



Avian Surveys and Nest Monitoring on Clark County Multiple Species Habitat Conservation Plan Properties 2022 Final Project Report

SEPTEMBER 2022

PREPARED FOR

**Desert Conservation Program
Clark County Department of
Environment and Sustainability**

PREPARED BY

SWCA Environmental Consultants

**AVIAN SURVEYS AND NEST MONITORING ON CLARK
COUNTY MULTIPLE SPECIES HABITAT CONSERVATION
PLAN PROPERTIES
FINAL PROJECT REPORT**

Prepared for

Desert Conservation Program
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EXECUTIVE SUMMARY

In 2022, SWCA Environmental Consultants (SWCA) conducted avian surveys across all properties managed by the Clark County Desert Conservation Program (County); these properties include the Riparian Reserve Units and the Boulder City Conservation Easement (BCCE). Surveys were conducted to build on the baseline dataset of avian species presence and distribution at the County's properties. These baseline data can be compared with future data to quantify the success of management and restoration efforts at the County's properties. Surveys consisted of three rounds of breeding bird point-count surveys at the Riparian Reserve Units and at the BCCE and species-specific surveys for southwestern willow flycatcher (*Empidonax traillii extimus*) and yellow-billed cuckoo (*Coccyzus americanus*) at the Riparian Reserve Units. In addition, SWCA continued intensive southwestern willow flycatcher monitoring at Mesquite West (a historic southwestern willow flycatcher breeding site that includes County Parcel 1-A) and Mormon Mesa Parcel 5-A and brown-headed cowbird (*Molothrus ater*) control at Mesquite West in 2022.

Surveys conducted in 2022 were completed between May 2 and August 9. During point-count surveys, surveyors detected five of the eight bird species covered by the Clark County Multiple Species Habitat Conservation Plan (MSHCP): Arizona Bell's vireo (*Vireo bellii arizonae*), blue grosbeak (*Passerina caerulea*), phainopepla (*Phainopepla nitens*), southwestern willow flycatcher, and summer tanager (*Piranga rubra*). In addition, two of the other bird species covered by the MSHCP were detected incidentally: a yellow-billed cuckoo was detected during southwestern willow flycatcher monitoring activities, and an American peregrine falcon (*Falco peregrinus anatum*) was detected during southwestern willow flycatcher surveys. The surveys also yielded three evaluation species: loggerhead shrike (*Lanius ludovicianus*), crissal thrasher (*Toxostoma crissale*), and LeConte's thrasher (*Toxostoma lecontei*). In total, 77 avian species were recorded across all the County's properties in 2022, and MSHCP-covered and evaluation species were observed at each property.

Southwestern willow flycatcher monitoring was conducted between May 15 and August 15, 2022, to determine residency of willow flycatchers (*E. traillii*), find and monitor southwestern willow flycatcher nests, and band adult and nestling southwestern willow flycatchers. The monitoring program was also important in assessing the effects of brown-headed cowbird control on southwestern willow flycatcher nest success at Mesquite West. In total, 28 adult willow flycatchers were detected at Mesquite West, Bunkerville East Parcel 2-D, Muddy River, and Mormon Mesa Parcel 5-A. The three willow flycatchers detected at Muddy River or Bunkerville East Parcel 2-D were detected only during the first round of surveys and were believed to be spring migrants passing through the Riparian Reserve Units. The remaining 25 individuals at Mesquite West and Mormon Mesa 5-A comprised seven pairs, five unpaired males, and eight individuals for which residency or breeding status, or both, could not be determined. Eleven confirmed nesting attempts were documented; seven of these attempts were successful. Seven adult and 16 nestling southwestern willow flycatchers were newly banded in 2022; three adults banded in a previous years were recaptured. Of the 16 nestlings banded at Mesquite West, 13 were confirmed to have fledged.

SWCA conducted brown-headed cowbird control at Mesquite West from May 11 through July 27, 2022. SWCA biologists performed targeted mist-netting of adult and fledgling brown-headed cowbirds over 17 mornings, totaling 22.1 net-hours. Male brown-headed cowbirds were released, and females and juveniles were euthanized. In total, 28 adult brown-headed cowbirds (1.3 adults/net-hour) were captured, of which 17 were male. Eleven brown-headed cowbird females and one juvenile were euthanized. One brown-headed cowbird egg was added, one was replaced with a fake egg, and one brown-headed cowbird nestling was removed from a flycatcher nest in 2022.

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1 INTRODUCTION

The Clark County Desert Conservation Program (County) manages compliance with the Endangered Species Act (ESA) through the Clark County Multiple Species Habitat Conservation Plan (MSHCP) (Clark County Department of Comprehensive Planning (CCDCP) and U.S. Fish and Wildlife Service [USFWS] 2000). This is accomplished, in part, through the management of a reserve system, which includes Riparian Reserve Units and the Boulder City Conservation Easement (BCCE). The MSHCP covers eight bird species, six of which are known to occur primarily in desert riparian habitats: Arizona Bell's vireo (*Vireo bellii arizonae*), blue grosbeak (*Passerina caerulea*), southwestern willow flycatcher (*Empidonax traillii extimus*), summer tanager (*Piranga rubra*), vermilion flycatcher (*Pyrocephalus rubinus*), and yellow-billed cuckoo (*Coccyzus americanus*). The other two MSHCP-covered bird species can occur either in or away from desert riparian habitats: phainopepla (*Phainopepla nitens*) is typically found in desert washes with mesquite (*Prosopis* spp.) or catclaw acacia (*Senegalia greggii*), and American peregrine falcon (*Falco peregrinus anatum*) can be found in almost any type of habitat but prefers to nest on cliff faces (CCDCP and USFWS 2000). Two of the eight covered bird species are also protected under the ESA—southwestern willow flycatcher, listed as endangered (USFWS 1995), and yellow-billed cuckoo, listed as threatened (USFWS 2014). In addition to the eight covered species, several evaluation species can be found in a variety of desert habitats, including upland habitats, which compose most of the BCCE.

The extent and quality of desert habitat across the Southwest, particularly desert riparian habitat, have been steadily diminishing for decades, threatened by urban and agricultural development, invasion of non-native species such as tamarisk (*Tamarix* spp.), fire, and the reduction of water tables through unsustainable water use (Clark County 2015). Because quality avian habitats, particularly riparian habitat, are scarce within arid environments, management of these areas, and conservation of the MSHCP-covered avian species that inhabit them, are essential to these species' survival.

1.1 Description of the Project

In 2019, the County solicited proposals to conduct continued avian surveys on its Riparian Reserve Units (Figure 1) and on the BCCE (Figure 2). The County contracted SWCA Environmental Consultants (SWCA) to conduct presence/absence surveys for both southwestern willow flycatcher and yellow-billed cuckoo across the Riparian Reserve Units (Muddy River, Virgin River Subunit 1 [Mesquite], Virgin River Subunit 2 [Bunkerville], Virgin River Subunit 3 [Riverside], and Virgin River Subunit 5 [Mormon Mesa]) (see Figure 1), as well as to conduct avian point counts at 47 locations across the Riparian Reserve Units and the BCCE. In 2020 and 2021, SWCA continued these surveys at all the properties surveyed in 2019 and at an additional property that the County purchased in early 2020 (Bunkerville Parcels 2-K, 2-L, and 2-M). In 2022, surveys were also conducted at an additional property that the county purchased in late 2021 known as Virgin River Subunit 6 (Mormon Mesa South) Parcels 6-A and 6-B. The resulting data build on baseline presence/absence and relative abundance data for all bird species on these properties, including any MSHCP-covered and evaluation avian species. Data collected during these surveys can be used to inform and evaluate the success of restoration efforts and land management decisions for these properties. Additionally, in 2021, SWCA was contracted by the County to perform southwestern willow flycatcher territory and nest monitoring at Mesquite West, which consists of Mesquite Parcel 1-A and adjacent habitat to the west (referred to as Mesquite West West), and at Mormon Mesa Parcel 5-A. Furthermore, in 2021, SWCA implemented a target-netting program for brown-headed cowbirds (*Molothrus ater*) at Mesquite West to evaluate the potential of target netting in reducing the negative effects of brood parasitism on southwestern willow flycatcher nest success. These programs were both continued in 2022.

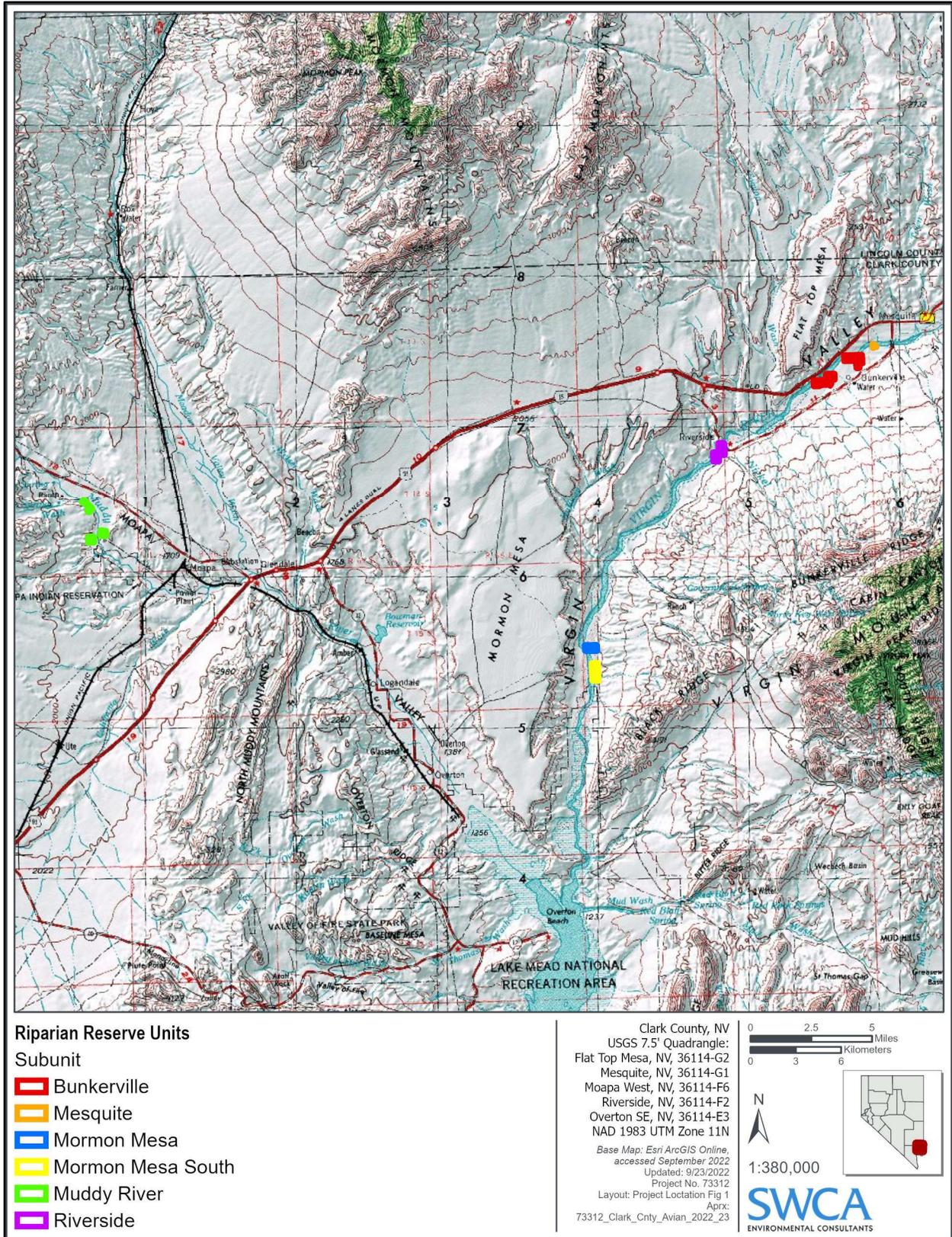


Figure 1. Riparian Reserve Unit locations.

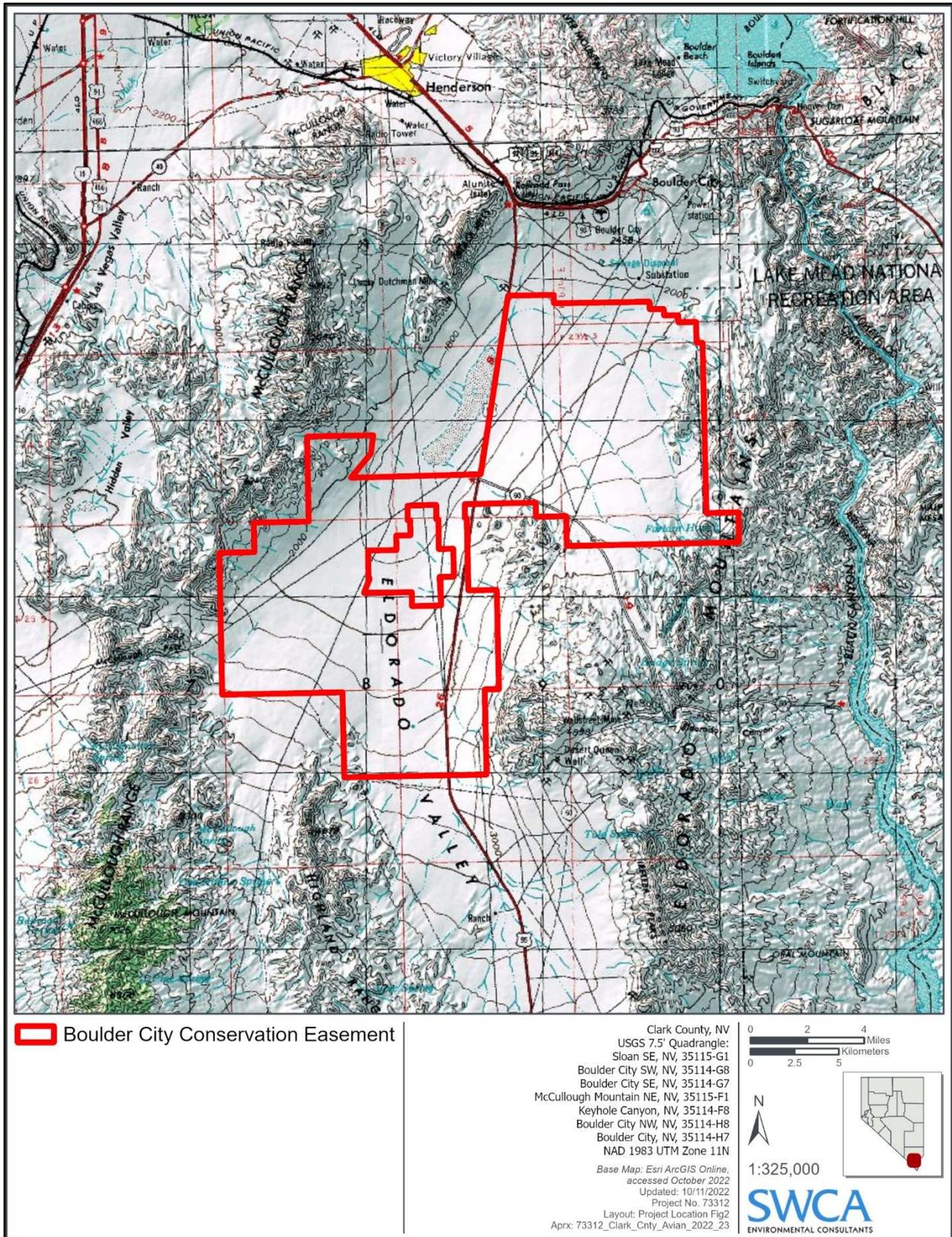


Figure 2. BCCE location.

1.2 Background and Need

On November 19, 2000, the USFWS issued the Intra-Service Biological and Conference Opinion on Issuance of an Incidental Take Permit to Clark County, Nevada, for an MSHCP (Biological and Conference Opinion) (USFWS 2000). Then, on March 28, 2001, the USFWS issued an amended incidental take permit for the Clark County MSHCP (USFWS 2001).

1.2.1 Riparian Reserve Units

According to both the Biological and Conference Opinion and Condition K.1 of the associated incidental take permit, the County must acquire private property that contains desert riparian habitat along the Virgin River, Muddy River, and Meadow Valley Wash in Clark County. It was recognized that proper management of desert riparian habitats would be crucial in conserving the six bird species covered by the MSHCP (including the two federally listed species) that are known to use this habitat. To date, the County has acquired approximately 318 hectares (ha) (785 acres) of land along the Muddy and Virgin Rivers in northeastern Clark County, Nevada.

Prior to 2017, the County acquired 116 ha (286 acres) along the Muddy and Virgin Rivers. SWCA began conducting avian surveys at these parcels in 2017 to establish a baseline dataset of avian species presence and distribution under two separate projects: 1) Federally Listed Bird Surveys on Riparian Properties (SWCA 2017a) and 2) Point-count Surveys on Riparian Properties (SWCA 2017b). In late 2017, the County acquired an additional 130 ha (320 acres) along the Virgin River. Point-count surveys and species-specific surveys for federally listed species were conducted at these newly acquired properties under one project in 2018 (SWCA 2018a). In 2019, avian surveys at all the County's properties were combined into one project (SWCA 2019a). Point-count surveys and species-specific surveys for federally listed species were conducted at all the County's riparian properties through 2021, including at the newly acquired Parcels 2-K, 2-L, and 2-M (24 ha [59 acres]) (SWCA 2020). In 2021, the County acquired an additional 48 ha (119 acres) along the Virgin River comprising Parcels 6-A and 6-B. Surveys were initiated at these parcels and continued at all other County properties in 2022, and those surveys are described herein.

1.2.1.1 FEDERALLY LISTED BIRD SURVEYS

1.2.1.1.1 Species Background

Southwestern Willow Flycatcher

Southwestern willow flycatcher is one of four subspecies of willow flycatcher (*E. traillii*) (Unitt 1987). Throughout this report, the term “willow flycatcher” is used for individuals for which the subspecies could not be confirmed. Southwestern willow flycatcher breeds in dense, mesic riparian habitats at scattered, isolated sites in New Mexico, Arizona, southern California, southern Nevada, southern Utah, southwestern Colorado, and, at least historically, extreme northwestern Mexico and western Texas (Unitt 1987). Factors contributing to the decline of southwestern willow flycatchers on their breeding grounds include loss, degradation, and/or fragmentation of riparian habitat; invasion of riparian habitat by non-native plants; and brood parasitism by brown-headed cowbirds. One of the last long-distance neotropical migrants to arrive in North America in spring, southwestern willow flycatchers typically arrive in May or June and depart in August (Sogge et al. 2010).

Southwestern willow flycatchers nest in a variety of habitats, but common characteristics of southwestern willow flycatcher breeding habitat include dense tree or shrub cover ≥ 3 meters (m) (9.8 feet) in height, vegetation with dense twig structure and high canopy closure, and proximity to surface water or saturated

soil (McLeod and Pellegrini 2013; Sogge et al. 2010). Southwestern willow flycatchers nest in habitat patches ranging in size from 0.8 ha (2.0 acres) to several hundred hectares but are rarely found in narrow strips of habitat less than 10 m (32.8 feet) wide (Sogge et al. 2010). During the nesting season, southwestern willow flycatchers occupy home ranges averaging less than 0.5 ha (1.2 acres) in size (Cardinal 2005). Willow flycatchers are generally monogamous, but polygyny has been documented (Ehrlich et al. 1988), particularly in the southwestern subspecies (SWCA 2019a, 2019b, 2020, 2021). Migrant willow flycatchers are found in both spring and fall in a variety of habitats that are unsuitable for breeding. These migration stopover habitats, though not necessarily used for breeding, are likely important for both reproduction and survival. Designated critical habitat for the southwestern willow flycatcher includes riparian habitats along the Virgin River from Berry Springs, Utah, downstream to the full pool level of Lake Mead (USFWS 2013a) and includes all five subunits of the Virgin River Riparian Reserve Unit.

Western Yellow-billed Cuckoo

The yellow-billed cuckoo was historically widespread and locally common along rivers throughout the western United States (USFWS 2013b). However, populations have declined across the West in recent years, largely as a result of loss, degradation, and fragmentation of riparian habitat. Consequently, the western distinct population segment was listed as threatened under the ESA in October 2014 (USFWS 2014). Critical habitat for the western yellow-billed cuckoo was designated in 2021, but no critical habitat units were designated within the state of Nevada (USFWS 2021).

Yellow-billed cuckoos are late neotropical migrants, arriving on their breeding grounds around mid-June and departing by mid-September. Yellow-billed cuckoo home ranges are generally at least 40 ha (100 acres) in size and often exceed 80 ha (200 acres), though home ranges as small as 1 ha (2.5 acres) have been documented (USFWS 2020). These patches are typically at least 100 m (328 feet) wide (USFWS 2020). Yellow-billed cuckoos have not been found nesting in isolated patches less than 1 ha (2.5 acres) in size or in linear habitats less than 10 to 20 m (33 to 66 feet) wide, but they may use these habitats during migration and early in the breeding season (Halterman et al. 2016). Breeding habitat typically includes multi-storied riparian woodlands dominated by willow (*Salix* spp.) or cottonwood (*Populus* spp.) (USFWS 2020). Breeding habitat is typically adjacent to watercourses with less than 3 percent slopes. Yellow-billed cuckoos are known to nest in dense early successional riparian habitats (Wohner et al. 2020). A study of nest placement in Arizona and California found that nests were placed between 1 and 22 m (3.3 and 72.2 feet) above ground, with an average height of 7 m (23 feet) (Hughes 2020). Wohner et al. (2020) found nest height ranged from 2 to 4 m (6.6 to 13.1 feet) across two studies and averaged 4.8 m (15.7) at another study. Yellow-billed cuckoos tend to be serially monogamous, but serial polyandry has been regularly documented in western populations.

1.2.1.1.2 Survey Background

By 2019, the County had outlined 53.5 ha (132.2 acres) within the Riparian Reserve Units that were targeted for southwestern willow flycatcher and yellow-billed cuckoo surveys. Habitat suitability and the need for species-specific surveys were assessed during a site reconnaissance. Any portions of the 53.5 ha (132.2 acres) identified in the County's solicitation that were devoid of woody vegetation \geq 3 m (9.8 feet) in height (as a result of scouring, restoration activities, etc.) were not surveyed. These areas were described (e.g., species, height, and percent cover of the dominant vegetation), photographed, delineated in the field, and then delineated in ArcGIS. Of the 53.5 ha (132.2 acres) originally estimated for survey by the County, SWCA delineated 47.9 ha (118.4 acres) in 2019 as potential habitat to be surveyed for both species across all subunits; these areas were resurveyed in 2020, although some minor changes were made to the survey area.

During yellow-billed cuckoo surveys in 2019, a cuckoo was detected in a screwbean mesquite (*Prosopis pubescens*)–dominated bosque outside the delineated survey area within Mormon Mesa Parcel 5-A. To better document cuckoo habitat use within this portion of the parcel, SWCA added this 5.1 ha (12.7 acres) of mesquite bosque to the Mormon Mesa 5-A yellow-billed cuckoo survey area in 2020.

