

# **Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2020, and Summary Data by Site and Watershed-wide, 2000-2020**

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## Table of Contents

<b>ABSTRACT</b> .....	1
<b>INTRODUCTION</b> .....	2
<b>METHODS</b> .....	3-16
<i>Study Location</i> .....	3
<i>Monitored Sites</i> .....	4
<i>Sampled Sites</i> .....	4
<i>Incidental Sites</i> .....	4
<i>San Jacinto (Monitored)</i> .....	4
<i>San Timoteo Canyon (Monitored)</i> .....	5
<i>Meridian Conservation Area (Monitored)</i> .....	5
<i>Mockingbird Canyon (Monitored)</i> .....	6
<i>Santa Ana River (SAR) – Upstream (Monitored/Sampled)</i> .....	6
<i>Norco Bluffs, I-15 to River Rd. (Monitored)</i> .....	7
<i>Temescal Canyon (Sampled)</i> .....	8
<i>Chino Hills (Sampled)</i> .....	9
<i>Santa Ana Canyon</i> .....	9
<i>Upper Canyon (Monitored)</i> .....	10
<i>Green River Golf Club (Monitored)</i> .....	11
<i>Featherly Regional Park (Monitored)</i> .....	12
<i>Vireo Monitoring</i> .....	12
<i>Brown-headed Cowbird Trapping</i> .....	15
<b>RESULTS</b> .....	16-39
<i>Vireo Abundance</i> .....	16
<i>Chronology of Breeding Activity</i> .....	17
<i>Reproductive Success</i> .....	17
<i>Nesting Site Preferences</i> .....	17
<i>Predation Rates</i> .....	18
<i>Brown-headed Cowbird Parasitism</i> .....	18
<i>Repaired Vireo Nests</i> .....	19
<i>Results and Discussion by Site</i> .....	19
<i>San Jacinto (Monitored)</i> .....	19
<i>San Timoteo Canyon (Monitored)</i> .....	20

<i>Meridian Conservation Area (Monitored)</i> .....	21
<i>Mockingbird Canyon (Monitored)</i> .....	22
<i>Santa Ana River (SAR) – Upstream</i> .....	23
<i>SAR - Riverside Ave. to Van Buren Blvd.</i> .....	23
<i>SAR - Riverside Ave. to Van Buren Blvd. Overall</i> .....	23
<i>SAR - Riverside Ave. to Van Buren Blvd. Non-Restoration (Sampled)</i> .....	25
<i>SAR - Riverside Ave. to Van Buren Blvd. Evans Lake Drain (Incidental)</i> .....	25
<i>SAR - Riverside Ave. to Van Buren Blvd. Anza/Old Ranch Creeks (Incidental)</i> .....	26
<i>SAR – Lower Hole Creek (Sampled)</i> .....	26
<i>SAR - Hidden Valley – North (Sampled)</i> .....	26
<i>SAR - Hidden Valley — South (Monitored)</i> .....	27
<i>SAR - Hidden Valley – South (south side of river) Overall</i> .....	27
<i>SAR - Hidden Valley – South (south side of river) Restoration</i> .....	28
<i>SAR - Hidden Valley – South (south side of river) Non - Restoration</i> .....	28
<i>SAR - Goose Creek, Norco to I-15 (Monitored)</i> .....	29
<i>Norco Bluffs, I-15 to River Rd. (Monitored)</i> .....	30
<i>Temescal Canyon (Sampled)</i> .....	31
<i>Chino Hills (Sampled)</i> .....	32
<i>Santa Ana Canyon (SAC)</i> .....	32
<i>Upper Canyon (Monitored)</i> .....	34
<i>Green River Golf Club (Monitored)</i> .....	34
<i>Featherly Regional Park (Monitored)</i> .....	35
<b><i>Sampled Sites</i></b> .....	37
<b><i>Incidental Sites</i></b> .....	37
<b><i>SIGHTINGS OF INTEREST – INCIDENTAL SPECIES OBSERVATIONS</i></b> .....	37
<i>Southwestern Willow Flycatcher</i> .....	38
<b><i>BROWN-HEADED COWBIRD TRAPPING RESULTS</i></b> .....	38
<i>Brown-headed Cowbird Trapping, March-July 2020</i> .....	38
<i>Non-target Captures in Cowbird Traps, March-July 2020</i> .....	39
<i>Fall/Winter 2019/2020 Brown-headed Cowbird Trapping and Non-target Captures</i> .....	39
<b><i>DISCUSSION</i></b> .....	39-41
<b><i>MANAGEMENT RECOMMENDATIONS</i></b> .....	41
<b><i>FUNDING ACKNOWLEDGEMENTS</i></b> .....	42
<b><i>ACKNOWLEDGEMENTS</i></b> .....	42

<b>REFERENCES.....</b>	<b>44</b>
<i>Figure 1. Map of the Santa Ana Watershed.....</i>	<i>46</i>
<i>Figure 2. Least Bell's Vireo survey sites in the Santa Ana Watershed, 2020. ....</i>	<i>47</i>
<i>Figure 3. Upper Santa Ana River Least Bell's Vireo Sites, 2020. ....</i>	<i>48</i>
<i>Figure 4. Norco Bluffs Vireo Survey Area, 2020.....</i>	<i>49</i>
<i>Figure 5. Brown-headed Cowbird trap locations in the Santa Ana Watershed, 2020.....</i>	<i>50</i>
<i>Figure 6. Least Bell's Vireo abundance in the Santa Ana Watershed, including Prado Basin, 2000-2020.....</i>	<i>51</i>
<i>Figure 7. Least Bell's Vireo territories at four sites in the Santa Ana Watershed, 2000-2020..</i>	<i>52</i>
<i>Figure 8. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2020.....</i>	<i>53</i>
<i>Figure 9. Least Bell's Vireo nesting success, predation rates, and parasitism rates in the Santa Ana Watershed, 2001-2020. ....</i>	<i>54</i>
<i>Figure 10. Brown-headed Cowbirds removed from sites in the Santa Ana Watershed, 2000-2020.....</i>	<i>55</i>
<i>Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.....</i>	<i>56</i>
<i>Table 2. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2020.....</i>	<i>61</i>
<i>Table 3. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2020. ....</i>	<i>62</i>
<i>Table 3B. Least Bell's Vireo breeding biology data detailed for SBVMWD-funded surveys at monitored (restoration) and sampled (non-restoration) sites in upper SAR, 2020. ....</i>	<i>64</i>
<i>Table 4: Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2020.....</i>	<i>66</i>
<i>Table 5. Observations of all species by location, 2020.....</i>	<i>68</i>
<i>Table 6. Brown-headed Cowbird trapping results, March-July 2020 (grouped by funding source).....</i>	<i>73</i>
<i>Table 7. Non-target avian captures in Brown-headed Cowbird traps, March-July 2020.....</i>	<i>76</i>
<i>Table 8. Brown-headed Cowbird trapping results, winter 2019-2020.....</i>	<i>78</i>
<i>Table 9. Non-target avian captures in Brown-headed Cowbird traps, winter 2019-2020. ....</i>	<i>79</i>
<b>APPENDIX A: SURVEY SITES, STARTING AND ENDING COORDINATES .....</b>	<b>A-1-A-3</b>
<b>APPENDIX B: WATERSHED-WIDE ANNUAL RESULTS, 2000-2020 .....</b>	<b>B-1-B-7</b>
<b>APPENDIX C: SUMMARY TABLES BY MANAGED SITE, 2000-2020.....</b>	<b>C-1-C-37</b>

## ABSTRACT

The Santa Ana Watershed is the largest coastal river system in Southern California. The Santa Ana Watershed Association (SAWA) is committed to the protection and improvement of natural areas within the watershed with major focus on the removal of invasive species, native habitat enhancement, and the monitoring and protection of endangered, threatened, and other sensitive species. Since 2000, populations of endangered Least Bell's Vireo (*Vireo bellii pusillus*) have been monitored and managed during the breeding season. Data were collected on status, distribution, breeding chronology, reproductive success, and nest site characteristics. Additionally, Brown-headed Cowbird (*Molothrus ater*) trapping was conducted concurrently in or near riparian habitat as well as during the winter at four dairies in Prado Basin and three dairies in San Jacinto. SAWA biologists documented 1,574 Least Bell's Vireo (hereafter "vireo") territories in the Santa Ana Watershed (excluding Prado Basin) in 2020, of which 827 were known to be paired. This represents a 16% increase in territories from 2019 (n=1,361) and the highest number documented to date. One thousand two hundred ninety-one fledglings were also documented. Prado Basin reported another 719 vireos in 2020, a 19% increase from the 606 documented in 2019. Nesting success was 53% overall and 247 well-monitored pairs had a 2.8 reproductive success rate. Ninety-three percent of 519 vireo nests were placed in native vegetation.

In 2020, the watershed-wide cowbird parasitism rate of vireo nests was 8%, down from 10% in 2019. San Jacinto, Mockingbird Canyon, Santa Ana River– Upstream (Hidden Valley South and Goose Creek), and Santa Ana Canyon – Green River Golf Club were sites in which parasitism was documented in 2020. During the nesting season, 3,957 cowbirds were removed from 44 traps in the watershed. Additionally, 4,788 cowbirds were removed from the watershed during the fall and winter of 2019-2020. Over 136,000 cowbirds have been removed from the watershed by SAWA since cowbird management began.

Breeding Southwestern Willow Flycatchers (*Empidonax traillii extimus*) were not detected by SAWA biologists in 2020; however, 10 migrant Willow Flycatchers were documented within the watershed. All wildlife species detected (165 avian, 20 mammalian, 22 herpetofauna, and four fish) were incidentally reported by site.

## INTRODUCTION

As the largest coastal river system in southern California, the Santa Ana Watershed is home to more than six million people and includes portions of San Bernardino, Riverside, Orange, and Los Angeles Counties. The Santa Ana Watershed Association (SAWA) is committed to the protection and enhancement of natural habitat within the Santa Ana River Watershed. Major focuses of SAWA are the removal of invasive species, native habitat enhancement, and protection of endangered, threatened, and other sensitive species. A large threat in the Santa Ana River Watershed is the extremely prolific invasive weed, *Arundo donax* (hereafter “arundo”). Arundo chokes riverine systems while out-competing native vegetation, resulting in a loss of habitat for native species and hampering flood control efforts. It can consume at least twice the amount of water as native plants, thereby stressing a region that already has little available water. In addition, arundo may contribute to the spread of fire due to its flammable nature. SAWA is dedicated to the restoration of the Santa Ana River Watershed with the interest of reestablishing natural riverine functions and enhancing riparian habitat in an effort to aid in the recovery of the endangered Least Bell’s Vireo (*Vireo bellii pusillus*) and Southwestern Willow Flycatcher (*Empidonax traillii extimus*).

The Least Bell’s Vireo is a small, insectivorous bird that occupies riparian habitat in southern California and northern Baja Mexico. This sub-species is listed as endangered by both the State of California and the federal government due to the loss of riparian habitat and brood parasitism by the Brown-headed Cowbird (*Molothrus ater*; hereafter “cowbird”). Vireo monitoring and cowbird control began in 1986 with only 19 known vireo pairs in the Prado Basin (Pike et al., 2005). The Prado Basin population has since increased to a high of 719 territorial males in 2020 (Preliminary data; Bonnie Johnson, personal communication). The watershed-wide population (including Prado Basin) totaled 2,293 territorial males in 2020. The Southwestern Willow Flycatcher (SWFL) occupies riparian habitat throughout the southwest. It too is listed as endangered by state and federal governments due to habitat loss and cowbird parasitism. Unfortunately, this species has not shown a similar recovery rate and is still in severe decline. These two endangered species and several other sensitive species have been monitored and managed in the Prado Basin annually since 1986 by the Orange County Water District (OCWD) and throughout the rest of the watershed by SAWA since 2000.

The work reported herein is an expansion upon the Prado Basin efforts into other portions of the watershed from 2000-2020 through the implementation of the Santa Ana Watershed Program by SAWA and OCWD. Data collected in Prado Basin are reported separately by OCWD. Monitoring is conducted during the avian nesting season to determine the number of vireos and SWFL present, breeding status, and nesting outcomes. Cowbird trapping in or near riparian

habitat is conducted concurrently as well as during the fall and winter at several dairies in the watershed. Past efforts have included nest monitoring in the major riparian corridors of the watershed. In 2020, nest monitoring occurred at several locations discussed here as monitored sites: San Jacinto, San Timoteo Canyon, Meridian Conservation Area, Mockingbird Canyon, proposed and current restoration areas within Santa Ana River (SAR – Upstream) from Riverside Ave. downstream to I-15, Norco Bluffs, and the Santa Ana Canyon (SAC) below Prado Dam. Abundance and distribution data were documented at Temescal Canyon and Chino Hills. Twenty-eight additional peripheral drainages within the watershed were sampled ( $\geq 3$  visits) and incidental sightings were documented at six sites visited on one or two occasions. Due to COVID-19 restrictions, some locations were not surveyed in 2020.

## METHODS

### *Study Location*

The Santa Ana Watershed is located in southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles Counties and covers nearly 3,000 square miles (Figure 1). The watershed includes a diversity of terrain including mountains, foothills, valleys, and the coastal plain. The main river is the Santa Ana River, which contains more than 50 tributaries.

Study sites contain typical southern Californian riparian vegetation including tall canopies of Fremont cottonwood (*Populus fremontii*) and Goodding's black willow (*Salix gooddingii*), sub-stories of arroyo and red willow (*Salix lasiolepis* and *Salix laevigata*, respectively), and mulefat (*Baccharis salicifolia*). Vegetation classifications follow nomenclatures listed in A Manual of California Vegetation (Sawyer et al. 2009). Lush riparian habitat is abundant throughout the study sites; however, dispersed stands of invasive arundo are still abundant in many locations of the middle watershed. Other non-native plants found dispersed among the sites include perennial pepperweed (*Lepidium latifolium*), castor bean (*Ricinus communis*), poison hemlock (*Conium maculatum*), and tamarisk (*Tamarix ramosissima*). Other than natural storm flow, the river's water comes from discharged treated water, urban runoff, very limited natural springs, upwelling in the Prado Basin, and releases from the Seven Oaks and Prado Dams. The river is subjected to heavy human impacts from homeless encampments, horseback riding, creation of unauthorized trails, swimming, fishing, off-highway vehicle (OHV) use, and trash dumping.

## ***Monitored Sites***

Monitored sites, for the purposes of this study, are those sites where territories were well-monitored (> 8 visits) and regular nest monitoring occurred. Vireos were monitored in the Santa Ana River and tributaries from Riverside Avenue in the city of Riverside downstream through the Santa Ana Canyon to Weir Canyon Road, excluding Prado Basin. These sites included Hidden Valley - south side of the river (SBVMWD restoration sites and a control site), Goose Creek mitigation areas - Norco to I-15, Norco Bluffs (I-15 to River Rd.) and SAC (Upper Canyon, Green River Golf Course, and Featherly Regional Park). Several tributaries of the Santa Ana River were also monitored including San Timoteo Canyon, Meridian Conservation Area, and Mockingbird Canyon, as well as portions of the San Jacinto River and San Jacinto Wildlife Area (Figure 2). See Appendix A for specific restoration area coordinates.

## ***Sampled Sites***

Sampled sites include assessment sites in which three surveys were conducted during designated dates as well as sites that were surveyed  $\geq 3$  times anytime throughout the breeding season, in which no or minimal nest monitoring occurred. The objectives were to document vireo occupancy and quantify a minimum number of territories. Territorial males were documented as well as incidental observations of females and fledglings. In 2020, the first assessment surveys were conducted between 4/27-5/1, the second surveys between 6/1-6/10, and the third between 6/26-7/10.

## ***Incidental Sites***

Incidental sites, for the purposes of this study, are those sites that were visited on one or two occasions and in which no nest monitoring occurred. Sites were visited in an attempt to obtain number of territories, pairs, and fledglings.

## ***San Jacinto (Monitored)***

San Jacinto includes three monitored sections: the San Jacinto River from Lake Park Drive to State Street, the San Jacinto River from Sanderson Avenue to Bridge Street, and the San Jacinto Wildlife Area. These sites are located within the San Jacinto Valley in Riverside County. The San Jacinto Wildlife Area is managed by the California Department of Fish and Wildlife (CDFW) and the San Jacinto River is managed by multiple authorities.



The riparian zone in the San Jacinto River is classified as a *Populus fremontii* Forest Alliance, with narrowleaf willow (*Salix exigua*) and mulefat as co-dominants (Sawyer et al. 2009). The habitat is also interspersed with Goodding's black willow. The dominant invasive plant in the riparian zone is tamarisk. The riparian zone in the San Jacinto Wildlife Area is classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). The area is also interspersed with red willow and mulefat. Dominant non-natives in the adjacent upland are perennial pepperweed and Russian thistle (*Salsola tragus*). To date, SAWA's non-native management efforts have been limited to the removal of tamarisk from Mystic Lake. The lands surrounding these sites include upland coastal sage scrub, grasslands, dairy farms, agricultural land, golf courses, and residential development.

### ***San Timoteo Canyon (Monitored)***

San Timoteo Canyon is located near the city of Redlands within the counties of San Bernardino and Riverside. San Timoteo Creek originally contained many invasive plant species, most notably arundo and tamarisk. A program initiated by SAWA removed 239 acres of invasive plants from 1997 to 2001 and continues a maintenance program to control regrowth. Restoration of the native plant community through natural recruitment has taken place throughout the canyon resulting in a healthy riparian understory, the effects of natural storm cycles notwithstanding. The canyon's immediate uplands contain citrus groves and remnants of over-grazed coastal sage scrub and chaparral. A railroad and a two-lane road border the canyon. Development of portions of the uplands continues to occur. San Timoteo Creek was surveyed from Cooper's Creek to approximately 15 miles (24 km) downstream at the point the creek becomes channelized. In September 2017, the Palmer fire destroyed dozens of acres of riparian habitat in San Timoteo Creek and a number of vireos have not returned to the historical territories that were burned in the fire. In 2020, some areas of the creek were unable to be surveyed due to access issues.

The riparian zone can be classified as a *Salix laevigata* Woodland Alliance (Sawyer et al. 2009), with arroyo willow as a co-dominant. However, the creek is also interspersed with Fremont cottonwood, Goodding's black willow, and mulefat. The dominant invasive plant in the riparian zone is tamarisk. Dominant invasives in the adjacent upland zone are Russian thistle, mustard (*Brassica* sp.) and perennial pepperweed.

### ***Meridian Conservation Area (Monitored)***

Meridian Conservation Area (former March SKR Preserve) is a conservation easement held by the Rivers and Lands Conservancy located along the eastern boundary of the city of Riverside in Riverside County. The riparian zone is classified as a *Salix laevigata* Woodland

Alliance (Sawyer et al. 2009), with arroyo willow as a co-dominant. Mustard and stinknet (*Oncosiphon piluliferum*) are the dominant invasive species in the adjacent upland zone.

The Meridian Conservation Area is protected from development; however, warehouses are being built directly to the east. During the 2020 breeding season, active construction in this area created noise and disturbance near vireo habitat. Furthermore, construction, landscaping, and re-paving on Van Buren Boulevard created noise and disturbance near vireo territories. Additionally, unauthorized trails, some of which cut through riparian habitat, were used by local residents for OHV recreation, bicycling, jogging, hiking, and sunbathing. The entrance gate to the conservation area south of Van Buren Boulevard was repeatedly forced open to allow for these activities, which could have had a potential negative effect on nesting vireos.

### ***Mockingbird Canyon (Monitored)***

Mockingbird Canyon is located in the city of Riverside in Riverside County. Its arroyo serves as a drainage tributary to the Santa Ana River. The riparian zone is classified as a *Salix gooddingii* Woodland Alliance, with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). However, red willow and arroyo willow are also interspersed within the arroyo. The dominant invasive plant in the riparian zone is perennial pepperweed. Mustard species are the dominant invasive species in the adjacent upland zone; however, stinknet is becoming more prevalent.

Although the reservoir and basin are protected from development at this time, residential development remains an issue in Mockingbird Canyon. Residents extend their property into the arroyo, which causes damage to the habitat and potential harm to nesting vireos. Much of the adjacent upland habitat is lost and the arroyo is becoming more fragmented by culverts and bridges. The riparian habitat throughout the entire site is continually threatened by OHVs, trash dumping, and other illegal activities. SAWA manages an 11-acre easement in Mockingbird Canyon east of Roosevelt St. and Markham St. and will continue to work with local stakeholders to enhance and protect the canyon's natural resources.

### ***Santa Ana River (SAR) – Upstream (Monitored/Sampled)***

The SAR-upstream section extends along the Santa Ana River from Riverside Ave. in the City of Riverside downstream to Interstate 15 in Norco. The site is divided into five different sections. These sections are Riverside Ave. to Van Buren Blvd., Lower Hole Creek, Hidden Valley - North side of river, Hidden Valley - South side of river, and Goose Creek-Norco to I-15 (Figure 3). A small portion of the Goose Creek section includes a mitigation area managed by the Inland Empire Resource Conservation District (IERCD). Prior to 2015, these sections of the river were not grouped together as "upstream". All sites were reported separately. In 2015, the upstream section did not include Goose Creek, Norco to I-15; however, in 2016 a change in funding source

incorporated this area as part of SAR - Upstream. In 2019, a previously unsurveyed site, Lower Hole Creek, was included as it is contiguous with the Santa Ana River ecosystem. Also in 2019, the Riverside Ave. to Van Buren Blvd section was modified to include approximately 87 acres of previously unsurveyed land in and near Fairmount Park in Riverside and approximately 20 acres of previously unsurveyed land near the eastern terminus of Rubidoux Ave. in Riverside. The Riverside Ave. to Van Buren Blvd section was analyzed as a whole and by three sub-sections (Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks) to isolate two proposed restoration areas (Evans Lake Drain and Anza/Old Ranch Creeks). Due to safety concerns regarding the density of homeless encampments and COVID-19, Evans Lake Drain and Anza/Old Ranch Creeks were not surveyed in 2020; data reported were incidental detections from biologists traversing the perimeter of the sites during the course of other fieldwork. In addition, the Hidden Valley South section was analyzed as a whole and by two sub-sections (Hidden Valley South – Restoration and Hidden Valley South Non-Restoration) to isolate one proposed restoration area.

There are a variety of vegetation types throughout the SAR - Upstream section of the Santa Ana River. The riparian zone can be classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). The most common invasive plant in the riparian zone is arundo. Other invasive plant species include tamarisk, castor bean, perennial pepperweed, tree of heaven (*Ailanthus altissima*), golden crownbeard (*Verbesina encelioides*), poison hemlock, white sweetclover (*Melilotus albus*), and various palm species.

Several land managers are engaged in different stages of restoration or mitigation along this portion of the river. Surrounding land use includes commercial and residential, recreational trails, parks, and golf courses. Within the riparian habitat, many homeless encampments occur. SAWA biologists often observe vegetation clearing, trash dumping, and inappropriate disposal of human excreta in this portion of the river.

### ***Norco Bluffs, I-15 to River Rd. (Monitored)***

Norco Bluffs is comprised of a 3-mile long riparian zone located along the river between Interstate 15 and River Road. The U.S Army Corps of Engineers (USACE) considers most of this area to be within the Prado Basin (566-foot elevation and below). In 2020, vireos were monitored in select areas within Norco Bluffs which excluded a 101-acre easement belonging to Riverside-Corona Resource Conservation District. In comparison to areas surveyed from 2015-2018, the area monitored exclusively by SAWA in 2019 and 2020 (Figure 4) is the largest to date. Prior to 2019 and 2020, the survey area changed from year-to-year, thus data cannot be compared across all years; comparable population level data are as follows: 2015 and 2018, 2016 and 2017, and 2019 and 2020.

SAWA removed arundo in the winter of 2006 and 2007 from a 15-acre area located immediately south of Eastvale Community Park. After reviewing the mitigation files in 2017, it was determined only 4.6 acres of habitat needed to be mitigated. Small patches of reestablished arundo were removed and subsequently treated with herbicide before nesting season. Additional monthly follow-up treatments have continued through 2020. Riparian vegetation growing beneath and alongside Interstate 15 was removed prior to the 2018 nesting season in preparation for the 15 Express Lanes Project; active construction occurred at the site throughout the 2019 and 2020 nesting season. In 2020, SAWA subcontractors cleared approximately 200-acres of arundo using various heavy equipment type mulchers. The removal area is located one mile upstream of River Rd bridge. Additional monthly follow-up treatments were conducted by SAWA and monitored by a biologist as needed.

Norco Bluffs is almost exclusively comprised of riparian vegetation without adjacent upland. Native species of willow, predominantly Goodding's black willow, dominate much of the landscape, but large swaths are still heavily dominated by invasive arundo. The riparian habitat within the Norco Bluffs survey area can be classified as a *Salix gooddingii* Woodland Alliance with arundo as a co-dominant (Sawyer et al. 2009). Areas not dominated by mature Goodding's black willow or arundo consist of early successional riparian woodland. These areas are where the river previously changed course and destroyed habitat, which has since regrown. Species in the more recently disturbed areas are composed of Goodding's black willow, arroyo willow, Pacific willow (*Salix lasiandra*), and narrowleaf willow.

### ***Temescal Canyon (Sampled)***

Temescal Canyon is approximately 26 miles (42 km) long and is located along Interstate 15 between Lake Elsinore and Highway 91 where it crosses into Prado Basin. Survey areas include Railroad Canyon, Lake Elsinore, and most of Temescal Wash. The wash extends from Lake Elsinore downstream to two miles upstream of the intersection of Magnolia Avenue where it becomes channelized and flows into Prado Basin.

SAWA has monitored vireos in Temescal Canyon since 2001 when it began its arundo removal program. Temescal Wash is currently being managed for arundo regrowth and native vegetation has begun to reestablish. Five biologists covered the canyon over three visits in 2014, 2015, and 2016 with the goal of documenting an accurate territory count and as much data on reproductive status as time allowed. A seasonal biologist was hired to cover the entirety of the canyon and collect the same data in 2017, 2018, 2019, and 2020 albeit over several more visits. The additional visits resulted in a more complete dataset than was possible in prior years. However, as in 2017 through 2019, SAWA was again unable to collect a complete dataset from

the riparian habitat within the Dos Lagos golf course due to denial of access to the area. This area has contained approximately 15% of vireo territories in Temescal in previous years.

The habitat within Temescal Canyon is characterized by patchy, but dense riparian vegetation. Privately owned sand and gravel mines operate downstream adjacent to the creek. A commercial fishing lake is located near the middle section of the wash. Areas of complete channelization without riparian habitat occur downstream of Lake Elsinore and the most downstream section of the wash. Many sections of the wash are channelized by riprap and berms, but still allow some meandering for quality riparian habitat. The riparian zone in Railroad Canyon and the wash downstream of Lake Elsinore is classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al. 2009). The riparian habitat surrounding Lake Elsinore is dominated by tamarisk. Semi-natural shrubland stands also occur with patches of sparse Goodding's black willow. Although SAWA has been effectively treating arundo since 2000, tamarisk has now become a dominant exotic throughout the wash, especially in areas surrounding Lake Elsinore.

### ***Chino Hills (Sampled)***

The fragments of riparian habitat in Chino Hills along Highway 71 have been surveyed annually since 2003. A total of 13 riparian habitat patches were monitored in Chino Hills, including Butterfield Park, Alterra Park, Vellano Park, a flood basin at Brookwood Lane, and a patch of habitat at Slate Drive. Formerly considered assessment sites, habitat at Soquel Canyon and the Community Park at English Channel were also monitored in 2020. Most of these assessment sites occur on private property for which access is restricted. The riparian patches in Chino Hills are classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al. 2009).

### ***Santa Ana Canyon***

SAC is located downstream of the Prado Dam to Weir Canyon Road, a distance of approximately nine miles (14 km). Due to the differences in the habitat throughout the canyon, it was divided into three sites: Upper Canyon, Green River Golf Club, and Featherly Regional Park. The Upper Canyon is located from Prado Dam downstream to the beginning of the Green River Golf Club. The Green River Golf Club covers approximately two miles (3.5 km) of the habitat and the remaining 4.4 miles (7 km) is in the County of Orange's Featherly Regional Park. This location description and site history discuss the entire SAC.

This site has undergone a variety of impacts in the past several years. The USACE Reach 9 Bank Stabilization Project construction in SAC has been ongoing since 2005. In 2014, Phase 3 of the USACE stabilization project began and subsequently impacted the habitat of 10 vireo territories. In 2015, no USACE project work occurred during the nesting season in SAC. In 2016,

Phase 5a of the USACE project began adjacent to La Palma Avenue in Yorba Linda, impacting nine vireo territories, though habitat was only partially removed from two territories. Additional disturbances in SAC in 2016 included repeated vegetation removal and grove expansion by the orange grove lessee in Featherly Park and the on-going brine-line project activities in the Upper Canyon and adjacent to the Green River Golf Club. In 2017, activities in Phase 5a continued and Phase 5b began upstream, removing habitat from an additional 10 vireo territories; Phase 4 began on the south side of the river upstream from Canyon RV Park, completely removing habitat from one vireo territory and partially impacting other territories. In 2018, activities from Phases 5a, 5b, and 4 construction continued throughout the nesting season. The footprint of Phase 5b was expanded downstream to Brush Canyon, removing vegetation from another three and a half territories. In 2019, Phase 5b and Phase 4 ran throughout the season. Phase 5a concluded and mitigation was installed prior to nesting season. The Burlington Northern Santa Fe (BNSF) railroad bridge construction project commenced in 2018 and continued in 2020. This project located in Green River Golf Club removed vegetation from two territories and partially impacted two additional territories in 2018. No additional vegetation removal occurred in 2020. Each of these project phases are followed by habitat restoration upon completion.

There is a variety of habitat types throughout SAC. Vireos typically inhabit the riparian zone along the river, but also use the adjacent upland habitats for nesting and foraging. The riparian zone is classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant. The least disturbed adjacent upland is classified as a *Sambucus nigra* Shrubland Alliance (Sawyer et al. 2009). Several areas adjacent to the riparian habitat are in various stages of restoration and cannot be classified at this time. Additionally, some adjacent areas are non-native dominant, such as the Green River Golf Club and Chino Hills State Park areas. The dominant invasive plants in the riparian zone are poison hemlock and arundo. The dominant invasives in the adjacent upland zone are Russian thistle, mustard, and tocalote (*Centaurea melitensis*). Other invasive plant species in SAC include tamarisk, tree of heaven, castor bean, perennial pepperweed, gum tree (*Eucalyptus* sp.), and Peruvian pepper tree (*Schinus molle*).

### *Upper Canyon (Monitored)*

Upper Canyon is located adjacent to Highway 91 within the County of Riverside, from downstream of Prado Dam to the northeast edge of Green River Golf Club. This site is the upstream portion of SAC. The Upper Canyon has undergone a barrage of habitat disturbances from native vegetation removal, subsequent restoration, additional vegetation removal, and a devastating fire in the last decade. Construction on a portion of the Santa Ana River trail began during the winter of 2018 and continued into April 2019. Trail construction did not occur during the 2020 spring/summer and it is not known when construction will resume. The trail is planned

to proceed through Upper Canyon and Green River Golf Club to connect to the existing Santa Ana River Trail located south of the golf course.

### *Green River Golf Club (Monitored)*

The Green River Golf Club is located along the Santa Ana River in San Bernardino, Riverside, and Orange Counties between Upper Canyon and Featherly Regional Park. This site is the middle portion of SAC.

Phase 3 of the USACE Reach 9 bank stabilization project started during the fall/winter of 2011 with several acres of riparian habitat removed that included mature willow and cottonwood trees from this site. This area supported 13 vireo territories during the 2011 breeding season. The 2011 project phase was roughly 75% complete at the end of the 2012 nesting season with some replanting underway, but habitat loss and construction activities likely contributed to the 27% decrease in territory numbers between 2011 and 2012. In 2014, no additional habitat was removed; however, construction continued adjacent to occupied habitat upstream of the railroad bridge in the beginning of the nesting season. On May 1 of that season, a vireo nest was found within 100 feet of construction activities that were moving toward the nest. The USACE and the U.S. Fish and Wildlife Service (USFWS) were both notified immediately, but work continued toward the nest. By the next week the nest had been abandoned with two eggs. Subsequently, other vireo nests were found near construction activities and work eventually stopped in this area for the rest of the 2014 season. Most recently, the BNSF rail bridge construction project, which began in 2018, continued into 2020. A total of four vireo territories were impacted prior to the avian nesting season in 2018. Riparian habitat for two territories was completely removed and habitat for two other territories was partially removed.

Habitat restoration work that began in 2019 on Chino Hills State Parks property adjacent to the golf course continued in 2020. Mowing work was conducted during the April 2019 and 2020 nesting seasons in the vicinity of vireo territories. Restoration work resumed this August and is anticipated to continue through the fall/winter.

Preparations to replace a golf cart bridge spanning Aliso Creek began before the 2020 nesting season. The project footprint was delineated with snow fencing and graded. Historically, there has been one vireo territory located along Aliso Creek; however, two new territories established within 100 feet of the project this season. No work in the area occurred until mid-June, when dump trucks and other earth moving equipment mobilized to restart work in the area. The two closest vireo territories had just fledged and fledglings were foraging with adults in vegetation along the construction access roads. Due to the close proximity to the active territories and noise concerns, the project was paused and is anticipated to resume in the fall.



### *Featherly Regional Park (Monitored)*

Featherly Regional Park is located along the Santa Ana River, between the west end of the Green River Golf Club and the bridge on Yorba Linda Blvd. and Weir Canyon Rd. in the County of Orange. This site is the downstream portion of SAC.

The Santa Ana River Trail and Parkway runs adjacent to the park. Public access is restricted; however, no fencing is in place to deter entry into the riparian habitat. Phase 4 of the USACE Santa Ana River Mainstem (SARM) Reach 9 reinforcement project began in 2014. Riparian habitat containing three vireo territories was removed on both sides of the river, upstream from the Canyon RV Park. This phase has since been completed and the habitat is being restored. In 2016, Phase 5a began on the north side of the river along La Palma Road, downstream of the Riverbend Car Wash. Vegetation removal partially impacted five vireo territories. In 2017, activities in Phase 5a continued and Phase 5b began upstream, removing habitat from an additional 10 vireo territories. Concurrently, Phase 4 construction expanded on the south side of the river upstream of Canyon RV Park, completely removing habitat from one vireo territory and partially impacting other vireo territories. In 2018, activities from Phases 5a, 5b, and 4 ran concurrently throughout the nesting season. The footprint of Phase 5b was expanded downstream to Brush Canyon in 2019, removing vegetation from another three and a half territories. In 2019, Phase 5a was completed and restoration began before the breeding season. Phase 4 construction was completed in early 2020 and restoration was in progress during the nesting season. Construction activities in Phase 5b continued throughout the 2020 nesting season.

### ***Vireo Monitoring***

SAWA's vireo management includes habitat restoration, biological monitoring, and cowbird control. The primary purpose of surveys at monitored sites was to locate all vireos and SWFL to determine accurate territory numbers, breeding status, and to enhance breeding output through management. Not all territories were monitored sufficiently to determine pairing success. Potential habitats were carefully traversed along the edges and open trails. The vegetation communities in areas of detection, including dominant native and exotic vegetation species, were documented. All vireos encountered were noted as to location, behavior, and reproductive status on each visit. GPS coordinates were taken in the approximate center of the territory, if known. Each point denotes a territory, not just a sighting. Coordinates were not typically taken at nest locations. Territory size range was estimated at monitored sites. Attributes were associated with each vireo territory location and are as follows: unique ID, notes, survey location, surveyor name, agency, category (monitored/sampled/incidental), breeding status, GPS



location, fledged (yes/no/unknown), number fledged, and parasitism (yes/no/unknown). A complete attribute table with detailed metadata is included in the shapefiles submitted to the USACE, CDFW, SBVMWD, and USFWS. Banded vireos are reported annually to the original bander, Barbara Kus of the U. S. Geological Survey (USGS) and the appropriate agencies. No playback of vireo vocalizations was used during surveys. Field data were collected using an iPhone with ESRI's ArcGIS Collector and Survey 123 applications. Field biologists worked under the direction of the Principal Field Investigator and all surveys and nest visitations were performed under, and in compliance with, all terms and conditions of Federal Endangered Species Permit #TE-839480-5.5 and a Memorandum of Understanding with the CDFW.

Surveys were conducted five days per week throughout the nesting season (March through July). Occasional visits to determine continued vireo presence occurred through August and September. Biologists watched for nesting behavior from a distance and did not approach nests during the nest-building stage. Subsequent nest visits were conducted from a greater distance with binoculars if possible. Otherwise, a telescopic mirror was used to observe nest contents. Extreme care was used to avoid leaving a trail to or scent near the nest. Nest searching or visitation was avoided if excessive scolding by an adult occurred or if predators were observed nearby (e.g. jays, crows, etc.). Nest monitoring was avoided if there was a chance of inducing premature fledging of nestlings, if approaching the nest would result in habitat destruction or trailing, and during extreme climatic factors that could cause disturbance to nesting birds. Nest visitation dates and times were variable depending on a pair's reproductive stage. Nests were visited once every seven to eight days during incubation to check for cowbird eggs. If found, cowbird eggs and nestlings were removed from nests ("manipulated"). If a parasitized nest had fewer than three remaining vireo eggs, a non-viable vireo egg was used to replace the cowbird egg. Beginning 2019, nests that were predated before it could be determined if they had been parasitized (seven days after incubation began) were excluded from parasitism rate calculations (Pike et al., 1999; Sharp & Kus, 2006).

