) Sensitive (USFS) WSC (AGFD)

With the exception of the lesser long-nosed bat, all of the bats identified as potentially occurring on or near the Parcel are insectivorous bats. Unlike nectar feeding bats, insectivorous bats are not dependent on the presence of particular flora or timing of flowering. For insectivorous bats, the presence or absence of roosting habitat and water availability become the limiting factors in habitat suitability. With hundreds of abandoned mines and adits, as well as exceptional crevice habitat, the Parcel and surrounding lands offer an almost unlimited amount of suitable roosting habitat for insectivorous bats. The presence of standing water on and near the Parcel increases the Parcel's suitability for bat habitat.

The *Baseline Biology and Land Use Report* (WestLand, 2003a) provided a summary of two reports produced by Bat Conservation International, a firm that conducted a bat survey and assisted in some shaft and adit closures for BHP, an adjacent property owner. Table 2 details the finding from Bat Conservation International's (1997) evaluation of approximately 350 underground mine workings in the vicinity of and on the Parcel.

Table 2. Results of Bat Conservation International Survey of Mine and Adit Roosting Potential

Percentage of Adits Surveyed	With Potential for Bat Habitat	Examples of Typical Working Configurations
48%	Provided no habitat for bats.	Completely collapsed adits, shafts or declines; prospect diggings
31%	Marginal to no bat habitat, no sign of bat use.	Short adits (≤ 50 feet), shafts, or declines.
14%	Some bat sign evident, occasional use probable.	Deeper (>50 feet) adits, shafts, declines.
4.5%	Bats were present, frequent use probable.	Deeper and/or more complex adits and shafts.
2.5%	Bats were present, high probability of significant bat use.	More complex workings with inner-connecting adits, shafts, and/or declines; good airflow.

WestLand contacted AGFD to determine if supplemental information regarding bat use of the Parcel was available. AGFD provided data collected during mist netting efforts at Boyce Thompson Arboretum (approximately 7 miles [11 kilometers] west of the Parcel). AGFD conducted mist netting at the arboretum in September 2001 and June 2002. AGFD has captured 11 different species of bats during their mist netting efforts at the arboretum (Table 3). All of the species detected by AGFD on Boyce

Thompson Arboretum land had been identified by WestLand (2003a) in the *Baseline Biology and Land Use Report* as potentially occurring on the Parcel. Of particular interest is the confirmation of the presence of the Townsend's big-eared bat and California leaf-nosed bat, both of which are listed as USFS Sensitive species.

Table 3. Bats Species Captured at Boyce Thompson Arboretum in 2001 and 2002

Common Name	Scientific Name
Pallid bat	*Antrozous pallidus*
Townsend's (or Western) big-eared bat	*Plecotus townsendii*
Western pipistrelle	*Pipistrellus hespurus hespurus*
California myotis	*Myotis californicus californicus*
Yuma myotis	*Myotis yumanensis*
Cave myotis	*Myotis velifer*
Mexican free-tailed bat	*Tadarida brasiliensis mexicana*
Pocketed free-tailed bat	*Nyctinomus femorosaccus*
Big brown bat	*Eptesiscus fuscus*
California leaf-nosed bat	*Macrotis californicus*
Western mastiff bat	*Eumops perotis*

Source: Tim Snow, pers. comm.

However, it is important to note that the environmental conditions occurring at the Boyce Thompson Arboretum are not exactly the same as the conditions on the Parcel. Boyce Thompson Arboretum has a multitude of large exotic trees and year round standing water, and lies at a lower elevation than the Parcel. The surrounding native desert (Sonoran Desertscrub) at the Boyce Thompson site more closely resembles the western portion of the Parcel below the Apache Leap and is certainly different than the Interior Chaparral biotic community found east of (atop) the Apache Leap escarpment.

2. METHODS

To confirm the presence of bat species utilizing the Parcel, limited mist netting was conducted. Although mist netting does not provide a complete census of bats present, it does provide an index of species present at the time of the field visit. July was identified as an optimal month to conduct mist netting based upon the migratory patterns of the species potentially using the Parcel. Six of the 17 potential bat species are not expected to be present in winter months (Table 4) due to the their migration south. The July event also provided a sampling of bats between the mist netting events conducted by AGFD (June and September) at the arboretum.