In early 2020, the County acquired three new parcels (2-K, 2-L, and 2-M) within the Bunkerville Subunit, totaling an additional 23.9 ha (59.0 acres). SWCA delineated 2.6 ha (6.4 acres) of riparian habitat within Parcels 2-L and 2-M (no habitat was identified in Parcel 2-K) to be surveyed for southwestern willow flycatchers and yellow-billed cuckoos, and this area was surveyed in 2020. Then in late 2020, the County masticated 14.6 ha (36 acres) of dead and dying tamarisk at Mormon Mesa Parcel 5-A. This area of masticated tamarisk were not surveyed for southwestern willow flycatcher or yellow-billed cuckoo in 2021. An additional 16.7 ha (41.3 acres) of tamarisk was masticated in early 2021, and this area was not surveyed in 2021 or 2022. In late 2021, the County acquired two additional parcels (6-A and 6-B) that constitute the Mormon Mesa South Subunit, totaling an additional 48.2 ha (119.1 acres). SWCA delineated 14.3 ha (35.4 acres) along the eastern boundaries of the parcels to be surveyed for southwestern willow flycatchers and yellow-billed cuckoos, and this area was surveyed in 2022. During the first round of southwestern willow flycatcher surveys at Bunkerville 2-I and 2-J in May 2022, the habitat in one previously surveyed portion of 2-I was deemed insufficient for southwestern willow flycatcher and yellow-billed cuckoo surveys due to defoliated tamarisk and lack of any continuous canopy. This 1.6-ha (4.0-acre) area was not surveyed in 2022.

Southwestern willow flycatcher monitoring data collected at Mesquite West from 2003 through 2013 show that southwestern willow flycatcher nest and territory locations varied from year to year, according to the distribution of suitable habitat within the Mesquite West study site, and sometimes were outside the County’s Parcel 1-A. Furthermore, monitoring at Parcel 1-A in 2020 resulted in detections of singing male willow flycatchers well west of the County’s Parcel 1-A boundary. Therefore, it was determined that southwestern willow flycatcher surveys across the entire Mesquite West site were important for detecting between-year habitat changes and southwestern willow flycatcher movements, as well as for assessing the effects of brown-headed cowbird control on the breeding success of southwestern willow flycatchers across all occupied habitat at Mesquite West. To accomplish these goals, 11.4 ha (28.1 acres) of additional habitat within Mesquite West, generally west of the County’s Parcel 1-A, was added to the southwestern willow flycatcher survey area in 2021. SWCA continued surveys in this area in 2022.

1.2.1.2 SOUTHWESTERN WILLOW FLYCATCHER MONITORING

SWCA has been conducting surveys and monitoring for southwestern willow flycatcher in southern Nevada since 2003, and SWCA has documented southwestern willow flycatcher nesting in Mesquite West (which includes the County’s Parcel 1-A) for decades. Surveys conducted for the County from 2017 through 2021 documented occupancy of Mesquite West by southwestern willow flycatcher throughout those years. Over the course of this work, SWCA has also documented consistently high rates of parasitism of southwestern willow flycatcher nests by brown-headed cowbirds.

From 2013 through 2019, the Mesquite study area (which encompasses several sites, including Mesquite West) consistently yielded one of the lowest average productivity rates (0.45 fledgling/nest) of all the southwestern willow flycatcher study areas in southern Nevada (SWCA 2019b). Productivity at all southern Nevada sites monitored in 2019 ranged from 0 to 2.5 fledglings/nest, with an overall average of 1.43 fledglings/nest (SWCA 2019b)—over three times greater than at Mesquite West. More recently, all nests at Mesquite West failed in 2020, and productivity in 2021 was 0.5 fledgling/nest (SWCA 2020, 2021).

SWCA and the County determined that continued monitoring of southwestern willow flycatcher territories and nests would be an essential component in determining whether brown-headed cowbird control had an impact on the nesting success of the southwestern willow flycatchers at Mesquite West (Bureau of Reclamation 2004). SWCA contracted with the County to conduct territory and nest monitoring of southwestern willow flycatchers at Mesquite West in 2021. Additionally, SWCA monitored southwestern willow flycatchers at Mormon Mesa Parcel 5-A in 2021, following successful breeding within that parcel in 2020. Territory and nest monitoring continued at Mesquite West and Mormon Mesa Parcel 5-A in 2022.

1.2.1.3 BROWN-HEADED COWBIRD CONTROL

It is believed that parasitism has significantly contributed to the nest failures and low productivity at Mesquite West (SWCA 2019b). As part of a previous project with the Bureau of Reclamation, SWCA trapped brown-headed cowbirds across the Mesquite study area from 2003 through 2007 (McLeod and Pellegrini 2013). Despite substantial trapping efforts, the percentage of successful nests did not significantly improve during or following trapping (pre-trapping: 48%; trapping: 49%; post-trapping: 36%).

Starting in 2010, SWCA began addling brown-headed cowbird eggs on southwestern willow flycatcher projects for the Bureau of Reclamation and the Nevada Department of Wildlife (NDOW). After addling began, the proportion of brown-headed cowbird eggs that hatched dropped from 74% (2003–2009) to 11% (2010–2012) (McLeod and Pellegrini 2013). Nest productivity did not increase significantly as a result of cowbird egg addling, possibly because high depredation rates obscured any benefits of egg addling. However, data collected in earlier years showed that nests with unhatched brown-headed cowbird eggs produced more southwestern willow flycatcher fledglings, on average, than nests with brown-headed cowbird nestlings; therefore, McLeod and Pellegrini (2013) recommended that addling continue to be used as a brown-headed cowbird control method in the Lower Colorado River watershed.

Southwestern willow flycatcher nests in the Mesquite study area had high (51%) nest parasitism rates from 2015 through 2021 (SWCA 2019b, 2020, 2021). Rothstein et al. (2003) recommended implementing a brown-headed cowbird control program when parasitism rates reach 20%–30% for a threatened or endangered host or 50% for non-protected host species. Although trapping or addling alone did not prove beneficial to southwestern willow flycatcher nest success or productivity across Mesquite West, several avian studies have shown an increase in nest success when different means of cowbird control were combined, such as shooting adult brown-headed cowbirds, addling cowbird eggs, and removing nestling cowbirds (Kostecke et al. 2005; Whitfield et al. 1999).

To reduce high levels of nest parasitism by brown-headed cowbirds on southwestern willow flycatchers, SWCA proposed a combined-method brown-headed cowbird control program at Mesquite West for 2021, which included brown-headed cowbird egg addling, nestling euthanasia, and target netting. This combined-method brown-headed cowbird control program was continued in 2022.

1.2.1.4 POINT-COUNT SURVEYS

In 2017, SWCA began conducting breeding bird point-count surveys for the County at 51 locations across the Riparian Reserve Units (SWCA 2017b). In 2018 and 2019, SWCA continued breeding bird point-count surveys at all or a subset of these locations as part of the comprehensive bird survey effort across all the County's properties (SWCA 2018a, 2019b). Four point-count locations were added with the acquisition of Bunkerville West Parcels 2-L and 2-M in 2020 (SWCA 2020), and four more point-count locations were added at Mormon Mesa South Parcels 6-A and 6-B at the beginning of surveys in 2022.

1.2.2 Boulder City Conservation Easement

In addition to the acquisition of riparian properties, implementation of the MSHCP required the establishment of a conservation easement in the Eldorado Valley. This easement, known as the BCCE, was established in July 1995 through an agreement between Clark County and Boulder City. Then, in early 2020, the County completed a land exchange for certain portions of the BCCE, resulting in a net increase of 325 ha (803 acres) within the BCCE.

According to both the Biological and Conference Opinion (USFWS 2000) and Condition P of the associated incidental take permit (USFWS 2001), the County is required to take measures necessary to ensure maintenance of connectivity for Mojave desert tortoise (*Gopherus agassizii*) and other covered species within the BCCE. While the BCCE is primarily managed for protection of the desert tortoise, it was recognized that proper management of desert tortoise habitat could also be beneficial for protecting habitat for other species covered by the MSHCP, including avian species (Clark County 2019).

1.2.2.1 POINT-COUNT SURVEYS

In 2018, SWCA began conducting breeding bird point-count surveys for the County at 40 locations across the BCCE (SWCA 2018b). From 2019 through 2021, SWCA continued breeding bird point-count surveys at a subset of these locations as part of the comprehensive bird survey effort across all the County's properties (SWCA 2019a, 2020, 2021).

1.3 Management Actions, Goals, and Objectives

The County's Riparian Reserve Unit Management Plan (Clark County 2015) identifies goals and objectives that help guide management directives on the Riparian Reserve Units. The first goal listed in this plan is to "manage reserve units to provide habitat for the six MSHCP covered bird species" (Clark County 2015:35) that use desert riparian habitat. The objective identified to reach this goal is to "restore, create, and enhance habitat for riparian bird species" (Clark County 2015:35). In addition, the BCCE Management Plan (Clark County 2019) identifies goals and objectives that help guide management directives within the BCCE. The second goal listed in the BCCE Management Plan is to "protect and manage the BCCE for other MSHCP covered species" (Clark County 2019:78).

Managing species covered under the MSHCP and their habitats requires an in-depth understanding of baseline conditions within a given management unit. Collecting species abundance and distribution data is a critical first step in monitoring of and conservation management efforts for the MSHCP-covered bird species found in Clark County. The short-term objectives for this project are 1) to continue building a record of federally listed and non-listed bird species present at the County's reserve system properties and 2) to assess the effect of brown-headed cowbird control on nesting southwestern willow flycatchers. The long-term goals are to 1) track changes in the presence and relative abundance of all bird species that use these properties to measure the success of management and restoration efforts conducted therein and 2) improve nest success of southwestern willow flycatchers at Mesquite West via brown-headed cowbird control.

2 METHODS

Surveys and monitoring for federally listed birds were conducted by biologists authorized under a USFWS 10(a)1(A) permit (No. ESPER0009523) and an NDOW permit (No. 495754). Bird banding was performed under a federal bird banding permit (No. 23258). Brown-headed cowbird control activities were conducted by personnel authorized under a USFWS 10(a)1(A) permit (No. ESPER0009523), a

USFWS Migratory Bird Scientific Collecting Permit (No. MBPER0038972), and an NDOW permit (No. 495754).

2.1 Federally Listed Bird Surveys

Multiple broadcast surveys for southwestern willow flycatcher conducted throughout the breeding season were used to assess the presence of the southwestern subspecies of willow flycatcher. Southwestern willow flycatcher surveys followed the standard five-survey protocol described in Sogge et al. (2010), which calls for one survey between May 15 and 31, two surveys between June 1 and 24, and two additional surveys between June 25 and July 17. The surveys were separated by a minimum of 5 days. To elicit responses from nearby southwestern willow flycatchers, surveyors stopped approximately every 30 m (98 feet) and broadcast 10 to 15 seconds of the willow flycatcher's primary song (*fitz-bew*) and call (*breet*). Surveyors watched for willow flycatchers and listened for vocal responses for 1 minute before proceeding to the next survey station. If an unidentified *Empidonax* flycatcher was observed but did not respond with song to the initial broadcast, other conspecific vocalizations were broadcast, including *creets/breets*, *wee-oos*, *whitts*, *churr/kitters*, and a set of interaction calls given by a mated pair of flycatchers (in accordance with Lynn et al. 2003). These calls are frequently effective in eliciting a *fitz-bew* song, thereby enabling surveyors to positively identify willow flycatchers.

Cuckoos vocalize infrequently, have a short breeding cycle, and typically occupy home ranges varying from 40 to 80 ha (100 to 200 acres) in size (USFWS 2020). These factors make it difficult to use survey results to determine the number of cuckoo territories at a site. However, repeated broadcast surveys allow an assessment of the presence or absence of cuckoos, and survey results can be used to estimate the number of possible and probable breeding territories (Halterman et al. 2016).

Yellow-billed cuckoo surveys followed the standard four-survey protocol described by Halterman et al. (2016). One survey was completed between June 15 and 30, two surveys were completed between July 1 and 31, and one survey was completed between August 1 and 15. Surveys were separated by 12–15 days. Surveyors stopped every 100 m (328 feet) and listened for 1 minute for spontaneously calling yellow-billed cuckoos, then broadcast five series of cuckoo contact calls (*kuk/kowlp*) at 1-minute intervals. Surveyors listened and watched for cuckoo responses between each set of broadcast calls; the total time spent at each survey point was approximately 6 minutes.

If willow flycatchers or yellow-billed cuckoos were detected, the observer recorded the location of the bird, the type of detection, and any other pertinent notes. The surveyor then proceeded at least 40 m (131 feet) beyond any detected willow flycatcher and 300 m (984 feet) beyond a cuckoo before resuming the survey to avoid double-counting individuals. All surveys commenced at or after first light, when it was light enough for observers to walk safely. And surveys should be concluded by 10:30 a.m. Pacific Daylight Time (PDT) for southwestern willow flycatcher (Sogge et al. 2010) and by 11:00 a.m. PDT or when the temperature reached 40° Celsius for yellow-billed cuckoo (Halterman et al. 2016). No surveys were conducted if winds exceeded 3 on the Beaufort scale (19.3–30.6 km [12–19 miles] per hour).

Starting points for southwestern willow flycatcher and yellow-billed cuckoo surveys varied between surveys. Standard southwestern willow flycatcher and yellow-billed cuckoo survey summary forms were completed. In addition to completing yellow-billed cuckoo and southwestern willow flycatcher surveys, SWCA recorded qualitative site descriptions for each parcel. Surveyors recorded the dominant vegetation species, visual estimates of vegetation height (to the nearest meter), canopy closure (to the nearest 5%), and qualitative assessments of surface hydrology. Surveys were completed in all areas that were dominated by trees or shrubs ≥ 3 m (9.8 feet) in height (Figures 3–8).

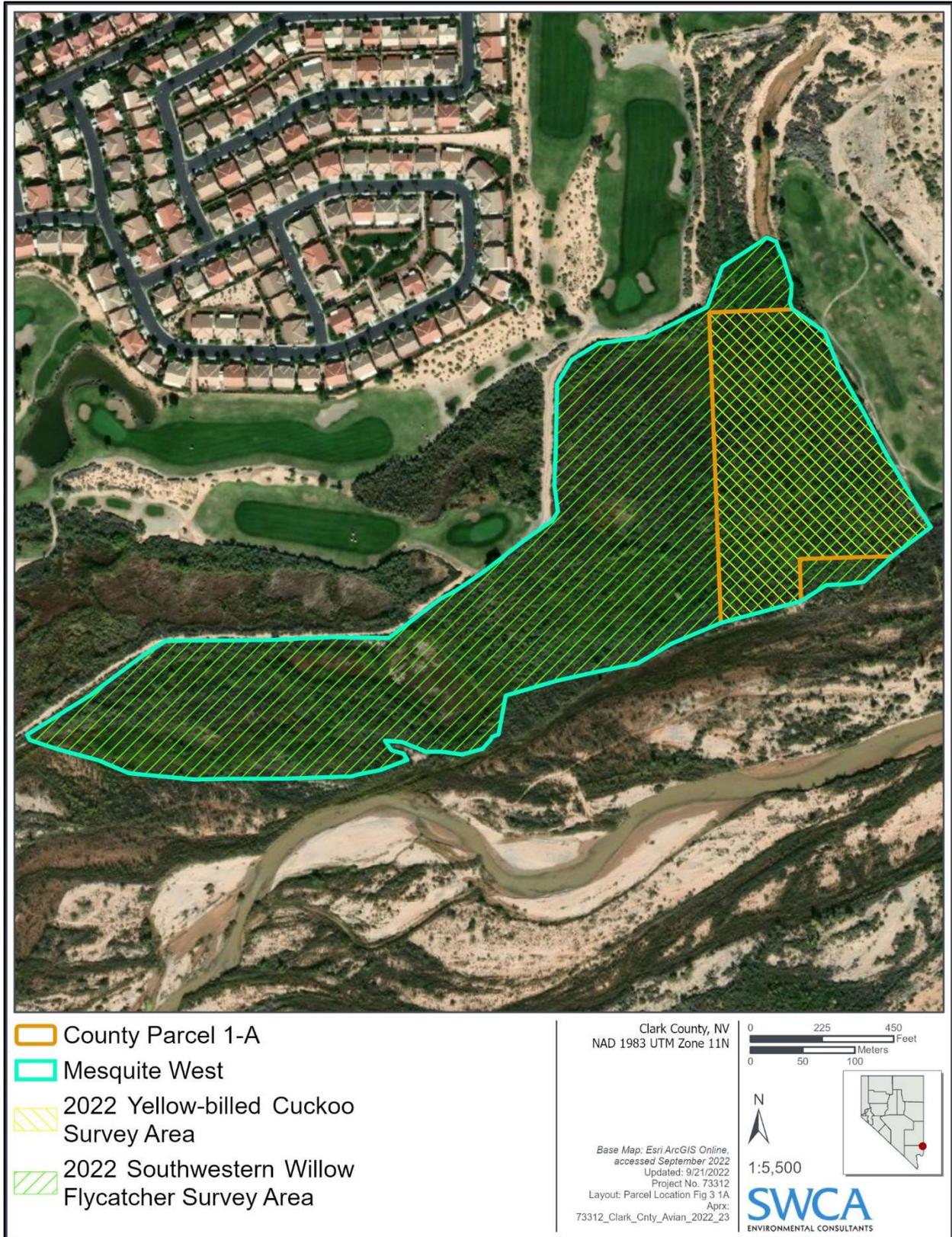


Figure 3. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mesquite Riparian Reserve Subunit.

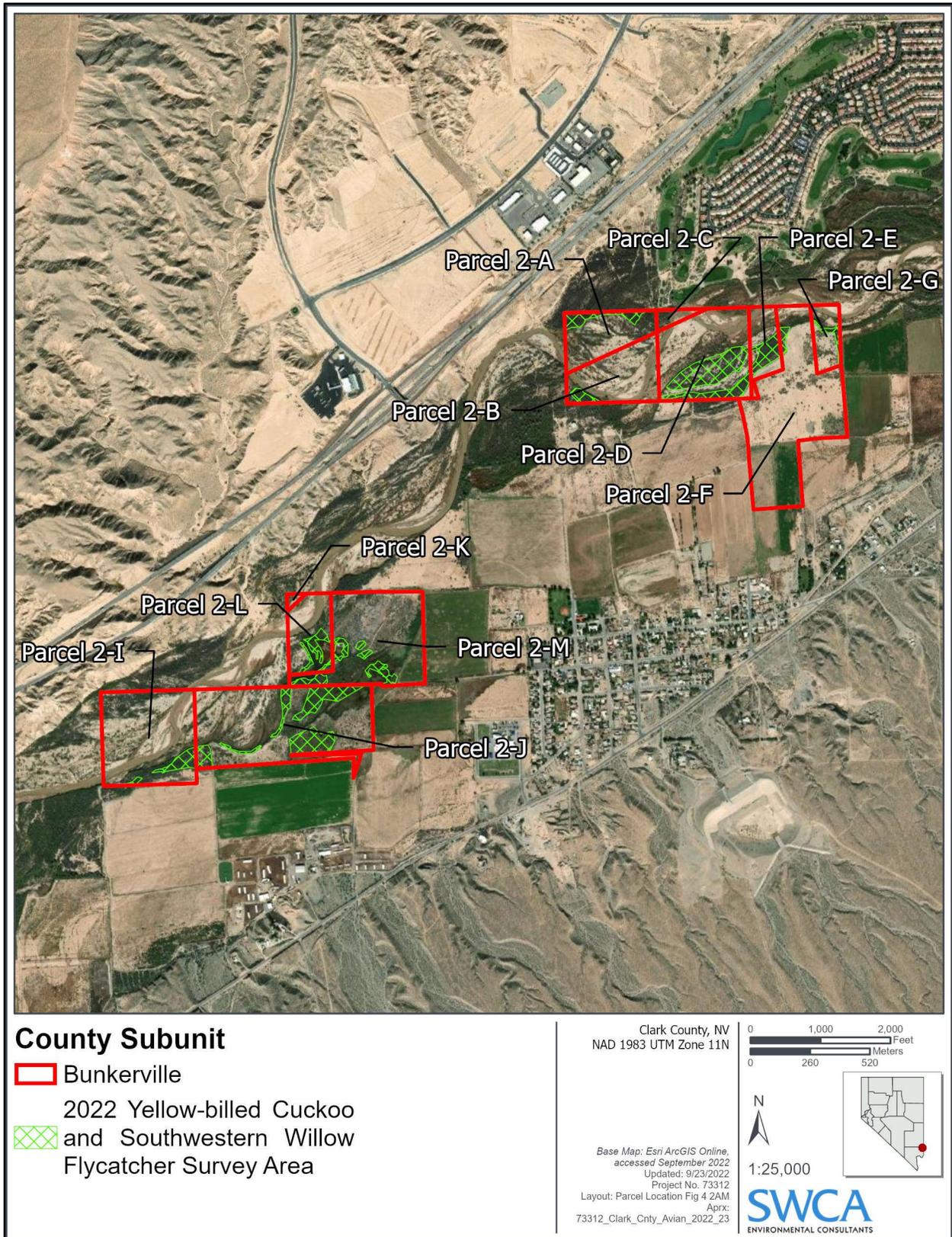


Figure 4. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Bunkerville Riparian Reserve Subunit.

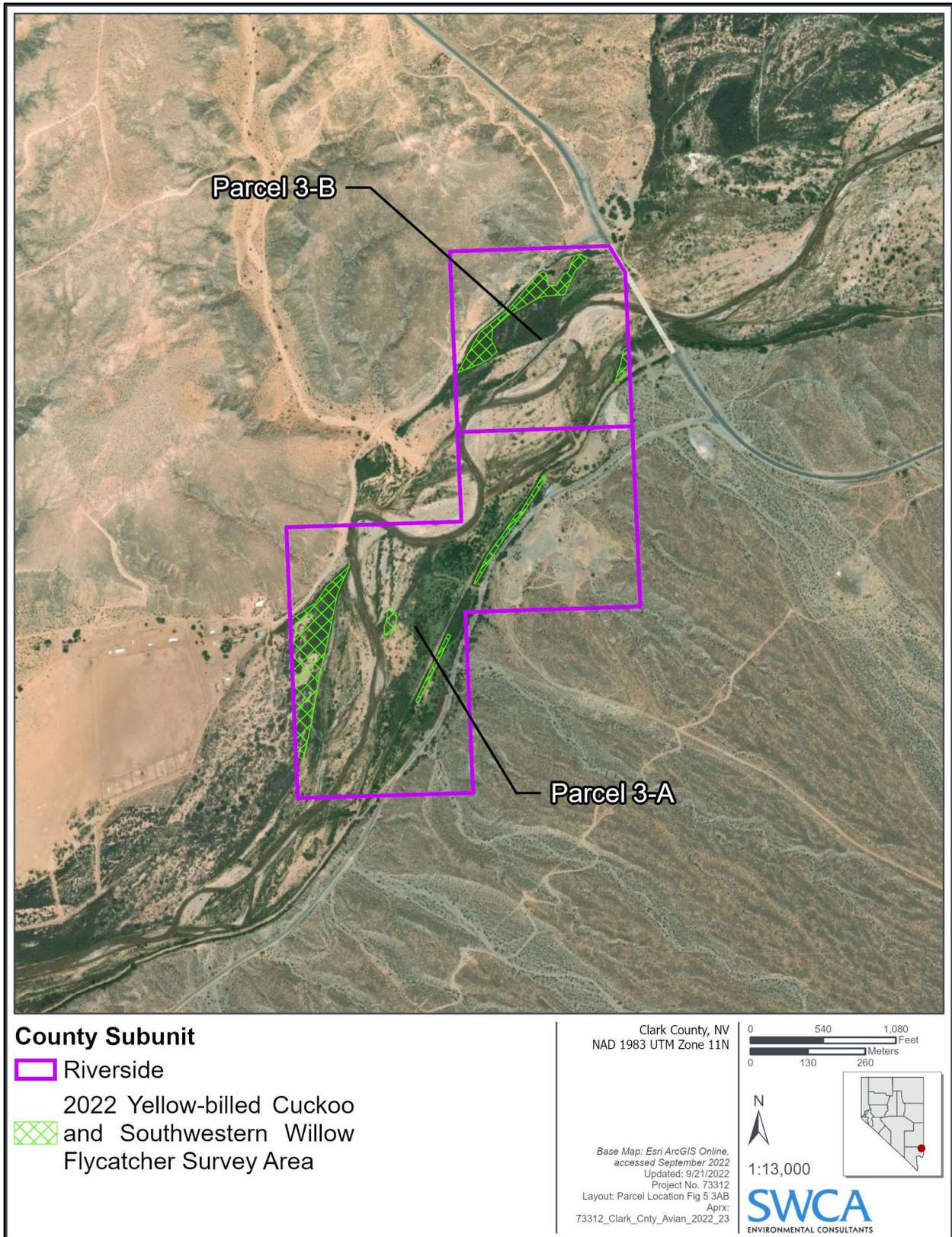


Figure 5. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Riverside Riparian Reserve Subunit.