Survey techniques and data analyses follow Pike et al. (1999). The following monitoring definitions, with some modifications, were taken from Pike et al. (2005):

Survey: any visit to a site(s) for the purpose of collecting data regardless of the duration or distance traveled. The term survey is used synonymously with visit.

Incidental: any species detection documented while conducting an unrelated survey.

Adult: an after hatch year bird; Male: a singing individual; Female: a non-singing individual accompanied by a male.

Breeding pair: only pairs for which nests were located, who were observed nest building or exhibiting other reproductive behavior, or were observed with at least one fledgling.

Well-monitored pair: visited frequently enough to observe and document all successful nesting attempts and accurately quantify number of young fledged from pair. Unsuccessful nests may or may not be found. Pairs that are known not to have fledged young may also be considered well-monitored.

Nesting attempt: any attempt by a pair to build a nest. Includes carrying nesting material though never finding nest.

Complete nest: a nest built by a pair and capable of receiving young.

Well-tracked nest: a complete nest observed with vireo egg(s) and/or nestling(s), and if successful, nestling(s) were observed at  $\geq 8$  days old.

Successful nest: a nest that fledged at least one known young.

Successful pair: a pair that produced at least one successful nest.

Failed nest: a nest that had egg(s) or nestling(s) but did not fledge young.

Presumed failure (nest): a complete nest in which no egg(s) or eggshell(s) were observed; no powder from pin feathers seen in nest; adults seen without fledgling(s).

Presumed successful (nest): a well-tracked nest with powder from pin feathers seen in the nest, or adults observed with fledgling(s).

Presumed predation: the loss of all eggs or nestlings in a nest.

Cowbird parasitism: classified as such only if a cowbird egg(s), eggshell(s), or nestling were found in, or below, the affected well-tracked nest.

Reproductive failure: classified as such when loss due to known reasons other than predation or parasitism (e.g. abandonment, etc.).

Unknown failure: classified as such when the cause of failure of nest could not be determined.

Manipulated nest: cowbird egg(s) or nestling(s) removed from nest.

Known fledged young: a fledgling seen out of the nest; nestlings from well-tracked nests, presumed fledged.

Juvenile: a fledgling that has been out of the nest over 14 days.

Reproductive success: the average number of fledglings produced by well-monitored pairs.

Migrant Willow Flycatchers were documented in conjunction with visual and auditory searches for vireos. If a Willow Flycatcher was incidentally observed, the biologist checked the location weekly to determine if the individual(s) remained throughout the season. Willow Flycatchers are deemed migrants if they fail to remain on-site through June. In addition to vireo data, special attention was paid to other sensitive species found on-site, which were reported to the appropriate agencies. A complete list of wildlife species detected on-site is provided with

sensitive species noted. GPS points were taken for all listed species and cowbirds detected in vireo habitat.

### ***Brown-headed Cowbird Trapping***

In 2020, 44 traps were deployed. Thirty-six traps were deployed in or near vireo habitat and the remaining eight were deployed at dairy farms (Figure 5). The USACE and the USFWS funded 27 habitat traps and eight dairy traps. The SAWA/IERCD Reach 3B project funded four traps and the San Bernardino County Transportation Authority funded two traps in San Timoteo Canyon. One trap in Yorba Linda (Cielo Vista) was funded by the North County BRS Project, LLC. The remaining two traps, located at the Meridian Conservation Area, were contracted by the Rivers and Lands Conservancy. Thirty-eight traps were opened by March 19. All traps were closed by July 31.

Traps are designed after Australian crow traps. The trap is a cubic wood frame covered in wire mesh and fitted with cloth to provide shade for the birds. Ideal trap locations are in accessible open areas near riparian habitat or near cowbird feeding areas such as stables and dairies. Most traps are placed in areas inaccessible to the general public to protect the trap from vandalism. Traps were kept free from weeds and vegetation and labeled with signs identifying the purpose of the trap as well as SAWA contact information. Consequences for tampering with the trap, according to the Migratory Bird Treaty Act, were also specified on these signs.

Trapping procedures adhered to the “Santa Ana Watershed Association and Orange County Water District Cowbird Trapping Protocol” (Tenant et al., 2008). Each trap contained a food bowl, one-gallon water dispenser, a large paint tray for use as a bath, and perches. Cowbirds were fed with a basic millet seed mixture. Field assistants were hired and trained by SAWA biologists to perform daily maintenance, safely handle birds, and properly identify and release non-target species. Non-target native species were released as soon as possible to minimize stress. Due to permit conditions, dated August 8, 2014, SAWA is required to dispatch all European Starlings (*Sturnus vulgaris*) and House Sparrows (*Passer domesticus*) caught in the traps. Since starlings require a different type of food and do not survive well in the traps, this permit condition required additional resources in supplies, time, and effort. Due to these extenuating circumstances, some of these non-native species were released to avoid unnecessary distress to the birds.

Field assistants recorded non-target species, number of cowbirds in the trap (males, females, and juveniles), and number of cowbirds removed. Hatch-year birds were considered “juveniles” even as their adult plumage developed. Traps were inspected daily for structural integrity. Assistants were in constant contact with their supervising biologist for quick resolution of any problems.

Traps were baited with male and female cowbirds that were captured over the fall and winter. The typical ratios used were two males to three females for the smaller-sized habitat traps and three males to four females for larger habitat traps. Large traps placed on dairies were typically baited with five males to nine females. The flight feathers on each cowbird were trimmed so that if a cowbird escaped, it may return to the trap or at least be unlikely to resume reproducing. A lock was placed on each trap to prevent unauthorized access. Removed cowbirds, starlings, and House Sparrows were transferred to a licensed falconer for dispatch or temporarily housed in a holding pen until the falconer could collect the birds. Holding pens contained extra food and water containers and were closed to entry by additional birds. If applicable, banded cowbirds were reported to the U.S. Bird Banding Laboratory, but only banded males were released. At the end of July, birds, food, and water were removed from all traps. Trap entry was closed and the door locked open to prevent unintended captures. SAWA removed traps from the field after they had been closed.

## RESULTS

### *Vireo Abundance*

In 2020, SAWA documented a total of 1,574 vireo territories, including 827 known pairs and 1,291 known fledglings at all monitored, sampled, and incidental sites. This represents a 16% increase in territories from 2019 (n=1,361). OCWD reported 719 territories in Prado Basin in 2020 (preliminary data; Bonnie Johnson, personal communication) for a total of 2,293 vireo territories watershed-wide, the highest number since monitoring began (Table 1). Watershed-wide abundance data over time can be found in Appendix B-1 and by site in Appendix C-1.

In 2020, monitoring efforts at most sites were similar to 2019; notable exceptions were San Jacinto, Hidden Valley – North, SAR – Upstream, Riverside Ave to Van Buren Blvd., including Evans Lake Drain, Anza/Old Ranch Creek, and Lower Hole Creek restoration areas where numerous homeless encampments and concerns about COVID-19 hampered observer visits. The decrease in territory numbers detected in SAR-Upstream, Riverside Ave. to Van Buren Blvd. are expected to be a result of access issues, not a true decrease in territories in this area. Additionally, several assessment areas were not surveyed due to COVID-19 safety concerns and park closures. Most monitored sites that had similar effort in 2019 were found to have increased territory numbers ranging from 5% to as high as 32%. Notably, the number of documented territories in San Jacinto increased 71% from 2019 (n=63) to 108 territories in 2020. Hidden Valley – North increased 21%, from 78 territories in 2019 to 94 territories in 2020 (Table 1). These two site increases are partially due to an increase in monitoring effort this year (see Results and Discussion

by Site). A total of 4,097.5 SAWA biologist hours were spent monitoring and surveying for vireos in 2020.

### ***Chronology of Breeding Activity***

Surveys at monitored sites began between March 11 and April 2. Surveys ended between September 8 and September 17. Sampled sites Chino Hills and Temescal are not included in these date ranges. The first vireo was detected on March 16 at Featherly Regional Park. The estimated earliest date for the arrival of 50% of vireo males was on April 1 at Goose Creek, Norco to I-15. The estimated earliest date for 50% of males paired was April 9 at Goose Creek, Norco to I-15. The first nests were found on March 31 at San Timoteo Canyon, Hidden Valley – South, and Goose Creek, Norco to I-15. The first date a nest fledged was May 4 at Norco Bluffs; the last date a nest fledged was July 26 at Mockingbird Canyon. The last date vireos were detected was September 16 at Meridian Conservation Area and Mockingbird Canyon (Table 2).

### ***Reproductive Success***

Reproductive success, as measured by productivity of well-monitored pairs, was 2.8 watershed-wide in 2020. This rate represents a substantial decrease from 3.8 in 2019. Nest success was 53% (n=454), a decrease from 62% (n=364) in 2019 (Appendix B-1). Average clutch size was 3.6 based on 402 complete clutches (Table 3). See Appendix C-1 for individual site data over time. Metrics specific to San Bernardino Valley Municipal Water District restoration sites can be found in Table 3B.

### ***Nesting Site Preferences***

Nesting site preferences followed parameters previously documented in Pike et al. (1999). Nests were found mostly in riparian vegetation, near water, along dirt trails or roads, and on edges of riparian habitat. Mulefat (20%), arroyo willow (19%), and Fremont cottonwood (9%) were the primary plant species used for nest placement by vireos in 2020 (n=519). Three other abundantly used species of willow were narrowleaf willow (8%), Goodding's black willow (7%), and red willow (7%). Blue elderberry (*Sambucus nigra* ssp. *caerulea*) and desert wild grape (*Vitis girdiana*) held another 6% and 4%, respectively. Thirty-five nests (7%) were placed in non-native vegetation. A complete list of plant species utilized by nesting vireo in 2020 can be found in Table 4. Historical nest site preference data can be found in Appendix C-2. Other vegetation used by vireos in the watershed in 2020 include coyote brush, laurel sumac (*Malosma laurina*), tamarisk,

black mustard (*Brassica nigra*), and poison hemlock (Appendix B-2). This suggests that vireos will use a variety of vegetation for nesting in otherwise suitable riparian or adjacent habitat. The use of non-traditional riparian vegetation for nesting by vireos supports the need for careful monitoring of all plants during the nesting season.

## ***Predation Rates***

Nests are assumed predated if all eggs or unfledged young were destroyed or removed. In 2020, the watershed-wide predation rate for well-tracked nests was 36% (n=454), an increase from 29% (n=364) in 2019 (Table 3; Appendix B-1). Predation rates varied at each site and can be found in individual site results. At sites with five or more well-tracked nests, predation rates varied between 0% and 53% (Table 3). Historically, nest loss due to predation is 33% (n=3,703) watershed-wide (Appendix B-1). Nest losses are typically due to unknown predators. Multiple vireo pairs were observed scolding or chasing California Scrub-jays (*Aphelocoma californica*) at several sites. Other suspected nest predators include American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), and various snake species. On one occasion at Mockingbird Canyon, a vireo heavily scolded a gray fox early in the breeding season. In both Featherly Park and Meridian Conservation Area, vireos were observed scolding gopher snakes in their respective territories. These predator species occur at most sites throughout the watershed.

Feral pigs (*Sus scrofa*) are another potential predator. This species occurs in high numbers in San Timoteo Canyon and the upstream portion of the Santa Ana River. Feral pigs are extremely disruptive to habitat by creating wallows, possibly trampling or knocking over nests, and eating a wide range of vegetation and animals.

## ***Brown-headed Cowbird Parasitism***

In 2020, 8% (n=386) of well-tracked nests were parasitized by cowbirds, down from 10% in 2019 (n=316; Appendix B-1). Parasitism was documented in San Jacinto, Mockingbird Canyon, Hidden Valley South, Goose Creek, and Green River Golf Club (Table 3). The watershed-wide parasitism rate has ranged from 3% to 10% in the last five years; however, failure of well-tracked nests due to parasitism has ranged from 1% to 4% during that time. The criterion for judging nest failure of well-tracked nests due to parasitism is the loss or abandonment of vireo eggs in the presence of a cowbird egg or nestling. The low parasitism rates over the last five years are likely attributed to SAWA's extensive cowbird trapping program. Nest "manipulations", the removal of cowbird eggs and nestlings by SAWA biologists, account for the even lower rate of nest failure

due to parasitism as almost all unmanipulated parasitized vireo nests fail. Since SAWA began nest monitoring in 2000, 277 nests have been manipulated and 122 of these nests successfully fledged 263 vireos (Appendix B-1).

### ***Repaired Vireo Nests***

Sixteen nests were repaired in 2020, 10 of which were ultimately successful and fledged 27 young. Since SAWA began monitoring vireos in the watershed, 63 nests have been repaired and 116 young have fledged from those nests (Appendix B-1).

## ***Results and Discussion by Site***

### ***San Jacinto (Monitored)***

In 2020, 108 territories were detected at San Jacinto, a 71% increase from 63 territories detected in 2019. This increase can partly be attributed to a section of habitat between Sanderson Ave. and State St. which was monitored in 2020 and previous years, but not monitored in 2019. This section contained 11 territories. Of the 108 territories in San Jacinto, 25 were in the San Jacinto Wildlife Area, 24 were in the river from Bridge St. to Sanderson Ave., 11 were in the river from Sanderson Ave. to State St., and 48 were in the river from State St. to Lake Park Dr. Eighty-three males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. One hundred forty-five fledglings were detected across all pairs in 2020, 77 of which fledged from 29 well-monitored pairs, resulting in an average of 2.7 fledglings produced per well-monitored pair. The average number of fledglings produced per well-monitored pair has ranged from 1.2 in 2016 (n=5) to 5.0 in 2019 (n=7; Appendix C-1-A).

Nest monitoring has occurred at San Jacinto at varying intensities since 2004. Sixty-nine nests were found in 2020, 56 of which were well-tracked. In 2020, apparent nest success was 63% (n=56), which is lower than in 2019 (69%; n=35). Predation was the most common cause of nest failure, accounting for 15 (27%) nests in 2020. The cause of two (4%) nest failures was unknown. Although seven (14%; n=49) nests were parasitized by cowbirds, just two (4%; n=56) failed due to parasitism. Predation (31%; n=234) has been the leading cause of failure every year nests were monitored (Appendix C-1-A).

Six of the seven parasitized nests were manipulated; one nest was found after cowbird hatching and vireo egg failure. Two of the six (33%) manipulated nests were successful. Parasitism was down from a high of 75% (n=8) in 2016 and down from 26% (n=19) in 2019. In addition to the parasitized vireo nests, cowbirds were observed in the habitat throughout the breeding season. Cowbird trapping has occurred in San Jacinto since 2003 (excluding 2015) and a total of



28,134 cowbirds have been removed during the breeding season over 14,078 trap days, mostly from local dairies (Appendix C-1-A).

Narrowleaf willow (32%) and mulefat (25%) were most frequently used for nest placement in 2020. Nests were placed in invasive substrates at the following frequencies: one in black mustard (1%) and five in tamarisk (7%; n=69). The remaining nests were located in various native substrates (Table 4). A total of 541.5 biologist hours were spent monitoring vireos at the San Jacinto site in 2020.

Current threats to the riparian habitat in San Jacinto primarily involve human encroachment, including the use of OHVs in the riverbed and trash dumping. In the San Jacinto River, approximately 1.5 miles upstream from State St., numerous homeless camps have been established, which have resulted in refuse in the habitat and vegetation clearing. Rains in February 2019 scoured the riverbed; however, the vegetation recovered well. Many of the previously standing dead trees, suspected to be a result of drought conditions, were washed downstream.

Several proposed commercial, residential, and infrastructure projects may potentially impact the San Jacinto River and areas adjacent the San Jacinto Wildlife Area. The indirect impacts associated with the construction and future use of a 40-million-square-foot World Logistics Center (Esquivel, 2015; Patch CA, 2016), the San Jacinto Gateway (Albert A. Webb and Associates, 2015), and 11,350 residential units (The Villages of Lakeview, 2017) remain to be seen.

### ***San Timoteo Canyon (Monitored)***

In 2020, 139 vireo territories were documented in San Timoteo Canyon, up 12% from the 124 documented in 2019 (Table 1). The population in the canyon is still below what it was before the Palmer fire that occurred in September 2017 that destroyed dozens of acres of riparian habitat in San Timoteo Creek; many historical territories in the burn areas have not been documented since. However, the population in San Timoteo has experienced a greater than 30-fold increase in 20 years. This increase can be attributed to the removal of invasive species and subsequent restoration of native vegetation, nest monitoring, and cowbird management.

One hundred five pairs and 207 fledglings were detected in 2020, though not all territories were monitored sufficiently to determine pairing success. Nesting success was 52%, higher than the 44% documented in 2019 (Appendix C-1-B). Nesting success is 55% over 20 years of monitoring (n=1,187). Fifty-eight well-monitored pairs had a 3.0 reproductive success rate in 2020, down from 3.2 in 2019. Overall reproductive success based on productivity of well-monitored pairs in the last 20 years is 3.0 (n=623). Nest losses in 2020 were primarily due to



predation, accounting for 34% of total nest outcomes. Predation (36%) has been the major cause of nest loss in the last 20 years (n=1,187; Appendix C-1-B).

Arroyo willow (32%) and red willow (21%) were the most frequently used substrates for nest placement in 2020 (n=104). Four (4%) nests were placed in non-native vegetation in 2020; the remaining nests were built in various native substrates (Table 4). Arroyo willow (24%), mulefat (24%), and red willow (17%) have been the primary plant species used for nest placement in San Timoteo since 2001. Only 21 nests found from 2001-2020 have been placed in non-native vegetation (n=1,302; Appendix C-2-B).

Brown-headed cowbird trapping has occurred in San Timoteo Canyon since 2001 and a total of 2,867 cowbirds have been removed during this time. In 2020, no well-tracked nests were found to have been parasitized by cowbirds. In 2019, 12 nests (15%; n=80) were parasitized by cowbirds and subsequently seven nests (8%; n=90) failed as a result. However, in 2019 cowbird traps were not placed in the area in which the majority of parasitism occurred. In 2020, two traps were deployed in the vicinity of where most parasitism was documented in 2019 and cowbirds were removed from the habitat. The 2019 parasitism rate remains a marked decrease from a high of 75% (n=4) in 2001. Although parasitism by cowbirds still occurs at a rate of 11% (n=1,163), over 20 years only 3% (n=1,187) of nests have failed due to parasitism (Appendix C-1-B; Appendix D). A total of 517.25 biologist hours were spent monitoring vireos at the San Timoteo site in 2020.

Although the riparian area is protected under existing laws, residential and utility development continues in San Timoteo Canyon. Current threats to the riparian habitat include removal of vegetation by landowners, human encroachment (e.g. all-terrain vehicle activity), fire, and cattle grazing. Feral pigs continue to disturb the habitat throughout the canyon.

### ***Meridian Conservation Area (Monitored)***

In 2020, 14 territories were detected in the Meridian Conservation Area, consistent with the 14 territories detected in 2019. Over the past 10 years, territory numbers on the site have ranged from a low of six territories in 2007 to a high of 21 territories in 2014 (Appendix D). Nine pairs and 24 fledglings were also documented in 2020. Reproductive success was very high at 3.7; however, only six pairs were well-monitored. Eight nests were discovered, seven (88%) of which were successful. The remaining nest was unsuccessful due to reproductive failure (Table 3). In 2020, nests were primarily placed in arroyo willow (63%). Since SAWA began monitoring in 2004, 39 nests have been primarily placed in arroyo willow (36%), Gooding's black willow (28%), and red willow (26%; Appendix C-2-C).

Two traps were deployed in 2020 that captured 10 cowbirds over 238 trap days. Cowbird trapping has occurred at this site since 2004 and a total of 258 cowbirds have been removed during this time. No parasitism has been documented in the Meridian Conservation Area since

monitoring and trapping began (Appendix C-1-C). A total of 106.75 biologist hours were spent monitoring vireos at the Meridian site in 2020.

Although the Meridian Conservation Area is protected from development at this time, development currently occurring in the adjacent upland habitat may severely limit foraging opportunities for vireos and other native birds. Other current threats to the habitat are human encroachment from recreational activities including OHV use, biking, jogging, and littering.

### ***Mockingbird Canyon (Monitored)***

In 2020, 45 vireo territories, 17 pairs, and 26 fledglings were detected in Mockingbird Canyon (Table 1). The number of territories slightly increased from 43 territories in 2019. Measures of reproductive success have varied over the years, due in part to differential monitoring efforts. Reproductive success was 2.2 in 2020; however, only nine pairs were well-monitored. This is slightly below the site average reproductive success of 2.9. In 2020, nest success was 35% (n=17), lower than the overall site nesting success of 51% (n=186). Nest failures were due to predation, reproductive failure, and unknown causes, accounting for 53%, 6%, and 6% of total nest outcomes, respectively (Appendix C-1-D). Since nest monitoring began in 2003, nest placement has primarily occurred in red willow (28%), blue elderberry (17%), and Goodding's black willow (16%; Appendix C-2-D). In 2020, nest placement also primarily occurred in red willow (22%). However, a large percentage of nests were also placed in arroyo willow (17%) and coyote brush (17%; Table 4).

In 2020, one instance of parasitism was documented. The cowbird egg was removed; however, the nest was later depredated. Beginning in 2003, an intensive cowbird management program was initiated in Mockingbird Canyon. In this same year, 62% of nests (n=13) were parasitized, the highest recorded in all survey years (Appendix D). The parasitism rate decreased sharply after the trapping program began and parasitism has only occurred episodically over subsequent years (n=184). Since 2003, a total of 2,265 cowbirds have been removed from Mockingbird Canyon (Appendix C-1-D). A total of 172.5 biologist hours were spent monitoring vireos at the Mockingbird Canyon site in 2020.

There are a multitude of threats to the vireo habitat in Mockingbird Canyon. Despite SAWA's efforts within its conservation easement, important habitat was bulldozed and destroyed in adjacent areas to both the west and east in 2016 and 2017. In the Mariposa Avenue area, homes are under construction, creating noise disturbance to the nesting birds and infringing upon riparian strips in the area. During the 2020 nesting season, much of the vegetation that had previously shown signs of heat and drought stress had died. In some areas, including the SAWA easement, large trees have died, resulting in a lack of canopy. In other areas, especially in the Mockingbird Canyon Archaeological Site on Harley John Road, dead understory vegetation has

been scoured, resulting in a lack of preferred vireo nesting habitat. Immediately southeast of the Mockingbird Reservoir, much of the riparian vegetation has died and upland invasive species have become established. Many of these areas were unoccupied by vireos in the 2020 nesting season and vireos were found in smaller, healthier patches of riparian vegetation. In addition to these threats, Mockingbird Canyon has extensive OHV use, trash dumping, hiking, dog-walking, and equestrian use along the narrow strips of riparian habitat. The area is also highly impacted by invasive species encroachment.

### ***Santa Ana River (SAR) – Upstream***

In 2020, 488 vireo territories were documented in the upstream portion of the Santa Ana River (Table 3B). There were likely additional undocumented territories in two sections (Evans Lake Drain and Anza/Old Ranch Creeks) that were not surveyed due to the high density of homeless camps and concerns associated with the COVID-19 outbreak. Despite a smaller survey area in 2020 compared to 2019, there was a 2% increase from the 477 territories documented in 2019 (Table 1). Vireo abundance has increased throughout the upstream section since monitoring began in 2000 and may be attributed to increased monitoring efforts, addition of new survey areas in some years, removal of invasive vegetation, mowing in the Riverside Flood Control channel upstream, and cowbird management (Appendix D). Two hundred seventy-six pairs and 431 fledglings were also documented. In 2020, apparent nest success was 50% (n=146), lower than the 61% in 2019 (n=119; Zembal et al., 2019). The most common cause of nest failure in 2020 was predation (40%; n=146). The parasitism rate was 16% (n=116; Table 3B). Six cowbird traps were located in this section of the river and a total of 39 cowbirds were removed over 492 trap days (Table 3). A total of 1,160.75 biologist hours were spend monitoring vireos at the SAR-Upstream site in 2020.

#### *SAR - Riverside Ave. to Van Buren Blvd.*

Historically, SAR – Riverside Ave to Van Buren Blvd. has been analyzed as one site. Because of two new restoration projects, SAR – Riverside Ave to Van Buren Blvd. has been split into three sections: Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks. However, to keep consistency with prior years, results are reported herein for SAR – Riverside Ave. to Van Buren Blvd. overall, in addition to the three sub-sections.

#### *SAR - Riverside Ave. to Van Buren Blvd. Overall*

In 2020, 128 territories were detected at SAR – Riverside Ave. to Van Buren Blvd., a 23% decrease from 166 territories detected in 2019 (Table 1). The decrease in territories can be

attributed to parts of the site not being covered due to the large number of homeless camps and safety concerns regarding the COVID-19 pandemic. Fifty-four males were known to be paired; none of which were well-monitored. Fifty-five fledglings were observed. Eighteen nests were found, three of which were well-tracked. The three nests failed due to predation. No BHCO eggs or chicks were observed at any of the nests found and no vireos were seen feeding cowbird fledglings. Information specific to each sub-section can be found in the following sections and Table 3B.

The COVID-19 pandemic had a substantial impact on survey activities in SAR. Due to safety concerns, biologists avoided areas with dense concentrations of encampments. Areas that were still surveyable became, in several cases, difficult to access due to the shutdown of public parks. Because of these closures, biologists had to park farther away and spend more time in their effort to access the river. Even with the closures and shutdown, large numbers of people continued to recreate in and near the river.

One hundred sixty-five homeless camps, compounds, and related sites were documented in this stretch of the Santa Ana River in 2020. This is likely an underestimate of the actual number of camps, as there were areas unsafe for biologists to traverse, which precluded documenting potential camps in those areas. In addition, each documented camp hosts an unknown number of individuals and it is likely that some camps are inhabited by multiple individuals. Some camps were compounds with multiple tents, structures, and vehicles. Observations related to the camps include clearing of understory, damage to and removal of large trees, compaction of dirt, unleashed dogs, free-roaming cats, chicken coops, chain-link and wooden structures, solar panels, generators, large scale latrines, small landfills, and various types of vehicles in the habitat. Along the mainstem, alteration of the levee was observed, with trails and stairs cut into the levee leading to trails and camps in the habitat. Within the habitat near the river at the end of Wilderness Ave., campers have created 'roads' using thousands of square feet of carpet and plywood. Brush fires occur regularly in and near the river bottom, with Sunnyslope burning after the 2019 field season and encampments near the Van Buren Bridge and General Road catching fire during the 2020 field season. The most notable of these fires, the 46 Fire, occurred October 31, 2019 near Sunnyslope, burning over 300 acres. Besides directly damaging the habitat, the fire made access into some areas easier via cleared vegetation during the fire fight and new homeless camps quickly appeared in those places. Further disturbance within the river bottom has been created via police activity related to the encampments, including officers on foot, officers driving OHVs through the river bottom, and low flying helicopters broadcasting announcements. While homeless camps have been an issue at this site for several years, the level of homeless inundation observed could be becoming detrimental to the habitat and vireos.

Recreational use and human encroachment continue to be threats to the habitat. Recreational activity was noted in the area near the end of Wilderness Avenue and at Sunnyslope,

where food trash, alcohol containers, and latrines were found. Similar disturbance has been noted near the Van Buren Bridge. Garbage in general, including clothing, tires, tents, syringes, and furniture, is abundant in large portions of the survey area, especially early in the spring after winter flooding. This garbage likely originates from multiple sources, including homeless camps, dumping, and improperly secured trash receptacles. Along the mainstem, multiple discarded vehicles, including sedans and pickups, were noted.

*SAR - Riverside Ave. to Van Buren Blvd. Non-Restoration (Sampled)*

In 2020, 123 vireo territories were documented along the Santa Ana River from Riverside Avenue to Van Buren Boulevard in the Non-Restoration section. This site was a sampled site in 2020, without focused nest searching or monitoring. Seventeen nests were found incidentally, three of which were well-tracked. The three nests failed due to predation. Fifty-two pairs and 52 fledglings were detected in 2020 (Table 3B). While efforts were made to count all territories and pairs in this section, the dangers in some parts of this site (e.g. homeless camps, marijuana grows, off-leash dogs, and open drug use) limit the number of areas that can be safely monitored.

Prior to the start of the 2014, 2016, and 2018 nesting seasons, Riverside County Flood Control conducted routine mowing of vegetation from Riverside Ave. to Mission Blvd. While there was a decline in vireo territories detected in the immediate area of mowing those years, the overall survey site did not see a significant decrease in territories, suggesting the vireos shifted to new areas downstream. In the years following mowing, monitoring efforts showed an increase in vireo territories. This suggests as the vireos move into different areas of the site immediately following mowing, the offspring, or possibly the breeding birds themselves, return to those newly inhabited territories, thus expanding the extent of occupied habitat. The exception was 2018, where there was a slight increase (6%) in vireo territories immediately following mowing (Table 1; Zembal et al., 2018). Research suggests vireos show strong natal-site fidelity, as well as strong site fidelity between breeding seasons (Greaves, 1990; Smith, 2000). The occupancy and distribution observed at this site appears to support these conclusions.

Brown-headed Cowbird trapping at this site has occurred on public land, private business, and residential properties since 2002 and 847 cowbirds have been removed during this time (Appendix C-1-E). In 2020, seven cowbirds were observed within the survey area.

*SAR - Riverside Ave. to Van Buren Blvd. Evans Lake Drain (Incidental)*

Evans Lake Drain was not formally surveyed in 2020 due to concerns associated with the high density of homeless encampments at this site and the COVID-19 outbreak. While traversing

the perimeter of the site during the course of other fieldwork, one territory was incidentally detected. No female or fledglings were detected (Table 3B).

*SAR - Riverside Ave. to Van Buren Blvd. Anza/Old Ranch Creeks (Incidental)*

Anza/Old Ranch Creeks was not formally surveyed in 2020 due to the high density of homeless encampments at this site and concerns associated with the COVID-19 outbreak. While traversing the perimeter of the site during the course of other fieldwork, four territories, two pairs, and three fledglings were incidentally detected. Neither pair was well-monitored. One nest was incidentally found, but it was not well-tracked (Table 3B).

*SAR – Lower Hole Creek (Sampled)*

Two territories were detected in 2020 whereas three were detected in 2019 (Table 1). One male was determined to be paired and one fledgling was detected (Table 3B). A portion of Lower Hole Creek was cleared of vegetation sometime during the fall or winter prior to the 2020 breeding season and could be associated with the decrease in territories. Although potential effects have not been quantified, homeless encampments and trash dumping may threaten habitat quality at Lower Hole Creek. Approximately nine encampments were documented over the course of the 2020 season and people frequently come to this location to illegally dump refuse.

*SAR - Hidden Valley – North (Sampled)*

Ninety-four territories were detected in 2020, a 21% increase from 78 territories detected in 2019. Sixty-one males were determined to be paired, though some territories were not monitored sufficiently to determine pairing success. Though no pairs were well-monitored in 2020, 74 fledglings were detected. Nest monitoring occurred at Hidden Valley – North in 2010, 2014, and 2016-2018, but did not occur in 2020. The average number of fledglings produced per well-monitored pair has ranged from 2.0 in 2014 (n=4; Appendix D) to 4.0 in 2017 (n=6; Appendix C-1-F). The sample sizes used to calculate these averages are low and may not accurately represent the vireo population at Hidden Valley – North.

Although potential effects have not been quantified, homeless encampments and recreation may threaten habitat quality at Hidden Valley – North. Multiple encampments were observed in 2020, many of which were established prior to 2018 and likely involved habitat removal at the time they were established. In addition, several homeless people at Hidden Valley – North keep unleashed dogs, which could possibly disturb vireo breeding behavior. Improper

garbage and human waste disposal from the sizable homeless population adds pollutants to the environment, which may also have an impact on vireos. City of Jurupa Valley Park located on Downey Street is a popular location for swimming, barbecuing, picnicking, and occasionally for bands to play music. These recreational uses of Hidden Valley – North result in additional noise and refuse in the vireo habitat.

#### *SAR - Hidden Valley — South (Monitored)*

Historically, Hidden Valley — South has been analyzed as one site. Because of a new restoration project, Hidden Valley — South was split into two sites in 2019: Hidden Valley – South Restoration and Hidden Valley – South Non-Restoration. However, to keep comparability with prior years, results are reported herein for both Hidden Valley – South Overall and the two sub-sections.

#### *SAR - Hidden Valley – South (south side of river) Overall*

In 2020, 176 territories were detected at Hidden Valley – South, a 26% increase from 140 territories detected in 2019 (Table 1). One hundred two males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Fifty-one pairs were well-monitored. One hundred eighty-seven fledglings were detected across all pairs in 2020, 126 of which fledged from 51 well-monitored pairs, resulting in an average of 2.5 fledglings produced per well-monitored pair in 2020. The average number of fledglings produced per well-monitored pair has ranged from 2.1 in 2010 (n=9; Appendix D) to 4.8 in 2017 (n=4; Appendix C-1-G).

Nest monitoring has occurred at Hidden Valley – South every year since 2000 with widely varying numbers of nests monitored. One hundred thirteen nests were found in 2020, 109 of which were well-tracked. In 2020, apparent nest success was 46% (n=109), lower than in 2019 (63%; n=76). Predation was the most common cause of nest failure accounting for 47 (43%) nests in 2020. The cause of seven (6%) nest failures was unknown. Though 18 (21%; n=86) nests were parasitized by cowbirds, just five (5%; n=109) failed due to parasitism. Predation has been the leading cause of failure every year nests were monitored (Appendix C-1-G).

Seventeen of the 18 parasitized nests were manipulated; one nest was abandoned at the time the cowbird egg was first observed, precluding manipulation. Six (35%) of the 17 manipulated nests were successful. Parasitism was down from a high of 44% (n=9; Appendix D) in 2007; however, parasitism was up from 9% (n=64) in 2019 (Appendix-C-1-G). There were 39 incidental adult cowbird observations at Hidden Valley South in 2020, though some of these observations could have been the same individuals observed on different days.



Arroyo willow (25%) and mulefat (21%) were most frequently used for nest placement in 2020. Nests were placed in invasive substrates at the following frequencies: five in poison hemlock (4%), one in summer cypress (*Kochia scoparia*; 1%), one in perennial pepperweed (1%), one in tree tobacco (1%), and one in tamarisk (1%; n=113). The remaining nests were located in various native substrates (Table 4).

A portion of Hidden Valley - South had burned during the winter before the breeding season. Vireos were generally not detected in historically occupied areas within the burn, but given the significant increase in territories at Hidden Valley South overall, it is possible the vireos simply moved to unburned areas. Two homeless camps were found during the course of fieldwork at Hidden Valley - South in 2020. Both were evicted by conservation officers. Portions of Hidden Valley South are used by recreationists for swimming. The shore of the Santa Ana River in these areas often has abundant litter and human waste strewn about. Hidden Valley – South is also used frequently by equestrians and hikers which could plausibly disturb vireo breeding behavior, but the potential effect recreation has on vireos is not well studied. Lastly, an individual was observed carrying plant fertilizer onsite in 2020, presumably to fertilize an illegal marijuana crop. Though no marijuana crops were ever observed, it is possible that an illegal marijuana grow existed either at Hidden Valley – South or north of the Santa Ana River in Hidden Valley – North in 2020.

#### *SAR - Hidden Valley – South (south side of river) Restoration*

In 2020, 31 territories were detected at Hidden Valley – South Restoration, a 29% increase from 2019 (Table 3B; Zembal et al., 2019). Twenty-seven males were determined to be paired, 19 of which were well-monitored. Sixty-four fledglings were detected across all pairs in 2020, 57 of which fledged from the 19 well-monitored pairs resulting in an average of 3.0 fledglings produced per well-monitored pair. Thirty-eight nests were found in 2020 and 36 were well-tracked. Apparent nest success was 50% (n=36). The parasitism rate was 17% (n=30). Additional information specific to Hidden Valley – South Restoration can be found in Table 3B.

#### *SAR - Hidden Valley – South (south side of river) Non - Restoration*

In 2020, 145 territories were detected at Hidden Valley – South Non-Restoration, a 25% increase from 2019 (Table 3B; Zembal et al., 2019). Seventy-five males were determined to be paired, 32 of which were well-monitored. One hundred twenty-three fledglings were detected across all pairs in 2020, 69 of which fledged from the 32 well-monitored pairs resulting in an average of 2.2 fledglings produced per well-monitored pair. Seventy-five nests were found in 2020, 73 of which were well-tracked. Apparent nest success was 44% (n=73). The parasitism rate



was 23% (n=56). Additional information specific to Hidden Valley – South Non-Restoration can be found in Table 3B.

