BUREAU OF RECLAMATION

Technical Report No. ENV-2022-050

Southwestern Willow Flycatcher Breeding Habitat Suitability, 2021

Middle Rio Grande, New Mexico
Upper Colorado Basin

U.S. Department of the Interior **May 2022**

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Cover Photo – Representative Southwestern willow flycatcher suitable breeding habitat vegetation (Photo credit: R. Siegle).

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Acronyms and Abbreviations

ac	acre
ft	foot/feet
GIS	Geographic Information Systems
m	meter(s)
MRG	Middle Rio Grande
n	sample size
NAIP	U.S. Department of Agriculture, National Agriculture Imagery Program
Reclamation	Bureau of Reclamation
RM	River Mile
SWFL	Southwestern Willow Flycatcher
USFWS	U.S. Fish and Wildlife Service

Symbols

>	greater than
≥	greater than or equal to
<	less than
%	percent

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Introduction/Background

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*), hereafter SWFL, is a State and Federally listed endangered species. It is an insectivorous, Neotropical migrant that nests in dense riparian or wetland vegetation in the Southwestern United States, including along the Middle Rio Grande (MRG) in New Mexico (Moore 2021). Bureau of Reclamation (Reclamation) began formal surveys for the SWFL in the MRG in 1996 and has continued annual surveying and monitoring efforts since that time. In 2005, the U.S. Fish and Wildlife Service (USFWS) designated critical habitat for the SWFL along the Middle Rio Grande (MRG); more habitat was added to the designation in 2011. Habitat modeling and monitoring are required by the USFWS to meet the obligations of the MRG Biological Opinion (USFWS 2016).

In 2021, Reclamation conducted field-based vegetation mapping in conjunction with a Geographic Information Systems (GIS)-based inventory in riparian areas along the Rio Grande from Los Lunas to Elephant Butte Reservoir in New Mexico (figure 1). This mapping project used 2020 aerial photography. Mapping methods employed a classification system created by the MRG Biological Survey (Hink and Ohmart 1984) with minor modifications. Hink and Ohmart conducted an exhaustive biological analysis of the Rio Grande that included a classification of vegetation community and structure in the riparian zone of the river (levee to levee). In addition, bird and mammal abundance were correlated with vegetation types, making this system useful for determining wildlife – habitat associations. The Hink and Ohmart protocol used English measures, which was carried through to this mapping project for consistency in comparisons over time.

Prior to vegetation mapping in 2021, six previous mapping projects were conducted by Reclamation along the MRG:

1. San Acacia Diversion Dam to Elephant Butte Reservoir; 1998

2. Chama River in New Mexico from El Vado Dam to the confluence with the Rio Grande and continuing south along the Rio Grande to Elephant Butte Reservoir; 2002–2004 (Callahan and White 2004)

3. Full pool elevation of Elephant Butte Reservoir (4407 feet [ft]) to Monticello Bay; 2005

4. Highway 60 to Elephant Butte Reservoir; 2008 (Ahlers et al. 2010)

5. Los Lunas, New Mexico, to Elephant Butte Reservoir; 2012 (Siegle et al. 2013)

6. Los Lunas, New Mexico, to Elephant Butte Reservoir; 2016 (Siegle and Ahlers 2017)

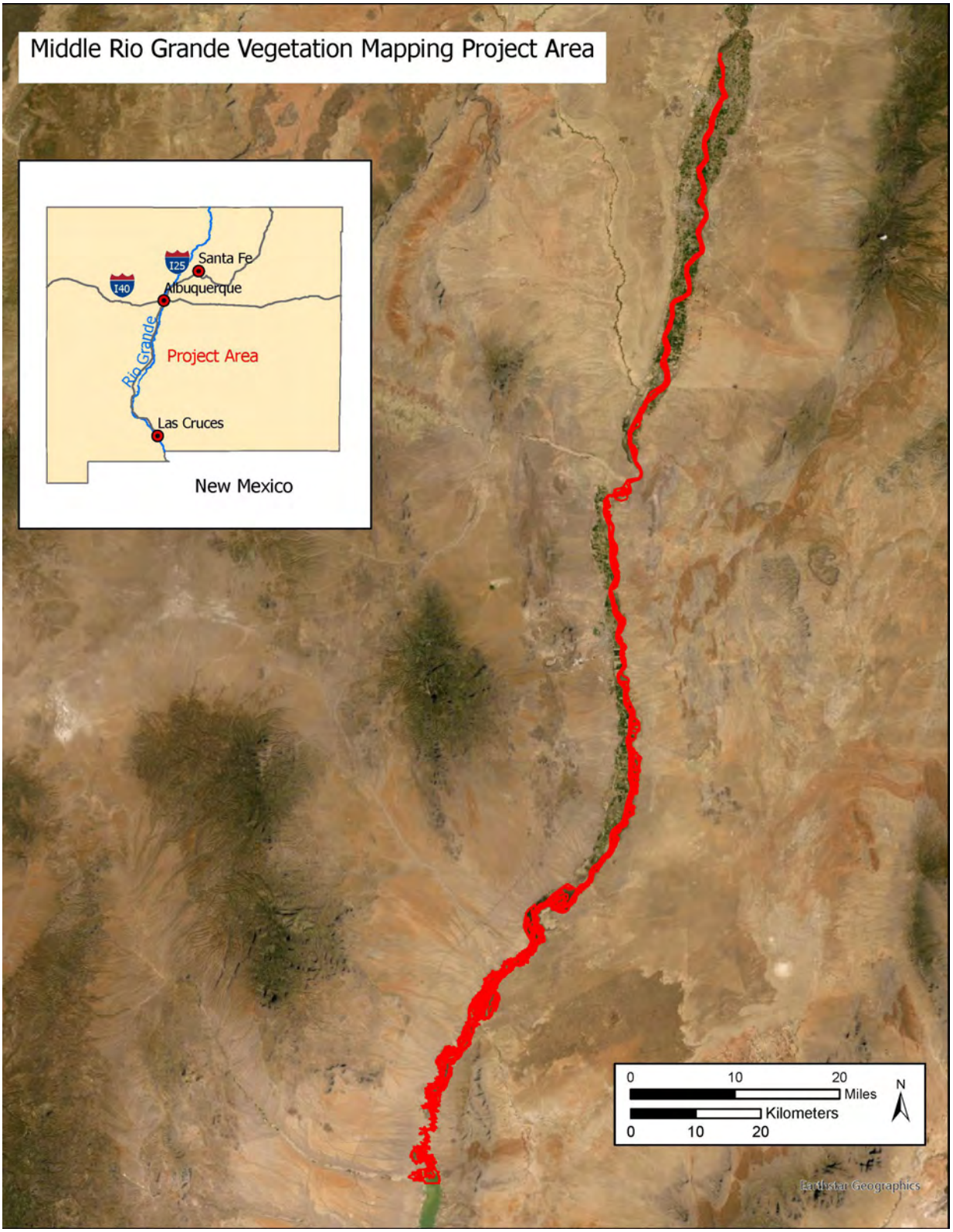


Figure 1.—Vegetation mapping project area in 2021 along the Middle Rio Grande, New Mexico.

The objectives of these mapping efforts were to capture trends in the development of vegetation within the study area as well as to identify potentially suitable habitat for the SWFL. Vegetation mapping is the critical link between SWFL detection information obtained through surveys and an understanding of the characteristics of the habitat in which these species occur.

Development of a SWFL habitat suitability model was initiated in 1998 and has been updated with each mapping period. The intent of the model was to provide data that could be used for making land management decisions in areas that were either occupied or likely to be occupied by SWFLs. Data could also be used to determine the extent of improving or deteriorating habitat conditions, the amount of suitable habitat that is available, and to assist in guiding restoration efforts within the study area.

Evaluation of habitat conditions is an ongoing process carried out through comparisons of past and present mapping efforts. Assessment of vegetation mapping data over time can aid in identifying factors that may cause trends in vegetation development, such as changes in density, structure, and species composition. As the SWFL habitat model has evolved over time, it has become apparent that an adaptive management approach to address changing habitat conditions in formulation of the model is essential. This model was developed for general planning purposes and was not intended to be used as a substitute for site specific assessment. The model is also specific to SWFLs occupying the MRG and may not be applicable to other areas where the species has been detected.

Methods

There were two stages of this mapping project: vegetation mapping and habitat modelling. The vegetation mapping phase began with on-the-ground verification, during which biologists were in the field collecting information pertaining to characteristics of the vegetation within the mapping area. Aerial imagery was used to delineate different vegetation types as data were gathered. These data were then used to classify each vegetation community type. GIS was used to produce vegetation maps with the recently collected data. In the modelling phase, SWFL detections from 2018 to 2021 were overlaid onto the vegetation maps to apply the SWFL habitat suitability model which was developed using territory locations collected from 2006 to 2021.

Vegetation Mapping

Fieldwork was conducted between May and August 2021 along the MRG. The project area consisted of approximately 127 river miles (RM) – from RM 166 (Los Lunas, New Mexico) downstream to RM 37 (Elephant Butte Reservoir). Private property within the project area was not mapped.

Aerial imagery was used for base maps in the field. Aerial photography was acquired in 2020 by the U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP New Mexico 1 meter [m] Natural Color). A field map was created using 2020 aerial imagery overlaid with polygons from the previous mapping effort. Polygon boundaries were revised as needed based on photo interpretation of the recent imagery. Center points were marked for each polygon, which provided a waypoint to navigate towards while evaluating vegetation in the respective polygon.

Biologists used Apple iPad 8th generation units onto which the polygon map that was created in ArcGIS Online and ArcGIS Collector version 21.0.1 apps were downloaded. These devices allowed mappers to navigate towards waypoints with the ability to know their location on the ground and their proximity to the mapped polygons at all times. If ground-truthing proved that vegetation boundaries had changed since previous mapping, polygons were revised on the field map and the extent of similar vegetation was estimated. In general, polygons larger than 1 acre (ac) were mapped unless vegetation was considered exceptional SWFL habitat or had the potential to develop into SWFL habitat, in which case polygons could be smaller than 1 ac. The Collector app was used to mark locations that best represented the polygon (typically near the center of the polygon). A photograph was taken at the waypoint to document the vegetation community and structure of each polygon.

Biologists entered data into Collector for each polygon. Data that were gathered included parameters shown on figure 2. A hard copy of this data sheet was used in cases where new polygons were created since Collector did not have the capability to enter data for polygons that were not already loaded onto devices. Collector was synced with ArcGIS Online daily to update the vegetation polygon map with the recently collected data.

H&O Classification Form						
Date			**Recorder**			
Polygon ID						
Photo Number						
UTM NAD 83 Coordinates	**x**					
	y					
Riparian Woody Vegetation						
	> 40 ft	Total % Cover	**1**–24%	**25**–49%	**50**–74%	**75**–100%
		Total % Dead	**1**–24%	**25**–49%	**50**–74%	**75**–100%
	Species (Relative foliage cover) – Circle one for each species present List with most dominant 1st then decreasing dominance					
Species Codes	> 40 Species #1		**1**–24%	**25**–49%	**50**–74%	**75**–100%
ATX = Fourwing saltbush	> 40 Species #2		**1**–24%	**25**–49%	**50**–74%	**75**–100%
B = Baccharis (Seep willow)	> 40 Species #3		**1**–24%	**25**–49%	**50**–74%	**75**–100%
C = Cottonwood	**15–40 ft**	Total % Cover	**1**–24%	**25**–49%	**50**–74%	**75**–100%
CAT = Cattail		Total % Dead	**1**–24%	**25**–49%	**50**–74%	**75**–100%
CR = Creosote	**Species (Relative foliage cover) –** Circle one for each species present					
CW = Coyote willow FI = False indigo GW = Goodding's willow	15–40 Species #1		**1**–24%	**25**–49%	**50**–74%	**75**–100%
HMS = Honey mesquite	15–40 Species #2		**1**–24%	**25**–49%	**50**–74%	**75**–100%
MB = Mulberry	15–40 Species #3		**1**–24%	**25**–49%	**50**–74%	**75**–100%
NMO = New Mexico olive	15–40 Species #4		**1**–24%	**25**–49%	**50**–74%	**75**–100%
RO = Russian olive	**5–15 ft****	Total % Cover	**1**–24%	**25**–49%	**50**–74%	**75**–100%
SBM = Screwbean mesquite		Total % Dead	**1**–24%	**25**–490%	**50**–74%	**75**–100%
SC = Saltcedar	**Species (Relative foliage cover) –** Circle one for each species present					
SE = Siberian elm	5–15 Species #1		**1**–24%	**25**–49%	**50**–74%	**75**–100%
TH = Tree of heaven	5–15 Species #2		**1**–24%	**25**–49%	**50**–74%	**75**–100%
WB = Wolfberry	5–15 Species #3		**1**–24%	**25**–49%	**50**–74%	**75**–100%
	5–15 Species #4		**1**–24%	**25**–49%	**50**–74%	**75**–100%
	< 5 ft*	Total % Cover	**1**–24%	**25**–49%	**50**–74%	**75**–100%
		Total % Dead	**1**–24%	**25**–490%	**50**–74%	**75**–100%
	Species (Relative foliage cover) – Circle one for each species present					
	< 5 Species #1		**1**–24%	**25**–49%	**50**–74%	**75**–100%
	< 5 Species #2		**1**–24%	**25**–49%	**50**–74%	**75**–100%
	< 5 Species #3		**1**–24%	**25**–49%	**50**–74%	**75**–100%
	< 5 Species #4		**1**–24%	**25**–49%	**50**–74%	**75**–100%
* Circle cover type for areas with woody vegetation < 25 %						
Wetlands/Herbaceous Vegetation/Non-vegetated						
MH = Cattail marsh	MH = Wet meadow (sedges, rushes)		MS = Grass meadow			
OW = Open water	OP = Open area (< 25% woody vegetation cover)					
****** If SC >50% cover in 5–15 ft layer, circle height: **5–12 ft** or **> 12 ft** Evidence of Diorhabda?						

Figure 2.—Data used for the Modified Hink and Ohmart vegetation classification and mapping.

The Modified Hink and Ohmart vegetation classification process included categorizing vegetation polygons into community types and structure classes using an alphanumeric descriptive code. Each woody riparian plant species was assigned a letter code (i.e., the species code, see table 1, which also includes scientific names for all species detected). Codes were also assigned for non-woody vegetation and non-vegetated land types which were considered non-habitat (table 2).

Table 1.—Plant species codes

Species code	Common name	Scientific name
ATX	Fourwing saltbush	*Atriplex canescens*
B	Seep willow/willow baccharis	*Baccharis salicifolia, B. salicina*
C	Cottonwood	*Populus* spp.
CAT	Cattail	*Typha* spp.
CR	Creosote	*Larrea tridentata*
CW	Coyote willow	*Salix exigua*
HMS	Honey mesquite	*Prosopis glandulosa*
MB	Mulberry	*Morus* spp.
NMO	New Mexico olive	*Forestiera pubescens*
RO	Russian olive	*Elaeagnus angustifolia*
SBM	Screwbean mesquite	*Prosopis pubescens*
SC	Saltcedar	*Tamarix* spp.
SE	Siberian elm	*Ulmus pumila*
TH	Tree of heaven	*Ailanthus altissima*
TW	Goodding's willow*	*Salix gooddingii*
WB	Wolfberry	*Lycium torreyi*

* Hink and Ohmart referred to this species as tree willow, thus TW code.

Table 2.—Codes used for non-woody vegetation and land types (non-habitat)

Code	Non-woody vegetation or land type
MS	Dry meadow (grasses)
MH	Wet meadow/marsh with cattail, sedge, rush or other wetland species
OP	Open area (woody vegetation < 25% aerial coverage)
OW	Open water
Channel	Rio Grande
LFCC	Low flow conveyance channel
Road	Road
RR	Railroad

The Modified Hink and Ohmart code consisted of species codes for the canopy layer, species codes for the understory layer, and a community type number signifying the height and density of each layer. Community type classifications are described in table 3. Overall, Types 1 and 2 were mature forest, Types 3 and 4 were intermediate aged forest or woodland, and Types 5 and 6 were shrub habitats (Hink and Ohmart 1984). Types 1 and 3 had a substantial understory while Types 2 and 4 had sparse understory.

Table 3.—Descriptions of community types used in the Modified Hink and Ohmart classification

Type 1 Tall/mature trees with well-developed understory	Tall or mature-aged trees (> 40 ft) with canopy covering ≥ 25% of the area of the community (polygon) **and** understory layer (0–15 ft) covering ≥ 25% of the area of the community (polygon) *Type 1d* – Type 1 with ≥ 50% total cover of one of the layers (canopy or understory)	
Type 2 Tall/mature trees with little or no understory	Tall or mature-aged trees (> 40 ft) with canopy covering ≥ 25% of the area of the community (polygon) **and** understory layer (0–15 ft) covering < 25% of the area of the community (polygon) *Type 2d* – Type 2 with ≥ 50% total cover of the canopy layer	
Type 3 Intermediate-sized trees with well-developed understory	Intermediate-sized trees (15–40 ft) with canopy covering ≥ 25% of the area of the community (polygon) **and** understory layer (0–15 ft) covering ≥ 25% of the area of the community (polygon) *Type 3d* – Type 3 with ≥ 50% total cover of one of the layers (canopy or understory)	
Type 4 Intermediate-sized trees with little or no understory	Intermediate-sized trees (15–40 ft) with canopy covering ≥ 25% of the area of the community (polygon) **and** understory layer (0–15 ft) covering < 25% of the area of the community (polygon) *Type 4d* – Type 4 with ≥ 50% total cover of the canopy layer	
Type 5 Shrub-sized stands	Understory layer (5–15 ft) covering ≥ 25% of the area of the community (polygon) with no overstory layer *Type 5d* – Type 5 with ≥ 50% total cover of the understory layer	
Type 6 Very young and low growth	Understory layer (0–5 ft) covering ≥ 25% of the area of the community (polygon) with no overstory layer	

In the field, the mapping process began by estimating total percent canopy cover within 4 layers of woody vegetation which included 2 overstory layers (i.e., > 40 feet [ft] and 15-40 ft; > 12 m and 4.6–12 m) and 2 understory layers (i.e., 5–15 ft and 0–5 ft; 1.5–4.6 m and 0–1.5 m). Plant species were recorded based on relative percentage of cover within each layer, with the most dominant species listed first. Species within the same layer were separated by a hyphen (-). Canopy and understory layers were separated by a forward-slash (/). Typically, one or two species were recorded for each layer, but as many as 4 species could qualify. Each height category in both layers (i.e., canopy and understory) had to comprise at least 25 percent total cover to qualify as a component in classification types and only one of the height categories in each layer was used for classification purposes (whichever was dominant). Each species had to cover at least 25 relative percent of the vegetation to be included in the Modified Hink and Ohmart classification code. Plant cover, along with tree and shrub height, was determined by visual estimates.

The Modified Hink and Ohmart code was written in the following format:

When a canopy and understory layer of ≥ 25% total cover were present:

Canopy Layer/Understory Layer + Type (1 or 3)
Example: C-TW/CW3

When a canopy layer was present but no understory:

Canopy Layer + Type (2 or 4)
Example: C2

When a canopy layer was not present:

Shrub or Young Growth Layer + Type (5 or 6)
Example: SC-B5

As aforementioned, the Hink and Ohmart methodology was modified to meet the needs of this particular mapping effort. The following were either exceptions or revisions to the original Hink and Ohmart study.

a) Polygons greater than 1 ac in size were mapped unless they showed exceptional SWFL habitat quality.
b) For all “non-woody” vegetation classes, no community type number was attached to the code. “MH” was defined to mean “marsh” or an area that was inundated with water for most of the survey season (i.e., wetland).
c) Only live canopy trees and understory shrubs were included in the classification. The percentage of dead woody vegetation in the stand was documented.

d) If a polygon had either two canopy or two understory components that were greater than 25 percent in cover, the community type fell under the height/age class of the layer with the highest cover. For example, if an overstory layer that was over 40 ft in height had a canopy cover of 25–50 percent and an overstory layer that was 15–40 ft in height had a canopy cover of 51–75 percent, then the polygon was classified as a 'Type 3 or 4' depending on whether or not the understory was over 25 percent in cover. If both height categories in each of the canopy or understory layers were < 25%, then that layer was not included in the classification.

e) A "d" qualifier was added to the Modified Hink and Ohmart code following type number if total vegetative cover was equal to or greater than 50 percent. The "d" signified "dense" and was meant to be an indicator for potential SWFL habitat.

f) In 2021, a "t" qualifier was added to the SC5d Modified Hink and Ohmart code if saltcedar height was between 12 and 15 ft (3.7-4.6 m). The "t" signified "tall" and was meant to delineate monotypic saltcedar habitat tall enough to be suitable for breeding SWFLs.

Field maps were digitized with ArcGIS Pro software. Using the digital aerial imagery as a backdrop, the 2016 polygon boundaries were revised if necessary based on the current field maps. This part of the process also involved photo-interpretation. In many places, the polygon boundary was clearly delineated on the aerial photo by an obvious change in vegetation that was not distinguished by biologists in the field. In areas where the boundary was not distinct, the location of the line was estimated based either on mapping notes and drawings or photo interpretation.

Vegetation maps were produced incorporating the updated information with each polygon assigned a classification code. Vegetation maps were then used to determine SWFL habitat suitability of the vegetation types that were classified in the study area.

Habitat Modeling

Originally, criteria for the habitat suitability model were developed by evaluating the distribution and habitat use of more than 1000 SWFL territories detected in surveys from 2006 through 2009, when habitat conditions along the MRG were optimal. Biological opinion and expertise were also variables in determining optimal breeding habitat. When the model was initiated, there were fewer vegetation types to evaluate, with the vast majority of SWFL habitat dominated by Goodding's willow, which kept the number of suitability designations to a minimum. Although criteria were established to assign suitability classifications, the standards were relatively vague due to the uniform habitat at the time. Over six mapping efforts and with 16 potential species in the mix (see table 1), it became difficult to assign suitability rankings to hundreds of combinations of species and community types in the Hink and Ohmart classification types. In 2021, a more rigorous and repeatable method of designating suitability was developed based on species and structure that also included an assessment of the most commonly occupied SWFL habitat types since 2010 (i.e., the 2012 mapping effort). Table 4 outlines these criteria for three habitat suitability classes, categorized as suitable, moderately suitable, and unsuitable, by community type. Non-habitat types are shown in table 2.

Table 4.—Criteria used in designating SWFL habitat suitability to Hink and Ohmart vegetation classification by community type (see tables 2 and 3)

Type 1		Type 2	Type 3	
a	**Moderately suitable** **Overstory:** Cottonwood and/or willow **Understory:** Willow dominant or in combination with cattail, Russian olive and/or saltcedar **Density:** Must be 'd' (note: 'd' somewhat uninformative in Type 1 because suitability assumes understory is dense layer) **Examples:** C/CW1d; TW-C/SC-TW1d	Always unsuitable	a	**Suitable** **Overstory:** Willow only **Understory:** Willow only or with cattail **Density:** 'd' or not **Examples:** TW/TW3; TW-CW/CW3d
			b	**Suitable** **Overstory:** Willow dominant or C-TW **Understory:** Willow, cattail, or saltcedar are dominant **Density:** Must be 'd' **Examples:** TW/SC3d; C-TW/CW-CAT3d
			c	**Moderately suitable** **Overstory:** Willow dominant or C-TW **Understory:** Willow, cattail, and/or saltcedar are present but not necessarily dominant **Density:** 'd' or not **Examples:** C-TW/CW-B3; TW-C-RO/SC3
			d	**Moderately suitable** **Overstory:** Willow present but not dominant or not present* **Understory:** Willow present, dominant or not, or not present* **Density:** must be 'd' * Willow must be present in at least one of the layers. **Examples:** TW-SC/B3d; RO/SC-CW3d

Table 4.—Criteria used in designating SWFL habitat suitability to Hink and Ohmart vegetation classification by community type (see tables 2 and 3)

Type 4		Type 5		Type 6	Unsuitable	
a	**Suitable** **Overstory:** Willow only **Density:** ‘d’ or not **Examples:** CW-TW4d; TW4	a	**Suitable** **Understory:** Willow only or willow with cattail **Density:** ‘d’ or not **Examples:** CW-CAT5d; TW5	Always unsuitable	a	If species ATX, HMS, SBM, CR, NMO, SE, TH, or WB is a component of the classification type
b	**Suitable** **Overstory:** Willow mixed with saltcedar only **Density:** must be ‘d’ **Examples:** TW-SC4d; SC-TW4d	b	**Suitable** **Understory:** Willow mixed with saltcedar only (with or without cattail) **Density:** must be ‘d’ **Examples:** SC-TW5d; CW-SC5d		b	If doesn’t meet type criteria
c	**Suitable** **Overstory:** Willow dominant but with species other than saltcedar only **Density:** must be ‘d’ **Examples:** TW-C-SC-RO4d; CW-C4d	c	**Moderately suitable** **Understory:** Willow mixed with saltcedar only (with or without cattail) **Density:** not ‘d’ **Examples:** SC-CW5; TW-SC5			
d	**Moderately suitable** **Overstory:** Willow mixed with saltcedar only **Density:** not ‘d’ **Examples:** TW-SC4; SC-TW4	d	**Moderately suitable** **Understory:** Willow dominant but with species other than only saltcedar, cattail **Density:** ‘d’ or not **Examples:** TW-C-SC5; CW-C-B5d			
e	**Moderately suitable** **Overstory:** Willow dominant but with species other than saltcedar only **Density:** not ‘d’ **Examples:** TW-C-RO4; TW-C-SC4	e	**Moderately suitable** **Understory:** Willow present but not dominant **Density:** must be ‘d’ **Examples:** SC-CW-B5d; RO-CW-SC5d			
f	**Moderately suitable** **Overstory:** Willow not dominant or not present, must be mix of species (> 1) **Density:** must be ‘d’ **Examples**: SC-RO4d; SC-TW-C4d					

There were a few limitations in using the Modified Hink and Ohmart classification system for modeling that could lead to misrepresentation of suitability:

- Only dominant layers in overstory and understory were included in the classification code, which was particularly limiting in representing the overstory. For example, if the > 40 ft layer was dominant but there was also a 15 to 40 ft component, only the upper canopy was documented in the code (Type 1), which often led to a determination of "Unsuitable." In fact, the 15 to 40 ft layer is very important for SWFL habitat but was not included for modelling purposes in this case since it was not dominant.

- Overall density of a stand may be greater than what is represented in the classification code. This happens when both understory and overstory are estimated to be 25 to 49 percent cover. The "d" qualifier is not added (because neither layer is greater than 50 percent), however when these layers are combined, they may create a stand with greater than 50 percent total cover (i.e. dense) if there is not much overlap in overstory and understory cover.

- The layer that qualified as dense ("d") was not specified. This was mostly a limitation in Type 1 vegetation classifications. If the understory was dense, the site had potential to be suitable. However, if the overstory (greater than 40 ft) was dense with a sparse understory, the site did not provide suitable SWFL habitat.

Some vegetation types that were occupied by SWFLs were not considered to be suitable habitat. Factors other than the location of territories were sometimes used to identify habitat suitability of vegetation types. It is important to recognize that the ultimate measure of habitat suitability is not simply whether or not a site is occupied (Sogge et al. 2010). Habitat suitability occurs along a gradient from high to poor to unsuitable; the optimum habitats are those in which flycatcher reproductive success and survivorship result in a growing population. Therefore, nest success was also considered in determining suitability of habitat. For example, a site in which habitat deteriorated over time may have continued to attract SWFLs due to site fidelity, but the ability to successfully fledge young decreased based on-site conditions. Conversely, some types in which no SWFL detections occurred were not necessarily considered unsuitable. It is also important to note that not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding flycatchers (Sogge et al. 2010). In general, however, the areas determined to provide the most suitable habitat were logically those that were the most heavily occupied by SWFLs.

GIS maps were used to calculate the number of acres by vegetation type and SWFL suitability class within each river reach (figure 3). Within the suitability classes, the number of acres of habitat within 50 m of surface water was also calculated. SWFLs prefer to nest above or near water, which is likely due to slightly greater vegetation density, higher relative humidity, cooler overall temperatures, and perhaps greater insect abundance within this zone (Smith and Johnson 2007; Peterson 2013; Moore 2020). Consequently, the potential for overbank flooding is an important characteristic in SWFL habitat. Therefore, acreages within 50 m of water provided estimates of the highest quality habitat available in the suitable and moderately suitable classes within the study area. Surface water was defined as the river channel, small ponds, side channels, and marshes. The Low Flow Conveyance Channel was not included in the 50-m buffer due to proximity of the road and the lack of potential for overbank flooding.

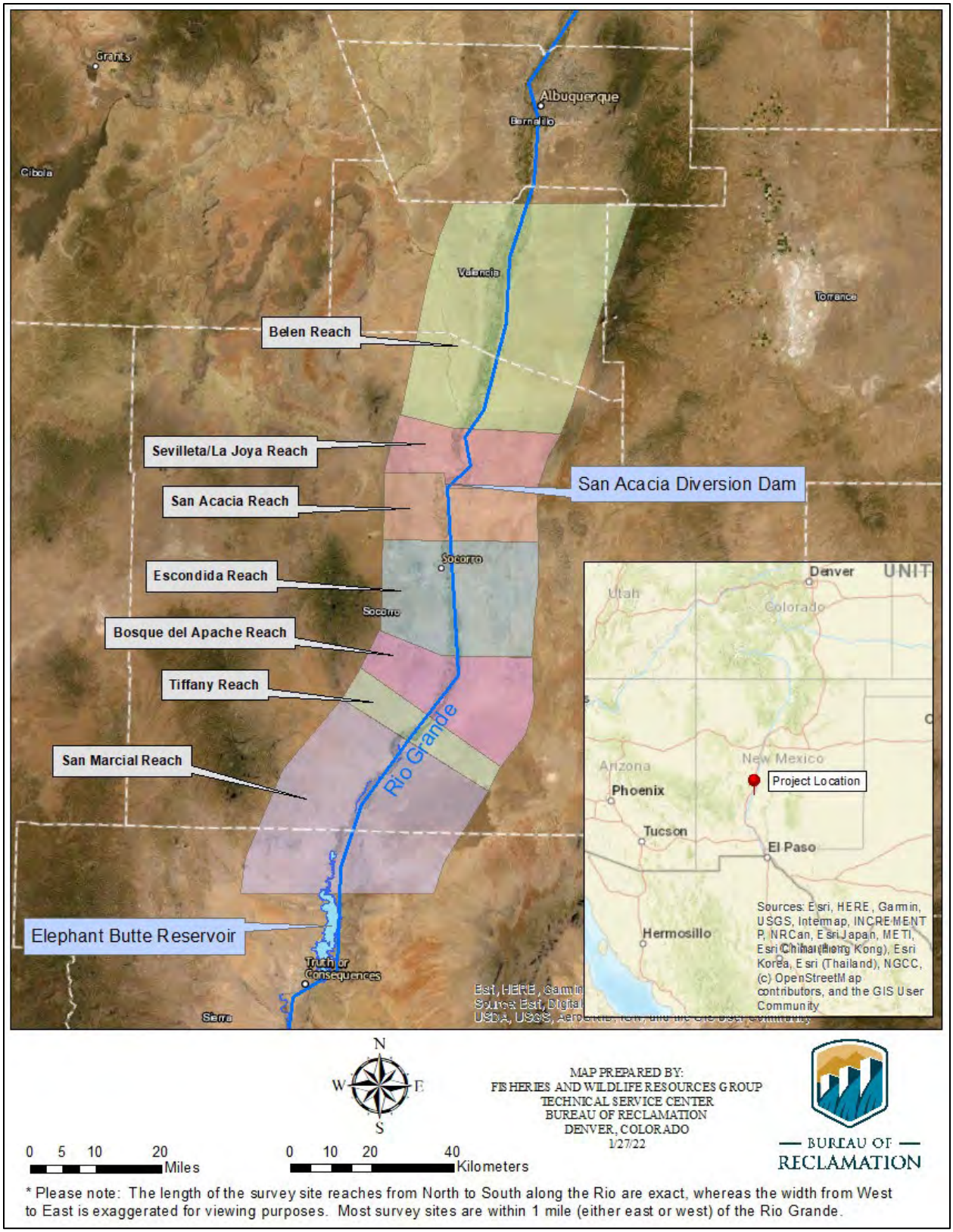


Figure 3.—Survey reaches within the project area along the Middle Rio Grande.