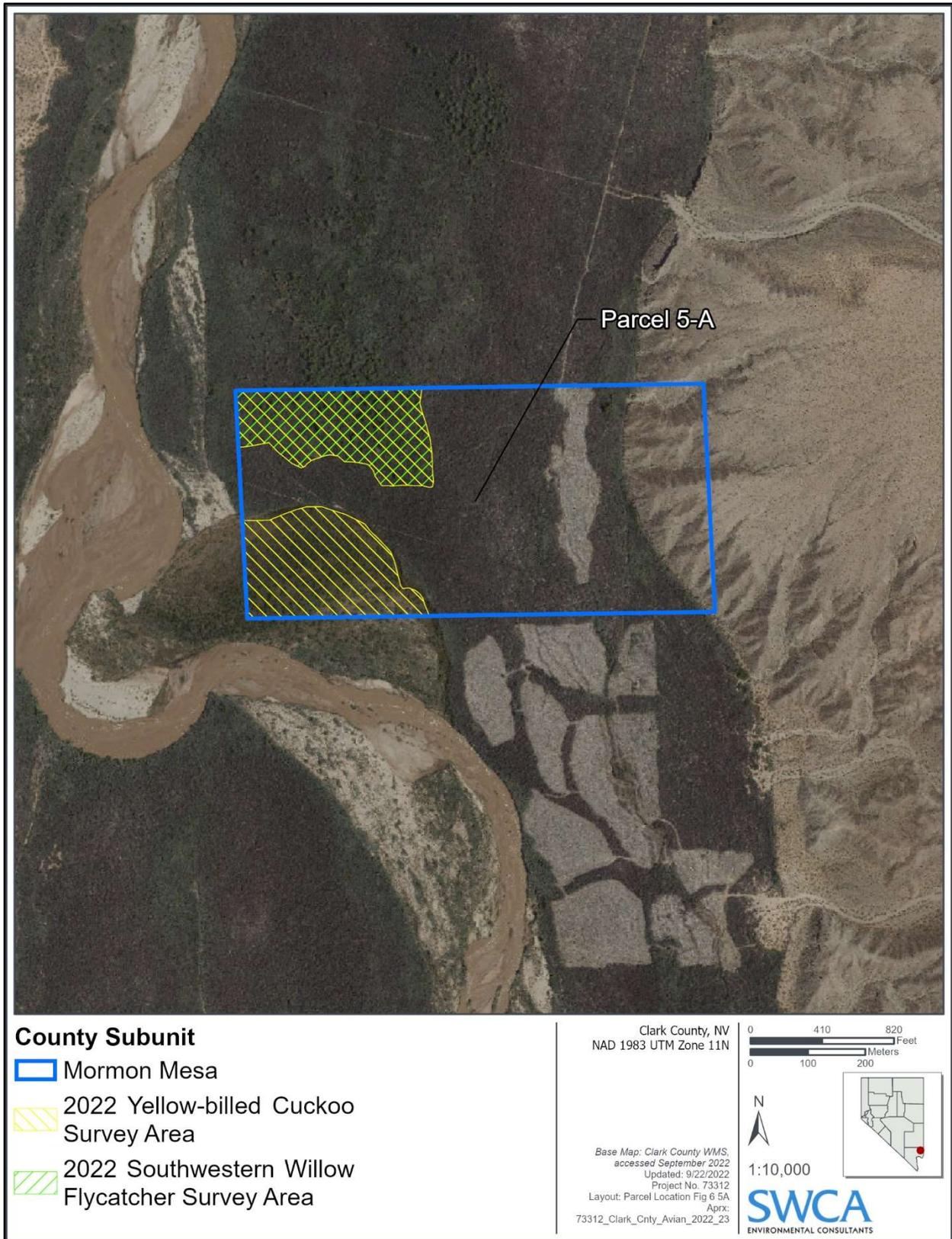


Figure 6. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mormon Mesa Riparian Reserve Subunit.

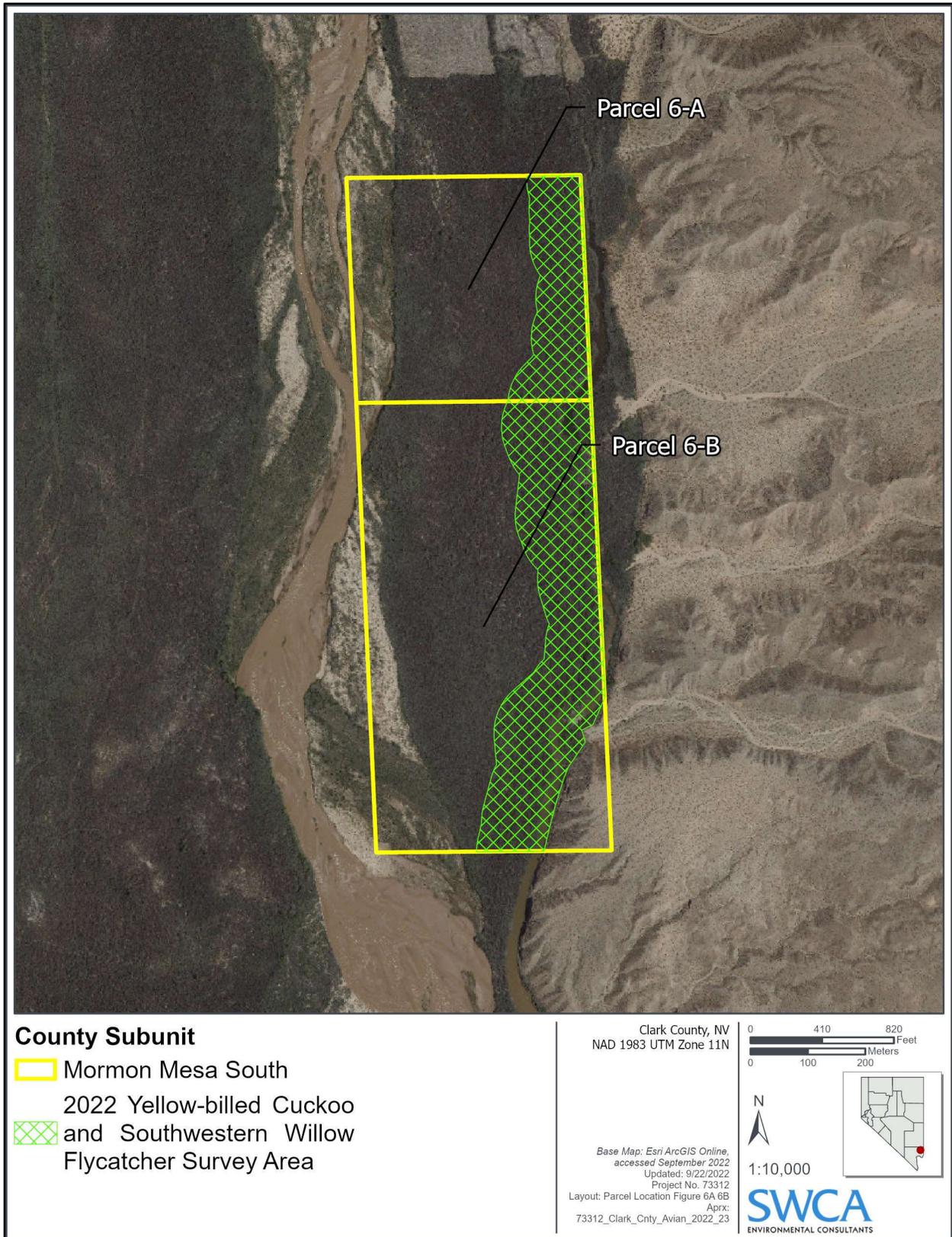


Figure 7. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mormon Mesa South Riparian Reserve Subunit.

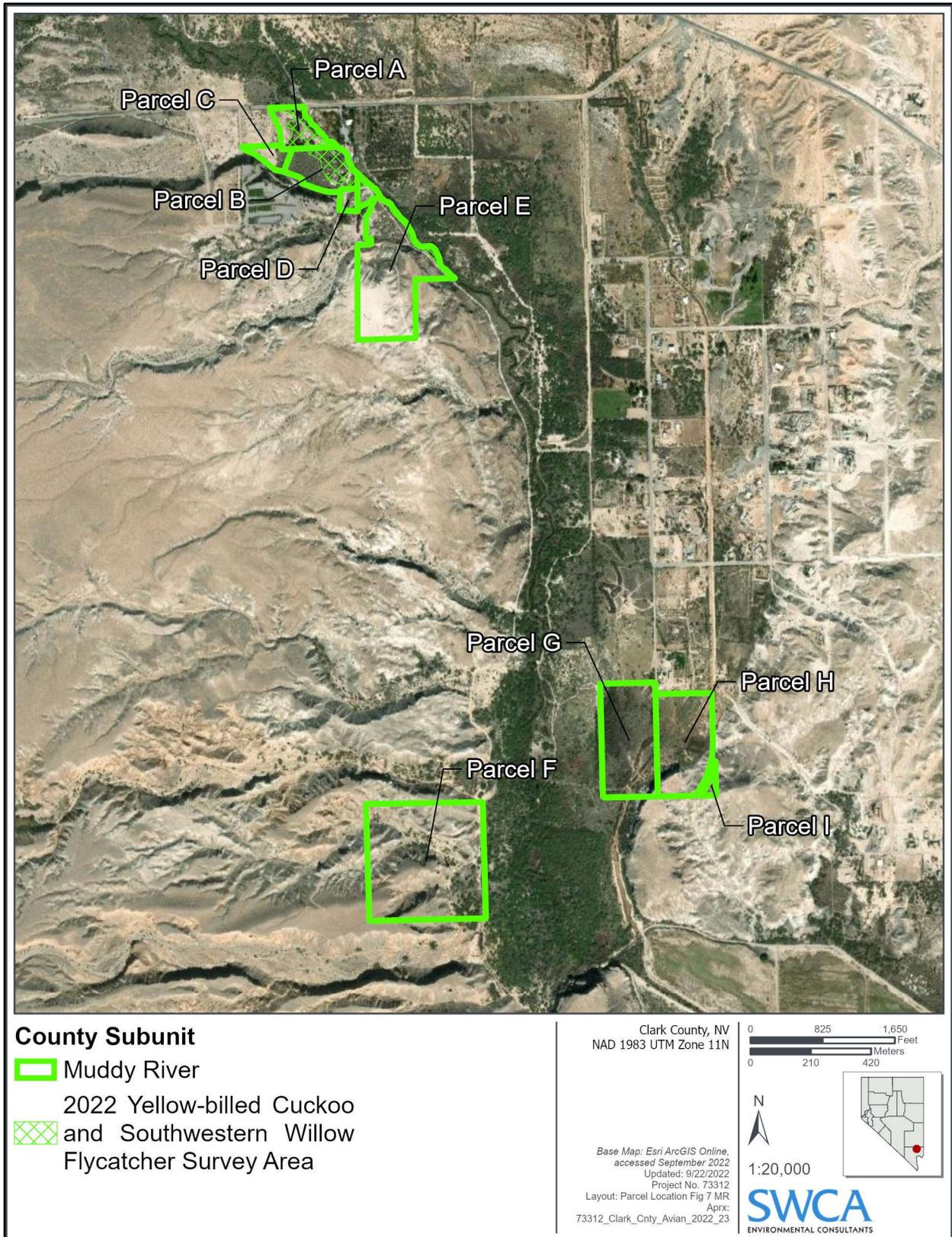


Figure 8. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Muddy River Riparian Reserve Unit.

2.2 Southwestern Willow Flycatcher Monitoring

Southwestern willow flycatcher territory and nest monitoring involves more frequent visits to southwestern willow flycatcher territories than do broadcast surveys alone and facilitates locating nests, determining nest fates, and calculating productivity. Territory monitoring commenced at Mesquite West and Mormon Mesa Parcel 5-A once a territorial willow flycatcher was detected. Nest searching and nest monitoring (when appropriate) commenced once a pair of southwestern willow flycatchers was detected. The methods for territory and nest monitoring described herein followed those described by Rourke et al. (1999), Martin et al. (1997), Martin and Geupel (1993), and Ralph et al. (1993), which recommend monitoring every 2–4 days, depending on territory stage and activity.

SWCA conducted southwestern willow flycatcher territory and nest monitoring at each territory approximately every 4 days to determine territory status, locate nests, and monitor known nests. Nests were monitored using a mirror on a telescoping pole to determine nest contents, including the presence of any brown-headed cowbird eggs or nestlings. When appropriate, biologists added brown-headed cowbird eggs or removed brown-headed cowbird nestlings from nests. No nest was mirror poled after nestlings reached 8 days of age to avoid forced fledging.

Nesting attempts were determined to be successful if fledged young were observed in the vicinity of the nest or were identified by their color bands. The number of nestlings produced from each nest was determined by the number of fledglings visually confirmed, resulting in a conservative number of nestlings produced per nest. Failed nests were inspected to determine the condition of the nest and to record the presence of eggs, eggshells, or dead nestlings in or around the nest. These data were used to determine the stage and cause of nest failure.

Color banding and subsequent resighting can greatly improve the certainty with which individual southwestern willow flycatchers can be associated with a specific territory or nest. Furthermore, color banding nestling southwestern willow flycatchers helps with confirming the number of fledglings produced from each nest and allows for a more accurate determination of nest success and productivity. Color banding involves fitting each flycatcher with an aluminum federal band (either standard silver or anodized in one of several colors) on one leg and a colored, metal, pin-striped band on the opposite leg, resulting in a unique color combination of bands. Resighting involves subsequently observing these color bands via binoculars to confirm a bird's identity. Resighting color-banded birds at different times of the season or in subsequent years can also help with understanding movements of southwestern willow flycatchers within and between study areas and sites.

Biologists captured, uniquely color banded, and subsequently monitored adult and nestling southwestern willow flycatchers whenever possible. Adult willow flycatchers were captured with mist nets, which provide the most effective technique for live capture of adult songbirds (Ralph et al. 1993). A targeted capture technique was used (in accordance with Sogge et al. 2001) whereby a variety of conspecific vocalizations were broadcast via MP3 players and remote speakers to lure territorial southwestern willow flycatchers into the nets. Nestlings were banded at 7 to 10 days of age, when they were large enough to retain leg bands, yet young enough that they would not prematurely fledge from the nest (Paxton et al. 1997; Whitfield 1990).

2.3 Data Management for Federally Listed Bird Surveys and Monitoring

For southwestern willow flycatcher and yellow-billed cuckoo surveys and southwestern willow flycatcher monitoring, biologists collected data on Samsung tablets, Samsung phones, or iPhones equipped with

Field Maps for ArcGIS and paired with an external GPS receiver. The GPS receiver was capable of submeter accuracy and provided real-time data corrections; data post-processing was not required. Several feature services were published to ArcGIS Online for use in Field Maps. These included site boundaries, trails, a feature service to record real-time locations of the surveyor at regular intervals (i.e., surveyor “tracks”), a 30 × 30-m (98 × 98-foot) grid, and feature services for field data. High-resolution aerial imagery of all survey sites was also loaded directly onto the tablets for use in Field Maps.

Data collected included point locations of survey points, willow flycatcher and yellow-billed cuckoo detections (e.g., territorial male, territory center, pair, nest, nest flag, or family group), and line features to show the relationship between any two willow flycatcher detection locations (e.g., same bird, different bird, countersinging males, or possible pair). All data collected in the field were recorded into an offline copy of the feature services.

Summary information for each resight and for each territory or nest visit (time in and out of the territory, breeding stage [e.g., single male, pair, nest stage, or no activity], nest contents [if applicable], and behavioral comments) was entered in a form in Survey123 for ArcGIS. Each form was a child feature linked to its respective territory center or nest flag parent point.

All data recorded in Field Maps were synced to and managed in a feature service that resided on the ESRI server. All data on the ESRI server were backed up to an SWCA server periodically and will be stored indefinitely. Quality control features that facilitate identifying common errors were built into Field Maps. All data were reviewed and proofed before data were delivered.

All spatial data collected in the field, as well as any spatial data provided by the County and edited by SWCA, were exported to a geodatabase and will be included as part of the 2022 Final Data Deliverable. A full list of the spatial layers and a description of the data that each layer contains are included in the metadata for the geodatabase. The geodatabase also includes general project information, such as the County project number, the name of SWCA’s project manager, the dates for the project, a brief project description, the title of the associated final report, the model of GPS receiver used for the project, and relative positional accuracy.

2.4 Brown-headed Cowbird Control

2.4.1 Target Netting

Brown-headed cowbird target netting commenced at Mesquite West at the beginning of the southwestern willow flycatcher breeding season (i.e., mid-May) in anticipation of the site being occupied by southwestern willow flycatchers. Target netting employed broadcasts of conspecific vocalizations to lure brown-headed cowbirds into a mist net. Each target-netting attempt consisted of erecting a single mist net 2.6 m (8.5 feet) in height with 38-mm (1.5-inch) mesh size and placing a female brown-headed cowbird decoy near the midpoint of the net. A small, portable speaker was placed near the decoy, and a second speaker was placed on the opposite side of the net. These speakers were coupled to MP3 players loaded with multiple tracks of brown-headed cowbird vocalizations.

Once the net was erected and the decoy and speakers were set in place, the observer hid approximately 10 m (32.8 feet) from the net in a place with a full view of the net. The observer began broadcasting a female brown-headed cowbird chatter vocalization, with periodic pauses to mimic a natural vocalization rate, until a female cowbird came near the net. Once a female brown-headed cowbird was in sight, different tracks were played to agitate the female and draw her into the net. Any male cowbirds or non-target species that were caught in the net were removed immediately and released. The observer clipped the tail of each male brown-headed cowbird in a “swallow pattern” prior to release to signify that the bird

had been previously captured, should the bird be caught again later in the season. All female and juvenile brown-headed cowbirds were euthanized via decapitation, a method approved under the current American Veterinary Medical Association guidelines for euthanizing small birds (American Veterinary Medical Association 2020).

2.4.1.1 NET LOCATIONS

Mist nets were placed in semi-open areas at least 70 m (230 feet) from all known southwestern willow flycatcher nests or territory centers, which resulted in net locations being approximately 50 m (164 feet) or more from the edge of those occupied territories. Because SWCA also conducted territory and nest monitoring for southwestern willow flycatchers at Mesquite West in 2022, biologists attempting to net brown-headed cowbirds had access to current information on all willow flycatcher detection, territory, and nest locations. All mist-net locations were approached from a direction that did not cause the observer to pass through or near a southwestern willow flycatcher territory.

Female brown-headed cowbirds can occupy territories of 5.0 ha (12.4 acres) or greater, which is a much larger area than a typical southwestern willow flycatcher territory (less than 0.5 ha [1.2 acres]); thus, placing netting attempts between 50 and 100 m (164 and 328 feet) from the edge of southwestern willow flycatcher territories targeted female brown-headed cowbirds whose ranges likely overlapped with southwestern willow flycatcher territories. Placing all netting attempts outside southwestern willow flycatcher territories minimized the chance of inadvertently capturing a southwestern willow flycatcher or drawing a brown-headed cowbird into a southwestern willow flycatcher territory. However, because it was still possible that a southwestern willow flycatcher could be captured during brown-headed cowbird target netting, all biologists who attempted to target net brown-headed cowbirds were also authorized through SWCA's existing 10(a)1(A) permit (ESPER0009523) and Master Banding permit (23258) to handle southwestern willow flycatchers.

2.4.1.2 TIMING OF NETTING ATTEMPTS

Any netting attempt that failed to attract female brown-headed cowbirds to the vicinity was terminated after 1 hour. The first netting attempt of the day began at first light, allowing for multiple netting attempts in a day. Female brown-headed cowbirds are typically on their laying territories in the early morning; thus, morning netting attempts targeted those cowbirds likely to parasitize hosts in the vicinity. Netting attempts were terminated by 10:00 a.m. PDT, and no netting attempts were conducted during inclement weather or with direct sunlight on the net. The net was removed at the conclusion of each netting attempt. Netting attempts began in mid-May and were conducted twice per week through June 4, then at least once per week through the end of July. Starting brown-headed cowbird control in mid-May allowed for four netting visits prior to the initiation of the earliest southwestern willow flycatcher nests.

2.4.2 *Egg Addling and Replacement*

When an accessible southwestern willow flycatcher nest was parasitized on or before the fifth day of incubation, the brown-headed cowbird egg(s) was either addled via vigorous shaking or replaced with a fake egg painted to resemble the speckled pattern of a brown-headed cowbird egg. Brown-headed cowbird eggs were not removed from the nest so as not to mimic a partial depredation event, which could cause nest desertion. Shaking brown-headed cowbird eggs greatly reduces the chance of the egg hatching, and there is no evidence that this activity results in nest desertion (McLeod and Pellegrini 2013; McLeod et al. 2018).

2.4.3 Nestling Euthanasia

Brown-headed cowbird nestlings may either be present in a southwestern willow flycatcher nest when the nest is found or after an addling attempt has failed and the cowbird egg hatches. When a brown-headed cowbird nestling was discovered in a nest, the nestling was removed and euthanized. If the nest was accessible without a ladder, the nestling was removed at the time of discovery. If a ladder was necessary to remove the nestling without causing damage to the nest, the nestling was removed on the next visit to the site.

2.5 Point-Count Surveys

Surveys conducted in 2022 followed methods used during the 2017–2021 point-count surveys (SWCA 2017b, 2018a, 2018b, 2019a, 2020, 2021), which applied established point-count protocols and drew from methods described in *A Habitat-based Monitoring Program for Breeding Birds of Nevada* (Great Basin Bird Observatory [GBBO] 2003) and in the *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al. 1993).

In 2019, SWCA randomly selected 25 of the 51 previously established point-count locations across the Riparian Reserve Units to be surveyed in odd-numbered years (i.e., 2019, 2021, 2023); the remaining 26 points were selected to be surveyed in even-numbered years (i.e., 2020, 2022) (Figures 9–14). In 2020, the County added four survey points in Parcels 2-L and 2-M, two to be surveyed in odd years and two to be surveyed in even years. In 2022, another four points were added in Parcels 6-A and 6-B, two to be surveyed in odd years and two to be surveyed in even years.

In 2022, SWCA conducted avian point-count surveys at the 30 even-year point-count locations. Prior to the commencement of surveys, SWCA Project Manager Justin Streit conducted a site reconnaissance to re-familiarize himself with the project parcels and identify any impediments to access. During the reconnaissance, Mr. Streit navigated to each survey point and marked each with flagging so that it could be easily located on subsequent visits.

In 2019, above-average winter precipitation yielded abnormally high water levels along the Virgin River. As a result, two of the riparian point-count locations scheduled for surveys in odd years were inundated by the active river channel, and these point-count locations were repositioned (BV-18 and RS-7a). The survey location for BV-18 was subsequently returned to its original location once the water receded, but RS-7a has remained as the new location for that point count ever since (see Figure 11). None of the point-count locations established for even years were affected by the high water levels; all originally established point-count locations for even-numbered years were used in 2022.