### *SAR - Goose Creek, Norco to I-15 (Monitored)*

In 2020, 88 vireo territories were documented in SAR - Goose Creek, only a 2% decrease from the 90 territories documented in 2019. Fifty-eight pairs and 114 fledglings were also documented (Table 3). Apparent nest success for 34 well-tracked nests was 68%, a decrease from 71% in 2019 (n=24), but still higher than the site average of 66% (n=408; Appendix C-1-H). Nest failures in 2020 were due to predation, reproductive failure, and parasitism, accounting for 24%, 6%, and 3% of total nest outcomes, respectively. The reproductive success rate was 3.5 fledglings per well-monitored pair in 2020, which is slightly above the average reproductive success rate of 3.1 at this site (Table 3; Appendix C-1-H). The lowest recorded rate was 1.0 fledglings in 2002; however, only three pairs were well-monitored that year (Appendix D). In 2020, nests were primarily placed in arroyo willow (22%) and Fremont cottonwood (14%; Table 4). Overall, since 2000, most nests have been placed in mulefat (30%) and arroyo willow (29%). Less frequently, nests have been placed in Goodding's black willow (13%), desert wild grape (6%), and Fremont cottonwood (5%; Appendix C-2-H).

Cowbird trapping has occurred at this site since 2004. Since then, five hundred eighty-eight cowbirds have been removed over 3,018 trap days (Appendix C-1-H). In 2020, the only trap at the site had to be removed due to COVID-19 closures. Subsequently, parasitism was documented at this site for the first time since 2013. This is only the third recorded parasitism event in the last 10 years. Overall, parasitism is low in Goose Creek, with a rate of 4% (n=403) since 2001 when surveys began at the site (Appendix C-1-H).

A new housing development near the west end of the IERCD Goose Creek mitigation parcels (southwest of the golf course) was finished prior to the 2020 breeding season. This housing development includes a neighborhood park with access to the habitat resulting in increased human and domestic animal use. Construction activity continues on the 1-15 bridge over the Santa Ana river and this year a small fire occurred in the area prior to the breeding season. Consequently, this small patch of habitat contains no vireo territories and could account for the decrease in the number of vireo territories this year. Additionally, due to COVID-19 access restrictions at the Goose Creek Golf Club, habitat patches within the course were not well surveyed this year. Feral pigs are prevalent in the area and damage the habitat. Evidence of feral pig trapping and hunting was also observed in the area. The site is impacted by human recreational use on an equestrian trail system and in areas where there is easy access to the river on the south side of the site. At this access point there are groups swimming in the river, littering,

and small structures being built. There is also significant tree die off due to polyphagous shot hole borer (*Euwallacea* sp.; PSHB).

### ***Norco Bluffs, I-15 to River Rd. (Monitored)***

In 2020, a total of 133 vireo territories were detected in Norco Bluffs, a 32% increase from the 101 documented in 2019<sup>1</sup>. Sixty-five males were known to be paired, though not all territories were monitored sufficiently to determine pairing success; 159 fledged young were documented (Table 1). A total of 47 nests were found, 43 of which were well-tracked. Nesting success of well-tracked nests was 70% (n=43), a large decrease from 89% (n=35) in 2019. The reproductive success rate also decreased from the previous high of 5.4 in 2019 to 3.2 in 2020. Average clutch size was 3.7 in 2020, slightly lower than 3.8 in 2019. Of the well-tracked nests, 26% (n=43) were lost due to predation, a large increase from 6% (n=35) in 2019. One nest failed due to reproductive failure in 2020, similar to 2019 with two nests; an additional nest failed for unknown reasons. (Appendix C-1-I). In 2020, estimated vireo territory size in Norco Bluffs ranged from approximately 0.4 to 2.0 acres.

From 2013-2018, cowbird trapping at Norco Bluffs was conducted by a contractor retained by USACE. Due to the absence of trapping within the area in 2019 and 2020, SAWA placed a trap at a site previously used by the contractor and removed one male, one female, and one juvenile over the course of 131 trap days (Appendix C-1-I). No cowbirds were detected in vireo habitat over the course of the season. Parasitism was not observed in 2020 or during any of the previous survey years and had not been documented since 2009 (Appendix D). A total of 290.5 biologist hours were spent monitoring vireos at the Norco Bluffs site in 2020.

As in the past four seasons, the primary sources of habitat degradation in 2020 were invasive plants and the continued negative impacts of the PSHB. This beetle drills into trees and brings with it a pathogenic fungus (*Fusarium* sp.) that can infect, and kill, many different tree species. Fortunately, the large-scale dieback of riparian habitat, as observed in the Tijuana River Valley (Boland, 2016), from PSHB infestation has yet to occur; nonetheless, arroyo willows have been significantly impacted by PSHB in Norco Bluffs. Many arroyo willows continue to show signs characteristic of heavy infestation (e.g. heavy staining and branch dieback) or are completely dead. Goodding's black willows infested with the beetle/fungus are declining in health as well, albeit at a slower rate. Over the long term, the loss of cover from these species may have a negative impact on the local vireo population as 47% (n=47) were placed in these two species in 2020 (Table 4). Before the arrival of PSHB, the Norco Bluffs habitat was characterized as healthy where arundo had yet to become dominant. OCWD and SAWA's arundo removal efforts that

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<sup>1</sup> Prior to 2019 and 2020 vireos were monitored in select areas within Norco Bluffs and excluded a 250-acre parcel monitored the previous two seasons; vireo within the parcel were surveyed using a different methodology by a USACE consultant. The on-going changes in the survey area preclude the possibility of comparing all data across all years; comparable population level data is as follows: 2015/2018, 2016/2017, and 2019/2020.

occurred in Norco Bluffs through the winter of 2019-2020 removed most mature stands of the invasive plant. Several removal areas already have recruitment of native species, including willows. In addition to arundo, there is a relatively small, yet highly dense, stand of mature Mexican fan palm (*Washingtonia robusta*) that appears to have a rapid rate of recruitment. The understory within the stand of palms consists primarily of younger palms with little presence of native plant species. Much like arundo, the palms provide relatively low-quality habitat compared to the surrounding areas dominated by native plant species. During the winter of 2019-2020 SAWA treated palms within OCWD property; however, numerous palms within USACE property will need to be treated as well. Treating the remaining arundo stands and palms would allow for additional natural recruitment of native riparian plant species and thereby increase functional habitat for vireos and other sensitive species.

### ***Temescal Canyon (Sampled)***

One hundred forty-seven territorial male vireos were detected in 2020, the highest number documented to date, compared to 127 in 2019 and 106 in 2018. Unlike the former high-count year, 2013 (n=131; Appendix D), the past four survey years (2017-2020) excluded the Dos Lagos Golf Course as SAWA biologists were prohibited from entering the area; thus, the 2020 count likely would have been higher. Thirty pairs and twenty fledglings were detected in 2020; no pairs were considered well-monitored (Appendix C-1-J).

Five cowbird traps were open during the 2020 season in Temescal Canyon. Four traps were located adjacent to riparian habitat and the fifth at a small dairy near Lake Elsinore where the highest parasitism rates typically occur. The five traps caught a total of 324 cowbirds over 561 trap days. Cowbird trapping has occurred during the nesting season in Temescal Canyon since 2001 and a total of 4,674 cowbirds have been removed during this time (Appendix C-1-J). Even with on-site cowbird trapping, parasitism has been documented in Temescal in 11 out of the 20 years it has been surveyed, reaching a peak rate of (42%) in 2007 (n=12; Appendix D). No cowbirds were detected within the habitat in 2020 that were not trapped.

In 2020, much of the habitat throughout Temescal Canyon continues to show drought stress, especially downstream of Dos Lagos Golf Course where effluent outflow by City of Corona Wastewater Treatment Plant #3 was suspended in 2013. In 2014, a SAWA biologist familiar with the area reported to CDFW massive vegetation die-off due to lack of water from the historical water treatment outflow. This die-off has been amplified by the ongoing drought conditions and habitat quality has continued to decline since the effluent outflow was halted. In addition to these stressors, the habitat in Temescal Canyon and Lake Elsinore is regularly impacted during the nesting season by off-road vehicle use, illegal vegetation removal, homeless encampments, and understory clearing to deter the establishment of additional homeless encampments around

Lake Elsinore. Management recommendations for this area include increased cowbird management, removal of tamarisk, enforcement of illegal vegetation removal during avian nesting season, and reestablishing outflow to the creek near Dos Lagos Golf Course.

### ***Chino Hills (Sampled)***

In 2020, Chino Hills was not monitored extensively due to inaccessibility to all vireo locations. Even though fewer site visits were conducted and survey effort was reduced, 36 territories, 10 pairs, and nine fledglings were documented in 2020, representing a 24% increase in territories from 2019 (n=29; Appendix C-1-K).

No cowbird trapping occurred in Chino Hills in 2020. In 2019, a cowbird trap was located near the Chino Hills Community Center at English Channel and did not capture any cowbirds over a period of 101 trap days. The trap encountered some predator issues due to Cooper's Hawks (*Accipiter cooperii*) utilizing it as a prey source. In 2018, 23 cowbirds were captured over 92 trap days. Trapping has occurred in Chino Hills since 2008 and a total of 236 cowbirds have been removed during this time (Appendix C-1-K). Before 2020, parasitism ranged from 0% (n=2) in 2016 to 60% (n=5) in 2007. Since 2008, when cowbird control began, only two nests were found to be parasitized, in 2015 and 2018, respectively (Appendix D). No vireos were observed with cowbird fledglings; however, a juvenile cowbird was observed being fed by a female Hooded Oriole in the habitat during monitoring in 2020. Parasitism, development, human activity, cattle grazing, and small fragmented habitat patches are factors that may threaten vireos and reduce productivity throughout the Chino Hills area.

### ***Santa Ana Canyon (SAC)***

These results are compiled from three sites (Upper Canyon, Green River Golf Club, and Featherly Park), collectively known as SAC. One hundred eighty-five vireo territories were detected in SAC during 2020, an increase of 24% from the 149 territories detected in 2019 (compiled from Table 1). Nesting success for 85 well-tracked nests in SAC was 46% overall, a substantial decrease from 72% (n=75) in 2019. Thirty-seven (44%) well-tracked nests were lost to predation, four (5%) were lost to reproductive failure, and five (6%) were unsuccessful for unknown reasons. The reproductive success rate in SAC in 2020 was 2.5, vastly different from the success rate of 4.6 in 2019 (compiled from Appendix C-1-L to C-1-N). For comparison, the watershed-wide rate of reproductive success in 2020 was 2.8 (n=247) and the watershed-wide rate of fledglings produced from 2001-2020 is 2.9 (n=2,019; Appendix B-1). One hundred eighty-one fledglings were documented in SAC in 2020, a decrease from a record high of 230 fledglings observed in 2019. A total of 1,681 fledglings have been documented in SAC over the last 19 years

(compiled from Appendix C-1). In 2020, mean clutch size was 3.7 (n=83), unchanged from 2019. Vireos used a variety of plant species (n=16) for nest substrate in 2020. Of the 93 total nests found, the highest number of nests were found in mulefat (38%), blue elderberry (12%), laurel sumac (12%), and Fremont cottonwood (10%; compiled from Table 4). Vireo territory size in SAC is estimated to be between 0.3 acre and 3.7 acres.

SAWA began cowbird trapping in SAC in 2001 when parasitism was documented in five (26%) of 19 nests. Parasitism was again documented in one (5%) of 21 nests in 2009 after five years of no occurrences (Appendix D). SAWA deployed two traps within a mile of that location and no parasitism had been recorded until 2020, when a productive trap was inaccessible because of the BNSF bridge project and five nests were parasitized. Since 2001, a total of 2,421 cowbirds have been removed from the canyon over 13,695 trap days during the vireo breeding season (compiled from Appendix C-1-L to C-1-N). There were no un-trapped cowbirds detected in vireo habitat in SAC in 2020. A total of 768 biologist hours were spent monitoring vireos at the SAC site in 2020.

In 2020, only one phase of the USACE Reach 9 project remained active in Featherly Park and the BNSF bridge project continued in Green River Golf Club. These on-going construction projects will continue for several years and may challenge future vireo recovery in the impact areas. However, proposed mitigation should expand and enhance vireo habitat in the post-construction years. For example, several vireos have already moved into restored areas in Phase 3, only three years after installation and in Phase 4 by the second year.

At this time, riparian habitat in SAC is becoming infested with arundo at all three sites. The restoration edges between the golf course and the homes have opened new areas for arundo to infest along the river, while the arundo patches in the Upper Canyon continue to spread. In the lower section (Featherly Regional Park) the arundo had been treated with Imazapyr, which damaged many of the surrounding native trees. Though most of the arundo at this location is dead, the biomass remains, hampering native regeneration at this site. Additionally, multiple native trees are suffering from Imazapyr over-spray. Trees damaged by Imazapyr continue to suffer and many were found dead in 2016.

PSHB is known to have infested trees in the Canyon RV Park within Featherly Regional Park and several trees in the riparian zone appear to have been infested (unconfirmed). There is no significant native tree die-off caused by the invasive PSHB observed in SAC at this time. In the past, SAWA deployed PSHB traps in this area to assist in a monitoring program coordinated with the University of California, Riverside. The County of Orange has implemented the Santa Ana River Canyon Habitat Management Plan and SAWA biologists sit on two subcommittees overseeing implementation of the plan, though no meetings have occurred in the last five years. Although the USACE riverbank stabilization (Reach 9) and BNSF bridge projects are expected to continue for several years, as well as the Santa Ana River Trail project set to resume, we hope

active management and restoration of the canyon will improve to maintain optimum conditions for native species.

### *Upper Canyon (Monitored)*

In 2020, 45 vireo territories were documented in Upper Canyon, a 29% increase from 2019 (n=35). Thirty territorial males were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 52 fledglings were documented (Table 1). Nesting success for 11 well-tracked nests was 73%, similar to 74% (n=19) success in 2019 and an increase from 50% (n=10) in 2018. Two (18%) well-tracked nests were lost to predation, bringing the overall rate of predation from 2001 through 2020 to 28%. Eight well-monitored pairs successfully produced a total of 26 fledglings (Table 3). Overall success of well-tracked nests for this site from 2001 to 2020 is 67% (n=126) and the overall reproductive success rate of well-monitored pairs during this time is 1.9. A total of 469 fledglings have been documented over the last 20 years (Appendix C-1-L). Nests were most frequently placed in mulefat (54%) and blue elderberry (15%; Table 4). Estimated territory size of the vireos in Upper Canyon ranged between 0.8 to 1.5 acres in 2020.

Cowbird trapping has occurred in Upper Canyon since 2001 when the first vireo was detected on-site. To date, 841 cowbirds have been removed from this area (Appendix C-1-L). Parasitism has only been documented two of the 20 years monitored and reached its highest rate (18%) in 2003. No parasitism has been detected in Upper Canyon since 2003 (Appendix D). No cowbirds were detected in the habitat in 2020.

No construction activities occurred within Upper Canyon in 2020. Unfortunately, this site continues to be plagued by other human-related impacts including illegal fishing, trash dumping, and illegal trail creation, in addition to large areas of invasive species (e.g. arundo, tamarisk) infestation.

### *Green River Golf Club (Monitored)*

In 2020, 61 territories were documented, an increase of 36% (n=45) from 2019 (Table 1). The vireo population at Green River Golf Club has increased six-fold since monitoring began in 2001 when only 10 vireos were detected (Appendix D). Forty-two males were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 63 fledglings were documented. Nesting success for 33 well-tracked nests was 48% in 2020, compared to a record high of 79% in 2019 (Appendix C-1-M). Overall nest success from 2001 to 2020 is 58%. Fifteen (45%) well-tracked nests were lost to predation and two (6%) nests were lost for unknown reasons. The reproductive success rate decreased from 4.3 in 2019 to 2.2 in



2020, as compared to the lowest reproductive rate observed of 0.6 in 2018. The overall reproductive success rate from 2001-2020 of well-monitored pairs is 2.5. A total of 606 fledglings have been documented over the last 20 years (Appendix C-1-M). Nests were most frequently placed in mulefat (32%), blue elderberry (21%), laurel sumac (15%), and Fremont Cottonwood (12%). Four nests were placed in non-native vegetation which included three (9%) in Peruvian pepper tree and one (3%) in Carrotwood (*Cupaniopsis anacardioides*; Table 4). In 2020, estimated territory size of the vireos at Green River Golf Club ranged between 0.5 to 3.5 acres. Though no banded vireos were detected during surveys, five territorial males and a paired female were banded as part of a USGS genetic study.

No cowbird trapping occurred in 2020 due to ongoing BNSF construction and limited access. Cowbird trapping has occurred at the golf club since 2001 when the first vireo was detected on-site and a total of 1,070 cowbirds have been removed from this area (Appendix C-1-M). When SAWA began monitoring this site in 2000, the parasitism rate was 44%. No parasitism had been documented since 2001 when cowbird trapping was initiated (Appendix D). With no cowbird trapping in 2020, five (17%) well-tracked nests were parasitized. Cowbird eggs from these five parasitized nests were removed; however, only two nests were successful and a total of six vireos were fledged from these manipulated nests (Table 3).

Management at the Green River Golf Club has continued its cooperative relationship with SAWA and is supportive of SAWA's efforts to control cowbirds, manage vireos and other sensitive species, and enhance habitat.

#### *Featherly Regional Park (Monitored)*

In 2020, 79 territorial vireo were detected in Featherly Regional Park, a 14% (n=69) increase from 2019. Forty-seven were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 66 fledglings were detected. A total of 606 fledglings have been observed over the last 20 years (Appendix C-1-N). These numbers emphasize the vireo population recovery at this site over the last 20 years given that no vireos were detected in 2001, the first year of monitoring. The population's first major increase came in 2004 when it quadrupled from six in 2003 to 24 the following year (Appendix D). However, productivity has greatly fluctuated at this site from a high of 5.6 in 2019 to a low of 1.0 in 2016 (Appendix C-1-N; Appendix D). In 2020, estimated territory size of the vireos in Featherly Park ranged between 0.28 to 3.7 acres. Though no banded vireos were detected during surveys, four territorial males were banded as part of a USGS genetic study.

Nesting success for 41 well-tracked nests in 2020 was 37%, a decrease from 2019 and much lower than the overall nesting success from 2002 to 2020 of 45%. Twenty (49%) of 41 well-tracked nests were lost to predation. Although parasitism was not documented at this site in

2020, four (10%) well-tracked nests failed due to reproductive failure, and two (5%) for unknown causes. Seventeen well-monitored pairs had a reproductive success rate of 2.6. The overall reproductive success rate of well-monitored pairs over 20 years of monitoring is 2.2 (Appendix C-1-N; Appendix D). Of the 46 nests found in 2020, eight (17%) were placed in non-native vegetation, with the highest number of native nest placement in mulefat (37%; Table 4).

The California Scrub-Jay, a well-known avian nest-predator, occurs in large numbers throughout Featherly Regional Park. One such predation was observed as a scrub-jay took three seven-day old nestlings from one nest in 2015. Another nest invader found in large numbers throughout the site is the Argentine ant. One nest was found containing three nestlings covered in Argentine ants while the adults were frantically trying to attend to the nestlings. Other indications of ant predation in prior years include: in 2015, a nest found with ants entering a pip hole in the eggs on hatch day (a later visit found the eggs to be completely empty with only the same small hole in each egg); in 2016, ants were observed eating two Black-headed Grosbeak (*Pheucticus melanocephalus*) nestlings and one egg; in 2017 and 2018, ants were observed preying on vireo nestlings and hatch-day eggs.

Cowbird trapping has occurred in Featherly Regional Park since 2001 when the first vireos were detected on-site and 510 cowbirds have been removed during this time. Parasitism has been documented three out of the 19 years monitored, reaching its highest rate (67%) in 2002. No parasitism has been detected in Featherly Regional Park since 2009 (Appendix D).

Until the abundant winter rains in 2016/2017, the habitat at Featherly Regional Park had become extremely drought-stressed, with the exception of the area immediately adjacent to the riverbanks. The dramatic increase in breeding success in 2017 and 2019 at this site was likely due to the increased precipitation and resulted in higher recruitment in 2018 and 2020. PSHB has been detected within the park, though no large die-off has been observed. Other ongoing disturbances at this site include habitat destruction during nesting season by the orange grove lessee, illegal fishing, and sporadic homeless camps. Invasive plants continue to be a problem at this site. In 2020, with the late winter/spring precipitation, poison hemlock and mustard were dense throughout most of the site. The highly invasive arundo began re-sprouting two weeks after the Freeway Complex Fire in 2008 and has since spread throughout the site. In an effort to take advantage of the arundo biomass removed by the fire, Orange County Public Works management was able to spray herbicide on the rapid arundo regrowth before the following nesting season, which helped control a large amount of regrowth. Unfortunately, many patches have reestablished since that time and a large amount of dead arundo biomass remains, hampering native plant regeneration. Additionally, the subsequent use of Imazapyr on arundo was found to have damaged over 200 nearby native trees in 2013. More damage was observed in 2020. The USACE Reach 9 project, Phase 5B, was still active in Featherly Park during part of the nesting season in 2020. However, proposed mitigation should expand and enhance vireo habitat



in the post-construction years. In fact, vireos (n=3) have already begun inhabiting the Phase 4 restoration area. The 8% decrease of territorial males at this site from 2016 (n=64) to 2017 (n=59) was likely due to habitat loss during construction. However, those numbers continue to rebound in 2020 (n=79; Appendix C-1-N).

### ***Sampled Sites***

Thirty sites were sampled in 2020 and 441 vireo territories were documented. Vireos were not detected at five of the 30 sampled sites. Nineteen sites sampled in 2020 reported an increase in detected vireo territories, while three sites reported a decrease in detected vireo territories. Eight sites reported the same number of territories in 2019 and 2020. Chino Hills State Park, that had 37 territories in 2019, was not surveyed in 2020 due to COVID-19 restrictions (Table 1). Cowbirds were reported in the habitat at both Chino Hills and Lake Perris sample sites. A total of 540.25 biologist hours were spent surveying vireos at all sampled sites in the watershed in 2020.

### ***Incidental Sites***

In 2020, 21 additional vireo territories were documented at six sites in which no formal surveys were conducted. Of those 21 territories, one male was incidentally determined to be paired and to have produced at least one fledgling (Table 1). Location names and GPS coordinates of incidental vireo detections can be found in Appendix A.

## **SIGHTINGS OF INTEREST – INCIDENTAL SPECIES OBSERVATIONS**

All incidental species sightings were documented at monitored sites and only sensitive species were documented at sampled and incidental sites during vireo monitoring. One hundred sixty-five avian, 20 mammal, 22 herpetofauna, and four fish species were observed at monitored and sampled sites. Sensitive species were documented by site and a combined total of 39 sensitive species were detected (Table 5). Sensitive species are defined as those listed as endangered, threatened, or a species of concern by resource agencies and those covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Observations are verified detections and are considered presence at each location and should not be considered as a complete species list for each site. For example, California Gnatcatcher (*Polioptila californica*; CAGN) were detected at three sites adjacent to vireo habitat; however, other CAGN likely occur in adjacent areas of other sites where biologists do not frequent and hence there may be many undetected CAGN. Similarly, some species are difficult to detect, such as the long-tailed weasel

and may occur in locations other than those reported here. Sensitive species sightings are reported annually to the appropriate resource agencies.

### ***Southwestern Willow Flycatcher***

SWFL have been documented sporadically in Prado Basin since 1996 and a total of 37 nests have been discovered on site from 1996-2013 (Pike et al., 2015). There were no detections of SWFL in the Prado Basin in 2020 (Bonnie Johnson, personal communication). In past years, the highest number of detections in the Prado Basin occurred in 2003, with nine individuals present.

In 2020, SAWA biologists detected 10 individual migrant Willow Flycatchers within the watershed. No breeding pairs were detected. One adult was detected at San Jacinto Wildlife Area on 5/15. On 5/20, a singing male was found at Hidden Valley South; a second was found at the same location on 5/21. Another individual was detected on 5/21 within the Prado Basin. On 5/26, an adult was observed near Chino Creek at Prado's Cuckoo Pond site. On 5/28, a male was found at the Inland Empire Utilities Agency site in Fontana. On 6/2, three flycatchers were detected at Lake Perris. On 6/8, an adult was observed along the San Jacinto River.

Migrant Willow Flycatchers have been observed periodically throughout the rest of the watershed over the years; however, SAWA has not documented any breeding attempts at monitored or sampled sites. All migrant Willow Flycatcher sightings are reported to USGS Riparian Birds Working Group and to the California Natural Diversity Database.

## **BROWN-HEADED COWBIRD TRAPPING RESULTS**

### ***Brown-headed Cowbird Trapping, March-July 2020***

Forty-four cowbird traps were deployed during the 2020 vireo season and 3,957 cowbirds were removed from all sites over 4,927 trap days. Of the 44 traps, eight were located at local dairies. The sex and ages of the cowbirds removed in 2020 were 2,596 adult males, 1,003 adult females, and 358 juveniles. SAWA biologists and field assistants spent 3,030 hours servicing traps during the vireo season, including installation and removal of traps from the field (Table 6).

Cowbird captures increased by 29% (n=3,069) from 2019. Twenty-eight percent more males, 19% more females, and 87% more juveniles were trapped during the 2020 breeding season compared to 2019. In 2020, the overall capture rate was 0.80 cowbirds per trap day, an increase from 0.65 in 2019. Since cowbird management began in 2001, 47,602 cowbirds have been removed from the watershed by SAWA during the breeding season (Appendix D). In 2020, the Goose Creek 2 trap was shut down after four trap days because of COVID-19 related access issues. Additionally, the Hidden Valley South trap was broken into near the end of the trapping season, releasing the cowbirds, and was not re-baited.

### ***Non-target Captures in Cowbird Traps, March-July 2020***

Twenty-six non-target native species and three exotic species were captured in 44 traps in 2020. Including all native species and the one non-nuisance exotic species, there were a total of 2,918 trapping occurrences (2,916 native and two non-nuisance exotic). It should be noted that many of these trapping occurrences are likely the same individuals returning to the same traps. In order of most frequently captured, the most common species were California Towhee (*Melospiza crissalis*), Red-winged Blackbird (*Agelaius phoeniceus*), Song Sparrow (*Melospiza melodia*), and House Finch (*Haemorhous mexicanus*). The percent of trapping occurrences that resulted in mortality was 1.1% in 2020 (Table 7). Numbers of the two nuisance exotic species released or removed, European Starlings and House Sparrows, are also listed in Table 7.

### ***Fall/Winter 2019-2020 Brown-headed Cowbird Trapping and Non-target Captures***

Seven cowbird traps were deployed at dairies during the non-breeding season (fall/winter) of 2019-2020. Two dairies in the Prado Basin each had two traps and three dairies near the San Jacinto River each had one trap. A total of 4,788 cowbirds were removed (1,656 adult males, 1,506 adult females, and 1,626 juveniles) over 639 trap days (Table 8). In the fall/winter of 2018-2019, 6,005 cowbirds were removed from four dairy traps over 666 trap days (Zemba et al., 2019). In 2019-2020, the capture rate was 7.5 cowbirds per trap day, a decrease from 9.0 in 2018-2019. Over 88,000 cowbirds have been removed from the watershed by SAWA during the fall/winter since cowbird management began (combined from SAWA annual reports 2001-2020).

Four non-target native species, consisting of 86 individual trapping occurrences, were captured in the seven dairy traps in 2019-2020. The most common species captured was the Red-winged Blackbird (n=58). No non-target native species died in traps in 2019-2020. Numbers of European Starlings and House Sparrows either removed or released from cowbird traps are reported in Table 9.

## **DISCUSSION**

With the exception of a few years, vireo abundance has increased annually in the Santa Ana Watershed since monitoring began in 2000. In 2020, 2,293 vireo territories were documented watershed-wide (including data from Prado Basin), a 17% increase from 2019

( $n=1,967$ ; Figure 6). The significant population increase over 20 seasons of monitoring at four sites is illustrated in Figure 7. The 1,574 vireos detected by SAWA biologists, outside of Prado Basin, in 2020 was up 16% from 2019 ( $n=1,361$ ). In 2019, the reproductive success rate was an unusually high 3.8 fledglings produced per well-monitored pair, which likely contributed to the increased abundance in 2020. Most survey sites throughout the watershed showed increased territory numbers, one exception being the large area of SAR – Riverside Ave. to Van Buren Blvd., which showed a 23% decrease between 2019 and 2020. This may be a result of decreased effort caused by access restrictions relating to homeless encampments during the COVID-19 pandemic. Survey efforts were otherwise similar at most sites with the exception of San Jacinto and SAR – Hidden Valley – North, which had a slightly increased effort.

Nesting success watershed-wide was 53% in 2020, down from 62% in 2019 and lower than the overall nesting success of 58% ( $n=3,703$ ) in the last 20 years. In 2020, the overall reproductive success rate (average number of fledglings produced by well-monitored pairs) was 2.8, just under the 20-year average of 2.9 and lower than the unusually high rate of 3.8 in 2019, which may have contributed to the increased abundance in 2020. Southern California received much lower than average precipitation during the winter of 2019-2020, which may have resulted in reduced prey availability for nesting vireos and potentially contributed to lower reproductive success than the prior year, which had higher than average precipitation (National Oceanic and Atmosphere Administration, 2020). Another potential factor for the lower than average reproductive success rate was an apparent delay in nest initiation for many pairs in several locations. Typically, the majority of first nest attempts are found in late March and early April. In 2020, many pairs did not initiate nesting until closer to mid-April. This delay may have been in response to unusually heavy precipitation in March/April after an otherwise dry winter. Predation remains the primary cause of nest failure, with an overall 36% of nests lost to predation in 2020, slightly higher than the 33% watershed-wide spanning all years of monitoring. The parasitism rate was 8% in 2020, though overall nest loss from cowbird parasitism was only 2% (20-year average of 3%). The watershed-wide parasitism rate has ranged from 3% to 10% in the last five years and these low rates can likely be attributed to SAWA's cowbird trapping program and nest monitoring. Kus and Whitfield (2005) showed that cowbird trapping reduces parasitism of vireo nests, thus enhancing productivity of nesting pairs and in turn increasing the population level. Figure 8 shows the increase in vireo territories in relation to the rate of cowbird parasitism in the Santa Ana Watershed from 2001-2020. A comparison of watershed-wide nesting success, predation, and parasitism rates from 2003-2020 are shown in Figure 9. Nest loss due to reproductive failure and other unknown factors in 2020 was 9%. Examples of nest loss due to reproductive failure are failure of the vegetation to support the nest and non-parasitized egg abandonment (Appendix B-1; Appendix D).

The two primary causes of vireo decline in the past, parasitism by the Brown-headed Cowbird and the loss of riparian habitat, are being successfully managed by SAWA through cowbird trapping and habitat restoration. SAWA biologists have removed over 136,000 cowbirds from the watershed in the last 20 years (Figure 10). SAWA has also removed over 5,000 acres of invasive arundo from the watershed, allowing for almost as many acres of riparian recovery.

The lack of documented nesting SWFL in the watershed in 2020 is not surprising given the dwindling numbers over the last decade. No breeding activity from this species has been documented in the watershed below Seven Oaks Dam since 2014. The habitat in the higher elevations of the watershed (above Seven Oaks Dam) has had SWFL territories reported in the past and should be surveyed to ascertain the status of this imperiled species in the mountains. SAWA and OCWD have plans to survey these areas in 2021.

## MANAGEMENT RECOMMENDATIONS

Parasitism by Brown-headed Cowbirds continues to occur episodically throughout the watershed. Vireo monitoring and cowbird trapping should continue along with the removal of non-native vegetation. The removal of arundo and other invasive vegetation, in conjunction with cowbird management, have had a positive influence on vireo territory numbers in the watershed since 2000. With the removal of over 5,000 acres of arundo and other invasive plants to date and an additional 600 acres in the process of being removed, SAWA continues to have extraordinary success with riparian habitat restoration along the Santa Ana River and its tributaries. Since invasive plants like arundo cannot typically be eradicated within a five-year mitigation term, we recommend that long-term maintenance of invasive plant regrowth become a mitigation opportunity much like cowbird trapping.

In recent years, large homeless encampments have become increasingly prevalent throughout the Santa Ana River. These encampments could have a strongly negative effect on habitat and water quality and cause increasing safety issues for biological monitors. In addition to restoration, as well as maintenance and procurement of new lands, there should be increased protection of lands for wildlife values. Specifically, enforcement of current laws that restrict illegal activities in sensitive riparian areas. Local landscapes are scarred with OHV tracks and the activity is damaging riparian habitat in areas such as Mockingbird Canyon, San Timoteo Canyon, the San Jacinto River, and the Santa Ana River. Additionally, laws meant to prevent other human disturbances such as streambed alteration, illegal fishing, and homeless encampments need increased enforcement. Enforcement of these laws can protect riparian habitat from degradation. There is also increasing awareness of the need to control feral pigs throughout the

watershed. Some multi-organizational planning attempts to control this destructive species have been publicized; however, a management plan has yet to be implemented.

Although existing laws are meant to protect these resources, even on private land, we must strive to invest the public in these resources and identify effective ways to ensure that floodplains are protected for future generations of humans and wildlife. Priorities for SAWA's vireo recovery program in the near future will continue to be based primarily on cowbird trapping and nest monitoring, which we believe provide the most immediate support for the recovering vireo population, the availability of ample invasive-free riparian habitat notwithstanding. SAWA will continue to provide accurate annual data on vireo status, distribution, and reproductive productivity as funding allows.

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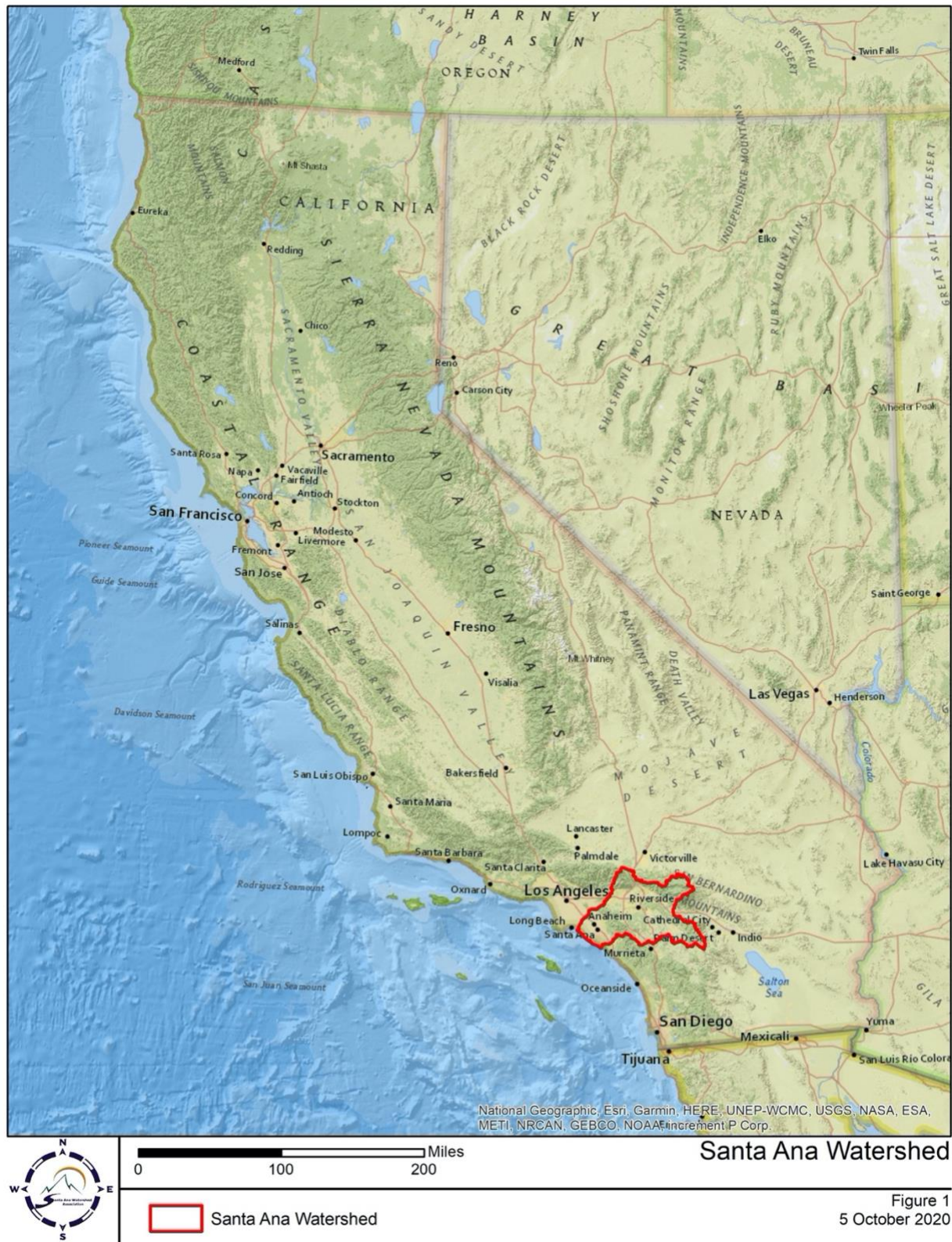


Figure 1. Map of the Santa Ana Watershed.



