Southwestern Willow Flycatcher Surveys and Nest Monitoring along the Gila River between Coolidge Dam and South Butte, 2008

Prepared for

US Bureau of Reclamation, Phoenix Area Office

Prepared by

SWCA Environmental Consultants

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SOUTHWESTERN WILLOW FLYCATCHER SURVEYS AND NEST MONITORING ALONG THE GILA RIVER BETWEEN COOLIDGE DAM AND SOUTH BUTTE, 2008

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EXECUTIVE SUMMARY

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) was federally listed as endangered in 1995. Probable factors contributing to population declines were believed to be loss, alteration, and fragmentation of native riparian breeding habitat, loss of wintering habitat, nest depredation, and brood parasitism by Brown-headed Cowbirds (USFWS 1995). Prompted by concern for population declines, from 1997 to 2007 surveys and nest monitoring were conducted along the Gila River by the Arizona Game and Fish Department (AGFD) under a cooperative agreement with the U.S. Bureau of Reclamation (Reclamation). In 2008, Reclamation contracted SWCA continue to survey and monitor the Gila River downstream of Coolidge Dam to document flycatcher abundance and distribution in relation to Coolidge Dam operations. Results of the 2008 survey and nest monitoring effort are summarized in this report.

In 2008, SWCA conducted flycatcher presence/absence surveys at 52 sites along the Gila River, Arizona, from Dripping Springs Wash downstream past the Kelvin Bridge to South Butte and the Ashurst-Hayden Diversion Dam. In coordination with Reclamation, survey sites were selected using a combination of existing knowledge, on-foot and boat reconnaissance, and high-resolution aerial photographs. All sites within the project area were visited at least once to determine suitability for flycatchers. Sites were considered unsuitable if vegetation clearly lacked the structural complexity necessary to support flycatchers. Sites consisting of mature native or exotic woody riparian vegetation with high canopy closure and standing water or saturated soil under or adjacent to the vegetation were considered the most suitable habitats for flycatchers. Early successional stands of young riparian vegetation >3 m in height in proximity to surface water or saturated soil were also considered suitable flycatcher habitat.

We completed a minimum of three broadcast surveys at each site deemed potentially suitable (with the exception of 14 sites where we completed two broadcast surveys from Kelvin Bridge to Ashurst-Hayden Diversion Dam), as recommended in the U.S. Fish and Wildlife Service (USFWS) Southwestern Willow Flycatcher Protocol (USFWS 2000), and general survey methods outlined in Sogge et al. (1997). We conducted additional site visits as needed to determine territory numbers and locations, the presence of pairs, and to conduct nest searching/monitoring as time permitted. Mayfield nest success (Mayfield 1961, 1975) was calculated for the study area.

We spent 176 hours surveying 52 sites covering approximately 94 linear km of riparian habitat within the study area. We detected 120 resident flycatchers at 17 sites. We located 63 flycatcher territories, with 60 pairs documented at 17 sites (the remaining 3 territories were classified as lone males, though mates may have been present and not detected). We detected 13 additional flycatchers: 10 migrants and 3 of unknown status.

We documented 95 nesting attempts at 17 sites. Of these, 88 nests were monitored as time permitted. Nest fate (success or failure) was determined for 62 monitored nests within the study area. Of the 62 nests with known outcomes, 40 (65%) were successful. Of the 22 failed nests, 18 were depredated, 3 were deserted, and 1 failed due to heat exposure (weather). Although brown-headed cowbirds were observed at all 17 sites with flycatchers, we did not detect cowbird parasitism at any nests. Mayfield nest success was 68% (n = 83). We estimated 90 young fledged from 38 successful nests.

Nesting substrate was documented for 95 nests at the Gila River study area. Tamarisk was the primary nesting substrate documented (87 nests); the remaining 8 nests were found in Goodding's willow (5 nests), snag (2 nests), and velvet ash (1 nest).

We continued streamflow analyses conducted from 1998 to 2007 by Weddle et al. (2007) and we concur with Weddle et al. (2007) that increased streamflow positively influences habitat quality at flycatcher sites within the study area. We found that increased streamflow from the previous beginning of the

previous monsoon season to the beginning of the flycatcher breeding season (July–April) had a positive effect on the number of flycatcher territories from 1998 to 2008 at the Gila River study area and explained 61% of the variation in the number of flycatcher territories.

INTRODUCTION

PROJECT HISTORY

The Southwestern Willow Flycatcher was placed on the federal endangered species list on February 17, 1995 (USFWS 1995), and critical habitat was designated on July 22, 1997 (USFWS 1997) and again in 2005 (USFWS 2005). A Southwestern Willow Flycatcher recovery plan was published in August 2002 (USFWS 2002).

From 1996 to 2005, AGFD conducted flycatcher surveys and nest monitoring along the Gila and San Pedro Rivers and Roosevelt Lake as part of a long-term demographic study under a cooperative agreement with Reclamation regarding the 1996 Biological Opinion on Roosevelt Dam (USFWS 1996). At the request of Reclamation, this effort continued in 2006 and 2007 with the exception that AGFD did not conduct field work at the San Pedro River or Roosevelt Lake study areas, and nest monitoring effort was reduced at the Gila River study area. In 2008, Reclamation contracted SWCA to continue to survey and monitor the Gila River downstream of Coolidge Dam to document flycatcher abundance and distribution in relation to Coolidge Dam operations. These surveys provide Reclamation with baseline flycatcher abundance and distribution data downstream of Coolidge Dam. Results of the 2008 survey and nest monitoring effort are summarized in this report.

This document serves as the summary report for 2008 study activities at the Gila River study area, including: 1) surveys: the systematic search of riparian habitat to record the presence and abundance of flycatchers at the study area; and 2) nest monitoring: the estimation of flycatcher nest success and productivity. SWCA's contract specifies the following field tasks:

At approximately 50 sites along the Gila River, complete the following:

a. where landowner permission can be obtained, survey suitable and potentially suitable habitat on the Gila River from Dripping Springs Wash downstream past the Kelvin Bridge to South Butte and the Ashurst-Hayden Diversion Dam;
b. conduct presence/absence surveys, as recommended in the U.S. Fish and Wildlife Service (USFWS) Southwestern Willow Flycatcher Protocol (USFWS 2000), and general survey methods outlined in Sogge et al. (1997);
c. attempt to locate flycatchers visually, focusing on determining whether the bird has leg bands, and recording the band combination if the bird is banded (as per permitting requirements);
d. conduct nest searches if territorial flycatchers are located and monitor at least 30 nests; calculate Mayfield nest success (Mayfield 1961, 1975) for the study area;
e. document the presence or absence of Brown-headed Cowbirds (*Molothrus ater*) at survey sites and determine impacts of cowbird parasitism on the flycatcher;
f. provide a general site description for each site, recording and providing all required information on standardized survey and detection forms;
g. document regeneration and loss of flycatcher habitat within the study area, highlighting the response of flycatchers to habitat change;
h. implement photo points at a subset of known flycatcher breeding sites to further examine future losses and regeneration of habitat and corresponding fluctuations in flycatcher numbers;
i. interpret and enter survey data into an Access database using the Arizona Willow Flycatcher Database format; and
j. compile all data into an annual report.

SPECIES INTRODUCTION

The Southwestern Willow Flycatcher is one of four subspecies of willow flycatcher currently recognized (Unitt 1987), although Browning (1993) posits a fifth subspecies (*E. t. campestris*) occurring in the central portions of the United States (Figure 1). The Southwestern Willow Flycatcher breeds in dense, mesic riparian habitats at scattered, isolated sites in New Mexico, Arizona, southern California, southern Nevada, southern Utah, southwestern Colorado, and, at least historically, extreme northwestern Mexico and western Texas (Unitt 1987).

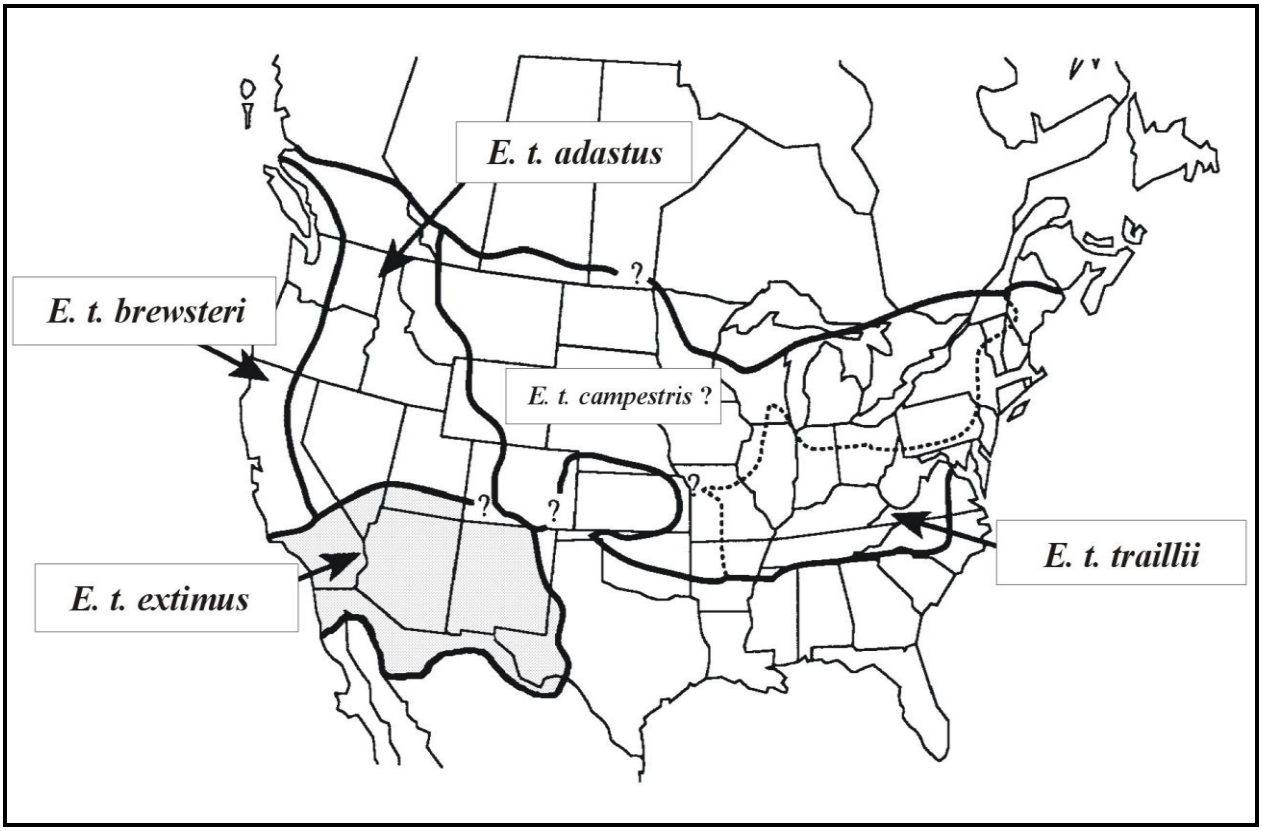

Figure 1. Breeding distribution of willow flycatcher subspecies. Question marks represent areas where actual location of the subspecies boundary is unknown. Adapted from Unitt (1987), Browning (1993), and Sogge et al. (1997).