Results and Discussion

Results of the 2021 mapping effort are provided in appendix A. Maps are organized by river reach (see figure 3) and by river mile. Data are summarized by reach and include the number of acres of each habitat suitability type including non-habitat and the river channel; the number of acres of each dominant vegetation type; the number of SWFL territories from 2018 through 2021; and vegetation and SWFL habitat suitability maps. If SWFL territories are missing from the map legend, that indicates that there were no SWFL territories in the mapped area, or that the area was not surveyed in certain years. Survey information is provided in the reach tables. Open areas in non-habitat are subdivided into “recently burned” areas, which signifies that fires were recent enough to eliminate vegetation from Hink and Ohmart classification (i.e., woody vegetation less than 25 percent total cover).

Table 5 lists the most common Hink and Ohmart vegetation types identified within the 49,064 acres mapped in 2021 based on acres of available habitat. The 3 most common vegetation types across the landscape were variations of SC5 (saltcedar monocultures in the 5 to 15 ft height range). Most of the highly available habitat was classified as unsuitable for SWFL breeding. Table 5 also lists acreage by the dominant species in the vegetation types. Vegetation types dominated by saltcedar were most abundant (16,755 ac), followed by types dominated by cottonwood (11,758 ac). All vegetation types classified in 2021 are listed in appendix B with acreage, habitat suitability category, and reach(es) in which they were documented.

Table 5.—The most abundant Hink and Ohmart vegetation classifications identified within the MRG in 2021 based on acreage (the acreage of the dominant species in vegetation classifications is also presented)

Vegetation classification	Acres available	Suitability
SC5	5,104	U
SC5d	2,911	U
SC5dt	2,546	U
C2d	1,768	U
C/SC1d	1,009	U
Cattail marsh	932	N
TW4	748	S
C2	739	U
SC4d	731	U
SC-WB5	725	U
SC4	713	U
Dominant species	**Acres available**	
Saltcedar dominant	16,755	
Cottonwood dominant	11,758	
Goodding’s willow dominant	5,183	
Coyote willow dominant	1,256	
Russian olive dominant	833	

Using the vegetation maps and the suitability criteria developed in 2021 (see table 4), each vegetation type was assigned a habitat suitability class to create the suitability maps included in appendix A. In 2021 there were 2,989 ac of suitable habitat composed of 70 vegetation types; 5,549 ac of moderately suitable habitat within 138 vegetation types; 28,082 ac of unsuitable habitat consisting of 302 vegetation types; and 12,443 ac of non-habitat.

The primary difference in results has been an increase in the occurrence of saltcedar within occupied habitats since the 2008 mapping period (2006 to 2009 interval). Table 6 shows the general increase in saltcedar and decrease in Goodding's willow within SWFL territories, although there was a shift in this trend with an increase in willow dominance and decrease in saltcedar from 2016 to 2021.

Table 6.—Percentage of SWFL territories detected within vegetation communities either dominated by Gooding's willow or saltcedar or with a component of Gooding's willow or saltcedar

	Percentage of territories within vegetation communities			
	Goodding's willow dominant	**Gooding's willow component**	**Saltcedar dominant**	**Saltcedar component**
2006 – 2009 (n = 1,057)	75	78	6	43
2010 – 2012 (n = 1,450)	57	66	16	61
2013 – 2016 (n = 1,395)	41	64	20	74
2018 – 2021 (n = 1,313)	54	64	11	69

The vegetation types that were occupied with at least one percent of total SWFL territories detected from 2018 to 2021 (n = 1,006), which comprised 77 percent of all territories, are shown in table 7. When interpreting SWFL territory data for the current mapping and modeling effort, an important consideration is that the 2020 and 2021 avian surveys were not complete due to a limited staff under COVID restrictions. As such, the actual number of territories and associated habitat types across the entire survey area were not captured, which skews comparisons to other years.

The increased presence of saltcedar in SWFL habitats is most likely correlated with a general increase in saltcedar within the mapping area as a whole. Unfortunately, to prove the theory that saltcedar has significantly spread over time would involve intensive analysis to determine the degree to which plant communities have changed by polygon. A vegetation monitoring study in the Bosque del Apache National Wildlife Refuge found a rise in saltcedar cover at sample sites from 2010 to 2020 (Siegle and Moore 2021), however analyses of mapping data did not indicate an increase in saltcedar monocultures since 2008. Instead, saltcedar appears to be encroaching into plant communities, not necessarily dominating them. The region suffered severe to extreme drought conditions from approximately 2011 through 2014 and again in 2018 and 2021 (National Drought Mitigation Center 2022), a factor that appeared to affect vegetation, in particular by increasing saltcedar and decreasing native willow. Native riparian species such as willow and cottonwood depend on a shallow water table for both recruitment and survival (Stromberg 1993; Sprenger 1999; Muldavin et al. 2015). Saltcedar, on the other hand, is a phreatophyte with the potential to send roots deeper than these native species and can sustain a declining water table during drought conditions (Glen and Nagler 2005; Colorado Weed Management Association 2016).

Table 7.—Summary of vegetation types in which at least 1 percent of all SWFL territories were detected from 2018 to 2021

H&O classification 2021	Number of SWFL territories	Percentage of territories	Habitat suitability[1]
TW-C-SC4d	93	7.1	S
TW/SC3d	89	6.8	S
TW-C/TW-SC1d	87	6.6	M
CW5d	63	4.8	S
C/SC1d	60	4.6	U
TW-C/CW-SC-B1d	54	4.1	M
TW/CW-SC3	51	3.9	M
CAT-CW5d	48	3.7	S
CW-C-B5d	45	3.4	M
SC-RO4d	41	3.1	M
C-TW/SC1d	40	3.0	U
TW-C/CW-SC1d	36	2.7	M
SC5dt	35	2.7	U
TW4	31	2.4	S
SC-TW-C4d	25	1.9	M
C2d	24	1.8	U
TW/TW-CW-SC3d	24	1.8	S
C-TW/CW-SC1d	23	1.8	M
TW-SC/CW-SC3d	23	1.8	S
TW/TW-C1	22	1.7	U
TW-C/CW-SC3d	21	1.6	S
TW/TW-C-SC3	21	1.6	M
TW/CAT-CW1d	18	1.4	M
SC4d	16	1.2	U
TW/TW-SC-B3d	15	1.1	S
C/CW1d	14	1.1	M
C/CW3	13	1.0	U
TW/CW-SC1	13	1.0	U
Total (≥ 1% of territories)	1,045	79.6	
Others (< 1% of territories)	268	20.4	
Total[2]	**1,313**	**100.0**	

[1] S = Suitable (38% of all territories found in this habitat); M = Moderately suitable (37%); U = Unsuitable (24%).
[2] Territories were detected within 108 different vegetation types.

As hydrologic conditions changed over the past several years, so did the species composition of the riparian community. Over time, the quality of native habitat in the MRG decreased as saltcedar and/or other species that can tolerate dryer environments moved in. Habitat in which SWFLs initially nested may change as saltcedar expands across the landscape, or as native vegetation matures beyond what is suitable for nesting, however SWFLs may return to the same location for several years prior to abandoning due to site fidelity, regardless of decreasing habitat quality (Sogge et al. 2010). Changing SWFL habitat use and correlating nest success from 2006 to 2021 are shown on figure 4.

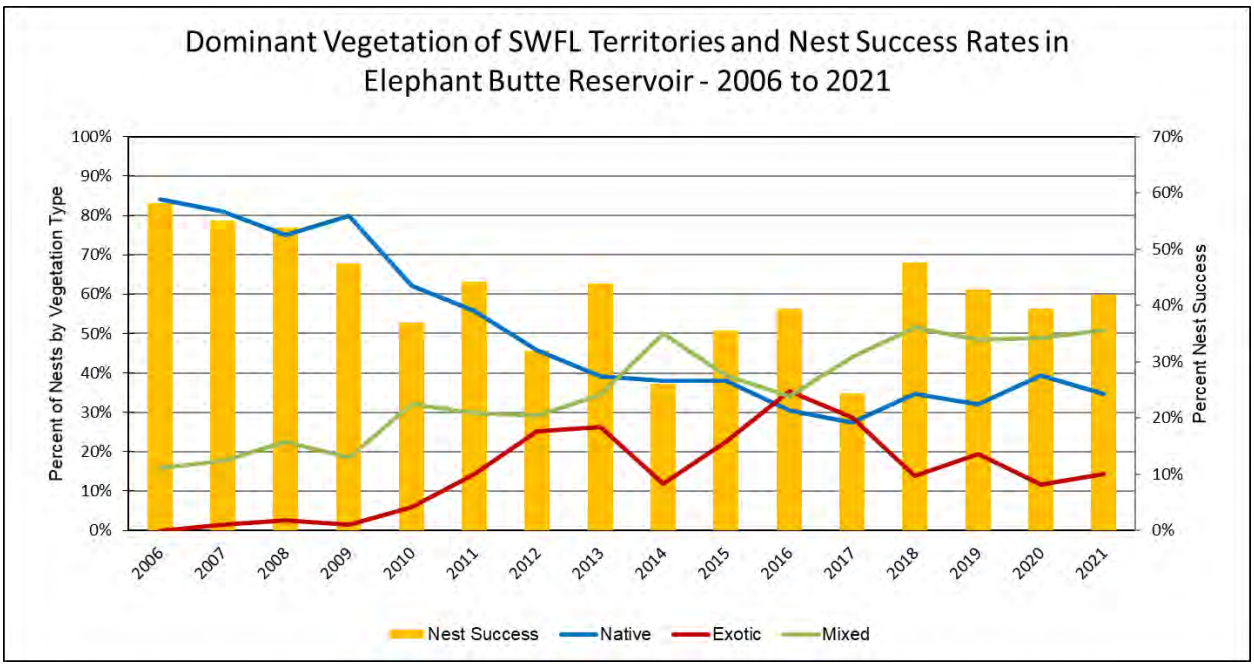


Figure 4.—Dominant vegetation in which SWFL territories were detected and nest success rates from approximately River Mile 60 to Elephant Butte Reservoir from 2006 to 2021.

Habitat suitability is driven by the structure and density of vegetation as well as hydrologic conditions, regardless of plant species composition. However, the structure and density of suitable habitat is most often found in association with areas which are seasonally flooded or possess a shallow water table and these areas are typically dominated by native vegetation. Although saltcedar is invasive and often considered an undesirable plant species, it can provide habitat for SWFLs in the study area when structure and density are adequate (see tables 6 and 7). Sixty-nine percent of all territories had a saltcedar component and saltcedar was the dominant species within 11 percent of the vegetation types in which territories were found from 2018 to 2021 (see table 5). Upon closer examination, however, territories detected within saltcedar monocultures from 2018 to 2021 were often adjacent to the river channel, drainages, or cattail marshes, which was most likely a more compelling variable in site location than species

preference. Several of these territories were also in habitat that had deteriorated since SWFL populations initially nested there. Overall, table 8 demonstrates that exotic species dominated habitat is not preferred by SWFLs for breeding.

Table 8.—Summary of dominant vegetation in which all SWFL territories were detected from 2018 to 2021

Dominant vegetation	Number of SWFL territories	Percent of territories
Native	378	37.4
Exotic	176	17.4
Mixed	456	45.1

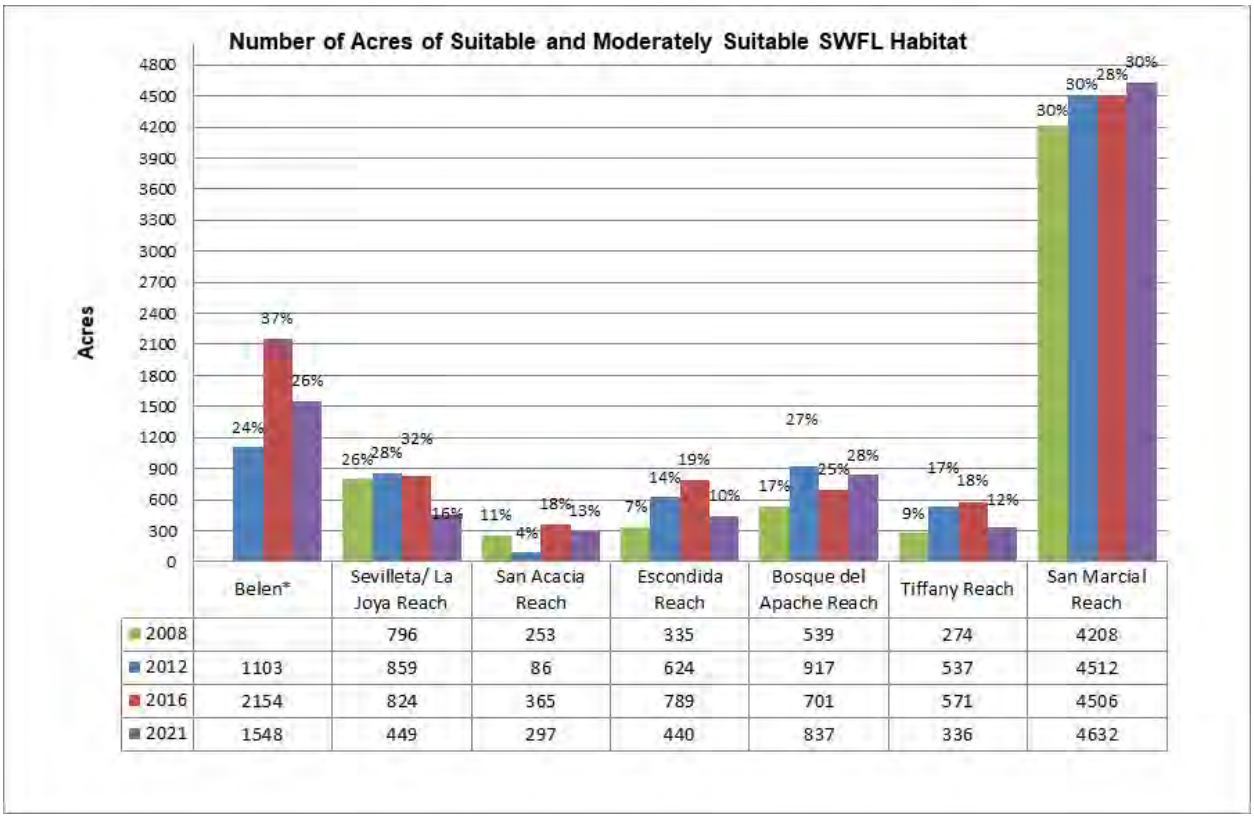
The increase of saltcedar occurrence in SWFL territories poses a challenge as the MRG SWFL habitat model evolves over time. The suitability criteria were modified in 2016 to include the habitat types SC/SC3d and SC4d as moderately suitable due to the unquestionable use of saltcedar monocultures as breeding habitat. Sogge et al (2010) describe “nearly monotypic, dense stands of exotics such as saltcedar or Russian olive, 4–10 m (13-33 ft) in height” as potential SWFL breeding habitat. The two types included as moderately suitable are both dense (≥50 percent cover; i.e., ”d”) and include a layer 4–10 m (13–33 ft) in height.

The “t” qualifier (i.e., “tall”) was added to the SC5d vegetation type (dense saltcedar stands averaging 5 to 15 ft in height) in 2021 based on observation that, over the years, territories were commonly located within this type. It was assumed that territories detected in SC5d stands were using the upper height range of that type (per Sogge et al. 2010), but the existing mapping criteria did not account for this apportionment. To further explore the assumption, Hink and Ohmart mapping protocol was modified to separate the height ranges into 5-12 ft (original SC5d) and 12-15 ft (SC5dt) in this type of saltcedar monoculture only. As expected, a much higher percentage of territories fell in SC5dt vegetation types (2.7 percent) than in SC5d (0.7 percent) from 2018 to 2021. Further examination in 2021 also found that although SC4d stands meet habitat standards, SWFLs were seldom occupying that vegetation type.

Hence, SWFL breeding habitat suitability classifications were again modified in 2021 to eliminate saltcedar monocultures from suitable habitat classifications. Although some saltcedar monocultures appear to provide suitable breeding habitat, this vegetation type is most likely used because of its high availability across the landscape, and in turn, less availability of high-quality native habitat, not necessarily because it is sought out. The habitat where SWFL territories were detected and the availability of that habitat across the mapped landscape suggests that SWFLs still prefer native and mixed riparian vegetation for breeding.

The inclusion of SC/SC3d and SC4d vegetation types as moderately suitable habitat types in 2016 affects comparisons of habitat to other vegetation maps in which all monotypic saltcedar vegetation types were classified as “unsuitable” (2006-2012 and 2018-2021) and in which

SC/SC3d and SC4d were considered “moderately suitable” (2016). Figure 5 shows the number of acres classified as suitable habitat (i.e., suitable and moderately suitable) over all mapping periods by reach. The percentage above each column in the graph represents the percent suitable habitat out of all potential habitat (i.e., suitable, moderately suitable, and unsuitable) in that reach. *On figure 5, the number of acres presented in the 2016 mapping and modeling report (Siegle and Ahlers 2017) were revised to exclude saltcedar monocultures from the suitable habitat classification, resulting in values that are constant and therefore comparable over time.*



	Belen*	Sevilleta/ La Joya Reach	San Acacia Reach	Escondida Reach	Bosque del Apache Reach	Tiffany Reach	San Marcial Reach
2008		796	253	335	539	274	4208
2012	1103	859	86	624	917	537	4512
2016	2154	824	365	789	701	571	4506
2021	1548	449	297	440	837	336	4632

Figure 5.—The number of acres of suitable and moderately suitable SWFL habitat mapped in 2008, 2012, 2016, and 2021 by river reach. The percentage associated with each column is the percent of suitable and moderately suitable habitat out of all potential habitat.

The vast majority of suitable habitat was found within the San Marcial Reach of the Rio Grande (see figure 5). San Marcial is the southernmost and furthest downstream of all reaches included in mapping, located immediately upstream and within the delta of Elephant Butte Reservoir. There were 4,632 acres of suitable and moderately suitable SWFL habitat mapped within this reach in 2021, far beyond all other reaches combined (although San Marcial is also larger in area than any of the other reaches). The development of relatively high-quality habitat in the San Marcial Reach can be attributed to declining

reservoir levels, which exposed soils and provided moist sites for willow to establish. The San Marcial Reach was followed by the Belen Reach (1,548 ac) and the Bosque del Apache (837 acres) in providing suitable breeding habitat for SWFLs (see figure 5).

When comparing the amount and percentage of suitable habitat since 2008, all reaches except for the Sevilleta/La Joya Reach generally increased. From 2016 to 2021, the amount of suitable habitat decreased in most reaches. There is a possibility that revisions to suitability criteria had some effect on results, however, as discussed below, other factors likely contributed to this decrease.

The suitability model revisions caused a minor shift in the proportion of suitable habitat versus unsuitable vegetation types. Prior to the revision, 48 percent of vegetation types detected were classified as suitable (i.e., suitable and moderately suitable) and 52 percent were considered unsuitable. With revisions applied in 2021, 51 percent of vegetation types detected were classified as suitable and 49 percent were unsuitable, although this only represents the number of types, not the acreage on the ground. Probably the greatest change in criteria was eliminating vegetation types that include only Russian olive alone or Russian olive with saltcedar from moderately suitable to unsuitable unless they fell under Type 4d communities (see table 3). For other community types, the criteria require willow to also be in combination with either of the two species. Therefore, the largest effect of the revision was in areas where Russian olive was most common.

Table 9 provides an analysis that examines potential causes for decreases in suitable habitat in 2021. For clarification, the difference in total area between years in Belen, Sevilleta/La Joya, San Acacia, and Escondida Reaches were due to a more exact assessment of private property in 2021, which excluded more acreage from mapping. In the San Marcial Reach, survey site boundaries adjacent to the reservoir were revised in 2020 when the channel in San Marcial was realigned, decreasing the mapped area.

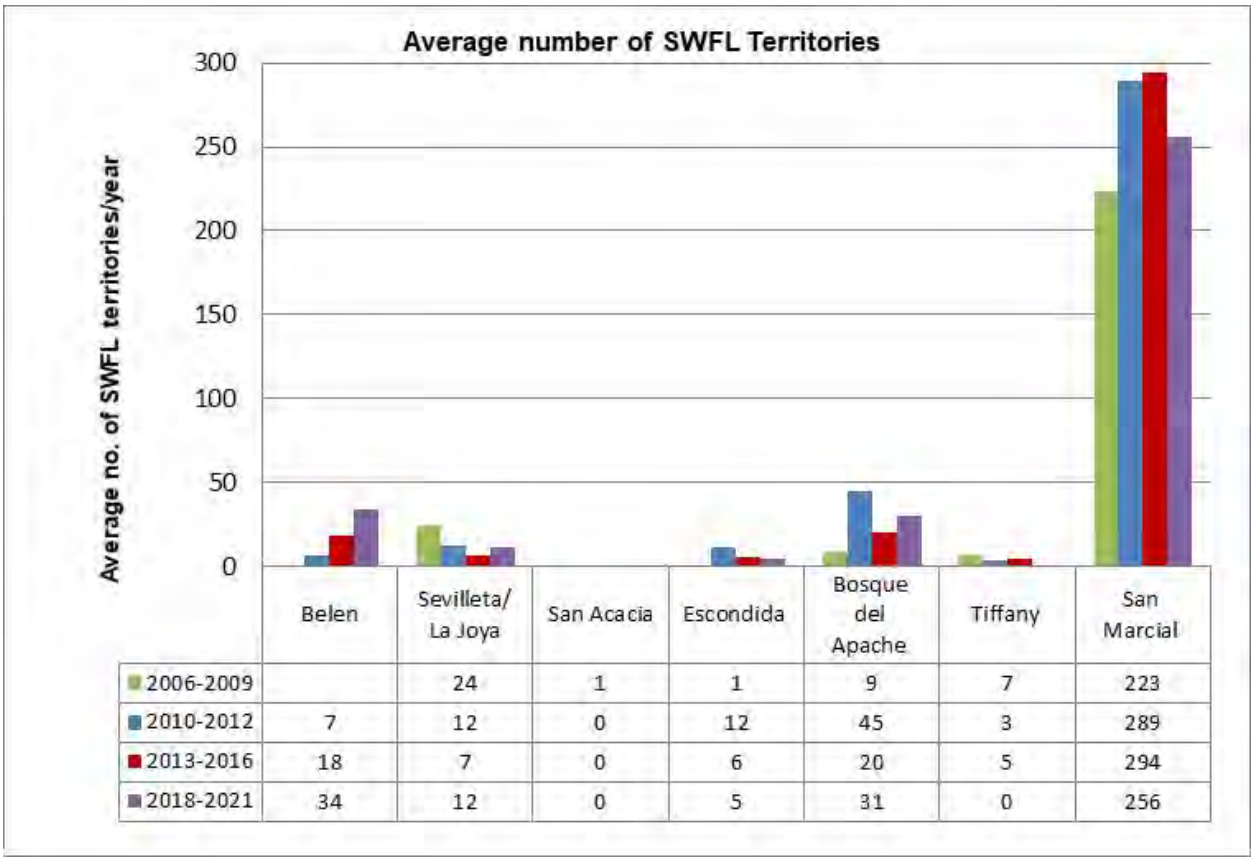
Table 9.—Comparison of available habitat from 2016 to 2021 versus the number of acres of Russian olive/saltcedar vegetation types by reach

Reach	2016				2021				Percent difference in habitat 2016 to 2021	RO/SC acres[2]
	Available habitat[1]	Non-habitat	Total acres	% Available habitat	Available habitat	Non-habitat	Total acres	Percent available habitat		
Belen	6,023	1,137	7,160	84.1	5,881	1,257	7,138	82.4	**-1.7**	**248**
Sevilleta/La Joya	2,840	881	3,721	76.3	2,896	684	3,580	80.9	**4.6**	**120**
San Acacia	2,063	744	2,807	73.5	2,349	418	2,767	84.9	**11.4**	**66**
Escondida	4,189	2,058	6,247	67.1	4,372	1,572	5,944	73.6	**6.5**	**141**
Bosque del Apache	2,978	1,007	3,985	74.7	3,033	951	3,984	76.1	**1.4**	**33**
Tiffany	3,180	594	3,774	84.3	2,782	990	3,772	73.8	**-10.5**	**0**
San Marcial	16,073	6,282	22,355	71.9	15,337	6,562	21,899	70.0	**-1.9**	**10**

[1] Available habitat = suitable, moderately suitable, and unsuitable habitat.
[2] Approximate number of acres of Russian olive-saltcedar types converted from moderately suitable to unsuitable in 2021.

The percentage of available habitat, defined as all vegetated areas (i.e., suitable, moderately suitable, and unsuitable habitat) decreased in the Belen, Tiffany, and San Marcial reaches from 2016 to 2021, which may have correlated with the decreases in the amount of suitable habitat in Belen and Tiffany Reaches in 2021. Both of these reaches had recent fires (increasing the amount of non-habitat), which was a probable cause. To examine the potential reasons for decreases in the other reaches, the number of acres that shifted from moderately suitable to unsuitable due to model revisions to the Russian olive/saltcedar types in 2021 was calculated (see table 9). The Belen, Sevilleta, and Escondida Reaches had the highest number of these vegetation types (248, 120 and 141 acres, respectively, which is still small compared to total acres mapped). Subsequently, there may have been some effect due to revising the suitability criteria within these reaches, although at least some of the loss of suitable habitat in the Belen Reach may have been related to recent burns and an overall drop in available habitat, as aforementioned. Likely more important, however, was that habitat deteriorated in general, a phenomenon that was observed in the field and in polygon mapping data. In 2021, there was evident die-off in the vegetation, apparently as a result of drought.

The average number of SWFL territories detected per mapping period by reach is shown on figure 6. When comparing territory numbers over time, trends were not conclusive because surveys in all reaches except Escondida were not complete in 2020 and 2021. The vast majority of suitable habitat and SWFL territories were found within the San Marcial Reach of the Rio Grande (see figure 5; figure 6). The suitability of this habitat for SWFLs was substantiated by an average of 256 territories documented per year from 2018 to 2021, again far more than in any of the other reaches in the study area. The number of territories in Belen Reach (34) and in the Bosque del Apache Reach (31) also correlated with the amount of moderately suitable and suitable habitat available (see figure 5; figure 6).



	Belen	Sevilleta/ La Joya	San Acacia	Escondida	Bosque del Apache	Tiffany	San Marcial
2006-2009		24	1	1	9	7	223
2010-2012	7	12	0	12	45	3	289
2013-2016	18	7	0	6	20	5	294
2018-2021	34	12	0	5	31	0	256

Figure 6.—Average number of Southwestern willow flycatcher territories detected per year from 2006 to 2009 (4-year average), 2010 to 2012 (3-year average), 2013 to 2016 (4-year average), and 2018 to 2021 (4-year average) by river reach.

Recommendations

Over the past 19-year period, portions of the Middle Rio Grande riparian corridor have been photographed, delineated and categorized as SWFL habitat. Some areas have experienced significant changes in structure, density, and species composition while other areas have been far more static, experiencing little or no change. In general, due to the SWFLs tendency to occupy young age classes (3-5 years) of developing riparian vegetation and the relatively short-lived nature of high-quality habitat, the habitat suitability model output has a limited application of 3 to 5 years. The MRG Biological Opinion requires that all suitable and potential flycatcher habitat be mapped and monitored at least once every 5 years (USFWS 2016).

Riparian areas subject to dynamic changes, such as those found within the conservation pool of Elephant Butte Reservoir or those within aggraded river reaches such as the Bosque del Apache NWR, should be considered as priority areas for future photography, mapping, and modeling efforts. As was observed between the 2008 and 2021 mapping projects, climatic conditions can lead to relatively rapid changes in vegetation as well.

In summary, the following actions are recommended:

1. Conduct vegetation mapping at a 5-year minimum as outlined in the MRG Biological Opinion.

2. Consider locations subject to dynamic changes in habitat conditions as priority areas for mapping projects based on availability of funding.

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Appendix A

Southwestern Willow Flycatcher Habitat Suitability and Major Plant Communities; Maps and Associated Tables

Belen Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	650	9	377	6
Moderately suitable habitat	898	13	306	5
Unsuitable habitat	4,333	60	646	11
Total habitat area	**5,881**	**82**	**1,329**	**22**
Non-habitat	548	8	-	-
River channel	709	10	-	-
Total area*	**7,138**	**100**	**-**	**-**

* Belen Reach also includes 29 acres unmapped private land (total 7,167 acres).