In 2019, SWCA randomly selected 20 of the 40 previously surveyed point-count locations at the BCCE to be surveyed in odd-numbered years (i.e., 2019, 2021, 2023); the remaining 20 locations were selected to be surveyed in even-numbered years (i.e., 2020, 2022) and were surveyed by SWCA in 2022 (Figure 15). As it was anticipated that conditions at the BCCE had not changed dramatically since 2020, no field reconnaissance was completed prior to field surveys at that property in 2022. Surveyors were able to access all 20 of the previously surveyed point-count locations without impediment, and all the original locations assigned to even-numbered years were used in 2022.

Each surveyor followed standard unlimited-radius point-count procedures, with surveys starting at sunrise and concluding by 10:00 a.m. PDT (GBBO 2003; Ralph et al. 1993). Consecutive surveys at each point were separated by a minimum of 7 days. The order in which a group of point counts was completed was alternated between each round of surveys so that a given point was not always surveyed at the same time of day.

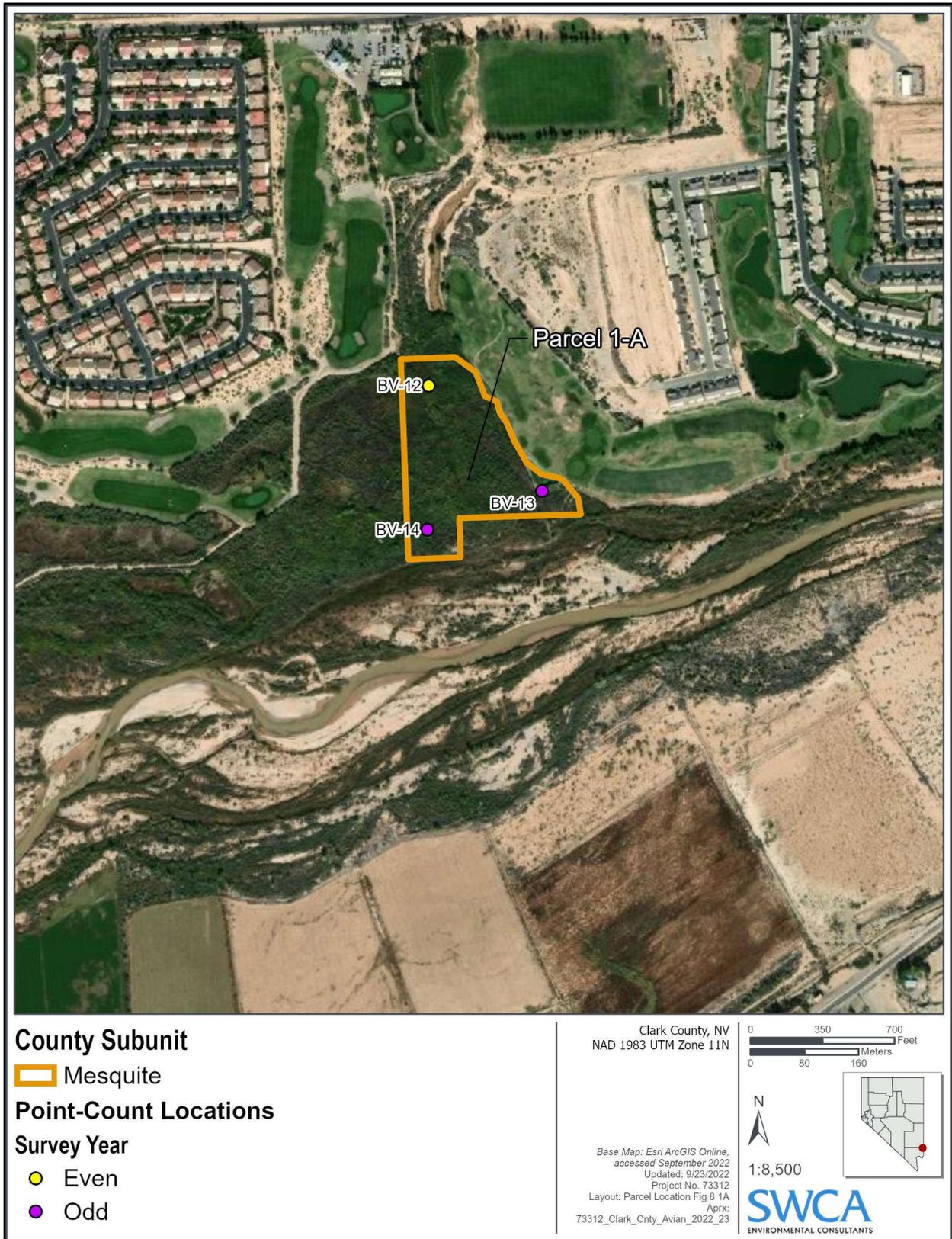


Figure 9. Point-count locations within the Mesquite Riparian Reserve Subunit.

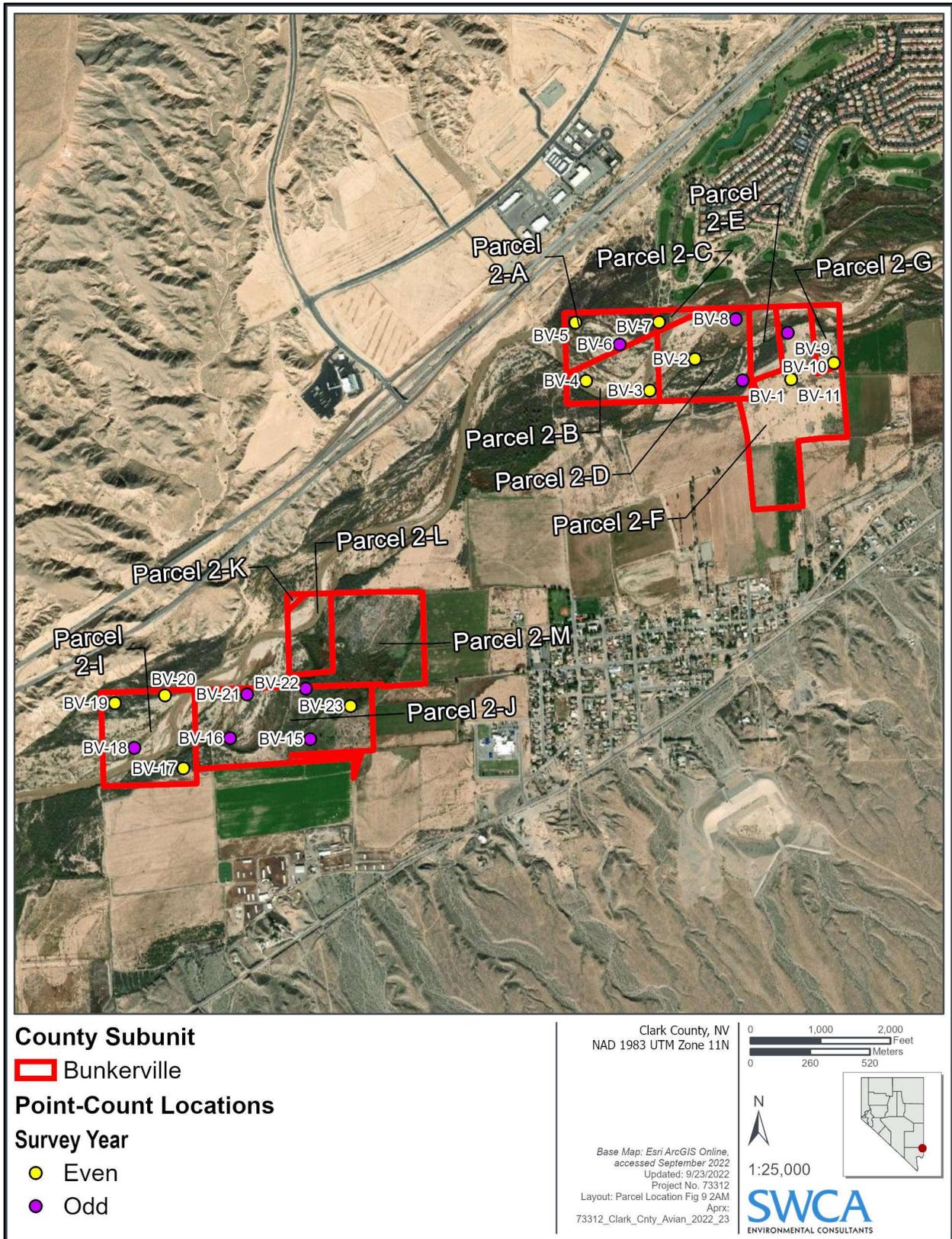


Figure 10. Point-count locations within the Bunkerville Riparian Reserve Subunit.

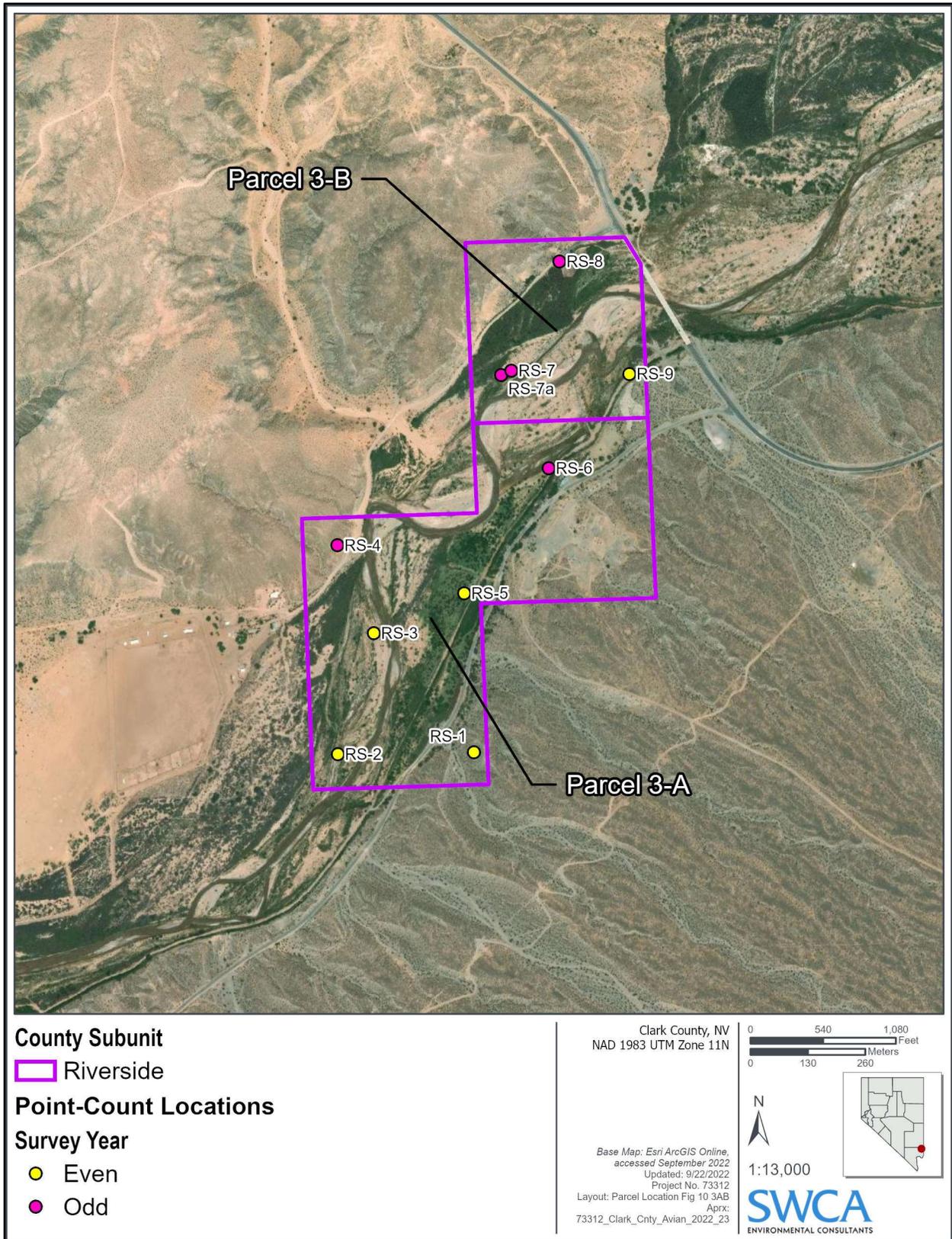


Figure 11. Point-count locations within the Riverside Riparian Reserve Subunit.

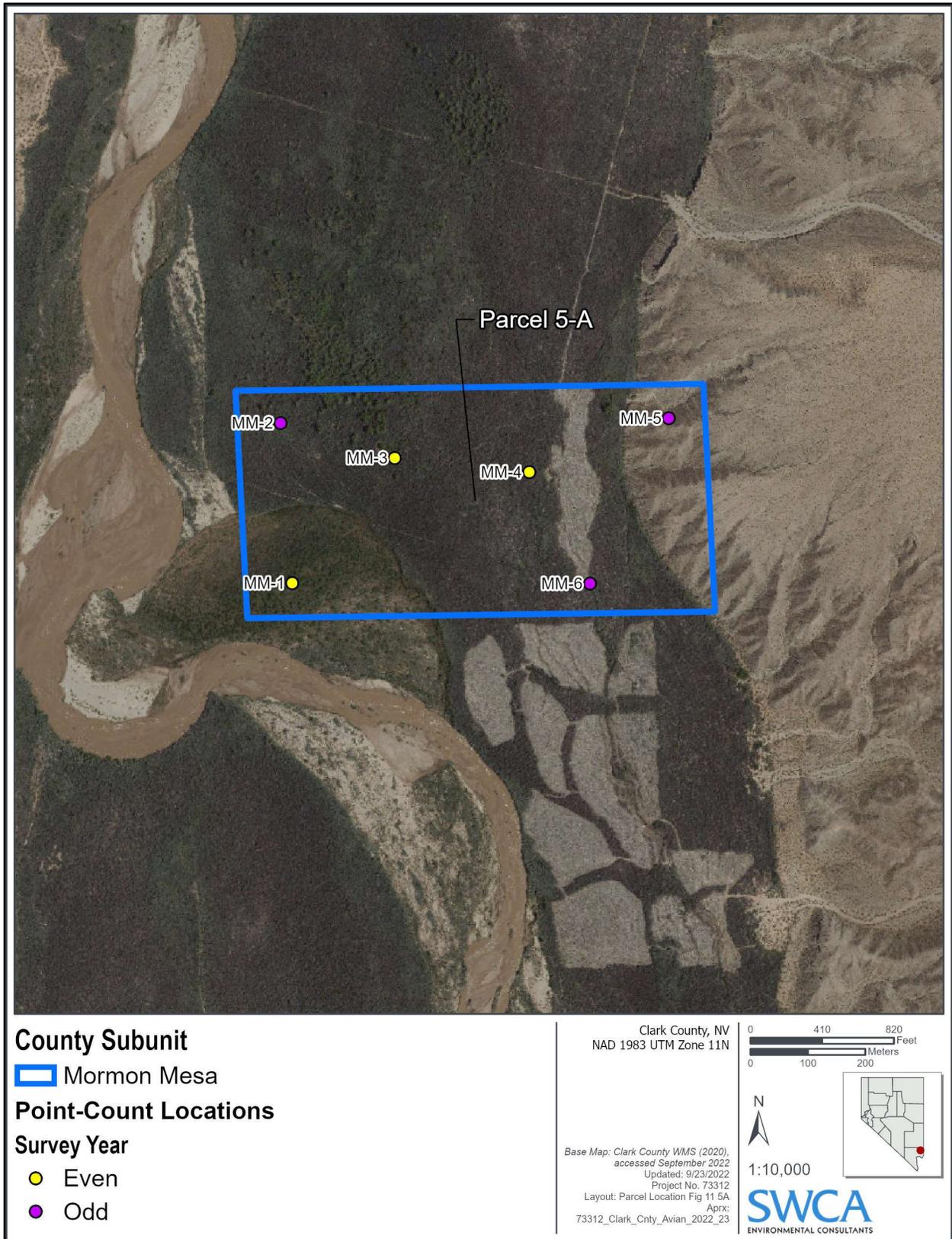


Figure 12. Point-count locations within the Mormon Mesa Riparian Reserve Subunit.

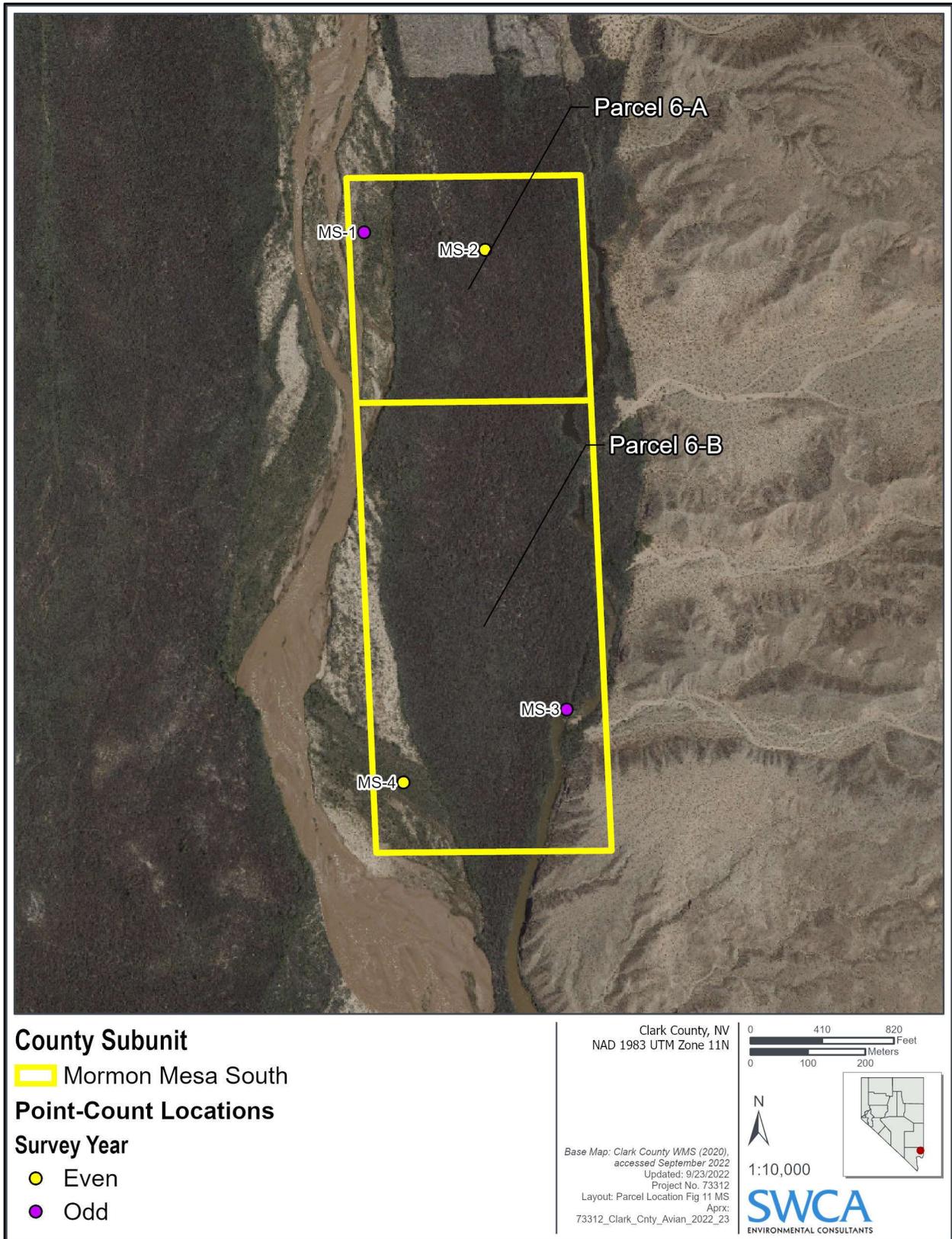


Figure 13. Point-count locations within the Mormon Mesa South Riparian Reserve Subunit.

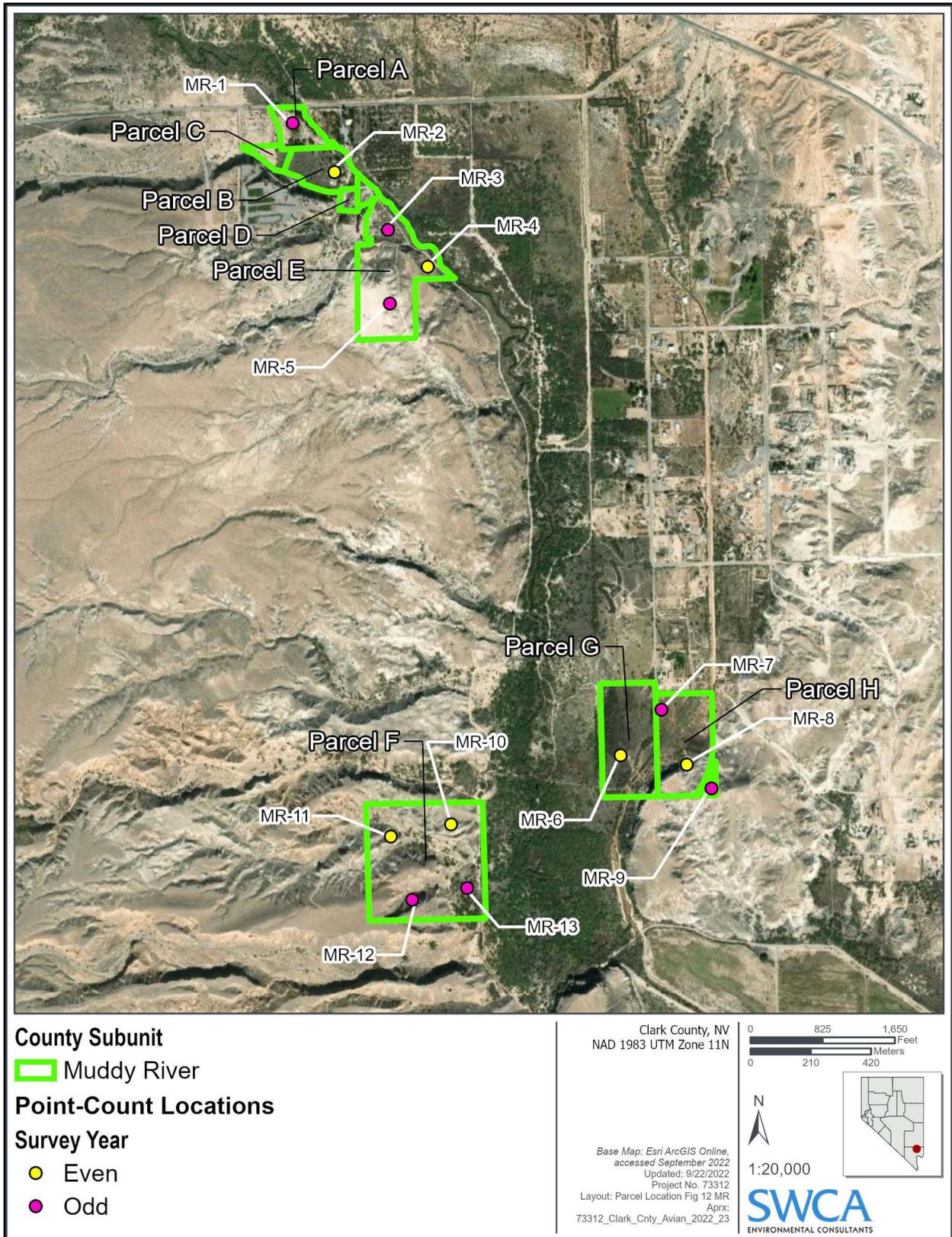


Figure 14. Point-count locations within the Muddy River Riparian Reserve Unit.

