Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Riparian Bird Surveys at Pre-Development Conservation Areas in the Lower Colorado Region, 2017

November 2017

Work conducted under LCR MSCP Work Task F2

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

Federal Participant Group

Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
City of Bullhead City
City of Lake Havasu City
City of Mesa
City of Somerton
City of Yuma
Electrical District No. 3, Pinal County, Arizona
Golden Shores Water Conservation District
Mohave County Water Authority
Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
North Gila Valley Irrigation and Drainage District
Town of Fredonia
Town of Thatcher
Town of Wickenburg
Salt River Project Agricultural Improvement and Power District
Unit "B" Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma County Water Users' Association
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

California Participant Group

California Department of Fish and Wildlife
City of Needles
Coachella Valley Water District
Colorado River Board of California
Bard Water District
Imperial Irrigation District
Los Angeles Department of Water and Power
Palo Verde Irrigation District
San Diego County Water Authority
Southern California Edison Company
Southern California Public Power Authority
The Metropolitan Water District of Southern California

Nevada Participant Group

Colorado River Commission of Nevada
Nevada Department of Wildlife
Southern Nevada Water Authority
Colorado River Commission Power Users
Basic Water Company

Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
Chemehuevi Indian Tribe

Conservation Participant Group

Ducks Unlimited
Lower Colorado River RC&D Area, Inc.
The Nature Conservancy

Lower Colorado River Multi-Species Conservation Program

Riparian Bird Surveys at Pre-Development Conservation Areas in the Lower Colorado Region, 2017

Prepared by:

SWCA Environmental Consultants, Flagstaff, Arizona

Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada
http://www.lcrmscp.gov

November 2017

SWCA Environmental Consultants. 2017. Riparian Bird Surveys at Pre-Development Conservation Areas in the Lower Colorado River Region, 2017. Submitted to the Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona, under contract No. R17PC00026.

ACRONYMS AND ABBREVIATIONS

AMM	Avoidance and Minimization Measure
Collector	Collector for ArcGIS
cottonwood-willow	Fremont cottonwood-willow species (*Populus fremontii-Salix* spp.)
GIS	Geographic Information System
ha	hectare(s)
HCP	Habitat Conservation Plan
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
m	meter(s)
MRM	Monitoring and Research Measure
n	sample size
PVER-South	Palo Verde Ecological Reserve-South
Reclamation	Bureau of Reclamation
spp.	unidentified multiple species in a genus
SWCA	SWCA Environmental Consultants

Symbols

x	by
=	equal to
>	greater than
≥	greater than or equal to
<	less than
%	percent

CONTENTS

Page

Executive Summary ES-1

Introduction 1
Methods 2
Survey Area 2
Data Collection 2
Data Processing 4
Data Quality Assurance and Control 7
Results 8
Planet Ranch 8
Palo Verde Ecological Reserve-South 12
Three Fingers Lake 14
Discussion 14
Literature Cited 19
Acknowledgments 21

Tables

Table Page

1 Number of plots and area by habitat stratum in pre-development conservation areas, 2017 2
2 Behavioral information collected during area search surveys and associated breeding evidence categories 6
3 Description of justification categories for breeding territories on rapid area search surveys 6
4 Number of probable or confirmed breeding territories by plot and habitat type for the four focal species detected at Planet Ranch, 2017 9
5 Number of probable or confirmed breeding territories by plot and habitat type for the 18 non-covered, territorial species detected at Planet Ranch, 2017 10
6 Number of estimated pairs by plot and habitat type for the 20 non-territorial species detected at Planet Ranch, 2017 11
7 Number of probable or confirmed breeding territories by plot for the nine non-covered species detected at PVER-South, 2017 13
8 Number of estimated pairs by plot for the 14 non-territorial species detected at PVER-South, 2017 13

Tables (continued)

Table Page

9 Number of probable or confirmed breeding territories by plot for the 12 non-covered species detected at Three Fingers Lake, 2017* 15

10 Number of estimated pairs by plot for the 16 non-territorial species detected at Three Fingers Lake, 2017* 16

Attachments

Attachment

1 Orthophotos Showing Boundaries of Selected Plots in Pre-Development Conservation Areas, 2017

2 Reference and Attribute Tables Used During Survey Season, 2017

3 Species Breeding in Pre-Development Conservation Areas, 2017

4 Orthophotos Showing Breeding Territories of Focal Species Detected in 2017: Arizona Bell's Vireo (*Vireo bellii arizonae*), Gila Woodpecker (*Melanerpes uropygialis*), Sonoran Yellow Warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), and Vermilion Flycatcher (*Pyrocephalus rubinus*)

EXECUTIVE SUMMARY

In 2017, SWCA Environmental Consultants conducted riparian bird surveys at three future (pre-development) conservation areas following the rapid area search survey methodology (Bart et al. 2010). A total of 20 plots were surveyed, with 9 at Planet Ranch, 2 at Palo Verde Ecological Reserve-South, and 9 at Three Fingers Lake. Surveyors detected a total of 51 breeding species across all 20 plots. These included four of the six focal species for this project: Arizona Bell's vireo (*Vireo bellii arizonae*), Gila woodpecker (*Melanerpes uropygialis*), Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), and vermilion flycatcher (*Pyrocephalus rubinus*). Also included were two additional species also covered by the Lower Colorado Multi-Species Conservation Program (LCR MSCP): western least bittern (*Ixobrychus exilis hesperis*) and Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]).

At Planet Ranch, surveyors detected 42 breeding species, which comprised 226.25 breeding territories or estimated pairs. Four of the breeding species were focal species (Arizona Bell's vireo, Gila woodpecker, Sonoran yellow warbler, and vermilion flycatcher) and one was a species also covered by the LCR MSCP (western least bittern). Some detections of one additional focal species (summer tanager [*Piranga rubra*]) were recorded at Planet Ranch, but no evidence of breeding was observed.

At Palo Verde Ecological Reserve-South, surveyors detected 23 breeding species, none of which were focal species or other species also covered by the LCR MSCP. A total of 143 breeding territories or estimated pairs were recorded across the 23 breeding species. One summer tanager and one yellow warbler (*Setophaga petechia*) were detected in one plot, but no evidence of breeding was observed.

At Three Fingers Lake, surveyors recorded 28 breeding species, 2 of which were species covered by the LCR MSCP (western least bittern and Yuma clapper rail). A total of 442 breeding territories or estimated pairs were recorded across the 28 breeding species. One detection of a yellow warbler was recorded, though no evidence of breeding was observed.

INTRODUCTION

The Lower Colorado River Multi-Species Conservation program (LCR MSCP) is a 50-year program that seeks to protect 26 species (hereafter covered species) and their habitats along the lower Colorado River (LCR) while maintaining river regulation and water management required by law. The LCR MSCP was approved in April 2005 with the signing of a Record of Decision by the Secretary of the U.S. Department of the Interior, and implementation of the program began in October 2005. Documentation for the LCR MSCP includes a Habitat Conservation Plan (HCP), biological assessment/biological opinion, and an environmental impact statement. The HCP specifies Avoidance and Minimization Measures as well as Monitoring and Research Measures (AMM1, AMM3, MRM1, and MRM2) that call for surveys and research to better define habitat requirements for covered species and studies to determine the effects of brown-headed cowbird (*Molothrus ater*) nest parasitism on the reproduction of covered bird species (LCR MSCP 2004). The HCP also calls for the creation of a system of conservation areas, where habitat would be created for the benefit of many species.

The Bureau of Reclamation (Reclamation) implemented a monitoring program along the LCR in 2002 to document bird use of riparian habitat in restoration sites that would become conservation areas for the LCR MSCP. The monitoring program included area search surveys, which were conducted by Reclamation from 2002 to 2006. In 2007, the U.S. Geological Survey designed and executed a sampling plan using area search surveys to produce density and trend estimates for bird species within riparian habitat along the LCR (Bart et al. 2010). From 2008 to 2016, the Great Basin Bird Observatory conducted riparian bird surveys using the developed methods, while also addressing specific questions on certain bird species covered by the LCR MSCP. Of the 12 bird species covered by the LCR MSCP, 6 are considered focal species for this project: Arizona Bell's vireo (*Vireo bellii arizonae*), Gila woodpecker (*Melanerpes uropygialis*), gilded flicker (*Colaptes chrysoides*), Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), summer tanager (*Piranga rubra*), and vermilion flycatcher (*Pyrocephalus rubinus*).

In 2017, SWCA Environmental Consultants (SWCA) continued the riparian bird monitoring studies along the LCR. The objective in 2017 was to inventory the number of breeding territories of the six focal species and other non-covered riparian bird species within both existing conservation areas and existing habitat in future (pre-development) conservation areas. Information presented in this report is specific to the pre-development conservation areas.

METHODS

Survey Area

Area search surveys were conducted to determine the presence and abundance of breeding bird species on 20 plots within the Planet Ranch, Palo Verde Ecological Reserve-South (PVER-South), and Three Fingers Lake pre-development conservation areas (table 1). The plots were selected by Reclamation and ranged in size from 9 to 13 hectares (ha) (attachment 1). Each plot was classified by Reclamation into one of three habitat strata: cottonwood-willow (Fremont cottonwood-willow species) (*Populus fremontii-Salix* spp.), mesquite (*Prosopis* spp.), and mixed (mixture of cottonwood-willow and mesquite). Each plot was assessed for access issues prior to the surveys. If vegetation density at or below chest height was found to inhibit movement through the habitat, trails were established. If the establishment of a trail was deemed necessary, vegetation was cut conservatively so as to impact the habitat as little as possible. All established trails were marked with biodegradable orange flagging. Reclamation selected additional plots that could be used as alternate options if access to or within a plot was deemed unsafe. All 20 of the originally selected plots were deemed safely accessible after assessment, and none of the alternate plots were surveyed in 2017.