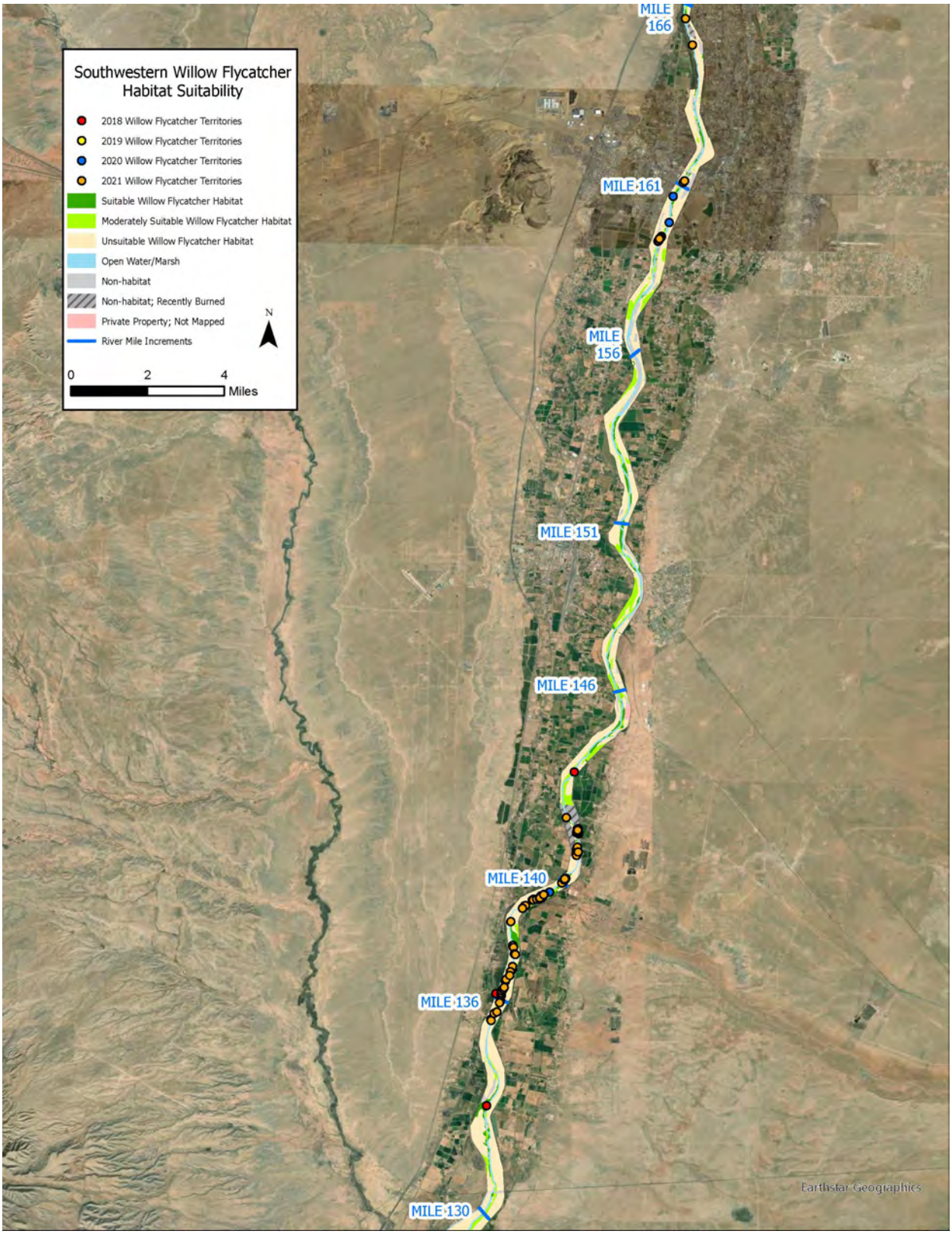
Acreage of plant communities within reach

Community type	Acres	Percentage of habitat
Native canopy/native understory	511	9
Native canopy/mixed understory	567	10
Native canopy/exotic understory	1,178	20
Mixed canopy/native understory	71	1
Mixed canopy/mixed understory	157	3
Mixed canopy/exotic understory	44	1
Exotic canopy/native understory	31	> 1
Exotic canopy/mixed understory	21	> 1
Exotic canopy/exotic understory	71	1
Native canopy	1,445	24
Mixed canopy	274	5
Exotic canopy	485	8
Native understory	466	8
Mixed understory	163	3
Exotic understory	397	7

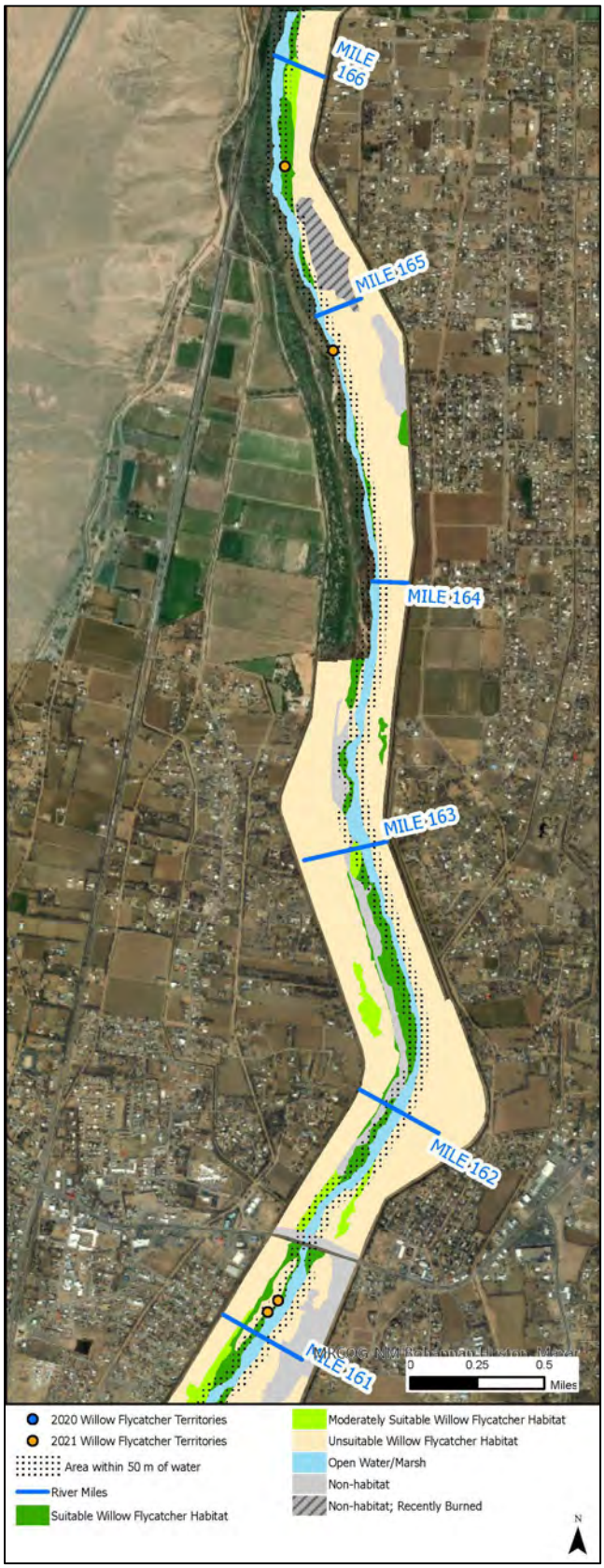
Southwestern willow flycatcher territories

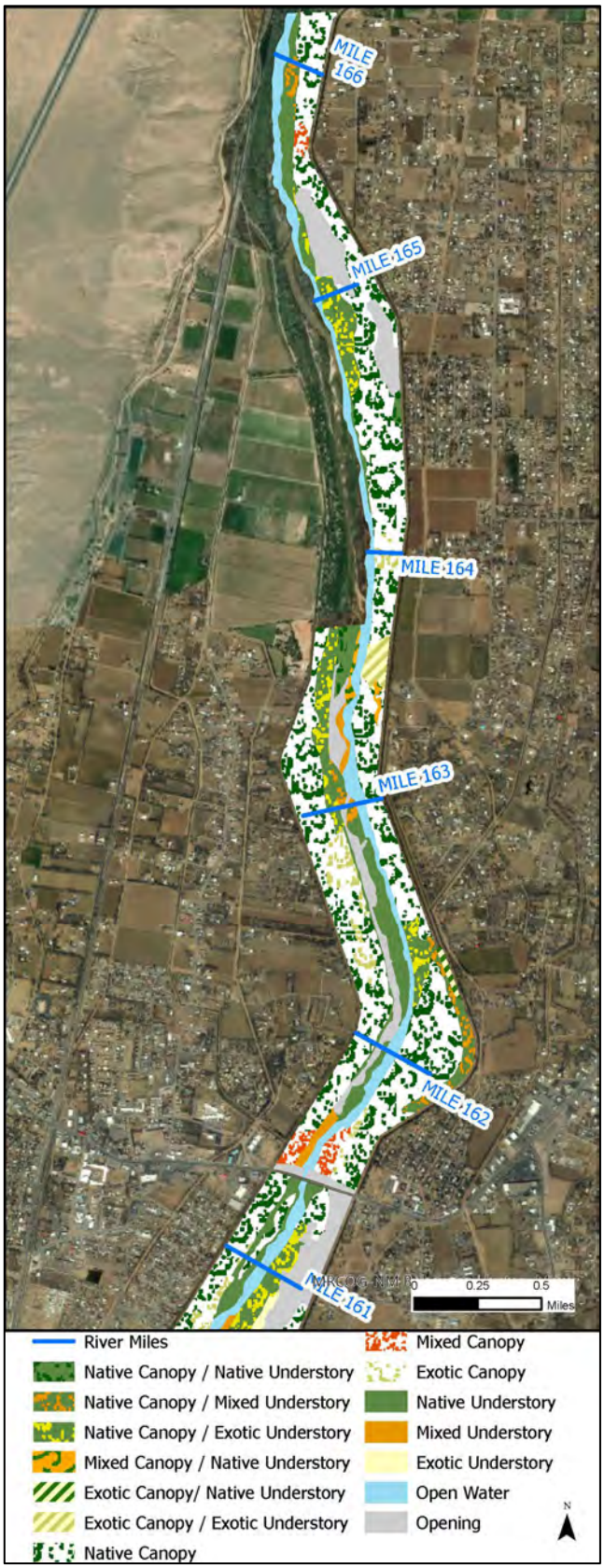
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018	3	17	20
2019	Not surveyed		
2020	5	20	25
2021	13	68	81