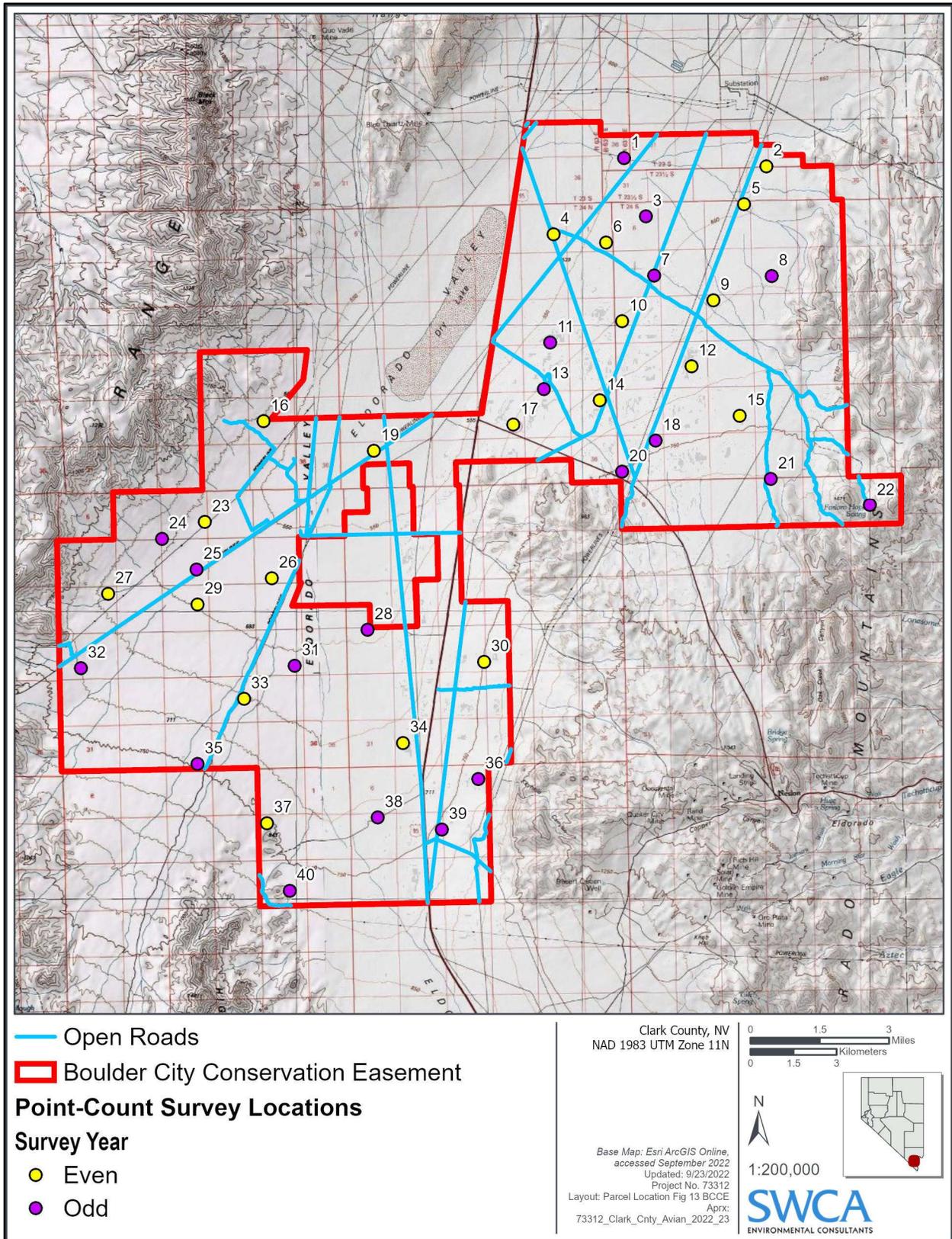


Figure 15. Point-count locations within the BCCE.

For each survey, the surveyor approached each point quietly to avoid overly disturbing any birds present. Prior to or immediately following each point count, the surveyor recorded weather data, including cloud cover, wind speed and direction, temperature, and precipitation, on a standardized form. No surveys were conducted when wind speeds exceeded 40 km (25 miles) per hour or during periods of heavy rain, as both conditions could have inhibited the comprehensive inventory of a survey area (GBBO 2003).

Point counts consisted of a 10-minute observation period, which was broken into four intervals (0–3, 3–5, 5–8, and 8–10 minutes). Surveyors noted the time interval in which the first detection of a given bird was made. Surveyors recorded species code, interval of detection, sex, age, estimated distance from the observer, bearing to the bird, and behavior of the bird as it pertained to its breeding status. Any bird that flushed as the surveyor approached the point-count location but that was not detected during the survey was recorded as observed during the 0- to 3-minute interval and in the location from where it flushed. All detections were recorded on hardcopy datasheets, and bird locations were plotted on a standard point-count map (with their associated behavior codes) to help avoid double-counting individuals within a survey location. Any bird that gave an unknown vocalization was tracked following the survey to determine its identity (Ralph et al. 1993).

3 RESULTS AND EVIDENCE OF THE RESULTS

3.1 Objectives Completed

The objectives for this project were 1) to continue building on a baseline record of federally listed and non-listed bird species present at both the Riparian Reserve Units and the BCCE and 2) to assess the effect of brown-headed cowbird control on nesting southwestern willow flycatchers. Both objectives were completed in 2022, and results of the 2022 field efforts are presented here.

3.2 Survey Effort

3.2.1 Federally Listed Bird Surveys

The five rounds of southwestern willow flycatcher surveys were completed by SWCA biologists Steve Dougill, Sarah Nichols, Justin Streit, and Mike Swink between May 16 and July 18¹, 2022 (Table 1). Each round of southwestern willow flycatcher surveys required from six to nine observer-mornings, sometimes requiring shorter survey mornings combined with other activities. In 2022, SWCA surveyed a total of 57.9 ha (143.0 acres) for southwestern willow flycatcher (see Figures 3–8), and surveys required 115.8 survey-hours (see Table 1). Southwestern willow flycatcher surveys concluded by 10:30 a.m. PDT. Descriptions of and rationale for areas excluded from surveys in 2022 are included in Section 4.0.

The four rounds of yellow-billed cuckoo surveys were completed by Mr. Swink, Mr. Streit, and Ms. Nichols between June 23 and August 9, 2022 (Table 2). Each yellow-billed cuckoo survey round required four or five observer-mornings. In 2022, SWCA surveyed a total of 51.2 ha (126.5 acres) for yellow-billed cuckoo across all subunits (see Figures 3–8), and surveys required 70.1 survey-hours (see Table 2). Yellow-billed cuckoo surveys concluded by 11:10 a.m. PDT or when the temperature reached 40° Celsius, whichever occurred first. Descriptions of and rationale for areas excluded from surveys in 2022 are included in Section 4.0.

¹ Due to scheduling constraints, the fifth southwestern willow flycatcher survey at Parcel 1-A was completed one day after the end of the southwestern willow flycatcher survey window.

Table 1. Survey Dates and Effort for Southwestern Willow Flycatcher Surveys, 2022

Subunit	Mesquite		Bunkerville			Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Parcel(s)	West West	1-A	2-A through 2-G	2-I and 2-J	2-K through 2-M	3-A and 3-B	5-A	6-A and 6-B	A through H
First survey	May 16	May 25	May 19	May 23	May 23	May 25	May 18	May 28	May 18
Second survey	June 1	June 10	June 7	June 8	June 8	June 16	June 3	June 7	June 3
Third survey	June 17	June 22	June 20	June 21	June 21	June 22	June 19	June 23	June 19
Fourth survey	July 3	July 6	July 4	June 28	June 28	July 4	June 27	June 29	June 29
Fifth survey	July 11	July 18	July 12	July 8	July 7	July 13	July 9	July 12	July 5
Area surveyed (acres)	28.2	9.9	20.4	13.9	6.3	9.6	10.8	35.4	8.5
Total survey hours	14.8	5.5	22.8	15.8	10.6	16.0	7.9	13.3	8.8

Table 2. Survey Dates and Effort for Yellow-Billed Cuckoo Surveys, 2022

Subunit	Mesquite	Bunkerville			Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Parcel(s)	1-A	2-A through 2-G	2-I and 2-J	2-K through 2-M	3-A and 3-B	5-A	6-A and 6-B	A through H
First Survey	June 27	June 27	June 23	June 23	June 25	June 27	June 29	June 25
Second Survey	July 10	July 10	July 6	July 6	July 7	July 9	July 12	July 7
Third Survey	July 25	July 25	July 21	July 21	July 22	July 23	July 24	July 22
Fourth Survey	August 9	August 9	August 2	August 2	August 3	August 5	August 5	August 3
Area surveyed (acres)	9.9	20.4	13.9	6.3	9.6	22.5	35.4	8.5
Total Survey hours	5.3	13.6	9.5	7.1	10.0	9.5	9.2	5.9

3.2.2 Point-Count Surveys

The three rounds of point-count surveys were completed at the Riparian Reserve Units by Mr. Swink and Mr. Dougill between May 9 and June 17, 2022 (Table 3). Each round of point counts required four mornings to cover the Riparian Reserve Units. Weather conditions were favorable during all three survey rounds, with no precipitation and wind speeds ranging from 0 to 14.0 km (0 to 8.7 miles) per hour. Mr. Swink and Mr. Dougill completed three rounds of point-count surveys within the BCCE between May 2 and June 4, 2022 (Table 4). Each round of point counts at the BCCE required three observer-mornings. Weather conditions were favorable during all three survey rounds, with no precipitation and wind speeds ranging from 0 to 17.1 km (0 to 10.6 miles) per hour.

3.3 Findings

3.3.1 Federally Listed Bird Surveys and Monitoring

3.3.1.1 SOUTHWESTERN WILLOW FLYCATCHER

Adult willow flycatchers detected for at least 7 days at a particular study area were considered to be residents at that study area. Additionally, adults detected between June 24 and July 20 were also considered residents of that study area, regardless of detection duration.

In total, 28 adult willow flycatchers were detected during survey and monitoring activities at the Riparian Reserve Units in 2022. Of the 28 adults, three were detected only during the first round of surveys at Bunkerville Parcel 2-D (one individual) or Muddy River Parcel E (two individuals). Band status could not be confirmed for these three individuals, and behavior observed during the initial detections and the lack of subsequent survey detections suggest these individuals were likely spring migrants.

Of the remaining 25 adults, 23 were detected at Mesquite West, and two were detected at Mormon Mesa Parcel 5-A (Table 5). Of these 25 adults, 17 were residents of the southwestern subspecies that were present for at least 7 days, and three were considered to be residents of the southwestern subspecies based on their dates of detection: one was detected on June 27, one was detected on July 3, and one was detected on July 18. One additional individual displayed territorial behavior and already had color bands but was detected for only one day (May 20); because this bird was banded, this individual was determined to be of the southwestern subspecies. Four adults were detected for less than seven days before June 24: one adult was detected for five days (May 16–20) and three were detected for one day each (one was detected on May 20, one was detected on June 1, and one was detected on June 10). As such, it is assumed that these four adults were likely northbound migrants.

Table 3. Survey Dates for Point-Count Surveys at the Riparian Reserve Units, 2022

Subunit	Mesquite	Bunkerville			Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Parcel(s)	1-A	2-A through 2-G	2-I and 2-J	2-K through 2-M	3-A and 3-B	5-A	6-A and 6-B	A through H
First survey	May 10	May 10	May 9	May 9	May 9	May 12	May 12	May 11
Second survey	May 27	May 27	May 24	May 24	May 24	May 26	May 26	May 25
Third survey	June 16	June 16	June 17	June 17	June 17	June 16	June 16	June 17

Table 4. Survey Dates for Point-Count Surveys at the BCCE, 2022

Survey Round	Dates
First	May 2, 4, 6
Second	May 17, 19, 20
Third	June 2, 3, 4

Table 5. Details of Southwestern Willow Flycatchers and Willow Flycatchers Detected at Monitored Parcels During the 2022 Breeding Season

Subunit ^a	Parcel	Date Banded ^b	Federal Band No. ^b	Color Combination ^c	Age ^d	Sex ^e	Territory or Location ^f	Observation Status ^g
MESQ	1-A ^h	July 15, 2022	2940-35228	Xs:BG(M)	AHY	F	01	N
		June 27, 2019	2660-23228	MY(M):VI	4Y	M	01, 13	R July 15
		July 15, 2022	2940-35231	MVM(M):Xs	L	U	01	N
		N/A	N/A	UB:UB	AHY	M	F02	RS; detected May 16–20
		June 25, 2022	2940-35207	Xs:BMB(M)	AHY	F	03	N
		May 27, 2020	2660-23165	MG(M):VI	A4Y	M	03, 12	RS
		June 25, 2022	2940-35205	GB(M):Xs	L	U	03	N
		June 25, 2022	2940-35206	Xs:BW(M)	L	U	03	N
		July 27, 2022	2940-35241	Xs:MYM(M)	L	U	03	N; not confirmed as fledged
		July 27, 2022	2940-35242	MK(M):Xs	L	U	03	N; not confirmed as fledged
		July 27, 2022	2940-35243	Xs:BR(M)	L	U	03	N; not confirmed as fledged
		INA	INA	banded	AHY	M	F04	RS; detected May 20
		July 27, 2022	2940-35240	VM(M):Xs	AHY	F	05	N
		July 1, 2021	2660-23379	EY:RKR(M)	3Y	M	05	R July 27
		July 27, 2022	2940-35238	Xs:MWM(M)	L	U	05	N
		July 27, 2022	2940-35239	BW(M):Xs	L	U	05	N
		July 13, 2021	2660-23393	EY:RVR(M)	A3Y	M	T06	RS; detected May 24 – June 5
		July 13, 2021	2660-23395	WGW(M):EY	3Y	F	07	RS
		June 2, 2022	2590-53195	Xs:BB(M)	AHY	M	07	N
		July 3, 2022	2940-35213	RZR(M):Xs	L	U	07	N
		July 3, 2022	2940-35214	Xs:MGM(M)	L	U	07	N
		August 11, 2022	2940-35244	DB(M):Xs	L	U	07	N
		August 11, 2022	2940-35245	Xs:YM(M)	L	U	07	N
		INA	INA	undetermined	AHY	U	F08	detected June 1
		N/A	N/A	UB:UB	AHY	U	F09	RS; detected June 4–9

Subunit ^a	Parcel	Date Banded ^b	Federal Band No. ^b	Color Combination ^c	Age ^d	Sex ^e	Territory or Location ^f	Observation Status ^g
		N/A	N/A	UB:UB	AHY	U	F10	RS; detected June 10
		June 13, 2022	2590-53199	Xs:KWK(M)	SY	M	T11	N; detected June 9–18
		July 19, 2022	2940-35234	Xs:YB(M)	AHY	F	12	N
		July 19, 2022	2940-35232	MWM(M):Xs	L	U	12	N
		July 19, 2022	2940-35233	Xs:BKB(M)	L	U	12	N
		August 14, 2021	2590-53196	WRW(M):Xs	SY	F	13	R June 15
		July 15, 2022	2940-35229	BK(M):Xs	L	U	13	N
		July 15, 2022	2940-35230	Xs:MBM(M)	L	U	13	N
		June 22, 2022	2940-35201	VB(M):Xs	SY	M	T15	N; detected June 17–29
		July 13, 2021	2660-23396	RYR(M):EY	SY	M	T16	RS; detected June 21–29
		INA	INA	banded	AHY	U	F18	RS; detected July 3
		N/A	N/A	UB:UB	AHY	F	19	RS
		July 13, 2021	2660-23394	EY:WYW(M)	3Y	M	19	RS
		INA	INA	undetermined	AHY	U	F20	detected July 18
MOME	5-A	June 15, 2022	2590-53200	Xs:BY(M)	AHY	M	T01	N; detected June 3–15
		N/A	N/A	UB:UB	AHY	U	F02	RS; detected June 27

^a MESQ = Mesquite and MOME = Mormon Mesa.

^b INA = information not available, and N/A = not applicable.

^c Color-band codes: B = light blue, D = dark blue, EY = electric yellow federal band, G = green, K = black, M = mulberry, (M) = metal pinstriped band, R = red, UB = unbanded, V = violet, VI = violet federal band, W = white, Xs = standard silver federal band, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two or three letters designate every band; color-band designations for left and right legs are separated with a colon. Combinations applied in 2022 could represent a re-use of combinations used in earlier years; standard silver federal bands applied prior to 2022 were reported as XX.

^d Age in 2022: L = nestling, SY = 2 years, AHY = 2 years or older, 3Y = 3 years, A3Y = 3 years or older, 4Y = 4 years, and A4Y = 4 years or older.

^e Sex codes: F = female, M = male, and U = unknown.

^f Territory or location code: Numbers indicate unique individual, pair, or nest locations; a number without an alpha prefix indicates a flycatcher pair; F = individual detected for less than 7 days; and T = territorial individual detected for at least 7 days.

^g Observation status codes: N = new capture, R = recapture followed by date captured, and RS = resight.

^h Includes Mesquite West West.

In total, of the 21 southwestern willow flycatchers detected in 2022, 17 (85%) were known to be banded. Eight of the 18 banded adults were banded in 2022, and eight were returning adults that had been banded in previous years. Two individuals were known to be already banded, but the band combinations could not be confirmed. Of the eight adults that had been banded in previous years and identified in 2022, two were identified for the first time since they were banded as juveniles (Table 6). Both individuals were detected at their natal study area. Of the six banded adults that had been previously detected as adults, five returned to the study area where they had been most recently detected, and one returned to a different study area (Table 7). Of the four individuals for which residency status could not be confirmed, two were unbanded, and the band status for two individuals could not be determined.

Table 6. Juvenile Southwestern Willow Flycatcher Banded as Hatch Year Birds in a Prior Year and Identified as Adults for the First Time in 2022

Study Area*/Survey Site Banded	Year Hatched	Study Area/Survey Site Detected 2022	Distance Moved (km)	Federal Band No.	Sex
MESQ/Parcel 1-A	2021	MESQ/West West	0.7	2590-53196	female
MESQ/West West	2021	MESQ/Parcel 1-A	0.7	2660-23396	male

* MESQ = Mesquite.

Table 7. Adult Southwestern Willow Flycatcher Between-Year Movements for All Individuals Identified in a Previous Year and Identified at a Different Study Area in 2022

Study Area*/Survey Site/Year Detected	Study Area/Survey Site Detected 2022	Distance Moved (km)	Federal Band No.	Sex
WMSP/Muddy Mac 01/2021	MESQ/West West	54.2	2660-23379	male

* MESQ = Mesquite, WMSP = Warm Springs Natural Area.

3.3.1.1.1 Mesquite West

Biologists spent 99.1 observer-hours on territory and nest monitoring at Mesquite West in 2022; activities included determining residency status, observing resident southwestern willow flycatchers, monitoring nests, and banding adults and nestlings. The 23 adults documented at Mesquite West in 2022 comprised seven pairs, four territorial males, and seven individuals for which residency and/or breeding status could not be confirmed. Two males were each polygynous with two females (see Table 5).

Seven new adults were color banded (see Table 5). Three adults banded in previous years were recaptured. Five additional adults were identified to individual via resighting. Two adults were determined to be banded, but their color combinations could not be confirmed. Four adults remained unbanded; band status could not be determined for the remaining two adults. Sixteen nestling southwestern willow flycatchers were newly banded in 2022 (see Table 5).

Nests were confirmed for all seven pairs documented in 2022. Eleven confirmed nesting attempts were documented (Appendix A: Figure A-1); seven of these were successful. Of the 11 nesting attempts that were documented at Mesquite West in 2022, nine were known to contain at least one southwestern willow flycatcher egg and were used in calculating nest success and productivity. Seven of these nine (78%) nests were successful and fledged young, one (11%) failed, and the fate of one nest (11%) was unknown (Table 8; Figure 16).

Table 8. Summary of Southwestern Willow Flycatcher Nest Monitoring Results at All Study Areas, 2019–2022

Subunit ^a	Year	Pairs	Nests with 1+ WE ^b	Successful Nests ^c	Failed Nests ^c	Nests with Unknown Fate	Nests with 1+ WE ^b and Known Parasitism Status	Parasitized Nests ^d	Young Fledged
MESQ	2019 ^e	6	9	4 (44)	4 (44)	1 (11)	8	4 (50)	5
	2020	4	5	0	5 (100)	0	5	2 (40)	0
	2021 ^e	3	6	2 (33)	4 (67)	0	6	3 (50)	3
	2022 ^e	7	9	7 (78)	1 (11)	1 (11)	9	2 (22)	13
	Total	20	29	13 (45)	14 (48)	2 (7)	28	11 (39)	21
MOME	2019	0	0	0	0	0	0	0	0
	2020	2	1	1 (100)	0	0	1	0	1
	2021	0	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0	0
	Total	2	1	1 (100)	0	0	1	0	1
All	2019	6	9	4 (44)	4 (44)	1 (11)	8	4 (50)	5
	2020	6	6	1 (17)	5 (83)	0	6	2 (33)	1
	2021	3	6	2 (33)	4 (67)	0	6	3 (50)	3
	2022	7	9	7 (78)	1 (11)	1 (11)	9	2 (22)	13
Overall total		22	30	14 (47)	14 (47)	2 (7)	29	11 (38)	22

^a MESQ= Mesquite and MOME = Mormon Mesa.

^b WE = willow flycatcher egg.

^c Only nests with at least one flycatcher egg were used in tallies and percentage calculations. Percentages are given in parentheses.

^d Parasitized nests include all nests that contained at least one flycatcher egg and one cowbird egg regardless of nest fate. Percentages in parentheses include only nests with at least one flycatcher egg and for which parasitism status could be determined.

^e Data presented are combined from Mesquite Parcel 1-A and Mesquite West West.



Figure 16. Left: Parasitized southwestern willow flycatcher nest containing two southwestern willow flycatcher eggs and one brown-headed cowbird nestling at nest 01B at Mesquite West West. Middle: Southwestern willow flycatcher fledgling from nest 05A at Mesquite West West. Right: Southwestern willow flycatcher fledglings from nest 13A at Mesquite West West

Nesting attempts were located for seven female southwestern willow flycatchers, of which six were known to have produced at least one egg. Of the seven females, three had one nesting attempt, and four had two nesting attempts. In total, 13 fledglings were produced from the eight nests that contained southwestern willow flycatcher eggs and had known outcomes. Productivity at Mesquite West was 1.63 young per nest in 2022, and fecundity was 1.83 young produced per female (Table 9).

Table 9. Southwestern Willow Flycatcher Nest Productivity and Fecundity at Mesquite West, 2019–2022

Year	No. Young Fledged	No. Nests with Known Outcome	Productivity Mean (SE) ^a	No. Females with Known Outcome	Fecundity Mean (SE) ^b
2019	5 ^c	8	0.63 (0.26)	5 ^d	0.80 (0.58)
2020	0	5	0	4	0
2021	3	6	0.50 (0.34)	3	1.00 (0.58)
2022	13 ^e	8	1.63 (0.26)	6 ^d	1.83 (0.54)
Total	21	27	0.78 (0.17)	18^f	1.00 (0.29)

^a Productivity calculations (number of young produced per nest) include nests that contained flycatcher eggs and had a known outcome. SE = standard error.

^b Fecundity calculations (number of young produced per female) include all females for which all nest outcomes were known. SE = standard error.

^c One fledgling associated with a female for which the fate of her subsequent nesting attempt is unknown is not included in the fecundity calculation.

^d One female that had one successful nest and one nest of unknown outcome is not included.