Table 4. Bats Species Expected to be Absent During Winter Months

Common Name	Scientific Name
Pallid bat	*Antrozous pallidus*
Hoary bat	*Lasiurus cinereus*
California myotis	*Myotis californicus californicus*
Yuma myotis	*Myotis yumanensis*
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*
Cave myotis	*Myotis velifer*

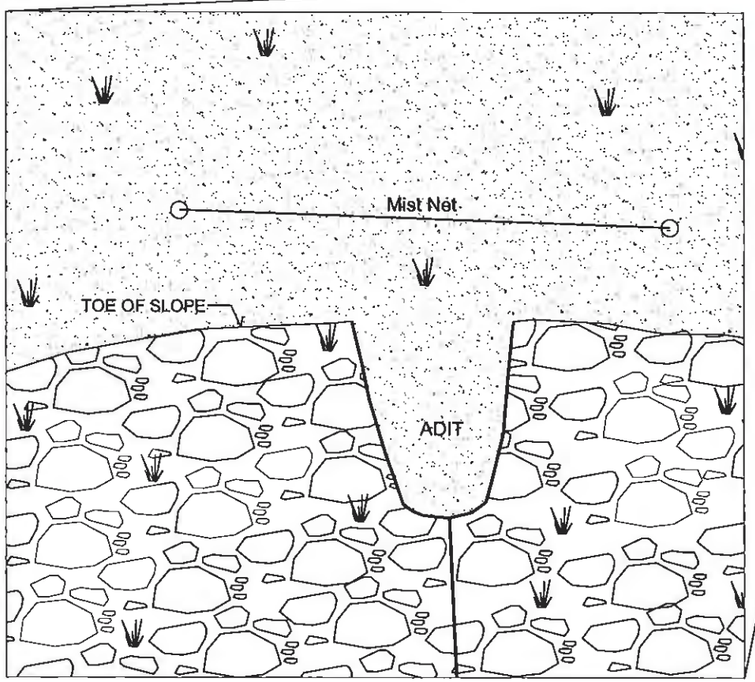
A field visit with AGFD nongame biologist Tim Snow was conducted on June 22, 2004 to obtain recommendations regarding mist netting sites. Two areas were identified as appropriate for mist netting. These areas were an abandoned adit west of Apache Leap and a stock tank identified as the Drill Road Stock Tank (Figure 2). The adit had previously been fitted with a bat gate. It was selected based on the assumption that if the adit merited the installation of bat gates, there was a high probability of bat use. The stock tank was selected because during summer months most bat species are reliant on standing water for foraging. The Drill Road Stock Tank was one of only two locations with standing water present on or near the Parcel at the time of the field visit and was in part selected due to accessibility.

Two different configurations of nets were utilized. Netting at the adit consisted of one 18-meter (60-foot) net. At the tank, an array of three nets was utilized ranging from 9 to 18 meters (30 to 60 feet) in length.

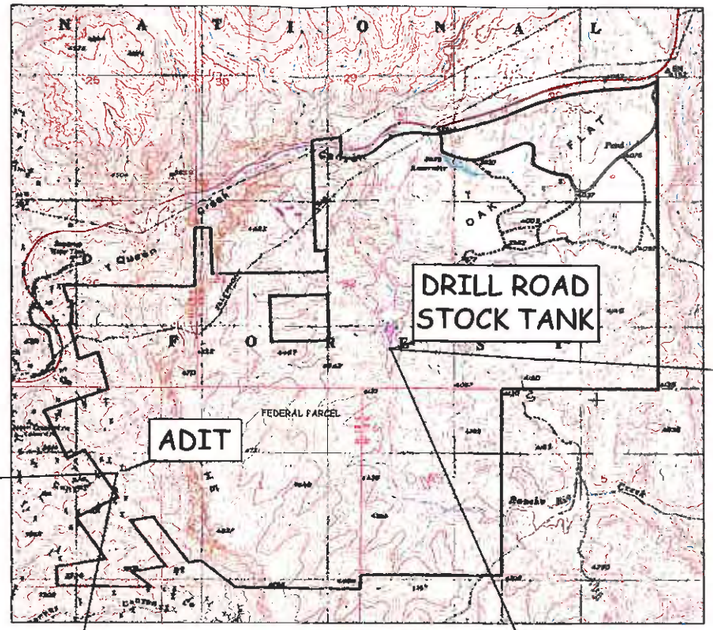
Mist netting was conducted at the adit on July 13, 2004. The single net used at the adit was stretched across the opening approximately 9 meters (30 feet) away from the adit opening, at the toe of the slope accessed by the adit (Figure 2). The net was open at dusk and remained open for approximately 4 hours. The effort was suspended due to high winds and rain.