Table 1.—Number of plots and area by habitat stratum in pre-development conservation areas, 2017

Pre-development conservation area	Number of plots	Total area (ha)	Area (ha)*		
			Cottonwood-willow (n)	Mesquite (n)	Mixed (n)
Planet Ranch	9	94.1	65.2 (6)	28.9 (3)	–
Palo Verde Ecological Reserve-South	2	18.9	–	–	18.9 (2)
Three Fingers Lake	9	102.9	–	–	102.9 (9)

* Numbers in parentheses equal the number of plots surveyed in that area.

Data Collection

Surveys at each plot consisted of two visits, following the rapid area search methodology (Bart et al. 2010). The first visit was conducted between April 10 and May 5, and the second was completed between May 5 and June 5. Visits were spaced at least 20 days apart, and both visits on a given plot were conducted by the same surveyor. Visits were conducted between first light and 11:00 a.m. Surveyors remained in the plot for 2 hours or the amount of time necessary to detect > 90% of the birds using the plot, whichever was longer. Given that visits

ended by 11:00 a.m., the maximum amount of time that could be spent in a plot was 6 hours. If sustained high winds or temperatures ≥ 100 degrees Fahrenheit occurred during a visit, the visit was postponed until conditions improved.

Field data were collected with Collector for ArcGIS (hereafter Collector) on a Panasonic FZ-B2 Toughpad tablet running an Android operating system. Several feature services were published to ArcGIS Online for use in Collector. These included plot boundaries, trails, a feature service to record real-time locations of the surveyor at regular intervals (i.e., surveyor "tracks"), a 50- x 50-meter (m) grid, and a "working data" service for field data. Field data included point locations of each individual or group of birds detected. The symbology in Collector is somewhat limited, and a total of five easily distinguished shapes (i.e., diamond, square, circle, triangle, and pentagon) were selected for use in the point feature. The list of species known to breed along the LCR was split into five groups of sometimes similar species (e.g., flycatchers) and sometimes dissimilar species (e.g., buntings, grosbeaks, warblers, and tanagers) depending on the number of species in each group. Each shape was then applied to a group of species, and different colors were selected to differentiate each species in the field. Feature services were structured such that there was one independent copy per surveyor. High-resolution, gray-scale aerial imagery of the pre-development conservation areas was loaded directly onto the tablets for use in Collector. All data collected in the field were recorded into an offline copy of a surveyor's feature services, which the surveyors downloaded onto their tablets prior to conducting a visit.

During each visit, surveyors ensured thorough coverage of their plot by walking a route that took them within 50 m of the plot boundary and each 50-m grid intersection point. Surveyors were also instructed to walk outside the plot boundary whenever possible to gather higher resolution data on territories located on the plot boundary. To maximize coverage within the plot during early morning hours when detection probability is highest, surveyors varied their start and stop locations within a plot between the first and second visits.

Surveyors recorded the plot ID, weather conditions, and their current location at the beginning and end of each visit. Weather conditions consisted of a wind code based on the Beaufort scale and a sky code (see attachment 2). Detection locations were recorded for individuals of all territorial species known to breed along the LCR. Data recorded for each point included species of the detection, behaviors observed, number of individuals by gender (i.e., male, female, or unknown), and number of dependent young. Surveyors drew lines between location points to indicate the relationship between two detections of the same species (e.g., same or different individual, possible pair, etc.), and these lines were later used in separating intraspecific territories (see the "Data Processing" section and attachment 2). If a detection location was offset from the surveyor's current location, the surveyor estimated the distance to the detection location and used a compass to note the bearing. The surveyor then visually estimated the location of

the detection on the map in Collector using the aerial imagery, bearing, and estimated distance to aid in location placement. Surveyors focused on recording at least one detection location per potential territory or pair,[1] while trying to avoid double counting territories or pairs. If a focal species was detected, surveyors attempted to record multiple location points to aid with delineating the territory. Any notes on complex behavioral observations that could not be adequately recorded in Collector were recorded in Microsoft OneNote (Microsoft Office Professional Plus 2013, Version 15.0.4901.1000) on the tablets. All surveyors had their own independent Microsoft OneNote notebook files loaded on their tablets.

If non-territorial or colonial species, or species deemed difficult to map using spot-mapping techniques (hereafter "non-territorial species"), were detected, surveyors estimated the number of pairs present in the plot. Surveyors also recorded any breeding behavior and the number of individuals by gender using Collector, Microsoft OneNote, or a combination of the two. Surveyors were not required to record all detection locations for non-territorial species, though location information could be helpful in determining the overall number of pairs present during the visit. Examples of groups of species classified as non-territorial in 2017 are shorebirds, wading birds, gulls, cormorants, marsh birds, waterfowl, colonial nesters, and raptors. A complete list of species considered to be non-territorial in 2017 can be found in attachment 2.

Whenever an LCR MSCP covered species was detected, surveyors recorded a detection location and associated information, even if the detection was outside of a plot. In addition to the six focal species, the other covered species are California black rail (*Laterallus jamaicensis coturniculus*), elf owl (*Micrathene whitneyi*), western least bittern (*Ixobrychus exilis hesperis*), southwestern willow flycatcher (*Empidonax traillii extimus*), yellow-billed cuckoo (*Coccyzus americanus occidentalis*), and Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]). The non-focal covered species are monitored under other efforts, and no effort was made to record multiple detection locations or to confirm breeding status.

Data Processing

Survey data were processed as soon as possible and no later than 2 days after a visit occurred. Upon returning to a field house, surveyors synchronized the survey data in Collector with ArcGIS Online. Surveyors then viewed the spatial data from ArcGIS Online on a laptop in an ArcMap map file. When viewing the data in ArcMap, surveyors were able to apply special symbols that were based on

[1] In this report, species that display territorial behavior are described in terms of breeding territories. Species that do not display territorial behavior, or whose breeding biology is not conducive to spot-mapping techniques, are described in terms of the estimated number of pairs.

both the species of the detection and a recorded behavior (see attachment 2), and which approximate the spot-mapping symbology developed by Bibby et al. (2000). Surveyors then reviewed the data for completeness (i.e., no fields with null values) and accuracy (i.e., no erroneous values). As part of this process, surveyors examined the relationships between and spatial distribution of detection locations and determined which location or group of locations constituted an individual or pair based on knowledge of the species' biology. A unique territory ID number was then assigned to each location or group of locations that were determined to be an individual or unique pair. Survey data from both ArcGIS Online and Microsoft OneNote were then summarized into a Microsoft Access (Microsoft Office Professional Plus 2013, Version 15.0.4893.1000) database provided by Reclamation. All surveyors had their own individual copies of the database. Once each individual surveyor's spatial data in ArcGIS Online had been reviewed, data were removed from the "working data" feature service and moved into the surveyor's "master data" feature service. Data located in the "master data" feature service remained available for future editing and viewing by the surveyor in ArcMap but were not visible in the field on the tablets. Surveyors removed the offline copy of their feature services on a daily basis prior to downloading a new copy specific to the plot they were scheduled to visit the next day. Completing the steps listed above ensured the surveyor would have a "working data" feature service clear of any previous days' data.

After the second visit to a plot, surveyors reviewed the cumulative data from both visits in ArcMap, the Microsoft Access database, and Microsoft OneNote to determine the breeding status of each territory. Surveyors lumped the observed breeding behaviors into one of four breeding evidence categories (table 2). They then applied a decision matrix based on the species' natural history (table 3) to the pattern of observed breeding evidence categories to obtain the breeding status. Each territorial species was classified as either a local breeder (i.e., not known to migrate during the survey season) or a species that is known to both breed and migrate during the season (see attachment 2). A conservative approach was employed when determining the category for each species. If there was any chance that late migrants (including lingering winter residents) could occur during any part of the survey season, the species was classified as both a migrant and breeder.

Once the breeding justification category was determined for a territory, surveyors determined the percentage of the territory that was in the plot. If a territory was not confirmed as breeding, the territory was considered 0% in the plot. For any territories on or near the plot boundary, territory boundaries were delineated by drawing polygons in ArcMap using the detection locations as vertices. Boundaries were delineated for each focal species territory regardless of whether it was near the plot boundary. If territorial behavior was primarily observed in a cluster of detection locations near a nest site or area of activity and was not observed sufficiently (i.e., very few detection locations spaced widely apart) to delineate a clear territory boundary beyond the cluster of detections, then

Table 2.—Behavioral information collected during area search surveys and associated breeding evidence categories

Breeding evidence category	Behavior/breeding evidence
Observed	Seen or heard only
Possible	Singing
	Pair seen or heard together
	Copulation
Probable	Territorial display
	Pair in suitable nesting habitat
	Courtship and/or mate guarding
	Agitated behavior
	Nest guarding
Confirmed	Nest building
	Carrying nest material
	Prolonged distraction behavior
	Occupied nest
	Food carrying
	Dependent young present
	Fecal sac carrying
	Nest with eggs
	Nest with young
	Nest colony
	Female observed on nest

Table 3.—Description of justification categories for breeding territories on rapid area search surveys

Category	Description
Observed Confirmed	Observed confirmed breeding evidence (see table 2) on at least one visit.
Observed Probable Evidence Local	Observed probable or possible breeding evidence (see table 2) on at least one visit **for known local breeders** (i.e., species that do not occur as migrants).
Observed Probable Evidence Both	Observed probable or possible breeding evidence (see table 2) on both visits **for species that are both migrants and breeders**.
No Standard Scenarios	Called it breeding but does not fit any of the standard scenarios. A detailed explanation was provided in the notes for this territory. This category might be selected for a species that breeds along the LCR but migrates partway through the survey season.

surveyors used 90% of the detection locations to approximate the area of the territory. Surveyors then visually assessed the percentage of the polygon in the plot. Percentages were recorded in the Microsoft Access database to the nearest 25% (i.e., 0%, 25%, 50%, 75%, and 100%). Any territory < 10% in the plot was considered to be 0% in the plot. If < 10% of the territory was in the plot, but the nest was located in the plot, the territory was considered to be 25% in the plot.