^e Two fledglings associated with a female for which the fate of her subsequent nesting attempt is unknown are not included in the fecundity calculation.

^f Two females that had one successful nest and one nest of unknown outcome are not included.

Three nest failures were documented at Mesquite West in 2022. Depredation was the cause of failure at one nest (33%), and the cause of failure for two nests (67%) was unknown (Table 10).

Table 10. Summary of Causes of Southwestern Willow Flycatcher Nest Failure at Mesquite West, 2022

Total No. of Nests	All Failed Nests	Depredated	Unknown
11	3	1 (33%)	2 (67%)

Note: All nesting attempts (those with and without southwestern willow flycatcher eggs) are included. Percentage of failed nests is shown in parentheses for each cause of failure. Depredated = nest empty or destroyed 2 days or more before anticipated fledge date.

Two of nine nests (22%) with southwestern willow flycatcher eggs and known parasitism status were brood parasitized by brown-headed cowbirds (Table 11). Nest 01B in Mesquite West West contained two southwestern willow flycatcher eggs and one brown-headed cowbird egg. Biologists attempted to addle the brown-headed cowbird egg via vigorous shaking; however, this egg hatched (see Figure 16), and the brown-headed cowbird nestling was subsequently removed from the nest. After removal of the brown-headed cowbird nestling, one of the two southwestern willow flycatcher eggs hatched; the nest produced one fledgling. Nest 13A contained three southwestern willow flycatcher eggs and one brown-headed cowbird egg; the brown-headed cowbird egg was replaced with a fake egg. Two of the three southwestern willow flycatcher eggs hatched; this nest produced two fledglings.

Table 11. Fates of Southwestern Willow Flycatcher Nests Parasitized by Brown-headed Cowbirds at Mesquite West, 2022

Nest ID	Outcome*
01B	2WE, 1CE in nest; CE addled. CE hatched; CN removed from nest. 1WE hatched; 1 flycatcher fledged.
13A	3WE, 1CE in nest; replaced CE with fake CE. 2WE hatched; 2 flycatchers fledged.

* WE = flycatcher egg(s), CE = cowbird egg(s), and CN = cowbird nestling(s).

3.3.1.1.2 Mormon Mesa

Biologists spent 12.9 observer-hours territory monitoring at Mormon Mesa Parcel 5-A in 2022; monitoring activities included determining residency status, observing the resident southwestern willow flycatcher, and banding one adult. Two adult southwestern willow flycatchers were documented at Mormon Mesa in 2022. The two adults comprised one territorial male and one individual for which residency and/or breeding status could not be confirmed. No breeding attempts were documented at Mormon Mesa in 2022. Ms. Nichols color-banded the territorial male.

3.3.1.2 YELLOW-BILLED CUCKOO

Yellow-billed cuckoo surveys across the Riparian Reserve Units in 2022 resulted in no yellow-billed cuckoo detections. One incidental yellow-billed cuckoo detection was recorded at Mormon Mesa Parcel 5-A on July 1, 2022, during southwestern willow flycatcher monitoring. This yellow-billed cuckoo was heard vocalizing a contact call just north of the Parcel boundary (Appendix A: Figure A-4). This bird was not detected during the two subsequent rounds of yellow-billed cuckoo surveys; however, NDOW personnel recorded a yellow-billed cuckoo detection during surveys north of Parcel 5-A on July 19. The distance between the two detections was estimated at 289 m (948 feet). Due to the timing of the detections (two different survey periods at least 12 days apart) and their relatively close proximity, these detections meet the criteria for a possible breeder at Mormon Mesa Parcel 5-A (Halterman et al. 2016). No incidental yellow-billed cuckoo detections were recorded at the Mesquite, Bunkerville, Riverside, Mormon Mesa South, or Muddy River Subunits in 2022.

3.3.2 Brown-headed Cowbird Control

Brown-headed cowbird netting was conducted over a period of 11 weeks, beginning May 11 and ending July 27 (Table 12). Netting occurred on 17 mornings, with a total of 39 separate net set-ups totaling 27.2 net-hours. No individual netting attempt lasted more than 1.2 hours. One to four nets were set up each morning, beginning at first light and ending by 10:00 am PDT. In total, 32 brown-headed cowbird captures were recorded: 20 males, 11 females, and one juvenile. Three of the 20 males were recaptures, as distinguished by the clipped tail feathers from their initial capture. Biologists used a small mammal guillotine to decapitate the 11 female and one juvenile brown-headed cowbirds immediately following extraction from the net. As detailed in Section 3.3.1, one brown-headed cowbird egg was added, one cowbird egg was replaced with a fake egg, and one brown-headed cowbird nestling was removed from a nest and euthanized (see Table 11).

One female southwestern willow flycatcher was captured during brown-headed cowbird netting activities on June 15, 2022. Brown-headed cowbird netting immediately ceased at this net location. On June 17, this female southwestern willow flycatcher was observed building a nest 62 m (203 feet) north of the brown-headed cowbird net location where she had been captured.

3.3.3 Point-Count Surveys

In total, 77 avian species were recorded across all the County’s properties during 2022 point-count surveys, and MSHCP-covered species were observed at each property.

3.3.3.1 RIPARIAN RESERVE UNITS

3.3.3.1.1 MSHCP Species

Of the eight avian species covered by the MSHCP, five were recorded during the 2022 point-count surveys: Arizona Bell’s vireo, blue grosbeak, phainopepla, southwestern willow flycatcher, and summer tanager. Additionally, an American peregrine falcon was incidentally detected on June 19 at Muddy River, and a yellow-billed cuckoo was incidentally detected on July 1 at the Mormon Mesa Riparian Reserve Unit (Table 13).

In addition to the eight covered bird species, the MSHCP also identifies seven evaluation bird species for which future viability is a concern and that may be considered for inclusion in subsequent phases or amendments to the MSHCP. Crissal thrasher (*Toxostoma crissale*) was recorded at several Bunkerville parcels, Parcel 5-A at Mormon Mesa, one parcel at the Mormon Mesa South Subunit, and two parcels in the Muddy River Subunit (see Table 13). Loggerhead shrike (*Lanius ludovicianus*) was recorded at one parcel each in the Bunkerville and Mormon Mesa Subunits (see Table 13).

For each species, the number of recorded individuals is listed for each set of connected parcels. To standardize the data and account for species that may be detected at greater distances than others (e.g., crissal thrasher), numbers reported in Table 13 only include birds detected within 100 m (328 feet) of a point-count location (GBBO 2003; Ralph et al. 1995).

Table 12. Number of Brown-headed Cowbirds Netted by Date at Mesquite West, 2022

Sex	May 11	May 14	May 17	May 21	May 24	May 28	May 30	Jun 4	Jun 10	Jun 15	Jun 22	Jun 29	Jul 3	Jul 6	Jul 13	Jul 20	Jul 27	Total
Male	0	2	0	2	1	0	3*	4*	0	0	4*	0	1	1	0	2	0	20
Female	1	0	2	1	1	0	0	1	0	1	2	0	1	1	0	0	0	11
Juvenile	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Total	1	2	2	3	2	0	3	5	0	1	6	0	2	3	0	2	0	32

* One male was a recapture.

Table 13. Number of Detections and Breeding Codes for MSHCP Avian Species Recorded at the Riparian Reserve Units During Point-Count Surveys, 2022

Subunit	Mesquite	Bunkerville		Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Parcel(s)	1-A	2-A through 2-G	2-I through 2-M	3-A and 3-B	5-A	6-A and 6-B	A-H
Arizona Bell's vireo	–	–	1 (PO)	5 (PO)	4 (PO)	X	2 (PO)
Blue grosbeak	–	4 (PO)	2 (PO)	1 (PO)	–	3 (PO)	1 (PO)
Crissal thrasher	–	3	1 (PO)	–	2 (PO)	2	1 (PO)
Loggerhead shrike	–	–	2 (PO)	–	X (CO)	–	–
Phainopepla	–	1	–	2	–	–	2
Summer tanager	–	–	–	–	1 (PO)	–	–
Southwestern willow flycatcher	2 (CO)*	–	–	–	–	–	–

Note: X = species recorded at that unit but never within 100 m (328 feet) of a point-count location; CO = Breeding confirmed—adult observed carrying nesting material, adult at a nest, or a fledgling observed; PO = breeding possible—individual(s) singing in appropriate habitat at that unit during the breeding season.

* Breeding was confirmed for this species during monitoring for federally listed birds but not during point-count surveys.

SWCA documented multiple southwestern willow flycatcher nesting attempts at Mesquite West in 2022. Several loggerhead shrike fledglings were observed at Mormon Mesa Parcel 5-A, confirming breeding at that site. Breeding could not be confirmed in 2022 for any of the other MSHCP species. Arizona Bell's vireo, blue grosbeak, crissal thrasher, and summer tanager were suspected of breeding at various Riparian Reserve Units (refer to breeding codes in Table 13; note that a species without a breeding code does not indicate that the species was not breeding in a particular subunit or set of parcels, but only that no evidence of such was recorded).

3.3.3.1.2 Non-MSHCP-listed Species

During the three rounds of point-count surveys in 2022, biologists recorded 66 non-MSHCP avian species across all the Riparian Reserve Units (Table 14). To account for species that may be detected at greater distances than others, numbers reported in Table 14 only include birds detected within 100 m (328 feet) of a point-count location (GBBO 2003; Ralph et al. 1995).

Of the 66 non-MSHCP species, six were recorded at each of the six subunits: Abert's towhee (*Pipilo aberti*), brown-headed cowbird, Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), yellow-breasted chat (*Icteria virens*), and yellow warbler (*Setophaga petechia*). Although some species (e.g., Cassin's vireo [*Vireo cassinii*], western tanager [*Piranga ludoviciana*], Wilson's warbler [*Cardellina pusilla*], and yellow-rumped warbler [*Setophaga coronata*]) were likely migrating through the area on their way to breeding grounds farther north or at higher elevations, most of the species recorded during point-count surveys are known to breed in the Mojave Desert. While breeding could not be confirmed for most of the species recorded at the Riparian Reserve Units, it is assumed that many may have bred or attempted to breed in the Riparian Reserve Units in 2022.

Breeding was confirmed for common raven (*Corvus corax*), house sparrow (*Passer domesticus*), Lucy's warbler (*Leiothlypis luciae*), mourning dove, rock wren (*Salpinctes obsoletus*), and Say's phoebe (*Sayornis saya*), for which biologists recorded the observation of a fledgling, an adult carrying food, or an adult at a nest. Additionally, 26 other species were recorded singing or performing territorial displays, indicating that breeding for those species was possible within the Riparian Reserve Units (though some species may also exhibit either of these behaviors during migration).

Species richness varied between the six Riparian Reserve Subunits. The Bunkerville Subunit showed the highest avian species richness, with 48 species recorded, while the Mesquite Subunit yielded the lowest species richness, with 10 species recorded. The five most commonly detected species across all the Riparian Reserve Units were cliff swallow (*Petrochelidon pyrrhonota*), Abert's towhee, mourning dove, Lucy's warbler, and Gambel's quail.

In addition to the American peregrine falcon mentioned above, two other species were recorded incidentally at the Riparian Reserve Units during southwestern willow flycatcher surveys: a Yuma Ridgway's rail (*Rallus obsoletus yumanensis*) was detected at Bunkerville Parcel 2-J on May 23, and on June 23, an active green heron (*Butorides virescens*) nest was observed along the backwater slough on the eastern border of Mormon Mesa South Parcel 6-A. Yuma Ridgway's rail (formerly Yuma clapper rail [*Rallus longirostris yumanensis*]) is listed as endangered under the ESA (USFWS 1967). This species prefers cattail (*Typha* spp.) or bulrush (*Scirpus* spp.) marshes interspersed with areas of shallow open water, surrounded by riparian trees and/or shrubs (USFWS 2010). The habitat in the section of Parcel 2-J where the Yuma Ridgway's rail was heard singing for a prolonged period on June 23 consisted of a 10-m-wide open marsh with cattails present along the edge of the inundated area, bordered by a narrow strip of tamarisk and mesquite trees.

Table 14. Number of Detections and Breeding Codes for Non-MSHCP Avian Species Recorded at the Riparian Reserve Subunits During Point-Count Surveys, 2022

Common Name	Scientific Name	Clark County Riparian Reserve Subunits					
		Mesquite	Bunkerville	Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Spotted sandpiper	<i>Actitis macularius</i>	–	1	–	–	–	–
White-throated swift	<i>Aeronautes saxatalis</i>	–	–	–	–	–	X
Red-winged blackbird	<i>Agelaius phoeniceus</i>	X (PO)	17 (PO)	7	1	1 (PO)	–
Black-throated sparrow	<i>Amphispiza bilineata</i>	–	–	2 (PO)	–	–	1
Mallard	<i>Anas platyrhynchos</i>	–	3	–	–	–	–
Black-chinned hummingbird	<i>Archilochus alexandri</i>	–	1	–	–	–	–
Great egret	<i>Ardea alba</i>	–	X	–	–	–	–
Great blue heron	<i>Ardea herodias</i>	–	X	X	–	–	X
Verdin	<i>Auriparus flaviceps</i>	–	18 (PO)	12 (PO)	2	2 (PO)	5 (PO)
Cedar waxwing	<i>Bombycilla cedrorum</i>	–	–	–	–	–	4
Canada goose	<i>Branta canadensis</i>	–	X	4	–	–	–
Red-tailed hawk	<i>Buteo jamaicensis</i>	–	X	–	–	–	X
Gambel's quail	<i>Callipepla gambelii</i>	2 (PO)	28 (PO)	3 (PO)	2 (PO)	X	11 (PO)
Anna's hummingbird	<i>Calypte anna</i>	–	2 (PO)	–	–	–	1 (PO)
Costa's hummingbird	<i>Calypte costae</i>	–	–	–	–	–	1
Wilson's warbler	<i>Cardellina pusilla</i>	–	2	4	–	–	–
Turkey vulture	<i>Cathartes aura</i>	–	3	X	–	–	X
Canyon wren	<i>Catherpes mexicanus</i>	–	–	–	–	–	X
Killdeer	<i>Charadrius vociferus</i>	–	6	2	X	–	–
Lesser nighthawk	<i>Chordeiles acutipennis</i>	–	–	3	3	–	X
Western Wood-Pewee	<i>Contopus sordidulus</i>	–	–	–	–	–	1
Common raven	<i>Corvus corax</i>	–	3 (CO)	X	X	X	1
Ladder-backed woodpecker	<i>Dryobates scalaris</i>	–	1	–	1	–	1 (PO)
Western flycatcher	<i>Empidonax occidentalis</i>	–	–	–	1	–	–

Common Name	Scientific Name	Clark County Riparian Reserve Subunits					
		Mesquite	Bunkerville	Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Prairie falcon	<i>Falco mexicanus</i>	–	–	–	–	–	X
American kestrel	<i>Falco sparverius</i>	–	1	–	–	–	–
American coot	<i>Fulica americana</i>	–	1	–	–	–	–
Greater roadrunner	<i>Geococcyx californianus</i>	–	1	5 (PO)	1 (PO)	X	X (PO)
Common yellowthroat	<i>Geothlypis trichas</i>	3 (PO)	5 (PO)	–	2 (PO)	–	–
House finch	<i>Haemorhous mexicanus</i>	–	19	7 (PO)	–	X (PO)	10 (PO)
Barn swallow	<i>Hirundo rustica</i>	–	5	10	–	–	–
Yellow-breasted chat	<i>Icteria virens</i>	5 (PO)	4 (PO)	7 (PO)	6 (PO)	4 (PO)	2 (PO)
Bullock's oriole	<i>Icterus bullockii</i>	–	X	–	X	–	3 (PO)
Lucy's warbler	<i>Leiothlypis luciae</i>	–	28 (PO)	7 (CO)	4 (PO)	2 (PO)	11 (PO)
Song sparrow	<i>Melospiza melodia</i>	8 (PO)	2 (PO)	–	3 (PO)	X	1 (PO)
Northern mockingbird	<i>Mimus polyglottos</i>	–	6 (PO)	–	–	–	2 (PO)
Brown-headed cowbird	<i>Molothrus ater</i>	3 (PO)	7 (PO)	18 (PO)	3 (PO)	1	7 (PO)
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>	–	6 (PO)	4 (PO)	2 (PO)	1 (PO)	2 (PO)
House sparrow	<i>Passer domesticus</i>	–	8	–	–	–	22 (CO)
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	–	62	38	–	–	–
Double-crested cormorant	<i>Phalacrocorax auratus</i>	–	X	X	–	–	–
Abert's towhee	<i>Pipilo aberti</i>	2	35 (PO)	7 (PO)	6 (PO)	4	31 (PO)
Western tanager	<i>Piranga ludoviciana</i>	–	X (PO)	2 (PO)	–	–	1
White-faced ibis	<i>Plegadis chihi</i>	–	–	X	–	–	–
Black-tailed gnatcatcher	<i>Poliophtila melanura</i>	–	1	–	–	–	1
Great-tailed grackle	<i>Quiscalus mexicanus</i>	–	5 (PO)	X	–	–	–
Bank swallow	<i>Riparia riparia</i>	–	1	–	–	–	–
Rock wren	<i>Salpinctes obsoletus</i>	–	–	3 (CO)	–	–	X (PO)
Black phoebe	<i>Sayornis nigricans</i>	–	–	–	–	–	1 (PO)
Say's phoebe	<i>Sayornis saya</i>	–	8 (CO)	1 (PO)	–	–	1

Common Name	Scientific Name	Clark County Riparian Reserve Subunits					
		Mesquite	Bunkerville	Riverside	Mormon Mesa	Mormon Mesa South	Muddy River
Yellow-rumped warbler	<i>Setophaga coronata</i>	–	–	–	1	–	–
Yellow warbler	<i>Setophaga petechia</i>	6 (PO)	5 (PO)	2 (PO)	4 (PO)	2 (PO)	1
Townsend's warbler	<i>Setophaga townsendi</i>	–	–	–	1	–	–
Lesser goldfinch	<i>Spinus psaltria</i>	–	4	1	–	–	1
Brewer's sparrow	<i>Spizella breweri</i>	–	1 (PO)	–	–	–	–
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	–	24	4	3	1	2
Eurasian collared-dove	<i>Streptopelia decaocto</i>	–	3	X (PO)	1 (PO)	–	4 (PO)
Western meadowlark	<i>Sturnella neglecta</i>	–	1 (PO)	–	–	X (PO)	–
Violet-green swallow	<i>Tachycineta thalassina</i>	–	22	2	4	–	2
Bewick's wren	<i>Thryomanes bewickii</i>	3 (PO)	–	–	3 (PO)	3 (PO)	6 (PO)
Cassin's vireo	<i>Vireo cassinii</i>	–	–	–	–	–	1
Warbling vireo	<i>Vireo gilvus</i>	–	–	–	2 (PO)	–	1 (PO)
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	–	1	–	–	–	–
White-winged dove	<i>Zenaida asiatica</i>	–	–	–	–	–	1 (PO)
Mourning dove	<i>Zenaida macroura</i>	2 (PO)	33 (CO)*	5 (PO)	6 (PO)	4 (PO)	11 (PO)
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	–	2	–	–	–	–

Note: X = species recorded at that unit but never within 100 m (328 feet) of a point-count location; CO = Breeding confirmed—adult observed carrying nesting material, adult at a nest, or a fledgling observed; PO = breeding possible—individual(s) singing or performing a territorial display in appropriate habitat at that unit during the breeding season.

* Breeding for this species was confirmed during southwestern willow flycatcher surveys but not during point-count surveys.

3.3.3.2 BCCE

3.3.3.2.1 MSHCP-listed Species

One of the eight MSHCP-covered bird species was recorded during point-count surveys in the BCCE in 2022: phainopepla. Biologists also recorded two evaluation bird species: loggerhead shrike and LeConte’s thrasher (*Toxostoma lecontei*) were each recorded from one point-count location in 2022 (Table 15). While breeding could not be confirmed for either species in 2022, LeConte’s thrasher nests have been documented in the BCCE during previous survey years (SWCA 2020).

Table 15. Number of Detections and Breeding Codes for MSHCP Evaluation Species Recorded at the BCCE during Point-Count Surveys, 2022

Common Name	Scientific Name	Total Detections	Detections Within 100 m	Breeding Codes
Loggerhead shrike	<i>Lanius ludovicianus</i>	1	0	–
LeConte’s thrasher	<i>Toxostoma lecontei</i>	1	0	–
Phainopepla	<i>Phainopepla nitens</i>	1	0	–

3.3.3.2.2 Non-MSHCP-listed Species

SWCA biologists recorded nine avian species not listed under the MSHCP across the BCCE point-count locations over all three rounds of point-count surveys in 2022 (Table 16). These data are presented as total detections and detections within 100 m (328 feet) of the observer to account for species with different detection probabilities and reduce bias towards species (e.g., common raven) that are more conspicuous at greater distances (GBBO 2003; Ralph et al. 1995). Of these nine species recorded during point-count surveys, six were recorded within 100 m (328 feet) of a point-count location. The two most commonly detected species at the BCCE, regardless of distance from surveyor, were common raven and horned lark (*Eremophila alpestris*) (see Table 16). The two species most commonly recorded within 100 m (328 feet) of a point-count location were horned lark and black-throated sparrow (*Amphispiza bilineata*).

Although some of the species detected at the BCCE in 2022 were likely migrating through the area on their way to breeding grounds farther north or at higher elevations (e.g., Brewer’s sparrow [*Spizella breweri*] and gray flycatcher [*Empidonax wrightii*]), most of these species are known to breed in the Mojave Desert and may have bred or attempted to breed within the BCCE boundary in 2022. For example, horned lark and black-throated sparrow were never confirmed to be breeding within the BCCE during the 2022 point-count surveys; however, these species are two of the most common breeders in the Mojave Desert scrub habitats, and they undoubtedly breed within the BCCE boundary.

Confirmation of breeding was recorded for one species not covered under the MSHCP: common raven. Four other species were recorded singing at the BCCE, which indicates that breeding for those species was possible (though some species sing during migration) (see Table 16). Species lacking a breeding code in Table 16 may have bred within the BCCE; however, no evidence of breeding was recorded.

Table 16. Number of Detections and Breeding Codes for Non-MSHCP-listed Species Recorded at the BCCE during Point-Count Surveys, 2022

Common Name	Scientific Name	Total Detections	Detections Within 100 m	Breeding Codes*
Black-throated sparrow	<i>Amphispiza bilineata</i>	6	3	PO
Red-tailed hawk	<i>Buteo jamaicensis</i>	4	0	–
Cactus wren	<i>Campylorhynchus brunneicapillus</i>	1	0	PO
Common raven	<i>Corvus corax</i>	23	1	CO
Gray flycatcher	<i>Empidonax wrightii</i>	1	1	–
Horned lark	<i>Eremophila alpestris</i>	12	8	PO
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>	2	2	PO
Brewer’s sparrow	<i>Spizella breweri</i>	1	1	–
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	1	0	–

* CO = Breeding confirmed—adult observed carrying nesting material; PO = breeding possible—individual(s) singing in appropriate habitat during the breeding season.

4 EVALUATION/DISCUSSION OF RESULTS

This project builds on a baseline avian dataset for the County’s MSHCP properties. Point-count surveys across the Riparian Reserve Units resulted in a total of 77 avian species detected, including eight MSHCP-covered and evaluation species; one additional MSHCP-covered species and two non-MSHCP-listed species were detected incidentally in 2022. Point counts across the BCCE yielded 12 total avian species, including three MSHCP-covered and evaluation species. Goals identified in both the Riparian Reserve Unit Management Plan (Clark County 2015) and the BCCE Management Plan (Clark County 2019) include managing these properties to protect MSHCP-covered species. Baseline vegetation community and structure data for the MSHCP properties are necessary to inform habitat management interventions for managing avian species at these properties. This section includes a closer analysis of avian species presence and distribution for each set of connected parcels within the Riparian Reserve Units and at the BCCE, as well as a qualitative assessment of existing vegetation conditions therein.