Belen Reach Maps

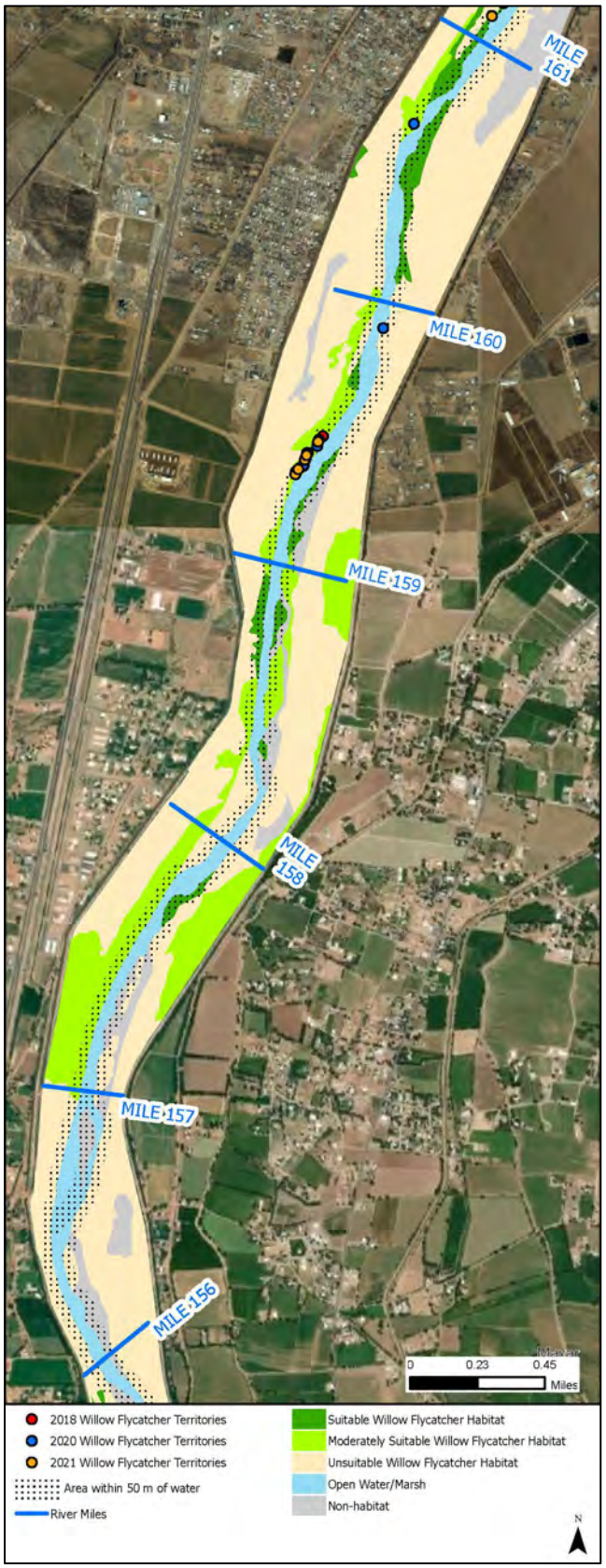


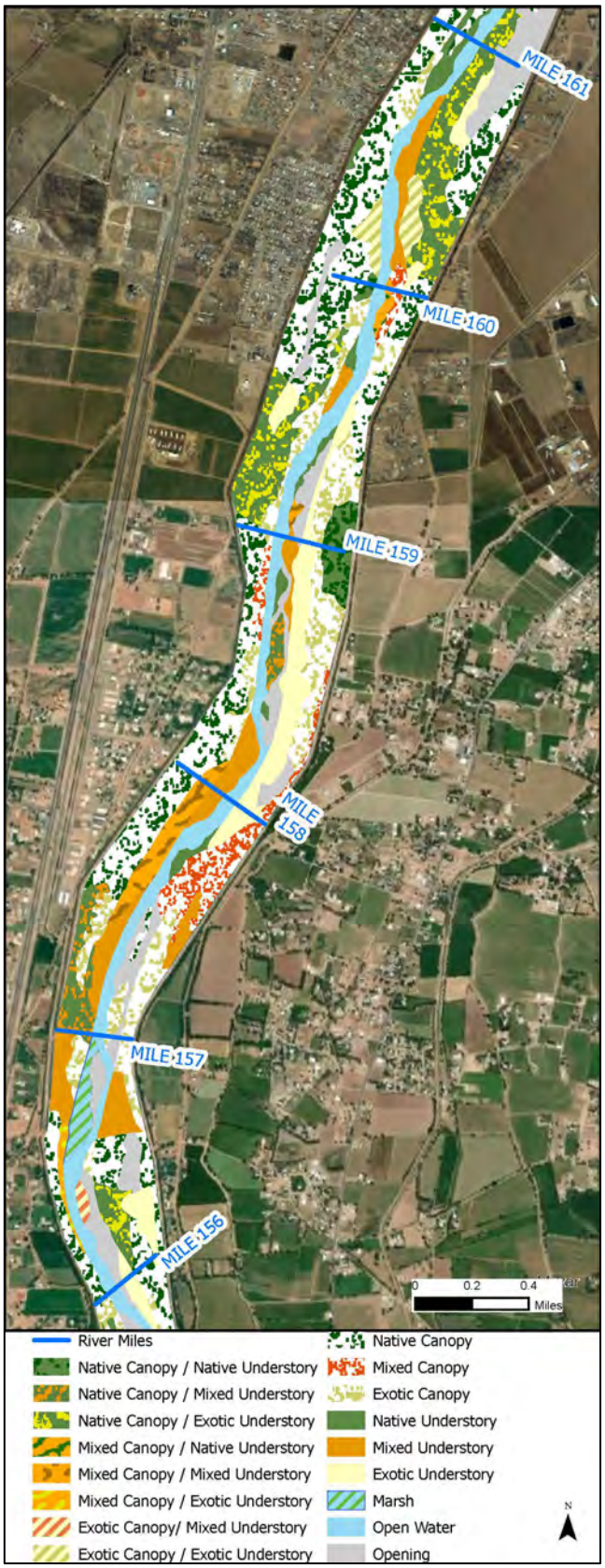
River Miles 161 to 166



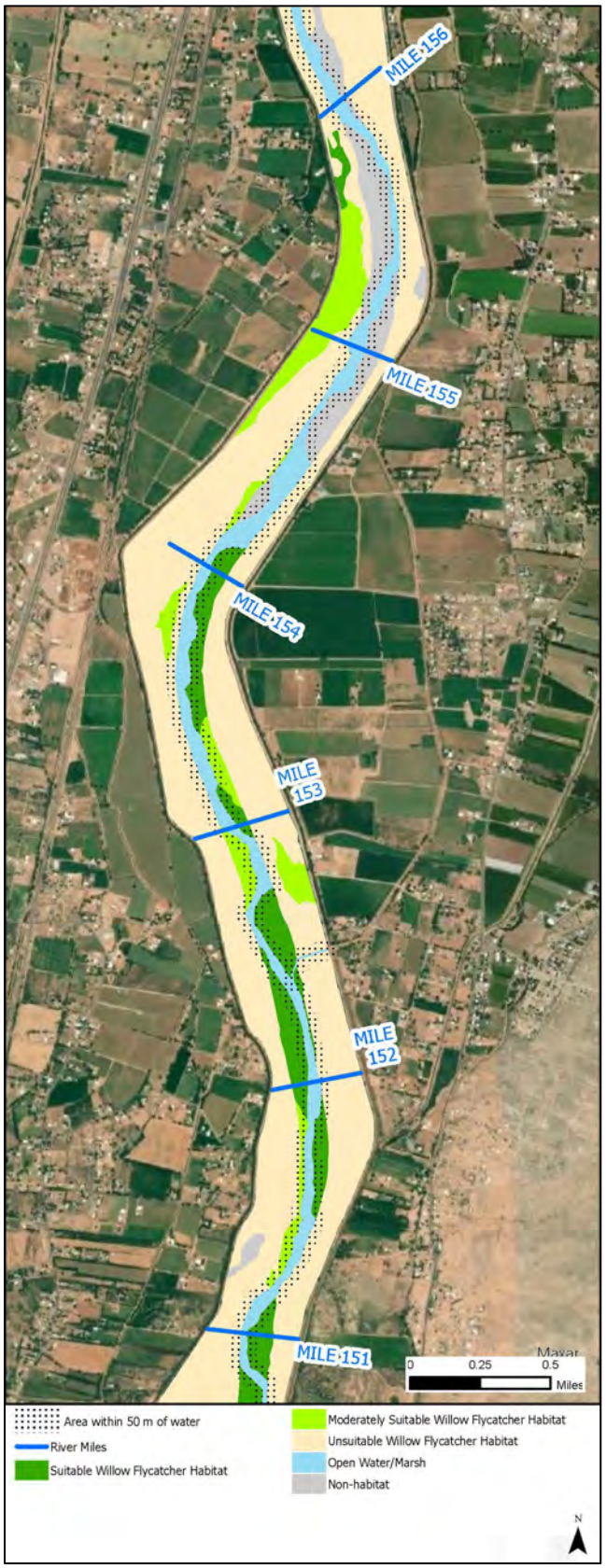


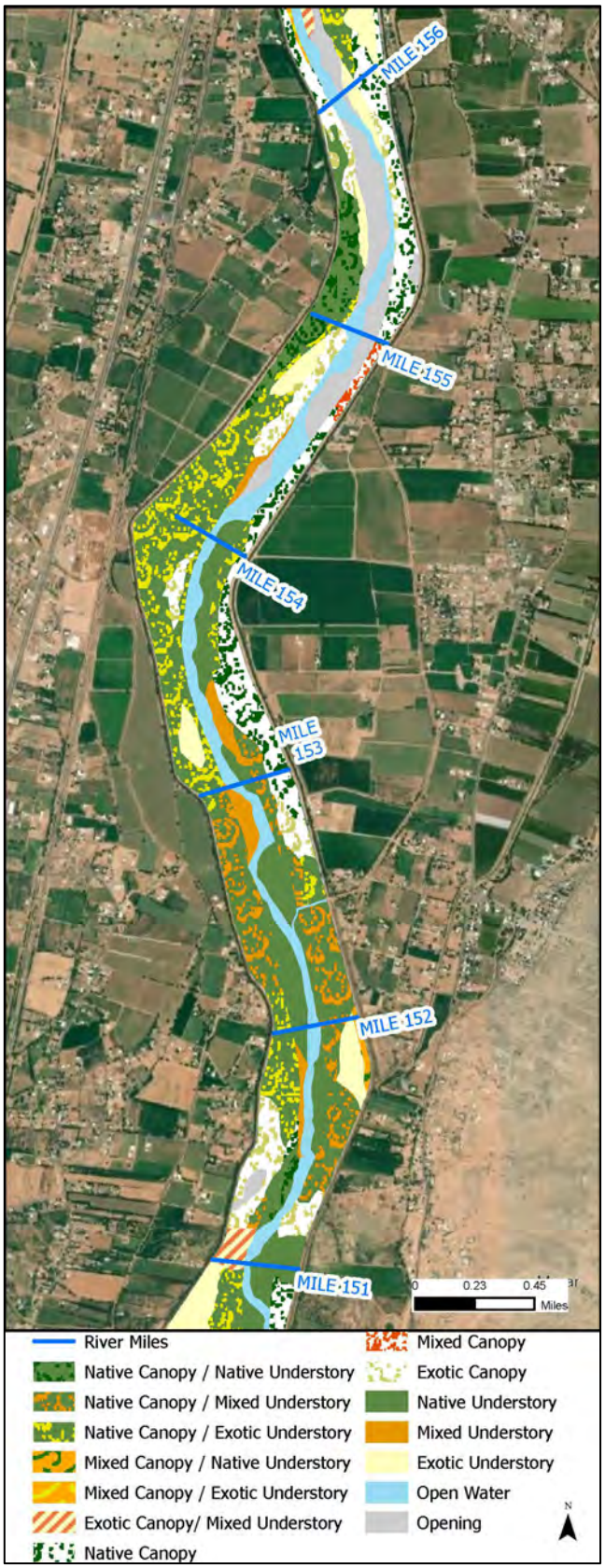
River Miles 156 to 161



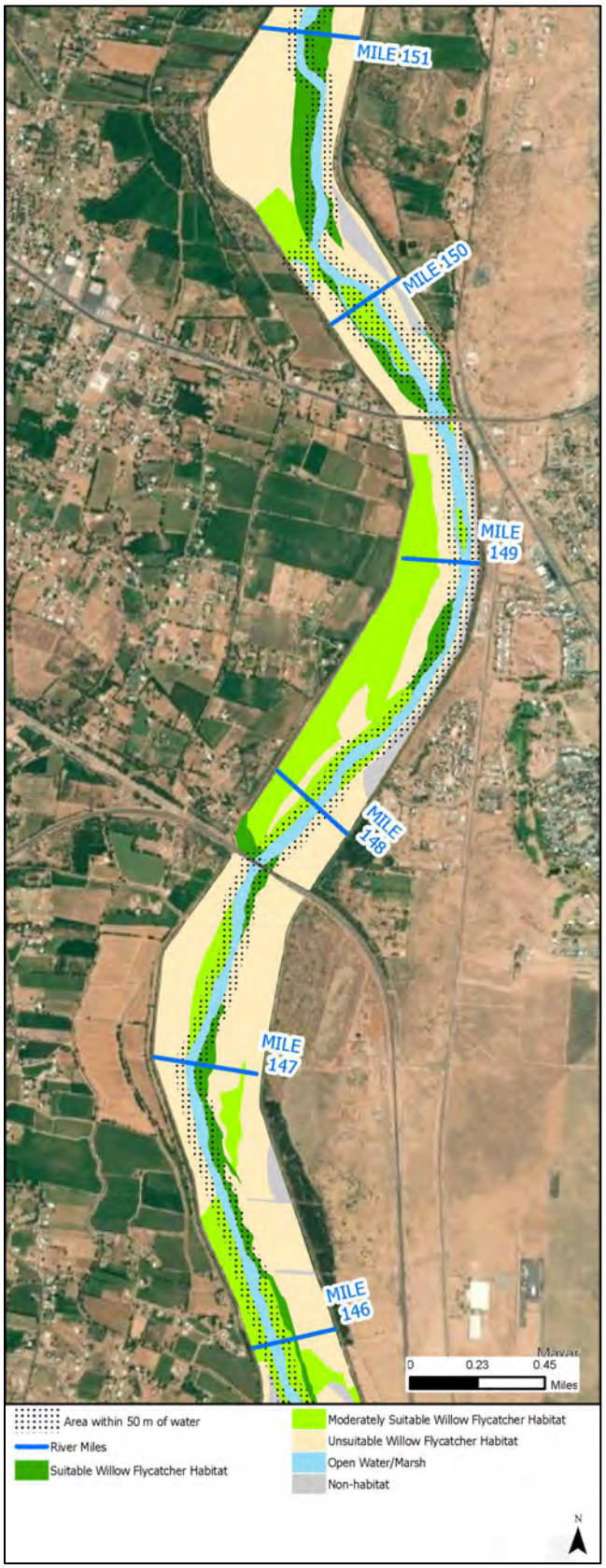


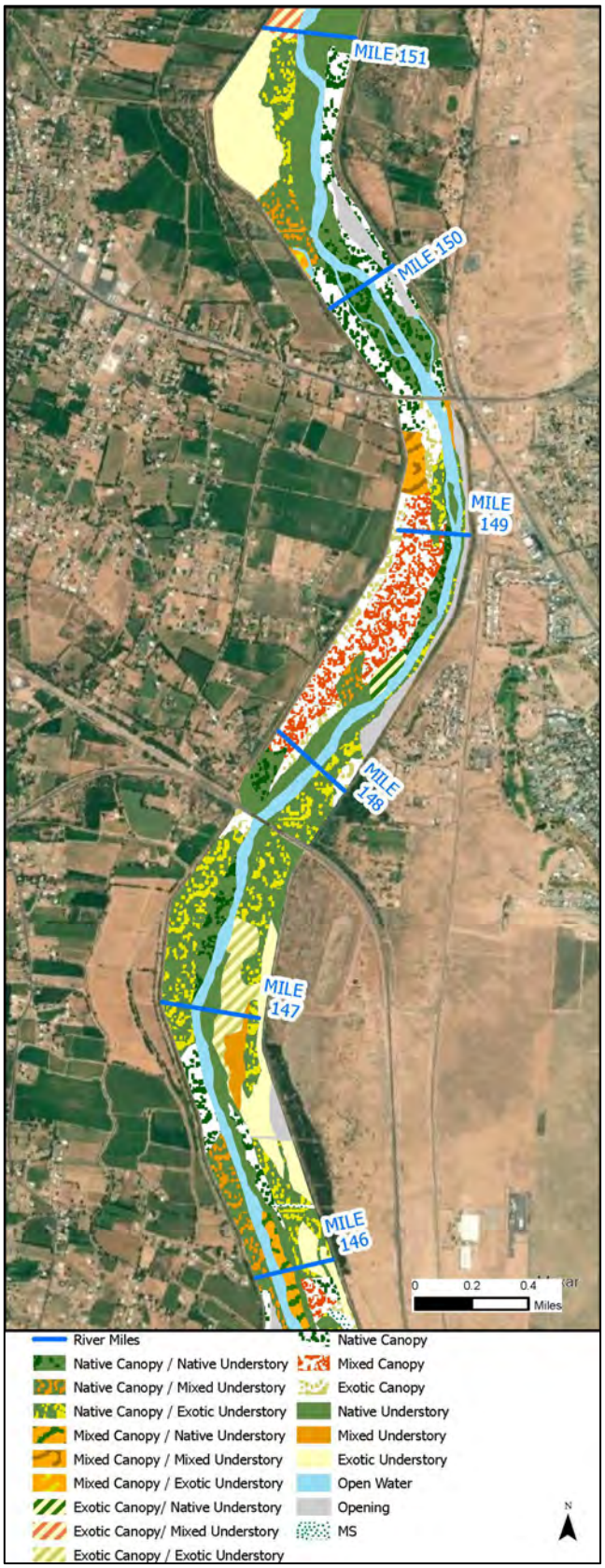
River Miles 151 to 156



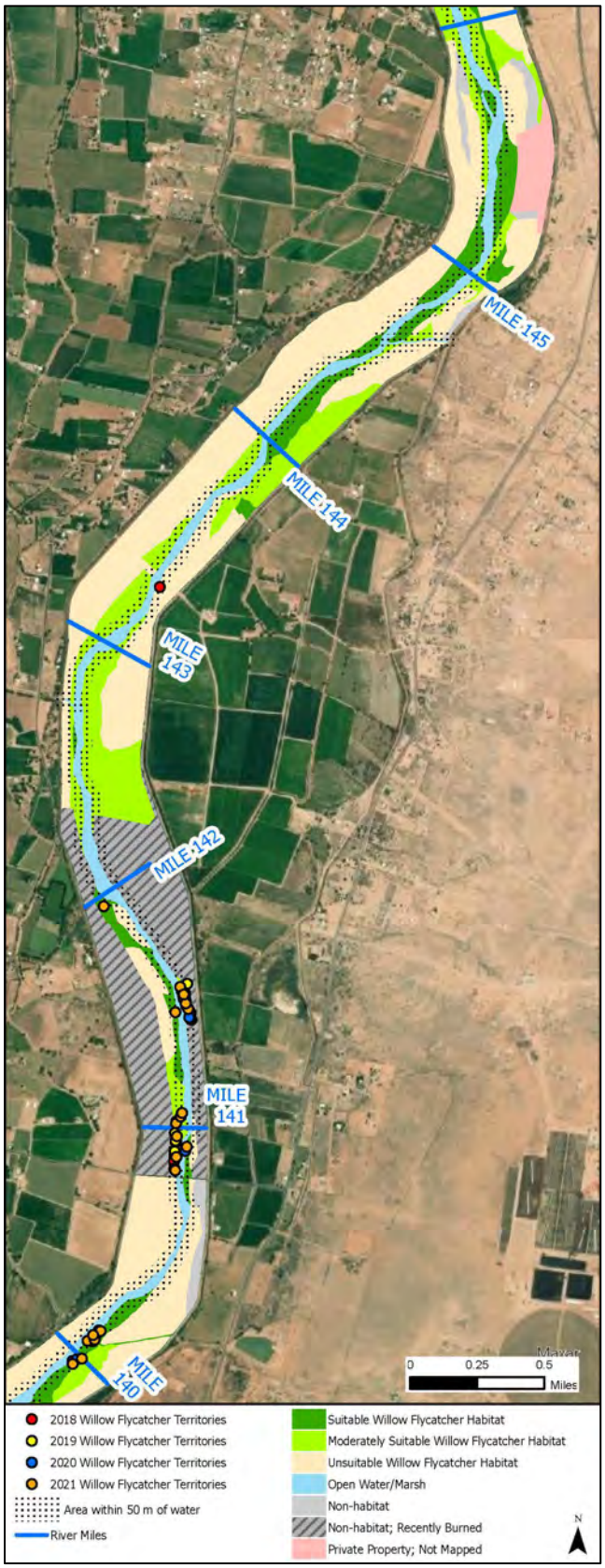


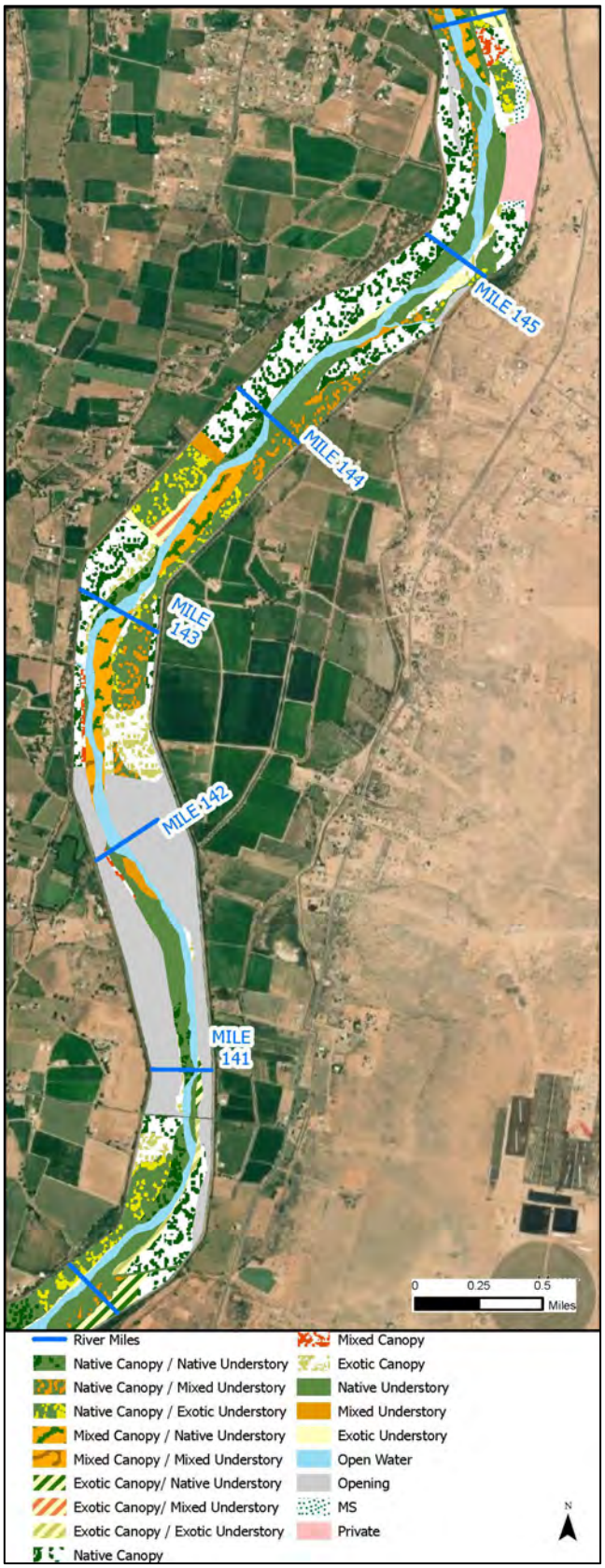
River Miles 146 to 151



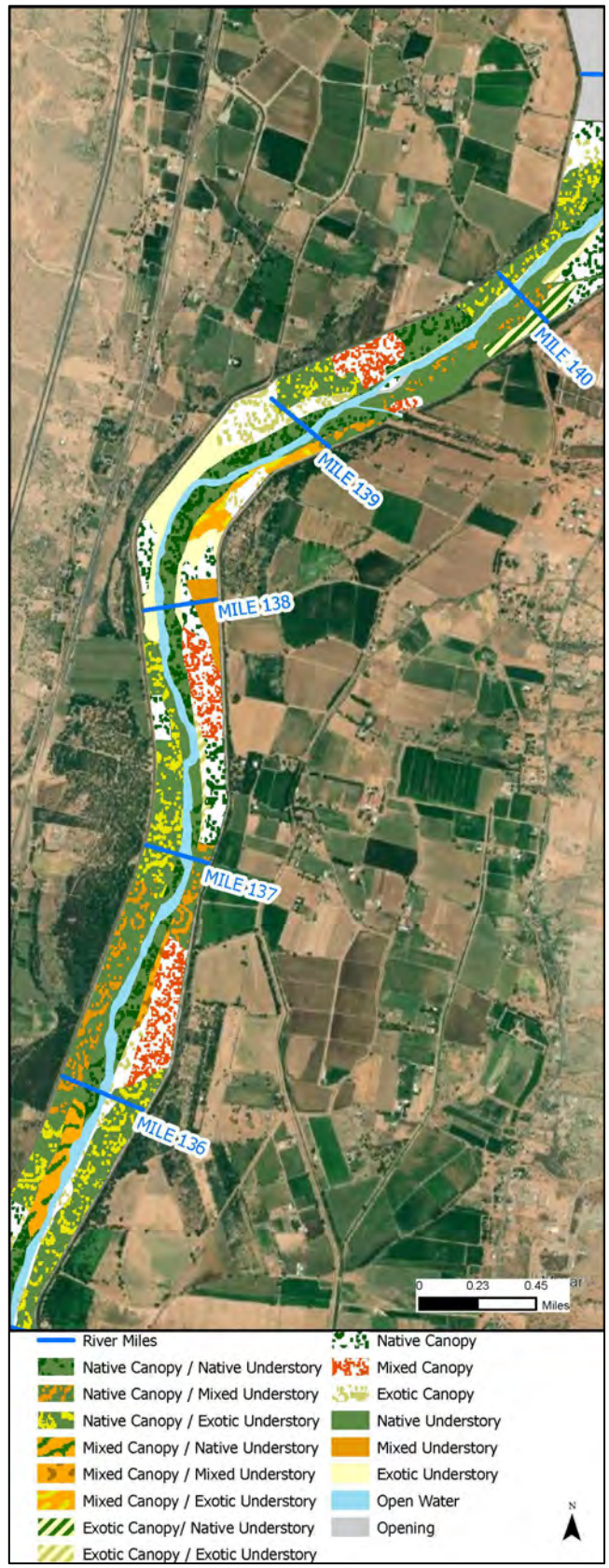


River Miles 140 to 146

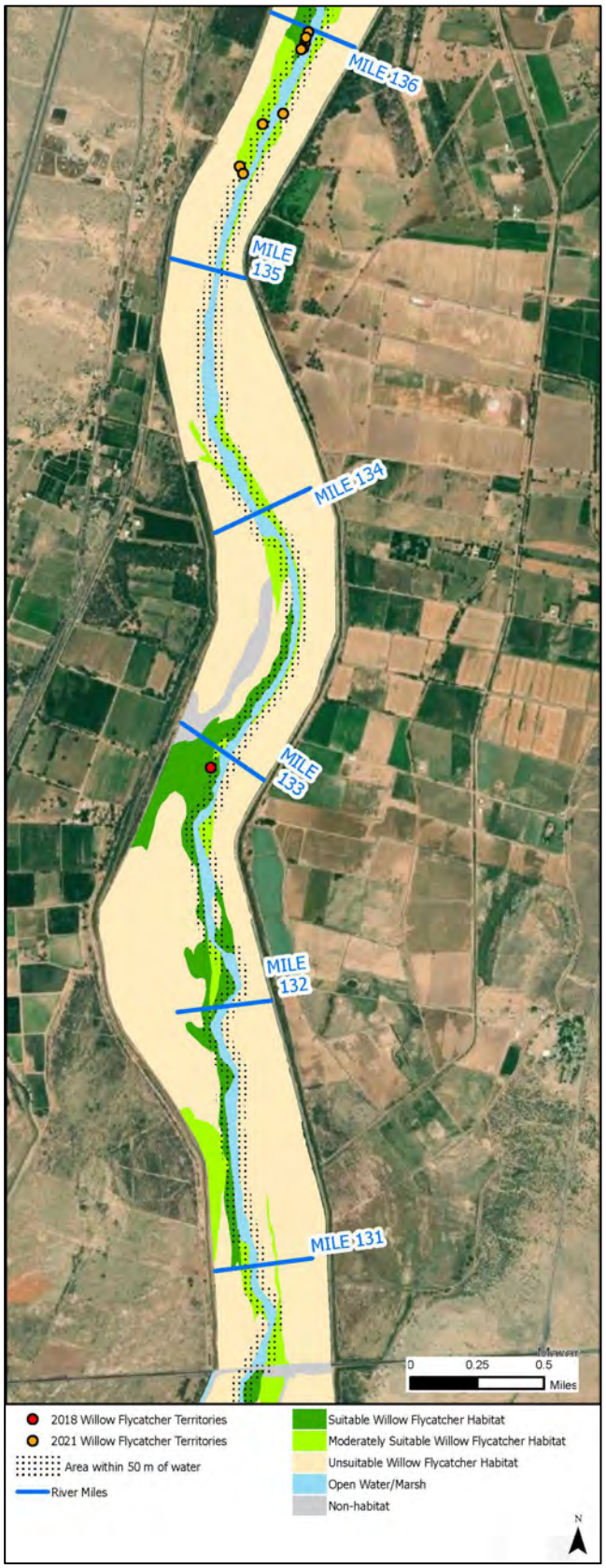


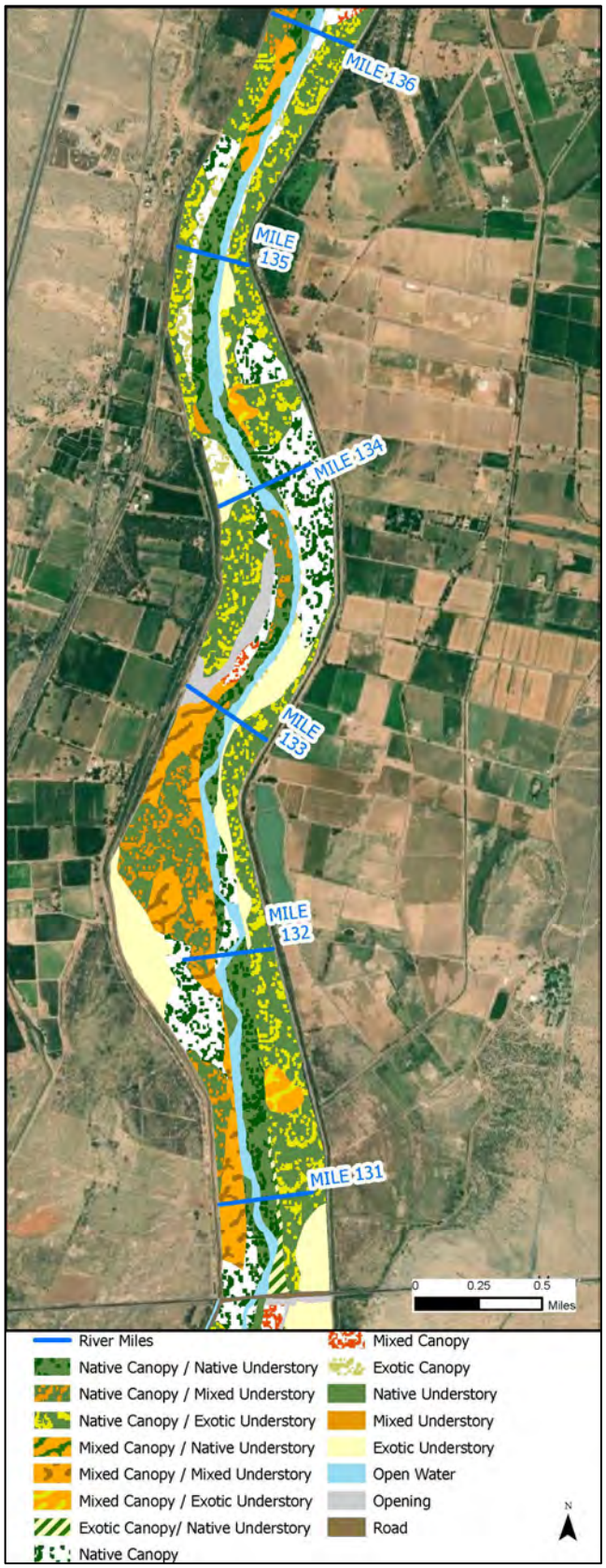


River Miles 136 to 140



River Miles 130.5 to 136





Sevilleta/La Joya Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	107	3	63	2
Moderately suitable habitat	342	10	166	6
Unsuitable habitat	2,447	68	293	10
Total habitat area	**2,896**	**81**	**522**	**18**
Non-habitat	371	10	-	-
River channel	313	9	-	-
Total area*	**3,580**	**100**	**-**	**-**

* Sevilleta Reach also includes 363 acres unmapped private land (total 3,943 acres).

Acreage of plant communities within reach

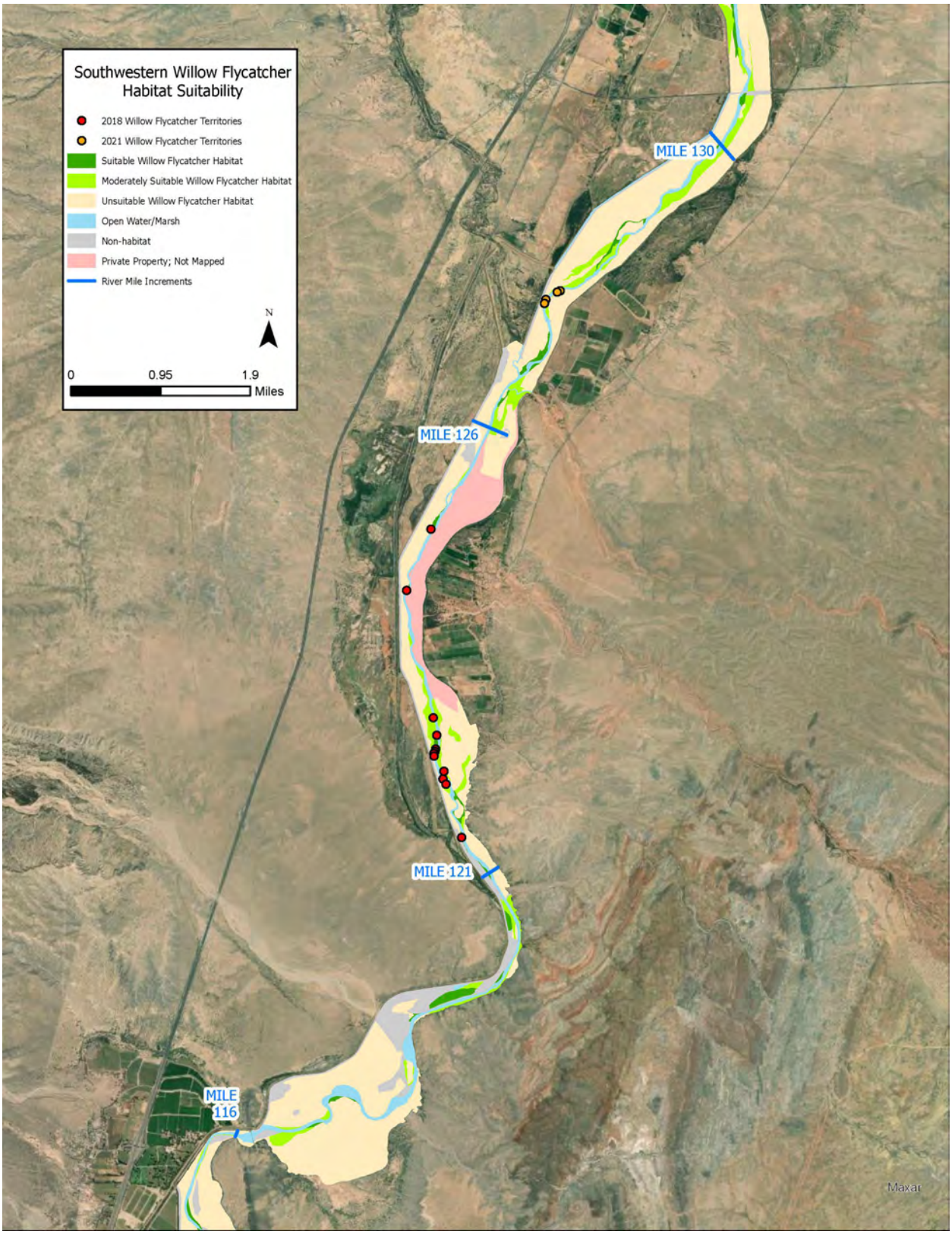
Community type	Acres	Percentage of habitat
Native canopy/native understory	518	9
Native canopy/mixed understory	567	10
Native canopy/exotic understory	1178	20
Mixed canopy/native understory	71	1
Mixed canopy/mixed understory	157	3
Mixed canopy/exotic understory	44	1
Exotic canopy/native understory	31	> 1
Exotic canopy/mixed understory	21	> 1
Exotic canopy/exotic understory	71	1
Native canopy	1445	24
Mixed canopy	274	5
Exotic canopy	485	8
Native understory	459	8
Mixed understory	163	3
Exotic understory	397	7

Southwestern willow flycatcher territories

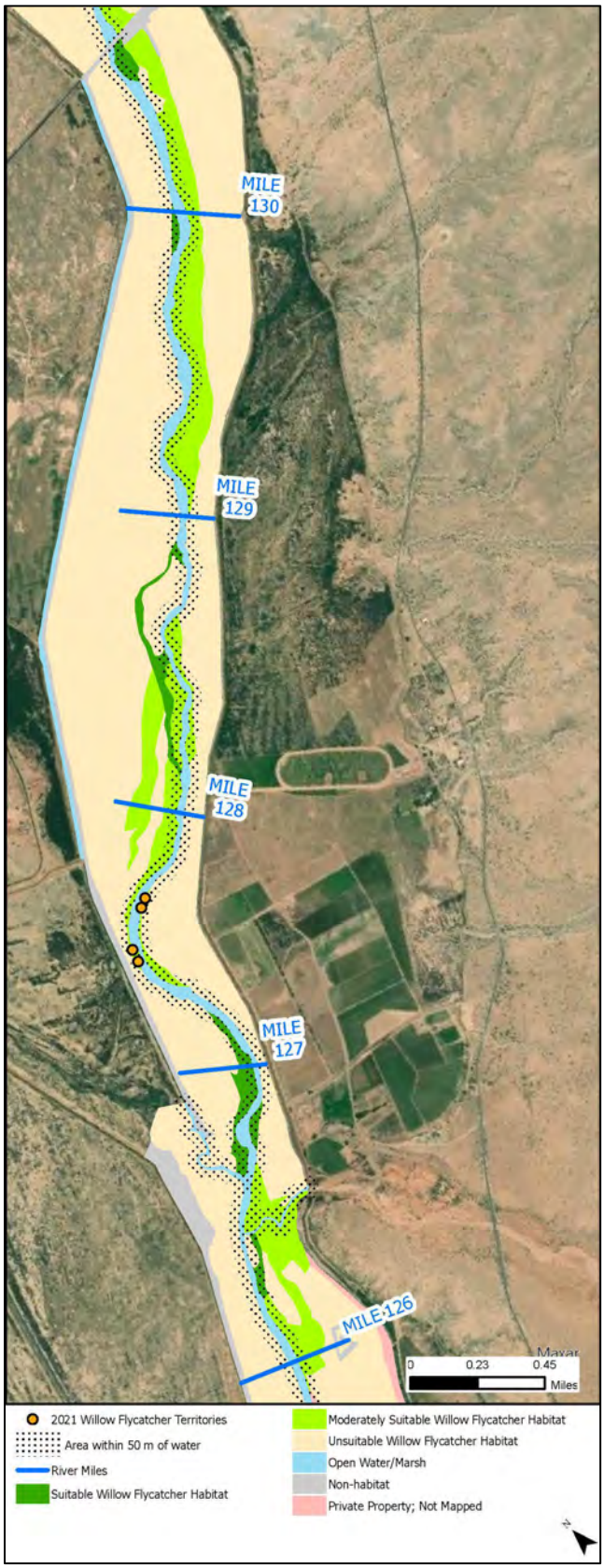
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018	5	7	12
2019	Not surveyed		
2020	Not surveyed		
2021*	1	3	4

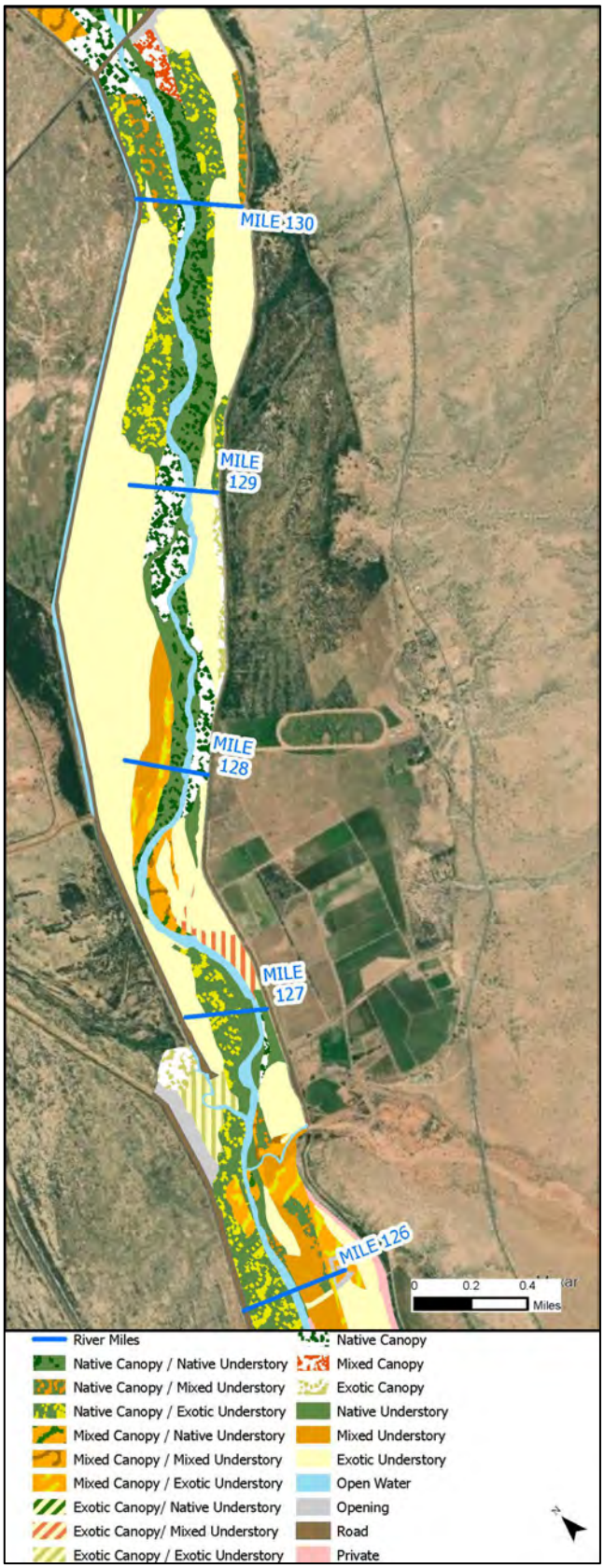
* Incidental detections only.

Sevilleta/La Joya Reach Maps

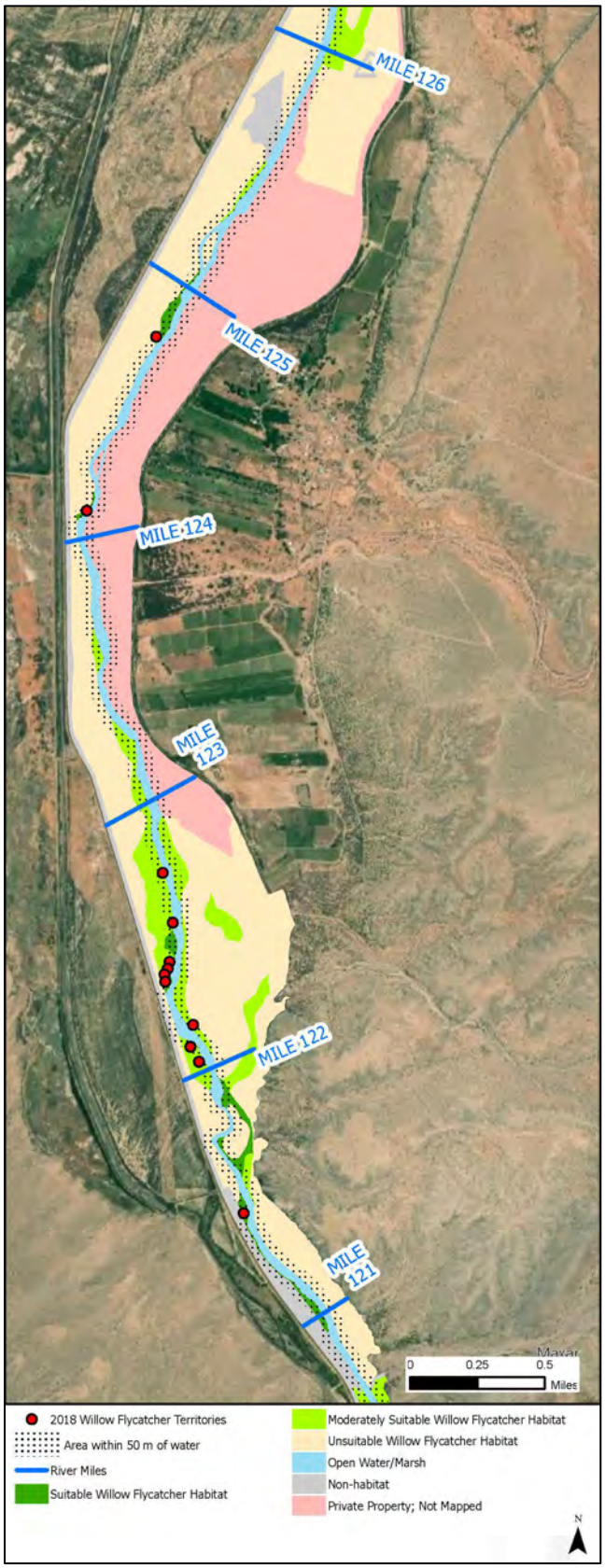


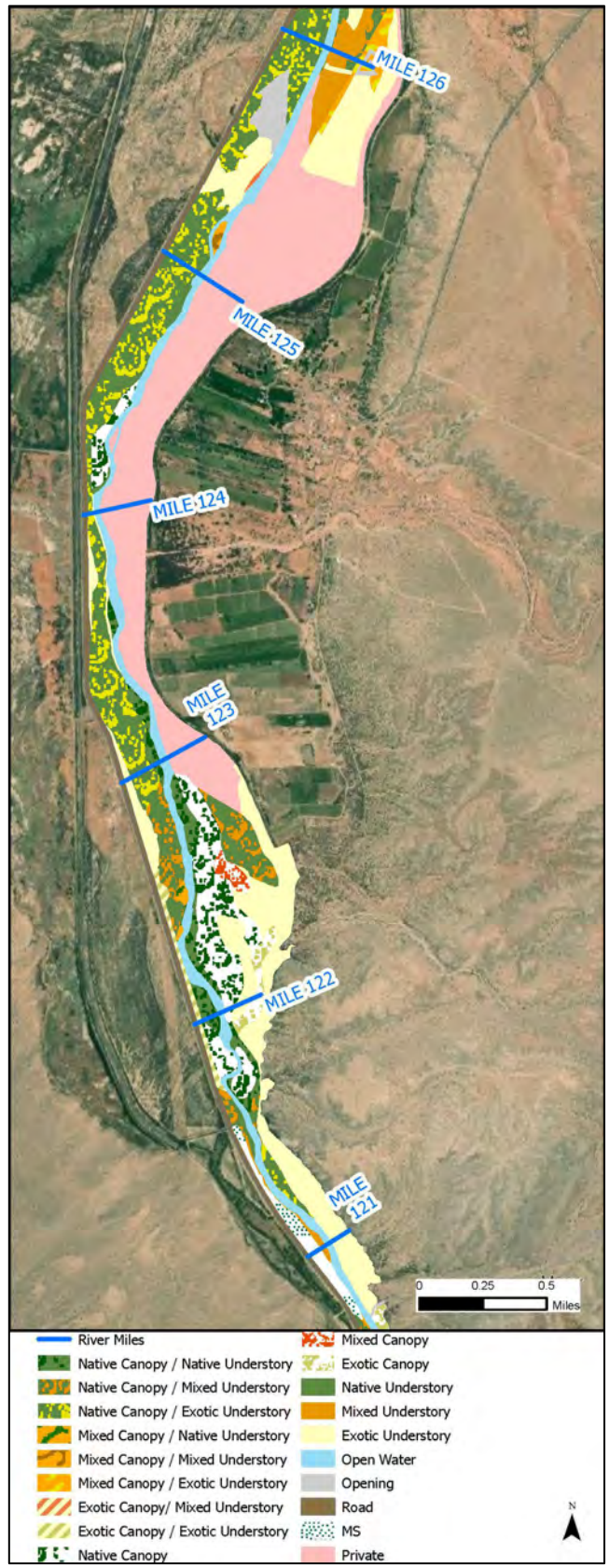
River Miles 126 to 130.5



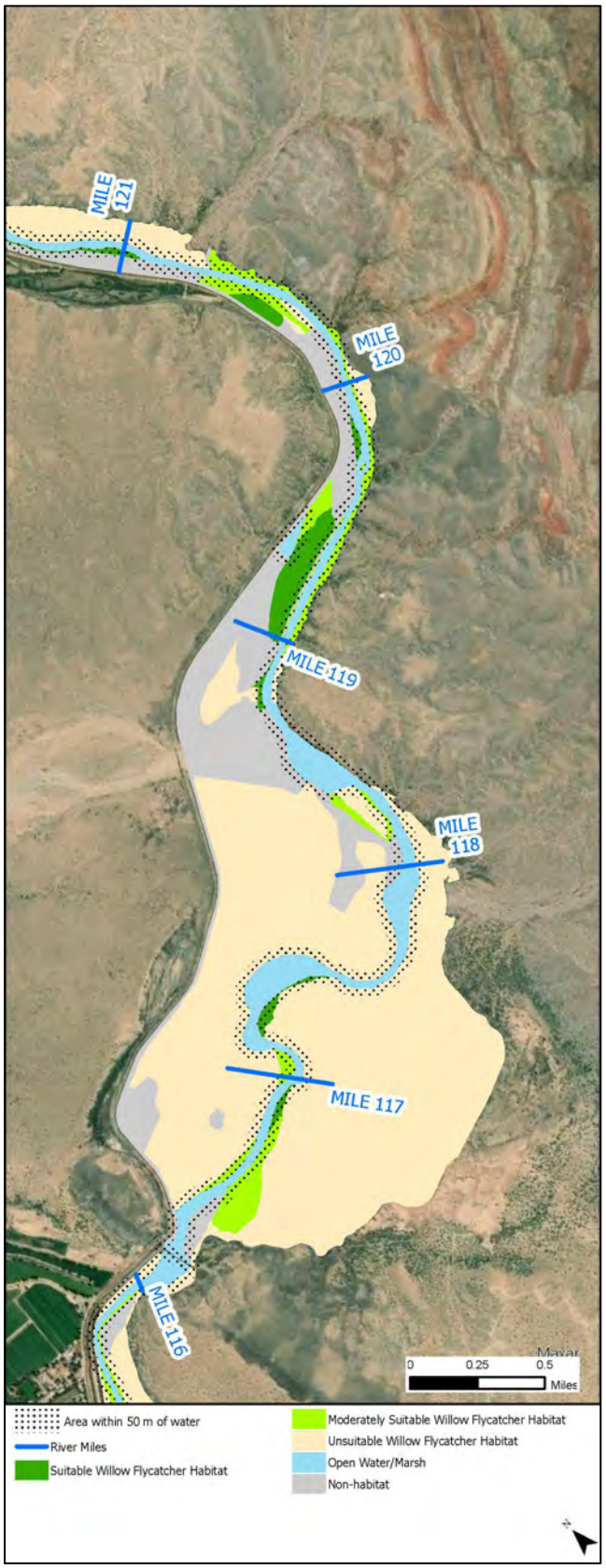


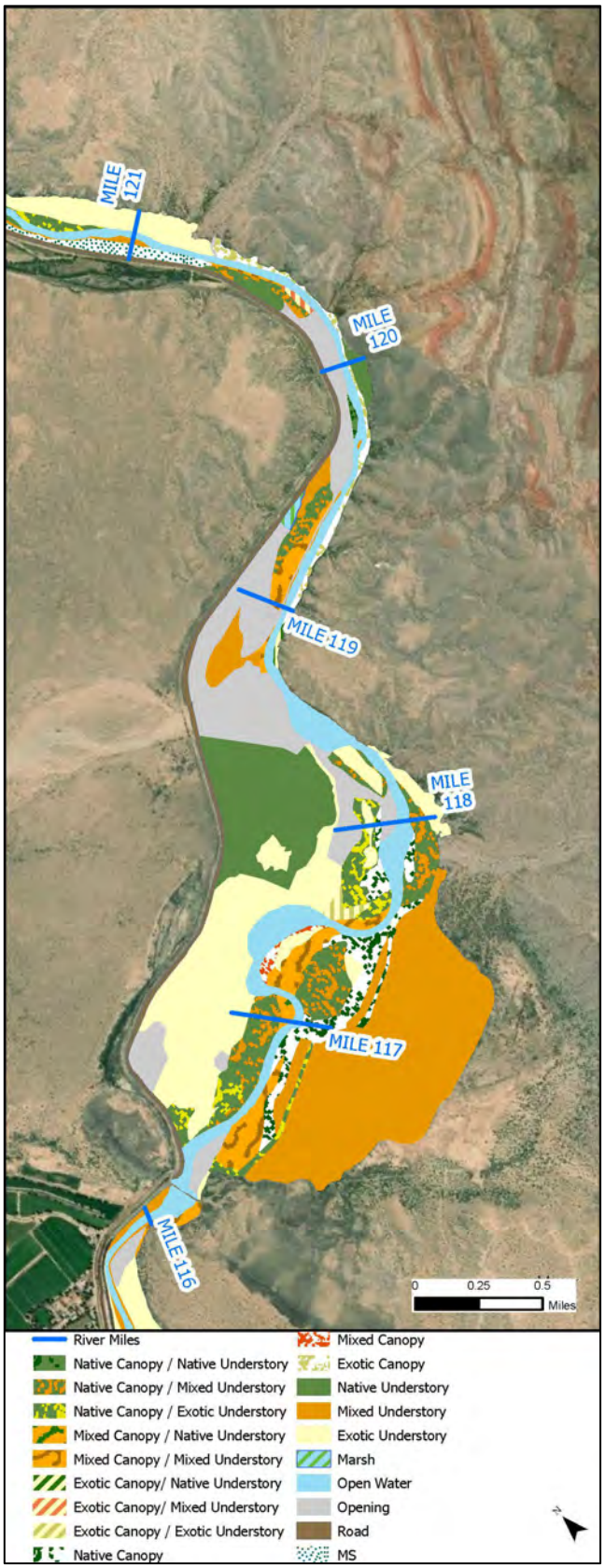
River Miles 121 to 126





River Miles 116 to 121





San Acacia Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	76	3	36	2
Moderately suitable habitat	220	8	106	4
Unsuitable habitat	2,045	74	276	12
Total habitat area	**2,340**	**85**	**418**	**18**
Non-habitat	182	6	-	-
River channel	244	9	-	-
Total area*	**2,767**	**100**	**-**	**-**

* San Acacia Reach also includes 42 acres unmapped private land (total 2,809 acres).