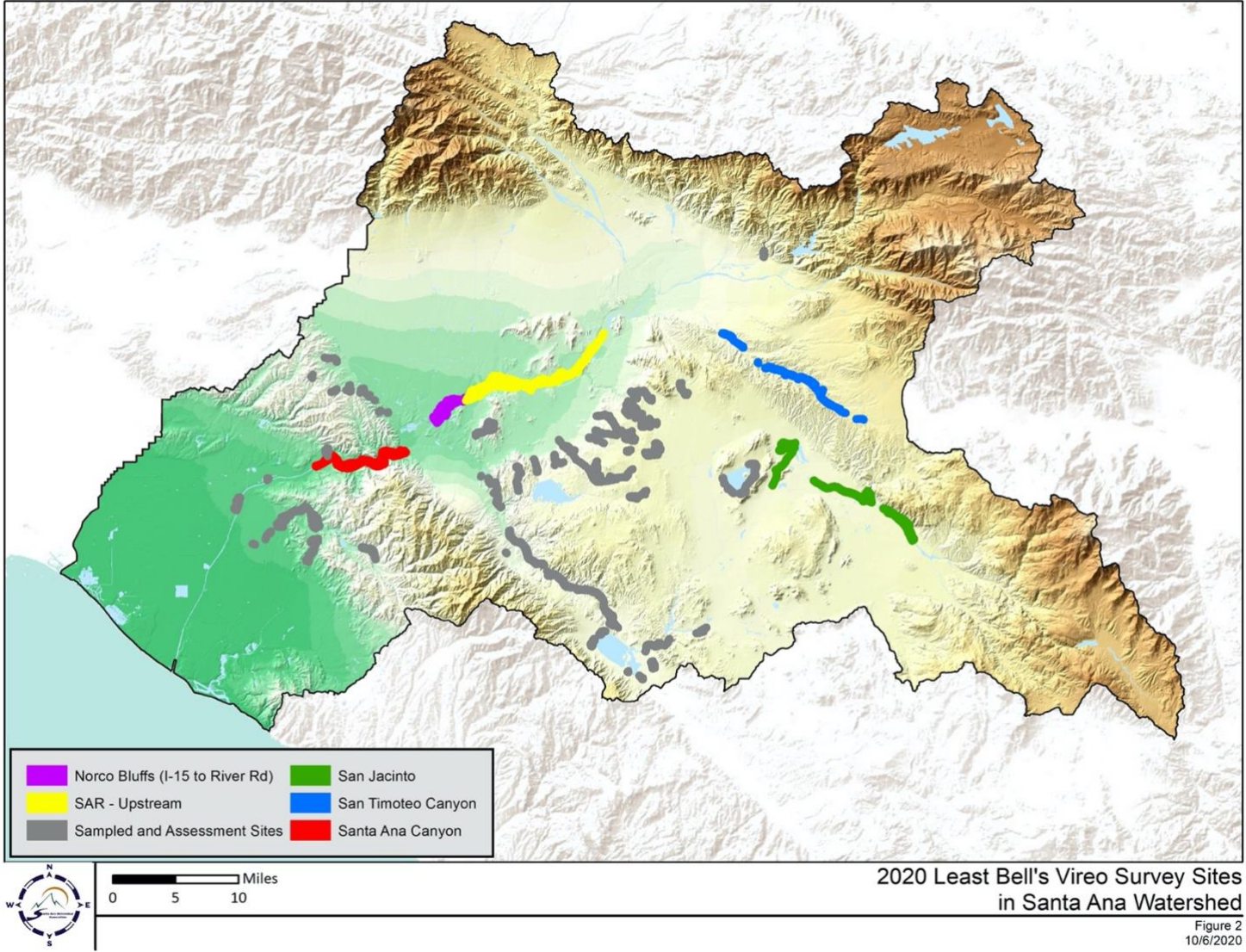


Figure 2. Least Bell's Vireo survey sites in the Santa Ana Watershed, 2020.



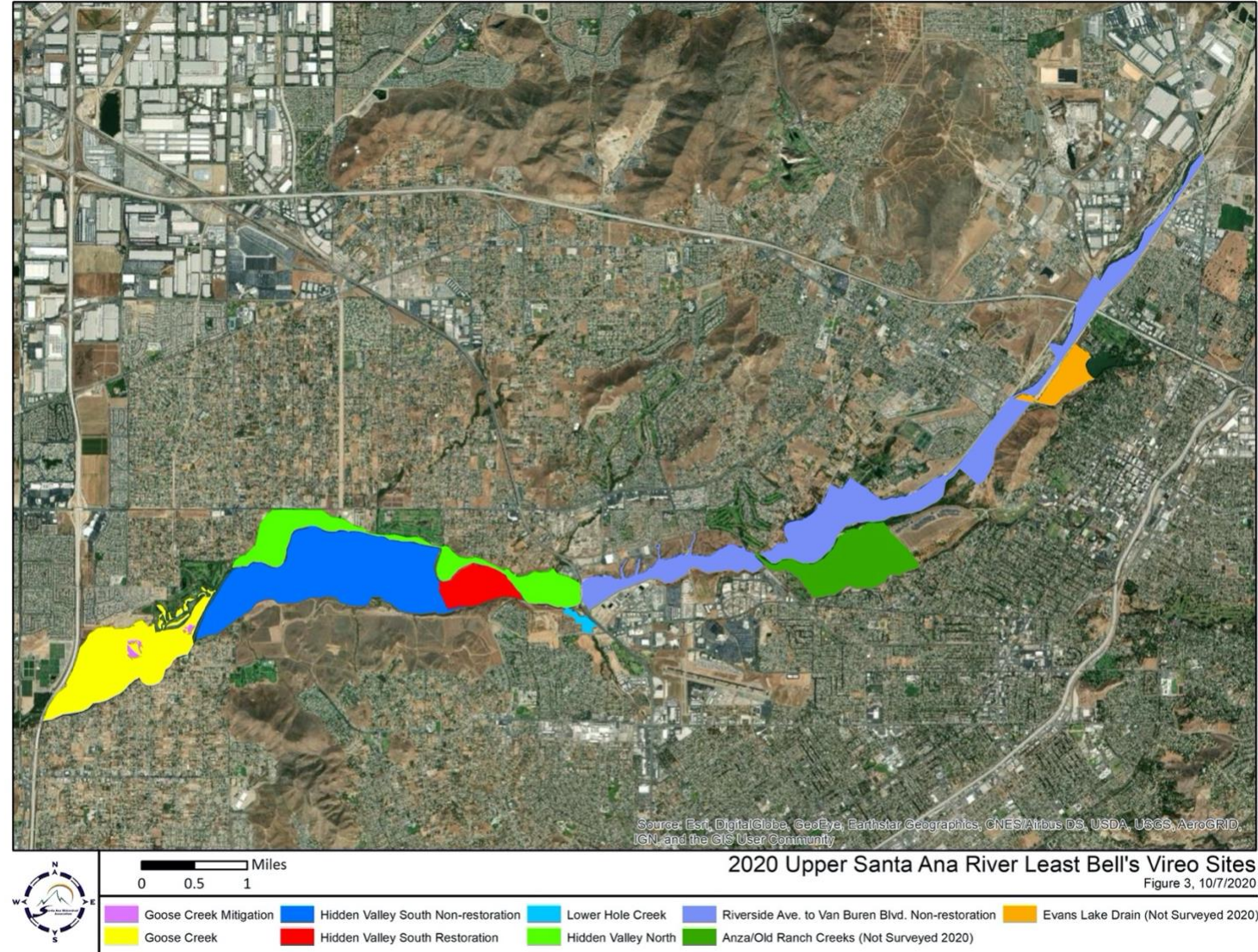


Figure 3. Upper Santa Ana River Least Bell's Vireo Sites, 2020.



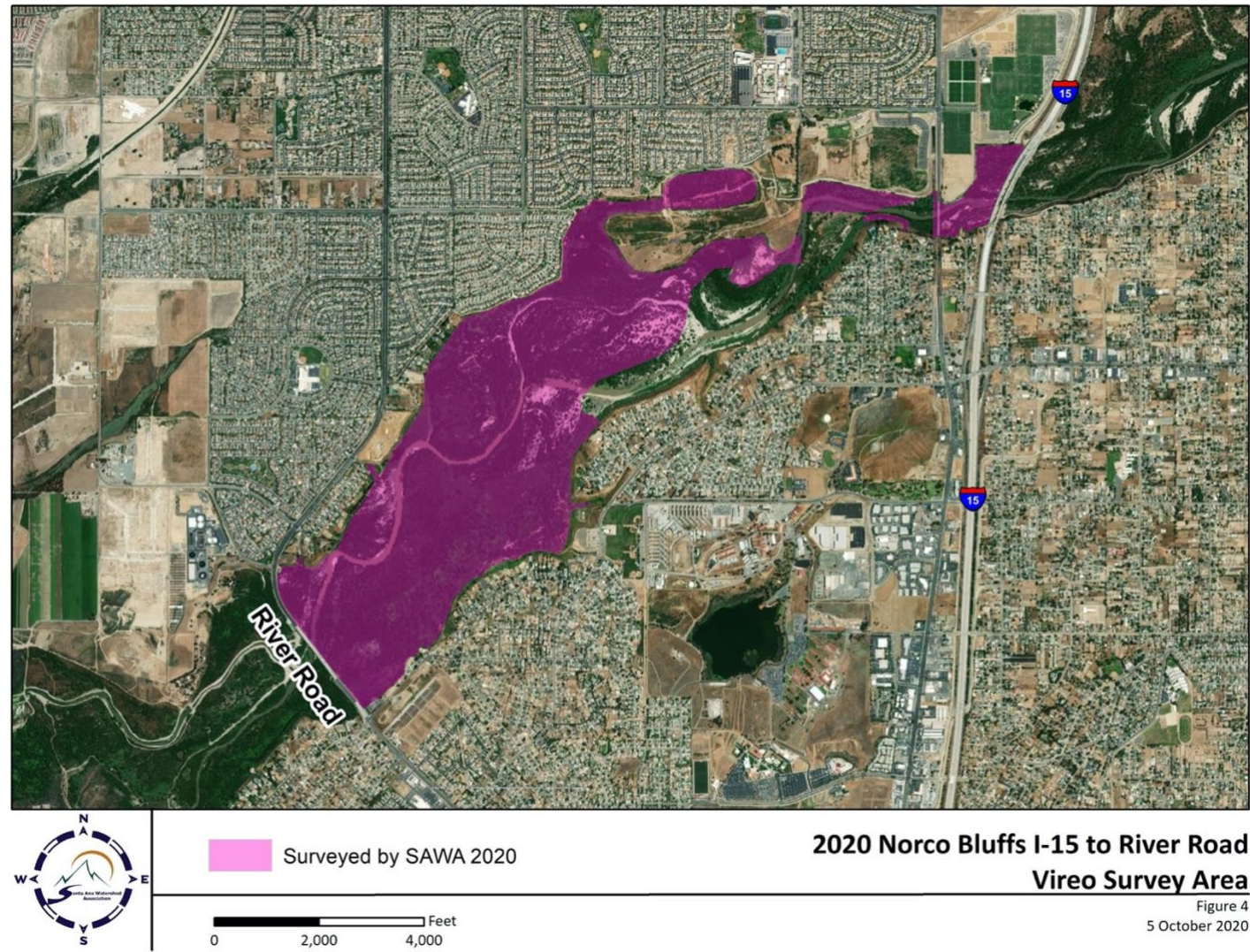


Figure 4. Norco Bluffs Vireo Survey Area, 2020.



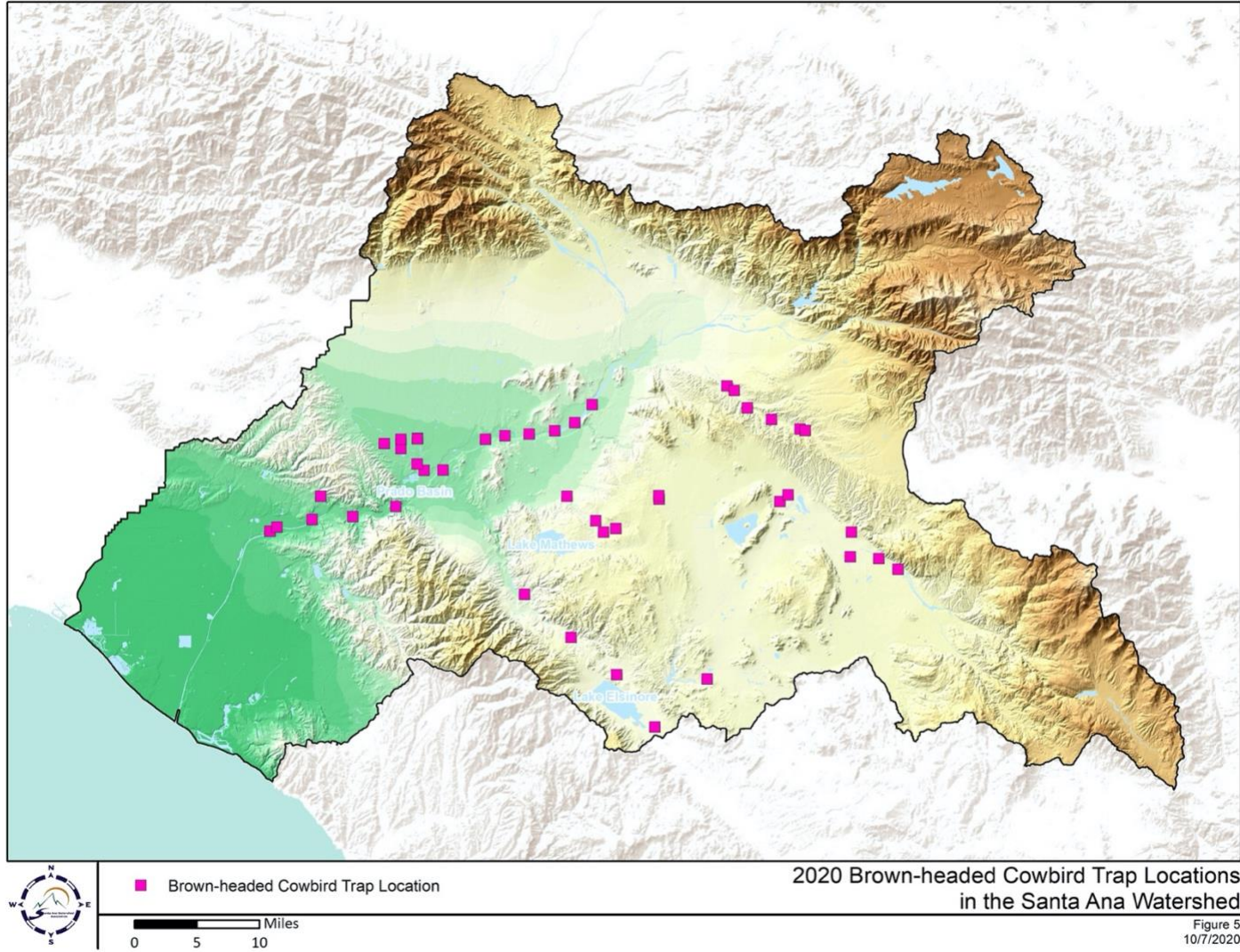


Figure 5. Brown-headed Cowbird trap locations in the Santa Ana Watershed, 2020.

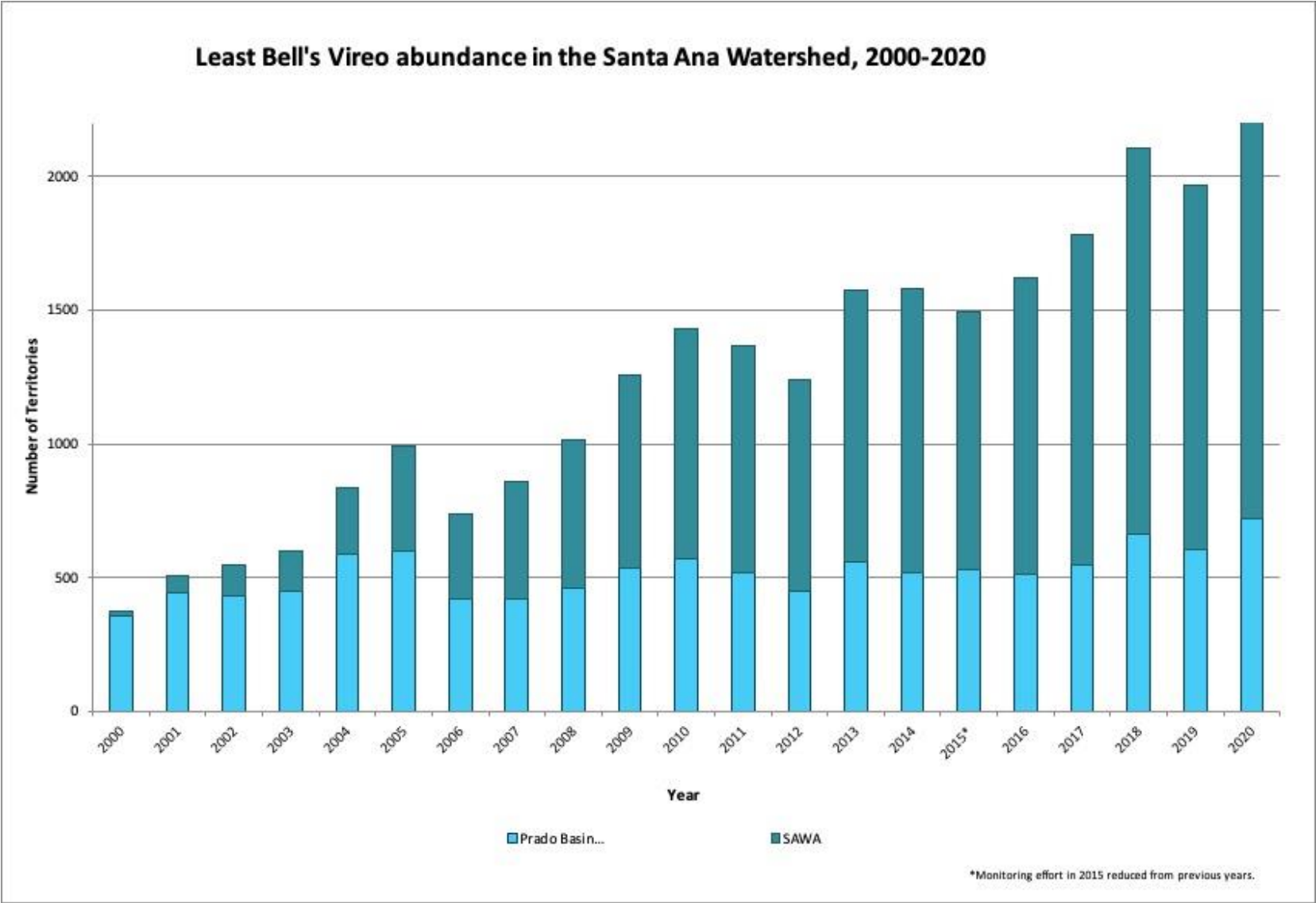


Figure 6. Least Bell's Vireo abundance in the Santa Ana Watershed, including Prado Basin, 2000-2020.

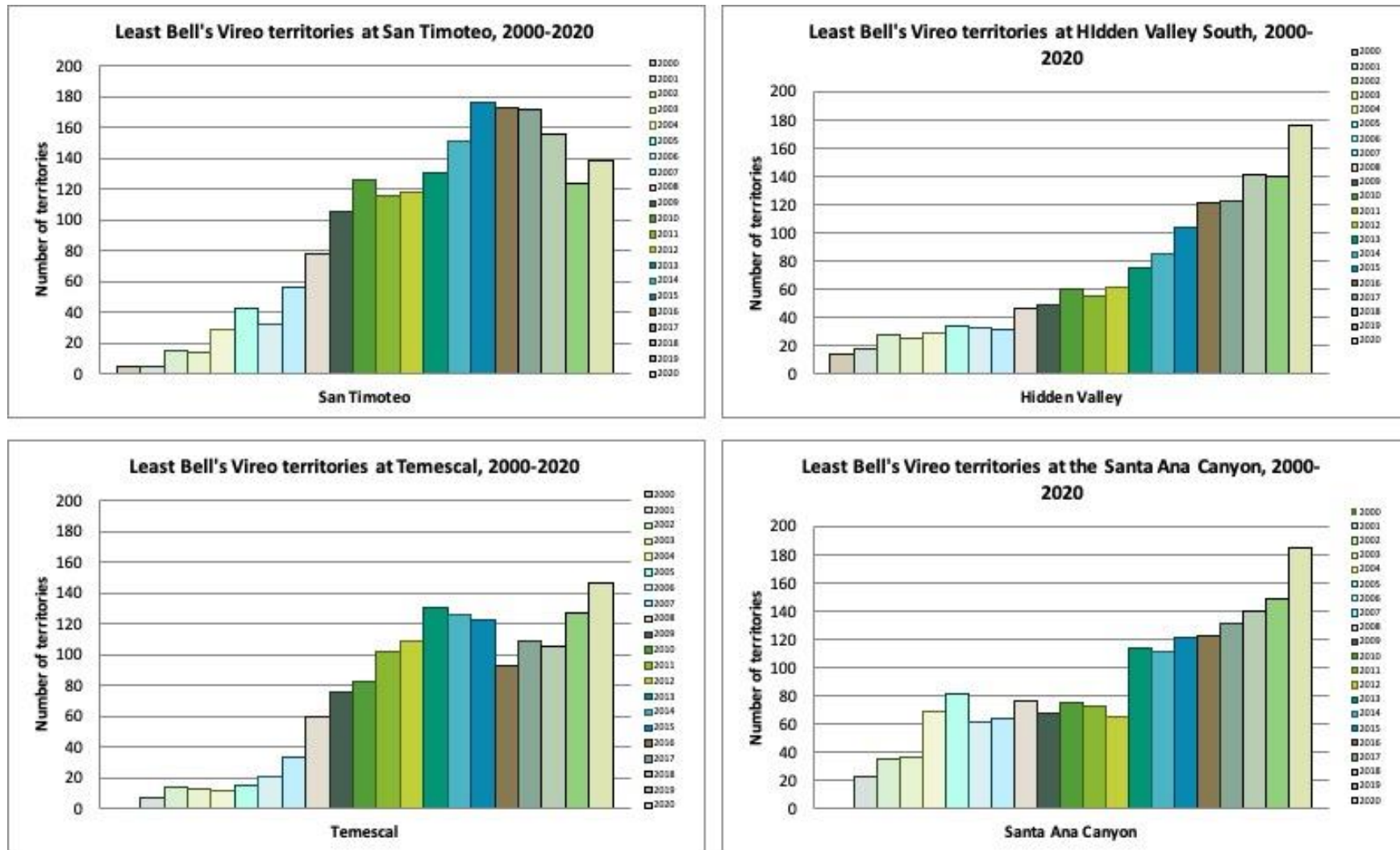


Figure 7. Least Bell's Vireo territories at four sites in the Santa Ana Watershed, 2000-2020.



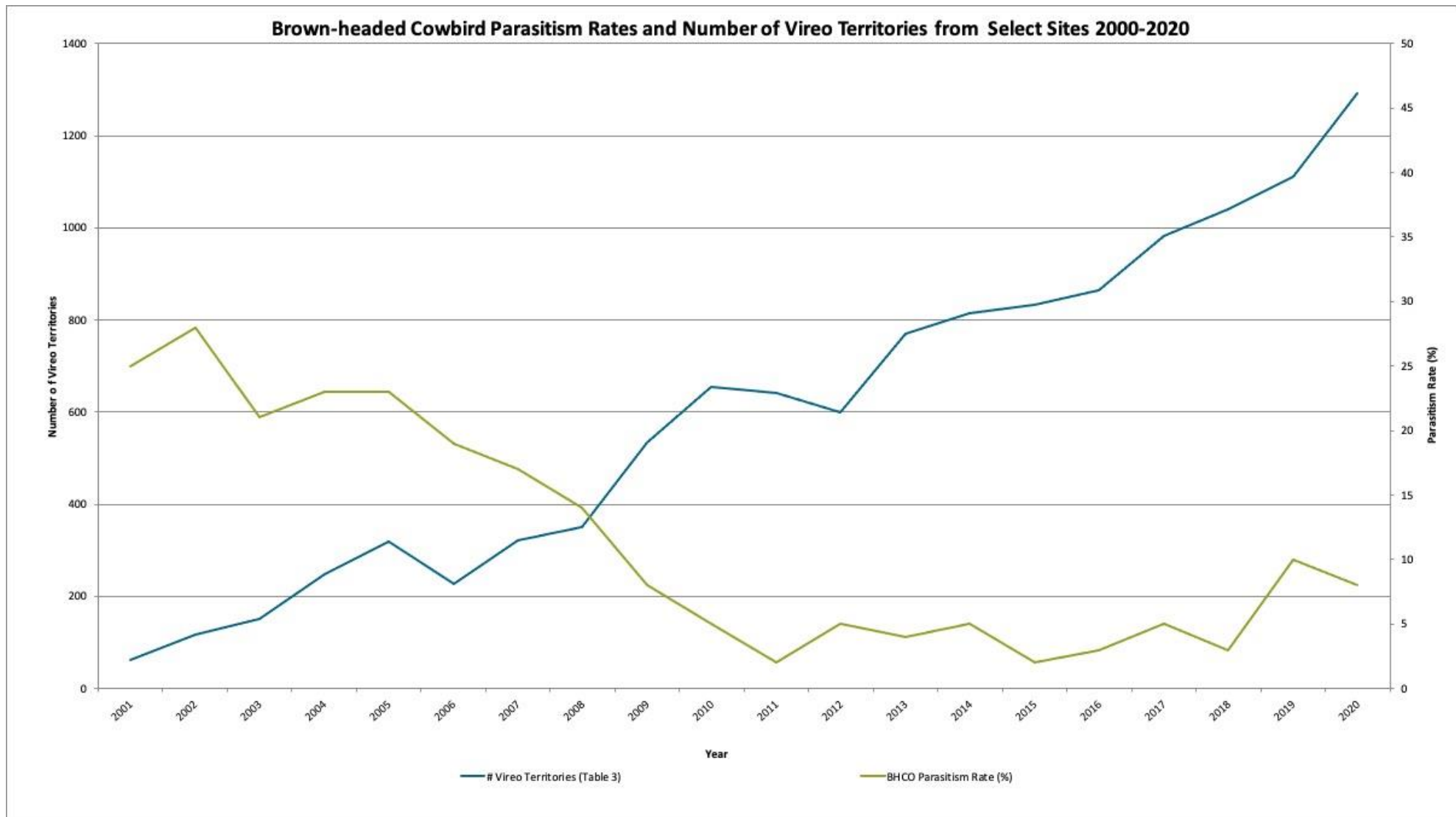


Figure 8. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2020.

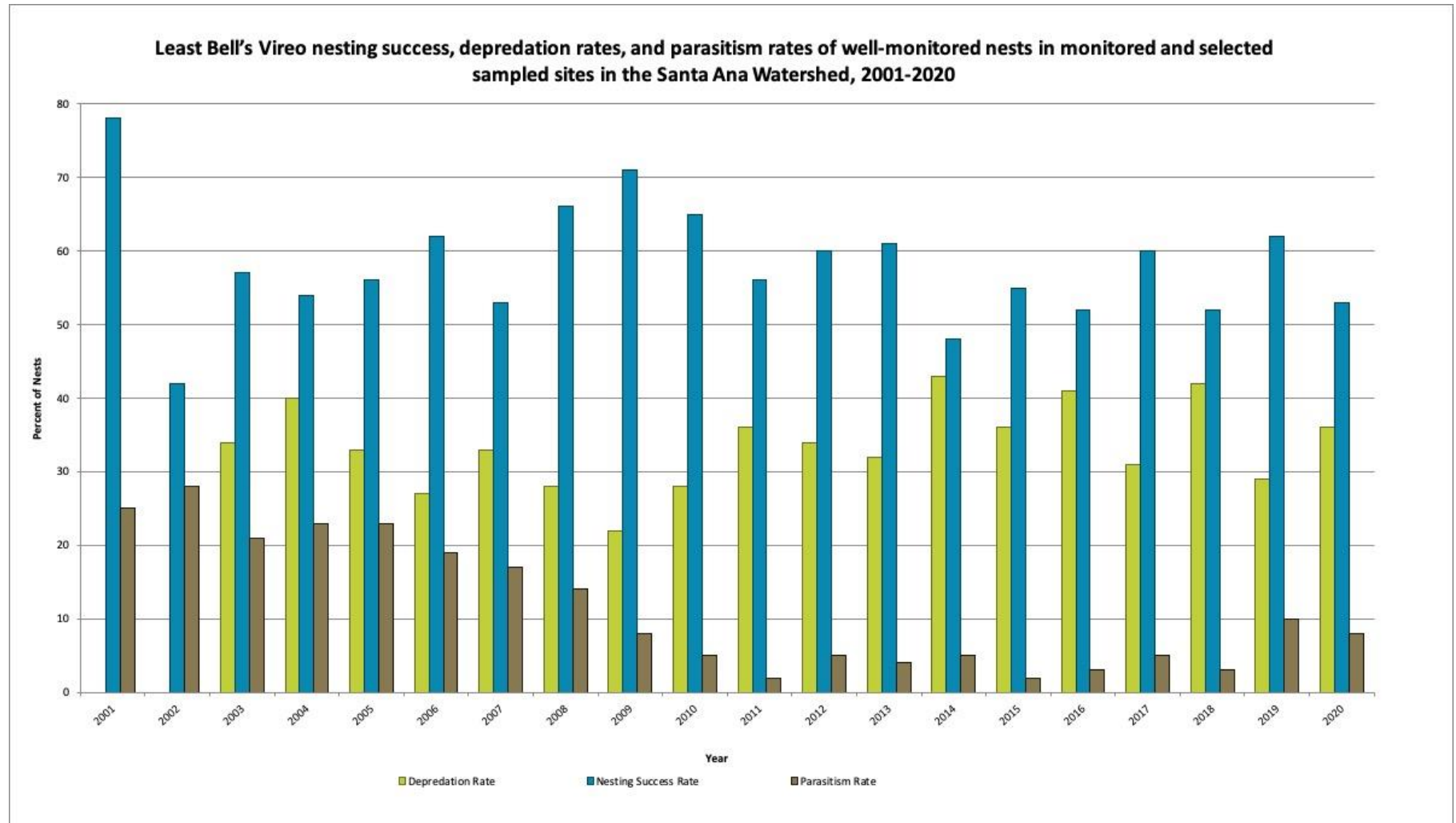


Figure 9. Least Bell's Vireo nesting success, predation rates, and parasitism rates in the Santa Ana Watershed, 2001-2020.

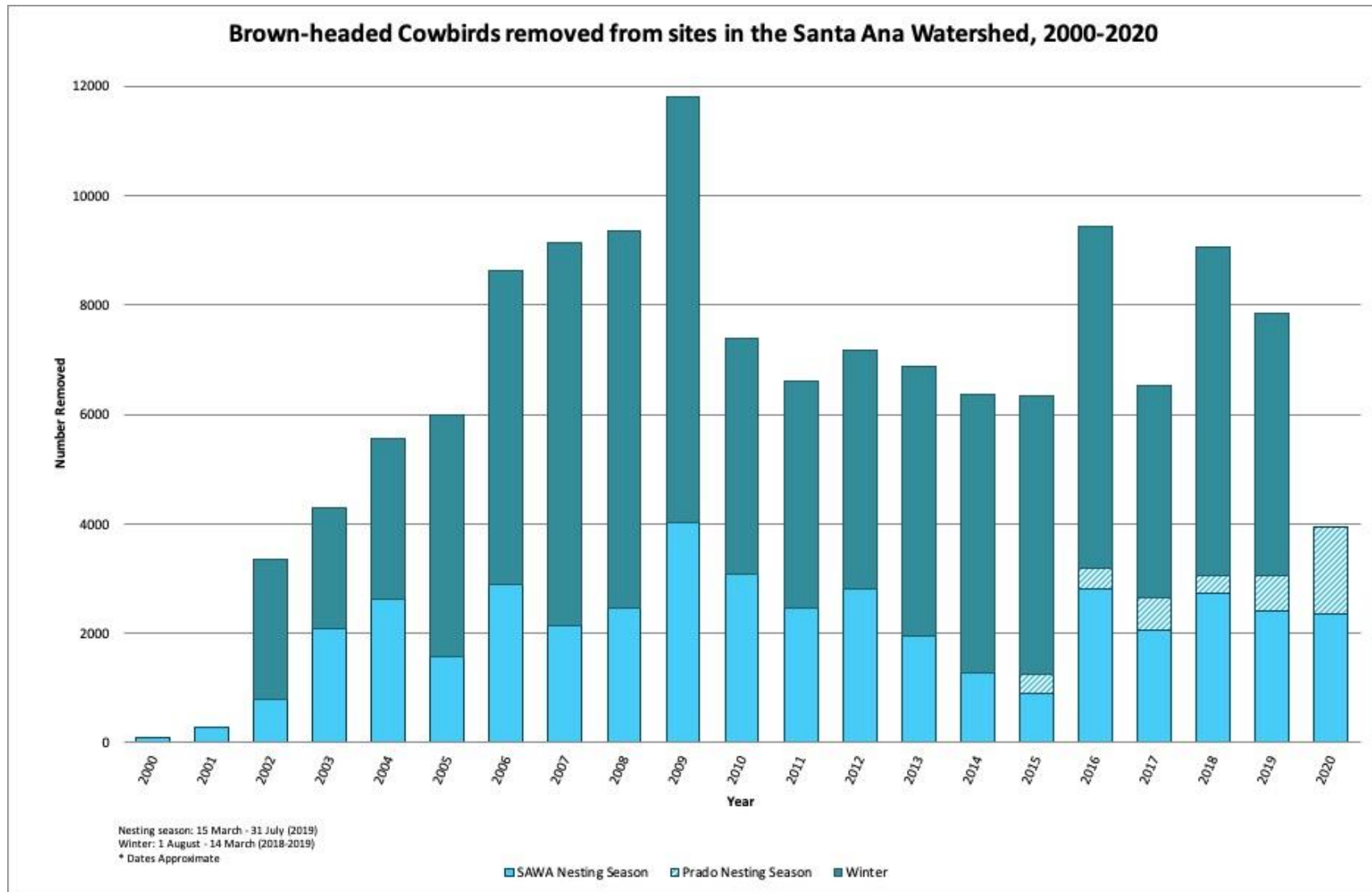


Figure 10. Brown-headed Cowbirds removed from sites in the Santa Ana Watershed, 2000-2020.

Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.

Site Name	2016	2017	2018	2019	2020
<b>Monitored Locations</b>					
Meridian Conservation Area (former March SKR Preserve)	14 / 5 / 6	16 / 9 / 23	20 / 2 / 2	14 / 2 / 2	14 / 9 / 24
Mockingbird Canyon	25 / 7 / 11	29 / 15 / 15	43 / 15 / 10	43 / 19 / 24	45 / 17 / 26
San Jacinto	37 / 17 / 12	45 / 27 / 48	74 / 34 / 60	63 / 44 / 117	108 / 83 / 145
San Timoteo Canyon	173 / 124 / 222	172 / 109 / 272	156 / 104 / 161	124 / 92 / 170	139 / 105 / 207
<b>Santa Ana River (SAR) - Upstream</b>					
Riverside Ave. to Van Buren Blvd.	109 / 43 / 62	155 / 95 / 169	164 / 96 / 95	166 / 72 / 82	128 / 54 / 55
Lower Hole Creek	n/s	n/s	n/s	3 / 1 / 0	2 / 1 / 1
Hidden Valley, north side of river	40 / 27 / 33	36 / 17 / 34	62 / 38 / 65	78 / 37 / 41	94 / 61 / 74
Hidden Valley, south side of river	121 / 66 / 97	123 / 67 / 87	141 / 60 / 88	140 / 79 / 209	176 / 102 / 187
Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)	63 / 31 / 45	73 / 34 / 54	91 / 56 / 86	90 / 58 / 110	88 / 58 / 114
Norco Bluffs (I-15 to River Rd., non-mitigation) <sup>1</sup>	63 / 28 / 45	69 / 31 / 76	36 / 17 / 39	101 / 50 / 139	133 / 65 / 159
<b>Santa Ana Canyon (SAC)</b>					
Upper Canyon	26 / 12 / 18	30 / 21 / 32	32 / 25 / 23	35 / 24 / 58	45 / 30 / 52
Green River Golf Club	33 / 26 / 27	42 / 33 / 76	42 / 38 / 20	45 / 34 / 96	61 / 42 / 63
Featherly Regional Park	64 / 39 / 23	59 / 36 / 57	66 / 25 / 25	69 / 33 / 76	79 / 47 / 66
<b>Sampled Locations</b>					
<b>Santa Ana River &amp; Tributaries:</b>					
Alessandro Arroyo/Prenda Arroyo	19 / 4 / 3	23 / 7 / 10	20 / 5 / 3	18 / 2 / 0	26 / 7 / 8
Box Springs	4 / 3 / 4	7 / 1 / 0	3 / 0 / 0	1 / 0 / 0	7 / 5 / 3
Burris Basin	2 / 1 / 4	1 / 1 / 0	0 / 0 / 0	0 / 0 / 0	1 / 0 / 0
Cajon Wash	0 / 0 / 0	n/s	n/s	n/s	n/s
Canyon Crest	1 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Carbon Canyon (Chino Hills Pkwy.)	0 / 0 / 0	n/s	n/s	n/s	n/s
Carbon Canyon Regional Park	10 / 2 / 0	14 / 5 / 2	26 / 9 / 5	n/s	See Incidentals
Castlevue Park	n/s	0 / 0 / 0	n/s	n/s	n/s
Chino Hills	18 / 11 / 10	25 / 7 / 3	26 / 9 / 3	29 / 17 / 19	36 / 10 / 9
Chino Hills State Park (CHSP)	15 / 4 / 4	20 / 4 / 4	32 / 9 / 0	37 / 17 / 13	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.