4.1 Mesquite

4.1.1 Parcel 1-A

More than 90% of the vegetation at Mesquite Parcel 1-A consists of narrowleaf willows (*Salix exigua*), most of which are 4–6 m (13.1–19.7 feet) in height (Figure 17); the remainder of the vegetation consists of tamarisk 4–6 m (13.1–19.7 feet) in height and patches of narrowleaf willows approximately 3–4 m (9.8–13.1 feet) in height. Parcel 1-A generally has canopy closure > 90%. Intermittently throughout the breeding season, irrigation return water ran generally from north to south throughout all but the southeast corner of Parcel 1-A. On days when there were no return flows, the site still contained saturated soils. This parcel contains the best habitat for southwestern willow flycatchers within the County’s Riparian Reserve Units. All 4.0 ha (9.9 acres) originally delineated for surveys by the County were considered habitat suitable for federally listed bird surveys in 2019 through 2022 (see Figure 3).



Figure 17. Typical narrowleaf willow habitat at Mesquite Parcel 1-A.

Habitat quality within Parcel 1-A is evidenced by the presence of multiple southwestern willow flycatcher territories (see Section 3.3.1 and Appendix A: Figure A-1). Parcel 1-A occupies most of the eastern portion of a larger study site known as Mesquite West, which has been monitored annually by SWCA (under various contracts) and NDOW biologists since 2003 (McLeod and Pellegrini 2013, 2014; NDOW, unpublished data). From 2003 through 2012, Mesquite West had anywhere from 6 to 30 resident adult southwestern willow flycatchers each year (McLeod and Pellegrini 2013). Hydrologic conditions within Parcel 1-A are highly variable from year to year, and soil moisture levels were noted to be decreasing in July 2020. All documented southwestern willow flycatcher nesting attempts failed in 2020, and the increasingly arid conditions observed toward the end of the nesting season may have been a contributing factor in southwestern willow flycatcher nests being abandoned or deserted (see Table 8). It appeared that more water was present in Mesquite West in 2021 than in 2020, and successful southwestern willow flycatcher breeding attempts were again documented. In 2022, water levels remained higher than in 2020, and more successful breeding attempts were documented than in the previous three seasons combined. Monsoon storms in late July of 2022 introduced up to a foot of new sediment into the northeastern portion of the habitat, which appears to have altered water flow within the site. How this altered water flow will affect habitat within Mesquite West is yet to be determined.

Yellow-billed cuckoo breeding was confirmed at Parcel 1-A in 2019, and there were four cuckoo detections within Parcel 1-A in 2020. However, no yellow-billed cuckoos were detected in Parcel 1-A in 2021 or 2022 during species-specific surveys or incidentally while conducting other work.

Though not an MSHCP-covered species, yellow warbler, a Mojave riparian indicator species (GBBO 2010), was also recorded singing multiple times within Mesquite Parcel 1-A in 2022, further indicating that Parcel 1-A has some of the best quality habitat of any of the parcels within the Riparian Reserve Units.

4.2 Bunkerville

The habitat at the Bunkerville Subunit is extremely varied, ranging from highly disturbed areas to mostly intact, native habitat. In vegetated areas, dominant species range from young, sparsely distributed arrowweed (*Pluchea sericea*) in sandy soil, to mature monotypic tamarisk, to dense stands of narrowleaf willow. The following section describes the habitat and avian detections within each unique set of connected parcels in the Bunkerville subunit: 1) Parcels 2-A through 2-G, 2) Parcels 2-I through 2-M.

4.2.1 **Parcels 2-A through 2-G**

Bunkerville Parcels 2-A through 2-G contain mostly shrubby habitat with frequent openings that have been scoured by flooding or cleared by anthropogenic activities. Parcels 2-A through 2-E are mostly within the active floodplain of the Virgin River, which experiences frequent high-flow events. These parcels therefore consist largely of sandy bare ground dotted with sapling arrowweed and tamarisk (Figure 18). In 2019, higher than normal winter precipitation yielded significant spring runoff that scoured portions of these parcels, creating more open, unvegetated habitat (Figure 19), and affected the habitat at point-count location BV-7 (Figure 20). Of the 9.8 ha (24.3 acres) originally delineated for surveys by the County, 1.3 ha (3.2 acres) were scoured by the 2019 flooding, and 0.3 ha (0.7 acre) was burned in a wildfire late in 2017 (SWCA 2017a). This 1.6 ha (3.9 acres) of previously tamarisk-dominated woodland were excluded from surveys starting in 2019.



Figure 18. Examples of flood-disturbed habitat at Bunkerville Parcels 2-A through 2-E.



Figure 19. Evidence of the 2019 flooding at Bunkerville Parcels 2-A through 2-E.



Figure 20. BV-7, facing north, in 2017 (left) and in 2020 (right).

Parcels 2-A through 2-F do not currently contain vegetation that resembles typical southwestern willow flycatcher or yellow-billed cuckoo breeding habitat, and, through 2020, neither species had been recorded within these parcels. In 2021, however, a yellow-billed cuckoo was recorded immediately south of Parcel 2-B in a patch of young narrowleaf willow. The vegetation south of Parcels 2-B where the cuckoo was incidentally observed contains fairly dense narrowleaf willow and may provide potential southwestern willow flycatcher or yellow-billed cuckoo nesting habitat. In 2022, one willow flycatcher detection was recorded in a sparsely vegetated patch of tamarisk in Parcel 2-D. This flycatcher responded weakly to survey playback and is suspected to have been a northbound migrant.

Parcels 2-A through 2-F lack the multistoried canopy that is generally used by yellow-billed cuckoos, and although the minimum canopy height for breeding southwestern willow flycatchers is considered to be 3 m (Sogge et al. 2010), occupied southwestern willow flycatcher sites along the Virgin River in 2003–2011 had median canopy heights of 5–6 m (16.4–19.7 feet) (McLeod and Pellegrini 2013). There is generally very little continuous canopy at this height within Parcels 2-A through 2-G. Median canopy closure of occupied southwestern willow flycatcher sites along the Virgin River from 2003 to 2011 was > 90% (McLeod and Pellegrini 2013). Portions of the site exhibit canopy closure that reaches 80%, but most of the site is much more open.

Bunkerville Parcels 2-F and 2-G are dominated by anthropogenically disturbed lands and include large areas that have been completely bladed and cleared of native vegetation (Figure 21). Any regrowth in this area is generally patchy tamarisk and arrowweed, 2–4 m (6.6–13.1 feet) in height, with little continuous canopy. Much of the southern portion of Bunkerville Parcel 2-F is currently being used for growing alfalfa (*Medicago sativa*) and grazing cattle (see Figure 4). The areas of Parcels 2-F and 2-G that have not been disturbed by anthropogenic activities are dominated by 1- to 3-m- (3.3- to 9.8-foot-) tall mule-fat (*Baccharis salicifolia*), tamarisk, and intermittent arrowweed (Figure 22).

There is a small patch of narrowleaf willow in Parcel 2-G (Figure 23). This patch consists largely of narrowleaf willow, with intermittent tamarisk and mule-fat, all of which ranges mostly between 3 and 4 m (9.8 and 13.1 feet) in height. This area of willow has intermittent surface water and relatively dense canopy cover (~75%) but is less than 0.4 ha (1 acre) in size, which is likely too small to support most of the MSHCP-covered bird species, including southwestern willow flycatcher (Sogge et al. 2010). A few mature Goodding’s willows (*Salix gooddingii*) and screwbean mesquite are also present within the Virgin River floodplain throughout Parcels 2-A through 2-G.



Figure 21. Anthropogenically disturbed habitat at Bunkerville Parcels 2-F and 2-G.



Figure 22. Examples of young mule-fat and arrowweed at Bunkerville Parcels 2-F and 2-G.



Figure 23. Monotypic tamarisk at Bunkerville Parcel 2-F (left) and the narrowleaf willow patch at Bunkerville Parcel 2-G (right).

Three MSHCP-covered and evaluation avian species were recorded at Bunkerville Parcels 2-A through 2-G: blue grosbeak, crissal thrasher, and phainopepla. Blue grosbeak was detected from four of seven point-count locations surveyed within this set of parcels in 2022, while phainopepla was detected at three of the seven point-count locations. While blue grosbeak is considered a desert riparian obligate, it appears that they can tolerate more open, scrubby habitat than can some of the other MSHCP riparian species. Crissal thrasher, an evaluation species, was also recorded from three of the seven point-locations within these parcels in 2022. This species prefers dense, scrubby vegetation often near water but is not a riparian obligate species.

4.2.2 *Parcels 2-I through 2-M*

Much of Bunkerville Parcels 2-I through 2-M appears to be subject to regular flooding, and some of the most abundant plants within these two parcels are sapling arrowweed and tamarisk less than 3 m (9.8 feet) tall (Figure 24). Additionally, much of the area is relatively unvegetated in comparison to other riparian habitat in the desert Southwest. This is likely due, at least in part, to regular flood events, including flooding in the spring of 2019. Of the 8.1 ha (20.1 acres) delineated for surveys by the County prior to 2019 surveys, 0.9 ha (2.2 acres) were scoured by spring flooding, leaving unvegetated bare ground (Figure 25). These areas were excluded from southwestern willow flycatcher and yellow-billed cuckoo surveys starting in 2019.



Figure 24. Typical open, scrubby habitat at Bunkerville Parcels 2-I and 2-J.



Figure 25. Evidence of the 2019 flooding at Bunkerville Parcel 2-I.

Bunkerville Parcels 2-I through 2-M host very few large native riparian trees, such as those used by southwestern willow flycatcher and yellow-billed cuckoo. Most of the mature riparian vegetation within these parcels consists of tamarisk and screwbean mesquite 2–5 m (6.6–16.4 feet) tall (Figure 26), and these stands have virtually no continuous canopy cover or nearby surface water. Additionally, much of the tamarisk is dead or dying, due to defoliation by tamarisk leaf beetles (*Diorhabda* spp.) or herbicidal treatment by the National Park Service (personal communication, C. Deuser, National Park Service, with Justin Streit, Project Manager, SWCA, August 28, 2019) (Figure 27). While tamarisk can provide habitat for desert riparian bird species, much of the tamarisk at Bunkerville Parcels 2-I and 2-J does not, due largely to its poor health at these two parcels. In 2022, a 1.8-ha (4.0-acre) polygon in the northwest corner of Parcel 2-I was excluded from southwestern willow flycatcher and yellow-billed cuckoo surveys due to tamarisk defoliation and lack of continuous canopy (Figure 28).



Figure 26. Open tamarisk (left) and screwbean mesquite (right) habitat at Bunkerville Parcels 2-I and 2-J.



Figure 27. Tamarisk stand treated with herbicide at Bunkerville Parcel 2-J, before (left) and after (right) treatment.



Figure 28. Defoliated tamarisk in the northwest corner of Parcel 2-I excluded from southwestern willow flycatcher and yellow-billed cuckoo surveys in 2022.

No southwestern willow flycatchers or yellow-billed cuckoos were detected during surveys at these parcels in 2022, and Bunkerville Parcels 2-I through 2-M do not currently contain any potential breeding habitat for southwestern willow flycatcher or yellow-billed cuckoo. Despite a lack of native trees, Parcels 2-I through 2-M do have flowing channels, a pond, and a wet meadow/wetland with emergent vegetation (Figure 29), all of which could support native riparian habitat in the future.



Figure 29. Open water (left) and wet meadow (right) habitats at Bunkerville Parcel 2-J.

The wet meadow is in the east half of Parcel 2-J and is composed largely of sedges (Cyperaceae family) and wetland grasses, with scattered Goodding’s willow and tamarisk. The wet meadow is unique within the County’s reserve system and could be an area to target for riparian restoration. In contrast with previous years, no cattle or recent sign thereof were observed within the wet meadow habitat at Parcel 2-J in 2021, and, subsequently, there appeared to be more vegetative cover than had been observed in previous years (Figure 30). In 2022, the meadow area was dry through late June, and much of the vegetation was dead or dying (see Figure 30). Water was again noted in the meadow area on June 28.



Figure 30. Left: Increased vegetative cover, relative to prior years, was noted in the wet meadow areas of Parcel 2-J in 2021. Right: Dead or dying vegetation in dry meadow area in Parcel 2-J in 2022.

Parcels 2-L and 2-M are characterized by isolated and/or narrow patches of riparian vegetation containing tamarisk, narrowleaf willow, and Goodding’s willow adjacent to wet meadows, marshes, and open water features (Figures 31 and 32). There were no areas mapped as potential yellow-billed cuckoo or southwestern willow flycatcher habitat within Parcel 2-K.

Outside the areas mapped as potential yellow-billed cuckoo and southwestern willow flycatcher habitat in Parcels 2-L and 2-M, vegetation consists primarily of riparian scrub dominated by arrowweed, and soils in these areas were generally dry in 2022 (Figure 33). Bunkerville Parcels 2-L and 2-M do not currently provide habitat for southwestern willow flycatcher or yellow-billed cuckoo; however, future restoration actions, including changes in vegetation and water management, could improve the habitat potential for these species within these areas.



Figure 31. Left: Tall, dense tamarisk along a backwater feature in Parcel 2-M provides potential southwestern willow flycatcher breeding habitat. Right: Defoliating tamarisk along the same backwater feature in Parcel 2-M in June 2022.



Figure 32. Goodding's and narrowleaf willow habitat in Bunkerville Parcel 2-M.



Figure 33. Typical open, scrubby habitat at Bunkerville Parcels 2-L and 2-M.

Two MSHCP-covered bird species (Arizona Bell's vireo and blue grosbeak) and two MSHCP evaluation bird species (loggerhead shrike and crissal thrasher) were recorded within Bunkerville Parcels 2-I through 2-M during 2022 point-count surveys.

4.3 Riverside

Much like Bunkerville Parcels 2-I and 2-J, Riverside Parcels 3-A and 3-B are composed mostly of the open, scrubby habitat typically found in riparian areas that experience frequent flooding (Figure 34). Also like Parcels 2-I and 2-J, the Riverside Subunit was subjected to substantial seasonal runoff associated with above-average winter precipitation in the Virgin River watershed in 2019. The 2019 flooding removed portions of a large, contiguous patch of tamarisk at the northern end of the Riverside Subunit. Subsequently, of the 5.3 ha (13.1 acres) that the County identified for federally listed bird surveys, 3.9 ha (9.6 acres) were deemed suitable for surveys by SWCA. The survey areas consisted of two general vegetation types: 1) relatively contiguous tamarisk 3–4 m (9.8–13.1 feet) in height, with canopy closure < 50%, and 2) a strip, generally less than 5 m (16.4 feet) wide, of 3- to 4-m- (9.8- to 13.1-feet-) tall narrowleaf willow along an irrigation ditch (Figure 35).



Figure 34. Scrubby, open habitat within the floodplain at Riverside Parcels 3-A and 3-B.



Figure 35. Narrowleaf willow along the irrigation ditch at Riverside Parcels 3-A and 3-B.

As of 2018, there were also large areas of dense 2-m- (6.6-foot-) tall arrowweed and fairly dense 2- to 4-m- (6.6- to 13.1-foot-) tall screwbean and honey mesquite (*Prosopis glandulosa*) (Figure 36). However, between the 2018 and 2019 surveys, most of this largest patch of mesquite was cut down by an unknown party (see Figure 36). Regrowth of these mesquite trees in Parcel 3-A was observed from 2020 through 2022 (Figure 37).

Three MSHCP-covered avian species were recorded at the Riverside Subunit: Arizona Bell’s vireo, blue grosbeak, and phainopepla. The MSHCP identifies blue grosbeak and phainopepla as capable of occupying habitat other than desert riparian, and blue grosbeak can occupy open riparian habitat (CCDCP and USFWS 2000). Phainopepla prefers shrub- or mesquite-dominated habitats and is not a desert riparian obligate, so its presence at the Riverside Subunit is not surprising.

Arizona Bell’s vireo is a desert riparian obligate. This species can also occupy dense mesquite habitat, and Arizona Bell’s vireos were regularly heard singing and seen foraging in screwbean and honey mesquite at the Riverside Subunit. Arizona Bell’s vireo was the third-most detected species at the Riverside Subunit (up from the sixth-most detected species in 2021).



Figure 36. Mesquite patch at Riverside Parcels 3-A and 3-B before (showing the location from where the right photo was taken; view facing north) (left) and after cutting in 2019 (view facing northwest) (right).



Figure 37. Mesquite patch at RS-5, view facing west, showing dense growth in 2018 (left), and regrowth in 2020 following thinning (right).

The Riverside Subunit does not currently contain vegetation that resembles typical southwestern willow flycatcher or yellow-billed cuckoo breeding habitat. The patch of narrowleaf willows along the irrigation ditch is generally not wide enough to provide suitable breeding habitat, and the patches of tamarisk are dry and open and do not have the saturated soils typical of southwestern willow flycatcher breeding habitat. Surface water at the Riverside Subunit is restricted to the active river channel and the irrigation ditch along the east side of the Subunit. Furthermore, the Riverside Subunit completely lacks the mature vegetation and multistoried canopy that are generally required by yellow-billed cuckoo.

4.4 Mormon Mesa

Since its acquisition by the County, Parcel 5-A in the Mormon Mesa Subunit has been largely dominated by monotypic tamarisk. However, much of this vegetation has died or is dying as the result of defoliation by tamarisk leaf beetles. In 2018, the County masticated 1.7 ha (4.3 acres) of dead tamarisk (Figure 38) and in 2020 masticated an additional 14.6 ha (36.0 acres) (Figure 39). These areas of masticated tamarisk were not surveyed for southwestern willow flycatcher or yellow-billed cuckoo in 2022 (see Figure 6).

Narrow patches of mostly dead and dying tamarisk remain outside the masticated area along the eastern and southern boundary of the Mormon Mesa Subunit (see Figure 39, right), but these areas do not provide the vegetative or hydrologic conditions used by nesting southwestern willow flycatchers or yellow-billed cuckoos and were not surveyed.



Figure 38. Dead and dying tamarisk at Parcel 5-A within the Mormon Mesa Subunit. Right: Overview of eastern Parcel 5-A after mastication in 2018.



Figure 39. Left: Masticated tamarisk at Parcel 5-A within the Mormon Mesa Subunit in 2022. Right: Narrow patches of mostly dead and dying tamarisk remain outside the masticated area within Parcel 5-A at the Mormon Mesa Subunit.

An approximately 5-ha (13-acre) patch of screwbean mesquite and arrowweed shrubland is present in the southwest corner of this Subunit, and some large Goodding’s willows and small patches of narrowleaf willows are present in the northwest corner. Seven restoration plots are also scattered throughout the northwest corner of the Mormon Mesa Subunit; in 2014, the County cleared non-native tamarisk and planted native vegetation within these plots (Figure 40; see Appendix A: Figure A-3). SWCA biologists observed cattle within multiple restoration plots at the Mormon Mesa Subunit in 2021. Cattle activity increased in 2022 as access to the restoration plots became easier, and cattle and associated browsing and trampling of the vegetation were routinely recorded in and around the restoration plots in 2022 (Figure 41).



Figure 40. Sample habitat within restoration plots at the Mormon Mesa Subunit.



Figure 41. Signs of cattle presence within restoration plots at the Mormon Mesa Subunit in 2022.

Although southwestern willow flycatchers successfully nested in one of the County’s restoration plots at Parcel 5-A in 2020 (SWCA 2020) (Figure 42), the lone male detected and subsequently monitored in 2021 was unsuccessful in attracting a mate; therefore, no nesting attempts were documented in the Mormon Mesa Subunit in 2021. In 2022, one unpaired male occupied a territory that encompassed restoration plot B (see Appendix A: Figure A-3) in the northern portion of Parcel 5-A as well as habitat to the north of the Parcel 5-A boundary. A second southwestern willow flycatcher was detected in restoration plot B on June 27, after the first territorial male was no longer detected; this second bird did not display territorial behavior and was not detected thereafter. Despite the lack of nesting attempts in 2021 and 2022, this habitat still appears suitable for southwestern willow flycatcher (see Figure 42).



Figure 42. Goodding's and narrowleaf willow habitat in the southwestern willow flycatcher-occupied restoration plot in Mormon Mesa Parcel 5-A.

While tamarisk can provide habitat for desert riparian species, the dead or dying tamarisk at the Mormon Mesa Subunit has less benefit to wildlife than does native vegetation or live tamarisk. This is corroborated by the fact that the Mormon Mesa Subunit yielded the lowest species richness of any of the subunits during the 2017, 2019, and 2021 point-count surveys (surveys were not conducted at Mormon Mesa in 2018) and the second lowest species richness in 2020 and 2022. In 2022, the newly acquired Mormon Mesa South was the only Subunit that displayed less species richness than the Mormon Mesa Subunit. The dying monotypic tamarisk stands at Mormon Mesa provide less concealment from predators and are relatively hot and dry compared to living vegetation. Reduced canopy cover results in decreased thermal protection for eggs and nestlings (McLeod 2019). McLeod and Pellegrini (2013) showed that occupied breeding habitat for southwestern willow flycatcher exhibited > 90% median canopy closure along the Virgin River between 2003 and 2011. However, despite much of the unit appearing to be in poor health, there are still patches of mature native vegetation that should be protected.

Three MSHCP-covered species were recorded at the Mormon Mesa Riparian Reserve Unit: Arizona Bell's vireo, southwestern willow flycatcher, and summer tanager. Additionally, one yellow-billed cuckoo was incidentally detected just north of the Parcel 5-A boundary during southwestern willow flycatcher monitoring activities. Two evaluation bird species were recorded: loggerhead shrike and crissal thrasher.

4.5 Mormon Mesa South

In late 2021, the County acquired two parcels, 6-A and 6-B, approximately 0.8 km south of Mormon Mesa Subunit Parcel 5-A. These parcels comprise the Mormon Mesa South Subunit. SWCA mapped 14.3 ha (35.4 acres) of potential southwestern willow flycatcher and yellow-billed cuckoo habitat to be surveyed in 2022. Much of the vegetation in the site is similar to that of Mormon Mesa Subunit Parcel 5-A: dead or dying tamarisk 3 to 4 m (9.8 to 13.1 feet) in height, with 8- to 12-m- (26.2- to 39.4-feet-) tall Goodding's willows scattered in low numbers throughout the parcels (Figure 43). A backwater slough, which appears to have been created by floods and/or American beaver (*Castor canadensis*) activity, is present along the eastern edge of the site (Figure 44). The southwestern willow flycatcher and yellow-billed cuckoo survey habitat adjoins this slough area, as this was deemed the best of the marginal habitat within this Subunit. Narrow patches of 3- to 4-m-tall narrowleaf willows, common reed (*Phragmites australis*), and cattail are present along the edge of the slough (see Figure 44).



Figure 43. Dead and dying tamarisk within the Mormon Mesa South Subunit.



Figure 44. Backwater slough and adjacent narrowleaf willows and cattail along the eastern boundary of the Mormon Mesa South Subunit.

The Mormon Mesa South Subunit exhibited the lowest species richness of any subunit in 2022. Like the tamarisk at the Mormon Mesa Subunit, the dead or dying tamarisk at the Mormon Mesa South Subunit has less benefit to wildlife than does native vegetation or live tamarisk. The narrowleaf willows present within the Mormon Mesa South Subunit lie in a narrow strip along the edge of the slough. These willows stand approximately 2 to 3 m in height and provide canopy closure of less than 50%. The height and density of these small areas of narrowleaf willow habitat are not suitable for southwestern willow flycatcher or yellow-billed cuckoo.