Mist netting was conducted at the stock tank on July 14, 2004. The three nets used at the Drill Road Stock Tank were placed in areas that were identified as likely bat flyways to the stock tank (Figure 2). Net #1 was placed at the northeast corner of the tank, Net #2 was placed at the northwest corner of the tank, and Net #3 was placed on the south end of the tank intercepting the channel that drains into the tank. Nets were opened at dusk and left open until 0230. Nets were checked for the presence of bats approximately every 15 to 20 minutes. A total of 21 net hours was expended at the stock tank.

In addition to the mist netting, a shallow adit located near the Oak Flat campground was investigated for the presence of bats on August 18, 2004. The visit to the adit revealed the presence of bat guano and large insect wings that had been clipped by an insectivorous bat.



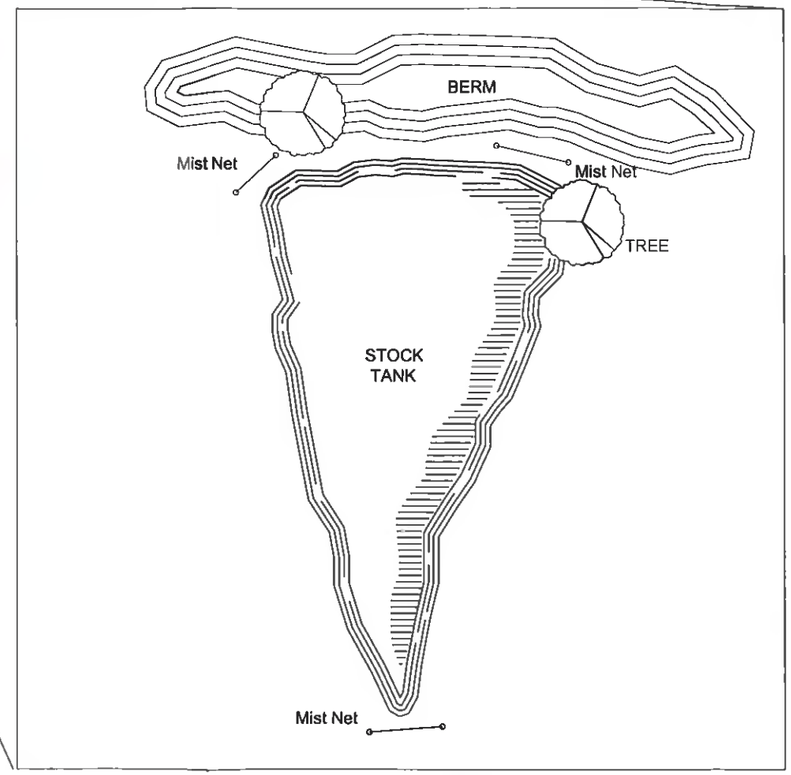
ADIT (Not to Scale)



LEGEND

Project Boundary

Private In-holding Boundary



DRILL ROAD STOCK TANK (Not to Scale)

Pinal County, Arizona
Superior 7.5' USGS Map

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Resolution Copper Company

BAT INVESTIGATION REPORT

MIST NETTING DETAILS

Figure 2

M:\projects\807.09\2004 bat survey\NETTING LOCATIONS-CLOSEUP.dwg 12-14-04

3. CONCLUSIONS

3.1 GENERAL FINDINGS

During two nights of mist netting, a total of eight individual bats were captured. No bats were captured at the adit; all bats handled were captured at the Drill Road Stock Tank. The eight bats represented a total of three different species: pallid bat, big brown bat, and small-footed myotis. Species accounts for these species are provided in the following section. All three of the species had been previously identified in the *Baseline Biology and Land Use Report* (WestLand, 2003a) as potentially occurring on the Parcel. Two of the species (the pallid bat and big brown bat) had previously been documented by AGFD at Boyce Thompson Arboretum. The small-footed myotis had not been confirmed through AGFD's mist netting efforts at Boyce Thompson Arboretum. Accordingly, 12 bat species have now been identified on or near the Parcel. Six species identified as potentially occurring on or near the Parcel have not been confirmed. The six species yet to be confirmed are the lesser long-nosed bat, spotted bat, Allen's big-eared bat, fringed myotis, and the hoary bat.