In the Southwest, most willow flycatcher breeding territories are found within small breeding sites containing five or fewer territories (Durst et al. 2007). One of the last long-distance Neotropical migrants to arrive in North America in spring, Southwestern Willow Flycatchers have a short, approximately 100-day breeding season, with individuals typically arriving in May or June and departing in August (Sogge et al. 1997). All four subspecies of willow flycatchers spend the non-breeding season in portions of southern Mexico, Central America, and northwestern South America (Stiles and Skutch 1989, Ridgely and Tudor 1994, Howell and Webb 1995, Unitt 1997), with wintering ground habitat similar to the breeding grounds (Lynn et al. 2003). Willow flycatchers have been recorded on the wintering grounds from central Mexico to southern Central America as early as mid-August (Stiles and Skutch 1989, Howell and Webb 1995), and wintering, resident individuals have been recorded in southern Central America as late as the end of May (Koronkiewicz et al. 2006).

METHODS

STUDY AREA

The Gila River study area (Figures 2, 3 and 4) is located approximately 20 km below San Carlos Reservoir, extending from Dripping Springs Wash (upstream of the town of Winkelman) past the Florence-Kelvin Highway Bridge (hereafter, Kelvin Bridge) to the Ashurst-Hayden Diversion Dam. In total, the study area includes approximately 78 km of suitable and potentially suitable habitat. Flows are variable on the Gila River, regulated by releases from Coolidge Dam and natural flow from the San Pedro River. The Gila Water Commissioner (www.gilawater.org) is appointed by the U.S. District Court to administer the Globe Equity 59 Decree which controls use of the waters of the Gila River in the reach from above Virden, New Mexico downstream to the confluence with the Salt River west of Phoenix. The San Carlos Irrigation Project controls releases from Coolidge Dam based on downstream water orders. Flycatcher breeding season (April–August) streamflow below Coolidge Dam averaged 525 cubic feet per second (cfs) from 1996 to 2001, but from 2002 to 2004 periods of little or no streamflow (average of 81 cfs) were recorded due to drought conditions and Central Arizona Project water exchanges (Weddle et al. 2007). Since 2005 to present, streamflow has averaged 604 cfs during the breeding season (USGS 2008). Riparian habitat along this reach varies from monotypic tamarisk (*Tamarix* spp.) to mixed native and exotic vegetation (primarily Fremont cottonwood [*Populus fremontii*], Goodding's willow [*Salix gooddingii*], and tamarisk). Riparian habitat is surrounded by Arizona Upland, a subdivision of the Sonoron Desertscrub biome (Turner and Brown 1994). The study area is subdivided into survey sites of distinct habitat patches 0.18–9.69 km in length. Elevation at survey sites range from 485 m to 622 m and average canopy height ranged from 5 to 9 m.

SURVEYS

Site Selection

Reclamation provided the Universal Transverse Mercator (UTM) coordinates for survey sites, and sent letters to private landowners requesting right-of-way access prior to the flycatcher breeding season. Landowner permission was acquired for all survey sites prior to the 2008 breeding season.

In coordination with Reclamation, survey sites were evaluated and selected using a combination of existing knowledge, on-foot and boat reconnaissance, and high-resolution aerial photographs. Surveys were not conducted in habitat determined to be unsuitable for flycatchers after initial field reconnaissance. All sites within the project area were visited at least once to determine suitability for flycatchers. Sites were determined to be unsuitable if vegetation clearly lacked the structural complexity necessary to support flycatchers (e.g., vegetation was dead or habitat was too narrow, such as 1–2 trees wide with sparse foliage). Sites consisting of mature native or exotic woody riparian vegetation with high canopy closure (>50%) and standing water or saturated soil under or adjacent to the vegetation were considered to be the most suitable habitats for flycatchers. Early successional stands of young riparian vegetation >3 m in height in proximity to surface water or saturated soil were also considered suitable flycatcher habitat.

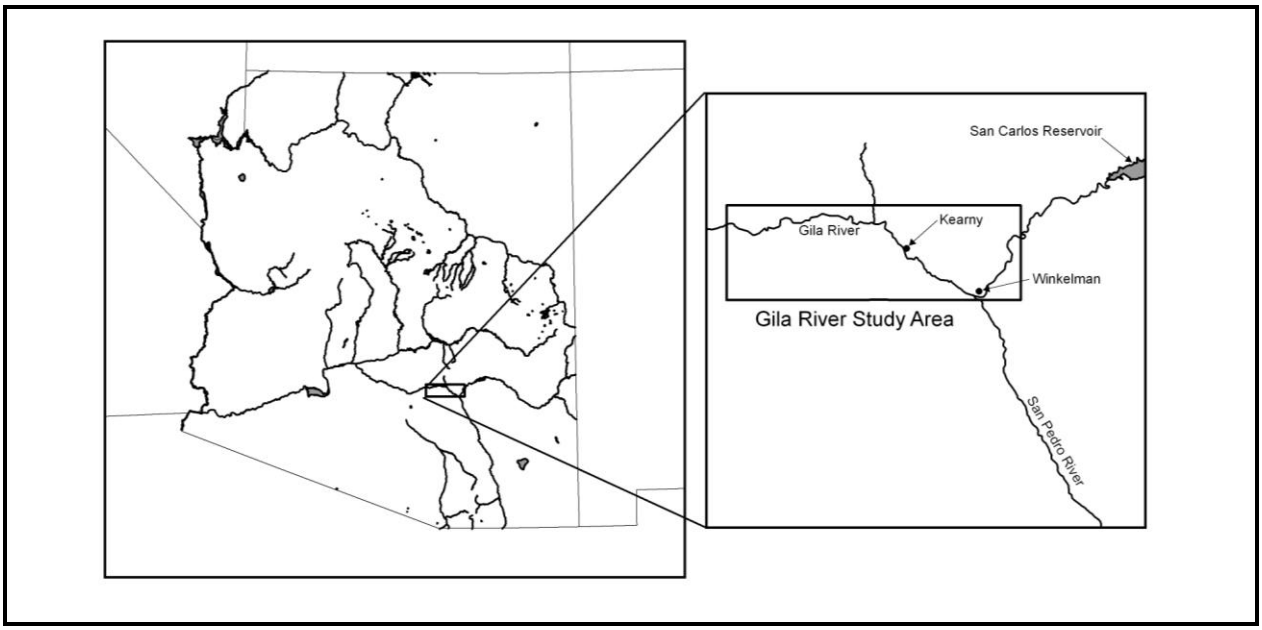

Figure 2. Project Area for Southwestern Willow Flycatcher Surveys, Gila River, Arizona.

Survey Technique

Unless sites were inaccessible by foot or boat (e.g., low streamflows, flooding), we completed a minimum of three broadcast surveys at each site deemed potentially suitable, as recommended in the USFWS Southwestern Willow Flycatcher Protocol (USFWS 2000), and general survey methods outlined in Sogge et al. (1997). We completed at least one survey between 15 and 31 May, at least one survey between 1 and 21 June, and at least one survey between 22 June and 17 July. All surveys were spaced a minimum of 5 days apart.

We conducted additional site visits as needed to determine territory numbers and locations, the presence of pairs, and to conduct nest searching/monitoring as time permitted. We were unable to conduct broadcast surveys during the first survey period at sites between the Kelvin Bridge and Ashurst-Hayden Diversion Dam—a kayak-only stretch with relatively low river depth—due to low streamflows. In 2006, AGFD determined that this stretch can only be surveyed when streamflow is at least 250 cfs. Streamflow was 129 cfs on 26 May when we planned to kayak this stretch (USGS 2008).

Surveys were conducted between 60 minutes before sunrise and 10:00 am and we used broadcasts of recorded conspecific vocalizations to elicit responses from flycatchers. The standard broadcast used for flycatcher surveys consisted of a series of *fitz-bew* (primary song) and *breet* calls. The call sequence at each survey point consisted of a 10-20 second pre-broadcast listening period, a 15-30 second broadcast period, and a 1-2 minute listening period. Additional vocalizations (*whitt*, *wheoo*, *brrr/kitter*, and interaction calls) were also included on the survey recording. These vocalizations were used to try to elicit a *fitz-bew* or *wheeo* response, which were used to confirm the bird as a willow flycatcher, from *Empidonax* flycatchers that were silent or that had not given a diagnostic *fitz-bew* or *wheeo* call. Wherever possible, surveys were conducted from the interior of the site, with broadcasts occurring approximately every 30 meters. In the few cases where surveys within the site were difficult or inefficient because of extremely dense vegetation, surveys occurred along the periphery of the site.