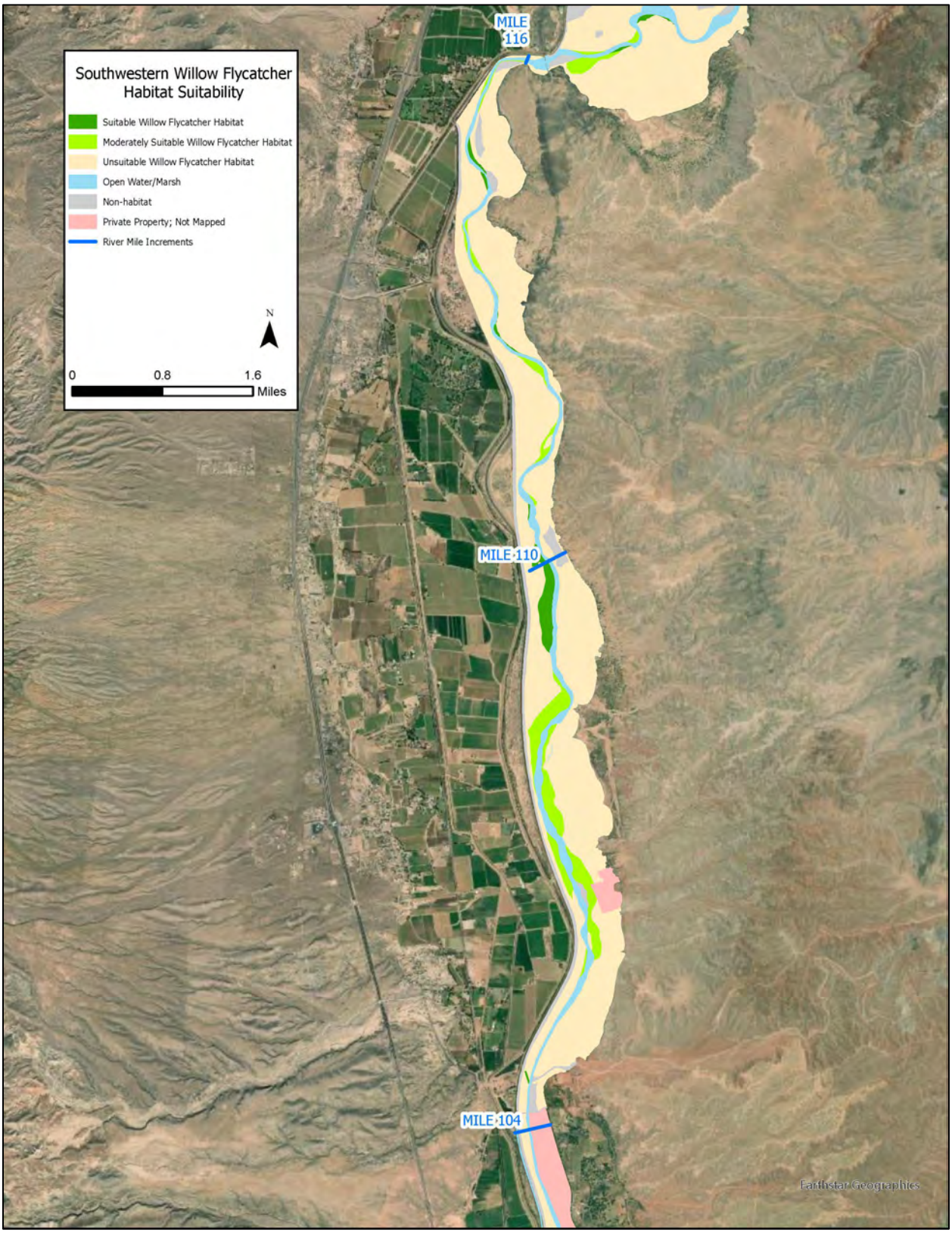
Acreage of plant communities within reach

Community type	Acres	Percentage of habitat
Native canopy/native understory	106	4
Native canopy/mixed understory	381	16
Native canopy/exotic understory	201	9
Mixed canopy/native understory	40	2
Mixed canopy/mixed understory	173	7
Mixed canopy/exotic understory	0	0
Exotic canopy/native understory	9	<1
Exotic canopy/mixed understory	0	0
Exotic canopy/exotic understory	0	0
Native canopy	68	3
Mixed canopy	178	8
Exotic canopy	45	2
Native understory	36	2
Mixed understory	396	17
Exotic understory	716	30

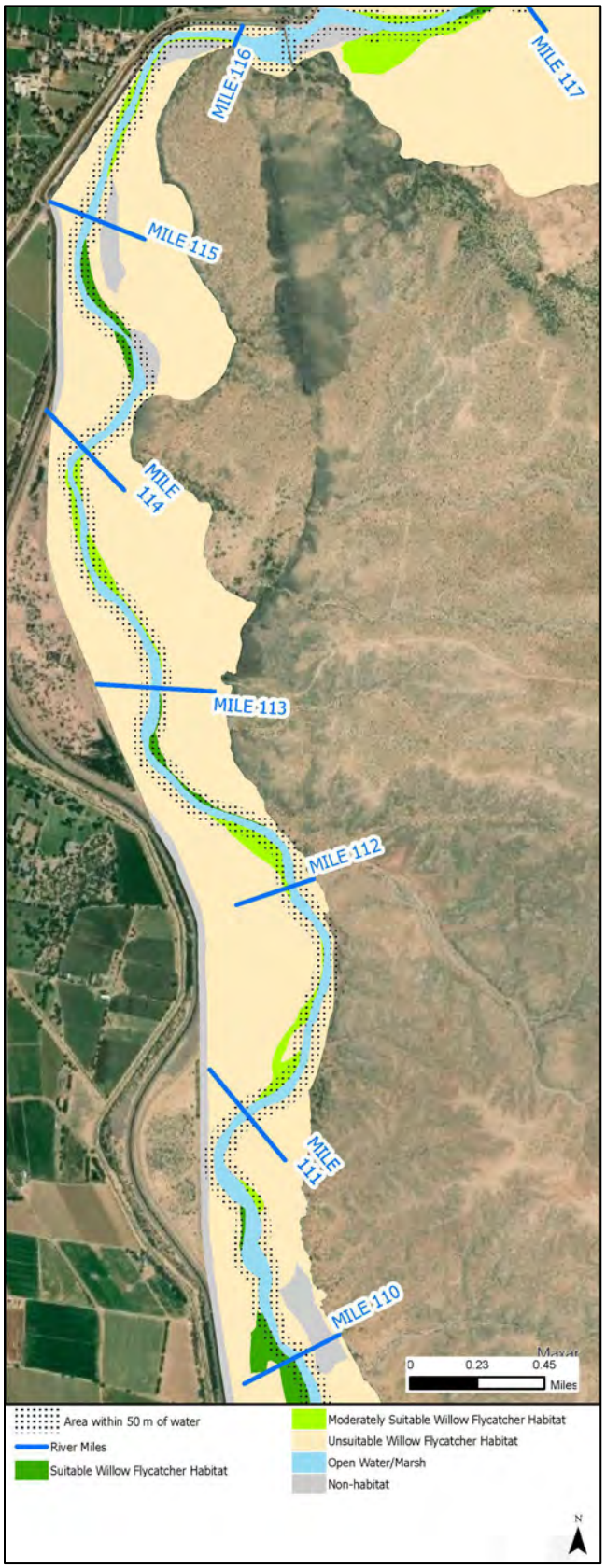
Southwestern willow flycatcher territories

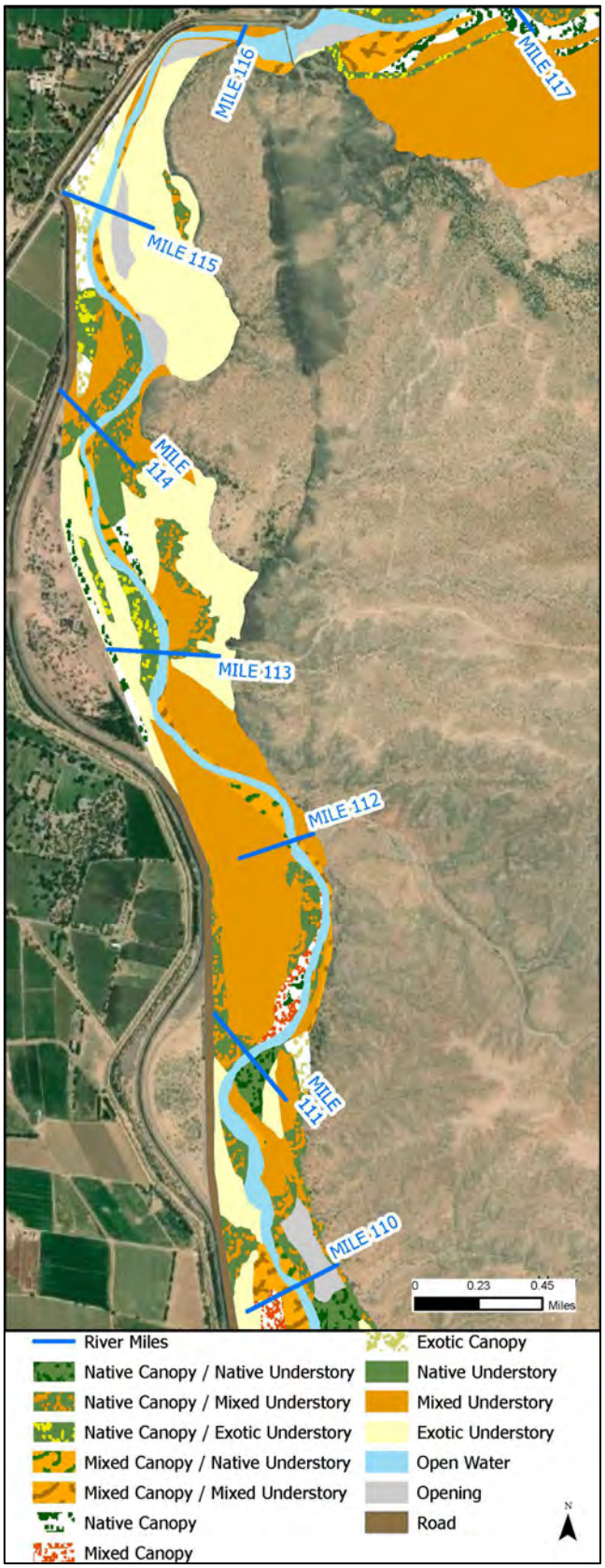
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018	0	0	0
2019	0	0	0
2020	Not surveyed		
2021	Not surveyed		

San Acacia Reach Maps

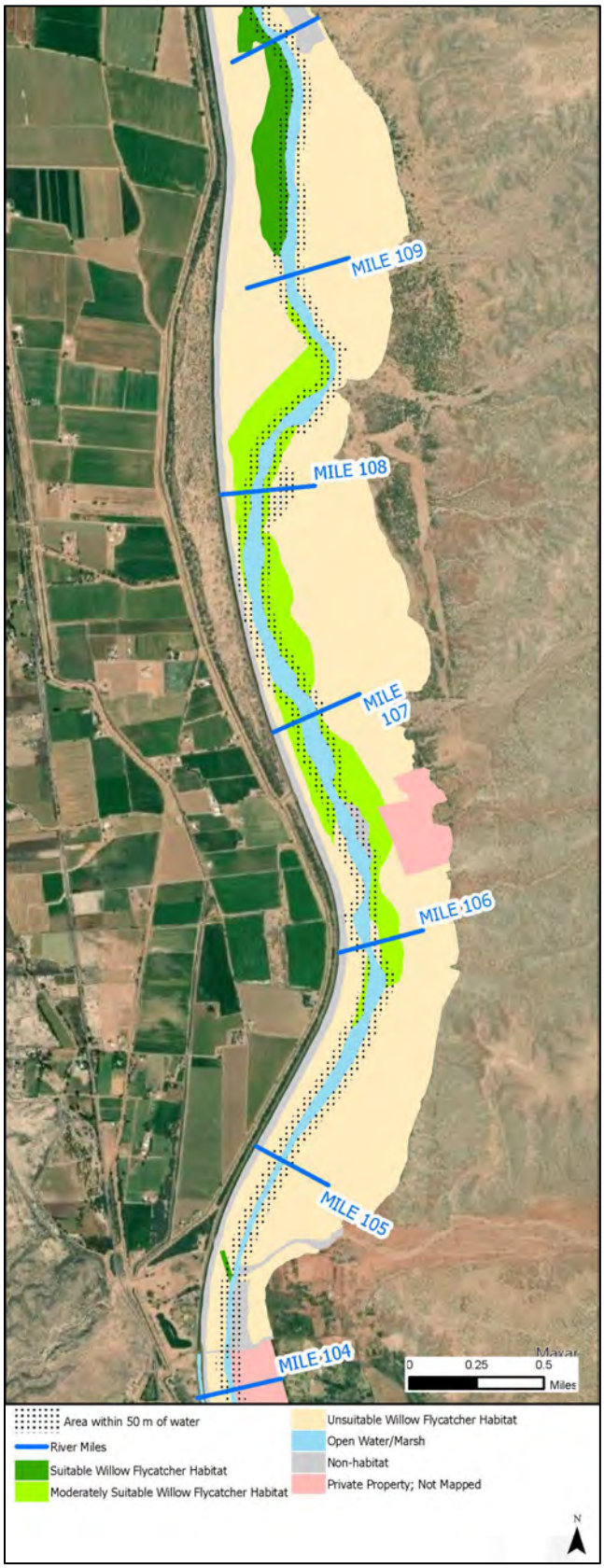


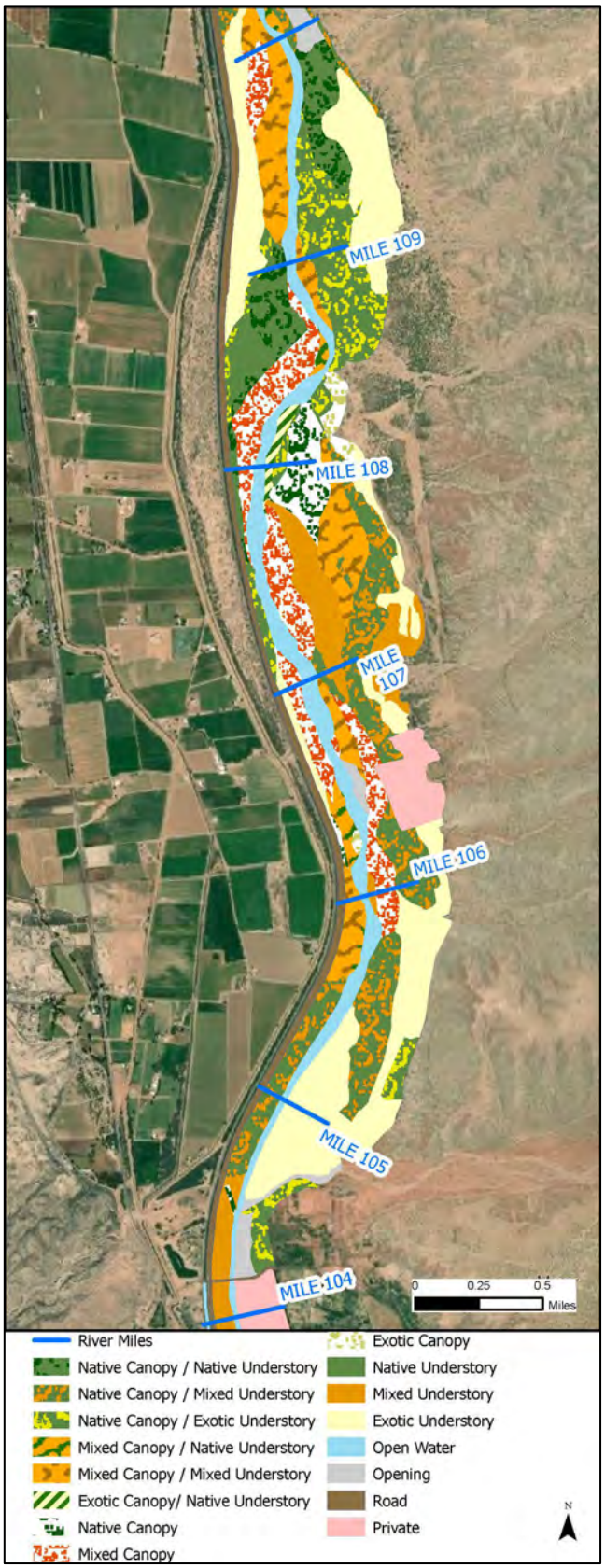
River Miles 110 to 116





River Miles 104 to 110





Escondida Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	32	1	13	< 1
Moderately suitable habitat	408	7	180	4
Unsuitable habitat	3,932	66	588	13
Total habitat area	**4,372**	**74**	**781**	**17**
Non-habitat	1,100	18	-	-
River channel	472	8	-	-
Total area*	5,944	100	-	-

* Escondida Reach also includes 291 acres unmapped private land (total 6,235 acres).

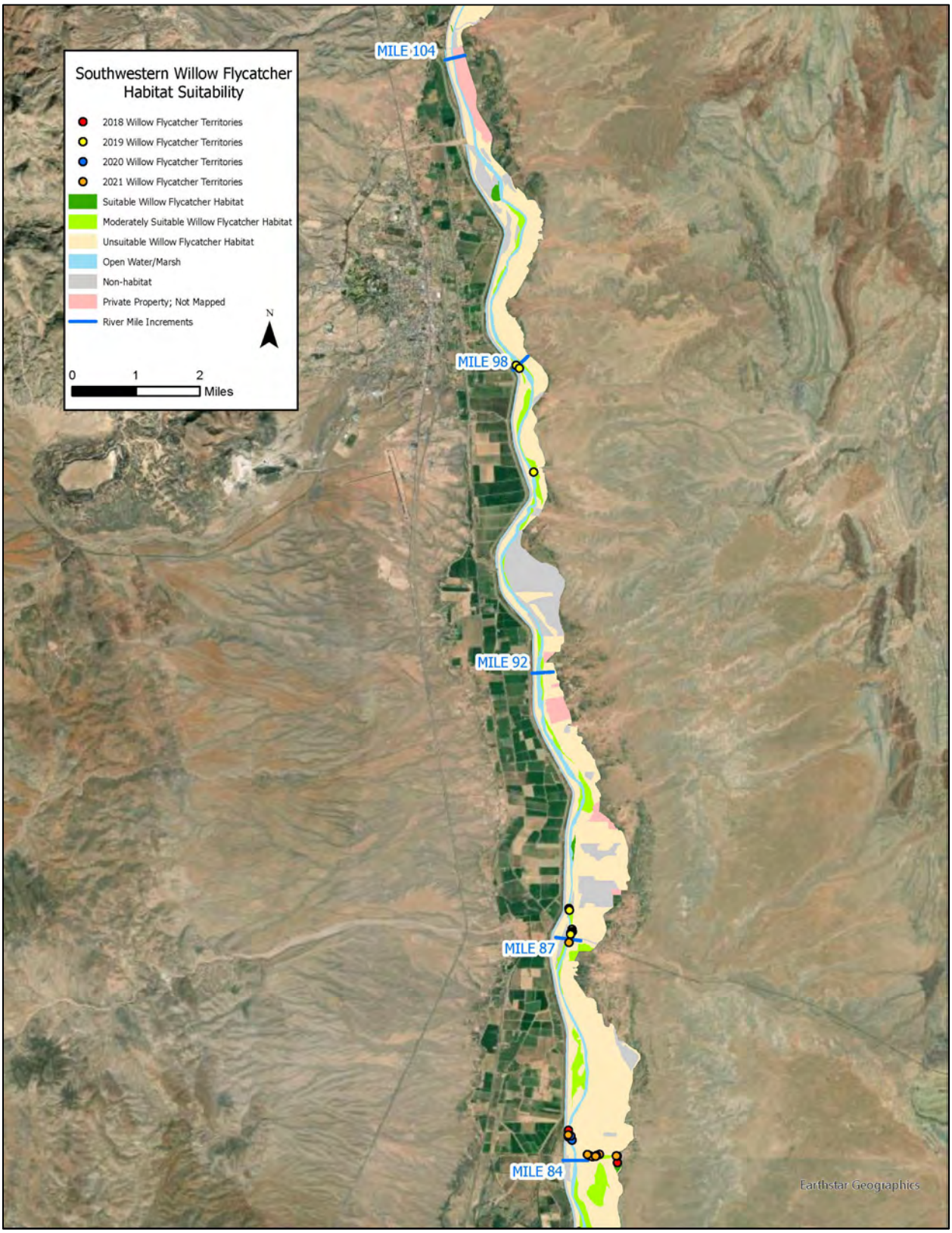
Acreage of plant communities within reach

Community type	Acres	Percentage of habitat
Native canopy/native understory	78	2
Native canopy/mixed understory	263	6
Native canopy/exotic understory	275	6
Mixed canopy/native understory	5	<1
Mixed canopy/mixed understory	252	6
Mixed canopy/exotic understory	9	<1
Exotic canopy/native understory	32	1
Exotic canopy/mixed understory	198	5
Exotic canopy/exotic understory	415	9
Native canopy	248	6
Mixed canopy	166	4
Exotic canopy	151	3
Native understory	4	<1
Mixed understory	526	12
Exotic understory	1,750	40

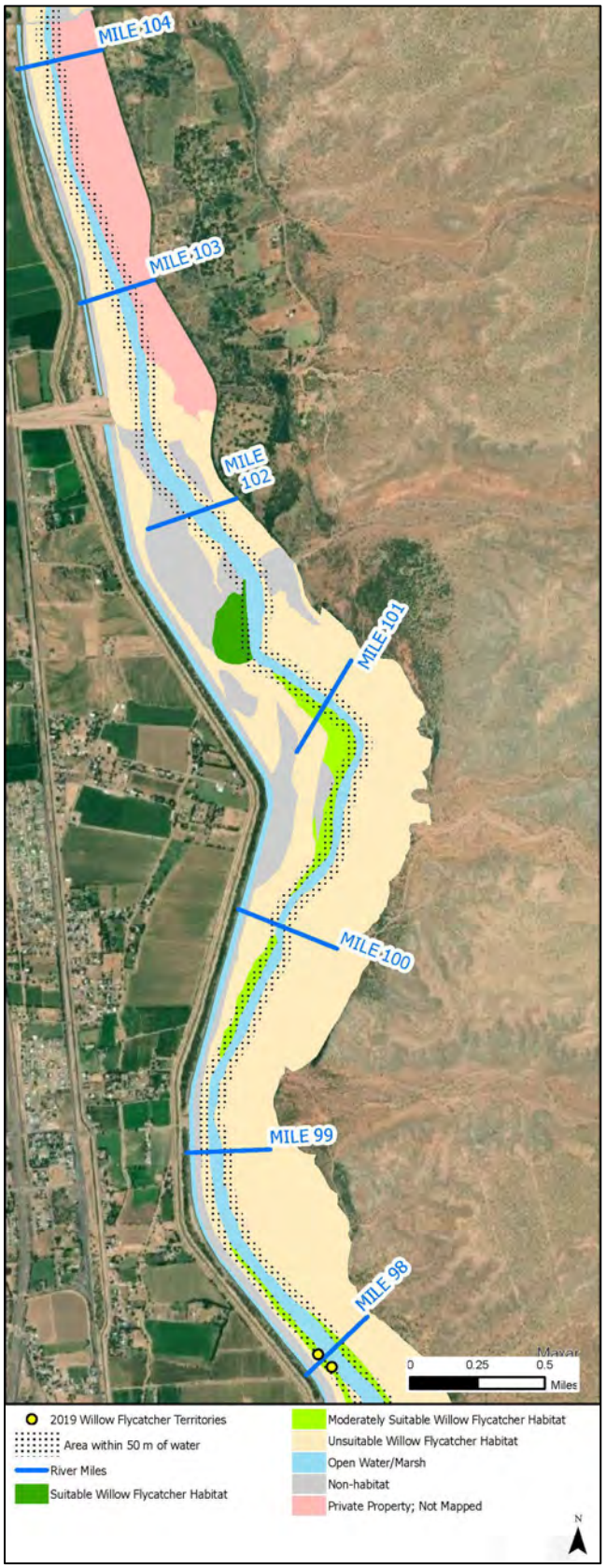
Southwestern willow flycatcher territories

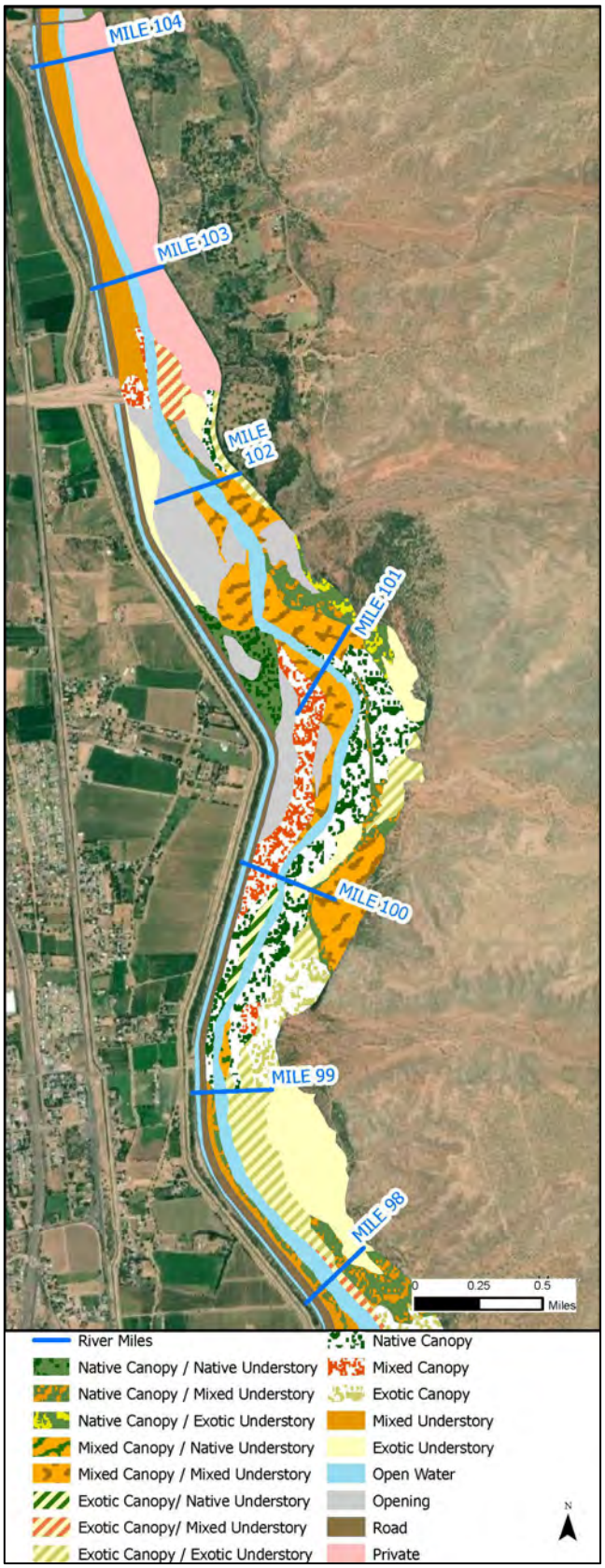
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018	0	4	4
2019	4	5	9
2020	1	2	3
2021	0	2	2