Territories with the entirety of their detections within the plot were considered to have a 100% territory regardless of how close to the plot boundary the detections were located. Several surveyors were each assigned a few sets of adjacent plots, and in these cases, they often had detailed information on the location of a territory that was present in both plots. If surveyors knew that the detections in both plots were in the same territory, they drew one additional polygon, delineating the boundary of the combined data from both plots. These combination polygons were stored in a separate layer and were not used in determining the percentage of the territory in either plot.

Data were summarized from the Microsoft Access database using queries provided by Reclamation. The number of territories in a plot was calculated as the sum of the percentages of each territory in the plot, with 100% equal to one territory, 75% equal to 0.75 territory, etc. The number of territories were summarized by species per plot, pre-development conservation area, and habitat stratum within the pre-development conservation area.

Data Quality Assurance and Control

Each surveyor's identification skills and knowledge of protocol were assessed during training and at the start of surveys. Identification skills were assessed through audio and visual quizzes. If there were species that surveyors were unable to identify, they studied and took the quiz again. Surveyors used personal copies of audio and visual identification materials (i.e., field guides and smartphone apps) to improve their identification skills. Knowledge of protocol was assessed through one-on-one shadowing in the field with an experienced surveyor. To ensure data were being processed correctly, experienced personnel periodically proofed the data and reviewed any errors with the surveyor. Surveyors were provided with protocols detailing step-by-step instructions on how to use the tablets and associated software, how to process data in ArcGIS, how to enter data into the Microsoft Access database, and how to conduct a survey. Surveyors were also provided with information on breeding biology of common species along the LCR to help with interpretation of field observations. Access to a Birds of North America account was provided so that surveyors could fill in knowledge gaps for a particular species as necessary. To prevent surveyors from being biased by other surveyors' observations, each surveyor's data were

kept completely separate from all other data in individual databases and feature services. Surveyors were instructed to not discuss their observations in great detail with other surveyors.

As part of final territory delineation after surveys were completed, surveyors reviewed their data in ArcGIS to ensure that the correct territory IDs had been assigned to each detection location. They also made sure that all data had been entered into Microsoft Access as they were completing the breeding justification and percentage of a territory in the plot for each potential territory. After surveyors had finished processing their data, all data were reviewed one final time by project personnel. Project personnel checked that data entered into the Microsoft Access database matched the data recorded in ArcGIS and Microsoft OneNote. They checked that the cluster of detection locations assigned to the same territory ID and the polygons drawn to delineate a territory made sense given the species biology and the lines recorded between detection locations. Project personnel also checked that the appropriate breeding justification code was selected for the information recorded for each pair and that the appropriate percentage was selected based on how much of the territory was in the plot.

RESULTS

Trail access was developed on one plot (P1919 in Planet Ranch) prior to the start of surveys. No weather events occurred during visits. A total of 51 species were detected breeding across all 3 pre-development conservation areas (attachment 3). Four focal species (Arizona Bell's vireo, Gila woodpecker, Sonoran yellow warbler, and vermilion flycatcher) were detected breeding across all three pre-development conservation areas (attachment 4).

Planet Ranch

Probable or confirmed breeding territories for four focal species (Arizona Bell's vireo, Gila woodpecker, Sonoran yellow warbler, and vermilion flycatcher) were recorded at Planet Ranch (table 4). Arizona Bell's vireo territories were recorded in three of the six cottonwood-willow plots (9.5 territories) and all three of the mesquite plots (5.75 territories). Gila woodpecker territories were recorded in two cottonwood-willow plots (2.5 territories) and one mesquite plot (0.5 territory). Two Sonoran yellow warbler territories were recorded in one cottonwood-willow plot. No Sonoran yellow warblers were detected in the mesquite habitat type. Overall, the most abundant focal species at Planet Ranch was the Arizona Bell's vireo (15.25 territories). Vermilion flycatcher territories were recorded in two of three mesquite plots (2 territories) and one of six

Table 4.—Number of probable or confirmed breeding territories by plot and habitat type for the four focal species detected at Planet Ranch, 2017

(Number of territories is the sum of the percentages of all territories in the plot. The numbers in parentheses represent the total number of whole [100%] and partial [< 100%] territories in the plot.)

Habitat type	Plot ID	Arizona Bell's vireo	Gila woodpecker	Sonoran yellow warbler	Vermilion flycatcher	Total
Cottonwood-willow	P1911	1.5 (2)	0	0	1 (1)	**2.5 (3)**
	P1914	6.5 (7)	1.75 (2)	2 (2)	0	**10.25 (11)**
	P1916	0	0	0	0	**0**
	P1917	0	0	0	0	**0**
	P1918	1.5 (2)	0.75 (1)	0	0	**2.25 (3)**
	P1919	0	0	0	0	**0**
	Total	**9.5 (11)**	**2.5 (3)**	**2 (2)**	**1 (1)**	**15 (17)**
Mesquite	P1901	1 (1)	0.5 (1)	0	1 (1)	**2.5 (3)**
	P1903	3 (4)	0	0	0	**3 (4)**
	P1904	1.75 (2)	0	0	1 (1)	**2.75 (3)**
	Total	**5.75 (7)**	**0.5 (1)**	**0**	**2 (2)**	**8.25 (10)**
Overall total		**15.25 (18)**	**3 (4)**	**2 (2)**	**3 (3)**	**23.25 (27)**

cottonwood-willow plots (1 territory). Surveyors observed summer tanagers once at P1911 and three times at P1914, but no possible, probable, or confirmed breeding behavior was observed, and no territories were designated.

Surveyors recorded breeding territories for 18 non-covered, territorial species (table 5), 15 of which were found in cottonwood-willow habitat and 11 of which were found in mesquite habitat. The most abundant non-covered, territorial species in both habitat types was the Lucy's warbler (*Oreothlypis luciae*) (26.25 total territories; table 5).

Surveyors also recorded 20 non-territorial species, 18 of which were detected in the cottonwood-willow habitat type and 9 of which were detected in the mesquite habitat type (table 6). One of the non-territorial species (least bittern) is an

Table 5.—Number of probable or confirmed breeding territories by plot and habitat type for the 18 non-covered, territorial species detected at Planet Ranch, 2017*

(Number of territories is the sum of the percentages of all territories in the plot. The numbers in parentheses represent the total number of whole [100%] and partial [< 100%] territories in the plot.)

Habitat type	Plot ID	Number of territories (n)																		
		ABTO	ATFL	BEWR	BLPH	BTGN	BLGR	BCFL	COYE	CRTH	HOLA	LBWO	LUWA	NOMO	PHAI	SAPH	SOSP	VERD	YBCH	Total
Cottonwood-willow	P1911	1 (1)	0.5 (1)	0	0	0	0	0.75 (1)	0	0	0	1 (1)	1 (1)	0	0	0	0	0	0	**4.25 (5)**
	P1914	1 (1)	0.25 (1)	1 (1)	1 (1)	0	0	1 (1)	4 (4)	0	0	1 (1)	3 (3)	0	0	0	8 (8)	1 (1)	8.5 (9)	**29.75 (31)**
	P1916	1 (1)	0	0	0	1 (1)	0	0	0	0	0	0	5.75 (6)	0	0	0	0	0	0	**7.75 (8)**
	P1917	1 (1)	1 (1)	0	0	0.5 (1)	1 (1)	0	0	0	0	0	4 (4)	1 (1)	0	0	0	0	0	**8.5 (9)**
	P1918	2.25 (3)	1 (1)	0.5 (1)	0	0	1 (1)	1 (1)	0	0	0	0	2.25 (3)	0	0	0	0	0	0	**8 (10)**
	P1919	1 (1)	0	1.5 (2)	0	1 (1)	0	0	0	0.75 (1)	0	0	7.25 (9)	0	0	0	0	0	0.5 (1)	**12 (15)**
	Total	**7.25 (8)**	**2.75 (4)**	**3 (4)**	**1 (1)**	**2.5 (3)**	**2 (2)**	**2.75 (3)**	**4 (4)**	**0.75 (1)**	**0**	**2 (2)**	**23.25 (26)**	**1 (1)**	**0**	**0**	**8 (8)**	**1 (1)**	**9 (10)**	**70.25 (78)**
Mesquite	P1901	0	0.5 (1)	0	0	0	1 (1)	0	0	0.5 (1)	1 (1)	0	1 (1)	0	1 (1)	1 (1)	0	1 (1)	0	**7 (8)**
	P1903	1 (1)	1 (1)	0	0	0	0	0	0	1 (1)	0	0	2 (2)	1 (1)	0.5 (1)	0	0	1 (1)	0	**7.5 (8)**
	P1904	0.25 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	**1.25 (2)**
	Total	**1.25 (2)**	**1.5 (2)**	**0**	**0**	**0**	**1 (1)**	**0**	**0**	**1.5 (2)**	**1 (1)**	**0**	**3 (3)**	**1 (1)**	**1.5 (2)**	**1 (1)**	**0**	**2 (2)**	**1 (1)**	**15.75 (18)**
Area total		**8.5 (10)**	**4.25 (6)**	**3 (4)**	**1 (1)**	**2.5 (3)**	**3 (3)**	**2.75 (3)**	**4 (4)**	**2.25 (3)**	**1 (1)**	**2 (2)**	**26.25 (29)**	**2 (2)**	**1.5 (2)**	**1 (1)**	**8 (8)**	**3 (3)**	**10 (11)**	**86 (96)**

* ABTO = Abert's towhee, ATFL = ash-throated flycatcher, BEWR = Bewick's wren, BLPH = black phoebe, BTGN = black-tailed gnatcatcher, BLGR = blue grosbeak, BCFL = brown-crested flycatcher, COYE = common yellowthroat, CRTH = crissal thrasher, HOLA = horned lark, LBWO = ladder-backed woodpecker, LUWA = Lucy's warbler, NOMO = northern mockingbird, PHAI = phainopepla, SAPH = Say's phoebe, SOSP = song sparrow, VERD = verdin, and YBCH = yellow-breasted chat.