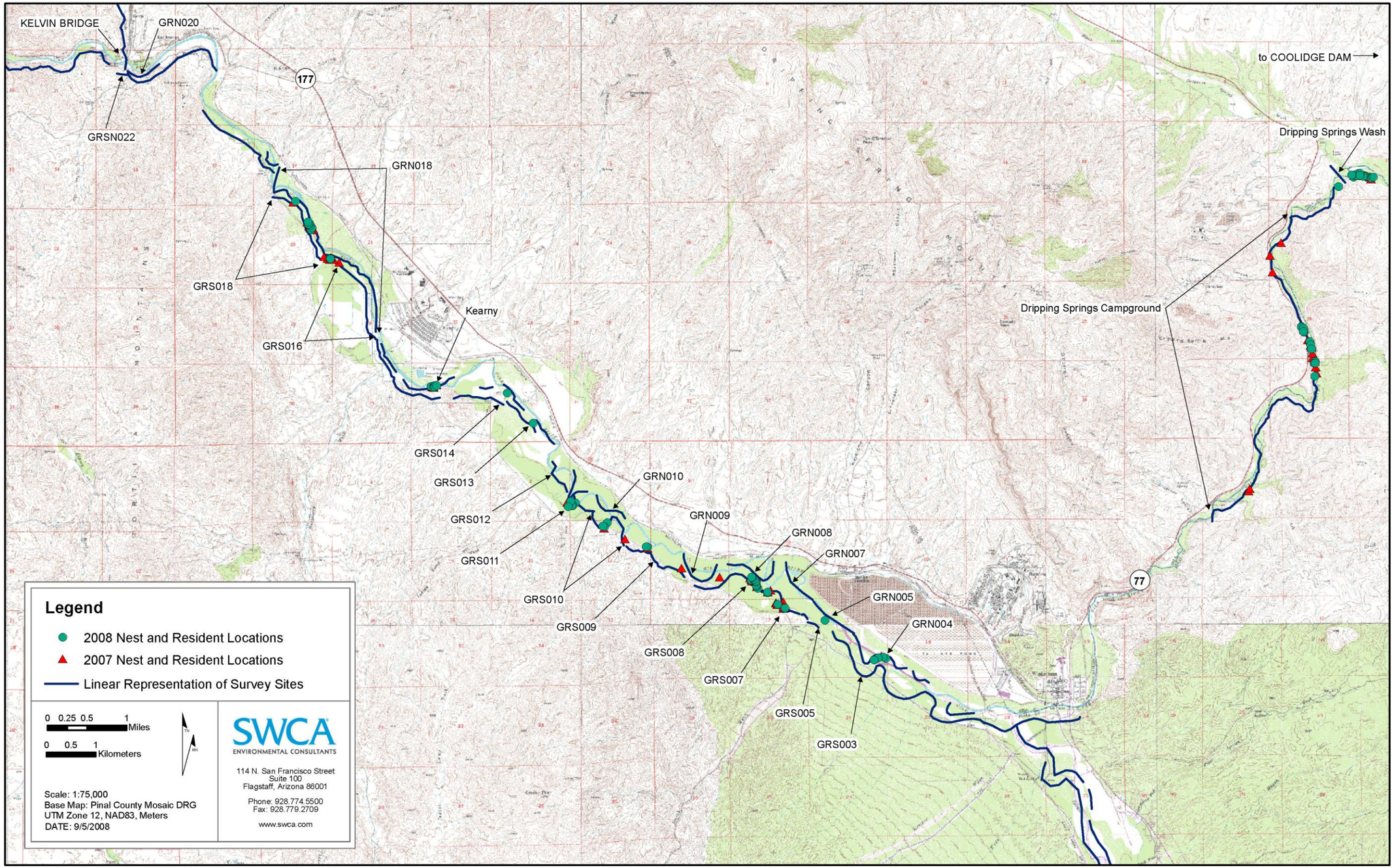

Figure 3. Gila Study Area between Dripping Springs Wash and the Kelvin Bridge depicting 2008 and 2007 nest and resident locations.

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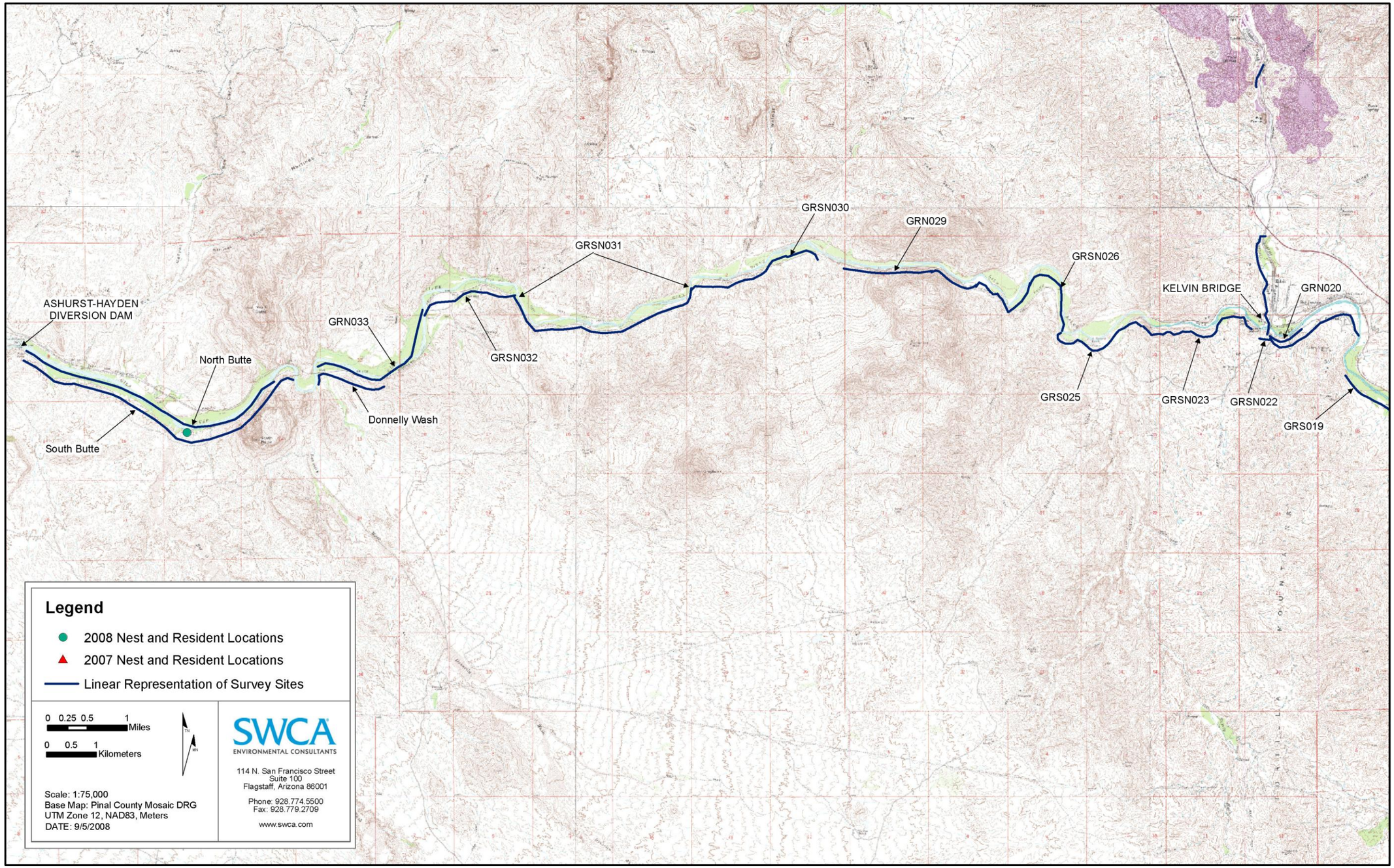

Figure 4. Gila Study Area between the Kelvin Bridge and the Ashurst-Hayden Diversion Dam depicting 2008 nest location (sites were not surveyed in 2007).

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Field personnel combined walking and boat (kayak) survey transects in all potentially suitable flycatcher habitats adjacent to and on the terrace above the Gila River. Two sites located away from the river's edge were surveyed by foot alone, 12 sites with substantial interior habitat away from the river's edge were surveyed by foot and by kayak, and 38 sites consisting of narrow and linear riparian vegetation (3–6 trees wide) were only surveyed by kayak (see Appendix H). Broadcast surveys were conducted by kayak; however, fast-moving current in some areas precluded the use of broadcasts every 30 meters. We believe survey coverage was sufficient at kayak-only sites due to habitat characteristics and modified protocol (ability to stop to further investigate habitat, additional surveys conducted, etc.). We were aware of the ever-changing flow conditions on the Gila River and determined proper flow levels prior to conducting each kayak survey (especially relevant for conducting surveys from the Kelvin Bridge to South Butte; this stretch is relatively more hazardous and remote, in addition to having lower river depth).

Flycatcher Residency and Breeding Status

When a willow flycatcher was detected, field personnel attempted to locate the bird visually, focusing on determining whether the bird had leg bands, and recording the band combination if the bird was banded (as per permitting requirements). Field personnel also noted general behavior of the bird, focusing on documenting evidence of territorial and breeding behavior (e.g., extended, unsolicited song; presence of an unchallenged flycatcher; soft *whitt* calls between two flycatchers; or any behavior that would indicate nesting, such as a flycatcher carrying nesting material or food). Field personnel recorded the GPS coordinates of each flycatcher detected, or, if the location of the flycatcher was not accessible, the location of the observer along with distance and direction to the responding bird. Wherever a territorial flycatcher was detected, further visits to that area focused on territory and nest monitoring (see below). Broadcast surveys were not conducted in that immediate area to minimize disturbance to territorial or breeding birds. We continued to survey portions of a site not determined to be occupied by territorial flycatchers.

Flycatchers were considered territorial or resident within a site if detected within the 15 June and 20 July "residency window", regardless of whether a possible or known mate was observed. Additionally, flycatchers were considered territorial if observations of nesting activity or nests were found before or after the "residency window". Flycatchers detected only during the first few days of the "residency window" were considered migrants based on additional field observations (i.e., they were not seen on repeated visits). Flycatchers documented prior to 15 June, but not detected in subsequent visits during the end of the second survey period or anytime during the third survey period, were considered migrants. An "unknown" designation was given to birds if not enough information was available to determine resident or migrant status.

Site Descriptions

For each survey site, surveyors recorded and provided all required information on standardized survey and detection forms. Surveyors recorded the overall vegetation type of the site (native broadleaf, >90% native; mixed native and exotic, 50–90% native; mixed exotic and native, 50–90% exotic; or exotic, >90% exotic); management authority, entity, or owner of survey site; length of area surveyed; 2–3 predominant trees/shrubs; average canopy height; whether the site contained surface water or saturated soil; and, if the site contained no surface water, distance to surface water. The surveyor also recorded any major hydrological changes across visits. Site descriptions included a detailed narrative description of the site and surrounding areas.