Escondida Reach Maps

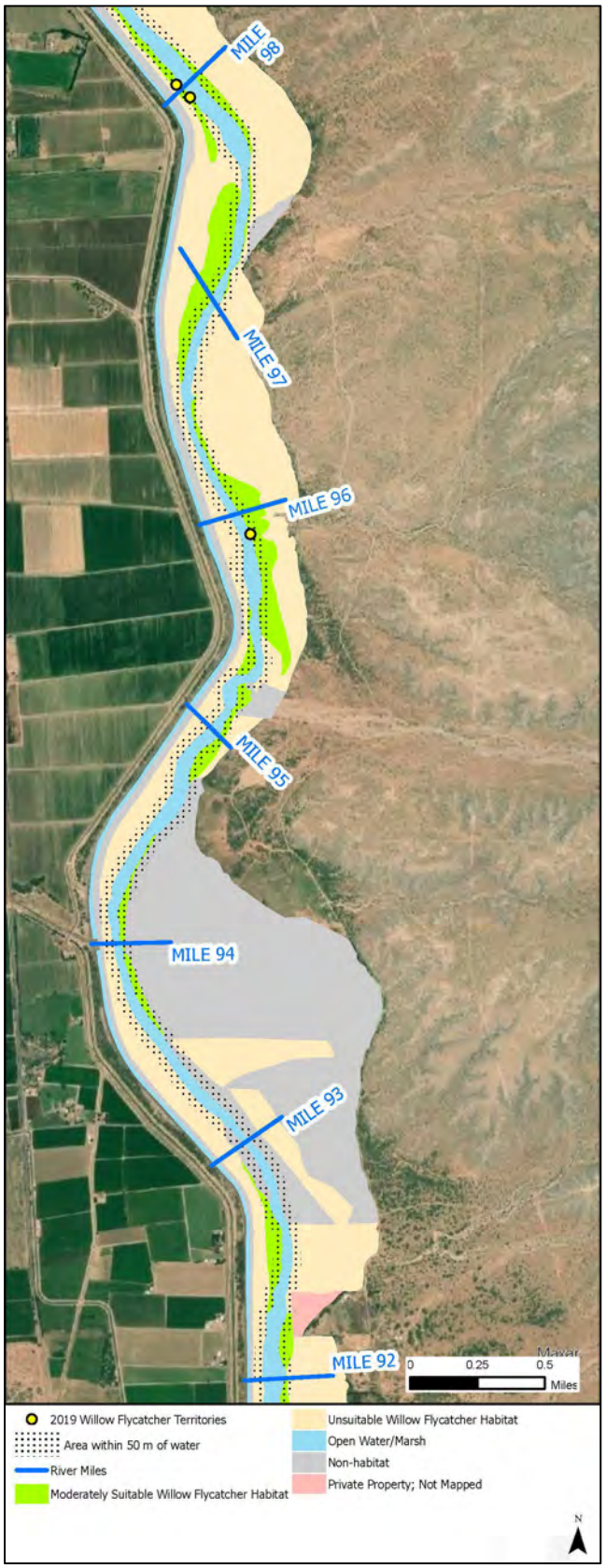


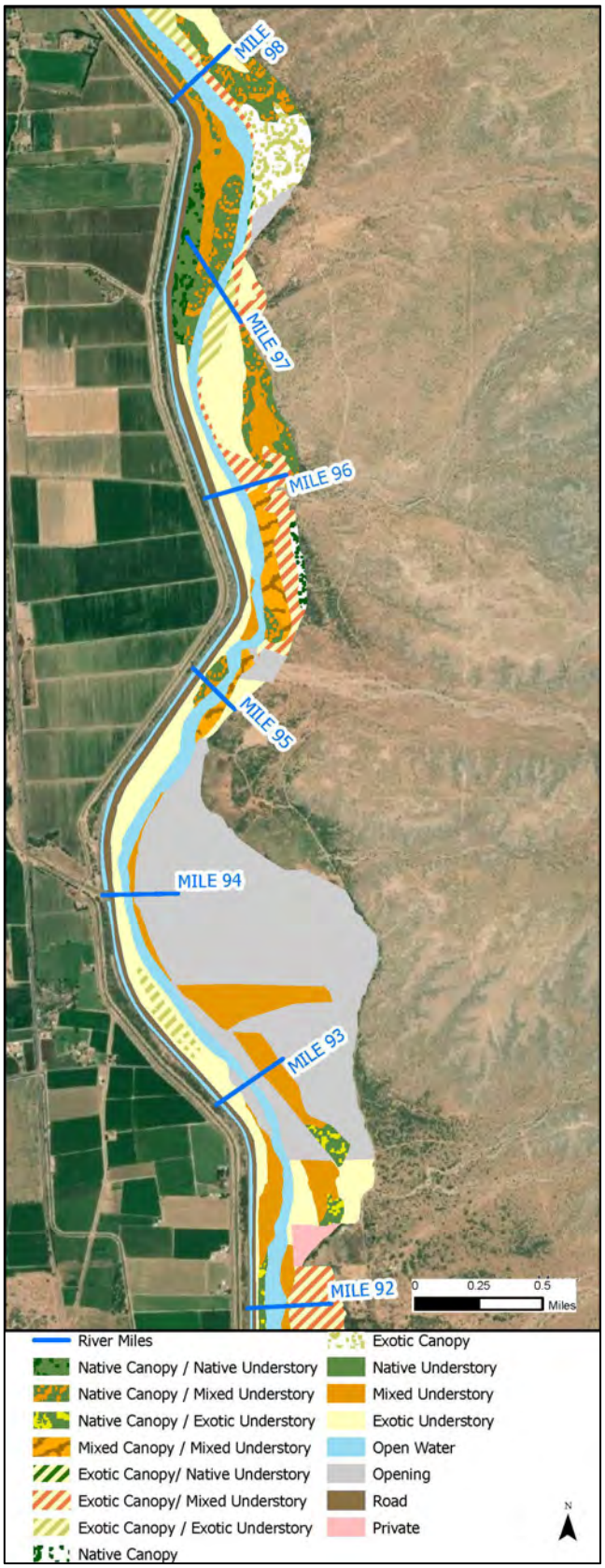
River Miles 98 to 104



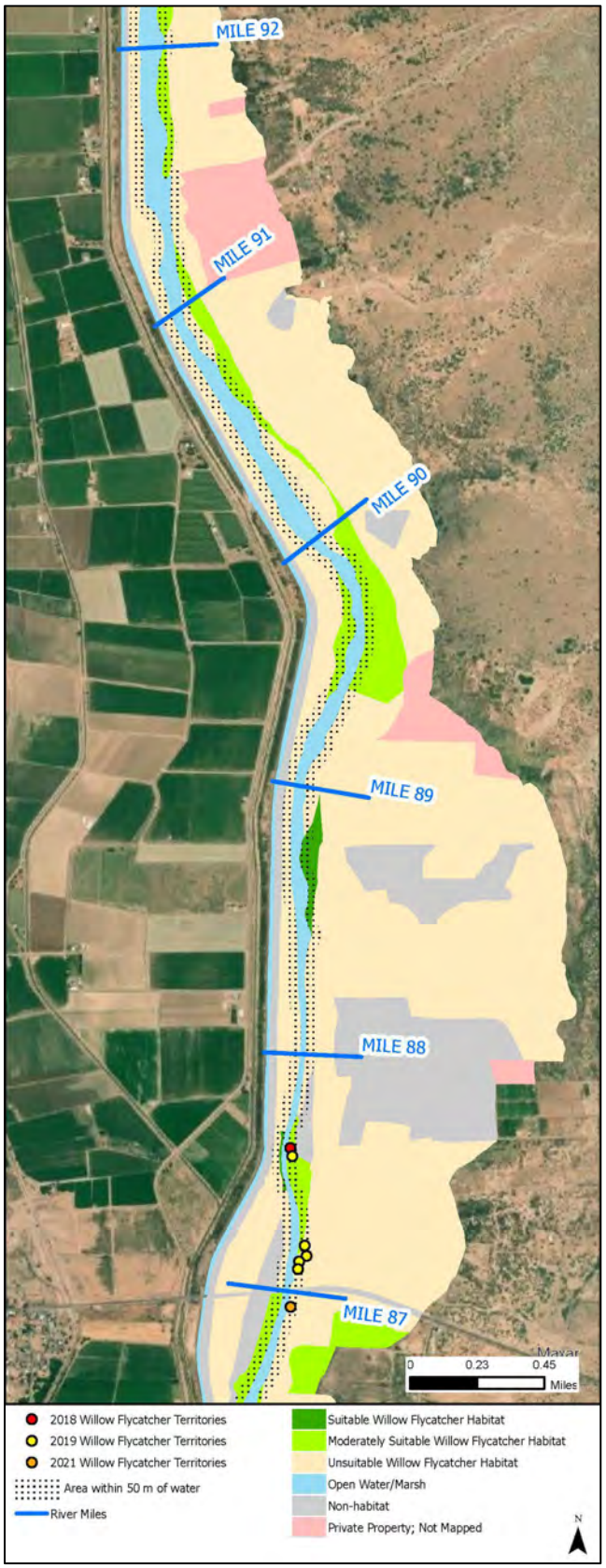


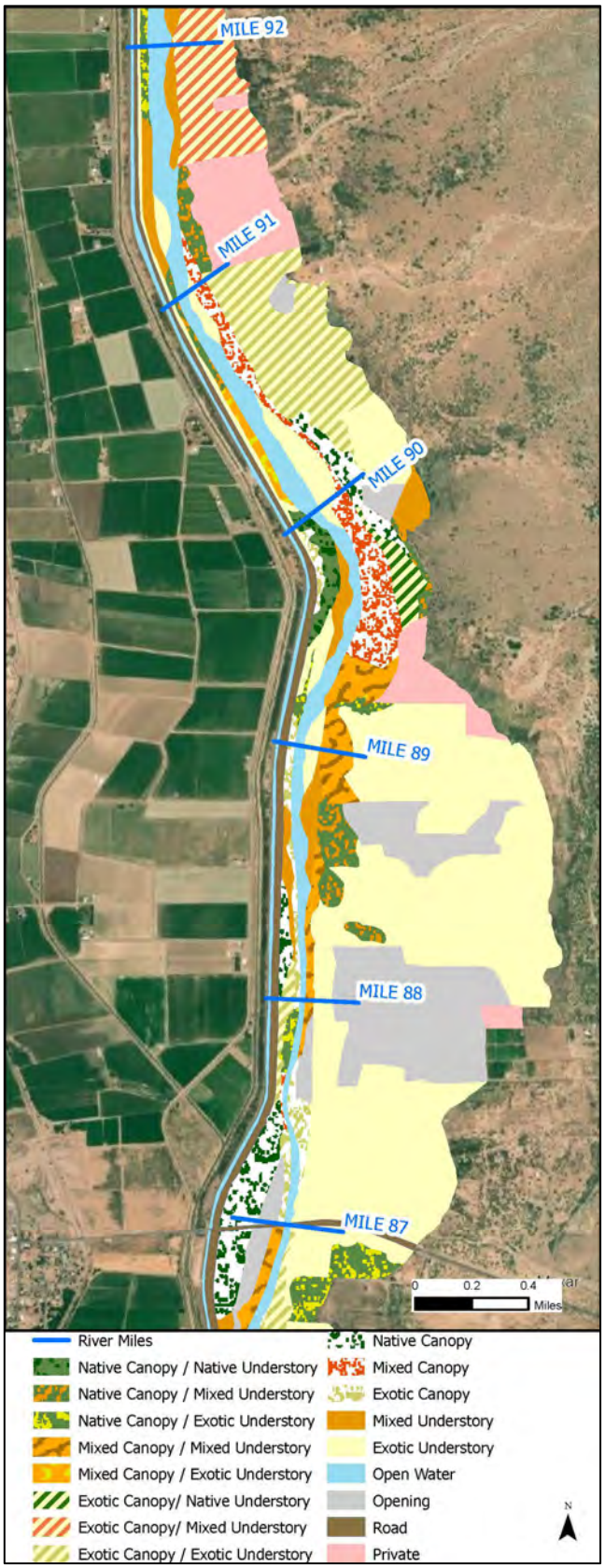
River Miles 92 to 98



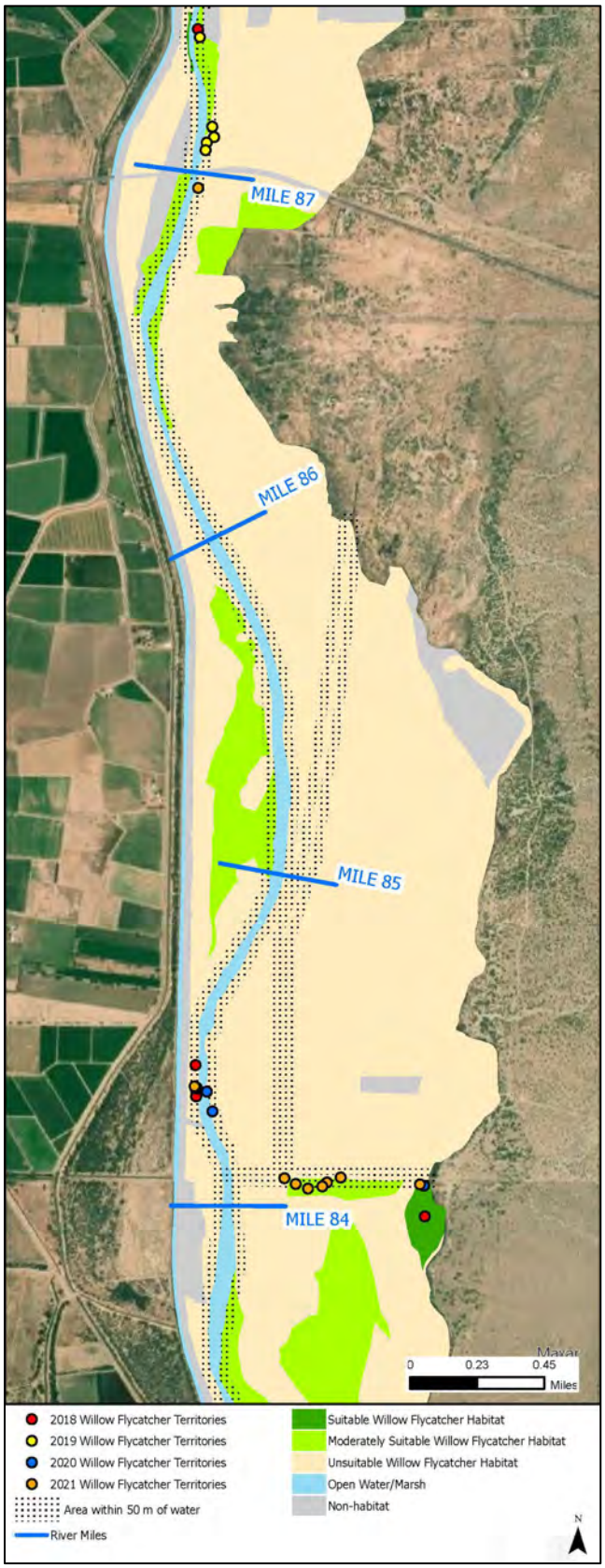


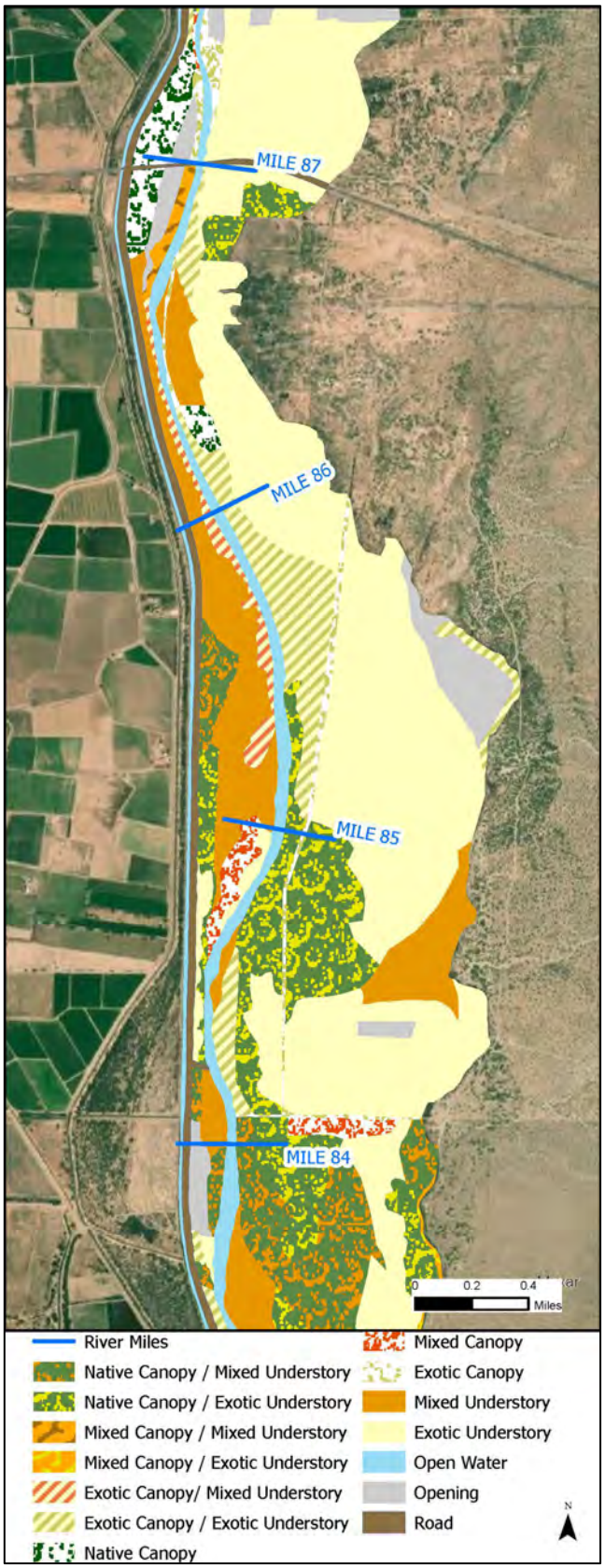
River Miles 87 to 92





River Miles 84 to 87





Bosque del Apache Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	118	3	37	1
Moderately suitable habitat	719	18	161	5
Unsuitable habitat	2,196	55	257	9
Total habitat area	**3,033**	**76**	**455**	**15**
Non-habitat	684	17	-	-
River channel	267	7	-	-
Total area*	**3,984**	**100**	**-**	**-**

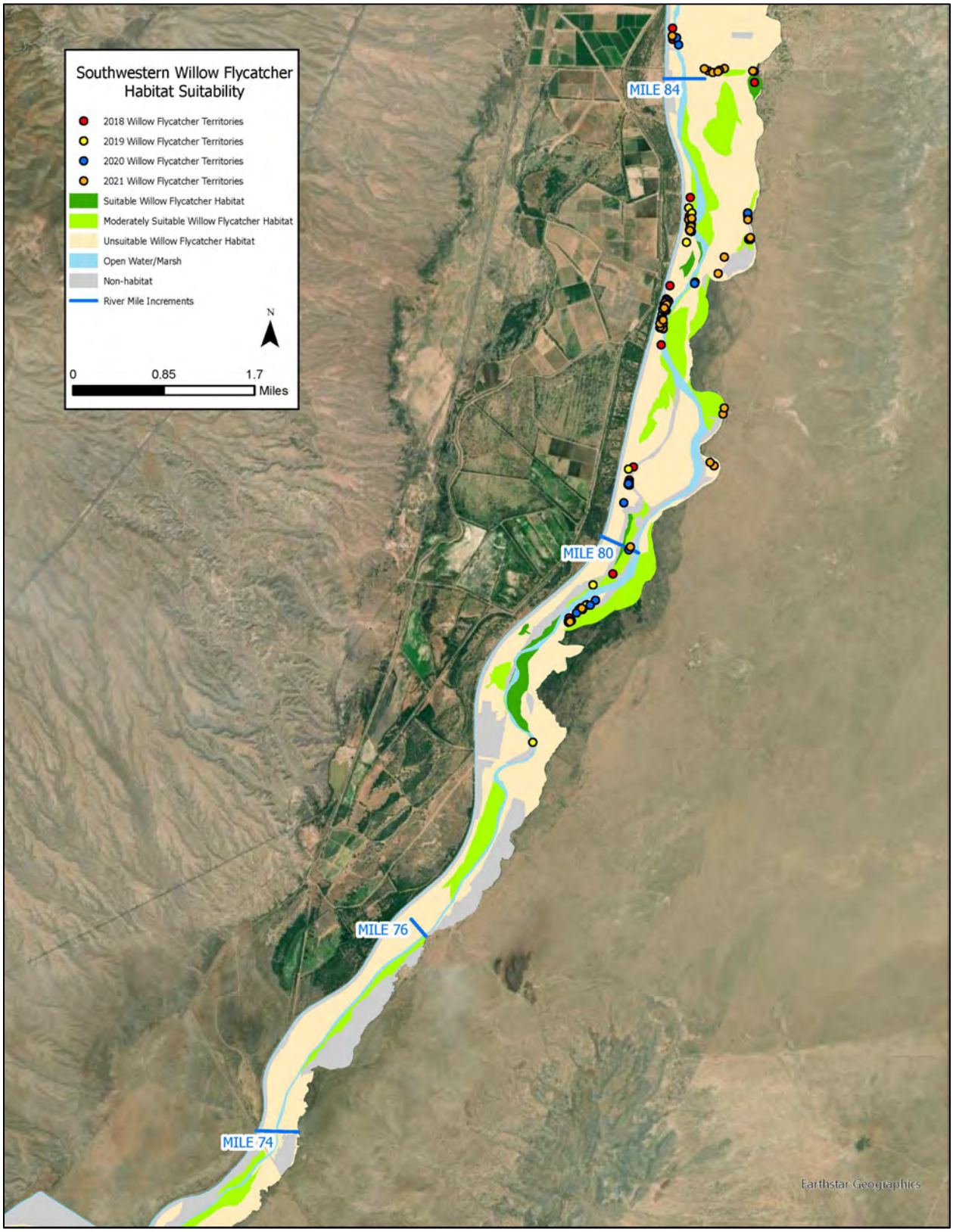
Acreage of plant communities within reach

Community type	Acres	Percentage of habitat
Native canopy/native understory	104	3
Native canopy/mixed understory	731	24
Native canopy/exotic understory	613	20
Mixed canopy/native understory	0	-
Mixed canopy/mixed understory	29	1
Mixed canopy/exotic understory	17	1
Exotic canopy/native understory	36	1
Exotic canopy/mixed understory	7	<1
Exotic canopy/exotic understory	58	2
Native canopy	324	11
Mixed canopy	76	3
Exotic canopy	129	4
Native understory	196	7
Mixed understory	343	11
Exotic understory	370	12

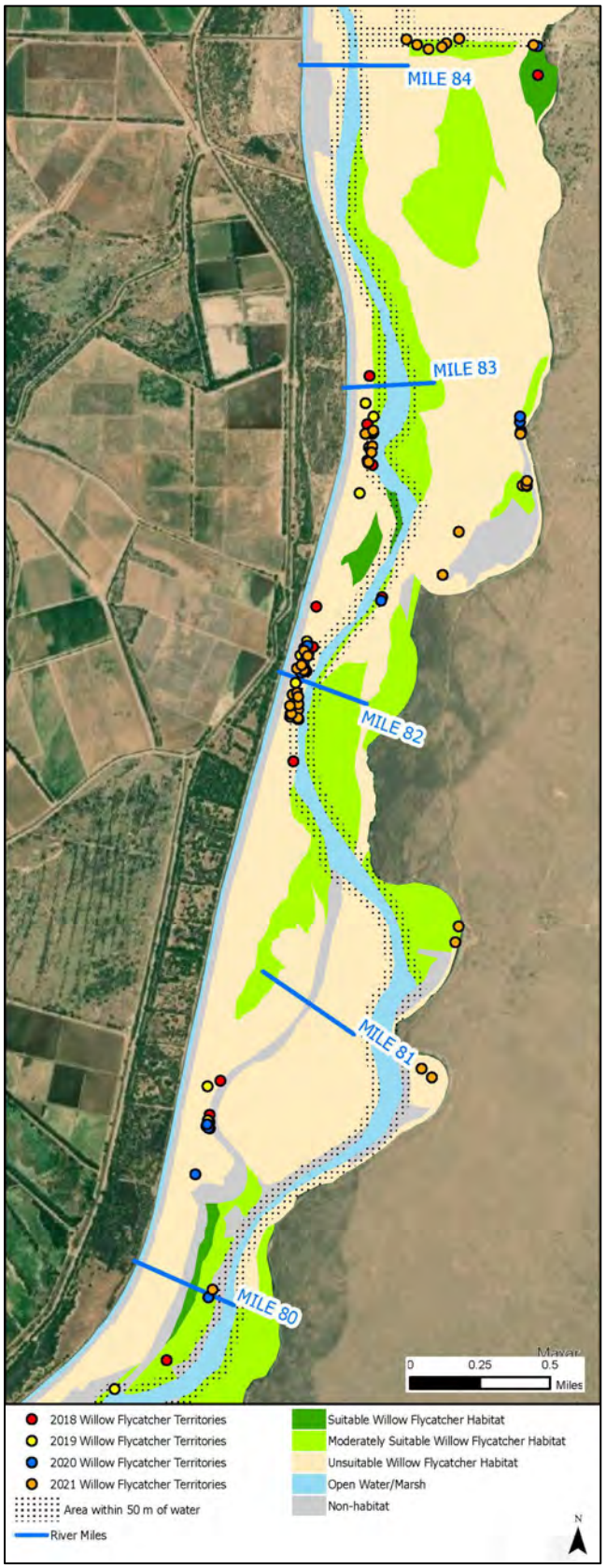
Southwestern willow flycatcher territories

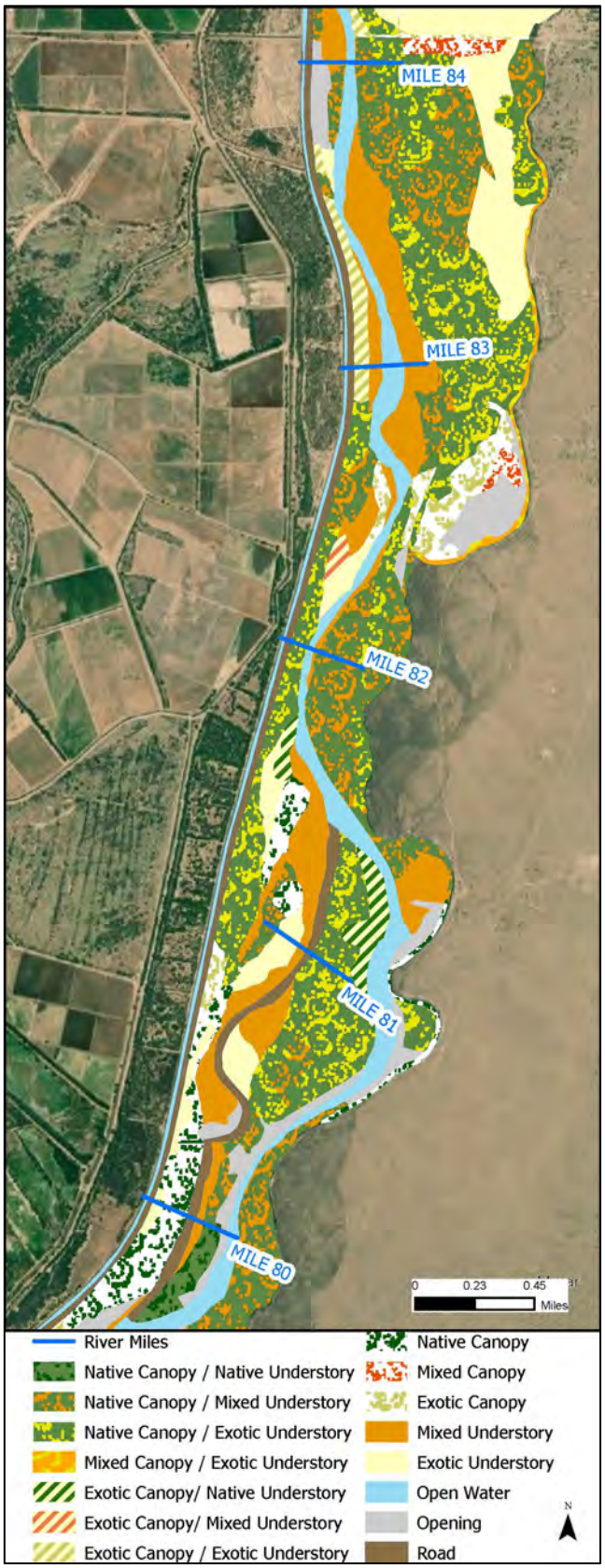
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018	3	21	24
2019	8	16	24
2020	1	34	35
2021	10	29	39