Note: The scientific names of the species can be found in attachment 3, table 3-1.

Table 6.—Number of estimated pairs by plot and habitat type for the 20 non-territorial species detected at Planet Ranch, 2017*

Habitat type	Plot ID	AMCO	BHCO	COGA	COPO	DCCO	EUCD	GADW	GAQU	GHOW	GRRO	GRHE	HOFI	LEBI	LENI	MODO	NRWS	PBGR	RWBL	TUVU	WWDO	Total
Cottonwood-willow	P1911	0	1	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	3	**8**
	P1914	2	2	1	0	1	0	1	2	0	0	1	1	1	0	5	1	1	1	0	4	**24**
	P1916	0	0	0	1	0	0	0	2	1	0	0	0	0	2	5	0	0	0	0	3	**14**
	P1917	0	0	0	0	0	0	0	1	0	1	0	0	0	1	3	0	0	0	0	1	**7**
	P1918	0	1	0	0	0	0	0	2	0	1	0	0	0	1	2	0	0	0	0	2	**9**
	P1919	0	1	0	0	0	0	0	5	1	1	0	0	0	0	6	0	0	0	0	6	**20**
	Total	**2**	**5**	**1**	**1**	**1**	**0**	**1**	**14**	**2**	**3**	**1**	**1**	**1**	**4**	**23**	**1**	**1**	**1**	**0**	**19**	**82**
Mesquite	P1901	0	1	0	0	0	0	0	4	0	0	0	6	0	0	6	0	0	0	0	0	**17**
	P1903	0	1	0	0	0	1	0	3	0	1	0	0	0	1	1	1	0	0	0	0	**9**
	P1904	0	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	2	0	**8**
	Total	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**11**	**0**	**1**	**0**	**6**	**0**	**1**	**9**	**1**	**0**	**0**	**2**	**0**	**34**
Area total		**2**	**7**	**1**	**1**	**1**	**1**	**1**	**25**	**2**	**4**	**1**	**7**	**1**	**5**	**32**	**2**	**1**	**1**	**2**	**19**	**116**

* AMCO = American coot, BHCO = brown-headed cowbird, COGA = common gallinule, COPO = common poorwill, DCCO = double-crested cormorant, EUCD = Eurasian collared-dove, GADW = gadwall, GAQU = Gambel's quail, GHOW = great horned owl, GRRO = greater roadrunner, GRHE = green heron, HOFI = house finch, LEBI = least bittern, LENI = lesser nighthawk, MODO = mourning dove, NRWS = northern rough-winged swallow, PBGR = pied-billed grebe, RWBL = red-winged blackbird, TUVU = turkey vulture, and WWDO = white-winged dove.

Note: The scientific names of the species can be found in attachment 3, table 3-1.

LCR MSCP covered species. The three most abundant species were mourning dove (*Zenaida macroura)* (32 estimated pairs), Gambel's quail (*Callipepla gambelii*) (25 estimated pairs), and white-winged dove (*Zenaida asiatica*) (19 estimated pairs). Within the cottonwood-willow habitat type, the most abundant species were mourning dove (23 estimated pairs), white-winged dove (19 estimated pairs), and Gambel's quail (14 estimated pairs). Within the mesquite habitat type, the most abundant species were Gambel's quail (11 estimated pairs), mourning dove (9 estimated pairs), and house finch (*Haemorhous mexicanus*) (6 estimated pairs).

Out of the 9 plots, P1914 had the highest species richness with 28 breeding species (focal species; territorial, non-covered species; and non-territorial species) and the highest abundance with a total of 64 territories and pairs. P1904 had the lowest species richness with 7 breeding species and the lowest abundance with a total of 12 territories and pairs.

Palo Verde Ecological Reserve-South

Surveyors did not detect any probable or confirmed breeding territories at PVER-South for any of the six focal species. Detections for one summer tanager and one yellow warbler were recorded in P2301, but no possible, probable, or confirmed breeding behavior was observed, and no territories were designated.

Surveyors recorded probable or confirmed breeding territories for a total of nine non-covered, territorial species within PVER-South (table 7). The three most abundant species were Abert's towhee (*Melozone aberti*) (7.75 territories), western kingbird (*Tyrannus verticalis*) (7.5 territories), and common yellowthroat (*Geothlypis trichas*) (4.5 territories) (table 7).

Surveyors recorded 14 non-territorial species within PVER-South (table 8). The three most abundant species were white-winged dove (29 estimated pairs), mourning dove (28 estimated pairs), and red-winged blackbird (*Agelaius phoeniceus*) (20 estimated pairs).

Of the two plots, P2301 had slightly higher species richness with 17 breeding species (non-covered, territorial, and non-territorial) compared to 16 species in P2302. P2302 had a higher abundance of territories and pairs than did P2301 (102.75 and 40.25, respectively).

Table 7.—Number of probable or confirmed breeding territories by plot for the nine non-covered species detected at PVER-South, 2017*

(Number of territories is the sum of the percentages of all territories in the plot. The numbers in parentheses represent the total number of whole [100%] and partial [< 100%] territories in the plot.)

Habitat type	Plot ID	Number of territories (n)									
		ABTO	ATFL	BLGR	COYE	CRTH	LBWO	LUWA	NOMO	WEKI	Total
Mixed	P2301	3.75 (4)	0.75 (1)	2.5 (3)	0.5 (1)	1 (1)	1 (1)	1 (2)	0	2.75 (3)	**13.25 (16)**
	P2302	4 (4)	1 (1)	0	4 (4)	0	1 (1)	0	1 (1)	4.75 (5)	**15.75 (16)**
Area total		**7.75 (8)**	**1.75 (2)**	**2.5 (3)**	**4.5 (5)**	**1 (1)**	**2 (2)**	**1 (2)**	**1 (1)**	**7.5 (8)**	**29 (32)**

* ABTO = Abert's towhee, ATFL = ash-throated flycatcher, BLGR = blue grosbeak, COYE = common yellowthroat, CRTH = crissal thrasher, LBWO = ladder-backed woodpecker, LUWA = Lucy's warbler, NOMO = northern mockingbird, and WEKI = western kingbird.

Note: The scientific names of the species can be found in attachment 3, table 3-1.

Table 8.—Number of estimated pairs by plot for the 14 non-territorial species detected at PVER-South, 2017

Habitat type	Plot ID	AMKE	BHCO	CORA	EUST	GAQU	GHOW	GRRO	GTGR	HOFI	LENI	MODO	NRWS	RWBL	WWDO	Total
Mixed	P2301	0	3	0	1	6	0	1	0	1	2	7	1	5	0	**27**
	P2302	1	6	1	5	5	1	0	3	0	0	21	0	15	29	**87**
Area total		**1**	**9**	**1**	**6**	**11**	**1**	**1**	**3**	**1**	**2**	**28**	**1**	**20**	**29**	**114**

* AMKE = American kestrel, BHCO = brown-headed cowbird, CORA = common raven, EUST = European starling, GAQU = Gambel's quail, GHOW = great horned owl, GRRO = greater roadrunner, GTGR = great-tailed grackle, HOFI = house finch, LENI = lesser nighthawk, MODO = mourning dove, NRWS = northern rough-winged swallow, RWBL = red-winged blackbird, and WWDO = white-winged dove.

Note: The scientific names of the species can be found in attachment 3, table 3-1.

Three Fingers Lake

Surveyors did not detect any probable or confirmed breeding territories at Three Fingers Lake for any of the six focal species. One detection of a yellow warbler was recorded at P2910, but no possible, probable, or confirmed breeding behavior was observed, and no territory was designated.

Surveyors recorded probable or confirmed breeding territories for a total of 12 non-covered, territorial species within Three Fingers Lake (table 9). The three most abundant species within the area were common yellowthroat (39 territories), song sparrow (*Melospiza melodia*) (32 territories), and yellow-breasted chat (*Icteria virens*) (29 territories).

Surveyors recorded 16 non-territorial species within Three Fingers Lake, 2 of which were LCR MSCP covered species (Yuma clapper rail and western least bittern) (table 10). The three most abundant non-territorial species were white-winged dove (65 estimated pairs), Gambel's quail (45 estimated pairs), and great-tailed grackle (*Quiscalus mexicanus*) (33 estimated pairs).

Of the 9 plots, P2903 had the highest abundance of territories and pairs (173.5) and highest species richness (22 species). P2913 had the lowest abundance (13.75 territories and pairs), and both P2913 and P2914 had the lowest species richness (7 species).

DISCUSSION

Data presented in this report represent baseline population levels in each pre-development conservation area. No unexpected species were detected in any location. Tamarisk (*Tamarix* spp.) was a significant vegetation component of all three pre-development conservation areas, primarily in the cottonwood-willow and mixed habitat types. At Planet Ranch, much of the tamarisk that was not adjacent to standing water was completely dead, whereas tamarisk near standing water was observed as defoliated at some point during the survey season.

Differences in diversity and abundance among plots within a pre-development conservation area were likely driven by differences in vegetation density, structure, and the presence of water. At Planet Ranch, P1914 had the highest species richness and abundance of territories and pairs. It also had standing water present within the plot throughout the survey season, relatively high vegetation density, and large variation in vegetation structure (from widely scattered shrubs to dense stands of trees). P1904 had the lowest species richness and abundance

Table 9.—Number of probable or confirmed breeding territories by plot for the 12 non-covered species detected at Three Fingers Lake, 2017*

(Number of territories is the sum of the percentages of all territories in the plot. The numbers in parentheses represent the total number of whole [100%] and partial [< 100%] territories in the plot.)