Documentation of Regeneration and Loss of Flycatcher Habitat

For several years, AGFD has documented regeneration and loss of flycatcher habitat within the project area (Graber et al. 2007, Weddle et al. 2007). We followed up on these topics, highlighting the response of flycatchers to habitat change within the project area. Specifically, we described regeneration of habitat at Kearny (following a fire in 2004) and sites between GRN004 and the Kelvin Bridge (following a flooding event in 2006). We also documented habitat regeneration associated with the continued presence of water in the project area since 2004 (e.g., Dripping Springs Wash and Campground). We implemented photo points at a subset of known flycatcher breeding sites to further examine future losses and regeneration of habitat and corresponding fluctuations in flycatcher numbers (see Appendix I).

Survey Data

All survey data was recorded on standardized AGFD and USFWS approved survey and detection forms (Appendix A). Site names remained consistent with those used during previous years of the study, and all sites were geographically defined using start and stop UTM coordinates and previously used site codes and names. Based on the above definitions for resident, migrant, and unknown flycatchers, we interpreted and entered survey data into an Access database using the Arizona Willow Flycatcher Database format. Copies of completed survey and detection forms (Appendix A) and electronic copies of the completed Access database were submitted to Reclamation, USFWS, and AGFD.

Interim Survey Updates

At the end of each of the three survey periods, we submited typewritten reports summarizing all field and post-field activities to Reclamation. These reports were in the form of an e-mail field update and summarized flycatcher detections, residency, and breeding data by site, as well as reporting notable bird sightings and any issues or concerns (e.g., loss of sites due to fire).

NEST MONITORING

Site Selection

We conducted flycatcher nest searching and monitoring at the same sites where breeding flycatchers were detected as part of surveys, detailed above. Because breeding flycatchers were not detected at all survey sites, nest searching and monitoring was conducted at a subset of the 52 survey sites along the Gila River, as depicted in Figures 3 and 4.

Nest Monitoring Technique

Once a territorial flycatcher was detected as part of surveys, territory and nest monitoring commenced at that location, following methods described by Rourke et al. (1999) and Martin et al. (1997). In general, territories consisting only of a lone male were monitored every 4 days, whereas territories consisting of pairs were monitored every 2–8 days, depending on nest stage. The majority of nests were found during nest construction or egg laying, allowing field personnel to visit the nest at more infrequent intervals while still determining nest success or the stage (laying, incubation, nestling) of nest failure. Nests were monitored using a mirror on a telescoping pole, when possible, to determine nest contents, including the

presence of any Brown-headed Cowbird eggs. Nests that were too high to be monitored with a mirror pole were observed with binoculars, and adult behavior, along with observation of any young in the nest, were used to determine nest stage. Once nestlings were confirmed, nests were observed from a distance to reduce the risk of nest predation and the possibility of premature fledging. If no adult or nestling activity was observed at a previously active nest, the nest was checked directly to identify nest contents; a search of the general area was conducted to locate possible fledglings if the nest was empty.

A nest was considered successful if any of four conditions were documented: 1) one or more young were visually confirmed fledging from the nest or located near the nest; 2) adults were seen feeding fledglings; 3) parents behaved as if dependent young were nearby (feeding trips, defensive behavior, and/or adults agitated) when the nest was empty; or 4) nestlings were observed in the nest within two days of the estimated fledge date (fledging considered to occur at 12 days; Rourke et al. 1999). We assumed that nestlings successfully fledged if they were observed in the nest within 2 days of the estimated fledge (based on observations of flycatchers successfully fledging at 10 days of age, AGFD, unpublished data). This assumption was not upheld if subsequent visits to the territory provided evidence that fledging did not occur (e.g., building or incubation dates for a re-nest contradicted the possible fledge date).

A nest was considered failed if any of six outcomes were documented: 1) depredated: the nest was found empty or destroyed more than 2 days prior to the estimated fledge date; 2) parasitized: the nest fledged no flycatcher young but contained cowbird eggs or young; 3) deserted: the nest was deserted with eggs remaining; 4) abandoned: the nest was abandoned prior to egg laying; 5) weather: the nest was destroyed due to weather; or 6) infertile: the entire clutch was incubated unsuccessfully for more than 20 days. An "unknown outcome" was designated if success or failure could not be determined.

All failed nests were inspected to determine the condition of the nest and to record the presence of eggs, eggshells, or dead nestlings in or around the nest. These data were used to determine the stage and cause of nest failure (e.g., depredation, desertion, brood parasitism).

Mayfield nest success (Mayfield 1961, 1975) was calculated for the study area. Exposure days was determined using the midpoint method for failed and successful nests and the last active date for nests of unknown fate, because this method has been demonstrated to provide the least biased Mayfield estimate (Manolis et al. 2000).

All nest and territory information was documented on standardized territory/nest record forms, which contained general information about each nest (e.g., GPS coordinates, height, substrate) as well as the observations made during each visit to the territory or nest (e.g., nest contents, adult behavior).

Nest Monitoring Data

All nest monitoring data was recorded on standardized data sheets (nest record forms) approved by AGFD. Site names remained consistent with those used during previous years of the study, and all nest locations were recorded using UTM coordinates. We entered nest monitoring data into an Access database using the Arizona Willow Flycatcher Database format. Electronic copies of the completed Access database was submitted to Reclamation, USFWS, and AGFD.

Interim Nest Monitoring Updates

We included nest monitoring results with the interim survey updates submitted to Reclamation as detailed in surveys above. These reports were in the form of an e-mail field update and summarized flycatcher nest numbers by site, as well as reporting notable bird sightings and any issues or concerns (e.g., loss of sites due to fire).

HYDROLOGICAL CHARACTERISTICS

Per the methods of Weddle et al. (2007), we evaluated the influence of variation in streamflow on the abundance of flycatchers in the Gila River study area. This will enable comparisons of hydrological and flycatcher occupancy data from previous years of study (1998–2007) within the study area with 2008 data. We performed a series of linear regressions on the number of flycatcher territories per breeding season as related to Gila River streamflow from 1998 to 2008.

Condition of habitat at the time of flycatcher settlement (late April to early June) is likely an important determining factor of flycatcher occupancy at sites. The Arizona Sonoran Desert experiences a bimodal rainfall pattern defined as a light winter and spring rainfall, a dry early summer, and heavy rainfall from July to September (Brown and Li 1996, Adams 1997, Xu et al. 2004, Diem and Brown 2006); at least 50% of this region's annual precipitation occurs between July and September (Adams 1997). Surface and ground-water availability (influenced by rainfall and dam discharge) have been found to positively affect woody and herbaceous species richness and cover on the San Pedro River near its confluence with the Gila River (Lite et al. 2005). We concur with Weddle et al. (2007) that there could be cumulative improvement of riparian habitat along the Gila River with increased streamflow prior to flycatcher settlement that could make the habitat more appealing to flycatchers and increase occupancy. However, the exact time period of increased streamflow that is important for the development and persistence of suitable flycatcher habitat is unknown. Therefore, we performed regressions on streamflow over a variety of time periods:

a. Annual streamflow (May of the previous year through April);
b. Beginning of previous monsoon season to the beginning of the flycatcher breeding season (July of the previous year through April);
c. Breeding season streamflow (April–August); and
d. Winter and spring streamflow (December–March).

We used mean monthly Gila River streamflow data collected at U.S. Geological Survey gauging stations located upstream (Gauging Station #09469500, Gila River Below Coolidge Dam; USGS 2008) and downstream (Gauging Station #09474000, Gila River at Kelvin; USGS 2008) of breeding flycatchers. Monthly streamflow data collected at the two gauging stations were averaged and used to calculate the sums used in the linear regressions based on the above delineations of time (Appendix B).

RESULTS

SURVEYS, DETECTIONS, AND DISTRIBUTION

In 2008, we surveyed 52 sites (Table 1; Appendix C), 19 of which were not surveyed to protocol due to time or access constraints or habitat deemed unsuitable for flycatchers. We detected 120 resident flycatchers occupying 63 territories (60 pairs) at 17 sites. The male to female ratio of residents was 1:1 since we detected an equal number of unpaired males (3) and polygynous males (3; each of the polygynous males was associated with 2 females). Because survey and monitoring protocols provide estimates of lone males and pairs (detection rates may not reach 100%), it is feasible that lone males and/or pairs went undetected and the "true" male to female ratio was different than 1:1. Resident flycatchers were detected for the first time at 4 sites that were surveyed at least once in previous years: North Butte, GRS014, GRN005, and GRS003. Among sites that were surveyed in both 2007 and 2008, there were 3 sites that had at least 1 resident flycatcher in 2007, but no residents in 2008 (GRS016, GRN007, and GRN004[1]) and 2 sites that had at least 1 resident flycatcher in 2008, but no residents in 2007 (GRS014 and GRS003).

We documented cowbirds at each of the 52 survey sites. We detected migrant flycatchers at 7 sites: GRN018, GRS016, GRN014, GRN013, GRN009, GRN008, and GRS003 (n = 10, Appendix C); one of the migrants detected was a late-season migrant (detected after the third survey period). Four of the 7 sites where migrant flycatchers were detected also supported breeding flycatchers (GRN018, GRN009, GRN008, and GRS003). There were 3 flycatchers of unknown status documented at 3 sites: GRSN022, GRS008, and GRS007.

NEST MONITORING

We documented 95 nesting attempts at 17 sites (Table 2; Appendix C); 41 nests were found in building stage, 12 in laying stage, 30 in incubation stage, 8 in nestling stage, 2 after fledging or assumed fledging, and 2 with stage unknown (unclear if building, laying, or incubating). Of the 95 nesting attempts, 88 nests were documented with eggs or nestlings and were monitored. For nests where complete clutches could be visually confirmed or presumed based on nestling number (n = 83), mean clutch size was 2.75 eggs. Of the 88 monitored nests, 40 (45%) fledged, 22 (25%) failed, and 26 (30%) had unknown outcomes. Of nests with known outcomes, 65% fledged at least 1 young and 35% failed. Depredation was the predominant cause of nest failure (82% of failed nests). Specific predators were not identified, but Common Kingsnakes (*Lampropeltis getula*) and Cooper's Hawks (*Accipiter cooperii*) have been documented as the most common predators of flycatcher nests at the Roosevelt Lake, San Pedro River, and Gila River study areas (Ellis et al. 2008).