Bosque del Apache Reach Maps

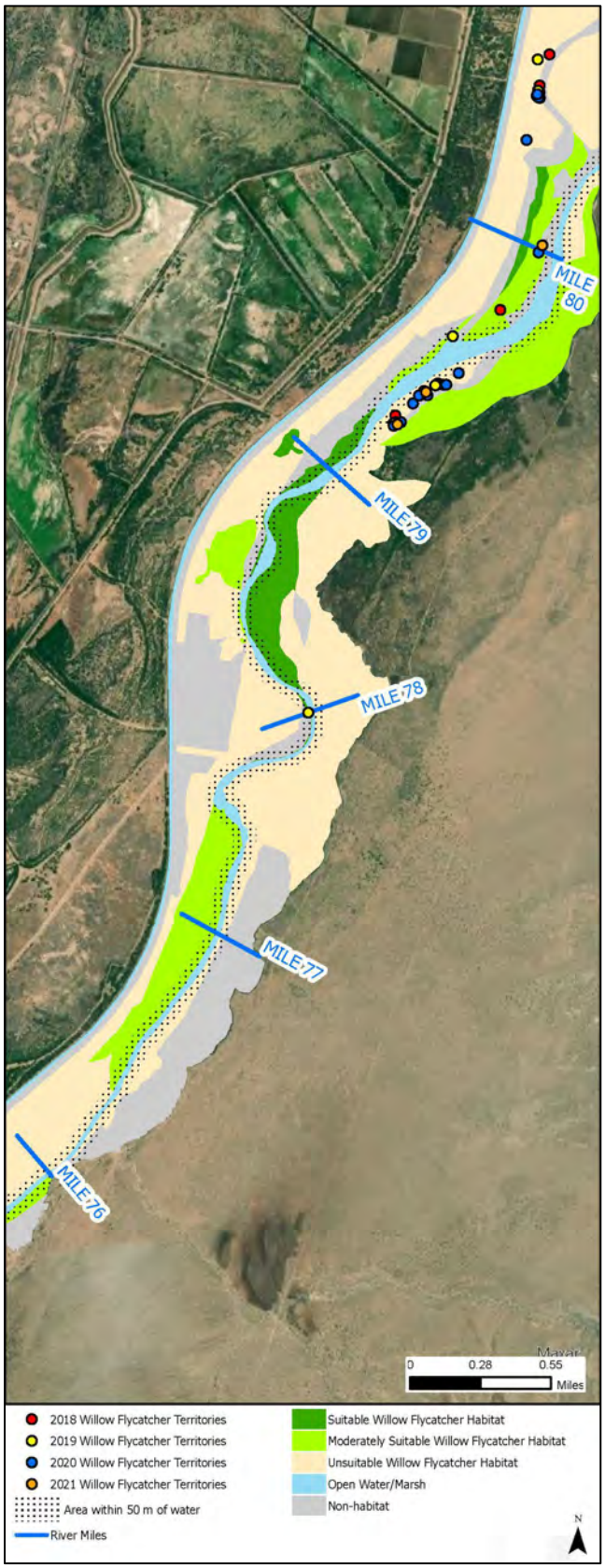


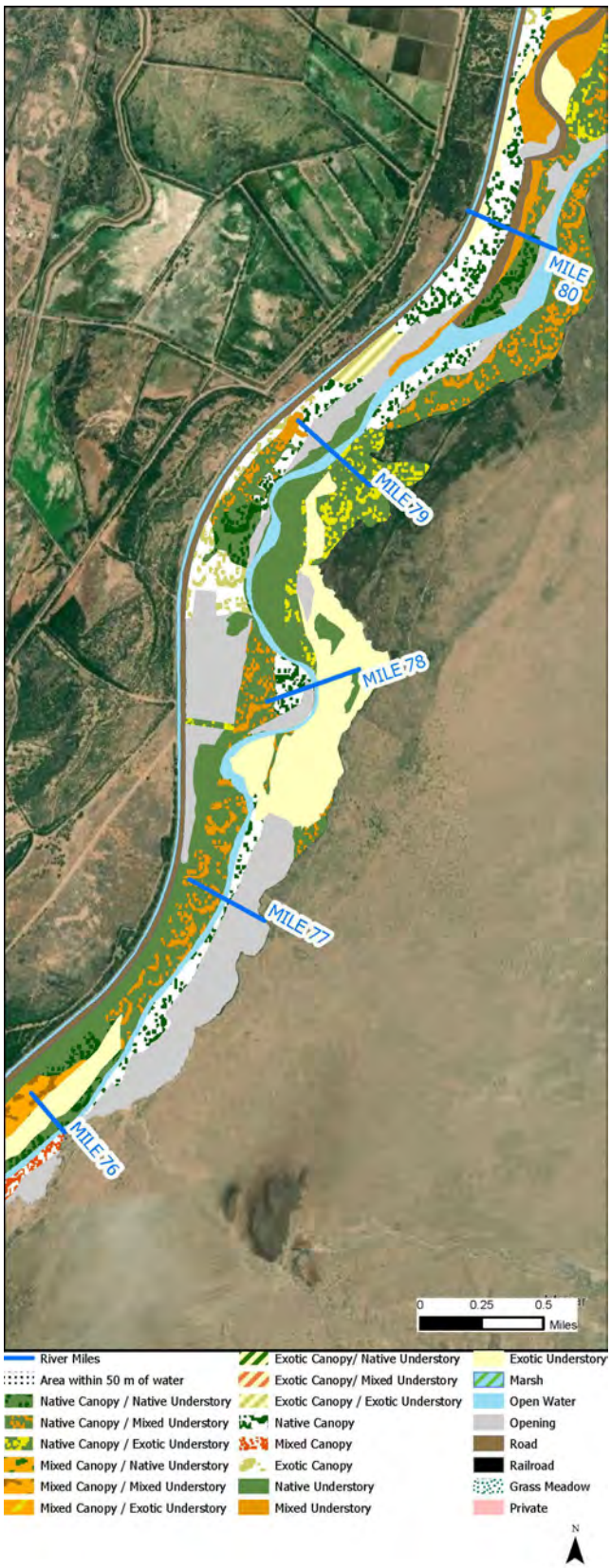
River Miles 80 to 84



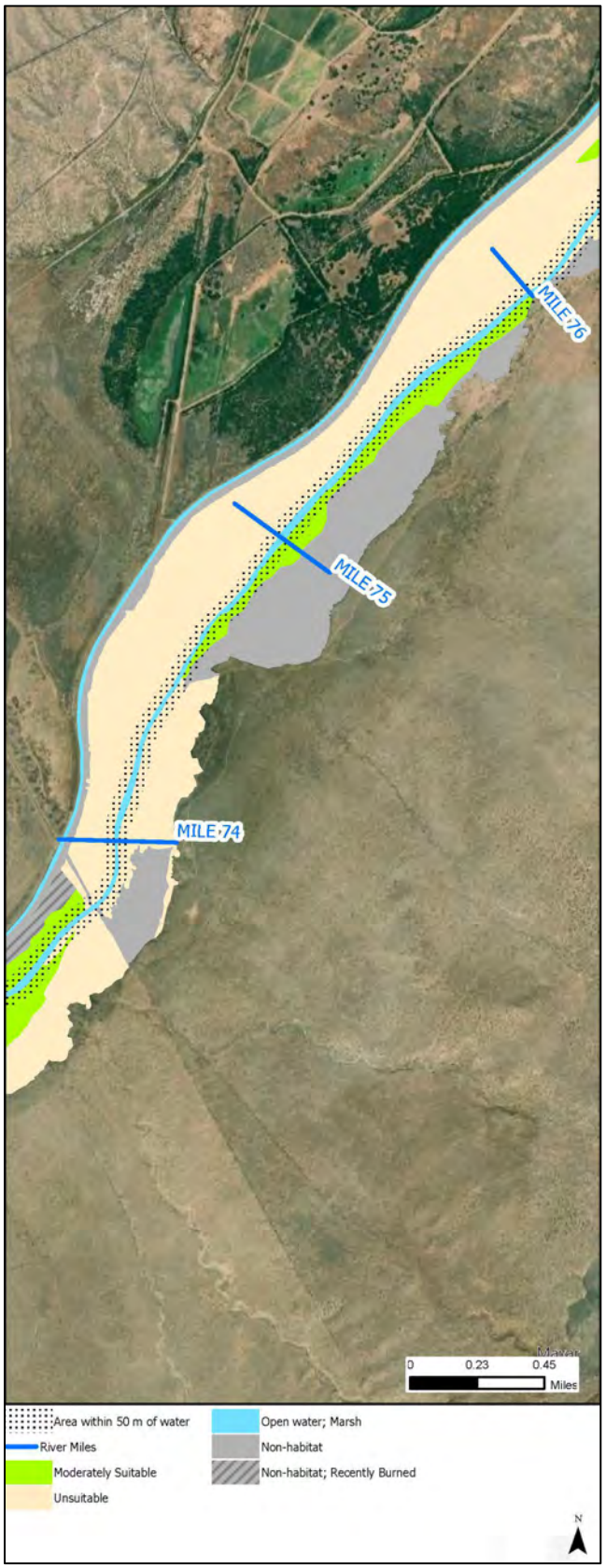


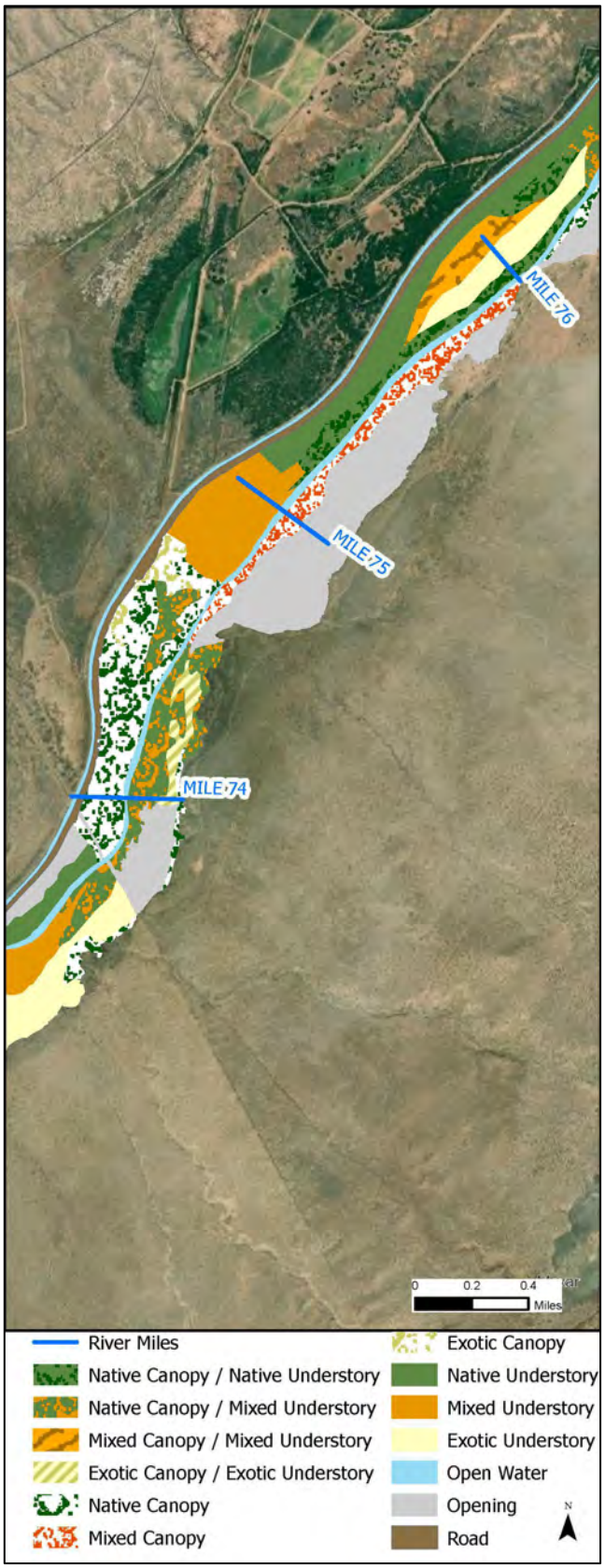
River Miles 76 to 80





River Miles 74 to 76





Tiffany Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	96	3	4	<1
Moderately suitable habitat	240	6	70	2.5
Unsuitable habitat	2,446	65	99	3.5
Total habitat area	**2,782**	**74**	**173**	**6**
Non-habitat	905	24	-	-
River channel	85	2	-	-
Total area*	**3,772**	**100**	**-**	**-**

Acreage of plant communities within reach

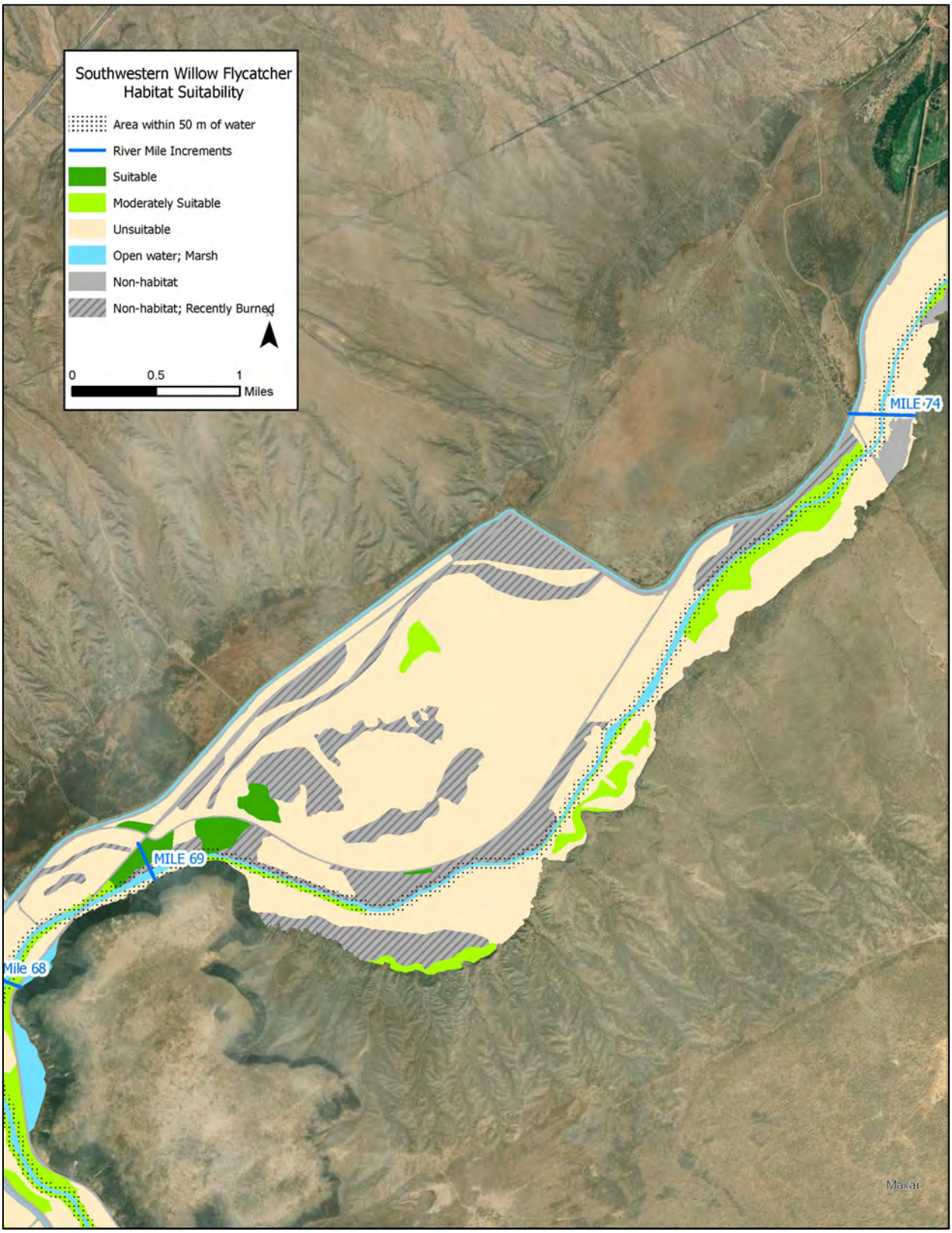
Community type	Acres	Percentage of habitat
Native canopy/native understory	82	3
Native canopy/mixed understory	35	1
Native canopy/exotic understory	42	2
Mixed canopy/native understory	0	0
Mixed canopy/mixed understory	0	0
Mixed canopy/exotic understory	38	1
Exotic canopy/native understory	0	0
Exotic canopy/mixed understory	0	0
Exotic canopy/exotic understory	0	0
Native canopy	131	5
Mixed canopy	40	1
Exotic canopy	52	2
Native understory	22	1
Mixed understory	235	8
Exotic understory	2,105	76

Southwestern willow flycatcher territories

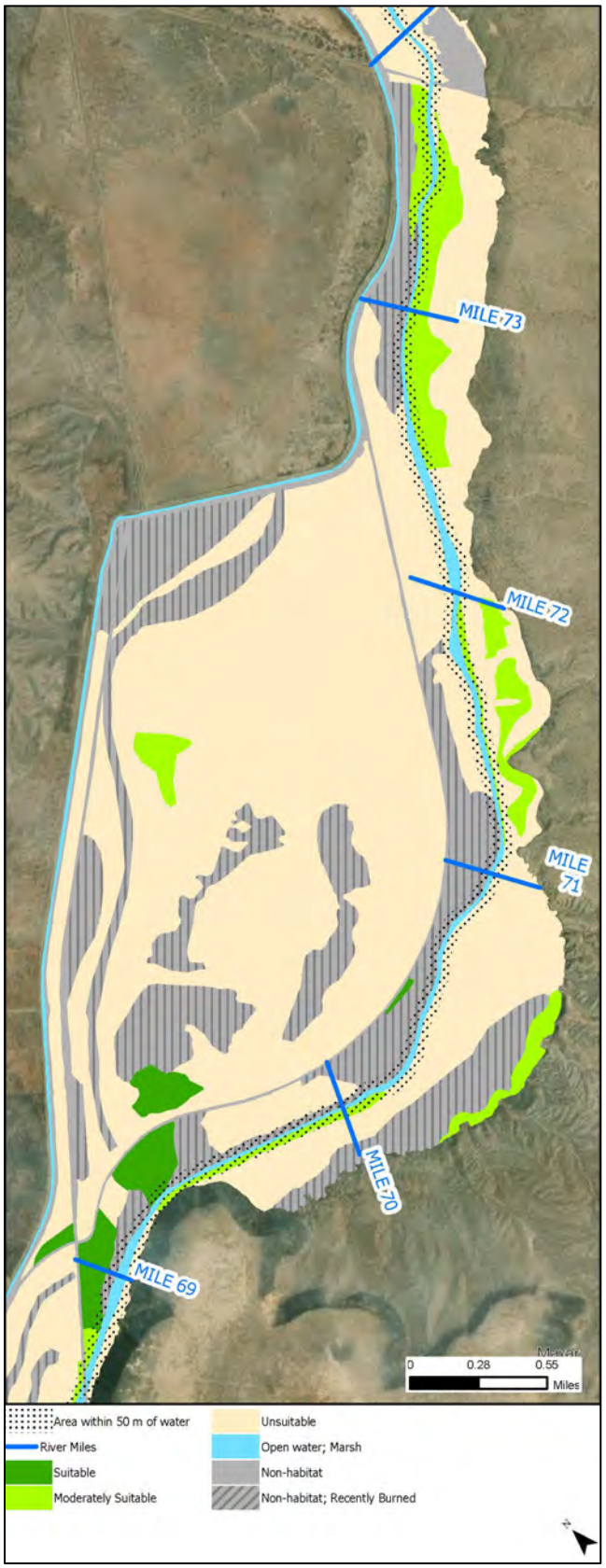
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018*	0	0	0
2019*	0	0	0
2020	Not Surveyed		
2021	Not Surveyed		

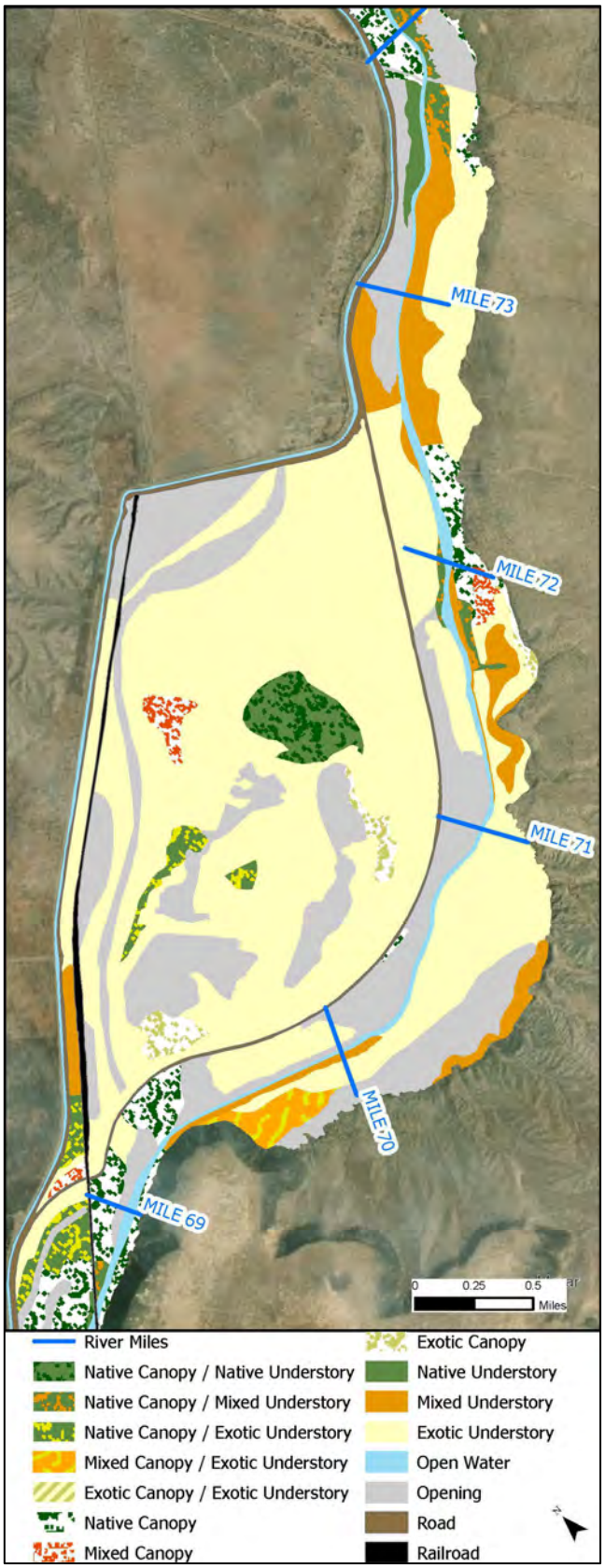
* Very little habitat due to fire in 2017.

Tiffany Reach Maps



River Miles 68.5 to 74





San Marcial Reach

Habitat acreage

Suitability class	Acreage		Acreage within 50m of water	
	Number of acres	Percentage of total	Number of acres	Percentage of habitat
Suitable habitat	1,910	9	600	4
Moderately suitable habitat	2,722	12	631	4
Unsuitable habitat	10,683	41	840	6
Total habitat area	**15,315**	**72**	**2,071**	**14**
Non-habitat	6,058	28	-	-
River channel	505	2	-	-
Total area*	**21,878**	**100**	**-**	**-**

Acreage of plant communities within reach

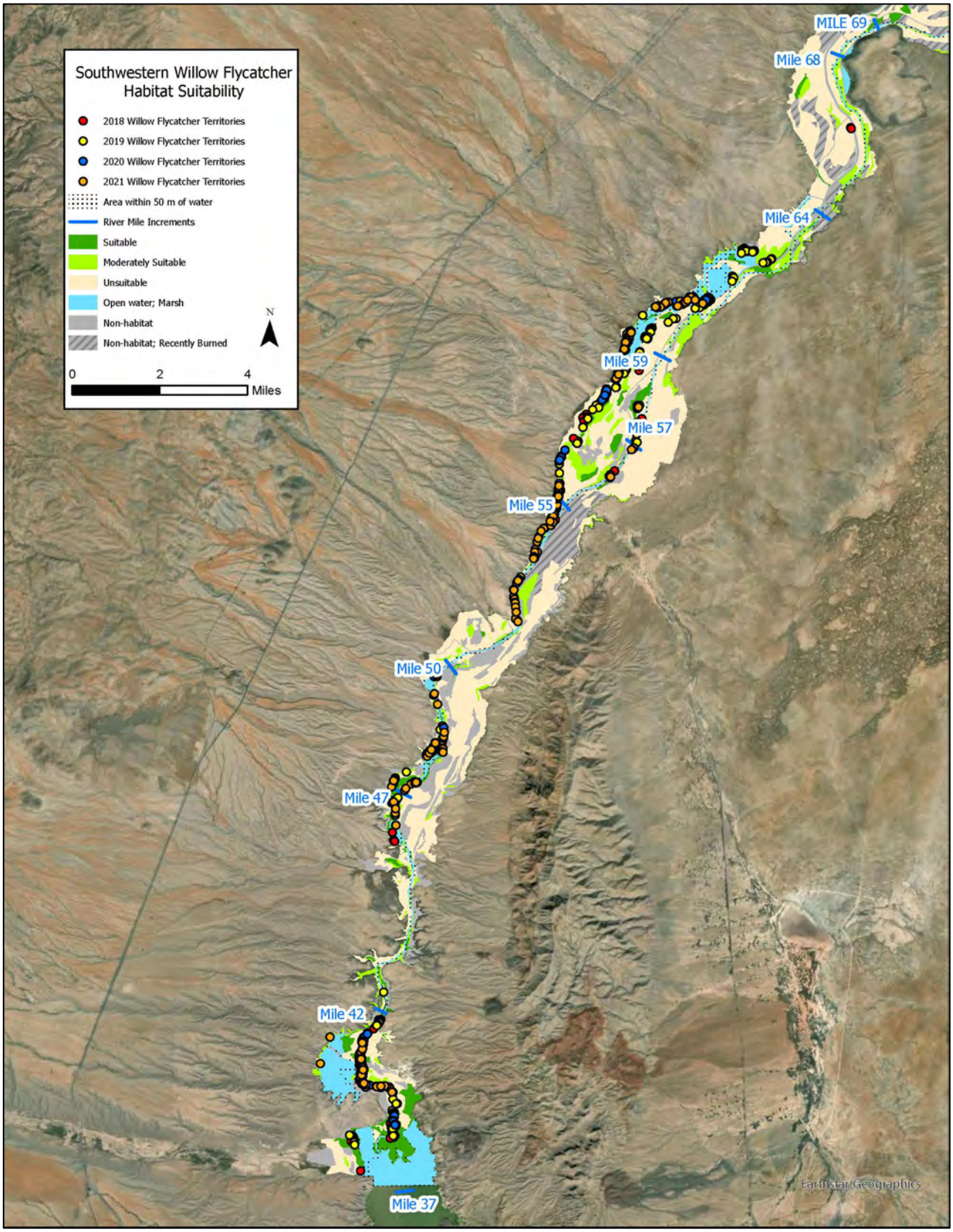
Community type	Acres	Percentage of habitat
Native canopy/native understory	522	3
Native canopy/mixed understory	1,627	11
Native canopy/exotic understory	678	4
Mixed canopy/native understory	102	1
Mixed canopy/mixed understory	138	1
Mixed canopy/exotic understory	165	1
Exotic canopy/native understory	16	< 1
Exotic canopy/mixed understory	18	< 1
Exotic canopy/exotic understory	63	< 1
Native canopy	2,254	15
Mixed canopy	742	5
Exotic canopy	1,215	8
Native understory	825	5
Mixed understory	2,068	13
Exotic understory	4,882	32

Southwestern willow flycatcher territories

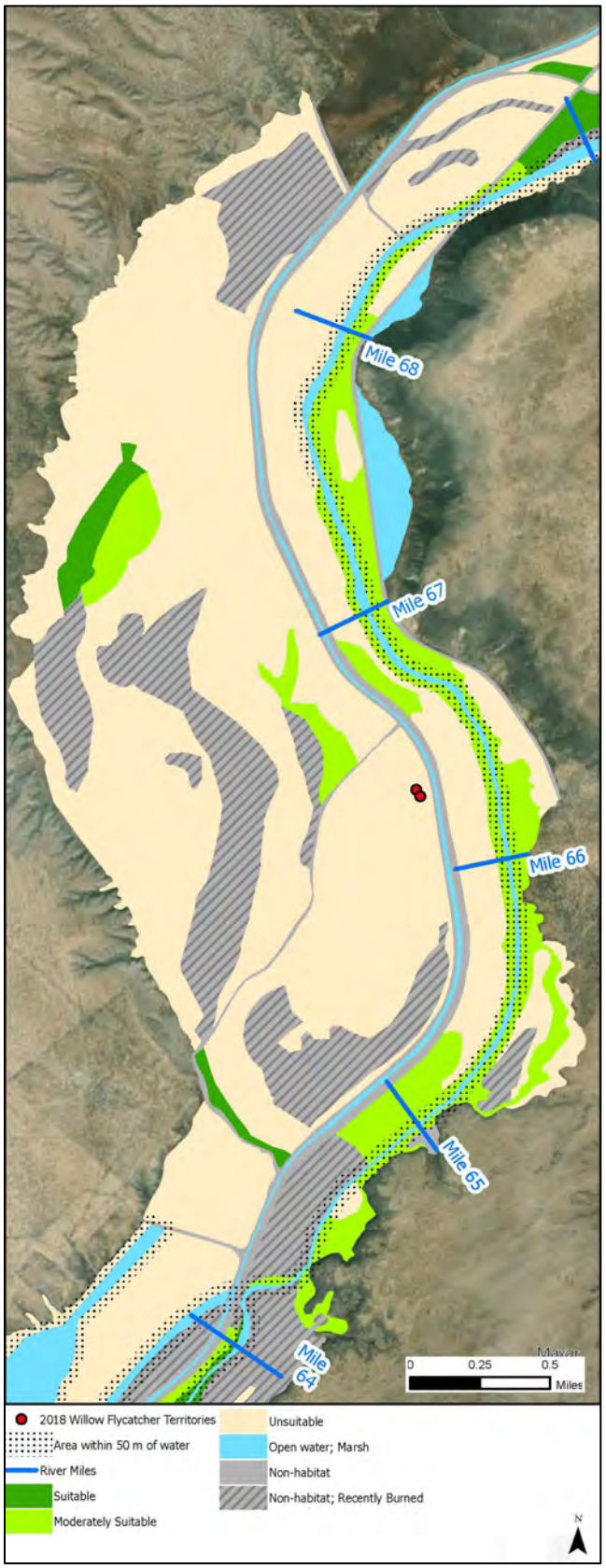
Year	Number of unpaired/undetermined	Number of pairs	Total number of territories
2018	37	240	277
2019	50	243	293
2020*	16	184	200
2021*	27	225	252

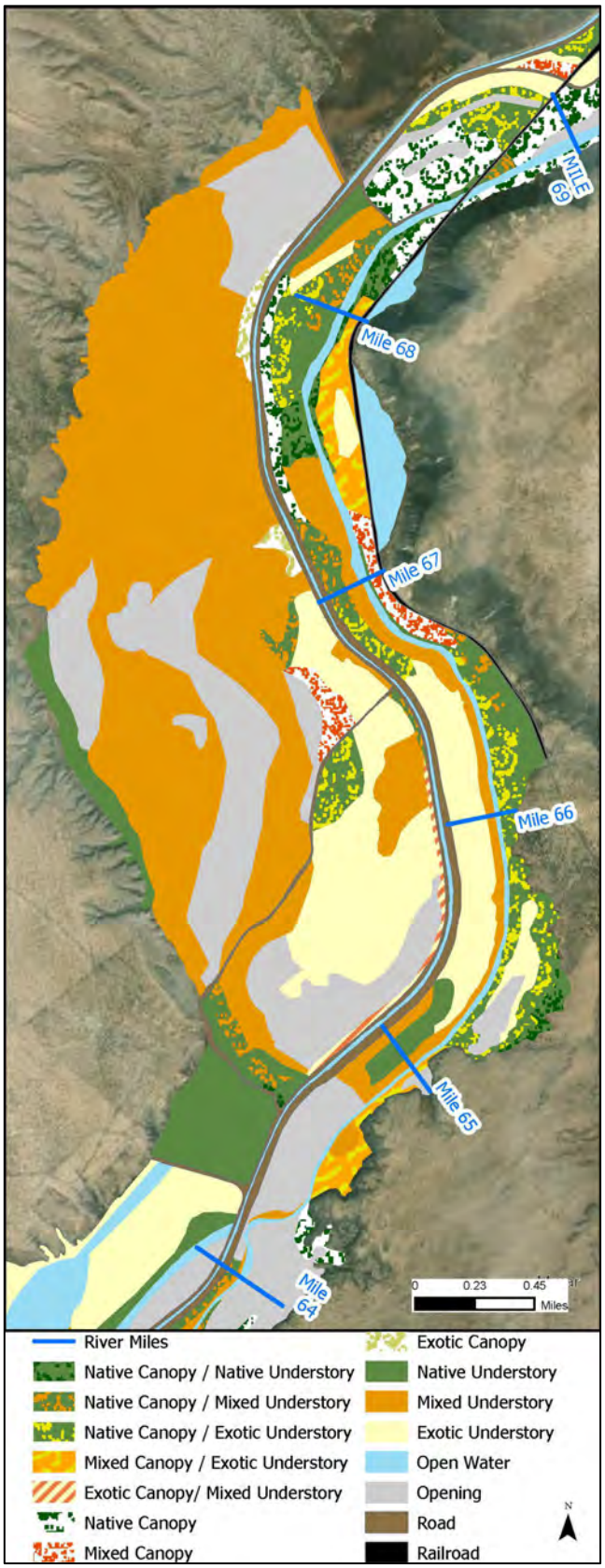
* Not all sites within San Marcial Reach were surveyed in 2020 and 2021.