Site Name	2016	2017	2018	2019	2020
<b>Sampled Locations</b>					
<b>Santa Ana River &amp; Tributaries:</b>					
City Creek (Highland)	2 / 0 / 0	1 / 1 / 0	1 / 0 / 0	2 / 0 / 0	n/s
Clearwater Pkwy. @ Glen Helen	2 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Conrock Basin FHQ	1 / 0 / 0	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0	1 / 1 / 0
Corona Ave. at Gilmore	1 / 0 / 0	1 / 0 / 0	n/s	n/s	n/s
Fontana Power Plant	0 / 0 / 0	n/s	n/s	n/s	n/s
Fresno Canyon	2 / 1 / 0	2 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s
Goldenstar	1 / 0 / 0	2 / 1 / 2	2 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Harrison Reservoir (aka McAllister Creek)	3 / 2 / 2	5 / 2 / 3	5 / 4 / 1	7 / 1 / 1	7 / 3 / 5
Hidden Valley Golf Club	7 / 2 / 0	9 / 1 / 0	9 / 1 / 1	8 / 2 / 1	12 / 3 / 3
La Sierra	3 / 0 / 0	5 / 2 / 1	2 / 1 / 1	4 / 0 / 0	5 / 2 / 0
Little Sand Basin	0 / 0 / 0	n/s	n/s	n/s	n/s
Mead Valley (Cajalco/Aqueduct)	7 / 3 / 3	13 / 8 / 7	9 / 4 / 0	7 / 3 / 1	9 / 5 / 1
Norco Hills Park Mitigation	0 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Plunge Creek	1 / 1 / 2	2 / 0 / 0	5 / 0 / 0	2 / 0 / 0	2 / 0 / 0
Poorman Reservoir	8 / 2 / 1	9 / 4 / 5	6 / 2 / 0	6 / 1 / 0	6 / 4 / 3
Pyrite Channel	1 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Quail Run	1 / 0 / 0	0 / 0 / 0	3 / 1 / 2	2 / 1 / 1	1 / 1 / 1
Ryan Bonaminio Park	n/s	0 / 0 / 0	n/s	n/s	n/s
Sun Canyon Park	0 / 0 / 0	n/s	n/s	n/s	n/s
Sycamore Canyon	13 / 4 / 6	18 / 9 / 9	20 / 8 / 5	22 / 5 / 3	43 / 28 / 19
Talbert Park (Orange County)	7 / 1 / 0	8 / 0 / 0	6 / 0 / 0	3 / 0 / 0	n/s
Temescal Canyon	93 / 9 / 5	109 / 59 / 48	106 / 48 / 16	127 / 56 / 48	147 / 30 / 20
Tequesquite Arroyo	0 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Tin Mine Rd. (Temescal)	n/s	n/s	n/s	4 / 0 / 0	10 / 1 / 1

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.

Site Name	2016	2017	2018	2019	2020
<b>Sampled Locations</b>					
<b>Santa Ana River &amp; Tributaries:</b>					
Van Buren Blvd. (Bountiful)	2 / 0 / 0	1 / 0 / 0	0 / 0 / 0	2 / 0 / 0	0 / 0 / 0
Van Buren Blvd. (Porter Rd.)	0 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Wardlow Wash	n/s	n/s	2 / 1 / 0	0 / 0 / 0	n/s
Woodcrest	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Wyle Labs	1 / 0 / 0	1 / 0 / 0	3 / 1 / 1	3 / 3 / 3	13 / 4 / 2
Yorba Linda (San Antonio Rd.)	n/s	0 / 0 / 0	n/s	n/s	n/s
Yorba Linda (Starlight Dr.)	1 / 1 / 0	4 / 0 / 0	5 / 0 / 0	9 / 1 / 1	15 / 4 / 4
Yorba Linda Lakebed Park	1 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
<b>San Jacinto River Sub-watershed:</b>					
Cottonwood Canyon	2 / 1 / 1	2 / 0 / 0	2 / 1 / 1	1 / 0 / 0	n/s
Kabian Park	9 / 4 / 3	8 / 3 / 3	7 / 5 / 2	2 / 2 / 1	n/s
Lake Perris	n/s	n/s	8 / 3 / 0	6 / 2 / 1	8 / 6 / 1
Meniffee (Salt Creek)	9 / 3 / 3	9 / 4 / 3	10 / 5 / 2	11 / 7 / 11	18 / 12 / 13
<b>Santiago Creek Sub-watershed:</b>					
Irvine Trust Management Area	n/s	0 / 0 / 0	n/s	1 / 0 / 0	2 / 0 / 0
Limestone Canyon	n/s	1 / 0 / 0	n/s	n/s	n/s
Peter's Canyon	25 / 11 / 6	27 / 8 / 9	23 / 7 / 1	22 / 8 / 9	24 / 9 / 6
Santiago Basin	1 / 0 / 0	3 / 0 / 0	3 / 0 / 0	5 / 0 / 0	5 / 0 / 0
Santiago Canyon (Irvine Park)	17 / 1 / 0	14 / 1 / 0	18 / 5 / 2	20 / 10 / 8	28 / 13 / 17
Santiago Creek (above Irvine Lake)	2 / 0 / 0	5 / 0 / 0	12 / 2 / 1	5 / 0 / 0	12 / 2 / 1
Santiago Creek (Cambridge Road)	0 / 0 / 0	1 / 0 / 0	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Santiago Creek (Chapman Ave.)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Santiago Oaks Regional Park (to Cannon Rd.)	n/s	2 / 0 / 0	1 / 0 / 0	2 / 0 / 0	n/s
Silverado Canyon	0 / 0 / 0	n/s	n/s	n/s	n/s
Smith Basin	4 / 0 / 0	3 / 1 / 0	3 / 0 / 0	4 / 1 / 0	3 / 2 / 0

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.

Site Name	2016	2017	2018	2019	2020
<b>Incidental Sightings</b>					
Carbon Canyon Regional Park	10 / 2 / 0	14 / 5 / 2	26 / 9 / 5	n/s	14 / 0 / 0
Chino Creek Wetlands Park	1 / 0 / 0	1 / 0 / 0	4 / 1 / 1	n/s	n/s
Cielo Vista	n/s	n/s	n/s	1 / 0 / 0	1 / 0 / 0
Hwy 71	n/s	n/s	1 / 0 / 0	n/s	n/s
Irvine Lake	2 / 1 / 1	2 / 0 / 0	1 / 0 / 0	1 / 0 / 0	n/s
Moreno Valley (near Pigeon Pass Rd.)	n/s	n/s	n/s	1 / 0 / 0	n/s
Raceway Ford	n/s	n/s	1 / 0 / 0	n/s	n/s
Rancho La Sierra West, Riverside	1 / 0 / 0	See Hidden Valley, south side of river	See Hidden Valley, south side of river	See Hidden Valley, south side of river	See Hidden Valley, south side of river
Riverside (near Goldenstar)	n/s	n/s	n/s	1 / 0 / 0	n/s
Riverside (Van Buren & Jurupa)	n/s	n/s	n/s	1 / 0 / 0	1 / 0 / 0
RLC Alessandro Arroyo - 1.52 ac	1 / 0 / 0	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo	2 / 1 / 1	See Alessandro Arroyo/Prenda Arroyo
Rock Vista Park	n/s	n/s	n/s	n/s	2 / 0 / 0
Santa Ana River - San Bernardino County Flood Control	See Santa Ana River - San Bernardino	See Santa Ana River - San Bernardino County <sup>7</sup>	30 / 3 / 5	8 / 0 / 0	2 / 0 / 0
Wolfskill	n/s	n/s	2 / 1 / 1	3 / 1 / 1	1 / 1 / 1
<b>SUBTOTAL</b>	<b>1,080 / 499 / 659</b>	<b>1,222 / 628 / 1,054</b>	<b>1,373 / 655 / 733</b>	<b>1,361 / 686 / 1,247</b>	<b>1,574 / 827 / 1,291</b>
<b>Reported by other agencies</b>					
Lake Perris <sup>2</sup>	14 / 0 / 0	10 / 0 / 0	See Lake Perris	See Lake Perris	See Lake Perris
SAR - Norco Bluffs USACE Mitigation Areas <sup>3,4,5</sup>	14 / 0 / 0	14 / n/a / n/a	76 / n/a / n/a	See Norco Bluffs	See Norco Bluffs
Santa Ana River - San Bernardino County <sup>6</sup>	14 / 0 / 0	Not reported	17 / 0 / 0	Not Reported	Not Reported
<b>TOTAL FOR SANTA ANA WATERSHED EXCLUDING PRADO BASIN</b>	<b>1,122 / 499 / 659</b>	<b>1,246 / 628 / 1,054</b>	<b>1,466 / 655 / 733</b>	<b>1,361 / 686 / 1,247</b>	<b>1,574 / 827 / 1,291</b>
PRADO BASIN <sup>7</sup>	511 / 208 / 328	549 / 218 / 409	665 / n/a / n/a	606 / n/a / n/a	719 / 373 / 577
<b>TOTAL FOR SANTA ANA WATERSHED</b>	<b>1,633 / 707 / 987</b>	<b>1,795 / 846 / 1,463</b>	<b>2,131 / 655 / 733</b>	<b>1,967 / 686 / 1,247</b>	<b>2,293 / 1200 / 1,868</b>

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.

Site Name	2016	2017	2018	2019	2020
<b>Outside Watershed</b>					
French Valley, Benton Channel <sup>8</sup>	n/s	n/s	1 / 0 / 0	n/s	n/s
French Valley, Warm Springs <sup>8</sup>	n/s	n/s	1 / 0 / 0	n/s	n/s
Temecula, Santa Gertrudis <sup>8</sup>	n/s	n/s	6 / 1 / 0	n/s	n/s
Wildomar, Helash Mitigation <sup>8</sup>	n/s	n/s	4 / 0 / 0	n/s	n/s

a. Entries correspond to numbers of territorial males/pairs/'known fledged young' for designated time period and locale.

b. "n/a" indicates that no data were available.

c. "n/s" indicates that no surveys were conducted.

<sup>1</sup> USACE mitigation areas of varying sizes not surveyed by SAWA in 2016-2018. Survey numbers for these areas can be found in this table under SAR-Norco Bluffs USACE Mitigation Areas reported by other agencies.

<sup>2</sup>Reported by California State Parks.

<sup>3</sup>Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2016."

<sup>4</sup>Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2017."

<sup>5</sup>Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2018."

<sup>6</sup>Reported by San Bernardino County Flood Control biologist Theresa Sims.

<sup>7</sup>Preliminary data. Bonnie Johnson personal communication.

<sup>8</sup>Outside Santa Ana Watershed, not included in totals.



Table 2. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2020.

	San Jacinto	San Timoteo Canyon	Meridian Conservation Area	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)		
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCDC)				Upper Canyon	Green River Golf Club	Featherly Reg. Park
Survey Start Date <sup>1</sup>	18-Mar	26-Mar	2-Apr	25-Mar	17-Mar	19-Mar	17-Mar	19-Mar	20-Mar	1-Apr	3-Apr	19-Mar	17-Mar	11-Mar
Survey End Date	17-Sep	3-Sep	16-Sep	16-Sep	14-Sep	16-Sep	15-Sep	1-Sep	11-Sep	31-Jul	5-Aug	15-Sep	15-Sep	8-Sep
Date First Detected	23-Mar	26-Mar	2-Apr	25-Mar	25-Mar	19-Mar	17-Mar	23-Mar	20-Mar	1-Apr	3-Apr	19-Mar	17-Mar	16-Mar
50% Arrival Observed	15-Apr	14-Apr	2-Apr	13-Apr	11-Apr	n/a	14-Apr	1-Apr	7-Apr	n/a	n/a	14-Apr	2-Apr	16-Apr
50% Pairs Observed	4-May	21-Apr	14-Apr	30-Apr	n/a	n/a	27-Apr	9-Apr	28-Apr	n/a	n/a	22-Apr	29-Apr	22-Apr
First Nest Found	3-Apr	31-Mar	14-Apr	13-Apr	11-Apr	n/a	31-Mar	31-Mar	14-Apr	n/a	n/a	11-Apr	8-Apr	16-Apr
Last Nest Found	25-Jun	25-Jun	25-Jun	1-Jul	10-Jun	n/a	6-Jul	19-Jun	15-Jun	n/a	n/a	25-Jun	2-Jul	10-Jul
First Nest Fledge	23-May	21-May	23-May	22-May	n/a	n/a	16-May	16-May	4-May	n/a	n/a	20-May	16-May	16-May
Last Nest Fledge	18-Jul	25-Jul	1-Jul	26-Jul	n/a	n/a	15-Jul	13-Jul	29-Jun	n/a	n/a	27-Jun	28-Jun	19-Jul
Date Last Detected <sup>2</sup>	11-Sep	3-Sep	16-Sep	16-Sep	14-Sep	9-Sep	15-Sep	1-Sep	11-Sep	31-Jul	5-Aug	24-Jul	4-Aug	8-Sep

<sup>1</sup> First date of full survey specifically for Least Bell's Vireo

<sup>2</sup> May vary from last survey date as an incidental sighting as opposed to a targeted survey.

Table 3. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2020.

	Parameter	San Jacinto	San Timoteo Canyon	Meridian Conservation Area*	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
						Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCDD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park	
A.	Number of territorial males	108	139	14	45	128	94	176	88	133	147	36	45	61	79	1,293
B.	Number of known pairs	83	105	9	17	54	61	102	58	65	30	10	30	42	47	713
C.	Number of known breeding (nesting) pairs	72	86	7	14	43	42	91	47	65	17	5	27	34	42	592
D.	Number of breeding pairs that were well-monitored throughout the season	29	58	6	9	0	0	51	22	25	0	0	8	22	17	247
E.	Number of known fledged young observed	145	207	24	26	55	74	187	114	159	20	9	52	63	66	1,201
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	77	173	22	20	n/a	n/a	126	78	81	n/a	n/a	26	49	44	696
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	2.4	3.4	1.9	1.3	1.8	2.1	2.4	2.4	n/a	n/a	1.9	1.9	1.6	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.7	3.0	3.7	2.2	n/a	n/a	2.5	3.5	3.2	n/a	n/a	3.3	2.2	2.6	2.8
I.	Number of nests that were discovered	69	104	8	18	18	13	113	36	47	0	0	13	34	46	519
J.	Number of well-tracked nests	56	99	8	17	3	0	109	34	43	n/a	n/a	11	33	41	454
K.	Number of successful well-tracked nests	63% 35 / 56	52% 51 / 99	88% 7 / 8	35% 6 / 17	0% 0 / 3	n/a	46% 50 / 109	68% 23 / 34	70% 30 / 43	n/a	n/a	73% 8 / 11	48% 16 / 33	37% 15 / 41	53% 241 / 454
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	14% 7 / 49	0% 0 / 85	0% 0 / 8	6% 1 / 17	n/a	n/a	21% 18 / 86	3% 1 / 30	0% 0 / 41	n/a	n/a	0% 0 / 10	17% 5 / 29	0% 0 / 31	8% 32 / 386
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 2 / 56	6% 6 / 99	13% 1 / 8	6% 1 / 17	0% 0 / 3	n/a	0% 0 / 109	6% 2 / 34	2% 1 / 43	n/a	n/a	0% 0 / 11	0% 0 / 33	10% 4 / 41	4% 16 / 454
	B. Number of well-tracked nests that failed as a result of parasitism	4% 2 / 56	0% 0 / 99	0% 0 / 8	0% 0 / 17	0% 0 / 3	n/a	5% 5 / 109	3% 1 / 34	0% 0 / 43	n/a	n/a	0% 0 / 11	0% 0 / 33	0% 0 / 41	2% 8 / 454

Table 3 continued. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2020.

	Parameter	San Jacinto	San Timoteo Canyon	Meridian Conservation Area*	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
						Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCID)				Upper Canyon	Green River Golf Club	Featherly Reg. Park	
M.	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	27% 15 / 56	34% 34 / 99	0% 0 / 8	53% 9 / 17	100% 3 / 3	n/a	43% 47 / 109	24% 8 / 34	26% 11 / 43	n/a	n/a	18% 2 / 11	45% 15 / 33	49% 20 / 41	36% 164 / 454
	D. Number of well-tracked nests that failed for unknown reasons	4% 2 / 56	8% 8 / 99	0% 0 / 8	6% 1 / 17	0% 0 / 3	n/a	6% 7 / 109	0% 0 / 34	2% 1 / 43	n/a	n/a	9% 1 / 11	6% 2 / 33	5% 2 / 41	5% 24 / 454
N.	Average clutch size	3.5	3.6	3.8	3.6	n/a	n/a	3.7	3.7	3.7	n/a	n/a	3.7	3.8	3.5	3.6
	Number of eggs/Number of clutches	169 / 48	342 / 95	30 / 8	54 / 15	n/a	n/a	298 / 81	110 / 30	154 / 42	n/a	n/a	44 / 12	122 / 32	137 / 39	1,460 / 402
O.	Number of cowbird eggs or nestlings found in or near vireo nests	9	0	0	1	0	0	18	1	0	n/a	n/a	0	5	0	34
P.	Number of 'manipulated' parasitized nests	6	n/a	n/a	1	n/a	n/a	17	0	n/a	n/a	n/a	n/a	5	n/a	29
Q.	Number of successful 'manipulated' nests	33% 2 / 6	n/a	n/a	0% 0 / 1	n/a	n/a	35% 6 / 17	n/a	n/a	n/a	n/a	n/a	40% 2 / 5	n/a	34% 10 / 29
R.	Number of vireo fledged from 'manipulated' nests	4	n/a	n/a	0	n/a	n/a	11	n/a	n/a	n/a	n/a	n/a	6	n/a	21
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests	2	4	0	0	0	0	1	1	0	n/a	n/a	0	5	3	16
U.	% of successful repaired nests	50% 1 / 2	75% 3 / 4	n/a	n/a	n/a	n/a	0% 0 / 1	100% 1 / 1	n/a	n/a	n/a	n/a	60% 3 / 5	67% 2 / 3	63% 10 / 16
V.	Number of vireo fledged from repaired nests	1	11	n/a	n/a	n/a	n/a	0	4	n/a	n/a	n/a	n/a	8	3	27
W.	Number of cowbirds removed from study area <sup>2</sup>	1,674	139	10	89	25	13	1	0	3	324	n/a	-1	n/a	15	2,292
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) <sup>2</sup>	586	700	238	503	359	68	61	4	131	561	n/a	127	n/a	245	3,583
Y.	Average number of cowbirds trapped per day (W/X)	2.86	0.20	0.04	0.18	0.07	0.19	0.02	0.00	0.02	0.58	n/a	0.00	n/a	0.06	0.64

<sup>1</sup>Sixty-eight of the 454 "tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 68 nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

<sup>2</sup>All traps are not accounted for in this total. See Table 6.

\* Former March Stephen's Kangaroo Rat Preserve

Table 3B. Least Bell's Vireo breeding biology data detailed for SBVMWD-funded surveys at monitored (restoration) and sampled (non-restoration) sites in upper SAR, 2020.

	Parameter	Evans Lake Drain Restoration <sup>4</sup>	Anza/Old Ranch Creeks Restoration <sup>4</sup>	SAR - Riverside to Van Buren Non-Restoration	SAR - Riverside to Van Buren - Overall <sup>4</sup>	Hidden Valley North	Lower Hole Creek Restoration	Hidden Valley South - Non - Restoration	Hidden Valley South - Restoration	Hidden Valley South - Overall	Goose Creek <sup>3</sup>	SAR Upstream - Overall
A.	Number of territorial males	1	4	123	128	94	2	145	31	176	88	488
B.	Number of known pairs	0	2	52	54	61	1	75	27	102	58	276
C.	Number of known breeding (nesting) pairs	0	2	41	43	42	1	64	27	91	47	224
D.	Number of breeding pairs that were well-monitored throughout the breeding season	0	0	0	0	0	0	32	19	51	22	73
E.	Number of known fledged young observed	0	3	52	55	74	1	123	64	187	114	431
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	n/a	n/a	n/a	n/a	n/a	n/a	69	57	126	75	201
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	n/a	1.5	1.3	1.3	1.8	1.0	1.9	2.4	2.1	2.4	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	n/a	n/a	n/a	n/a	n/a	n/a	2.2	3.0	2.5	3.4	2.8
I.	Number of nests that were discovered	0	1	17	18	13	0	75	38	113	36	180
J.	Number of well-tracked nests	0	0	3	3	0	0	73	36	109	34	146
K.	Number of successful well-tracked nests	n/a	n/a	0% 0 / 3	0% 0 / 3	n/a	n/a	44% 32 / 73	50% 18 / 36	46% 50 / 109	68% 23 / 34	50% 73 / 146
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	n/a	n/a	n/a	n/a	n/a	n/a	23% 13 / 56	17% 5 / 30	21% 18 / 86	3% 1 / 30	16% 19 / 116
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	n/a	n/a	0% 0 / 3	0% 0 / 3	n/a	n/a	0% 0 / 73	0% 0 / 36	0% 0 / 109	6% 2 / 34	1% 2 / 146
	B. Number of well-tracked nests that failed as a result of parasitism	n/a	n/a	0% 0 / 3	0% 0 / 3	n/a	n/a	5% 4 / 73	3% 1 / 36	5% 5 / 109	3% 1 / 34	4% 6 / 146

Table 3B continued. Least Bell's Vireo breeding biology data detailed for SBVMWD-funded surveys at monitored (restoration) and sampled (non-restoration) sites in upper SAR, 2020.

	Parameter	Evans Lake Drain Restoration <sup>4</sup>	Anza/Old Ranch Creeks Restoration <sup>4</sup>	SAR - Riverside to Van Buren Non-Restoration	SAR - Riverside to Van Buren - Overall <sup>4</sup>	Hidden Valley North	Lower Hole Creek Restoration	Hidden Valley South - Non - Restoration	Hidden Valley South - Restoration	Hidden Valley South - Overall	Goose Creek <sup>3</sup>	SAR Upstream - Overall
M.	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	n/a	n/a	100% 3 / 3	100% 3 / 3	n/a	n/a	45% 33 / 73	39% 14 / 36	43% 47 / 109	24% 8 / 34	40% 58 / 146
	D. Number of well-tracked nests that failed for unknown reasons	n/a	n/a	0	0% 0 / 3	n/a	n/a	5% 4 / 73	8% 3 / 36	6% 7 / 109	0% 0 / 34	5% 7 / 146
N.	Average clutch size	n/a	n/a	n/a	n/a	n/a	n/a	3.6	3.8	3.7	3.7	3.7
	Number of eggs/Number of clutches	n/a	n/a	n/a	n/a	n/a	n/a	191 / 53	107 / 28	298 / 81	110 / 30	408 / 111
O.	Number of cowbird eggs or nestlings found in or near vireo nests	n/a	n/a	n/a	n/a	n/a	n/a	13	5	18	1	19
P.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	12	5	17	0	17
Q.	Number of successful 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	25% 3 / 12	60% 3 / 5	35% 6 / 17	n/a	35% 6 / 17
R.	Number of vireo fledged from 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	6	5	11	n/a	11
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	1	0	1	1	2
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	0% 0 / 1	n/a	0% 0 / 1	100% 1 / 1	50% 1 / 2
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a	0	4	4
W.	Number of cowbirds removed from study area <sup>2</sup>	n/a	n/a	25	25	13	n/a	1	n/a	1	0	39
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) <sup>2</sup>	n/a	n/a	359	359	68	n/a	61	n/a	61	4	492
Y.	Average number of cowbirds trapped per day (W/X)	n/a	n/a	0.07	0.07	0.19	n/a	0.02	n/a	0.02	0.00	0.08

<sup>1</sup> Some of the "well-tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

<sup>2</sup> All traps are not accounted for in this total. See Table 6.

<sup>3</sup> This site includes mitigation areas funded by IERCD

<sup>4</sup> This site was not surveyed in 2020 due to COVID outbreak. Data reported are incidental detections and do not reflect actual population

Table 4: Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2020.

Host Plant Species (listed in taxonomic order <sup>1</sup> )	San Jacinto	San Timoteo Canyon	Meridian Conservation Area	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCID)				Upper Canyon	Green River Golf Club	Featherly Reg. Park		
Giant Reed <sup>a</sup> ( <i>Arundo donax</i> )								1							1	<1%
Western Sycamore ( <i>Platanus racemosa</i> )							1					1		2	4	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )		9			1		6	2	3						21	4%
Fremont Cottonwood ( <i>Populus fremontii</i> )	3	13		2	3	1	9	5					4	5	45	9%
Narrowleaf Willow ( <i>Salix exigua</i> )	22				3	4	7	3	3						42	8%
Dead Narrowleaf Willow ( <i>Salix exigua</i> )					1										1	<1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	13	3	1				10	1	7						35	7%
Red Willow ( <i>Salix laevigata</i> )		22	1	4	2		3	2	1						35	7%
Arroyo Willow ( <i>Salix lasiolepis</i> )	1	33	5	3	1	3	28	8	15			1			98	19%
Pacific Willow ( <i>Salix lasiandra</i> )		4						1	1						6	1%
Willow sp. ( <i>Salix</i> sp.)					1									2	3	1%
Blue Palo Verde ( <i>Parkinsonia florida</i> )	1														1	<1%
Asian Pear <sup>a</sup> ( <i>Cydonia oblonga</i> )		1													1	<1%
Holly Leaf Cherry ( <i>Prunus ilicifolia</i> )					1										1	<1%
California Wild Rose ( <i>Rosa californica</i> )							1								1	<1%
California Blackberry ( <i>Rubus ursinus</i> )								3	1						4	1%
White Mulberry <sup>a</sup> ( <i>Morus alba</i> )		2													2	<1%
Wild Cucumber ( <i>Marah macrocarpa</i> )														1	1	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	1	1										1			3	1%
Southern California Black Walnut <sup>f</sup> ( <i>Juglans californica</i> )														2	2	<1%
Laurel Sumac ( <i>Malosma laurina</i> )													5	6	11	2%
Peruvian Pepper Tree <sup>a</sup> ( <i>Schinus molle</i> )													3		3	1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )							2						1		3	1%
Carrotwood <sup>a</sup> ( <i>Cupaniopsis anacardioides</i> )													1		1	<1%



Table 4 continued: Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2020.

Host Plant Species (listed in taxonomic order <sup>1</sup> )	San Jacinto	San Timoteo Canyon	Meridian Conservation Area	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCDC)				Upper Canyon	Green River Golf Club	Featherly Reg. Park		
Orange Tree <sup>a</sup> ( <i>Citrus sinensis</i> )		1													1	<1%
Chaparral Mallow ( <i>Malacothamnus fasciculatus</i> )		2													2	<1%
Black Mustard <sup>a</sup> ( <i>Brassica nigra</i> )	1													2	3	1%
Perennial Pepperweed <sup>a</sup> ( <i>Lepidium latifolium</i> )				1			1								2	<1%
Tamarisk <sup>a</sup> ( <i>Tamarix ramosissima</i> )	5			1			1								7	1%
Fourwing Saltbush ( <i>Atriplex canescens</i> )		1													1	<1%
Summer Cypress <sup>a</sup> ( <i>Kochia scoparia</i> )							1								1	<1%
Arizona Ash ( <i>Fraxinus velutina</i> )							1								1	<1%
Ash sp. ( <i>Fraxinus</i> sp.)					3										3	1%
Tree Tobacco <sup>a</sup> ( <i>Nicotiana glauca</i> )							1								1	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )		1					1								2	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )				3								1		1	5	1%
Mulefat ( <i>Baccharis salicifolia</i> )	17	6		1	1	5	24	2	15			7	11	17	106	20%
Common Sunflower ( <i>Helianthus annuus</i> )							1								1	<1%
Arrowweed ( <i>Pluchea sericea</i> )	2														2	<1%
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )							5	1						6	12	2%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	3	5		1			7	3				2	7	2	30	6%
California Blackberry ( <i>Rubus ursinus</i> ) and dead unknown									1						1	<1%
Deadfall			1	2	1			3							7	1%
Unknown/No Data							3	1					2		6	1%
Total	69	104	8	18	18	13	113	36	47	0	0	13	34	46	519	100%

<sup>1</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> = Using Jepson eFlora



Table 5. Observations of all species by location, 2020.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other <sup>1</sup>
<b>Avian</b>								
Canada Goose	<i>Branta canadensis</i>	X		X			X	
Wood Duck	<i>Aix sponsa</i>					X		
Blue-winged Teal	<i>Spatula discors</i>			X				
Cinnamon Teal	<i>Spatula cyanoptera</i>	X					X	
Northern Shoveler	<i>Spatula clypeata</i>	X		X				
Gadwall	<i>Mareca strepera</i>	X						
American Wigeon	<i>Mareca americana</i>						X	
Mallard	<i>Anas platyrhynchos</i>	X	X	X	X	X	X	
Green-winged Teal	<i>Anas crecca</i>	X						
Redhead	<i>Aythya americana</i>	X						
Lesser Scaup	<i>Aythya affinis</i>	X						
Bufflehead	<i>Bucephala albeola</i>	X						
Common Merganser	<i>Mergus merganser</i>	X						
Ruddy Duck	<i>Oxyura jamaicensis</i>	X	X				X	
California Quail	<i>Callipepla californica</i>	X	X	X		X	X	
Pied-billed Grebe	<i>Podilymbus podiceps</i>				X	X		
Eared Grebe	<i>Podiceps nigricollis</i>	X						
Western Grebe	<i>Aechmophorus occidentalis</i>	X		X		X		
Rock Pigeon <sup>1</sup>	<i>Columba livia</i>	X		X		X	X	
Band-tailed Pigeon	<i>Patagioenas fasciata</i>			X				
Eurasian Collared-Dove <sup>1</sup>	<i>Streptopelia decaocto</i>	X		X				
Common Ground-Dove	<i>Columbina passerina</i>	X	X	X				
Mourning Dove	<i>Zenaida macroura</i>	X	X	X	X	X	X	
Greater Roadrunner	<i>Geococcyx californianus</i>	X	X	X	X	X	X	
Lesser Nighthawk	<i>Chordeiles acutipennis</i>			X				
Vaux's Swift	<i>Chaetura vauxi</i>			X				
White-throated Swift	<i>Aeronautes saxatalis</i>	X		X	X	X		
Black-chinned Hummingbird	<i>Archilochus alexandri</i>		X	X		X		
Anna's Hummingbird	<i>Calypte anna</i>	X	X	X	X	X	X	
Costa's Hummingbird	<i>Calypte costae</i>	X		X				
Rufous Hummingbird	<i>Selasphorus rufus</i>			X				
Allen's Hummingbird	<i>Selasphorus sasin</i>	X	X	X	X	X		
Sora	<i>Porzana carolina</i>	X						
American Coot	<i>Fulica americana</i>	X	X	X	X	X	X	
Black-necked Stilt	<i>Himantopus mexicanus</i>	X		X			X	
American Avocet	<i>Recurvirostra americana</i>	X					X	
Killdeer	<i>Charadrius vociferus</i>	X	X	X		X	X	
Least Sandpiper	<i>Calidris minutilla</i>	X						
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	X						
Wilson's Snipe	<i>Gallinago delicata</i>	X					X	
Spotted Sandpiper	<i>Actitis macularius</i>			X		X		
Greater Yellowlegs	<i>Tringa melanoleuca</i>	X		X			X	
Gull spp.	<i>Larus spp.</i>	X						
Forster's Tern	<i>Sterna forsteri</i>			X				

Table 5 continued. Observations of all species by location, 2020.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other <sup>a</sup>
<b>Avian</b>								
Double-crested Cormorant <sup>f</sup>	<i>Phalacrocorax auritus</i>	X	X	X	X	X	X	
American White Pelican	<i>Pelecanus erythrorhynchos</i>	X						
Great Blue Heron <sup>f</sup>	<i>Ardea herodias</i>	X		X	X	X	X	
Great Egret	<i>Ardea alba</i>	X		X	X	X	X	
Snowy Egret	<i>Egretta thula</i>	X		X	X	X	X	
Green Heron	<i>Butorides virescens</i>	X			X			
Black-crowned Night-Heron <sup>f</sup>	<i>Nycticorax nycticorax</i>	X	X			X	X	X
White-faced Ibis <sup>f</sup>	<i>Plegadis chihi</i>	X						
Turkey Vulture <sup>f</sup>	<i>Cathartes aura</i>	X		X		X	X	
White-tailed Kite <sup>f</sup>	<i>Elanus leucurus</i>	X	X					X
Northern Harrier <sup>f</sup>	<i>Circus hudsonius</i>	X					X	
Sharp-shinned Hawk <sup>f</sup>	<i>Accipiter striatus</i>			X			X	
Cooper's Hawk <sup>f</sup>	<i>Accipiter cooperii</i>	X	X	X	X	X	X	X
Bald Eagle <sup>f</sup>	<i>Haliaeetus leucocephalus</i>	X						X
Red-shouldered Hawk	<i>Buteo lineatus</i>	X	X	X		X	X	
Swainson's Hawk <sup>f</sup>	<i>Buteo swainsoni</i>			X				
Red-tailed Hawk	<i>Buteo jamaicensis</i>	X	X	X	X	X	X	
Barn Owl	<i>Tyto alba</i>	X	X	X		X	X	
Western Screech-Owl	<i>Megascops kennicottii</i>		X	X				
Great Horned Owl	<i>Bubo virginianus</i>	X	X	X			X	
Belted Kingfisher	<i>Megaceryle alcyon</i>	X		X			X	
Acorn Woodpecker	<i>Melanerpes formicivorus</i>		X	X		X	X	
Downy Woodpecker <sup>f</sup>	<i>Dryobates pubescens</i>	X	X	X	X	X		X
Nuttall's Woodpecker	<i>Dryobates nuttallii</i>	X	X	X	X	X	X	
Hairy Woodpecker	<i>Dryobates villosus</i>			X				
Northern Flicker	<i>Colaptes auratus</i>	X	X	X	X	X	X	
American Kestrel	<i>Falco sparverius</i>	X	X	X		X	X	
Merlin <sup>f</sup>	<i>Falco columbarius</i>	X						
Peregrine Falcon <sup>f</sup>	<i>Falco peregrinus</i>	X						X
Red-crowned Amazon <sup>i</sup>	<i>Amazona viridigenalis</i>					X		X
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	X	X	X	X	X	X	
Cassin's Kingbird	<i>Tyrannus vociferans</i>	X	X	X	X	X		
Western Kingbird	<i>Tyrannus verticalis</i>	X	X	X	X	X	X	
Olive-sided Flycatcher	<i>Contopus cooperi</i>			X		X	X	
Western Wood-Pewee	<i>Contopus sordidulus</i>		X	X				
Willow Flycatcher <sup>f</sup>	<i>Empidonax traillii</i>	X		X				X
Hammond's Flycatcher	<i>Empidonax hammondi</i>			X				
Gray Flycatcher	<i>Empidonax wrightii</i>	X		X				
Dusky Flycatcher	<i>Empidonax oberholseri</i>	X						
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	X	X	X	X	X		
Black Phoebe	<i>Sayornis nigricans</i>	X	X	X	X	X	X	
Say's Phoebe	<i>Sayornis saya</i>	X	X	X		X	X	
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	X		X		X		
Loggerhead Shrike <sup>f</sup>	<i>Lanius ludovicianus</i>	X						
Hutton's Vireo	<i>Vireo huttoni</i>	X	X	X	X	X		
Cassin's Vireo	<i>Vireo cassinii</i>			X				