As stated above, mist netting does not provide a complete census of bats occurring; however, mist netting does provide an index of presence at the time of the field visit. Several variables can affect the success of mist netting. Environmental conditions such as rain and wind can make the nets more detectable to bats and therefore less effective. Net placement also determines capture success. With eight bats captured, the three net set appears to have been relatively effective, particularly since the tank was large enough to provide multiple access points for bats utilizing the tank. Since poor weather was experienced during the survey at the adit, it is not possible to determine if the bats were detecting the net and therefore avoiding capture, or if no bats were exiting from the adit. Bats were observed exiting another open shaft just north of the netted entrance. Due to the close proximity, it is assumed that the other shaft is part of the same mine complex.

The guano and insect wings found in the shallow adit near the Oak Flat Campground are almost certainly evidence of a night feeding roost for a pallid bat (pers. comm. Tim Snow). This determination is based on the known presence of pallid bats and the large size of the insect wing clippings, indicative of pallid bat foraging.

3.2 SPECIES ACCOUNTS

3.2.1 Pallid Bat

The pallid bat is insectivorous and has the ability to take larger prey items such as beetles and moths (AGFD, 2002). The pallid bat is even known to take prey such a centipedes off the ground. The shallow cave at Oak Flat campground is an excellent example of a pallid bat feeding area. Pallid bats often take

large prey items to feeding roosts to clip wings and ingest the insect body; evidence of this practice was observed at the shallow cave.

The pallid bat is a colonial species and roosts in groups of up to 100 individuals (AGFD, 2002). The pallid bat is known to roost in a multitude of differing sites, including buildings, attics, roofs of barns and sheds, the underside of bridges, mine tunnels, crevices of cliffs, exposed eves of buildings, and many other shelters. The many mines, adits, boulder piles, and rock crevices occurring on the Parcel provide an abundance of roosting habitat for this species.

The pallid bat primarily inhabits desert scrub habitat, but has been known to be present in a wide range of habitats including scrub-oak and even evergreen forests. The presence of the pallid bat on the Parcel was not surprising as they are one of the most common bats found at the lower elevations in Arizona (Hoffmeister, 1986). In fact, the pallid bat has been detected almost statewide (AGFD, 2002).

Currently the pallid bat is not listed as a "special status" species under any state or federal program.

3.2.2 Big Brown Bat

The big brown bat is an insectivorous bat which feeds on a large array of insect species, including termites, flying ants, and leafhoppers (AGFD, 2004). It is a generalist in its roosting habitat, roosting in man-made structures such as attics, behind shutters, and beneath bridges, as well as in natural caves and mine tunnels (AGFD, 2004). It appears that this bat roosts in small colonies, with the highest recorded number of individuals being 40 (Hoffmeister, 1986). This bat is widely distributed in Arizona (AGFD, 2004) and is commonly found in woodlands, deciduous and coniferous forests, and desert scrub (Hoffmeister, 1986). With such an ability to utilize a large array of roosting structures, the Parcel offers plentiful roosting habitat for this species. As with the pallid bat, it is not a surprise that this bat was captured during the mist netting effort.

Currently, the big brown bat is not listed as a "special status" species under any state or federal program.

3.2.3 Small-Footed Myotis

The small-footed myotis is an insectivorous bat which feeds on a large array of smaller insect species, including termites, flying ants, and a variety of small beetles (AGFD, 2003).

The small-footed myotis roosts in crevices, and cavities of cliffs or rocks, or possibly in caves and abandoned mines (Hoffmeister, 1986). As with the aforementioned species, the Parcel offers an abundance of suitable habitat for this species.

The small-footed myotis is widely distributed in Arizona and utilizes a variety of habitat types, including oak, juniper, chaparral, and riparian areas (AGFD, 2003). The small-footed myotis is one of nine species

of myotis in Arizona (Hoffmeister, 1986). The occurrence of this bat, like the other two species collected, was not unexpected on the Parcel.

Currently the small-footed myotis is not listed as a "special status" species under any state or federal program.

4. REFERENCES

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