Habitat type	Plot ID	Number of territories (n)												
		ABTO	ATFL	BTGN	BLGR	COYE	CRTH	LBWO	LUWA	MAWR	SAPH	SOSP	YBCH	Total
Mixed	P2901	2 (2)	0	3 (3)	1 (1)	0	0	0	0	1 (1)	0	0	0	**7 (7)**
	P2903	3 (3)	4.5 (5)	2.5 (3)	2 (2)	22 (22)	2 (2)	1 (1)	6 (6)	6 (6)	0	10.5 (11)	15 (15)	**74.5 (76)**
	P2904	2 (2)	1 (1)	0	0	2 (2)	0	1 (1)	0	0	0	6.5 (7)	3 (3)	**15.5 (16)**
	P2910	3 (3)	1 (1)	0	0	3 (3)	0.75 (1)	0	0	0	0	4 (4)	1 (1)	**12.75 (13)**
	P2913	0.75 (1)	0	1 (1)	0	0	0	0	0	0	0	0	0	**1.75 (2)**
	P2914	1 (1)	0	1 (1)	0	0	0	0	0	0	0	0	0	**2 (2)**
	P2916	2 (2)	0	0	2 (2)	7 (7)	0	0	0	0	0	7 (7)	4 (4)	**22 (22)**
	P2918	1 (1)	1.75 (2)	2 (2)	2 (2)	5 (5)	2 (2)	1 (1)	0	0	0	4 (4)	6 (6)	**24.75 (25)**
	P2919	0.75 (1)	1 (1)	0.5 (1)	1 (1)	0	0.5 (1)	0	0	0	1 (1)	0	0	**4.75 (6)**
Area total		**15.5 (16)**	**9.25 (10)**	**10 (11)**	**8 (8)**	**39 (39)**	**5.25 (6)**	**3 (3)**	**6 (6)**	**7 (7)**	**1 (1)**	**32 (33)**	**29 (29)**	**165 (169)**

* ABTO = Abert's towhee, ATFL = ash-throated flycatcher, BTGN = black-tailed gnatcatcher, BLGR = blue grosbeak, COYE = common yellowthroat, CRTH = crissal thrasher, LBWO = ladder-backed woodpecker, LUWA = Lucy's warbler, MAWR = marsh wren, SAPH = Say's phoebe, SOSP = song sparrow, and YBCH = yellow-breasted chat.

Note: The scientific names of the species can be found in attachment 3, table 3-1.

Table 10.—Number of estimated pairs by plot for the 16 non-territorial species detected at Three Fingers Lake, 2017*

Habitat type	Plot ID	AMCO	BHCO	CLRA	COGA	GAQU	GRRO	GTGR	GRHE	KILL	LEBI	LENI	MODO	NRWS	RWBL	SORA	WWDO	Total
Mixed	P2901	1	1	0	0	2	0	0	0	0	1	2	2	0	0	0	3	**12**
	P2903	0	15	1	0	7	0	30	3	0	3	8	5	0	5	2	20	**99**
	P2904	0	7	2	1	2	0	0	0	1	0	5	2	0	0	0	2	**22**
	P2910	0	1	0	0	0	0	2	0	0	0	2	3	0	0	0	5	**13**
	P2913	0	0	0	0	3	1	0	0	0	0	2	2	0	0	0	4	**12**
	P2914	0	0	0	0	4	1	0	0	0	0	4	3	0	0	0	5	**17**
	P2916	0	5	0	2	10	0	1	0	1	3	3	4	0	7	0	10	**46**
	P2918	0	2	0	0	14	2	0	1	0	1	5	9	1	0	0	11	**46**
	P2919	0	0	0	0	3	0	0	0	0	0	1	1	0	0	0	5	**10**
Area total		**1**	**31**	**3**	**3**	**45**	**4**	**33**	**4**	**2**	**8**	**32**	**31**	**1**	**12**	**2**	**65**	**277**

* AMCO = American coot, BHCO = brown-headed cowbird, CLRA = Yuma clapper rail, COGA = common gallinule, GAQU = Gambel's quail, GRRO = greater roadrunner, GTGR = great-tailed grackle, GRHE = green heron, KILL = killdeer, LEBI = least bittern, LENI = lesser nighthawk, MODO = mourning dove, NRWS = northern rough-winged swallow, RWBL = red-winged blackbird, SORA = sora, and WWDO = white-winged dove.

Note: The scientific names of the species can be found in attachment 3, table 3-1.

of territories and pairs at Planet Ranch. It lacked surface water during the survey season, and vegetation within the plot consists of widely scattered mesquite trees, located primarily around the perimeter of the plot. At Three Fingers Lake, the three plots with the lowest species richness and abundance of territories and pairs (P2913, P2914, and P2919) were also the three plots that were not adjacent to standing water.

The data collection methods of using a tablet, Collector for ArcGIS, and ArcGIS Online were new for this project in 2017. A discussion of the benefits, drawbacks, and recommendations will be presented in the 2017 annual report of riparian bird surveys at LCR MSCP conservation areas.

LITERATURE CITED

Bart, J., L. Dunn, and A. Leist. 2010. A Sampling Plan for Riparian Birds of the Lower Colorado River—Final Report. U.S. Geological Survey Open-File Report 2010–1158. 20 p.

Bibby, C.J., N.D. Burgess, D.A. Hill, and S.H. Mustoe. 2000. Bird Census Techniques, 2nd ed. Academic Press, London.

Lower Colorado River Multi-Species Conservation Program. 2004. Lower Colorado River Multi-Species Conservation Program, Volume III: Biological Assessment, Final. December 17 (J&S 00450.00). Sacramento, California.

ACKNOWLEDGMENTS

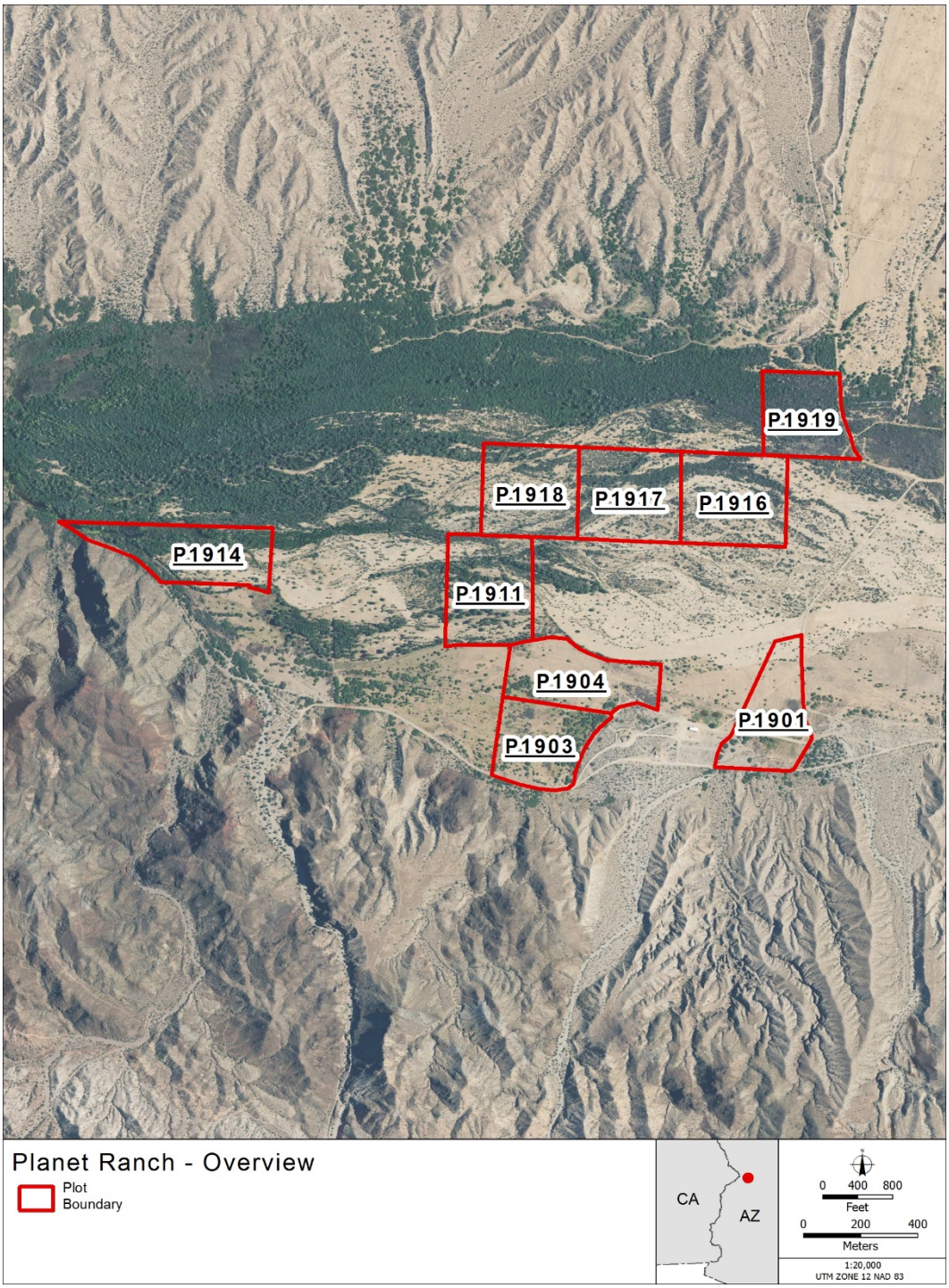
This project was made possible by the support of many persons, agencies, and SWCA's dedicated staff and field crew. Funding was provided by Reclamation, Boulder City, Nevada (Contract No. R17PC00026). Beth Sabin from Reclamation provided background information and guidance.

Many thanks to the following national wildlife refuges and personnel for all their assistance: Glenn Klingler and Dr. Kathleen Blair at the Lake Havasu National Wildlife Refuge Complex, and Brenda Zaun, Curt Kessler, Linda Miller, and Ryan Munes at the Southwestern Arizona National Wildlife Refuge Complex. Thanks to Richard Kim with the California Department of Fish and Wildlife and Jeremy Pennell with the Arizona Game and Fish Department.