Table 5 continued. Observations of all species by location, 2020.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other <sup>1</sup>
<b>Avian</b>								
Warbling Vireo	<i>Vireo gilvus</i>	X	X	X		X		
California Scrub-Jay	<i>Aphelocoma californica</i>	X	X	X	X	X	X	
American Crow	<i>Corvus brachyrhynchos</i>	X	X	X	X	X	X	
Common Raven	<i>Corvus corax</i>	X	X	X	X	X	X	
Horned Lark <sup>2</sup>	<i>Eremophila alpestris</i>	X		X			X	X
Tree Swallow <sup>2</sup>	<i>Tachycineta bicolor</i>	X		X		X	X	X
Violet-green Swallow	<i>Tachycineta thalassina</i>	X		X				
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	X	X	X	X	X	X	
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	X		X	X	X		
Barn Swallow	<i>Hirundo rustica</i>	X		X	X	X	X	
Bushtit	<i>Psaltirparus minimus</i>	X	X	X	X	X	X	
White-breasted Nuthatch	<i>Sitta carolinensis</i>			X				
Rock Wren	<i>Salpinctes obsoletus</i>	X		X			X	
House Wren	<i>Troglodytes aedon</i>	X	X	X	X	X	X	
Marsh Wren	<i>Cistothorus palustris</i>	X			X		X	
Bewick's Wren	<i>Thryomanes bewickii</i>	X	X	X	X	X	X	
Coastal Cactus Wren <sup>2</sup>	<i>Campylorhynchus brunneicapillus</i>					X		
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	X	X	X	X	X	X	
California Gnatcatcher <sup>2</sup>	<i>Polioptila californica</i>					X	X	X
Ruby-crowned Kinglet	<i>Regulus calendula</i>	X	X	X	X	X		
Wrentit	<i>Chamaea fasciata</i>	X	X	X	X	X	X	
Western Bluebird	<i>Sialia mexicana</i>	X	X	X	X	X		
Swainson's Thrush	<i>Catharus ustulatus</i>			X	X			
Hermit Thrush	<i>Catharus guttatus</i>	X	X	X	X			
American Robin	<i>Turdus migratorius</i>			X		X		
California Thrasher	<i>Toxostoma redivivum</i>	X	X	X	X	X	X	
Northern Mockingbird	<i>Mimus polyglottos</i>	X	X	X	X	X	X	
European Starling <sup>2</sup>	<i>Sturnus vulgaris</i>	X	X	X		X	X	
Cedar Waxwing	<i>Bombycilla cedrorum</i>		X	X				
Phainopepla	<i>Phainopepla nitens</i>	X	X	X	X	X	X	
Scaly-breasted Munia <sup>2</sup>	<i>Lonchura punctulata</i>					X		
House Sparrow <sup>2</sup>	<i>Passer domesticus</i>	X	X	X	X	X	X	
American Pipit	<i>Anthus rubescens</i>	X		X	X			
House Finch	<i>Haemorhous mexicanus</i>	X	X	X	X	X	X	
Lesser Goldfinch	<i>Spinus psaltria</i>	X	X	X	X	X	X	
Lawrence's Goldfinch	<i>Spinus lawrencei</i>	X	X	X	X			
American Goldfinch	<i>Spinus tristis</i>	X	X	X	X	X	X	
Spotted Towhee	<i>Pipilo maculatus</i>	X	X	X	X	X	X	
Rufous-crowned Sparrow <sup>2</sup>	<i>Aimophila ruficeps canescens</i>	X		X		X		X
California Towhee	<i>Melospiza crissalis</i>	X	X	X	X	X	X	
Chipping Sparrow	<i>Spizella passerina</i>	X						
Brewer's Sparrow	<i>Spizella breweri</i>			X				
Fox Sparrow	<i>Passerella iliaca</i>			X				
Lark Sparrow	<i>Chondestes grammacus</i>	X	X			X		
Bell's Sparrow <sup>2</sup>	<i>Artemisiospiza belli</i>							X
Savannah Sparrow	<i>Passerculus sandwichensis</i>	X				X		
Song Sparrow	<i>Melospiza melodia</i>	X	X	X	X	X	X	
Lincoln's Sparrow <sup>2</sup>	<i>Melospiza lincolni</i>			X				X

Table 5 continued. Observations of all species by location, 2020.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other <sup>1</sup>
<b>Avian</b>								
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	X	X	X	X	X	X	
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>			X				
Yellow-breasted Chat <sup>f</sup>	<i>Icteria virens</i>	X	X	X	X	X		X
Yellow-headed Blackbird <sup>f</sup>	<i>Xanthocephalus xanthocephalus</i>	X						X
Western Meadowlark	<i>Sturnella neglecta</i>	X	X	X			X	
Hooded Oriole	<i>Icterus cucullatus</i>	X	X	X	X	X	X	
Bullock's Oriole	<i>Icterus bullockii</i>	X	X	X		X		
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	X	X	X	X	X	X	
Tricolored Blackbird <sup>f</sup>	<i>Agelaius tricolor</i>	X	X				X	
Brown-headed Cowbird <sup>i</sup>	<i>Molothrus ater</i>	X		X				
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	X		X				
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	X	X				X	
Black-and-white Warbler	<i>Mniotilta varia</i>		X	X				
Orange-crowned Warbler	<i>Oreothlypis celata</i>	X	X	X	X	X	X	
Nashville Warbler	<i>Leiothlypis ruficapilla</i>	X	X	X				
MacGillivray's Warbler	<i>Geothlypis tolmiei</i>			X				
Common Yellowthroat	<i>Geothlypis trichas</i>	X	X	X	X	X	X	
Yellow Warbler <sup>f</sup>	<i>Setophaga petechia</i>	X	X	X	X	X	X	X
Yellow-rumped Warbler	<i>Setophaga coronata</i>	X	X	X	X	X	X	
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>	X	X	X	X	X	X	
Townsend's Warbler	<i>Setophaga townsendi</i>	X		X				
Hermit Warbler	<i>Setophaga occidentalis</i>				X	X		
Wilson's Warbler <sup>f</sup>	<i>Cardellina pusilla</i>	X	X	X	X	X	X	X
Western Tanager	<i>Piranga ludoviciana</i>	X	X	X		X	X	
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	X	X	X	X	X		
Blue Grosbeak	<i>Passerina caerulea</i>	X	X	X	X	X	X	
Lazuli Bunting	<i>Passerina amoena</i>	X	X	X				
<b>Mammals (tracks/other evidence used)</b>								
Virginia Opossum <sup>i</sup>	<i>Didelphis virginiana</i>	X						
San Diego Black-tailed Jackrabbit <sup>f</sup>	<i>Lepus californicus bennettii</i>	X					X	
Desert Cottontail	<i>Sylvilagus audubonii</i>	X	X	X	X	X	X	
Feral Dog <sup>i</sup>	<i>Canis familiaris</i>	X		X	X		X	
Coyote <sup>f</sup>	<i>Canis latrans</i>	X	X	X		X	X	X
Gray Fox	<i>Urocyon cinereoargenteus</i>	X						
Feral Cat <sup>i</sup>	<i>Felis catus</i>	X		X				
Bobcat <sup>f</sup>	<i>Lynx rufus</i>	X	X	X	X			X
Striped Skunk	<i>Mephitis mephitis</i>	X	X	X				
Long-tailed Weasel <sup>f</sup>	<i>Mustela frenata</i>	X						X
Badger <sup>f</sup>	<i>Taxidea taxus</i>		X					
Raccoon	<i>Procyon lotor</i>	X	X	X			X	
Mule Deer	<i>Odocoileus hemionus</i>	X	X			X		
Feral Pig <sup>f</sup>	<i>Sus scrofa</i>		X	X	X		X	
Woodrat sp. (nest)	<i>Neotoma sp.</i>		X			X	X	
North American Deermouse	<i>Peromyscus maniculatus</i>		X					
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>		X	X				
Norway Rat	<i>Rattus norvegicus</i>	X						
California Ground Squirrel	<i>Otospermophilus beecheyi</i>	X	X	X	X	X	X	
Eastern Fox Squirrel <sup>i</sup>	<i>Sciurus niger</i>			X		X		

Table 5 continued. Observations of all species by location, 2020.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other <sup>1</sup>
<b>Herpetofauna</b>								
Western Toad	<i>Anaxyrus boreas</i>			X	X			
American Bullfrog <sup>i</sup>	<i>Lithobates catesbeianus</i>	X		X	X	X	X	
Baja California Treefrog	<i>Pseudacris hypochondriaca</i>	X	X		X	X	X	
Belding's Orange-throated Whiptail <sup>f</sup>	<i>Aspidoscelis hyperythra beldingi</i>		X	X				X
San Diegoan Tiger Whiptail <sup>f</sup>	<i>Aspidoscelis tigris stejnegeri</i>		X			X	X	X
Zebra-tailed Lizard	<i>Callisaurus draconoides</i>			X				
Southern Alligator Lizard	<i>Elgaria multicarinata</i>	X	X	X	X			
Blainville's Horned Lizard <sup>f</sup>	<i>Phrynosoma blainvillii</i>	X		X				
Western Skink	<i>Plestiodon skiltonianus</i>			X		X	X	
Western Fence Lizard	<i>Sceloporus occidentalis</i>	X	X	X	X	X	X	
Granite Spiny Lizard <sup>f</sup>	<i>Sceloporus orcutti</i>						X	X
Side-blotched Lizard	<i>Uta stansburiana</i>	X	X	X		X	X	
Red Racer/Coachwhip	<i>Coluber flagellum piceus</i>	X	X	X		X		
California Striped Racer	<i>Coluber lateralis lateralis</i>					X		
Southern Pacific Rattlesnake	<i>Crotalus oreganus helleri</i>	X	X			X		
Red Diamond Rattlesnake <sup>f</sup>	<i>Crotalus ruber</i>							X
San Bernardino Ring-necked Snake	<i>Diadophis punctatus modestus</i>			X				
California Kingsnake	<i>Lampropeltis californiae</i>	X		X			X	
San Diego Gopher Snake	<i>Pituophis catenifer annectens</i>	X				X		
Texas Spiny Softshell <sup>i</sup>	<i>Apalone spinifera emoryi</i>				X	X		
Common Snapping Turtle	<i>Chelydra serpentina</i>	X						
Red-eared Slider <sup>i</sup>	<i>Trachemys scripta elegans</i>	X		X	X	X		
<b>Fish</b>								
Bluegill <sup>i</sup>	<i>Lepomis macrochirus</i>			X				
Common Carp <sup>i</sup>	<i>Cyprinus carpio</i>			X				
Mosquitofish <sup>i</sup>	<i>Gambusia affinis</i>			X	X		X	
Santa Ana Sucker <sup>f</sup>	<i>Catostomus santaanae</i>			X				

<sup>1</sup> - Includes detections of sensitive species at sampled and incidental locations. Observations have been reported to CNDDB.

<sup>i</sup> = invasive or non-native

<sup>f</sup> = endangered, threatened, or sensitive: are those that are listed as endangered, threatened, or species of concern by the resource agencies and those that are covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP).

Note: This list is not intended as a complete species list for these sites. This is a list of species observed in the riparian zone and adjacent habitat, caught in cowbird traps, or otherwise observed during the vireo monitoring from March 11, 2020 to September 17, 2020.

Table 6. Brown-headed Cowbird trapping results, March-July 2020 (grouped by funding source).

Site Name	Trap/Location	2020 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
San Jacinto	Alta	3/17 - 7/30	89	13	8	5	0	0.15	0.15
	SJWA A1	4/28 - 7/31	83	23	19	3	1	0.27	0.28
	SJWA E1	4/28 - 7/31	86	34	19	10	5	0.34	0.40
Subtotal			258	70	46	18	6	0.25	0.27
Santa Ana River (upstream)	Fairmount Park	3/16 - 7/28	120	21	14	7	0	0.18	0.18
	Crestmore	3/16 - 7/28	120	0	0	0	0	0.00	0.00
	Sunnyslope Lift Station	3/17 - 7/28	119	4	2	2	0	0.03	0.03
	Shelter	3/31 - 6/9	68	13	7	6	0	0.19	0.19
	Hidden Valley South	5/11 - 7/16	61	1	2	-1	0	0.02	0.02
	Goose Creek 2	3/17 - 3/21	4	0	0	0	0	0.00	0.00
Subtotal			492	39	25	14	0	0.08	0.08
Mockingbird Canyon	Reservoir	3/17-7/31	129	74	32	36	6	0.53	0.57
	Estates	3/17-7/29	125	12	10	2	0	0.10	0.10
	Dak	3/17-7/31	127	1	0	1	0	0.01	0.01
	Markham	3/17-7/29	122	2	2	0	0	0.02	0.02
Subtotal			503	89	44	39	6	0.17	0.18
Prado/Chino Hills	IEUA	3/16 - 7/27	128	38	24	10	4	0.27	0.30
	Regional Park	3/16 - 7/27	128	27	7	12	8	0.15	0.21
	Bluff	3/16 - 7/28	131	3	1	1	1	0.02	0.02
	Olive Grove	3/16 - 7/28	116	-4	-1	-3	0	-0.03	-0.03
	Trailer	3/16 - 7/30	132	2	0	2	0	0.02	0.02
Subtotal			635	66	31	22	13	0.08	0.10



Table 6 continued. Brown-headed Cowbird trapping results, March-July 2020 (grouped by funding source).

Site Name	Trap/Location	2020 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
Temescal	New Sump	3/16 - 7/29	115	117	110	7	0	1.02	1.02
	Rockery	3/17 - 7/29	105	10	5	2	3	0.07	0.10
	Baker	3/16-7/29	112	3	1	2	0	0.03	0.03
	Salt Creek	3/18-7/30	114	15	10	5	0	0.13	0.13
Subtotal			446	145	126	16	3	0.32	0.33
San Jacinto, Prado and Lake Elsinore Dairies	Vanderwoude 2	3/17 - 5/21	62	279	244	35	0	4.50	4.50
	Tuls 1	3/17 - 7/31	133	402	236	75	91	2.34	3.02
	Scott Bros	3/17 - 7/31	133	923	625	208	90	6.26	6.94
	Euclid 1	3/16 - 7/31	128	434	278	138	18	3.25	3.39
	Euclid 2	3/16 - 7/31	129	257	155	87	15	1.88	1.99
	Weststeyn 1	3/16 - 7/31	123	606	436	129	41	4.59	4.93
	Weststeyn 2	3/16 - 7/31	123	234	123	82	29	1.67	1.90
	Dejongs	3/17 - 7/30	115	179	108	59	12	1.45	1.56
Subtotal			946	3,314	2,205	813	296	3.19	3.50
Santa Ana Canyon	Yorba Park	3/18-7/30	122	14	9	4	1	0.11	0.11
	RV Park E	3/16-7/28	123	1	0	1	0	0.01	0.01
	Chino Hills State Park	3/16-7/28	127	-1	-1	0	0	-0.01	-0.01
Subtotal			372	14	8	5	1	0.03	0.04
Anaheim	Conrock	3/17-7/31	122	49	27	14	8	0.34	0.40
	Huckleberry	3/17-7/31	125	15	7	4	4	0.09	0.12
Subtotal			247	64	34	18	12	0.21	0.26
TOTAL (USFWS/USACE/SARM)			3,899	3,801	2,519	945	337	0.89	0.97



Table 6 continued. Brown-headed Cowbird trapping results, March-July 2020 (grouped by funding source).

Site Name	Trap/Location	2020 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
<b>NORTH COUNTY BRS PROJECT, LLC</b>	Cielo Vista	3/16-7/30	90	7	2	4	1	0.07	0.08
<b>Santa Ana Canyon</b>									
<b>IERCD/SAWA</b>									
<b>San Timoteo</b>	Headlee	3/16 - 7/31	131	73	35	26	12	0.47	0.56
	Harned	3/16 - 7/30	118	11	4	6	1	0.08	0.09
	Fisherman's Retreat	3/30 - 7/31	105	29	11	13	5	0.23	0.28
	Younglove 1	3/16 - 7/30	132	19	12	7	0	0.14	0.14
<b>SBCTA</b>	Bees 1	4/30 - 7/27	85	0	0	0	0	0.00	0.00
	Bees 2	3/16 - 7/27	129	7	5	2	0	0.05	0.05
<b>Subtotal</b>			<b>700</b>	<b>139</b>	<b>67</b>	<b>54</b>	<b>18</b>	<b>0.17</b>	<b>0.20</b>
<b>Rivers and Lands Conservancy</b>									
<b>Meridian C.A.</b>	Meridian 1	3/18-7/30	116	8	6	1	1	0.06	0.07
<b>(formerly March SKR Preserve)</b>	Meridian 2	3/19-7/30	122	2	2	-1	1	0.01	0.02
<b>Subtotal</b>			<b>238</b>	<b>10</b>	<b>8</b>	<b>0</b>	<b>2</b>	<b>0.03</b>	<b>0.04</b>
<b>GRAND TOTAL</b>			<b>4,927</b>	<b>3,957</b>	<b>2,596</b>	<b>1,003</b>	<b>358</b>	<b>0.73</b>	<b>0.80</b>
<b>*TOTAL BHCO FIELD HOURS</b>		<b>3,030</b>							

\*hours also include installation and removal of traps from field

Table 7. Non-target avian captures in Brown-headed Cowbird traps, March-July 2020.

2020 Non-target Species *		USFWS/USACE/SARM Project																IERCD/SBCTA		Rivers and Lands Conservancy		2020 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		San Jacinto, Prado, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
Common Name	Scientific Name	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died
California Towhee	<i>Melozone crissalis</i>	79	2	410	0	121	3	169	2	533	2	2	0	150	0	2	0	453	1	41	0	1,960	10
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	3	0							40	0	66	0			21	0	100	1	187	0	417	1
Song Sparrow	<i>Melospiza melodia</i>							155	2	3	0			7	2	4	0	17	0			186	4
House Finch	<i>Haemorhous mexicanus</i>			1	0	114	1	6	0					16	0	15	0	9	0	10	0	171	1
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>											55	0									55	0
Hooded Oriole	<i>Icterus cucullatus</i>			2	0	1	0			1	0	1	0					19	0			24	0
Northern Mockingbird	<i>Mimus polyglottos</i>	8	0	1	1	1	0	1	0							4	1			1	0	16	2
Bewick's Wren	<i>Thryomanes bewickii</i>			1	0	3	2			3	0							8	0			15	2
Lark Sparrow	<i>Chondestes grammacus</i>					1	0											2	0	11	3	14	3
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>											8	1									8	1
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>							2	0							3	0	3	0			8	0
Loggerhead Shrike	<i>Lanius ludovicianus</i>	7	0																			7	0
Bullock's Oriole	<i>Icterus bullockii</i>	2	0	2	0									1	0	1	1					6	1
Great-tailed Grackle	<i>Quiscalus mexicanus</i>											6	0									6	0
Tricolored Blackbird	<i>Agelaius tricolor</i>											2	0					2	0			4	0
Black Phoebe	<i>Sayornis nigricans</i>					2	2							1	0							3	2
Unknown Oriole	<i>Icterus sp.</i>															3	0					3	0
House Wren	<i>Troglodytes aedon</i>							3	0													3	0
California Thrasher	<i>Toxostoma redivivum</i>									1	1							1	0			2	1
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	1	0															1	0			2	0
California Scrub Jay	<i>Aphelocoma californica</i>									1	0											1	0

Table 7 continued. Non-target avian captures in Brown-headed Cowbird traps, March-July 2020.

2020 Non-target Species *		USFWS/USACE/SARM Project																IERCD/SBCTA		Rivers and Lands Conservancy		2020 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		San Jacinto, Prado, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
Common Name	Scientific Name	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died
Anna's Hummingbird	<i>Calypte anna</i>																	1	1			1	1
Lesser Goldfinch	<i>Spinus psaltria</i>													1	0							1	0
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>									1	1											1	1
Mourning Dove	<i>Zenaida macroura</i>															1	1					1	1
Say's Phoebe	<i>Sayornis saya</i>	1	1																			1	1
Exotic Non-targets																							
Scaly-breasted Munia	<i>Lonchura punctulata</i>													1	0	1	0					2	0
TOTAL		101	3	417	1	243	8	336	4	583	4	140	1	177	2	55	3	616	3	250	3	2,918	32
#/trap day		0.4		0.8		0.5		0.5		1.3		0.1		0.4		0.2		0.9		1.1		0.6	
Mortality %			3.0%		0.2%		3.3%		1.2%		0.7%		0.7%		1.1%		5.5%		0.5%		1.2%		1.1%

\*Number of dead non-targets included in number caught

Exotic Nuisance Species Captures in Brown-headed Cowbird Traps, March-July 2020

2020 Exotic Nuisance Species**		USFWS/USACE/SARM Project																IERCD/SBCTA		Rivers and Lands Conservancy		2020 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
		released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed
Common Name	Scientific Name																						
European Starling	<i>Sturnus vulgaris</i>	18	15	0	1	2	0	19	8	11	1	1545	345	0	1	98	111	39	12	0	0	1,732	494
House Sparrow	<i>Passer domesticus</i>	4	26	0	6	2	0	28	28	0	0	12	309	2	0	2	136	6	73	2	4	58	582
TOTAL		22	41	0	7	4	0	47	36	11	1	1557	654	2	1	100	247	45	85	2	4	1,790	1,076

\*\*Non-natives removed under CDFW authorization to control Brown-headed Cowbirds

Table 8. Brown-headed Cowbird trapping results, winter 2019-2020.

Site Name	Trap/Location	Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
<b>Prado</b>	Euclid 1 Dairy	7/25/19 - 3/15/20	113	1,299	501	412	386	8.1	11.5
	Euclid 2 Dairy	7/25/19 - 3/15/20	114	826	281	368	177	5.7	7.2
	Weststeyn 1 Dairy	7/25/19 - 3/15/20	108	1,600	479	368	753	7.8	14.8
	Weststeyn 2 Dairy	7/26/19 - 2/20/20	100	479	58	111	310	1.7	4.8
<b>Subtotal</b>			<b>435</b>	<b>4,204</b>	<b>1,319</b>	<b>1,259</b>	<b>1,626</b>	<b>5.9</b>	<b>9.7</b>
<b>San Jacinto</b>	Vanderwoude 2	11/5/19 - 3/15/20	68	221	130	91	0	3.3	3.3
	Tuls 1	11/5/19 - 3/15/20	68	49	20	29	0	0.7	0.7
	Scott Bros	11/5/19 - 3/15/20	68	314	187	127	0	4.6	4.6
<b>Subtotal</b>			<b>204</b>	<b>584</b>	<b>337</b>	<b>247</b>	<b>0</b>	<b>2.9</b>	<b>2.9</b>
<b>GRAND TOTAL</b>			<b>639</b>	<b>4,788</b>	<b>1,656</b>	<b>1,506</b>	<b>1,626</b>	<b>4.9</b>	<b>7.5</b>

Table 9. Non-target avian captures in Brown-headed Cowbird traps, winter 2019-2020.

2019-2020 Winter Non-target Species		Prado		San Jacinto		Total	
Common Name	Scientific Name	caught	died	caught	died	caught	died
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	32	0	26	0	58	0
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	17	0			17	0
Tricolored Blackbird	<i>Agelaius tricolor</i>	10	0			10	0
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	1	0			1	0
TOTAL		60	0	26	0	86	0
#/trap day		0.14		0.13		0.13	
Mortality %			0.0%		0.0%		0.0%

Exotic nuisance species captures in Brown-headed Cowbird traps, winter 2019-2020.

2019-2020 Winter Exotic Nuisance Species		Prado		San Jacinto		Total	
Common Name	Scientific Name	released	removed	released	removed	released	removed
House Sparrow	<i>Passer domesticus</i>	1	326	0	0	1	326
European Starling	<i>Sturnus vulgaris</i>	93	78	10	0	103	78
TOTAL		94	404	10	0	104	404

## APPENDIX A – SURVEY SITES, STARTING AND ENDING COORDINATES

[All coordinates –WGS 1984 (Zone 11S) except where noted otherwise]

### Monitored Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>San Jacinto:</u>		
-San Jacinto River	506079, 3738423	493412, 3746014
-San Jacinto Wildlife Area	488055, 3745444	490979, 3750919
<u>San Timoteo Canyon:</u>		
-Riverside County	486193, 3761215	499865, 3753848
-San Bernardino County	481628, 3764975	484320, 3763100
<u>Santa Ana River (SAR):</u>		
-Riverside Ave. to Van Buren Blvd.	466416, 3765008	456998, 3758228
-Evans Lake Drain	464761, 3761889	464031, 3761150
-Anza/Old Ranch Creeks	462172, 3758697	459646, 3758831
-Hidden Valley, north side of river	456941, 3758360	451647, 3758651
-Hidden Valley, south side of river	456067, 3758152	451089, 3757558
-Hidden Valley South - Restoration	456067, 3758152	454817, 3758428
-Hidden Valley South - Control	454835, 3758920	451089, 3757558
-Lower Hole Creek	457147, 3757662	456737, 3758025
-Hidden Valley to River Rd <sup>1</sup>		
-SAR-Goose Creek, Norco to I-15	451560, 3758574	448772, 3756316
-Goose Creek Mitigation, Norco	451083, 3757763	450045, 3757296
-Norco Bluffs (I-15 to River Rd, non-mitigation)	448907, 3756725	444876, 3753717
<u>Santa Ana Canyon (SAC):</u>		
-Upper Canyon	441121, 3749692	438609, 3749795
-Green River Golf Club	438609, 3749795	436613, 3748409
-Featherly Park	436604, 3748585	429512, 3747922

### Sampled Locations and Incidental Sighting Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>Santa Ana River &amp; Tributaries:</u>		
Alessandro Arroyo/Prenda Arroyo	465500, 3754365	470391, 3751168
	465354, 3752493	468066, 3751913
Box Springs	471086, 3757494	472592, 3756430
Burris Basin <sup>3</sup>	419850, 3743943	419150, 3742378
Cajon Wash <sup>2</sup>	456784, 3796197	457285, 3791752
Canyon Crest <sup>2</sup>	468329, 3757116	468644, 3756933
Carbon Canyon (Chino Hills Pkwy) <sup>2</sup>	431500, 3760294	431143, 3759777
Carbon Canyon Regional Park <sup>2</sup>	422957, 3752929	425648, 3754031
Castlevue Park <sup>2</sup>	467826, 3755173	468565, 3754997
Chino Creek Wetlands Park <sup>2</sup>	437541, 3758309	437358, 3758832
Chino Hills	438794, 3754812	429061, 3759386
Chino Hills State Park (Bane Cyn) <sup>2</sup>	435061, 3757365	435376, 3753499

**Sampled Locations and Incidental Sighting Locations (cont.)**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
Chino Hills State Park (Lower Aliso Cyn) <sup>2</sup>	435288, 3753302	438033, 3749528
Chino Hills State Park (Telegraph Cyn) <sup>2</sup>	434818, 3753694	424101, 3753165
Chino Hills State Park (Upper Aliso Cyn) <sup>2</sup>	435111, 3753336	433834, 3755029
City Creek (Highland) <sup>2</sup>	482136, 3775290	482454, 3777612
Conrock Basin (FHQ) <sup>3</sup>	423314, 3746089	423465, 3746370
Fresno Canyon <sup>2</sup>	440631, 3748012	440954, 3749370
Golden Star	465359, 3751458	466469, 3750869
Harrison Reservoir (aka McAllister Creek)	460113, 3749435	460002, 3747712
Hidden Valley Golf Club	451635, 3752238	451557, 3754114
Highway 71 <sup>2</sup>	439575, 3753329	439937, 3752095
La Sierra	457473, 3748848	457824, 3747117
Little Sand Basin <sup>2</sup>	478157, 3779714	478805, 3780527
Mead Valley (Cajalco/aqueduct)	471930, 3744796	469980, 3743887
Meridian CA (former March SKR Preserve)	471761, 3749213	473403, 3750887
Mockingbird Canyon	461624, 3750450	469580, 3747044
Norco Hills Park Mitigation <sup>2</sup>	449570, 3751384	449818, 3751233
Plunge Creek	486953, 3774720	486987, 3775572
Poorman Reservoir	476434, 3758610	477243, 3757320
Pyrite Channel <sup>2</sup>	456489, 3762199	455222, 3760761
Quail Run	469907, 3757374	471038, 3757541
Riverside (Van Buren and Jurupa)	457145, 3757620	457172, 3757560
Ryan Bonaminio Park <sup>2</sup>	463782, 3759521	463195, 3759424
San Bernardino Flood Control	468779, 3767632	467036, 3766052
Sun Canyon Park <sup>2</sup>	454614, 3749211	454788, 3749119
Sycamore Canyon	470209, 3757079	473225, 3753435
Talbert Park (Orange County)	411746, 3722974	411932, 3723803
Tequesquite Arroyo <sup>2</sup>	467671, 3756303	468003, 3757103
Tin Mine Road	455337, 3747953	455530, 3744748
Van Buren Blvd. (Bountiful)	469382, 3749787	469934, 3750036
Van Buren (Porter Road) <sup>2</sup>	467009, 3749689	466421, 3750042
Wardlow Wash <sup>2</sup>	442819, 3748289	441873, 3749262
Woodcrest	464548, 3751638	464847, 3751471
Wyle Labs (at El Paso only)	450013, 3751824	451547, 3752543
Yorba Linda (San Antonio Rd) <sup>2</sup>	429199, 3750653	429494, 3751473
Yorba Linda (Starlight Dr.)	431071, 3749184	431140, 3750240
Yorba Linda Lakebed Park <sup>2</sup>	424747, 3748248	424886, 3748817
<b>San Jacinto River Sub-watershed:</b>		
Cottonwood Canyon <sup>2</sup>	475769, 3725678	477572, 3723954
Kabian Park <sup>2</sup>	478467, 3734032	475650, 3730501
Lake Perris	483092, 3744484	485461, 3748329
Menifee (Salt Creek)	478298, 3726507	479627, 3727241
Temescal Canyon	450725, 3746717	471425, 3720558
<b>Santiago Creek Sub-watershed:</b>		
Irvine Lake <sup>3</sup>	432717, 3736629	434691, 3737547



**Sampled Locations and Incidental Sighting Locations (cont.)**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
Irvine Trust Management Area	429805, 3738275	429786, 3738632
Limestone Canyon <sup>2</sup>	434012, 3736548	434897, 3735784
Peter's Canyon	429752, 3738563	428604, 3735584
Santiago Basin <sup>3</sup>	425344, 3740796	424678, 3740612
Santiago Canyon (Irvine Park)	430063, 3740268	428977, 3741769
Santiago Creek (above Irvine Lake)	437147, 3736028	435376, 3737521
Santiago Creek (Cambridge Road)	421800, 3737876	421425, 3737985
Santiago Creek (Chapman Ave.)	423094, 3738524	423740, 3739316
Santiago Oaks Regional Park (to Cannon Rd) <sup>4</sup>	425540, 3741436	428769, 3742280
Silverado Canyon <sup>2</sup>	437692, 3734768	438878, 3734047
Smith Basin <sup>4</sup>	425362, 3741441	426377, 3741912

**Miscellaneous Locations**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
Cielo Vista <sup>3</sup>	429825, 3750579	429825, 3750579
Moreno Valley <sup>2</sup>	475810, 3758624	474960, 3759974
San Bernardino Flood Control <sup>3</sup>	477956, 3771549	477956, 3771549
Van Buren and Jurupa <sup>3</sup>	457187, 3757558	457187, 3757558
Wolfskill	498156, 3747889	497980, 3747499

<sup>1</sup> In 2015, Hidden Valley to River Rd was divided into separate sites due to funding constraints. These sites are SAR-Goose Creek, Norco to I-15, which also includes Goose Creek Mitigation (funded by IERCD), and Norco Bluffs (I-15 to River Rd, non-mitigation), which as of 2016 includes an additional 250 acres that was not surveyed by SAWA in 2015.

<sup>2</sup> Denotes sites that were not surveyed this year.

<sup>3</sup> Incidental observations of LBVI at this site.

<sup>4</sup> In 2018, Santiago Creek (to Cannon, including Smith Basin) was broken out to make Smith Basin a separate site and Santiago Oaks Regional Park was expanded to include the area up to Cannon Road.

<sup>5</sup> In 2017, Rancho La Sierra West was added to SAR – Upstream, Hidden Valley south side of the river.

## **APPENDIX B: WATERSHED-WIDE ANNUAL RESULTS, 2000-2020**

Appendix B-1: Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020 (sites vary by year).

	Parameter	2000-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	865	983	1,039	1,110	1,293	n/a
B.	Number of known pairs	4,161	440	560	565	615	713	7,054
C.	Number of known breeding (nesting) pairs	3,516	353	486	418	528	592	5,893
D.	Number of breeding pairs that were well-monitored throughout the season	1,243	95	135	148	151	247	2,019
E.	Number of known fledged young observed	6,635	610	994	691	1,189	1,201	11,320
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	3,382	248	490	363	581	696	5,760
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.9	1.7	2.0	1.7	2.3	2.0	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.7	2.6	3.6	2.5	3.8	2.8	2.9
I.	Number of nests that were discovered	2,618	206	316	333	420	519	4,412
J.	Number of well-tracked nests	2,159	180	279	267	364	454	3,703
K.	Number of successful well-tracked nests	59% 1,281 / 2,159	52% 93 / 180	62% 172 / 279	52% 140 / 267	62% 225 / 364	53% 241 / 454	58% 2,152 / 3,703
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	11% 242 / 2,159	3% 6 / 180	5% 13 / 279	3% 9 / 267	10% 32 / 316	8% 32 / 386	9% 334 / 3,587
	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 99 / 2,159	6% 10 / 180	4% 11 / 279	4% 10 / 267	6% 22 / 364	4% 16 / 454	5% 168 / 3,703
	B. Number of well-tracked nests that failed as a result of parasitism	4% 76 / 2,159	1% 1 / 180	2% 6 / 279	1% 2 / 267	4% 13 / 364	2% 8 / 454	3% 106 / 3,703
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	32% 698 / 2,159	41% 74 / 180	31% 86 / 279	42% 113 / 267	29% 104 / 364	36% 164 / 454	33% 1,239 / 3,703
	D. Number of well-tracked nests that failed for unknown reasons	<1% 5 / 2,159	1% 2 / 180	1% 4 / 279	1% 2 / 267	0% 0 / 364	5% 24 / 454	1% 37 / 3,703
M.	Average clutch size	n/a	3.4	3.7	3.4	3.7	3.6	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	309	8	13	12	33	34	409
P.	Number of 'manipulated' parasitized nests	196	6	11	9	26	29	277
Q.	Number of successful 'manipulated' nests <sup>1</sup>	47% 93 / 196	33% 2 / 6	9% 1 / 11	44% 4 / 9	46% 12 / 26	34% 10 / 29	44% 122 / 277
R.	Number of vireo fledged from 'manipulated' nests	198	6	3	9	26	21	263
S.	Number of cowbird young fledged by vireo observed	15	0	2	0	1	0	18
T.	Number of repaired nests	34	0	3	4	6	16	63
U.	% of successful repaired nests	74% 25 / 34	n/a	33% 1 / 3	50% 2 / 4	67% 4 / 6	63% 10 / 16	67% 42 / 63
V.	Number of vireo fledged from repaired nests	70	n/a	4	6	9	27	116
W.	Number of cowbirds removed from study area <sup>2</sup>	30,248	3,177	1,953	2,637	2,345	2,292	42,652
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) <sup>2</sup>	71,852	5,707	4,061	3,096	3,119	3,583	91,418
Y.	Average number of cowbirds trapped per day (W/X) <sup>2</sup>	0.42	0.29	0.48	0.85	0.75	0.64	0.47

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

<sup>2</sup>In 2015 and 2016 all Brown-headed Cowbird traps are included in this total. In all other years, only Brown-headed Cowbird traps included in Table 3 for that year are included in this total.

Appendix B-2. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020.

Host Plant Species (listed in taxonomic order)	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Giant Reed <sup>a</sup> ( <i>Arundo donax</i> )	1			1	1	1	4	<1%
Western Sycamore ( <i>Platanus racemosa</i> )	6		3	2	2	4	17	<1%
Coulter's Matilija Poppy <sup>f</sup> ( <i>Romneya coulteri</i> )	0	1					1	<1%
Golden Currant ( <i>Ribes aureum</i> )	4	1					5	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	112	14	21	19	27	21	214	5%
Fremont Cottonwood ( <i>Populus fremontii</i> )	104	6	14	21	17	45	207	5%
Dead Fremont Cottonwood ( <i>Populus fremontii</i> )	2						2	<1%
Black Cottonwood ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> )	2	1					3	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )	108	4	20	26	40	42	240	6%
Dead Narrowleaf Willow ( <i>Salix exigua</i> )	1					1	2	<1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	300	19	28	24	35	35	441	10%
Dead Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Dead Goodding's Black Willow covered with living Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Red Willow ( <i>Salix laevigata</i> )	255	25	30	22	31	35	398	9%
Arroyo Willow ( <i>Salix lasiolepis</i> )	481	46	73	62	69	98	829	19%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )	1			1	1		3	<1%
Yellow Willow ( <i>Salix lasiandra</i> )	16	3			2	6	27	1%
Willow sp. ( <i>Salix</i> sp.)	8			3		3	14	<1%
Dead Willow sp. ( <i>Salix</i> sp.)	4		1				5	<1%
Castorbean <sup>ia</sup> ( <i>Ricinus communis</i> )	1		1				2	<1%
Bank Catclaw <sup>o</sup> ( <i>Acacia redolens</i> )	0	1					1	<1%
Western False Indigo ( <i>Amorpha fruticosa</i> )	1				1		2	<1%
Blue Palo Verde ( <i>Parkinsonia florida</i> )	0				1	1	2	<1%
Asian Pear <sup>o</sup> ( <i>Cydonia oblonga</i> )	0				1	1	2	<1%
Holly Leaf Cherry ( <i>Prunus ilicifolia</i> )	0					1	1	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020.