In 2008, the earliest observed occurrence of egg laying was on 20 May at Kearny, followed by the first hatching event on 6 June at the same nest (which later failed due to depredation). The first fledging event was recorded on 22 June at Dripping Springs Wash. Nest monitoring was conducted until 31 July. The last documented fledging event occurred on 30 July at Dripping Springs Wash. There were 25 nests still active on the last day of monitoring (31 July)—12 containing eggs and 13 containing nestlings—and we predicted these nests would fledge between 1 August and 23 August.

[1] A nesting pair associated with GRS003 (territory 41) placed nests at both GRS003 and GRN004.

Table 1. Willow Flycatcher Survey Effort, Detections, and Nesting Attempts at the Gila River Study Area, 2008

Survey hours	176
Sites surveyed	52
Linear km of habitat covered	94
Sites with resident willow flycatchers	17
Sites with documented pairs	16
Sites with documented breeding[2]	17
Resident willow flycatchers	120
Territories	63
Pairs	60
Nesting attempts	95
Sites with cowbirds detected	52
Breeding sites with cowbirds detected	17

Parasitism

Although Brown-headed Cowbirds were present at all breeding sites, cowbird parasitism was not documented at the Gila River study area in 2008. We incidentally observed an abandoned Yellow Warbler (*Dendroica petechia*) nest containing 4 host eggs and 1 cowbird egg placed approximately 8 m from a flycatcher nest (nest 56A at Dripping Springs Campground). We also observed a female cowbird sitting for a brief moment—but not laying an egg—in a flycatcher nest that had successfully fledged young 6 days earlier (nest 43A at GRS003).

Nest Success

We were able to determine exposure days to calculate Mayfield nest survival probability (Mayfield 1961, 1975) for 83 of the 95 nests found at sites in the study area; some nests of unknown outcome had enough observations to be included in the analysis (n = 21). We calculated a 68% chance that a nest fledged at least one young (Appendix D).

Nest Productivity

We estimated 90 young fledged from 39 of the 83 nests used for calculating Mayfield nest survival probability (Appendix D). This fledgling total does not include a fledgling or fledglings associated with one nest used in the Mayfield calculation (nest 25A, GRS007: unknown number of presumed or confirmed fledglings) and one nest that was not used in the Mayfield calculation (nest 83A, Dripping Springs Wash: 3 fledglings associated with a nest found after the fledging event). Of the young presumed to have fledged, we were able to confirm 35% left the nest (i.e., confirmed fledglings were either seen leaving the nest, seen in the area directly around the nest, or seen associating with adults from the nest). The remaining fledglings (65%) were presumed fledged if they were siblings of confirmed fledglings (and were alive prior to the outcome determination) or the nest they were associated with met the conditions for success (e.g., defensive or feeding behavior by adults, nestlings observed two days prior to the estimated fledge date).

[2] There are more sites with documented breeding than sites with documented pairs because a nesting pair associated with one site (territory 41, GRS003) placed a second nest at a different site across the river (GRN004).

Table 2. Results of Nesting Attempts at the Gila River Study Area, 2008[3]

Site	Pairs	Nests	Successful Nests	Failed Nests	Unknown Outcome[4]
North Butte	1	1	0	0	1
GRN018	2	3	2	0	1
GRS018	4	9	2	3	4
Kearny	4	6	1	4	1
GRS014	1	1	0	0	1
GRS013	1	1	0	0	1
GRN011	1	1	0	1	0
GRS011	2	3	2	0	1
GRS010	3	3	2	0	1
GRN009	2	2	0	1	1
GRS008	4	7	3	2	2
GRN008	5	11	3	4	4
GRS007	2	3	2	0	1
GRN004[5]	0	1	0	1	0
GRS003	3	4	3	0	1
Dripping Springs Campground	11	18	10	4	4
Dripping Springs Wash	14	21	11	6	4
Total	**60**	**95**	**41**	**26**	**28**

Table 3. Causes of Nest Failure at the Gila River Study Area, 2008[6]

Site	Depredated	Deserted[7]	Abandoned[8]	Weather	Other[9]
GRS018	3	0	0	0	0
Kearny	2	0	1	1	0
GRN011	0	1	0	0	0
GRN009	1	0	0	0	0
GRS008	2	0	0	0	0
GRN008	3	0	1	0	0
GRN004	1	0	0	0	0
Dripping Springs Campground	2	0	1	0	1
Dripping Springs Wash	4	2	0	0	0
Total	**18**	**3**	**3**	**1**	**1**

[3] Includes non-monitored nests.

[4] Nests monitored for only a portion of the nesting cycle or insufficient evidence for determining outcome.

[5] A nesting pair associated with GRS003 (territory 41) placed nests at both GRS003 and GRN004.

[6] Includes non-monitored nests; monitored nests that failed include the "Depredated", "Deserted", and "Weather" categories.

[7] Nest deserted after egg-laying.

[8] Nest abandoned prior to egg-laying.

[9] Nest failed due to unknown causes or failure can not be categorized (i.e. unclear if abandoned or depredated).

Female Productivity

We determined that productivity estimates (fecundity: mean fledges per female; productivity: mean fledges per nesting attempt per female) were not comparable to that reported by AGFD in previous years because nests (25) were still active when field studies ended. We did not calculate productivity estimates as these results would have misrepresented actual productivity.

We documented 11 (29%) monitored females with 1 nesting attempt, 22 (58%) monitored females with 2 nesting attempts, and 5 (13%) monitored females with 3 nesting attempts. Two females renested in the same nest cup as the first attempt and 1 female built a new nest on top of a first attempt. Of the 27 females with renesting attempts, 12 attempted a double-brood (nesting attempt following a successful nest), but we were unable to monitor double-brooding females through completion of both nests due to time constraints. We documented 6 females at the Gila River study area that failed to fledge any young successfully; however because we ended nest monitoring on 31 July, it is possible that these females had a successful nest in August or September that went undetected.

HABITAT AND HYDROLOGICAL CHARACTERISTICS

General vegetation characteristics at breeding sites at the Gila River study area were characterized as mixed native and exotic associations; however, the amount of tamarisk varied within and among sites. Most breeding sites were composed of dense monotypic stands of tamarisk (>90% exotic). Older breeding sites (e.g., GRS007, Kearny, and GRN018) contained mature tamarisk forming a nearly continuous closed canopy (overstory) while newer breeding sites (e.g., Dripping Springs Wash, Dripping Springs Campground, GRS003, and GRS008) were primarily composed of dense young tamarisk lacking a mature overstory. Although vegetation composition and structure varied, all sites were adjacent to flowing or standing water during the breeding season.

Nesting Substrate Characterization

Nesting substrate was documented for all nesting attempts (n = 95) at the Gila River study area. Tamarisk was the primary nesting substrate documented (n = 87 nests); followed by Goodding's willow (5 nests), snag (2 nests), and velvet ash (*Fraxinus velutina*; 1 nest). Mean estimated nest height was 4.2 m.

Streamflow and Number of Flycatcher Territories

All linear regressions showed a positive relationship between Gila River streamflow and the number of flycatcher territories. Streamflow from the beginning of the previous monsoon season to the beginning of the flycatcher breeding season (July–April) had the strongest relationship with the number of territories (R^2 = 0.61, t = 3.77, P = 0.004). July–April streamflow explains 61% of the variation in flycatcher territories from 1998 to 2008. On average, for every additional 100 cubic feet per second (cfs), there was an increase of 1.3 territories.

Annual streamflow (May–April) also had a strong relationship with the number of territories (R^2 = 0.59, t = 3.60, P = 0.006). On average, for every additional 100 cfs, there was an increase of 0.9 territories. Winter and spring streamflow (December–March) had a comparatively weak relationship with the number of territories (R^2 = 0.31, t = 2.03, P = 0.073). On average, for every additional 100 cfs, there was an increase of 0.40 territories. Breeding season streamflow (April–August) had the weakest relationship with the number of territories (R^2 = 0.023, t = 0.456, P = 0.659). On average, for every additional 100 cfs, there was an increase of 0.19 territories.

DISCUSSION

SURVEYS, DETECTIONS, AND DISTRIBUTION

Proposed water exchanges involving the San Carlos Apache Tribe and downstream water users have the potential to decrease releases from Coolidge Dam that would otherwise flow downstream in the Gila River study area. The flycatcher which requires habitat associated with surface water or saturated soil for breeding could be affected by a decrease in flows. From 2002–2004, decreased releases from Coolidge Dam resulted in the Gila River drying by mid-season and the number of flycatcher territories declined by nearly half each year (43% decline from 2002 to 2003, 46% decline from 2003 to 2004; Munzer et al. 2005). Since 2004, flows within the Gila River study area have been greater and more consistent annually and throughout the breeding season. With increased flows, territories doubled from 2004–2005 (14 to 28 territories) and continued to increase from 2005–2006 (39% increase; 28 to 39 territories) and from 2006 to 2007 (59% increase; 39 to 62 territories; Weddle et al. 2007). In 2008, the number of flycatcher territories only increased by 1 (2% increase; 62 to 63 territories), resulting in an overall increase of 49 territories (350% increase) from 2004 to 2008 (Appendix E). The minor increase in territories between 2007 and 2008 may indicate flycatchers have recovered from the 2002–2004 decreased flows.