Two MSHCP-covered species were recorded at the Mormon Mesa South Riparian Reserve Unit: Arizona Bell's vireo and blue grosbeak. One evaluation bird species was recorded: crissal thrasher.

4.6 Muddy River

Vegetation at the Muddy River Riparian Reserve Unit is highly diverse. Parcels A–E are dominated by horticultural plantings (e.g., pine [*Pinus* spp.] and California fan palm [*Washingtonia filifera*]) (Figure 45), creosote bush (*Larrea tridentata*) scrubland, and big saltbush (*Atriplex lentiformis*). Parcel F is dominated almost completely by creosote bush scrub, with smaller patches of honey mesquite,

particularly in the central and southeastern portions of the parcel (Figure 46). Parcels G–I are composed largely of very dense thickets of big saltbush and Mojave seablite (*Suaeda moquinii*), mixed with scattered honey mesquite and tamarisk (Figure 47). Although the Muddy River runs near the Muddy River Riparian Reserve Unit, it does not run through any of the southern parcels and only forms the eastern boundary of Parcels A–E. This portion of the Muddy River is also deeply incised, and desert riparian vegetation, consisting of widely scattered tamarisk and velvet ash (*Fraxinus velutina*), is generally limited to within a couple of meters (approximately 6 feet) of the riverbank.



Figure 45. Horticultural trees planted at Muddy River Parcels A–E.



Figure 46. Creosote bush habitat with scattered honey mesquite at Muddy River Parcel F.



Figure 47. Varied scrub habitat at Muddy River Parcels G-I.

Three MSHCP-covered bird species (Arizona Bell’s vireo, blue grosbeak, and phainopepla) and one MSHCP evaluation bird species (crissal thrasher) were recorded during point-count surveys at the Muddy River Riparian Reserve Unit in 2022. Most of the desert riparian obligates (e.g., southwestern willow flycatcher and yellow warbler) were not detected in the Muddy River Riparian Reserve Unit in 2022, which is not surprising given the lack of desert riparian habitat at this property. Although multiple yellow-billed cuckoo detections were recorded at the Muddy River Riparian Reserve Unit in both 2019 and 2020, surveys at this Unit yielded no cuckoo detections in 2021 and 2022.

Crissal thrasher was recorded from two of the six point-count locations at the Muddy River Riparian Reserve Unit in 2022, and this species is typically found in dense cover within mesquite and riparian woodlands (Floyd et al. 2007). Phainopepla was recorded from three Muddy River point-count locations. This species depends heavily on mistletoe (*Phoradendron* spp.) berries that grow on mesquite, and Muddy River has a relatively abundant population of honey mesquite compared to the other Riparian Reserve Units. Given the abundance of their preferred habitats therein, it is suspected that both crissal thrasher and phainopepla are breeding within the Muddy River Riparian Reserve Unit.

4.7 BCCE

Mojave Desert scrub, which is co-dominated by creosote bush and burrobrush (*Ambrosia dumosa*), is the dominant vegetation community across the Mojave Desert, and this community covers over 97% of the BCCE (Clark County 2019). Most point-count survey locations at the BCCE are within this habitat type (Figure 48). The remainder of the BCCE is composed of salt desert scrub (1.5%), mesquite/acacia habitat (less than 1%), and previously disturbed habitat (Clark County 2019). A few survey points were in areas of dense cholla (*Cylindropuntia* spp.) or desert wash habitat (Figure 49).

The BCCE Management Plan identified that no MSHCP-covered avian species are known to occur within the BCCE (Clark County 2019). During the initial site reconnaissance and point-count surveys of the BCCE in 2018, biologists did not observe any habitat, including desert riparian habitat, that could be considered suitable breeding habitat for the MSHCP-covered avian species. One MSHCP-covered species was detected during point counts at the BCCE in 2022: phainopepla. Two evaluation species, LeConte’s thrasher and loggerhead shrike, are known to occur within the BCCE (Clark County 2019) and were each recorded once within the BCCE during point-count surveys in 2022 (see Table 15).



Figure 48. Mojave Desert scrub habitat at point-count locations 12 (left) and 17 (right).



Figure 49. Dense cholla at point-count location 33 (left) and desert wash habitat at point-count location 37 (right).

4.8 Brown-headed Cowbird Control and Southwestern Willow Flycatcher Nest Success

Following limited brown-headed cowbird control and continued high brood parasitism rates of southwestern willow flycatcher nests at Mesquite West in 2020, SWCA implemented a target-netting program for brown-headed cowbirds at Mesquite West in 2021; this program continued in 2022. The goal of this program was to reduce the incidence of brood parasitism on southwestern willow flycatcher nests and improve nest success of southwestern willow flycatchers. SWCA was successful in target netting brown-headed cowbirds in 2022 and removed 11 female brown-headed cowbirds (Table 17). In addition, one brown-headed cowbird nestling was removed from a southwestern willow flycatcher nest, and one brown-headed cowbird egg was replaced with a fake egg at another nest at Mesquite West West in 2022 (see Table 17). Both nests later fledged southwestern willow flycatcher young; the nest at which the cowbird nestling was removed produced one fledging, and the nest at which the cowbird egg was replaced with a fake egg produced two fledglings.

Table 17. Brown-headed Cowbird Control by Method Used and Southwestern Willow Flycatcher Parasitism and Productivity, 2019–2022

Year	Parasitism Rate (%)	Brown-headed Cowbird Control Method ^a				Nest Success (%)
		Female Removal (No. Females Removed)	Egg Addling (No. CE ^b Added)	Egg Replacement (No. CE ^b replaced with fake egg)	Nestling Removal (No. CN ^c Removed)	
2019	50	–	–	–	–	44
2020	40	–	1	–	0	0
2021	50	14	3	–	0	33
2022	22	11	1	1	1	78

^a A dash within a specific brown-headed cowbird control method indicates that SWCA was not permitted to conduct that method in that given year, and, therefore, the method was not practiced.

^b CE = cowbird egg.

^c CN = cowbird nestling.

Prior to increased brown-headed cowbird control in 2021, the parasitism rate of southwestern willow flycatcher nests at Mesquite West was 50% in 2019 and 40% in 2020 (see Table 17). Forty-four percent of southwestern willow flycatcher nests were successful in 2019; nest success dropped to 0 in 2020. In 2021, despite the implementation of a more intensive brown-headed control program, 50% of southwestern willow flycatcher nests at Mesquite West were parasitized. This parasitism rate indicated that brown-headed cowbird control efforts were initially unsuccessful in reducing parasitism rates. Nest success was 33% in 2021; two successful nests produced a total of three southwestern willow flycatcher fledglings. In 2022, the intensive brown-headed cowbird control program continued, and only 22% of southwestern willow flycatcher nests were parasitized. Nest success was 78%; seven successful nests produced a total of 13 fledglings. The number of successful nests (7) in 2022 was higher than in the previous three years combined.

5 CONCLUSION

Seven MSHCP-covered and three MSHCP evaluation bird species were recorded at the County’s reserve system properties in 2022. Intensive southwestern willow flycatcher monitoring and brown-headed cowbird control were also continued in 2022. Some notable conclusions about this year’s efforts and the habitats at the County’s properties are listed below.

- Despite multiple detections of yellow-billed cuckoos from multiple properties in 2019 and 2020, no yellow-billed cuckoos were detected during targeted surveys for that species within the Riparian Reserve Units in 2021 or 2022. One yellow-billed cuckoo was incidentally detected north of Mormon Mesa Parcel 5-A during southwestern willow flycatcher monitoring activities.
- Southwestern willow flycatcher monitoring resulted in documentation of seven pairs at Mesquite West in 2022, all of which were confirmed to be nesting. These seven pairs had 11 nesting attempts, seven of which were successful and produced 13 fledglings.
- SWCA successfully target netted 28 adult brown-headed cowbirds (11 female, 17 male) and one juvenile at Mesquite West in 2022; the female and juvenile brown-headed cowbirds were subsequently euthanized.
- Biologists attempted to addle one brown-headed cowbird egg at Mesquite West. The cowbird egg later hatched, and the cowbird nestling was removed from the nest. This nest fledged one southwestern flycatcher fledgling.

- One brown-headed cowbird egg was replaced with a fake egg at Mesquite West. This nest fledged two southwestern flycatcher fledglings.
- Increased brown-headed cowbird control in 2022 coincided with a parasitism rate of 22% in southwestern willow flycatcher nests at Mesquite West. This rate of parasitism is lower than the rates observed in 2019 (50%), 2020 (40%), and 2021 (50%), suggesting that increased brown-headed cowbird control may play a role in reducing the parasitism rates at Mesquite West.
- Mature native desert riparian habitat within the County’s Riparian Reserve Units is limited to small patches throughout the parcels and one large patch of narrowleaf willow that constitutes almost all of Mesquite Parcel 1-A. Due to a number of factors, native riparian habitats throughout the southwestern United States have largely died off or been replaced by non-native species such as tamarisk. While tamarisk can provide valuable habitat for some species, such as the southwestern willow flycatcher, habitat quality often diminishes after infestation and defoliation by the tamarisk leaf beetle, which typically causes dieback and mortality of the tamarisk.
- It appears that cattle have been successfully excluded from portions of Bunkerville Parcel 2-J. The early stages of a positive vegetative response that were observed in 2021 were obscured by lack of water and dying vegetation in the same area in 2022.
- Breeding habitat for the MSHCP-covered bird species is currently limited or non-existent within the BCCE. Habitat for phainopepla could be created or enhanced with the establishment of more mesquite/acacia habitat, as long as that habitat also includes mistletoe, a required food source for phainopepla. One phainopepla was recorded at the BCCE during the 2022 point counts; this is the second occurrence of phainopepla recorded since point counts began in 2018.
- Biologists recorded two MSHCP evaluation species at the BCCE in 2022: LeConte’s thrasher and loggerhead shrike. Although breeding of LeConte’s thrasher could not be confirmed within the BCCE during 2021 and 2022 point-count surveys, this species is known to breed at the BCCE as several active nests were incidentally recorded in 2019 and 2020.

Aggressive efforts are likely required to restore, create, and enhance additional habitat for most of the MSHCP avian species at the County’s Riparian Reserve Units. Continued monitoring of avian populations before, during, and after the restoration process is needed to document restoration success within the County’s properties. Recommendations to achieve these objectives are detailed in the following section.

6 RECOMMENDATIONS

The following recommendations are based on observations from the 2022 avian surveys and factors discussed in this report. These actions would support the County’s long-term goals for the Riparian Reserve Units and the BCCE in Clark County:

- As directed by the *Clark County Desert Conservation Program Riparian Reserve Units Management Plan* (Clark County 2015), the County should continue to purchase parcels along the Virgin and Muddy Rivers, particularly available parcels adjacent to the existing Riparian Reserve Units (if possible), and attempt to purchase parcels along the Meadow Valley Wash.
- Tamarisk that has been killed or has suffered substantial dieback from tamarisk leaf beetles provides little benefit to avian species that require at least some degree of canopy closure for nesting. The County should begin or continue the removal of tamarisk from all its Riparian Reserve Units, particularly these dead or dying stands, provided that tamarisk removal is

immediately followed by planting of native vegetation, such as willow and Fremont cottonwood (*Populus fremontii*), in suitable areas (SWCA 2017c).

- The County could plant honey and screwbean mesquite in areas of increased soil saturation that do not have the hydrological potential to support wetland facultative species like willow or cottonwood. Portions of the Riparian Reserve Units are susceptible to scouring floods, as evidenced by conditions recorded in 2019. Any restoration plan should take this into account by limiting plantings in flood-prone areas or taking steps to protect planted areas from floods. The potential to create mature habitats at these sites may be limited by the flood risk.
- Areas of native vegetation that currently provide nesting habitat for MSHCP-covered and evaluation bird species should not be disturbed during restoration and should be allowed appropriate buffers. These areas include the existing willow stands in the Mesquite West, Bunkerville, and Mormon Mesa Subunits and the patches of honey and screwbean mesquite scattered throughout the County's properties.
- Because the Virgin River Riparian Reserve Unit is within designated critical habitat for the southwestern willow flycatcher, restoration plans should be designed in coordination with the USFWS.
- Cattle have been observed at all the Riparian Reserve Subunits except Muddy River; they should be inhibited from foraging on native plantings, wherever practicable. Cattle exclusion fencing should be erected in any area where native trees are newly planted. At parcels where fencing already exists, such as portions of Mormon Mesa and Bunkerville Parcel 2-J, the County should remove cattle from within fenced areas and make sure that all fences and gates are maintained and in proper working order. At Mormon Mesa, cattle have bypassed incomplete or ineffective fencing; maintenance of existing fencing and erection of additional perimeter fencing could prevent future breaches into the parcel.
- Avian point counts and species-specific surveys should be continued to help build on baseline data and to track changes in avian populations throughout the land management, restoration, and post-implementation processes. These surveys should use the protocols established for this project to ensure datasets are standardized and comparable.
- Additional target netting concentrated during the early part of the southwestern willow flycatcher breeding season may increase the number of female brown-headed cowbirds removed from the site prior to the onset of the southwestern willow flycatcher nesting period and may result in higher southwestern willow flycatcher productivity and fecundity.

7 LITERATURE CITED

- American Veterinary Medical Association. 2020. *Guidelines for the Euthanasia of Animals*. Rev. ed. Schaumburg, Illinois. Available at: <https://www.avma.org/sites/default/files/2020-01/2020-Euthanasia-Final-1-17-20.pdf>. Accessed September 2022.
- Bureau of Reclamation. 2004. *Brown-headed Cowbird Management Techniques Manual*. Denver, Colorado: U.S. Department of the Interior Bureau of Reclamation, Technical Service Center, Ecological Planning and Assessment.
- Cardinal, S.N. 2005. Conservation of southwestern willow flycatchers: Home range and habitat use by an endangered passerine. Unpublished M.S. thesis, Northern Arizona University, Flagstaff.
- Clark County. 2015. *Clark County Desert Conservation Program Riparian Reserve Units Management Plan*. February 2015.
- . 2019. *Clark County Desert Conservation Program Boulder City Conservation Easement Management Plan*. Version 3.4, February 2019. Available at: <https://files.clarkcountynv.gov/clarknv/Environmental%20Sustainability/Desert%20Conservation/Forms%20and%20Attachments/BCCE%20Management%20Plan%20%20Version%203.4%20Final.pdf?t=1625231652552&t=1625231652552>. Accessed September 2022.
- Clark County Department of Comprehensive Planning (CCDCP) and U.S. Fish and Wildlife Service (USFWS). 2000. *Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada*. San Diego, California: RECON.
- Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. *The Birder's Handbook*. New York, New York: Simon and Schuster Inc.
- Floyd, T., C.S. Elphick, G. Chisholm, K. Mack, R.G. Elston, E.M. Ammon, and J.D. Boone. 2007. *Atlas of the Breeding Birds of Nevada*. Las Vegas: University of Nevada Press.
- Great Basin Bird Observatory (GBBO). 2003. *Nevada Bird Count. A Habitat-Based Monitoring Program for the Breeding Birds of Nevada. Instruction Package and Protocol for Point-count Surveys*. April. Available at: <https://www.gbbo.org/s/Instructions2003.doc>. Accessed September 2022.
- . 2010. *Nevada Comprehensive Bird Conservation Plan*, ver. 1.0. Reno, Nevada: Great Basin Bird Observatory. Available at: http://www.gbboinfo.org/secure/Whole%20Document%20PDF/NV_Bird_Conservation_Plan_ver1.0_Dec2010.pdf. Accessed September 2022.
- Halterman, M.D., M.J. Johnson, J.A. Holmes, and S.A. Laymon. 2016. *A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo*. U.S. Fish and Wildlife Techniques and Methods. Available at: <https://www.fws.gov/sites/default/files/documents/survey-protocol-yellow-billed-cuckoo-western-distinct-population-segment.pdf>. Accessed August 2022.
- Hughes, J.M. 2020. Yellow-billed cuckoo (*Coccyzus americanus*). Version 1.0. In *Birds of the World*, edited by P.G. Rodewald. Ithaca, New York: Cornell Lab of Ornithology.

- Kostecke, R.M., S.G. Summers, G.H. Eckrich, and D.A. Cimprich. 2005. Effects of brown-headed cowbird (*Molothrus ater*) removal on black-capped vireo (*Vireo atricapilla*) nest success and population growth at Fort Hood, Texas. *Ornithological Monographs* 57:28–37.
- Lynn, J.C., T.J. Koronkiewicz, M.J. Whitfield, and M.K. Sogge. 2003. Willow flycatcher winter habitat in El Salvador, Costa Rica, and Panama: Characteristics and threats. In *Ecology and Conservation of the Willow Flycatcher*, edited by M.K. Sogge, B.E. Kus, S.J. Sferra, and M.J. Whitfield, pp. 41–51. Studies in Avian Biology No. 26. Cooper Ornithological Society.
- Martin, T.E., and G.R. Geupel. 1993. Nest-monitoring plots: Methods for locating nests and monitoring success. *The Journal of Field Ornithology* 64:507–519.
- Martin, T.E., C.R. Paine, C.J. Conway, W.M. Hochachka, P. Allen, and W. Jenkins. 1997. *Breeding Biology Research and Monitoring Database (BBIRD) Field Protocol*. Missoula: Montana Cooperative Wildlife Research Unit, University of Montana.
- McLeod, M.A. 2019. Responses of southwestern willow flycatchers to tamarisk defoliation. Paper presented at 15th Biennial Conference of Science and Management on the Colorado Plateau and Southwest Region, Flagstaff, Arizona.
- McLeod, M.A., and A.R. Pellegrini. 2013. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the Lower Colorado River and Tributaries, 2008–2012*. Submitted to Bureau of Reclamation, Boulder City, Nevada. Flagstaff, Arizona: SWCA Environmental Consultants.
- . 2014. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the Lower Colorado River and Tributaries, 2013*. Submitted to Bureau of Reclamation, Boulder City, Nevada. Flagstaff, Arizona: SWCA Environmental Consultants.
- McLeod, M.A., A.R. Pellegrini, and G. Cummins. 2018. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the Lower Colorado River and Tributaries: 2013–2017 Summary Report*. Submitted to the Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada. Flagstaff, Arizona: SWCA Environmental Consultants.
- Paxton, E., S. Langridge, and M.K. Sogge. 1997. *Banding and Population Genetics of Southwestern Willow Flycatchers in Arizona – 1997 Summary Report*. Flagstaff: U.S. Geological Survey Colorado Plateau Research Station and Northern Arizona University.
- Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. DeSante. 1993. *Handbook of Field Methods for Monitoring Landbirds*. Gen Tech. Rep. PSW-GTR-144. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.
- Ralph, C.J., J.R. Sauer, and S. Droege. 1995. *Monitoring Bird Populations by Point Counts*. General Technical Report PSW-GTR-149. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.
- Rothstein, S.I., B.E. Kus, M.J. Whitfield, and S.J. Sferra. 2003. Recommendations for cowbird management in recovery efforts for the southwestern willow flycatcher. In *Ecology and Conservation of the Willow Flycatcher*, edited by M.K. Sogge, B.E. Kus, S.J. Sferra, and M.J. Whitfield, pp 157–167. Studies in Avian Biology No. 26. Cooper Ornithological Society.

- Rourke, J.W., T.D. McCarthy, R.F. Davidson, and A.M. Santaniello. 1999. *Southwestern Willow Flycatcher Nest Monitoring Protocol*. Nongame and Endangered Wildlife Program Technical Report No. 144. Phoenix: Arizona Game and Fish Department.
- Sogge, M.K., J.C. Owen, E.H. Paxton, S.M. Langridge, and T.J. Koronkiewicz. 2001. A targeted mist net capture technique for the willow flycatcher. *Western Birds* 32:167–172.
- Sogge, M.K., D. Ahlers, and S.J. Sferra. 2010. *A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher*. U.S. Geological Survey Techniques and Methods 2A-10. Available at: <https://pubs.usgs.gov/tm/tm2a10/pdf/tm2a10.pdf>. Accessed August 2022.
- SWCA Environmental Consultants (SWCA). 2017a. *Federally Listed Bird Surveys on Three Riparian Reserve Units in Clark County, Nevada – Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2017b. *Point-Count Surveys on Riparian Properties – Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2017c. *Mormon Mesa Parcel Restoration – Virgin River Riparian Reserve Unit 1*. October. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2018a. *Avian Surveys on Riparian Properties – Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2018b. *Desert Upland Baseline Bird Surveys – Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2019a. *Avian Surveys on MSHCP Properties – Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2019b. *Southwestern Willow Flycatcher Surveys and Monitoring in Southern Nevada – 2019*. Prepared for Animal and Plant Health Inspection Service, Riverdale, Maryland. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2020. *Avian Surveys and Nest Monitoring on MSHCP Properties – 2020 Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- . 2021. *Avian Surveys and Nest Monitoring on MSHCP Properties – 2021 Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants.
- Unitt, P. 1987. *Empidonax traillii extimus*: an endangered subspecies. *Western Birds* 18:137–162.
- U.S. Fish and Wildlife Service (USFWS). 1967. Native fish and wildlife, endangered species. *Federal Register* 32:4001.

- . 1995. Final rule determining endangered status for the southwestern willow flycatcher. *Federal Register* 60:10694–10715.
- . 2000. *Intra-Service Biological and Conference Opinion on Issuance of an Incidental Take Permit to Clark County, Nevada for a Multiple Species Habitat Conservation Plan*. Available at: https://files.clarkcountynv.gov/clarknv/Environmental%20Sustainability/Desert%20Conservation/Library/Guiding%20Docs/MSHCP_BioOpin.pdf. Accessed September 2019.
- . 2001. *Clark County Desert Conservation Plan Permit TE-034927-0*. Available at: https://files.clarkcountynv.gov/clarknv/Environmental%20Sustainability/Desert%20Conservation/Library/Guiding%20Docs/MSHCP_Permit.pdf.
- . 2010. Draft Yuma Clapper Rail (*Rallus longirostris yumanensis*) Recovery Plan, First Revision. *Federal Register* 75:6697–6698. Available at: https://ecos.fws.gov/docs/recovery_plan/Draft%20Yuma%20Clapper%20Rail%20Recovery%20Plan,%20First%20Revision.pdf. Accessed September 2022.
- . 2013a. Designation of critical habitat for southwestern willow flycatcher. *Federal Register* 78:344–534.
- . 2013b. Proposed threatened status for the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*). *Federal Register* 78:61622–61666.
- . 2014. Determination of threatened status for the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*). *Federal Register* 79:59992–60038.
- . 2020. Endangered and threatened wildlife and plants; revised designation of critical habitat for the western distinct population segment of the yellow-billed cuckoo; proposed rule. *Federal Register* 85:11458–11594.
- . 2021. Endangered and threatened wildlife and plants; designation of critical habitat for the western distinct population segment of the yellow-billed cuckoo; final rule. *Federal Register* 86:20798–21005.
- Whitfield, M.J. 1990. Willow flycatcher reproductive response to brown-headed cowbird parasitism. M.S. thesis. California State University, Chico.
- Whitfield, M.J., K.M. Enos, and S.P. Rowe. 1999. Is brown-headed cowbird trapping effective for managing populations of the endangered southwestern willow flycatcher? In *Research and Management of the Brown-headed Cowbird in Western Landscapes*, edited by M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D. Caldwell Hahn, and T.D. Rich, pp. 260–266. Studies in Avian Biology 18. Cooper Ornithological Society.
- Wohner, P.J, S.A. Laymon, J.E. Stanek, S.L. King, and R.J. Cooper. 2020. Challenging our understanding of western Yellow-billed Cuckoo habitat needs and accepted management practices. *Restoration Ecology* 29(3):e13331.

APPENDIX A

Location Maps for Federally Listed Birds

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