Host Plant Species (listed in taxonomic order)	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
California Wild Rose ( <i>Rosa californica</i> )	5	2	1	1	1	1	11	<1%
California Blackberry ( <i>Rubus ursinus</i> )	1		2			4	7	<1%
Chinese Elm <sup>a</sup> ( <i>Ulmus parvifolia</i> )	0	1					1	<1%
Fig <sup>a</sup> ( <i>Ficus</i> sp.)	1						1	<1%
White Mulberry <sup>a</sup> ( <i>Morus alba</i> )	1				2	2	5	<1%
Wild Cucumber ( <i>Marah macrocarpa</i> )	0					1	1	<1%
Hoary Nettle ( <i>Urtica dioica</i> )	1				1		2	<1%
Coast Live Oak ( <i>Quercus agrifolia</i> )	2						2	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	6			1	1	3	11	<1%
Oak sp. ( <i>Quercus</i> sp.)	1						1	<1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	12		5	1	1	2	21	<1%
White Alder ( <i>Alnus rhombifolia</i> )	1		1				2	<1%
Laurel Sumac ( <i>Malosma laurina</i> )	12	2	6	9	8	11	48	1%
Fragrant Sumac ( <i>Rhus aromatica</i> )	1						1	<1%
Sugar Sumac ( <i>Rhus ovata</i> )	2			1			3	<1%
Peruvian Pepper Tree <sup>ia</sup> ( <i>Schinus molle</i> )	12		3	4	1	3	23	1%
Brazilian Pepper Tree <sup>ia</sup> ( <i>Schinus terebinthifolius</i> )	1						1	<1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	18	4	2		1	3	28	1%
Carrotwood <sup>a</sup> ( <i>Cupaniopsis anacardioides</i> )	0					1	1	<1%
Boxelder ( <i>Acer negundo</i> )	2						2	<1%
Orange Tree <sup>a</sup> ( <i>Citrus sinensis</i> )	3					1	4	<1%
Tree of Heaven <sup>ia</sup> ( <i>Ailanthus altissima</i> )	1			1	1		3	<1%
Chaparral Mallow ( <i>Malacothamnus fasciculatus</i> )	0				1	2	3	<1%
Black Mustard <sup>ia</sup> ( <i>Brassica nigra</i> )	12				7	3	22	1%
Perennial Pepperweed <sup>ia</sup> ( <i>Lepidium latifolium</i> )	6				1	2	9	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020.

Host Plant Species (listed in taxonomic order)	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Dead Perennial Pepperweed <sup>ia</sup> ( <i>Lepidium latifolium</i> )	1						1	<1%
Tamarisk <sup>ia</sup> ( <i>Tamarix ramosissima</i> )	9		1	5	6	7	28	1%
Cape Leadwort <sup>a</sup> ( <i>Plumbago auriculata</i> )	2						2	<1%
Fourwing Saltbush ( <i>Atriplex canescens</i> )	2				2	1	5	<1%
Summer Cypress <sup>a</sup> ( <i>Kochia scoparia</i> )	0					1	1	<1%
Arizona Ash ( <i>Fraxinus velutina</i> )	0					1	1	<1%
Ash sp. ( <i>Fraxinus</i> sp.)	1					3	4	<1%
Privet sp. <sup>a</sup> ( <i>Ligustrum</i> sp.)	1				1		2	<1%
Olive <sup>a</sup> ( <i>Olea europaea</i> )	0				1		1	<1%
Lollypop Tree <sup>a</sup> ( <i>Myoporum laetum</i> )	1						1	<1%
Black Sage ( <i>Salvia mellifera</i> )	1			1			2	<1%
Tree Tobacco <sup>ia</sup> ( <i>Nicotiana glauca</i> )	1			1	2	1	5	<1%
California Sagebrush ( <i>Artemisia californica</i> )	1			1			2	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	24				2	2	28	1%
Coyote Brush ( <i>Baccharis pilularis</i> )	8	3	2	4	13	5	35	1%
Mulefat ( <i>Baccharis salicifolia</i> )	726	55	75	93	62	106	1117	26%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	5	2	1				8	<1%
Willow Baccharis ( <i>Baccharis salicina</i> )	3						3	<1%
Desertbroom Baccharis ( <i>Baccharis sarothroides</i> )	1						1	<1%
Yellowspine Thistle <sup>ia</sup> ( <i>Cirsium ochrocentrum</i> )	2						2	<1%
Brittlebush ( <i>Encelia farinosa</i> )	1				2		3	<1%
Common Sunflower ( <i>Helianthus annuus</i> )	1					1	2	<1%
Arrowweed ( <i>Pluchea sericea</i> )	3		1	1	2	2	9	<1%
Milk Thistle <sup>a</sup> ( <i>Silybum marianum</i> )	1						1	<1%
Rough Cockelburr ( <i>Xanthium strumarium</i> )	2						2	<1%



Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020.

Host Plant Species (listed in taxonomic order)	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Wild Celery <sup>a</sup> ( <i>Apium graveolens</i> )	1						1	<1%
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )	11				6	12	29	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	154	8	13	5	36	30	246	6%
Dead Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	0		1				1	<1%
Fiddleneck sp. ( <i>Amsinckia</i> sp.)	1						1	<1%
Thickleaf Yerba Santa ( <i>Eriodictyon crassifolium</i> )	3						3	<1%
Yerba Santa sp. ( <i>Eriodictyon</i> sp.)	1						1	<1%
Fresh water reed ( <i>Typha</i> sp.) and Arroyo Willow ( <i>S. lasiolepis</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Goodding's Black Willow ( <i>S. gooddingii</i> )	1			1			2	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Arroyo Willow ( <i>S. lasiolepis</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and California Wild Rose ( <i>R. californica</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Peruvian Pepper Tree <sup>a</sup> ( <i>S. molle</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	4		1				5	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	<1%
Dead Goodding's Black Willow ( <i>S. gooddingii</i> ) and Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Perennial Pepperweed <sup>a</sup> ( <i>L. latifolium</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Poison Hemlock <sup>a</sup> ( <i>C. maculatum</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	<1%
Red Willow ( <i>S. laevigata</i> ) and Wild Cucumber ( <i>Marah macrocarpa</i> )	0		1				1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and dead Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Black Mustard <sup>a</sup> ( <i>B. nigra</i> )	1						1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Sweet Fennel <sup>a</sup> ( <i>Foeniculum vulgare</i> )	1						1	1%
Willow sp. ( <i>Salix</i> sp.) and California Blackberry ( <i>Rubus ursinus</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.) and Perennial Pepperweed <sup>a</sup> ( <i>L. latifolium</i> )	1						1	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020.

Host Plant Species (listed in taxonomic order)	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Castorbean <sup>ia</sup> ( <i>R. communis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
California Blackberry ( <i>Rubus ursinus</i> ) and dead unknown	0					1	1	<1%
Black Mustard <sup>ia</sup> ( <i>B. nigra</i> ) and Poison Hemlock <sup>ia</sup> ( <i>C. maculatum</i> )	0				1		1	<1%
Black Mustard <sup>ia</sup> ( <i>B. nigra</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Coyote Brush ( <i>B. pilularis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Mulefat ( <i>B. salicifolia</i> ) and Poison Hemlock <sup>ia</sup> ( <i>C. maculatum</i> )	1						1	<1%
Deadfall	5					7	12	<1%
Unknown/No data	15	8	4	22	29	6	84	2%
<b>Total</b>	<b>2,550</b>	<b>206</b>	<b>311</b>	<b>333</b>	<b>419</b>	<b>519</b>	<b>4,338</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

## **APPENDIX C: SUMMARY TABLES BY MANAGED SITE, 2000-2020**

Appendix C-1-A. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

San Jacinto								
	Parameter	2003-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	37	45	74	63	108	n/a
B.	Number of known pairs	177	17	27	34	44	83	382
C.	Number of known breeding (nesting) pairs	146	10	25	30	44	72	327
D.	Number of breeding pairs that were well-monitored throughout the breeding season	45	5	8	18	7	29	112
E.	Number of known fledged young observed	258	12	48	60	117	145	640
F.	Number of known fledged young produced by pairs monitored throughout the season	127	6	22	40	35	77	307
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	1.2	1.9	2	2.7	2.0	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.8	1.2	2.8	2.2	5.0	2.7	2.7
I.	Number of nests that were discovered	112	11	17	38	47	69	294
J.	Number of well-tracked nests	94	8	11	30	35	56	234
K.	Number of successful well-tracked nests	53% 50 / 94	25% 2 / 8	64% 7 / 11	63% 19 / 30	69% 24 / 35	63% 35 / 56	59% 137 / 234
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	10% 9 / 94	75% 6 / 8	9% 1 / 11	10% 3 / 30	26% 5 / 19	14% 7 / 49	15% 31 / 211
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 4 / 94	0% 0 / 8	9% 1 / 11	7% 2 / 30	3% 1 / 35	4% 2 / 56	4% 10 / 234
	B. Number of well-tracked nests that failed as a result of parasitism	6% 6 / 94	13% 1 / 8	9% 1 / 11	7% 2 / 30	3% 1 / 35	4% 2 / 56	6% 13 / 234
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	36% 34 / 94	63% 5 / 8	18% 2 / 11	23% 7 / 30	26% 9 / 35	27% 15 / 56	31% 72 / 234
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 94	0% 0 / 8	0% 0 / 11	0% 0 / 30	0% 0 / 35	4% 2 / 56	1% 2 / 234
N.	Average clutch size	n/a	4.0	3.8	3	3.5	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	12	8	1	3	6	9	39
P.	Number of 'manipulated' parasitized nests	5	6	0	3	6	6	26
Q.	Number of successful 'manipulated' nests	60% 3 / 5	33% 2 / 6	n/a	33% 1 / 3	67% 4 / 6	33% 2 / 6	46% 12 / 26
R.	Number of vireo fledged from 'manipulated' nests	7	6	n/a	1	11	4	29
S.	Number of cowbird young fledged by vireo observed	7	0	0	0	0	0	7
T.	Number of repaired nests	3	0	0	0	0	2	5
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	50% 1 / 2	80% 4 / 5
V.	Number of vireo fledged from repaired nests	10	n/a	n/a	n/a	n/a	1	11
W.	Numbers of cowbirds removed from study area	19,081	2,101	1,405	2,099	1,774	1,674	28,134
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	11,374	390	589	659	480	586	14,078
Y.	Average number of cowbirds trapped per trap day (W/X)	1.68	5.39	2.39	3.19	3.70	2.86	2.00

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-B. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

San Timoteo Canyon								
	Parameter	2001-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	1,195	173	172	156	124	139	n/a
B.	Number of known pairs	975	124	109	104	92	105	1,509
C.	Number of known breeding (nesting) pairs	821	107	99	85	75	86	1,273
D.	Number of breeding pairs that were well-monitored throughout the season	409	39	48	30	39	58	623
E.	Number of known fledged young observed	1,791	222	272	161	170	207	2,823
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	1,187	119	202	86	123	173	1,890
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.2	2.1	2.7	1.9	2.3	2.4	2.2
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.9	3.1	4.2	2.9	3.2	3.0	3.0
I.	Number of nests that were discovered	870	78	94	75	96	104	1,317
J.	Number of well-tracked nests	771	73	91	63	90	99	1,187
K.	Number of successful well-tracked nests	9%	51%	63%	44%	44%	52%	55%
		439 / 771	37 / 73	57 / 91	28 / 63	40 / 90	51 / 99	652 / 1,187
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	0%	0%	1%	0%	15%	0%	11%
		114 / 771	0 / 73	1 / 91	0 / 63	12 / 80	0 / 85	127 / 1,163
	A. Number of well-tracked nests that failed as a result of reproductive failure	1%	7%	2%	8%	4%	6%	5%
		37 / 771	5 / 73	2 / 91	5 / 63	4 / 90	6 / 99	59 / 1,187
	B. Number of well-tracked nests that failed as a result of parasitism	0%	0%	0%	0%	8%	0%	3%
		28 / 771	0 / 73	0 / 91	0 / 63	7 / 90	0 / 99	35 / 1,187
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	5%	42%	35%	48%	43%	34%	36%
		264 / 771	31 / 73	32 / 91	30 / 63	39 / 90	34 / 99	430 / 1,187
	D. Number of well-tracked nests that failed for unknown reasons	0%	0%	0%	0%	0%	8%	1%
		3 / 771	0 / 73	0 / 91	0 / 63	0 / 90	8 / 99	11 / 1,187
M.	Average clutch size	n/a	3.5	3.8	3.4	3.7	3.6	n/a
N.	Number of cowbird eggs found in or near vireo nests	135	0	1	2	12	0	150
P.	Number of 'manipulated' parasitized nests	93	n/a	1	n/a	8	n/a	102
Q.	Number of successful 'manipulated' nests	51%	n/a	0%	n/a	38%	n/a	49%
		47 / 93		0 / 1		3 / 8		50 / 102
R.	Number of vireo fledged from 'manipulated' nests	102	n/a	0	n/a	4	n/a	106
S.	Number of cowbird young fledged by vireo observed	2	0	0	0	0	0	2
T.	Number of repaired nests	8	0	1	1	3	4	17
U.	% of successful repaired nests	75%	n/a	0%	0	33%	75%	59%
		6 / 8		0 / 1	0 / 1	1 / 3	3 / 4	10 / 17
V.	Number of vireo fledged from repaired nests	18	n/a	0	0	3	11	32
W.	Numbers of cowbirds removed from study area	2,388	87	93	88	72	139	2,867
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	13,001	832	794	574	500	700	16,401
Y.	Average number of cowbirds trapped per trap day (W/X)	0.18	0.10	0.12	0.15	0.14	0.20	0.17

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-C. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Meridian Conservation Area\***

	Parameter	2004-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	14	16	20	14	14	n/a
B.	Number of known pairs	97	5	9	2	2	9	124
C.	Number of known breeding (nesting) pairs	77	4	8	2	2	7	100
D.	Number of breeding pairs that were well-monitored throughout the season	13	0	3	0	0	6	22
E.	Number of known fledged young observed	157	6	23	2	2	24	214
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	60	n/a	9	n/a	n/a	22	91
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	1.5	2.9	n/a	n/a	3.4	2.1
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	4.6	n/a	3.0	n/a	n/a	3.7	4.1
I.	Number of nests that were discovered	26	0	5	0	0	8	39
J.	Number of well-tracked nests	25	n/a	5	n/a	0	8	38
K.	Number of successful well-tracked nests	72% 18 / 25	n/a	100% 5 / 5	n/a	n/a	88% 7 / 8	79% 30 / 38
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	0% 0 / 25	n/a	0% 0 / 5	n/a	n/a	0% 0 / 8	0% 0 / 38
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 25	n/a	0% 0 / 5	n/a	n/a	13% 1 / 8	3% 1 / 38
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 25	n/a	0% 0 / 5	n/a	n/a	0% 0 / 8	0% 0 / 38
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	28% 7 / 25	n/a	0% 0 / 5	n/a	n/a	0% 0 / 8	18% 7 / 38
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 25	n/a	0% 0 / 5	n/a	n/a	0% 0 / 8	0% 0 / 38
N.	Average clutch size	n/a	n/a	3.8	n/a	n/a	3.8	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	1	0	0	n/a	n/a	0	1
P.	Number of 'manipulated' parasitized nests	n/a	0	0	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	n/a	0	n/a	n/a	0	0
T.	Number of repaired nests	0	0	0	0	n/a	0	0
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Numbers of cowbirds removed from study area	216	3	18	6	5	10	258
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,606	248	260	221	248	238	3,821
Y.	Average number of cowbirds trapped per trap day (W/X)	0.08	0.01	0.07	0.03	0.02	0.04	0.07

\*Former March SKR Preserve

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).



Appendix C-1-D. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Mockingbird Canyon								
	Parameter	2003-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	25	29	43	43	45	n/a
B.	Number of known pairs	266	7	15	15	19	17	339
C.	Number of known breeding (nesting) pairs	230	4	13	10	12	14	283
D.	Number of breeding pairs that were well-monitored throughout the season	64	1	0	0	3	9	77
E.	Number of known fledged young observed	415	11	15	10	24	26	501
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	194	3	n/a	n/a	3	20	220
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	2.8	1.2	n/a	2.0	1.9	1.8
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.0	3.0	n/a	n/a	1.0	2.2	2.9
I.	Number of nests that were discovered	180	3	2	0	12	18	215
J.	Number of well-tracked nests	153	3	2	n/a	11	17	186
K.	Number of successful well-tracked nests	53% 81 / 153	67% 2 / 3	50% 1 / 2	n/a	36% 4 / 11	35% 6 / 17	51% 94 / 186
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	10% 16 / 153	0% 0 / 3	0% 0 / 2	n/a	22% 2 / 9	6% 1 / 17	10% 19 / 184
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 11 / 153	0% 0 / 3	0% 0 / 2	n/a	9% 1 / 11	6% 1 / 17	7% 13 / 186
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 153	0% 0 / 3	0% 0 / 2	n/a	9% 1 / 11	0% 0 / 17	4% 7 / 186
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 53 / 153	33% 1 / 3	50% 1 / 2	n/a	45% 5 / 11	53% 9 / 17	37% 69 / 186
	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 153	0% 0 / 3	0% 0 / 2	n/a	0% 0 / 11	6% 1 / 17	2% 3 / 186
N.	Average clutch size	n/a	3.3	3.5	n/a	3.8	3.6	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	29	0	0	n/a	2	1	32
P.	Number of 'manipulated' parasitized nests	13	n/a	n/a	n/a	1	1	15
Q.	Number of successful 'manipulated' nests	31% 4 / 13	n/a	n/a	n/a	0% 0 / 1	0% 0 / 1	27% 4 / 15
R.	Number of vireo fledged from 'manipulated' nests	8	n/a	n/a	n/a	0	0	8
S.	Number of cowbird young fledged by vireo observed	1	0	0	n/a	0	0	1
T.	Number of repaired nests	3	0	0	n/a	0	0	3
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
V.	Number of vireo fledged from repaired nests	7	n/a	n/a	n/a	n/a	n/a	7
W.	Numbers of cowbirds removed from study area	1,915	52	84	52	73	89	2,265
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	9,457	385	451	295	383	503	11,474
Y.	Average number of cowbirds trapped per trap day (W/X)	0.20	0.14	0.19	0.18	0.19	0.18	0.20

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-E. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.**

	Parameter	2002-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	109	155	164	166	128	n/a
B.	Number of known pairs	307	43	95	96	72	54	667
C.	Number of known breeding (nesting) pairs	251	29	87	68	58	43	536
D.	Number of breeding pairs that were well-monitored throughout the season	72	7	27	12	8	0	126
E.	Number of known fledged young observed	426	62	169	95	82	55	889
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	179	28	78	24	11	n/a	320
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.7	2.1	1.9	1.4	1.4	1.3	1.7
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.5	4.0	2.9	2	1.4	n/a	2.5
I.	Number of nests that were discovered	140	16	58	32	24	18	288
J.	Number of well-tracked nests	102	12	46	24	18	3	205
K.	Number of successful well-tracked nests	1% 1 / 102	83% 10 / 12	59% 27 / 46	63% 15 / 24	39% 7 / 18	0% 0 / 3	29% 60 / 205
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	16% 16 / 102	0% 0 / 12	13% 6 / 46	21% 5 / 24	41% 7 / 17	n/a	30% 34 / 115
	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 3 / 102	0% 0 / 12	7% 3 / 46	0% 0 / 24	22% 4 / 18	0% 0 / 3	5% 10 / 205
	B. Number of well-tracked nests that failed as a result of parasitism	7% 7 / 102	0% 0 / 12	9% 4 / 46	0% 0 / 24	17% 3 / 18	0% 0 / 3	7% 14 / 205
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	25% 26 / 102	17% 2 / 12	26% 12 / 46	38% 9 / 24	22% 4 / 18	100% 3 / 3	27% 56 / 205
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 102	0% 0 / 12	0% 0 / 46	0% 0 / 24	0% 0 / 18	0% 0 / 3	0% 0 / 205
M.	Average clutch size	n/a	3.9	3.7	3.2	4.0	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	21	0	6	6	7	0	40
P.	Number of 'manipulated' parasitized nests	14	n/a	6	5	5	n/a	30
Q.	Number of successful 'manipulated' nests	21% 3 / 14	n/a	0% 0 / 6	60% 3 / 5	20% 1 / 5	n/a	23% 7 / 30
R.	Number of vireo fledged from 'manipulated' nests	7	n/a	0	8	3	n/a	18
S.	Number of cowbird young fledged by vireo observed	3	0	1	0	0	0	4
T.	Number of repaired nests	1	0	0	0	0	0	1
U.	% of successful repaired nests	0% 0 / 1	n/a	n/a	n/a	n/a	n/a	0% 0 / 1
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0
W.	Numbers of cowbirds removed from study area	654	65	46	14	43	25	847
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	6,346	534	513	266	401	359	8,419
Y.	Average number of cowbirds trapped per trap day (W/X)	0.10	0.12	0.09	0.05	0.11	0.07	0.10

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-F. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream -Hidden Valley, north side of river**

	Parameter	2005-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	40	36	62	78	94	n/a
B.	Number of known pairs	61	27	17	38	37	61	241
C.	Number of known breeding (nesting) pairs	36	20	16	35	31	42	180
D.	Number of breeding pairs that were well-monitored throughout the season	10	3	6	11	0	0	30
E.	Number of known fledged young observed	66	33	34	65	41	74	313
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	22	11	24	35	n/a	n/a	92
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	1.7	2.1	1.9	n/a	1.8	1.7
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.2	3.7	4.0	3.2	n/a	n/a	3.1
I.	Number of nests that were discovered	16	5	11	25	1	13	71
J.	Number of well-tracked nests	12	5	10	25	0	0	52
K.	Number of successful well-tracked nests	58% 7 / 12	60% 3 / 5	70% 7 / 10	56% 14 / 25	n/a	n/a	60% 31 / 52
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	25% 3 / 12	0% 0 / 5	20% 2 / 10	0% 0 / 25	n/a	n/a	10% 5 / 52
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 12	0% 0 / 5	0% 0 / 10	0% 0 / 25	n/a	n/a	0% 0 / 52
	B. Number of well-tracked nests that failed as a result of parasitism	25% 3 / 12	0% 0 / 5	10% 1 / 10	0% 0 / 25	n/a	n/a	8% 4 / 52
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	17% 2 / 12	20% 1 / 5	20% 2 / 10	44% 11 / 25	n/a	n/a	31% 16 / 52
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 12	20% 1 / 5	0% 0 / 10	0% 0 / 25	n/a	n/a	2% 1 / 52
N.	Average clutch size	n/a	3.4	4.0	3.7	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	2	0	n/a	0	6
P.	Number of 'manipulated' parasitized nests	2	n/a	2	n/a	n/a	n/a	4
Q.	Number of successful 'manipulated' nests	0% 0 / 2	n/a	50% 1 / 2	n/a	n/a	n/a	25% 1 / 4
R.	Number of vireo fledged from 'manipulated' nests	0	n/a	3	n/a	n/a	n/a	3
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	n/a	0	0
T.	Number of repaired nests	0	0	0	0	n/a	0	0
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	19	0	13	32
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	113	2	68	183
Y.	Average number of cowbirds trapped per trap day (W/X)	n/a	n/a	n/a	0.2	0	0.19	0.2

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-G. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream -Hidden Valley, south side of river**

	Parameter	2000-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	121	123	141	140	176	n/a
B.	Number of known pairs	447	66	67	60	79	102	821
C.	Number of known breeding (nesting) pairs	392	57	54	46	77	91	717
D.	Number of breeding pairs that were well-monitored throughout the season	85	7	4	28	39	51	214
E.	Number of known fledged young observed	662	97	87	88	209	187	1,330
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	217	21	19	67	148	126	598
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.7	1.7	1.6	1.9	2.7	2.1	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.6	3.0	4.8	2.4	3.8	2.5	2.8
I.	Number of nests that were discovered	168	21	18	47	78	113	445
J.	Number of well-tracked nests	131	16	16	45	76	109	393
K.	Number of successful well-tracked nests	65% 85 / 131	75% 12 / 16	44% 7 / 16	49% 22 / 45	63% 48 / 76	46% 50 / 109	57% 224 / 393
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	7% 9 / 131	0% 0 / 16	0% 0 / 16	0% 0 / 45	9% 6 / 64	21% 18 / 86	9% 33 / 358
	A. Number of well-tracked nests that failed as a result of reproductive failure	n/a 4 / 131	0% 0 / 16	0% 0 / 16	4% 2 / 45	3% 2 / 76	0% 0 / 109	2% 8 / 393
	B. Number of well-tracked nests that failed as a result of parasitism	5% 6 / 131	0% 0 / 16	0% 0 / 16	0% 0 / 45	1% 1 / 76	5% 5 / 109	3% 12 / 393
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	27% 36 / 131	25% 4 / 16	44% 7 / 16	47% 21 / 45	33% 25 / 76	43% 47 / 109	36% 140 / 393
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 131	0% 0 / 16	13% 2 / 16	0% 0 / 45	0% 0 / 76	6% 7 / 109	2% 9 / 393
M.	Average clutch size	n/a	3.5	3.6	3.5	3.8	3.7	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	10	0	0	0	6	18	34
P.	Number of 'manipulated' parasitized nests	3	n/a	n/a	n/a	6	17	26
Q.	Number of successful 'manipulated' nests	100% 3 / 3	n/a	n/a	n/a	67% 4 / 6	35% 6 / 17	50% 13 / 26
R.	Number of vireo fledged from 'manipulated' nests	8	n/a	n/a	n/a	8	11	27
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	0	0	0	1	0	1	2
U.	% of successful repaired nests	n/a 1 / 1	n/a	n/a	100% 1 / 1	n/a	0% 0 / 1	50% 1 / 2
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	3	n/a	0	3
W.	Number of cowbirds removed from study area	708	n/a	n/a	n/a	n/a	1	709
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5,215	n/a	n/a	n/a	n/a	61	5,276
Y.	Average number of cowbirds trapped per day (W/X)	0.14	n/a	n/a	n/a	n/a	0.02	0.13

\*As of 2010, reported as south side of the river

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-H. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream -Goose Creek, Norco to I-15\***

		2000-2015	2016	2017	2018	2019	2020	Combined
	Parameter							
A.	Number of territorial males	n/a	63	73	91	90	88	n/a
B.	Number of known pairs	527	31	34	56	58	58	764
C.	Number of known breeding (nesting) pairs	495	28	32	46	52	47	700
D.	Number of breeding pairs that were well-monitored throughout the season	170	9	7	16	10	22	234
E.	Number of known fledged young observed	987	45	54	86	110	114	1,396
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	520	21	20	43	41	78	723
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	1.6	1.7	1.9	2.1	2.4	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.1	2.3	2.9	2.7	4.1	3.5	3.1
I.	Number of nests that were discovered	340	22	19	28	25	36	470
J.	Number of well-tracked nests	285	21	19	25	24	34	408
K.	Number of successful well-tracked nests	67% 192 / 285	43% 9 / 21	68% 13 / 19	64% 16 / 25	71% 17 / 24	68% 23 / 34	66% 270 / 408
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	6% 17 / 285	0% 0 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 23	3% 1 / 30	4% 18 / 403
	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 13 / 285	0% 0 / 21	0% 0 / 19	0% 0 / 25	8% 2 / 24	6% 2 / 34	4% 17 / 408
	B. Number of well-tracked nests that failed as a result of parasitism	1% 4 / 285	0% 0 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 24	3% 1 / 34	1% 5 / 408
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	27% 76 / 285	52% 11 / 21	32% 6 / 19	36% 9 / 25	21% 5 / 24	24% 8 / 34	28% 115 / 408
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 285	5% 1 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 24	0% 0 / 34	0% 1 / 408
N.	Average clutch size	n/a	3.4	3.5	3.8	3.6	3.7	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	23	0	0	0	0	1	24
P.	Number of 'manipulated' parasitized nests	16	n/a	n/a	n/a	n/a	0	16
Q.	Number of successful 'manipulated' nests	69% 11 / 16	n/a	n/a	n/a	n/a	n/a	69% 11 / 16
R.	Number of vireo fledged from 'manipulated' nests	18	n/a	n/a	n/a	n/a	n/a	18
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	2	0	1	100%	0	1	5
U.	% of successful repaired nests	50% 1 / 2	n/a	100% 1 / 1	1 1 / 1	n/a	100% 1 / 1	80% 4 / 5
V.	Number of vireo fledged from repaired nests	4	n/a	4	3	n/a	4	15
W.	Number of cowbirds removed from study area	556	12	7	11	2	0	588
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,543	136	129	110	96	4	3,018
Y.	Average number of cowbirds trapped per day (W/X)	0.22	0.09	0.05	0.10	0.02	0.00	0.19

\*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd. From 2016-2020 area surveyed includes IERC mitigation parcels

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).



Appendix C-1-I. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Norco Bluffs (I-15 to River Rd., non-mitigation)\*\***

	Parameter	2015*	2016*	2017*	2018*	2019	2020	Combined
A.	Number of territorial males	30	63	69	36	101	133	n/a
B.	Number of known pairs	17	28	31	17	50	65	208
C.	Number of known breeding (nesting) pairs	17	28	30	17	48	65	205
D.	Number of breeding pairs that were well-monitored throughout the season	3	5	12	13	16	25	74
E.	Number of known fledged young observed	43	45	76	39	139	159	501
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	11	15	42	35	87	81	271
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.5	1.6	2.5	2.3	2.9	2.4	2.4
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.7	3.0	3.5	2.7	5.4	3.2	3.7
I.	Number of nests that were discovered	14	12	25	16	35	47	149
J.	Number of well-tracked nests	13	12	22	15	35	43	140
K.	Number of successful well-tracked nests	69% 9 / 13	58% 7 / 12	77% 17 / 22	73% 11 / 15	89% 31 / 35	70% 30 / 43	75% 105 / 140
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 41	0% 0 / 138
	A. Number of well-tracked nests that failed as a result of reproductive failure	15% 2 / 13	8% 1 / 12	5% 1 / 22	7% 1 / 15	6% 2 / 35	2% 1 / 43	6% 8 / 140
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 43	0% 0 / 140
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	15% 2 / 13	33% 4 / 12	18% 4 / 22	20% 3 / 15	6% 2 / 35	26% 11 / 43	19% 26 / 140
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	2% 1 / 43	1% 1 / 140
M.	Average clutch size	3.4	3.4	3.6	3.6	3.8	3.7	n/a
N.	Number of cowbird eggs or nestlings found in or near vireo nests	0	0	0	0	0	0	0
O.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
P.	Number of successful 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of vireo fledged from 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
S.	Number of repaired nests	0	0	0	0	0	0	0
T.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
U.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
V.	Number of cowbirds removed from study area	n/a	n/a	n/a	n/a	2	3	5
W.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	n/a	113	131	244
X.	Average number of cowbirds trapped per day (W/X)	n/a	n/a	n/a	n/a	0.02	0.02	0.02

\* USACE mitigation areas of varying size surveyed by other agencies and not included in the SAWA survey area

\*\*Formerly monitored as part of Goose Creek Golf Club to River Rd.

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).