The only year exceeding 2008 in the number of flycatcher territories detected since surveys began in 1996 was 1999 (69 territories); however the survey effort in 1999 was greater than 2008 by a large margin (544 and 176 survey hours, respectively). There also may have been more suitable habitat in 1999 than in 2008, as riparian vegetation along the Gila River recovered from the scouring floods of 1992, 1993, and 1995. In 2008, we surveyed all 52 sites in the Gila Rivers study area for the first time and detected residents at 17 sites exceeding the previous high of 16 sites occupied in 2006 (12 sites were occupied in 1999). Resident flycatchers were detected for the first time at four sites that were surveyed at least once in previous years: North Butte, GRS014, GRN005, and GRS003 (North Butte was the only one of these sites not surveyed in 2007; it was last surveyed in 2006). Comparing sites surveyed in both 2007 and 2008 (n = 22), seven sites increased in the number of territories detected and seven sites decreased in the number of territories detected. The largest increases were at Dripping Springs Wash (increased by five territories) and GRS003 (increased by three territories) while the largest decreases were at GRS007 (decreased by four territories), Dripping Springs Campground (decreased by three territories), and GRN018 (decreased by three territories). Three sites supported at least one territory in 2007 but not in 2008 (GRS016, GRN007, and GRN004) while two sites supported at least one territory in 2008 but not in 2007 (GRS014 and GRS003). Fluctuations of territory numbers at specific sites are further discussed in the 'Habitat and Hydrological Characteristics' section below.

NEST MONITORING

In 2008, similar to AGFD's nest monitoring effort in 2007, we searched for and monitored nests as time allowed until 31 July. Prior to 2007, nest monitoring was conducted until the last active monitored nest fledged or failed, typically between 9 August and 28 August. The latest fledge day at the Gila River study area occurred in 2005 on 2 September (English et al. 2006). In 2006, nest monitoring was conducted until the last active monitored nest fledged or failed, but general nest monitoring effort throughout the season was similar to 2007 and 2008. When making comparison between years, it is important to note that 2006–2008 nest monitoring efforts were different than previous years and parameter estimates (e.g., nest survival probability, female productivity, number of re-nesting attempts, last fledge date) should not be directly compared. Results from previous years are given below to provide an informal comparison.

In AGFD's 10-year summary report, Ellis et al. (2008) reported overall simple nest success for all years combined[10] was 55.8%, but this varied significantly among years. In 2008, simple nest success was 65%; however, as noted above 2008 may not be comparable to all years of AGFD's study because we did not monitor nests in August (and it is possible that late season nests have a different probability of surviving). Simple nest success in 2007, when nest monitoring efforts were similar, was 75%. In AGFD's study, Mayfield nest survival probability ranged from 35% to 100% (mean: 62%) from 1996 to 2007. Mayfield nest probability in 2008 (68%, $n = 88$) was similar to 2007 (72%, $n = 44$). Nest survival probability for both years was higher than in 2006 (53%, $n = 41$) but not as high as in 2005 (77%, $n = 30$; Appendix D). The decrease in nest survival probability in 2006 was attributed to a high failure rate at Kearny (Graber et al. 2007). Since monitoring ceased after 31 July, the total number of renesting attempts and double-broods at the study area is unknown.

In previous years of this study, AGFD reported female fecundity (mean fledges per female) and female productivity (mean fledges per nesting attempt per female). In 2008, we determined that productivity estimates would not be comparable to previous years because nests (25) were still active when field studies ended. We determined not to calculate productivity estimates as these results would have misrepresented actual productivity.

For the fifth consecutive year, there was no Brown-headed Cowbird trapping at the Gila River study area. Although cowbirds were detected at all of the 52 sites at the Gila River study area, no cases of parasitism were documented for the fourth consecutive year. We incidentally observed an abandoned Yellow Warbler (*Dendroica petechia*) nest containing 4 host eggs and 1 cowbird egg placed approximately 8 m from a flycatcher nest (nest 56A at Dripping Springs Campground). We also observed a female cowbird sitting for a brief moment—but not laying an egg—in a flycatcher nest that had successfully fledged young 6 days earlier (nest 43A at GRS003). The parasitism rate at the Gila River study area was low for several years prior to 2005 (only 2 parasitized nests from 2002–2004); the last year to exceed a nest parasitism rate of 10% was 2001 (7 parasitized nests, $n = 56$).

HABITAT AND HYDROLOGICAL CHARACTERISTICS

The flycatcher occupies a wide variety of riparian habitats across its range (Skaggs 1996; Whitfield and Enos 1996; McCarthey et al. 1998; and USFWS 2002, 2005). The majority of occupied sites in Arizona are mixed native and exotic vegetation, with tamarisk being a significant component. Importance of riparian vegetation for this species has continuously been at the forefront of recovery discussions (USFWS 2002). Diversity in species composition of occupied habitats suggests that flycatchers may rely on structure of vegetation as much as, or more than, specific species of vegetation. Recent studies of flycatcher physiology, immunology, site fidelity, productivity, and survivorship suggest native and exotic habitats do not differ in quality for flycatchers (Owen et al. 2005, Sogge et al. 2006). Presence of water or saturated soil adjacent to habitat may be more important for flycatcher site selection along the Gila River in central Arizona than dominant vegetation type.

In 2008, flows did not fluctuate considerably throughout the season; therefore, sites were not subjected to significant flooding or drying events. In 2008, monsoon rains in July pushed gravel and rubble into the river in some locations (e.g., Dripping Springs Wash, GRS010) and at times increased turbity in the river; however, these rains, and associated increases in stream flow, did not seem to alter habitat conditions or cause nest failures. For the fourth consecutive year, streamflow within the Gila River study area was greater and more consistent annually and throughout the breeding season. As noted above, flycatcher territories have increased by 350% since 2004. The presence of ground and surface water (using streamflow as a relative indicator at the Gila River study area) may also influence factors such as food

[10] AGFD analyzed years 1996-2005 and included Gila and San Pedro rivers and Roosevelt Lake study areas

abundance and riparian microclimate conditions (Reitan and Thingstad 1999). Riparian habitat on the Gila River in central Arizona may be improving in suitability for flycatchers with increased streamflow.

We found that the streamflow from the beginning of the previous monsoon season through the beginning of the flycatcher breeding season (July–April) explained the most variability (62%) in the number of flycatcher territories in the following breeding season (an increase of 1.4 flycatchers per 100 cfs). We concur with Weddle et al. (2007) that there is a cumulative effect of increased streamflow during the approximately 10 months prior to flycatcher settlement. Although breeding season streamflow (April–August) had the weakest relationship in the number of territories as related to streamflow, this result is likely a function as to how annual streamflow was categorized. It is likely that adequate streamflow during the flycatcher breeding season is important to breeding flycatchers.

Flycatchers typically complete their first nesting attempt in early July (Ellis et al. 2008); therefore, monsoon rains and the subsequent increase in streamflow and prey abundance are more likely to have an immediate positive effect on fledgling survival and second nesting attempt success. Increased streamflow annually will have a long-term positive effect by encouraging suitable habitat to develop and support pre-existing habitat adjacent to the river, which may encourage immigration and support more flycatchers. Other variables such as rainfall, food abundance, and breeding success, may interact and contribute to the number of flycatcher territories each year. Paxton et al. (2007) found habitat type (native, exotic, or mixed) in which flycatchers breed along the San Pedro and Gila Rivers does not appear to influence adult survivorship. However, Paxton et al. (2007) did find the breeding status of an individual did, with successful breeders having higher survivorship than non-successful breeders, unpaired individuals, and those of unknown status. Sedgwick (2004) found that willow flycatchers maintain a higher rate of site and territory fidelity when they have greater breeding success, which may be directly (e.g., food abundance) or indirectly (e.g., vegetation and habitat quality) affected by increased streamflow and/or moisture availability.

Dripping Springs Wash and Dripping Springs Campground, 2 sites on the Gila River upstream of Winkelman, have shown the greatest increase in flycatcher territories since increased and constant streamflow has been restored. Dripping Springs Campground, which supported 1 territory for the first time in 2005, increased to 5 territories in 2006, and 14 territories in 2007. In 2008, Dripping Springs Campground supported 11 territories. Dripping Springs Wash, which supported 1 territory in 1999 and 1 territory in 2005, increased to 3 territories in 2006, 9 territories in 2007, and 14 territories in 2008. At Dripping Springs Campground, flycatchers colonized mature tamarisk stands (characterized with a canopy height of approximately 6 m with a closed canopy overstory) as well as younger tamarisk (characterized with a canopy height of approximately 3 m). The primary habitat patches used by flycatchers at Dripping Springs Wash were small islands of tamarisk with an average canopy height of 5 m. These sites are the only sites upstream of Gila River's confluence with the San Pedro River and are, therefore, the areas likely experiencing the greatest benefits from increased discharges from San Carlos Dam. This could explain the noticeable improvement in habitat at these sites and the larger increase in flycatcher occupancy compared to smaller, more widely distributed increases at other sites in the study area.

Occupied sites within the Gila River study area consisted primarily of tamarisk (50–90% or >90% exotic) with tamarisk being the most common nesting substrate. Young tamarisk used by flycatchers was either inundated with 0.35–1.0 m of flowing water or was associated with saturated soil. Many flycatcher territories in young tamarisk were on small islands within the river. Young tamarisk was primarily found within the floodplain with the only associated overstory occurring on steep eroded banks abutting the floodplain. Occupied mature tamarisk stands were associated with steep eroded banks adjacent to the river with an understory of dying tamarisk. Average canopy height varied among sites, with the densest canopy layer varying between 2 m and 9 m. The range of nest heights (2–9.5 m; average 4.2 m) reflects the diversity of canopy and understory structure among sites.

GRN008 and GRS008, 2 sites recently colonized downstream of Winkelman, are also improving with increased streamflow adjacent to the site to support suitable habitat. GRS008 consists of mature Goodding's willow and Fremont cottonwood with a tamarisk understory and is adjacent to a steep bank with large tamarisk; this site may have lacked the understory, an important component of flycatcher breeding habitat, prior to returned streamflow. The occupied habitat directly across the river at GRN008 is similar to the new emergent habitat found at Dripping Springs Wash and Dripping Springs Campground and may make GRS008 more appealing to flycatchers. Flycatchers occupy GRN008 in a patch composed of young tamarisk with no distinct overstory and an average canopy height of 3 m. Several resident flycatchers were observed using both sides of the river to forage.