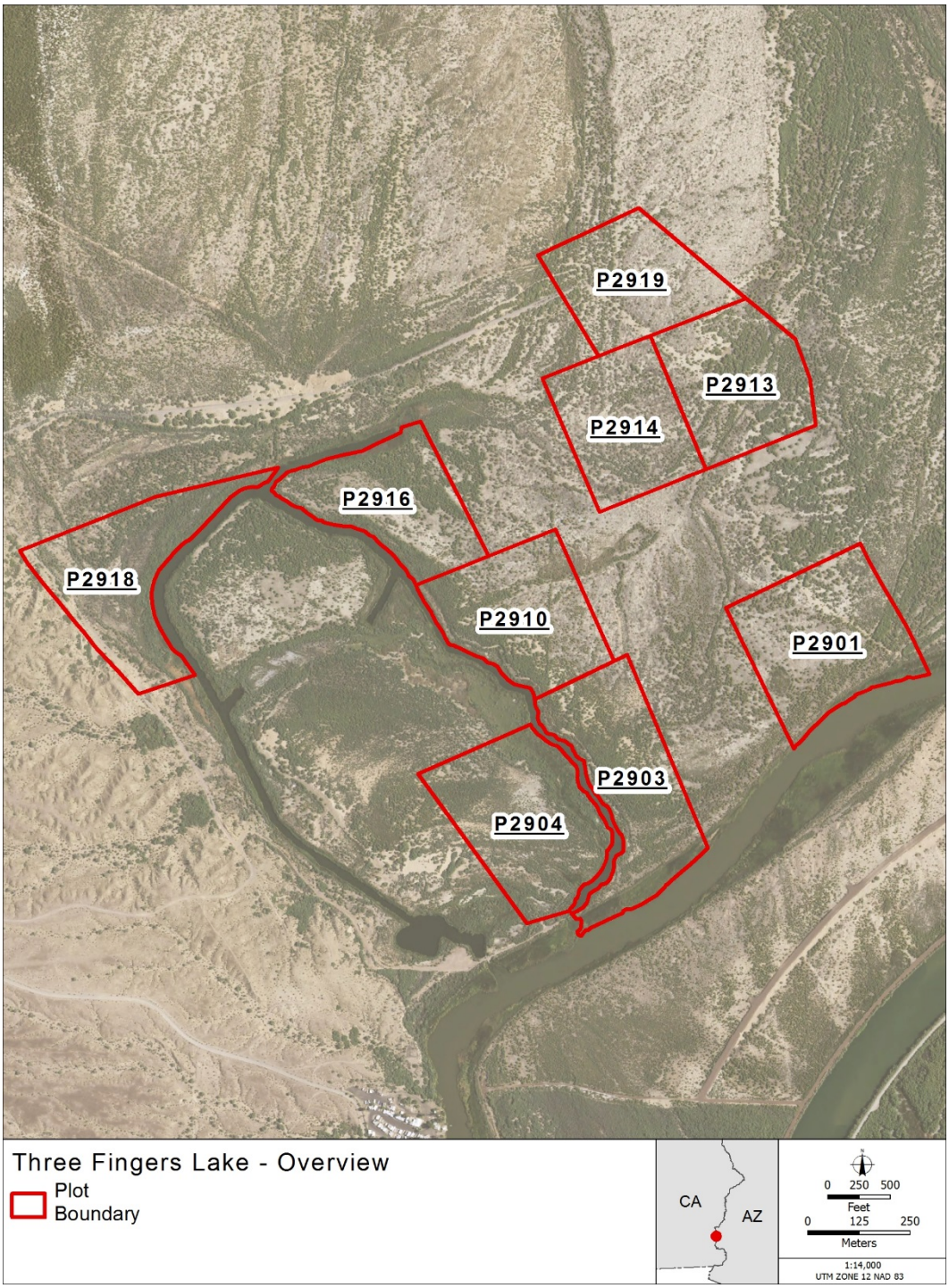
This project would not be a success without SWCA's dedicated staff and field personnel. Many thanks to Jacque Muehlbauer for going above and beyond her administrative duties to coordinate housing, vehicles, safety, and telecommunications. A very special thanks to Clay Donaldson and Glenn Dunno for their Geographic Information System talents. Thanks also to Paul Johnson for his accounting support. And sincere thanks to Amber Gillett, Corina Anderson, Evan Gunn, Garrett Moss, Jon Orona, Mike Swink, Tom Gleason, and Trevor Hinckley for their hard work, dedication, and sweat.

ATTACHMENT 1

Orthophotos Showing Boundaries of Selected Plots in Pre-Development Conservation Areas, 2017


P1919
P1918
P1917
P1916
P1914
P1911
P1904
P1903
P1901
Planet Ranch - Overview
Plot
Boundary
CA
AZ
0 400 800
Feet
0 200 400
Meters
1:20,000
UTM ZONE 12 NAD 83

P2302
P2301
PVER South - Overview
Plot
Boundary
CA
AZ
0 250 500
Feet
0 125 250
Meters
1:12,000
UTM ZONE 12 NAD 83


P2919
P2913
P2914
P2916
P2918
P2910
P2901
P2903
P2904
Three Fingers Lake - Overview
Plot
Boundary
CA
AZ
0 250 500
Feet
0 125 250
Meters
1:14,000
UTM ZONE 12 NAD 83

ATTACHMENT 2

Reference and Attribute Tables Used During Survey Season, 2017

Table 2-1.—Beaufort wind scale

Code	Wind speed (mph)[1]	Wind description	Conditions on land
0	< 1	Calm	Calm. Smoke rises vertically.
1	1–3	Light air	Smoke drift indicates wind direction. Leaves are stationary.
2	4–7	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8–12	Gentle breeze	Leaves and small twigs constantly moving.
4	13–18	Moderate breeze	Dust and loose paper raised. Small branches begin to move.
5	19–25	Fresh breeze	Branches of a moderate size move. Small trees with leaves begin to sway.
6	26–31	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Empty plastic bins tip over.
7	32–38	High wind	Whole trees in motion. Effort needed to walk against the wind.
8	39–46	Gale	Some twigs broken from trees. Progress on foot is seriously impeded.

[1] mph = miles per hour.

Table 2-2.—Sky conditions

Code	Sky conditions
0	Clear/few clouds
1	Partly cloudy variable
2	Cloudy/overcast
3	Fog
4	Drizzle
5	Showers

Table 2-3.—ArcGIS line attribute values, 2017

Code	Description
1	Seen flying
2	Same singing bird at two locations
3	Possible pair
4	Possibly same individual
5	Two separate singing birds
6	Counter-singing males
7	Suspect different individuals

Table 2-4.—Complex symbols used in ArcMap and associated behavior codes, 2017

Symbol[1,2]	Behavior code
X	Seen
	Singing
	Nest
	Territory Dispute
	Calling
	Calling Male
	Calling Female
	“Vocalizing Other” = vocalizing (not song) with likely territorial/reproductive significance
	“Vocalizing Other, Female” = female vocalizing (not song) with likely territorial/reproductive significance
	“Vocalizing Other, Male” = male vocalizing (not song) with likely territorial/reproductive significance
	Pair
	Carrying Nest Material
X	Female, Carrying Nest Material
X	Male, Carrying Nest Material
	Incubating Female

Table 2-4.—Complex symbols used in ArcMap and associated behavior codes, 2017

Symbol[1,2]	Behavior code
	Young Found in Nest
	Carrying Food
	Carrying Food, Female
	Carrying Food, Male
	Carrying Fecal Sac
	Dependent Young
	Copulation
	Squeal Duet
	Mate Guarding
	Agitation
	Independent Young

[1] Abert's Towhee (*Melozone aberti*) is used as an example species only. Each symbol is populated by the alpha code of the species selected in the detection location.

[2] Behavior codes with a red "X" next to them were added at the beginning of the field season and did not have an associated complex symbol in 2017.

Table 2-5.—Locally breeding species, 2017*

Common name	Scientific name
Abert's towhee	*Melozone aberti*
Anna's hummingbird	*Calypte anna*
Black phoebe	*Sayornis nigricans*
Black-tailed gnatcatcher	*Polioptila melanura*
Cactus wren	*Campylorhynchus brunneicapillus*
Canyon wren	*Catherpes mexicanus*
Crissal thrasher	*Toxostoma crissale*
Gila woodpecker	*Melanerpes uropygialis*
Gilded flicker	*Colaptes chrysoides*
Ladder-backed woodpecker	*Picoides scalaris*
Northern cardinal	*Cardinalis cardinalis*
Verdin	*Auriparus flaviceps*

* Table includes species known to breed along the lower Colorado River and tributaries, which are not known to migrate during the survey season. The table is limited to focal species and species detected during the 2017 survey season.