Appendix C-1-J. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Temescal Canyon								
	Parameter	2001-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	93	109	106	127	147	n/a
B.	Number of known pairs	436	9	59	48	56	30	638
C.	Number of known breeding (nesting) pairs	351	4	39	21	40	17	472
D.	Number of breeding pairs that were well-monitored throughout the season	118	0	1	0	0	0	119
E.	Number of known fledged young observed	683	5	48	16	48	20	820
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	327	n/a	3	n/a	n/a	n/a	330
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.9	1.3	1.2	n/a	n/a	n/a	1.7
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.8	n/a	3.0	n/a	n/a	n/a	2.8
I.	Number of nests that were discovered	245	1	16	19	16	0	297
J.	Number of well-tracked nests	192	0	13	0	0	n/a	205
K.	Number of successful well-tracked nests	65% 124 / 192	n/a /	38% 5 / 13	n/a	n/a	n/a	63% 129 / 205
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	16% 31 / 192	n/a /	23% 3 / 13	n/a	n/a	n/a	17% 34 / 205
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 5 / 192	n/a /	15% 2 / 13	n/a	n/a	n/a	3% 7 / 205
	B. Number of well-tracked nests that failed as a result of parasitism	3% 6 / 192	n/a /	0% 0 / 13	n/a	n/a	n/a	3% 6 / 205
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	30% 57 / 192	n/a /	31% 4 / 13	n/a	n/a	n/a	30% 61 / 205
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 192	n/a /	15% 2 / 13	n/a	n/a	n/a	1% 2 / 205
N.	Average clutch size	n/a	4.0	3.3	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	41	0	3	n/a	0	n/a	44
P.	Number of 'manipulated' parasitized nests	32	n/a	2	n/a	n/a	n/a	34
Q.	Number of successful 'manipulated' nests	47% 15 / 32	n/a	0% 0 / 2	n/a	n/a	n/a	44% 15 / 34
R.	Number of vireo fledged from 'manipulated' nests	34	n/a	0	n/a	n/a	n/a	34
S.	Number of cowbird young fledged by vireo observed	2	n/a	1	n/a	1	n/a	4
T.	Number of repaired nests	3	0	0	n/a	0	0	3
U.	% of successful repaired nests	67% 2 / 3	n/a	n/a	n/a	n/a	n/a	67% 2 / 3
V.	Number of vireo fledged from repaired nests	3	n/a	n/a	n/a	n/a	n/a	3
W.	Number of cowbirds removed from study area	3,263	297	240	212	338	324	4,674
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	11,515	644	652	547	579	561	14,498
Y.	Average number of cowbirds trapped per day (W/X)	0.28	0.46	0.37	0.39	0.58	0.58	0.32

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-K. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Chino Hills**

	Parameter	2003-2015	2016*	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	18	25	26	29	36	n/a
B.	Number of known pairs	70	11	7	9	17	10	124
C.	Number of known breeding (nesting) pairs	51	8	3	5	12	5	84
D.	Number of breeding pairs that were well-monitored throughout the season	23	0	0	0	0	0	23
E.	Number of known fledged young observed	77	10	3	3	19	9	121
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	32	n/a	n/a	n/a	n/a	n/a	32
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.5	1.3	1.0	n/a	n/a	n/a	1.4
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	1.4	n/a	n/a	n/a	n/a	n/a	1.4
I.	Number of nests that were discovered	36	4	0	2	1	0	43
J.	Number of well-tracked nests	29	2	n/a	2	0	n/a	33
K.	Number of successful well-tracked nests	34% 10 / 29	50% 1 / 2	n/a	0% 0 / 2	n/a	n/a	33% 11 / 33
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	24% 7 / 29	0% 0 / 2	n/a	50% 1 / 2	n/a	n/a	24% 8 / 33
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 2 / 29	50% 1 / 2	n/a	0% 0 / 2	n/a	n/a	9% 3 / 33
	B. Number of well-tracked nests that failed as a result of parasitism	7% 2 / 29	0% 0 / 2	n/a	0% 0 / 2	n/a	n/a	6% 2 / 33
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	52% 15 / 29	0% 0 / 2	n/a	100% 2 / 2	n/a	n/a	52% 17 / 33
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 29	0% 0 / 2	n/a	0% 0 / 2	n/a	n/a	0% 0 / 33
N.	Average clutch size	n/a	3.0	n/a	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	10	0	n/a	1	0	n/a	11
P.	Number of 'manipulated' parasitized nests	7	n/a	n/a	1	n/a	n/a	8
Q.	Number of successful 'manipulated' nests	0% 0 / 7	n/a	n/a	0% 0 / 1	n/a	n/a	0% 0 / 8
R.	Number of vireo fledged from 'manipulated' nests	0	n/a	n/a	0	n/a	n/a	0
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	n/a	0	0
T.	Number of repaired nests	0	0	n/a	1	0	n/a	1
U.	% of successful repaired nests	n/a	n/a	n/a	0% 0 / 1	n/a	n/a	0% 0 / 1
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	0	n/a	n/a	0
W.	Number of cowbirds removed from study area	141	53	22	23	-3	n/a	236
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	1,052	262	113	92	101	n/a	1,620
Y.	Average number of cowbirds trapped per day (W/X)	0.13	0.20	0.19	0.25	0.00	n/a	0.15

\*2016 includes former assessment sites

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-L. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana Canyon (SAC) - Upper Canyon**

	Parameter	2001-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	26	30	32	35	45	n/a
B.	Number of known pairs	180	12	21	25	24	30	292
C.	Number of known breeding (nesting) pairs	156	11	18	15	19	27	246
D.	Number of breeding pairs that were well-monitored throughout the season	56	3	1	7	9	8	84
E.	Number of known fledged young observed	286	18	32	23	58	52	469
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	147	7	2	13	37	26	232
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	1.6	1.8	1.5	3.1	1.9	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.6	2.3	2.0	1.9	4.1	3.3	2.8
I.	Number of nests that were discovered	118	3	6	13	22	13	175
J.	Number of well-tracked nests	78	3	5	10	19	11	126
K.	Number of successful well-tracked nests	68% 53 / 78	100% 3 / 3	40% 2 / 5	50% 5 / 10	74% 14 / 19	73% 8 / 11	67% 85 / 126
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	5% 4 / 78	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 17	0% 0 / 10	3% 4 / 123
	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 3 / 78	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 19	0% 0 / 11	2% 3 / 126
	B. Number of well-tracked nests that failed as a result of parasitism	3% 2 / 78	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 19	0% 0 / 11	2% 2 / 126
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	26% 20 / 78	0% 0 / 3	60% 3 / 5	50% 5 / 10	26% 5 / 19	18% 2 / 11	28% 35 / 126
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 78	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 19	9% 1 / 11	1% 1 / 126
N.	Average clutch size	n/a	3.3	3.7	3.1	3.7	3.7	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	0	0	0	0	4
P.	Number of 'manipulated' parasitized nests	1	n/a	n/a	n/a	n/a	n/a	1
Q.	Number of successful 'manipulated' nests	100% 1 / 1	n/a	n/a	n/a	n/a	n/a	100% 1 / 1
R.	Number of vireo fledged from 'manipulated' nests	1	n/a	n/a	n/a	n/a	n/a	1
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	2	0	0	0	1	0	3
U.	% of successful repaired nests	0% 0 / 2	n/a	n/a	n/a	100% 1 / 1	n/a	33% 1 / 3
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	3	n/a	3
W.	Number of cowbirds removed from study area	678	28	1	94	41	-1	841
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,140	134	47	118	113	127	3,679
Y.	Average number of cowbirds trapped per day (W/X)	0.22	0.21	0.02	0.80	0.36	0.00	0.23

<sup>1</sup> Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-M. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana Canyon (SAC) - Green River Golf Club**

	Parameter	2001-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	33	42	42	45	61	n/a
B.	Number of known pairs	204	26	33	38	34	42	377
C.	Number of known breeding (nesting) pairs	178	22	30	22	32	34	318
D.	Number of breeding pairs that were well-monitored throughout the season	73	8	7	5	12	22	127
E.	Number of known fledged young observed	324	27	76	20	96	63	606
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	171	9	31	3	51	49	314
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	1.2	2.5	0.9	3.0	1.9	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.3	1.1	4.4	0.6	4.3	2.2	2.5
I.	Number of nests that were discovered	131	14	21	20	33	34	253
J.	Number of well-tracked nests	111	13	17	16	28	33	218
K.	Number of successful well-tracked nests	61% 68 / 111	31% 4 / 13	76% 13 / 17	25% 4 / 16	79% 22 / 28	48% 16 / 33	58% 127 / 218
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	4% 4 / 111	0% 0 / 13	0% 0 / 17	0% 0 / 16	0% 0 / 26	17% 5 / 29	4% 9 / 212
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 6 / 111	23% 3 / 13	0% 0 / 17	0% 0 / 16	7% 2 / 28	0% 0 / 33	5% 11 / 218
	B. Number of well-tracked nests that failed as a result of parasitism	1% 1 / 111	0% 0 / 13	0% 0 / 17	0% 0 / 16	0% 0 / 28	0% 0 / 33	0% 1 / 218
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	32% 36 / 111	46% 6 / 13	24% 4 / 17	69% 11 / 16	14% 4 / 28	45% 15 / 33	35% 76 / 218
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 111	0% 0 / 13	0% 0 / 17	6% 1 / 16	0% 0 / 28	6% 2 / 33	1% 3 / 218
N.	Average clutch size	n/a	2.7	3.5	3.4	3.7	3.8	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	0	0	0	5	9
P.	Number of 'manipulated' parasitized nests	2	n/a	n/a	n/a	n/a	5	7
Q.	Number of successful 'manipulated' nests	100% 2 / 2	n/a	n/a	n/a	n/a	40% 2 / 5	57% 4 / 7
R.	Number of vireo fledged from 'manipulated' nests	6	n/a	n/a	n/a	n/a	6	12
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	5	0	0	0	2	5	12
U.	% of successful repaired nests	80% 4 / 5	n/a	n/a	n/a	100% 2 / 2	60% 3 / 5	75% 9 / 12
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	3	8	11
W.	Number of cowbirds removed from study area	1,004	36	27	-1	4	n/a	1,070
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,249	260	130	83	114	n/a	4,836
Y.	Average number of cowbirds trapped per day (W/X)	0.24	0.14	0.21	0.00	0.04	n/a	0.22

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

Appendix C-1-N. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana Canyon (SAC) - Featherly Regional Park**

	Parameter	2001-2015	2016	2017	2018	2019	2020	Combined
A.	Number of territorial males	n/a	64	59	66	69	79	n/a
B.	Number of known pairs	311	39	36	25	33	47	491
C.	Number of known breeding (nesting) pairs	257	25	32	18	28	42	402
D.	Number of breeding pairs that were well-monitored throughout the season	77	8	11	8	8	17	129
E.	Number of known fledged young observed	359	23	57	25	76	66	606
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	133	8	38	17	45	44	285
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.4	0.9	1.8	1.4	2.7	1.6	1.5
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	1.7	1.0	3.5	2.1	5.6	2.6	2.2
I.	Number of nests that were discovered	177	16	24	18	30	46	311
J.	Number of well-tracked nests	128	12	22	12	28	41	243
K.	Number of successful well-tracked nests	44% 56 / 128	25% 3 / 12	50% 11 / 22	50% 6 / 12	64% 18 / 28	37% 15 / 41	45% 109 / 243
L.	Rate of cowbird parasitism (well-tracked nests) <sup>1</sup>	4% 5 / 128	0% 0 / 12	0% 0 / 22	0% 0 / 12	0% 0 / 26	0% 0 / 31	2% 5 / 231
	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 6 / 128	0% 0 / 12	9% 2 / 22	0% 0 / 12	14% 4 / 28	10% 4 / 41	7% 16 / 243
	B. Number of well-tracked nests that failed as a result of parasitism	2% 2 / 128	0% 0 / 12	0% 0 / 22	0% 0 / 12	0% 0 / 28	0% 0 / 41	1% 2 / 243
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	50% 64 / 128	75% 9 / 12	41% 9 / 22	42% 5 / 12	21% 6 / 28	49% 20 / 41	47% 113 / 243
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 128	0% 0 / 12	0% 0 / 22	8% 1 / 12	0% 0 / 28	5% 2 / 41	1% 3 / 243
M.	Number of cowbird eggs or nestlings found in or near vireo nests	5	0	0	0	0	0	5
N.	Average clutch size	n/a	3.2	3.8	3	3.6	3.5	n/a
P.	Number of 'manipulated' parasitized nests	3	n/a	n/a	n/a	n/a	n/a	3
Q.	Number of successful 'manipulated' nests	33% 1 / 3	n/a	n/a	n/a	n/a	n/a	33% 1 / 3
R.	Number of vireo fledged from 'manipulated' nests	2	n/a	n/a	n/a	n/a	n/a	2
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	7	0	1	0	0	3	11
U.	% of successful repaired nests	86% 6 / 7	n/a	0% 0 / 1	n/a	n/a	67% 2 / 3	73% 8 / 11
V.	Number of vireo fledged from repaired nests	18	n/a	0	n/a	n/a	3	21
W.	Number of cowbirds removed from study area	452	8	10	26	-1	15	510
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,678	398	383	239	237	245	5,180
Y.	Average number of cowbirds trapped per day (W/X)	0.12	0.02	0.03	0.11	0.00	0.06	0.10

<sup>1</sup>Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).



Appendix C-2-A. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**San Jacinto**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2004-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Fremont Cottonwood ( <i>Populus fremontii</i> )	0			1	1	3	5	2%
Narrowleaf Willow ( <i>Salix exigua</i> )	55	1	5	23	24	22	130	46%
Dead Narrowleaf Willow ( <i>Salix exigua</i> )	1						1	<1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	5	4	3	5	4	13	34	12%
Red Willow ( <i>Salix laevigata</i> )	0	2	1				3	1%
Arroyo Willow ( <i>Salix lasiolepis</i> )	0					1	1	<1%
Western False Indigo ( <i>Amorpha fruticosa</i> )	0				1		1	<1%
Blue Palo Verde ( <i>Parkinsonia florida</i> )	0					1	1	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	0					1	1	<1%
Black Mustard <sup>a</sup> ( <i>Brassica nigra</i> )	1					1	2	1%
Tamarisk <sup>a</sup> ( <i>Tamarix ramosissima</i> )	2			3	4	5	14	5%
Coyote Brush ( <i>Baccharis pilularis</i> )	1	3	2	3	9		18	6%
Mulefat ( <i>Baccharis salicifolia</i> )	34	1	1	1	1	17	55	19%
Arrowweed ( <i>Pluchea sericea</i> )	0		1	1	2	2	6	2%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	0					3	3	1%
Unknown/No data	4		3	1	1		9	3%
<b>Total</b>	<b>103</b>	<b>11</b>	<b>16</b>	<b>38</b>	<b>47</b>	<b>69</b>	<b>284</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora



Appendix C-2-B. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

San Timoteo Canyon										
Host Plant Species (listed in taxonomic order <sup>1</sup> )	2000	2001	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )			1						1	<1%
Golden Currant ( <i>Ribes aureum</i> )			4	1					5	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )			56	8	13	8	5	9	99	8%
Fremont Cottonwood ( <i>Populus fremontii</i> )			37	3	3	8	6	13	70	5%
Dead Fremont Cottonwood ( <i>Populus fremontii</i> )			1						1	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )			22	1	6	1	4		34	3%
Goodding's Black Willow ( <i>Salix gooddingii</i> )			69	4	3	3	9	3	91	7%
Red Willow ( <i>Salix laevigata</i> )			134	16	14	6	23	22	215	17%
Arroyo Willow ( <i>Salix lasiolepis</i> )		1	174	22	33	26	18	33	307	24%
Pacific Willow ( <i>Salix lasiandra</i> )			9	3				4	16	1%
Willow sp. ( <i>Salix</i> sp.)			1						1	<1%
Dead Willow sp. ( <i>Salix</i> sp.)			1						1	<1%
Asian Pear <sup>a</sup> ( <i>Cydonia oblonga</i> )			0				1	1	2	<1%
Toyon ( <i>Heteromeles arbutifolia</i> )		1	21		1		1		24	2%
California Wild Rose ( <i>Rubus californica</i> )			1		1				2	<1%
White Mulberry <sup>a</sup> ( <i>Morus alba</i> )			1				2	2	5	<1%
Hoary Nettle ( <i>Urtica dioica</i> )			0				1		1	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )			1			1	1	1	4	<1%
Oak sp. ( <i>Quercus</i> sp.)			1						1	<1%
Southern California Black Walnut <sup>t</sup> ( <i>Juglans californica</i> )			1		1	1			3	<1%
Fragrant Sumac ( <i>Rhus aromatica</i> )			1						1	<1%
Sugar Sumac ( <i>Rhus ovata</i> )			0			1			1	<1%
Boxelder ( <i>Acer negundo</i> )			2						2	<1%
Orange Tree <sup>a</sup> ( <i>Citrus sinensis</i> )			0					1	1	<1%

Appendix C-2-B continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**San Timoteo Canyon**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2000	2001	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Tree of Heaven <sup>ia</sup> ( <i>Ailanthus altissima</i> )			1						1	<1%
Chaparral Mallow ( <i>Malacothamnus fasciculatus</i> )			0				1	2	3	<1%
Black Mustard <sup>ia</sup> ( <i>Brassica nigra</i> )			1				1		2	<1%
Mustard sp. <sup>ia</sup> ( <i>Brassica</i> sp.)			4						4	<1%
Perennial Pepperweed <sup>ia</sup> ( <i>Lepidium latifolium</i> )			1						1	<1%
Tamarisk <sup>ia</sup> ( <i>Tamarix ramosissima</i> )			2						2	<1%
Fourwing Saltbush ( <i>Atriplex canescens</i> )			1				1	1	3	<1%
Olive <sup>a</sup> ( <i>Olea europaea</i> )			0				1		1	<1%
Tree Tobacco <sup>ia</sup> ( <i>Nicotiana glauca</i> )			0				1		1	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )		1	19				1	1	22	2%
Mulefat ( <i>Baccharis salicifolia</i> )		1	239	19	14	19	8	6	306	24%
Willow Baccharis ( <i>Baccharis salicina</i> )			1						1	<1%
Brittlebush ( <i>Encelia farinosa</i> )			0				2		2	<1%
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )			0				1		1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )			38	1	5	1	7	5	57	4%
Desert Wild Grape ( <i>V. girdiana</i> ) and Arroyo Willow ( <i>S. lasiolepis</i> )			1						1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Sweet Fennel <sup>ia</sup> ( <i>Foeniculum vulgare</i> )			1						1	<1%
Deadfall			2						2	<1%
Unknown/No data			2				1		3	<1%
<b>Total</b>	<b>0</b>	<b>4</b>	<b>851</b>	<b>78</b>	<b>94</b>	<b>75</b>	<b>96</b>	<b>104</b>	<b>1,302</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-C. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Meridian Conservation Area\***

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2004-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Goodding's Black Willow ( <i>Salix gooddingii</i> )	10					1	11	28%
Red Willow ( <i>Salix laevigata</i> )	7		2			1	10	26%
Arroyo Willow ( <i>Salix lasiolepis</i> )	8		1			5	14	36%
Dead Willow sp. ( <i>Salix</i> sp.)	0		1				1	3%
Mulefat ( <i>Baccharis salicifolia</i> )	1		1				2	5%
Deadfall	0					1	1	3%
<b>Total</b>	<b>26</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>39</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*Former March SKR Preserve

<sup>1</sup> Using Jepson eFlora

Appendix C-2-D. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Mockingbird Canyon**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2003-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )	1						1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	7						7	3%
Fremont Cottonwood ( <i>Populus fremontii</i> )	2				1	2	5	2%
Narrowleaf Willow ( <i>Salix exigua</i> )	1						1	<1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	31				2		33	16%
Red Willow ( <i>Salix laevigata</i> )	56					4	60	28%
Arroyo Willow ( <i>Salix lasiolepis</i> )	15	1			1	3	20	9%
Willow sp. ( <i>Salix</i> sp.)	1						1	<1%

Appendix C-2-D continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Mockingbird Canyon**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2003-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Dead Willow sp. ( <i>Salix</i> sp.)	1						1	<1%
Hollyleaf Cherry ( <i>Prunus ilicifolia</i> )	1						1	<1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1						1	<1%
Peruvian Pepper Tree <sup>ia</sup> ( <i>Schinus molle</i> )	4						4	2%
Perennial Pepperweed <sup>ia</sup> ( <i>Lepidium latifolium</i> )	3					1	4	2%
Dead Perennial Pepperweed <sup>ia</sup> ( <i>Lepidium latifolium</i> )	2						2	1%
Tamarisk <sup>ia</sup> ( <i>Tamarix ramosissima</i> )	0				1	1	2	1%
Fourwing Saltbush ( <i>Atriplex canescens</i> )	1				1		2	1%
Coyote Brush ( <i>Baccharis pilularis</i> )	0				1	3	4	2%
Mulefat ( <i>Baccharis salicifolia</i> )	15					1	16	8%
Willow Baccharis ( <i>Baccharis salicina</i> )	2						2	1%
Arrowweed ( <i>Pluchea sericea</i> )	1						1	<1%
Wild Celery <sup>a</sup> ( <i>Apium graveolens</i> )	1						1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	27	2			5	1	35	17%
Desert Wild Grape ( <i>V. girdiana</i> ) and Goodding's Black Willow ( <i>S. gooddingii</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Perennial Pepperweed <sup>ia</sup> ( <i>L. latifolium</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.) and Perennial Pepperweed <sup>ia</sup> ( <i>L. latifolium</i> )	1						1	<1%
Coyote Brush ( <i>B. pilularis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Deadfall	0					2	2	1%
Unknown/No data	2						2	1%
<b>Total</b>	<b>179</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>18</b>	<b>212</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-E. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2002-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )	0		3				3	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	6	2	4	4	5	1	22	8%
Fremont Cottonwood ( <i>Populus fremontii</i> )	8		4		2	3	17	6%
Narrowleaf Willow ( <i>Salix exigua</i> )	5		5			3	13	5%
Dead Narrowleaf Willow ( <i>Salix exigua</i> )	0					1	1	<1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	11	2	7	5	1		26	9%
Dead Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Red Willow ( <i>Salix laevigata</i> )	8	1	5	6	1	2	23	8%
Arroyo Willow ( <i>Salix lasiolepis</i> )	37	3	9	3	3	1	56	20%
Pacific Willow ( <i>Salix lasiandra</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.)	1			1		1	3	1%
Holly Leaf Cherry ( <i>Prunus ilicifolia</i> )	0					1	1	<1%
California Wild Rose ( <i>Rosa californica</i> )	1	1					2	1%
California Blackberry ( <i>Rubus ursinus</i> )	0		1				1	<1%
Hoary Nettle ( <i>Urtica dioica</i> )	1						1	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	2						2	1%
White Alder ( <i>Alnus rhombifolia</i> )	0		1				1	<1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	0	1					1	<1%
Tamarisk <sup>1a</sup> ( <i>Tamarix ramosissima</i> )	1		1				2	1%
Ash sp. ( <i>Fraxinus</i> sp.)	0					3	3	1%
Tree Tobacco <sup>1a</sup> ( <i>Nicotiana glauca</i> )	1				1		2	1%
Coyote Brush ( <i>Baccharis pilularis</i> )	0				1		1	<1%

Appendix C-2-E continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2002-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Mulefat ( <i>Baccharis salicifolia</i> )	37	5	16	10	3	1	72	26%
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )	0				1		1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	4	1	2				7	3%
Desert Wild Grape ( <i>V. girdiana</i> ) and Goodding's Black Willow ( <i>S. gooddingii</i> )	0			1			1	<1%
Dead Goodding's Black Willow ( <i>S. gooddingii</i> ) and Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Deadfall	0					1	1	<1%
Unknown/No Data	0			2	6		8	3%
<b>Total</b>	<b>126</b>	<b>16</b>	<b>58</b>	<b>32</b>	<b>24</b>	<b>18</b>	<b>274</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora



Appendix C-2-F. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana River (SAR) - Upstream - Hidden Valley, north side of river**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2010-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Arundo <sup>i</sup> ( <i>Arundo donax</i> )	0			1			1	1%
Western Sycamore ( <i>Platanus racemosa</i> )	0			1			1	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	3						3	4%
Fremont Cottonwood ( <i>Populus fremontii</i> )	0	1	3	1		1	6	9%
Narrowleaf Willow ( <i>Salix exigua</i> )	1					4	5	7%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	0			2			2	3%
Red Willow ( <i>Salix laevigata</i> )	2		1				3	4%
Arroyo Willow ( <i>Salix lasiolepis</i> )	1	2	2	5		3	13	19%
California Blackberry ( <i>Rubus ursinus</i> )	0		1				1	1%
Mulefat ( <i>Baccharis salicifolia</i> )	6	2	4	15		5	32	47%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	3						3	4%
Unknown/No Data	0				1		1	1%
<b>Total</b>	<b>13</b>	<b>5</b>	<b>11</b>	<b>25</b>	<b>1</b>	<b>13</b>	<b>68</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-G. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana River (SAR) - Upstream - Hidden Valley, south side of river\***

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )	0				1	1	2	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	11	1		4	4	6	26	6%
Fremont Cottonwood ( <i>Populus fremontii</i> )	0	1			3	9	13	3%
Narrowleaf Willow ( <i>Salix exigua</i> )	3	1		1	3	7	15	3%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	18	1	2	5	8	10	44	10%
Red Willow ( <i>Salix laevigata</i> )	10	3	5	2	5	3	28	6%
Arroyo Willow ( <i>Salix lasiolepis</i> )	56	2	4	17	30	28	137	31%
Pacific Willow ( <i>Salix lasiandra</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.)	2						2	<1%
California Wild Rose ( <i>Rosa californica</i> )	0	1			1	1	3	1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	1					2	3	1%
Perennial Pepperweed <sup>1a</sup> ( <i>Lepidium latifolium</i> )	0				1	1	2	<1%
Tamarisk <sup>1a</sup> ( <i>Tamarix ramosissima</i> )	0			1		1	2	<1%
Summer Cypress <sup>1a</sup> ( <i>Kochia scoparia</i> )	0					1	1	<1%
Arizona Ash ( <i>Fraxinus velutina</i> )	0					1	1	<1%
Tree Tobacco <sup>1a</sup> ( <i>Nicotiana glauca</i> )	0					1	1	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	0					1	1	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	1				1		2	<1%
Mulefat ( <i>Baccharis salicifolia</i> )	46	4	2	17	16	24	109	25%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	0		1				1	<1%

Appendix C-2-G continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana River (SAR) - Upstream - Hidden Valley, south side of river\***

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2000-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Common Sunflower ( <i>Helianthus annuus</i> )	0					1	1	<1%
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )	0					5	5	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	3	1	1		3	7	15	3%
Dead Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	0		1				1	<1%
Fresh water reed ( <i>Typha</i> sp.) and Arroyo Willow ( <i>S. lasiolepis</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and California Wild Rose ( <i>R. californica</i> )	1						1	<1%
Red Willow ( <i>S. laevigata</i> ) and Wild Cucumber ( <i>Marah macrocarpa</i> )	0		1				1	<1%
Willow sp. ( <i>Salix</i> sp.) and California Blackberry ( <i>Rubus ursinus</i> )	1						1	<1%
Mulefat ( <i>B. salicifolia</i> ) and Poison Hemlock <sup>a</sup> ( <i>C. maculatum</i> )	1						1	<1%
Unknown/No data	2	6	1		2	3	14	3%
<b>Total</b>	<b>158</b>	<b>21</b>	<b>18</b>	<b>47</b>	<b>78</b>	<b>113</b>	<b>435</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*As of 2010, reported as south side of the river

<sup>1</sup>Using Jepson eFlora

Appendix C-2-H. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**(SAR) - Upstream - Goose Creek, Norco to I-15**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Giant Reed <sup>1a</sup> ( <i>Arundo donax</i> )	0					1	1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	19		1	1	3	2	26	6%
Fremont Cottonwood ( <i>Populus fremontii</i> )	14		1	3	1	5	24	5%
Dead Fremont Cottonwood ( <i>Populus fremontii</i> )	1						1	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )	12		1	1	1	3	18	4%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	51	2			5	1	59	13%
Red Willow ( <i>Salix laevigata</i> )	7	1	2	6	1	2	19	4%
Arroyo Willow ( <i>Salix lasiolepis</i> )	100	9	6	5	7	8	135	29%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )	2						2	<1%
Pacific Willow ( <i>Salix lasiandra</i> )	1					1	2	<1%
Willow sp. ( <i>Salix</i> sp.)	1			2			3	1%
Dead Willow sp. ( <i>Salix</i> sp.)	1						1	<1%
California Blackberry ( <i>Rubus ursinus</i> )	0					3	3	1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1						1	<1%
Tree of Heaven <sup>1a</sup> ( <i>Ailanthus altissima</i> )	0				1		1	<1%
Tamarisk <sup>1a</sup> ( <i>Tamarix ramosissima</i> )	0				1		1	<1%
Ash sp. ( <i>Fraxinus</i> sp.)	1						1	<1%
California Sagebrush ( <i>Artemisia californica</i> )	0			1			1	<1%
Mulefat ( <i>Baccharis salicifolia</i> )	112	8	7	9	4	2	142	30%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	4	2					6	1%

Appendix C-2-H continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**(SAR) - Upstream - Goose Creek, Norco to I-15**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )	4					1	5	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	3		1		1	3	8	2%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Poison Hemlock <sup>a</sup> ( <i>C. maculatum</i> )	1						1	<1%
Deadfall	0					3	3	1%
Unknown/No data	3					1	4	1%
<b>Total</b>	<b>338</b>	<b>22</b>	<b>19</b>	<b>28</b>	<b>25</b>	<b>36</b>	<b>468</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

\*\*Includes Goose Creek mitigation funded by IERCD

<sup>1</sup>Using Jepson eFlora

Appendix C-2-I. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Norco Bluffs (I-15 to River Rd., non-mitigation)\***

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Desert Wild Grape ( <i>Vitis girdiana</i> )		3	2	2	6	3	16	11%
Narrowleaf Willow ( <i>Salix exigua</i> )		1	1		2	3	7	5%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	3	2	5	3	2	7	22	15%
Red Willow ( <i>Salix laevigata</i> )						1	1	1%
Arroyo Willow ( <i>Salix lasiolepis</i> )	5	5	10	5	10	15	50	34%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )				1	1		2	1%
Pacific Willow ( <i>Salix lasiandra</i> )					2	1	3	2%
California Wild Rose ( <i>Rosa californica</i> )				1			1	1%
California Blackberry ( <i>Rubus ursinus</i> )						1	1	1%
Coyote Brush ( <i>Baccharis pilularis</i> )					1		1	1%
Mulefat ( <i>Baccharis salicifolia</i> )	5	1	6	4	8	15	39	26%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )					2		2	1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	1		1				2	1%
California Blackberry ( <i>Rubus ursinus</i> ) and dead unknown						1	1	1%
Unknown/No Data					1		1	1%
<b>Total</b>	<b>14</b>	<b>12</b>	<b>25</b>	<b>16</b>	<b>35</b>	<b>47</b>	<b>149</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*Formerly monitored as part of Goose Creek Golf Club to River Rd.

<sup>1</sup> Using Jepson eFlora



Appendix C-2-J. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

Temescal Canyon								
Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )	1						1	<1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	4		1				5	2%
Narrowleaf Willow ( <i>Salix exigua</i> )	1		1				2	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	30	1	4				35	12%
Red Willow ( <i>Salix laevigata</i> )	14						14	5%
Arroyo Willow ( <i>Salix lasiolepis</i> )	72		5				77	26%
Yellow Willow ( <i>Salix lasiandra</i> )	4						4	1%
Dead Willow sp. ( <i>Salix</i> sp.)	1						1	<1%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	<1%
California Blackberry ( <i>Rubus ursinus</i> )	1						1	<1%
Sugar Sumac ( <i>Rhus ovata</i> )	2						2	1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	1						1	<1%
Mustard sp. <sup>1a</sup> ( <i>Brassica</i> sp.)	1						1	<1%
Perennial Pepperweed <sup>1a</sup> ( <i>Lepidium latifolium</i> )	1						1	<1%
Tamarisk <sup>1a</sup> ( <i>Tamarix ramosissima</i> )	4						4	1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	1						1	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	2						2	1%
Mulefat ( <i>Baccharis salicifolia</i> )	80		5				85	29%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	4						4	1%

Appendix C-2-J continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Temescal Canyon**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Brittlebush ( <i>Encelia farinosa</i> )	1						1	<1%
Common Sunflower ( <i>Helianthus annuus</i> )	1						1	<1%
Arrowweed ( <i>Pluchea sericea</i> )	2						2	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	8						8	3%
Arroyo Willow ( <i>S. lasiolepis</i> ) and dead Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Deadfall	3						3	1%
Unknown/No data	0			19	16		35	12%
<b>Total</b>	<b>241</b>	<b>1</b>	<b>16</b>	<b>19</b>	<b>16</b>	<b>0</b>	<b>293</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-K. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Chino Hills**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2003-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Desert Wild Grape ( <i>Vitis girdiana</i> )	1						1	2%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	14	1					15	32%
Red Willow ( <i>Salix laevigata</i> )	6	1					7	15%
Arroyo Willow ( <i>Salix lasiolepis</i> )	1						1	2%
Bank Catclaw <sup>a</sup> ( <i>Acacia redolens</i> )	0	1					1	10%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	2%
Chinese Elm <sup>a</sup> ( <i>Ulmus parvifolia</i> )	0	1					1	2%
Coast Live Oak ( <i>Quercus agrifolia</i> )	1						1	2%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	1						1	2%
Peruvian Pepper Tree <sup>a</sup> ( <i>Schinus molle</i> )	0			1			1	2%
Privet sp. <sup>a</sup> ( <i>Ligustrum</i> sp.)	0				1		1	2%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	3						3	6%
Mulefat ( <i>Baccharis salicifolia</i> )	10						10	21%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	2			1			3	6%
Unknown/No Data	0						0	0%
<b>Total</b>	<b>40</b>	<b>4</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>47</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-L. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana Canyon (SAC) - Upper Canyon**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )	1					1	2	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	4				2		6	3%
Fremont Cottonwood ( <i>Populus fremontii</i> )	8			1	1		10	6%
Narrowleaf Willow ( <i>Salix exigua</i> )	1						1	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	11		1		3		15	9%
Red Willow ( <i>Salix laevigata</i> )	3			1			4	2%
Arroyo Willow ( <i>Salix lasiolepis</i> )	3					1	4	2%
Willow sp. ( <i>Salix</i> sp.)	1						1	1%
Castorbean <sup>ia</sup> ( <i>Ricinus communis</i> )	1						1	1%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	1%
California Wild Rose ( <i>Rosa californica</i> )	3						3	2%
Coast Live Oak ( <i>Quercus agrifolia</i> )	1						1	1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	2					1	3	2%
Laurel Sumac ( <i>Malosma laurina</i> )	0			1	1		2	1%
Peruvian Pepper Tree <sup>ia</sup> ( <i>Schinus molle</i> )	2			1			3	2%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	5				1		6	3%
Mustard sp. <sup>ia</sup> ( <i>Brassica</i> sp.)	2						2	1%
Coyote Brush ( <i>Baccharis pilularis</i> )	1					1	2	1%
Mulefat ( <i>Baccharis salicifolia</i> )	43	2	2	7	8	7	69	40%
Desertbroom Baccharis ( <i>Baccharis sarothroides</i> )	1						1	1%
Milk Thistle <sup>ia</sup> ( <i>Silybum marianum</i> )	1						1	1%
Rough Cockelburrr ( <i>Xanthium strumarium</i> )	1						1	1%

Appendix C-2-L continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana Canyon (SAC) - Upper Canyon**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )	2						2	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	18	1	1	2	6	2	30	17%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	1%
Black Mustard <sup>a</sup> ( <i>B. nigra</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	1%
<b>Total</b>	<b>117</b>	<b>3</b>	<b>4</b>	<b>13</b>	<b>22</b>	<b>13</b>	<b>172</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-M. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana Canyon (SAC) - Green River Golf Club**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Giant Reed <sup>ia</sup> ( <i>Arundo donax</i> )	1				1		2	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	3		1		2		6	2%
Fremont Cottonwood ( <i>Populus fremontii</i> )	7		2	4	1	4	18	7%
Narrowleaf Willow ( <i>Salix exigua</i> )	2						2	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	13	1	2	1	1		18	7%
Red Willow ( <i>Salix laevigata</i> )	5	1					6	2%
Arroyo Willow ( <i>Salix lasiolepis</i> )	4	1	1				6	2%
Toyon ( <i>Heteromeles arbutifolia</i> )	2						2	1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1		3		1		5	2%
Laurel Sumac ( <i>Malosma laurina</i> )	3	2	2	3	4	5	19	8%
Peruvian Pepper Tree <sup>ia</sup> ( <i>Schinus molle</i> )	6		3	2	1	3	15	6%
Brazilian Pepper Tree <sup>ia</sup> ( <i>Schinus terebinthifolius</i> )	1						1	<1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	3	2				1	6	2%
Carrotwood <sup>a</sup> ( <i>Cupaniopsis anacardioides</i> )	0					1	1	<1%
Tree of Heaven <sup>ia</sup> ( <i>Ailanthus altissima</i> )	0			1			1	<1%
Black Mustard <sup>ia</sup> ( <i>Brassica nigra</i> )	0				4		4	2%
Cape Leadwort <sup>a</sup> ( <i>Plumbago auriculata</i> )	2						2	1%
Privet sp. <sup>a</sup> ( <i>Ligustrum</i> sp.)	1						1	<1%
Lollypop Tree <sup>ia</sup> ( <i>Myoporum laetum</i> )	1						1	<1%
Tree Tobacco <sup>ia</sup> ( <i>Nicotiana glauca</i> )	0			1			1	<1%



Appendix C-2-M continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana Canyon (SAC) - Green River Golf Club**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2001-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
California Sagebrush ( <i>Artemisia californica</i> )	1						1	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	1						1	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	3			1			4	2%
Mulefat ( <i>Baccharis salicifolia</i> )	50	5	7	6	7	11	86	34%
Poison Hemlock <sup>a</sup> ( <i>Conium maculatum</i> )	2						2	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	13	2	1	1	10	7	34	13%
Yerba Santa sp. ( <i>Eriodictyon</i> sp.)	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Peruvian Pepper Tree <sup>a</sup> ( <i>S. molle</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	<1%
Unknown/No data	1				1	2	4	2%
<b>Total</b>	<b>130</b>	<b>14</b>	<b>22</b>	<b>20</b>	<b>33</b>	<b>34</b>	<b>253</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

Appendix C-2-N. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana Canyon (SAC) - Featherly Regional Park**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2002-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Coulter's Matilija Poppy <sup>7</sup> ( <i>Romneya coulteri</i> )	0	1					1	<1%
Western Sycamore ( <i>Platanus racemosa</i> )	3			1	1	2	7	2%
Desert Wild Grape ( <i>Vitis girdiana</i> )	1						1	<1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	23	1		3	1	5	33	11%
Black Cottonwood ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> )	2	1					3	1%
Narrowleaf Willow ( <i>Salix exigua</i> )	5		1		6		12	4%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	20	1	1				22	7%
Dead Goodding's Black Willow covered with living Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Red Willow ( <i>Salix laevigata</i> )	4			1	1		6	2%
Arroyo Willow ( <i>Salix lasiolepis</i> )	5	1	2	1			9	3%
Willow sp. ( <i>Salix</i> sp.)	1					2	3	1%
Blue Palo Verde ( <i>Parkinsonia florida</i> )	0				1		1	<1%
Castorbean <sup>10</sup> ( <i>Ricinus communis</i> )	0		1				1	<1%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	<1%
Wild Cucumber ( <i>Marah macrocarpa</i> )	0					1	1	<1%
Southern California Black Walnut <sup>7</sup> ( <i>Juglans californica</i> )	8		1			2	11	4%
White Alder ( <i>Alnus rhombifolia</i> )	1						1	<1%
Laurel Sumac ( <i>Malosma laurina</i> )	9		4	5	3	6	27	9%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	8	1	2				11	4%
Orange Tree <sup>8</sup> ( <i>Citrus sinensis</i> )	3						3	1%
Black Mustard <sup>10</sup> ( <i>Brassica nigra</i> )	3		2		2	2	9	3%

Appendix C-2-N continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2020.

**Santa Ana Canyon (SAC) - Featherly Regional Park**

Host Plant Species (listed in taxonomic order <sup>1</sup> )	2002-2015	2016	2017	2018	2019	2020	Combined	Percentage of Combined
Tamarisk <sup>ia</sup> ( <i>Tamarix ramosissima</i> )	0			1			1	<1%
Black Sage ( <i>Salvia mellifera</i> )	1			1			2	1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	0				1		1	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	0					1	1	<1%
Mulefat ( <i>Baccharis salicifolia</i> )	34	8	8	5	7	17	79	25%
Yellowspine Thistle <sup>a</sup> ( <i>Cirsium ochrocentrum</i> )	2						2	1%
Rough Cocklebur ( <i>Xanthium strumarium</i> )	1						1	<1%
Poison Hemlock <sup>ia</sup> ( <i>Conium maculatum</i> )	3				4	6	13	4%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	29		2		2	2	35	11%
Fiddleneck sp. ( <i>Amsinckia</i> sp.)	1						1	<1%
Thickleaf Yerba Santa ( <i>Eriodictyon crassifolium</i> )	3						3	1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	2						2	1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Black Mustard <sup>ia</sup> ( <i>B. nigra</i> )	1						1	<1%
Castorbean <sup>ia</sup> ( <i>R. communis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Black Mustard ( <i>B. nigra</i> ) and Poison Hemlock ( <i>C. maculatum</i> )	0				1		1	<1%
Unknown/No data	1	2					3	1%
<b>Total</b>	<b>177</b>	<b>16</b>	<b>24</b>	<b>18</b>	<b>30</b>	<b>46</b>	<b>311</b>	<b>100%</b>

<sup>i</sup> = Invasive

<sup>a</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

<sup>1</sup> Using Jepson eFlora

## **APPENDIX D: SUMMARY TABLES BY MANAGED SITE, 2000-2020**

*Available by request under separate cover.*