At the Kearny site, a fire burned approximately two-thirds of the suitable habitat late in the 2004 breeding season (Munzer et al. 2005) when the site supported 5 territories. Since the fire, this site has supported 3 territories (in 2005), 5 territories (in 2006) and 4 territories (in 2007 and 2008). Kearny historically supported many more flycatchers than those detected in recent years (e.g., 25 territories in 1998); however, steady declines had been documented in years prior to the fire (19 territories in 2000, 14 in 2001, 14 in 2002, 9 in 2003). In 2008, flycatchers occupied the same area occupied from 2005–2007. This occupied patch is maintained by standing water or well saturated soil throughout the breeding season (as mandated by the Kearny Biological Opinion; USFWS 1998). Tamarisk (sprouting from the roots of burned and partially burned trees) and tree tobacco (*Nicotiana glauca*) have continued to regenerate in the burned area. By the end of the breeding season, tamarisk was approximately 5 m in height (up from 3 m in 2006), but still lacks horizontal structural complexity compared to typical nearby flycatcher habitat. The Gila River flood event in 2006 increased the area of standing water, felled some of the remaining dead trees, and encouraged Russian thistle (*Salsola kali*) to sprout in exposed sandy areas (Graber et al. 2007). We also noticed in 2008, that fiddleneck (*Amsinckia* spp.) has filled in many of the exposed areas. The flooding event in 2006, seemed to encourage continued regeneration of flycatcher habitat (tamarisk) at the site. Native plant regeneration at this site has not been documented.

The importance of continued monitoring along the Gila River was demonstrated this year as previously unoccupied areas became occupied. Continued monitoring effort will assist in assessing further flycatcher response to variable annual and seasonal streamflow on the Gila River. Flycatcher habitat historically scours out and regenerates frequently (USFWS 2002). As several sites at the Gila River study area have demonstrated, unsuitable habitat may become suitable within a few years with an increase of streamflow. Habitat at sites now occupied by flycatchers were considered unsuitable as recently as 2004. If streamflow continues to be favorable on the Gila River, future surveys may document flycatchers returning to previously occupied or new sites as habitat develops.

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APPENDIX A

Standardized Southwestern Willow Flycatcher Survey and Detection Form

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ feet / meters (circle one)

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ☐ *Yes* ☐ *No*

Site Coordinates: Start: N_____ E_____ UTM Datum _____(NAD27 preferred)
Stop: N_____ E_____ UTM Zone _____

***** Fill in additional site information on back of this page *****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found ? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1_____	Date Start Stop Total hrs ____							
2_____	Date Start Stop Total hrs ____							
3_____	Date Start Stop Total hrs ____							
4_____	Date Start Stop Total hrs ____							
5_____	Date Start Stop Total hrs ____							
Overall Site Summary (Total **resident** WIFLs only) Total survey hrs_____		Adults	Pairs	Territories	Nests	Were any WIFLs color-banded? Yes No If yes, report color combination(s) in the comments section on back of form		

Reporting Individual _____ Date Report Completed _____
US Fish and Wildlife Service Permit #_____ AZ Game and Fish Department (or other state) Permit # _____

Submit original form by August 1st. Retain a copy for your records.

Fill in the following information completely. <u>Submit original</u> form by August 1st. Retain a copy for your records.

Reporting Individual _____ Phone # _____
Affiliation _____ E-mail _____
Site Name _____ Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes / No (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? Yes / No If no, summarize in comments below.

Management Authority for Survey Area (circle one): Federal Municipal/County State Tribal Private
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: _____ (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)

☐ Mixed native and exotic plants (mostly native)

☐ Mixed native and exotic plants (mostly exotic)

☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: _____

Average height of canopy (Do not put a range): _____ (specify units)

Was surface water or saturated soil present at or adjacent to site? Yes / No (circle one)
Distance from the site to surface water or saturated soil: _____ (specify units)

Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes / No (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

_____
_____
_____
_____
_____
_____
_____

WIFL Detection Locations:

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM

APPENDIX B

Table of the Mean Monthly Streamflow at the Gila River Study Area

Table B.1. Mean Monthly Streamflow (cfs) at the Gila River Study Area, Arizona, 1997–2008

Year	Territories	Mean Monthly Streamflow (cfs)[a]											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	33	166	248	677	521	538	672	816	542	83	147	7	165
1998	48	110	208	493	441	610	699	852	923	443	153	44	320
1999	69	90	172	367	166	253	5	100	373	130	72	6	154
2000	52	81	144	278	340	118	8	5	70	22	190	80	216
2001	40	54	154	411	494	540	635	725	481	246	205	5	245
2002	46	107	138	243	25	14	1	1	52	56	103	8	108
2003	26	68	166	338	217	87	6	51	37	4	0	1	55
2004	14	85	141	297	382	230	3	6	110	84	37	11	122
2005	28	208	374	382	609	535	695	818	618	500	226	7	289
2006	39	177	234	224	403	479	480	650	722	351	236	11	294
2007	64	194	194	418	487	542	662	706	467	195	134	8	138
2008	62	334	240	548	666	511	569	629	411	–	–	–	–

[a]Mean monthly streamflow calculated by averaging mean monthly streamflow recorded at two U.S. Geological Survey gauging stations: #09469500 (Gila River Below Coolidge Dam) and #09474000 (Gila River at Kelvin; USGS 2007).

APPENDIX C

Willow Flycatcher Survey Results by Site in the Gila River Study Area

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2008

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
South Butte [e, f, i] Pinal, 485, 2.30	6/22/2008 7/18/2008	0 0	0	0	0	0	0	0	Y
North Butte [e, f, i] Pinal, 491, 2.09	6/22/2008 7/18/2008	2 0	2	1	1	1	0	0	Y
GRN033 [e, f, i] Pinal, 494, 1.08	6/22/2008 7/18/2008	0 0	0	0	0	0	0	0	Y
Donnelly Wash [e, f, i] Pinal, 495, 0.54	6/22/2008 7/18/2008	0 0	0	0	0	0	0	0	Y
GRS032 [e, f, i] Pinal, 494, 0.74	6/22/2008 7/18/2008	0 0	0	0	0	0	0	0	Y
GRSN031[e, f, i] Pinal, 506, 1.70	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRSN030 [e, f, i] Pinal, 506, 1.18	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRN029 [e, f, i] Pinal, 515, 0.74	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRN028 [e, f, i] Pinal, 518, 0.37	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRN027 [e, f, i] Pinal, 521, 0.67	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRSN026 [e, f, i] Pinal, 536, 0.67	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRS025 [e, f, i] Pinal, 536, 0.89	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRSN023 [e, f, i] Pinal, 536, 1.11	6/21/2008 7/17/2008	0 0	0	0	0	0	0	0	Y
GRSN022 [e, f, i] Pinal, 540, 0.99	6/21/2008 7/4/2008 7/17/2008	0 0 0	0	0	0	0	1	0	Y
GRS020 [e, f] Pinal, 543, 1.34	5/24/2008 6/5/2008 6/24/2008 7/2/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN020 [e, f] Pinal, 549, 0.42	5/24/2008 6/5/2008 6/24/2008 7/2/2008	0 0 0 0	0	0	0	0	0	0	Y
GRS019 [e, f] Pinal, 555, 1.22	5/24/2008 6/5/2008 6/24/2008 7/2/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN019 [e, f] Pinal, 549, 0.27	5/24/2008 6/5/2008 6/24/2008 7/2/2008	0 0 0 0	0	0	0	0	0	0	Y

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2008 (Continued)

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
GRN018 [f] Pinal, 561, 15.80	Monitored 5/08 to 7/08	N/A	5	3	2	3	0	1	Y
GRS018 [f] Pinal, 543, 5.70	Monitored 5/08 to 7/08	N/A	8	4	4	9	0	0	Y
GRS016 [f] Pinal, 549, 8.18	Monitored 5/08 to 7/08	N/A	0	0	0	0	0	3	Y
GRS015 [e, f] Pinal, 555, 1.97	5/24/2008 6/5/2008 6/24/2008 7/4/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN015 [e, f] Pinal, 550, 0,62	5/24/2008 6/5/2008 6/24/2008 7/4/2008	0 0 0 0	0	0	0	0	0	0	Y
Kearny Pinal, 555, 8.34	Monitored 5/08 to 7/08	N/A	8	4	4	6	0	0	Y
GRS014 [e, f] Pinal, 555, 1.90	Monitored 5/08 to 7/08	N/A	2	1	1	1	0	0	Y
GRN014 [e, f] Pinal, 558, 0.99	Monitored 5/08 to 7/08	N/A	0	0	0	0	0	1	Y
GRN013 [e, f] Pinal, 558, 2.49	Monitored 5/08 to 7/08	N/A	0	0	0	0	0	1	Y
GRS013 [e, f] Pinal, 558, 1.32	Monitored 5/08 to 7/08	N/A	2	1	1	1	0	0	Y
GRN012 [e, f] Pinal, 579, 1.21	5/24/2008 6/5/2008 6/24/2008 7/4/2008	0 0 0 0	0	0	0	0	0	0	Y
GRS012 [f] Pinal, 555, 1.95	5/21/2008 6/8/2008 7/4/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN011 [e, f] Pinal, 579, 2.35	Monitored 5/08 to 7/08	N/A	2	1	1	1	0	0	Y
GRS011 [f] Pinal, 561, 3.31	Monitored 5/08 to 7/08	N/A	5	3	2	3	0	0	Y
GRN010 [f] Pinal, 573, 2.50	5/21/2008 5/25/2008 6/8/2008 7/4/2008 7/16/2008	0 0 0 0 0	0	0	0	0	0	0	Y
GRS010 [f, h] Pinal, 561, 5.70	Monitored 6/08 to 7/08	N/A	5	3	3	3	0	0	Y
GRS009 [e, f] Pinal, 567, 1.22	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2008 (Continued)

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
GRN009[f, h] Pinal, 579, 6.34	Monitored 5/08 to 7/08	N/A	3	2	2	2	0	1	Y
GRS008[e, f] Pinal, 567, 8.59	Monitored 5/08 to 7/08	N/A	8	4	4	7	1	0	Y
GRN008[f] Pinal, 579, 13.25	Monitored 5/08 to 7/08	N/A	10	5	5	11	0	2	Y
GRS007 Pinal, 573, 15.47	Monitored 5/08 to 7/08	N/A	4	2	2	3	1	0	Y
GRN007[e, f] Pinal, 579, 1.33	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRS006[e, f] Pinal, 567, 0.24	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRS005[e, f] Pinal, 567, 0.34	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN005[e, f] Pinal, 579, 2.50	Monitored 5/08 to 7/08	N/A	1	1	0	0	0	0	Y
GRS004[e, f] Pinal, 600, 1.09	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN004[e, f] Pinal, 585, 1.92	Monitored 5/08 to 7/08	N/A	0	0	0	1	0	0	Y
GRS003[e] Pinal, 585, 3.54	Monitored 5/08 to 7/08	N/A	6	3	3	4	0	1	Y
GRN003[e, f] Pinal, 585, 0.35	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRN002[e, f] Pinal, 585, 0.63	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRS002[e, f] Pinal, 585, 1.10	5/21/2008 6/8/2008 7/5/2008 7/16/2008	0 0 0 0	0	0	0	0	0	0	Y
GRS001[e, i] Pinal, 585, 1.00	7/7/2008	0	0	0	0	0	0	0	Y
Dripping Springs Campground[e, h] Pinal, 610, 20.09	Monitored 5/08 to 7/08	N/A	21	11	11	18	0	0	Y

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2008 (Continued)

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
Dripping Springs Wash [e, g] Gila, 621, 14.11	Monitored 5/08 to 7/08	N/A	28	14	14	21	0	0	Y
Total	**–**	**–**	**120**	**63**	**60**	**95**	**3**	**10**	**–**

[a] WIFL = adult willow flycatcher (*Empidonax trailii extimus*).