Table 2-6.—Breeding species potentially occurring as migrants during the survey season, 2017*

Common name	Scientific name
American robin	*Turdus migratorius*
Arizona Bell's vireo	*Vireo bellii arizonae*
Ash-throated flycatcher	*Myiarchus cinerascens*
Bewick's wren	*Thryomanes bewickii*
Black-chinned hummingbird	*Archilochus alexandri*
Black-throated sparrow	*Amphispiza bilineata*
Blue grosbeak	*Passerina caerulea*
Blue-gray gnatcatcher	*Polioptila caerulea*
Brown-crested flycatcher	*Myiarchus tyrannulus*
Bullock's oriole	*Icterus bullockii*
Common yellowthroat	*Geothlypis trichas*
Costa's hummingbird	*Calypte costae*
Elf owl	*Micrathene whitneyi*
Hooded oriole	*Icterus cucullatus*
Horned lark	*Eremophila alpestris*
House wren	*Troglodytes aedon*
Indigo bunting	*Passerina cyanea*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Lesser goldfinch	*Spinus psaltria*
Loggerhead shrike	*Lanius ludovicianus*
Lucy's warbler	*Oreothlypis luciae*
Marsh wren	*Cistothorus palustris*
Northern mockingbird	*Mimus polyglottos*
Phainopepla	*Phainopepla nitens*
Rock wren	*Salpinctes obsoletus*
Say's phoebe	*Sayornis saya*
Song sparrow	*Melospiza melodia*
Sonoran yellow warbler	*Dendroica petechia sonorana* = *Setophaga petechia sonorana*
Summer tanager	*Piranga rubra*
Vermilion flycatcher	*Pyrocephalus rubinus*
Western kingbird	*Tyrannus verticalis*
Yellow-billed cuckoo	*Coccyzus americanus occidentalis*
Yellow-breasted chat	*Icteria virens*

* Table includes species known to breed along the lower Colorado River or tributaries, which could migrate during some portion of the survey season. The table is limited to focal species and species detected during the 2017 survey season.

Table 2-7.—Non-territorial breeding species, 2017*

Common name	Scientific name
American coot	*Fulica americana*
American kestrel	*Falco sparverius*
Black-crowned night-heron	*Nycticorax*
Black-necked stilt	*Himantopus mexicanus*
Brown-headed cowbird	*Molothrus ater*
Common gallinule	*Gallinula galeata*
Common ground-dove	*Columbina passerina*
Common poorwill	*Phalaenoptilus nuttallii*
Common raven	*Corvus corax*
Double-crested cormorant	*Phalacrocorax auritus*
Eurasian collared-dove	*Streptopelia decaocto*
European starling	*Sturnus vulgaris*
Gadwall	*Anas strepera*
Gambel's quail	*Callipepla gambelii*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Great horned owl	*Bubo virginianus*
Greater roadrunner	*Geococcyx californianus*
Great-tailed grackle	*Quiscalus mexicanus*
Green heron	*Butorides virescens*
House finch	*Haemorhous mexicanus*
Killdeer	*Charadrius vociferus*
Least bittern	*Ixobrychus exilis*
Lesser nighthawk	*Chordeiles acutipennis*
Mourning dove	*Zenaida macroura*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Osprey	*Pandion haliaetus*
Pied-billed grebe	*Podilymbus podiceps*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Sora	*Porzana carolina*
Snowy egret	*Egretta thula*
Turkey vulture	*Cathartes aura*
Virginia rail	*Rallus limicola*
White-faced ibis	*Plegadis chihi*
White-winged dove	*Zenaida asiatica*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yuma clapper rail	*Rallus longirostris yumanensis (also known as Yuma Ridgway's rail = R. obsoletus yumanensis)*

* Table includes species whose breeding biology is not conducive to spot-mapping techniques. The table is limited to species detected during the 2017 survey season.

ATTACHMENT 3

Species Breeding in Pre-Development Conservation Areas, 2017

Table 3-1.—Species detected breeding in Planet Ranch, Palo Verde Ecological Reserve-South, and Three Fingers Lake, 2017

Common name	Scientific name	Planet Ranch	Palo Verde Ecological Reserve-South	Three Fingers Lake
Abert's towhee	*Melozone aberti*	X	X	X
American coot	*Fulica americana*	X		X
American kestrel	*Falco sparverius*		X	
Arizona Bell's vireo	*Vireo bellii arizonae*	X		
Ash-throated flycatcher	*Myiarchus cinerascens*	X	X	X
Bewick's wren	*Thryomanes bewickii*	X		
Black phoebe	*Sayornis nigricans*	X		
Black-tailed gnatcatcher	*Polioptila melanura*	X		X
Blue grosbeak	*Passerina caerulea*	X	X	X
Brown-crested flycatcher	*Myiarchus tyrannulus*	X		
Brown-headed cowbird	*Molothrus ater*	X	X	X
Common gallinule	*Gallinula galeata*	X		X
Common poorwill	*Phalaenoptilus nuttallii*	X		
Common raven	*Corvus corax*		X	
Common yellowthroat	*Geothlypis trichas*	X	X	X
Crissal thrasher	*Toxostoma crissale*	X	X	X
Double-crested cormorant	*Phalacrocorax auritus*	X		
Eurasian collared-dove	*Streptopelia decaocto*	X		
European starling	*Sturnus vulgaris*		X	
Gadwall	*Anas strepera*	X		
Gambel's quail	*Callipepela gambelii*	X	X	X
Gila woodpecker	*Melanerpes uropygialis*	X		
Great horned owl	*Bubo virginianus*	X	X	
Greater roadrunner	*Geococcyx californianus*	X	X	X
Great-tailed grackle	*Quiscalus mexicanus*		X	X
Green heron	*Butorides virescens*	X		X
Horned lark	*Eremophila alpestris*	X		
House finch	*Haemorhous mexicanus*	X	X	
Killdeer	*Charadrius vociferus*			X
Ladder-backed woodpecker	*Picoides scalaris*	X	X	X
Lesser nighthawk	*Chordeiles acutipennis*	X	X	X
Lucy's warbler	*Oreothlypis luciae*	X	X	X

Table 3-1.—Species detected breeding in Planet Ranch, Palo Verde Ecological Reserve-South, and Three Fingers Lake, 2017

Common name	Scientific name	Planet Ranch	Palo Verde Ecological Reserve-South	Three Fingers Lake
Marsh wren	*Cistothorus palustris*			X
Mourning dove	*Zenaida macroura*	X	X	X
Northern mockingbird	*Mimus polyglottos*	X	X	
Northern rough-winged swallow	*Stelgidopteryx serripennis*	X	X	X
Phainopepla	*Phainopepla nitens*	X		
Pied-billed grebe	*Podilymbus podiceps*	X		
Red-winged blackbird	*Agelaius phoeniceus*	X	X	X
Say's phoebe	*Sayornis saya*	X		X
Song sparrow	*Melospiza melodia*	X		X
Sonoran yellow warbler	*Dendroica petechia sonorana = Setophaga petechia sonorana*	X		
Sora	*Porzana carolina*			X
Turkey vulture	*Cathartes aura*	X		
Verdin	*Auriparus flaviceps*	X		
Vermilion flycatcher	*Pyrocephalus rubinus*	X		
Western kingbird	*Tyrannus verticalis*		X	
Western least bittern	*Ixobrychus exilis hesperis*	X		X
White-winged dove	*Zenaida asiatica*	X	X	X
Yellow-breasted chat	*Icteria virens*	X		X
Yuma clapper rail	*Rallus longirostris yumanensis (also known as Yuma Ridgway's rail = R. obsoletus yumanensis)*			X

ATTACHMENT 4

Orthophotos Showing Breeding Territories of Focal Species Detected in 2017: Arizona Bell's Vireo (*Vireo bellii arizonae*), Gila Woodpecker (*Melanerpes uropygialis*), Sonoran Yellow Warbler (*Dendroica petechia sonorana* = *Setophaga petechia sonorana*), and Vermilion Flycatcher (*Pyrocephalus rubinus*)

Figure 4-1.—Locations of Arizona Bell's vireo, Gila woodpecker, and Sonoran yellow warbler breeding territories in P1914 at Planet Ranch, 2017.
Point locations represent detections that met the criteria for a breeding territory but for which there were insufficient points to delineate the territory with a polygon.

Figure 4-2.—Locations of Arizona Bell's vireo and vermilion flycatcher breeding territories in P1911 at Planet Ranch, 2017.
Point locations represent detections that met the criteria for a breeding territory but for which there were insufficient points to delineate the territory with a polygon.

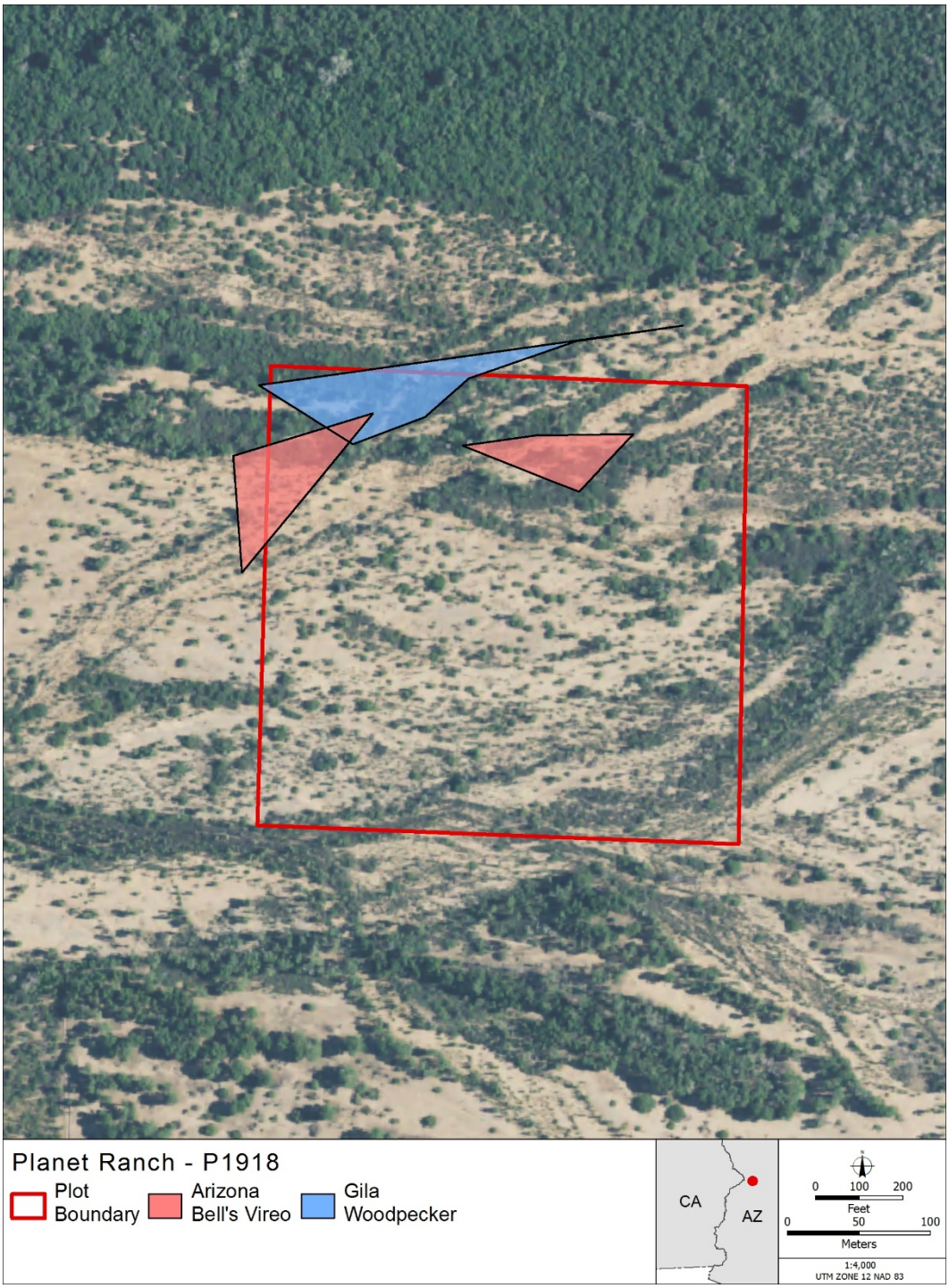


Figure 4-3.—Locations of Arizona Bell's vireo and Gila woodpecker breeding territories in P1918 at Planet Ranch, 2017.

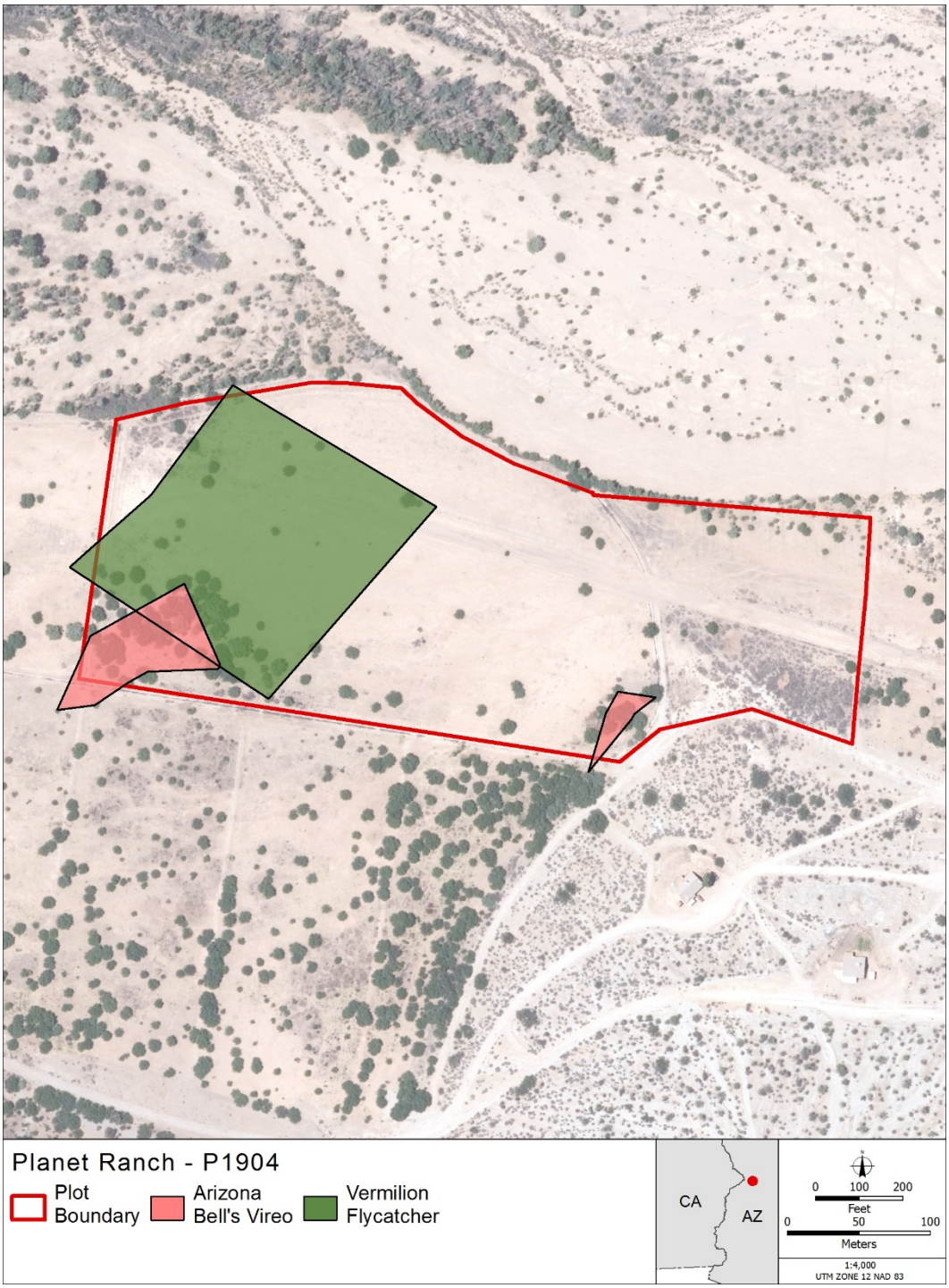


Figure 4-4.—Locations of Arizona Bell's vireo and vermilion flycatcher breeding territories in P1904 at Planet Ranch, 2017.

Figure 4-5.—Locations of Arizona Bell's vireo breeding territories in P1903 at Planet Ranch, 2017.

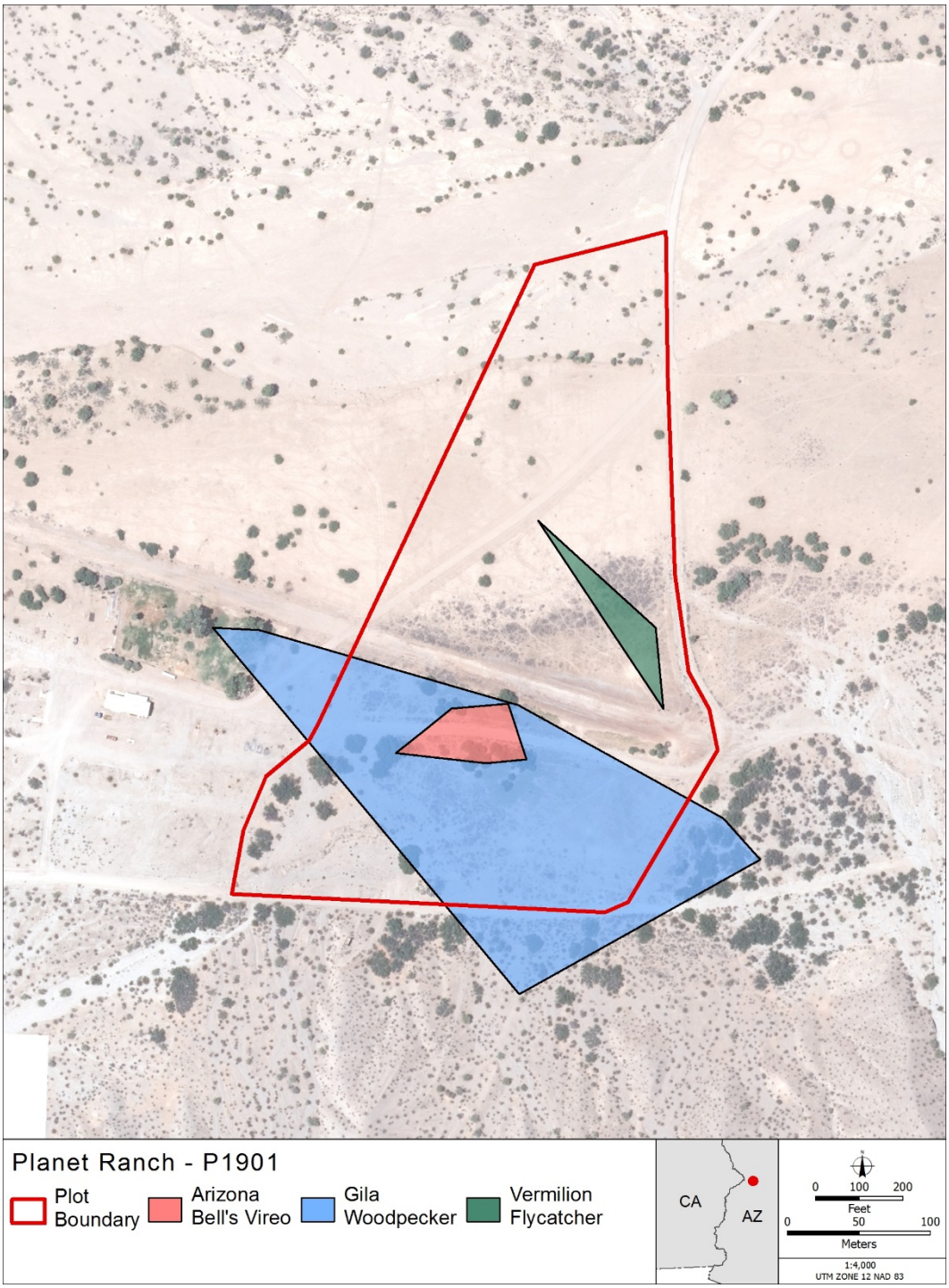


Figure 4-6.—Locations of Arizona Bell's vireo, Gila woodpecker, and vermilion flycatcher breeding territories in P1901 at Planet Ranch, 2017.