[b] Estimated number of willow flycatchers that could not be classified as resident or migrant due to brief appearance at the site during the breeding season, lack of survey data, or confusion with distinguishing neighboring territories.

[c] Maximum number of migrant willow flycatchers detected during any single survey event.

[d] BHCO = brown-headed cowbirds (*Molothrus ater*).

[e] Surveys were conducted by kayak only.

[f] Survey hours estimated because site was part of a multiple-site kayak survey.

[g] Total nest number includes one instance where fledglings were found and confirmed to a territory but no actual nest was found before fledglings were discovered.

[h] Number of territories + number of pairs does not equal number of residents due to a polygynous male (associated with two females).

[i] Survey did not meet 3-survey period USFWS protocol guidelines due to habitat determined to be unsuitable or accessibility constraints

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APPENDIX D

Willow Flycatcher Nest Success and Productivity of Monitored Nests at the Gila River Study Area

Table D.1. Willow Flycatcher Nest Success and Productivity of Monitored Nests at the Gila River Study Area, Arizona, 1996–2008

Year	Mayfield nest success, % (exposure days)	Number of young fledged	Mean number of young fledged per nest (*n*)[a]	Mean number of young fledged per successful nest (*n*)
1996	100 (20)	2	2.00 (1)	2.00 (1)
1997	71 (163)	16	1.60 (10)	2.00 (8)
1998	61 (1096)	75	1.39 (54)	2.27(33)
1999	48 (777)	41	1.08 (38)	2.41 (17)
2000	70 (620)	42	1.62 (26)	2.33 (18)
2001	52 (1134)	74	1.32 (56)	2.47 (30)
2002	35 (404)	19	0.83 (23)	2.38 (8)
2003	70 (394)	40	2.00 (20)	2.86 (14)
2004	35 (214)	13	1.00 (13)	2.60 (5)
2005	77 (654)	57	1.90 (30)	2.71 (21)
2006	53 (709)	52	1.27 (41)	2.36 (22)
2007	72 (838)	82	1.86 (44)	2.73 (30)
2008	68 (1576)	90	1.08 (83)	2.31 (39)

[a] n = number of nests used for calculating Mayfield (Mayfield 1961, 1975) nest survival estimates including nests with unknown outcome

APPENDIX E

Willow Flycatcher Survey Results for the Gila River Study Area

Table E.1. Willow Flycatcher Survey Results for the Gila River Study Area, Arizona, 1996–2008

Year	No. Sites Surveyed	Survey Hours	Residents[a]	Territories	Pairs	Nests
1996	15	126	13	10	3	4
1997	48	715	63	33	30	26
1998	42	575	94	48	46	71
1999	34	544	119	69	58	94
2000	37	578	97	52	48	69
2001	21	83	77	40	40	63
2002	24	120	88	46	43	45
2003	18	134	49	26	23	24
2004	15	106	26	14	12	14
2005	15	142	54	28	26	34
2006	22	148	73	39	34	54
2007	22	149	119	62	57	54
2008	52	176	120	63	60	95

[a] Number of territories + number of pairs may not equal total number of residents due to polygynous males and non-territorial floaters.

APPENDIX F

Willow Flycatcher Territories by Site within the Gila River Study Area

Table F.1. Willow Flycatcher Territories by Site[a] within the Gila River Study Area

Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
North Butte[b]	--	0	0	0	0	--	--	--	--	--	0	--	1
GRN033[b]	1	0	0	0	0	--	--	--	--	--	0	--	0
GRSN031[b]	1	0	0	--	--	--	--	--	--	--	0	--	0
GRN020[b]	2	2	2	5	0	0	0	0	0	0	1	0	0
GRS018	--	1	1	4	4	2	7	4	2	9	7	6	4
GRN018	--	2	2	5	4	9	7	5	3	6	5	6	3
GRS016	--	0	--	--	--	--	--	1	0	1	1	2	0
GRN015[b]	--	--	--	--	1	0	0	0	--	--	--	--	0
GRS015[b]	--	1	1	1	1	0	0	0	--	--	--	--	0
Kearny	6	8	25	23	19	14	14	9	5	3	5	4	4
GRS014[b]	--	0	0	0	0	0	0	--	--	--	0	0	1
GRS013[b]	--	1	0	0	0	0	0	0	--	--	--	--	1
GRS012	--	4	6	8	7	5	3	1	0	0	0	0	0
GRN011[b]	--	2	0	0	0	--	--	--	--	--	--	--	1
GRS011	--	0	0	1	2	1	1	0	0	0	0	1	3
GRN010	--	5	4	4	2	1	1	0	0	0	0	0	0
GRS010	--	3	0	4	0	0	0	0	0	1	1	2	3
GRS009[b]	--	0	0	--	--	--	--	--	--	--	1	0	0
GRN009	--	0	0	0	0	1	2	0	0	0	1	2	2
GRS008[b, c]	--	0	0	0	0	0	0	--	--	--	1	3	4
GRN008	--	0	0	0	0	0	2	0	0	0	1	4	5
GRS007	--	3	6	11	10	5	7	5	4	6	4	6	2
GRN007[b, c]	--	0	0	0	0	0	0	--	--	--	1	2	0
GRS005[b, c]	--	0	0	--	--	--	--	--	--	--	1	0	0
GRN005[b]	--	0	0	--	0	--	--	--	--	--	--	--	1
GRN004[b, c]	--	1	1	2	2	2	2	1	0	0	1	1	0[d]
GRS003[b, c]	--	0	--	--	--	--	--	--	--	--	0	0	3
Dripping Sprgs Campground[b, c]	--	--	0	0	0	0	0	0	0	1	5	14	11
Dripping Sprgs Wash[b, c]	--	--	0	1	0	0	0	0	0	1	3	9	14
Yearly sum of territories	10	33	48	69	52	40	46	26	14	28	39	62	63
# of sites with territories	4	12	9	12	10	9	10	7	4	8	16	14	17[d]

[a] Sites ordered downstream to upstream; only sites with documented flycatcher residents are included.

[b] Kayak-only surveys conducted in 2008.

[c] Kayak-only surveys conducted in 2006 and 2007.

[d] A nesting pair associated with GRS003 placed nests at both GRS003 and GRN004; this territory was designated to GRS003. Both sites were included in the final "sites with territories" number.

APPENDIX G

AGFD and Rangewide Site Names with Total Site Number, Management Unit and County for the Gila River Study Area

Table G.1. AGFD and Rangewide Site Names with Total Site Number, Management Unit and County for the Gila River Study Area

AGFD Site Name	Total Site Number	Rangewide Site Name	Management Unit	County
GRN033	AZGI098	Gila River GRN033	Middle Gila/San Pedro	Pinal
GRSN031	AZGI096	Gila River GRSN031	Middle Gila/San Pedro	Pinal
GRN020	AZGI087	Gila River GRN020 (Kelvin Bridge)	Middle Gila/San Pedro	Pinal
GRN018	AZGI083	Gila River GRN018	Middle Gila/San Pedro	Pinal
GRS018	AZGI082	Gila River GRS018	Middle Gila/San Pedro	Pinal
GRS016	AZGI081	Gila River GRS016	Middle Gila/San Pedro	Pinal
GRS015	AZGI080	Gila River GRS015	Middle Gila/San Pedro	Pinal
GRN015	AZGI113	Gila River GRN015	Middle Gila/San Pedro	Pinal
Kearny	AZGI042	Gila River Kearny Sewage Ponds	Middle Gila/San Pedro	Pinal
GRS013	AZGI076	Gila River GRS013	Middle Gila/San Pedro	Pinal
GRS012	AZGI074	Gila River GRS012	Middle Gila/San Pedro	Pinal
GRN011	AZGI073	Gila River GRN011	Middle Gila/San Pedro	Pinal
GRS011	AZGI072	Gila River GRS011	Middle Gila/San Pedro	Pinal
GRN010	AZGI071	Gila River GRN010	Middle Gila/San Pedro	Pinal
GRS010	AZGI070	Gila River GRS010	Middle Gila/San Pedro	Pinal
GRS009	AZGI068	Gila River GRS009	Middle Gila/San Pedro	Pinal
GRN009	AZGI069	Gila River GRN009	Middle Gila/San Pedro	Pinal
GRS008	AZGI066	Gila River GRS008	Middle Gila/San Pedro	Pinal
GRN008	AZGI067	Gila River GRN008	Middle Gila/San Pedro	Pinal
GRS007	AZGI064	Gila River GRS007	Middle Gila/San Pedro	Pinal
GRN007	AZGI065	Gila River GRN007	Middle Gila/San Pedro	Pinal
GRS005	AZGI061	Gila River GRS005	Middle Gila/San Pedro	Pinal
GRN004	AZGI060	Gila River GRN004	Middle Gila/San Pedro	Pinal
Dripping Springs Campground	AZGI036	Gila River - Dripping Springs Wash	Middle Gila/San Pedro	Pinal, Gila
Dripping Springs Wash	AZGI004	Gila River - Dripping Springs Wash	Middle Gila/San Pedro	Gila