San Marcial Reach Maps

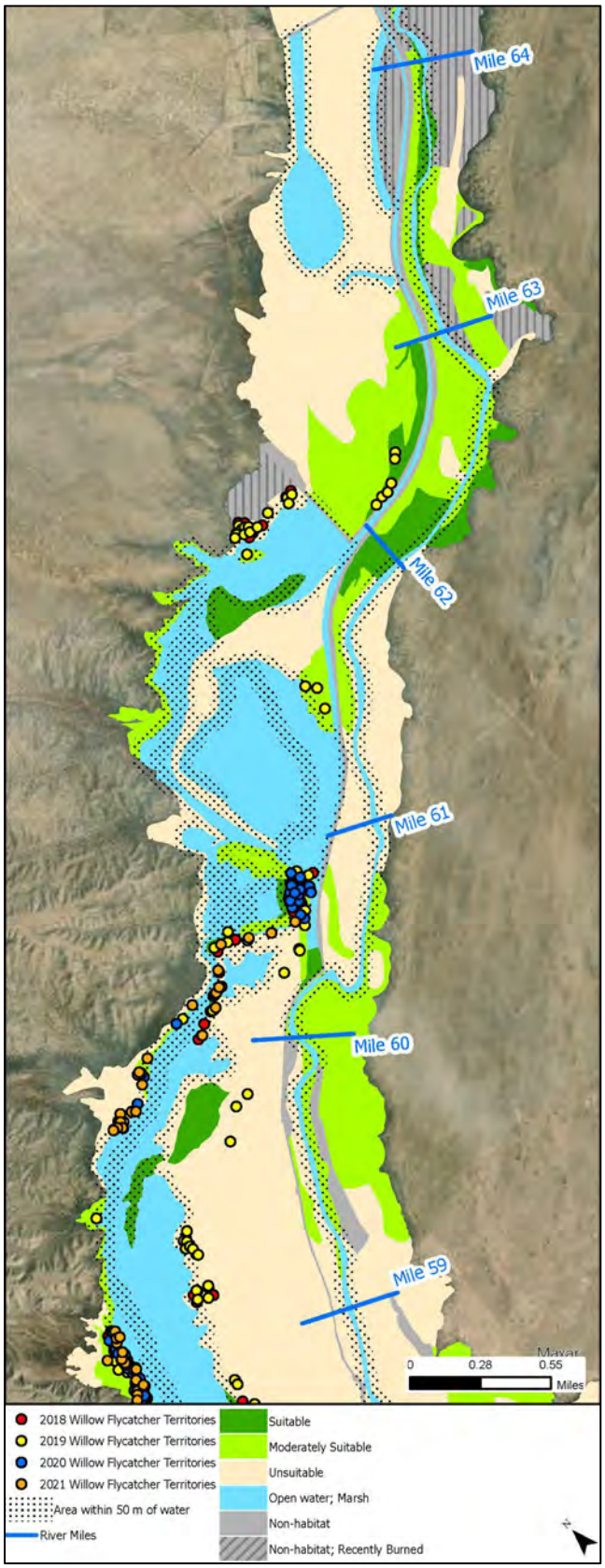


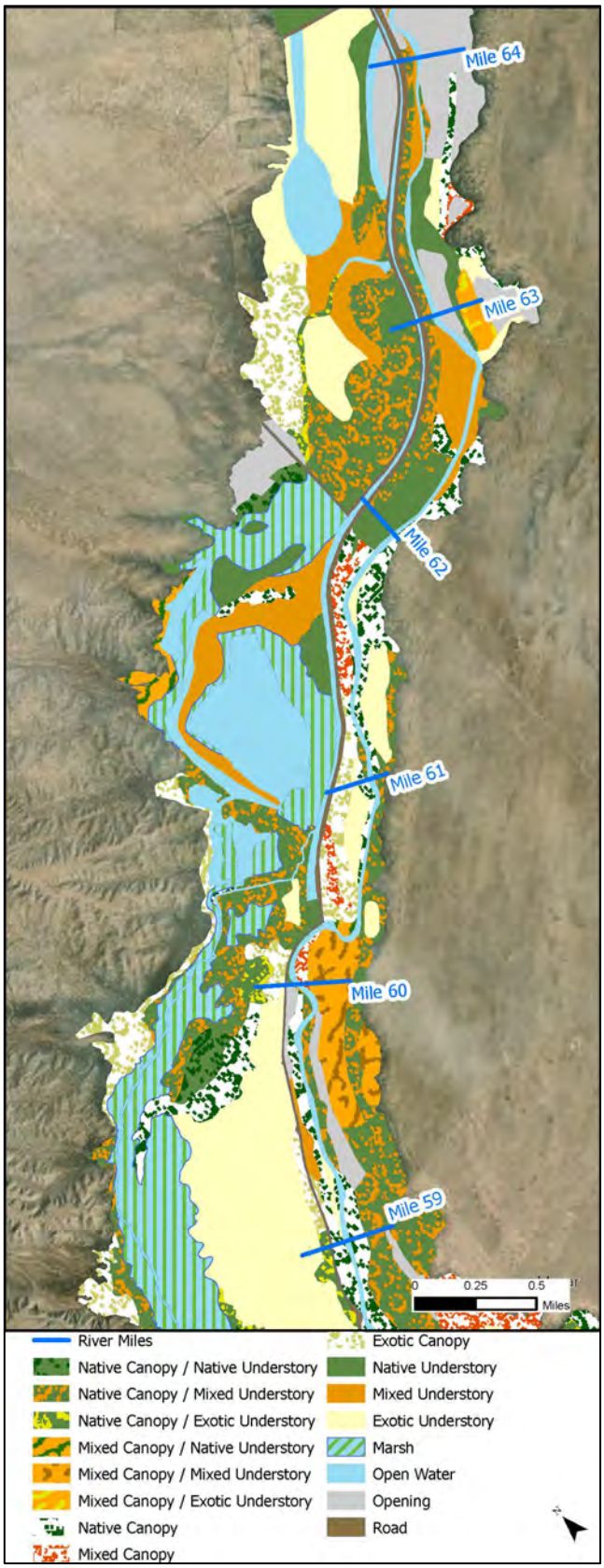
River Miles 64 to 69



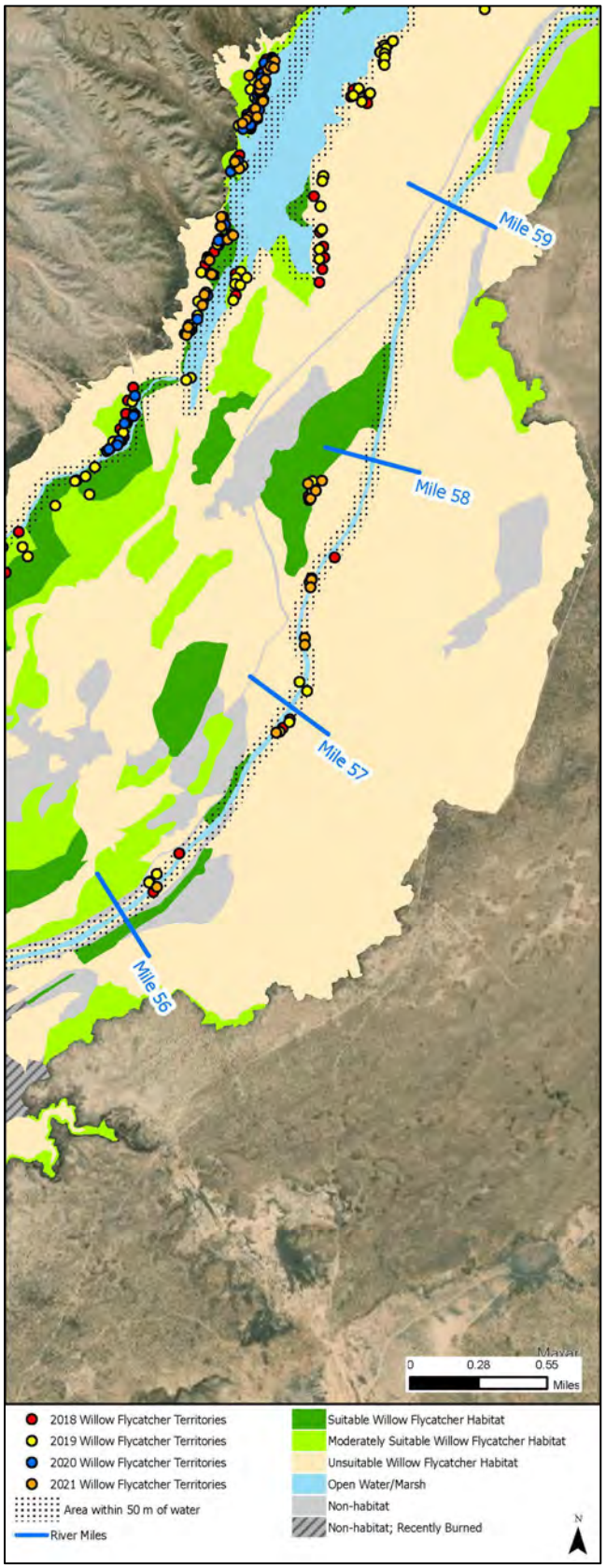


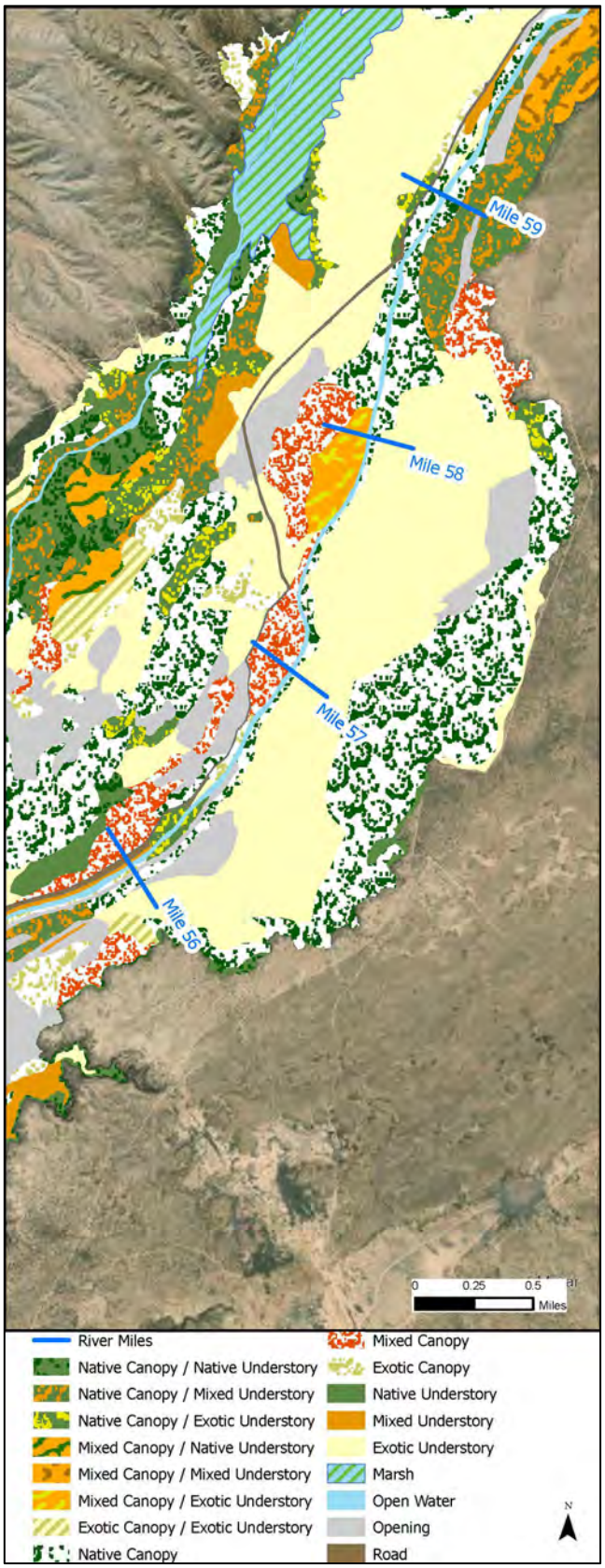
River Miles 59 to 64



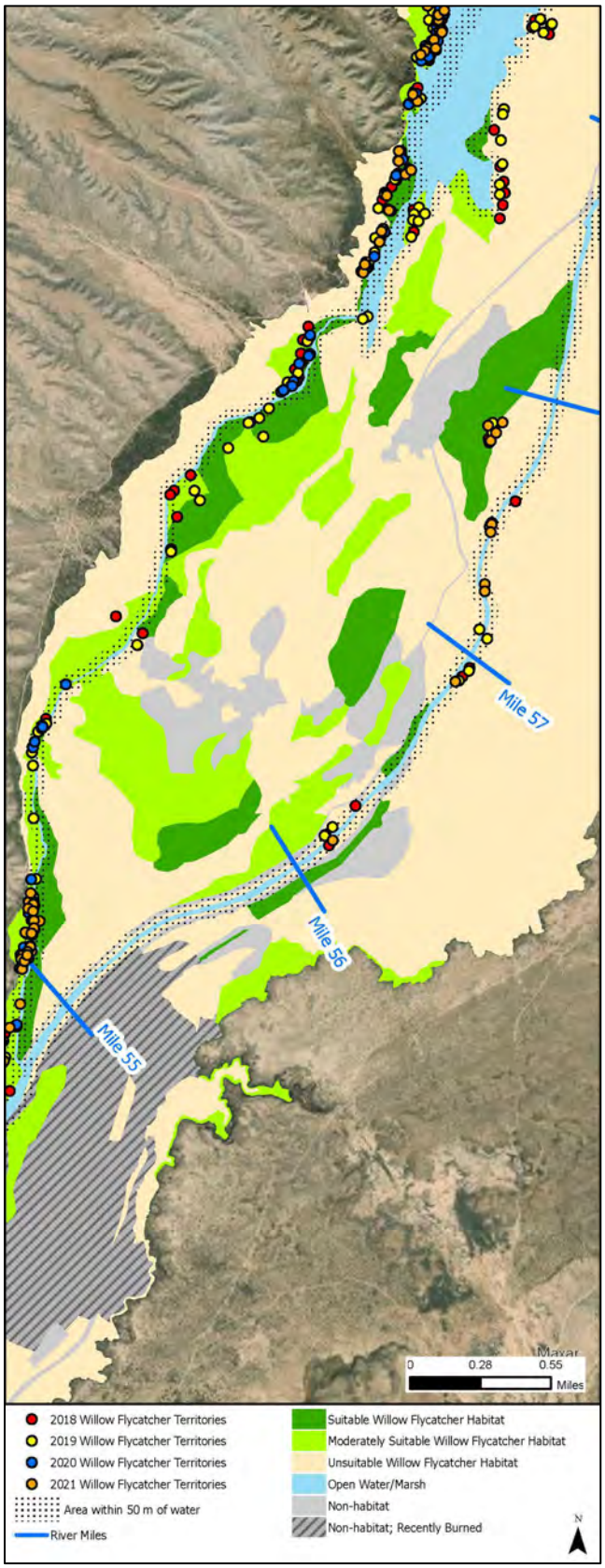


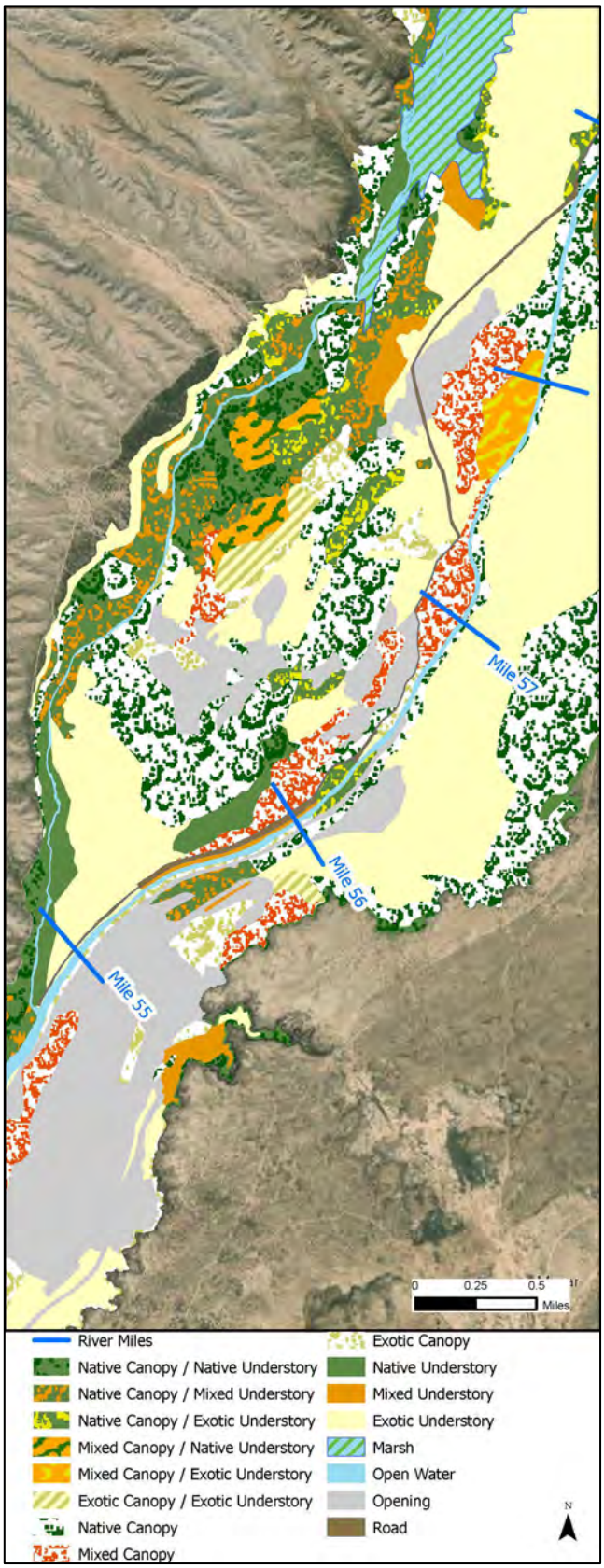
River Miles 57 to 59



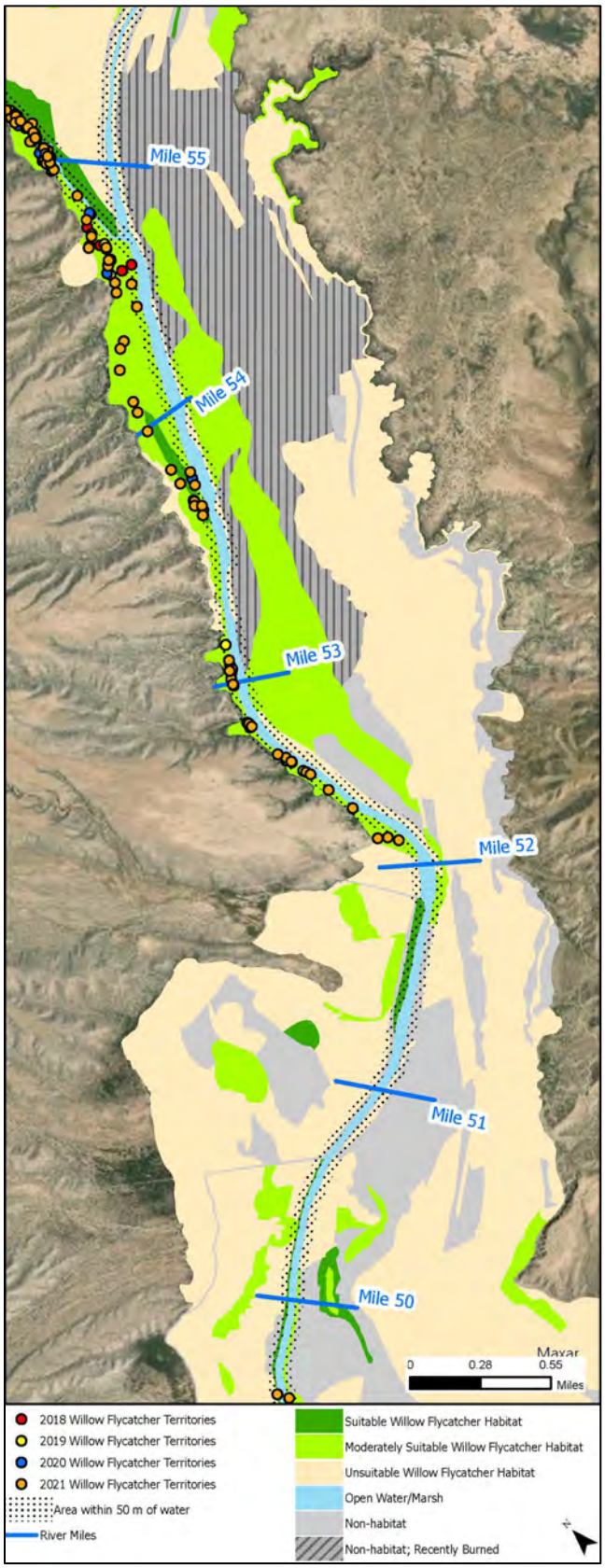


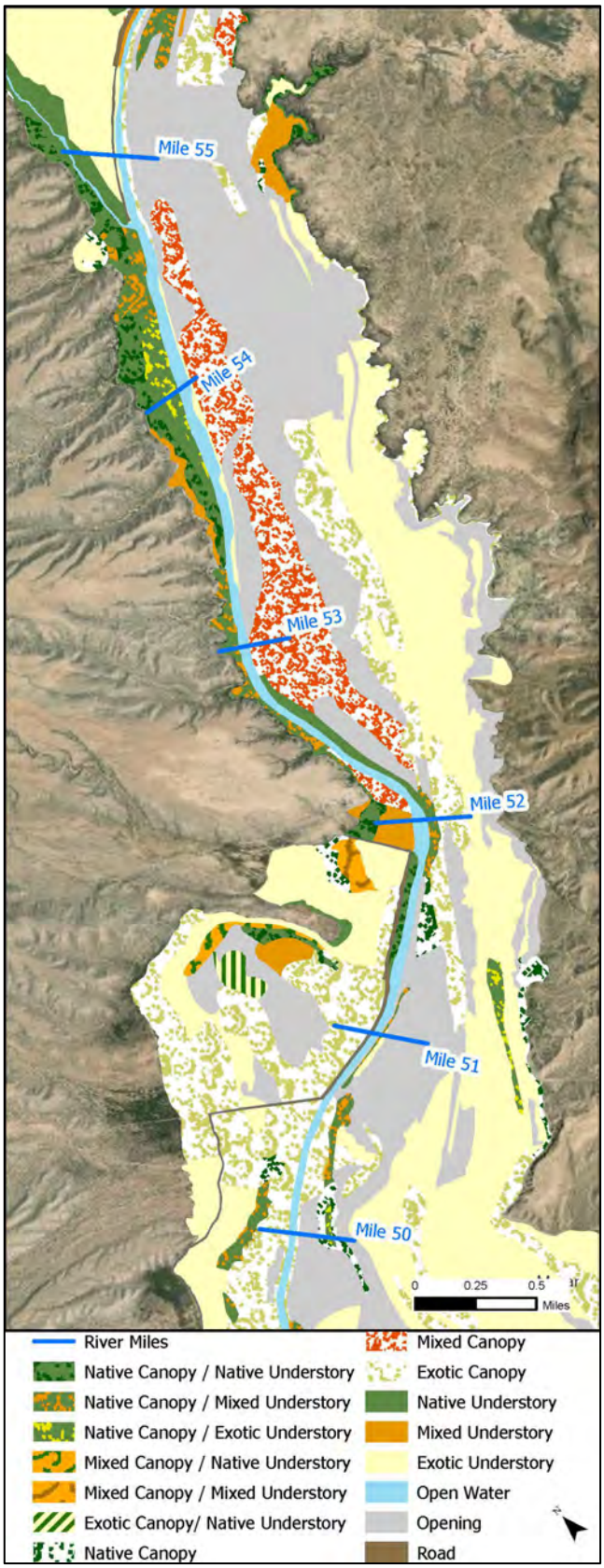
River Miles 55 to 57



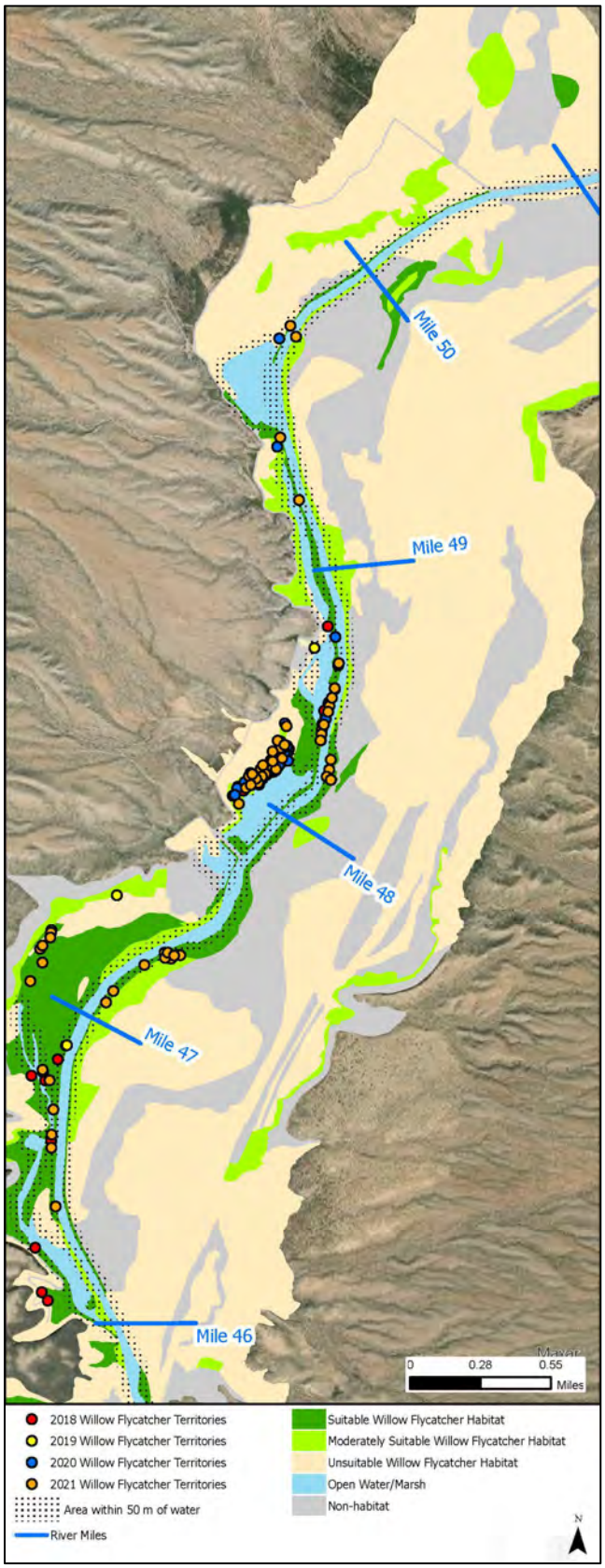


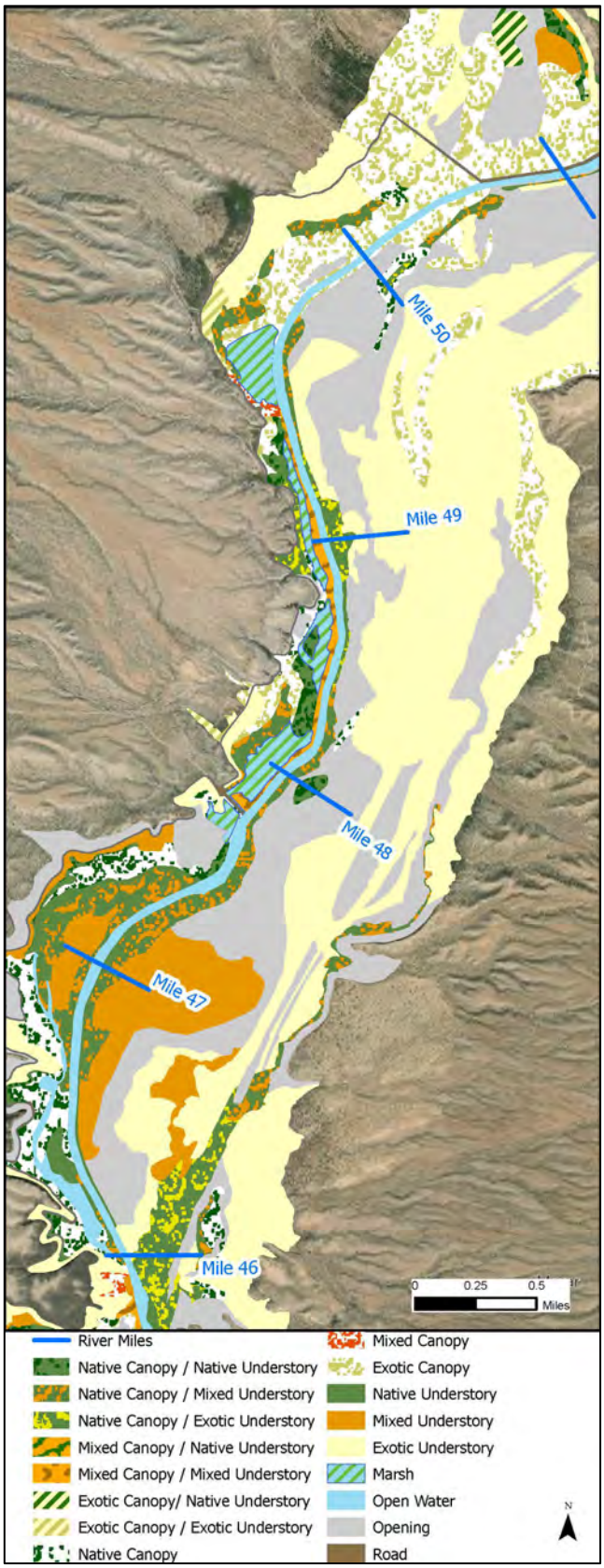
River Miles 50 to 55



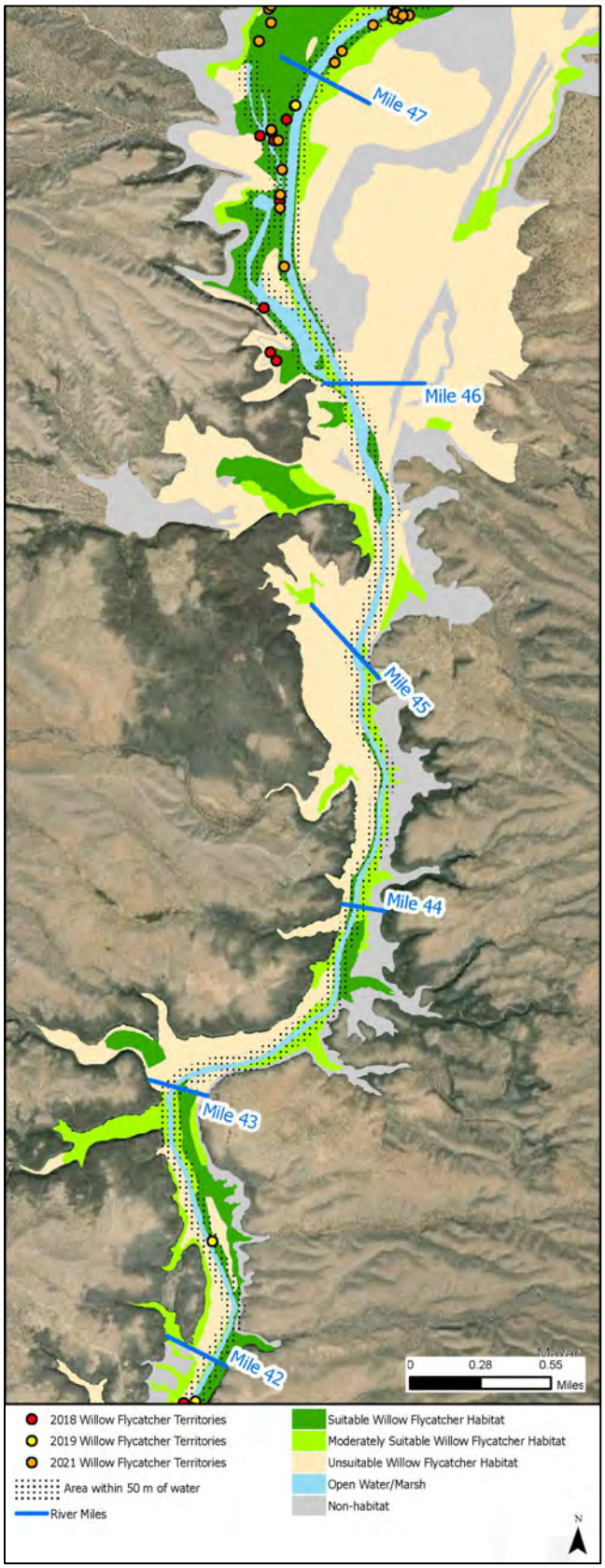


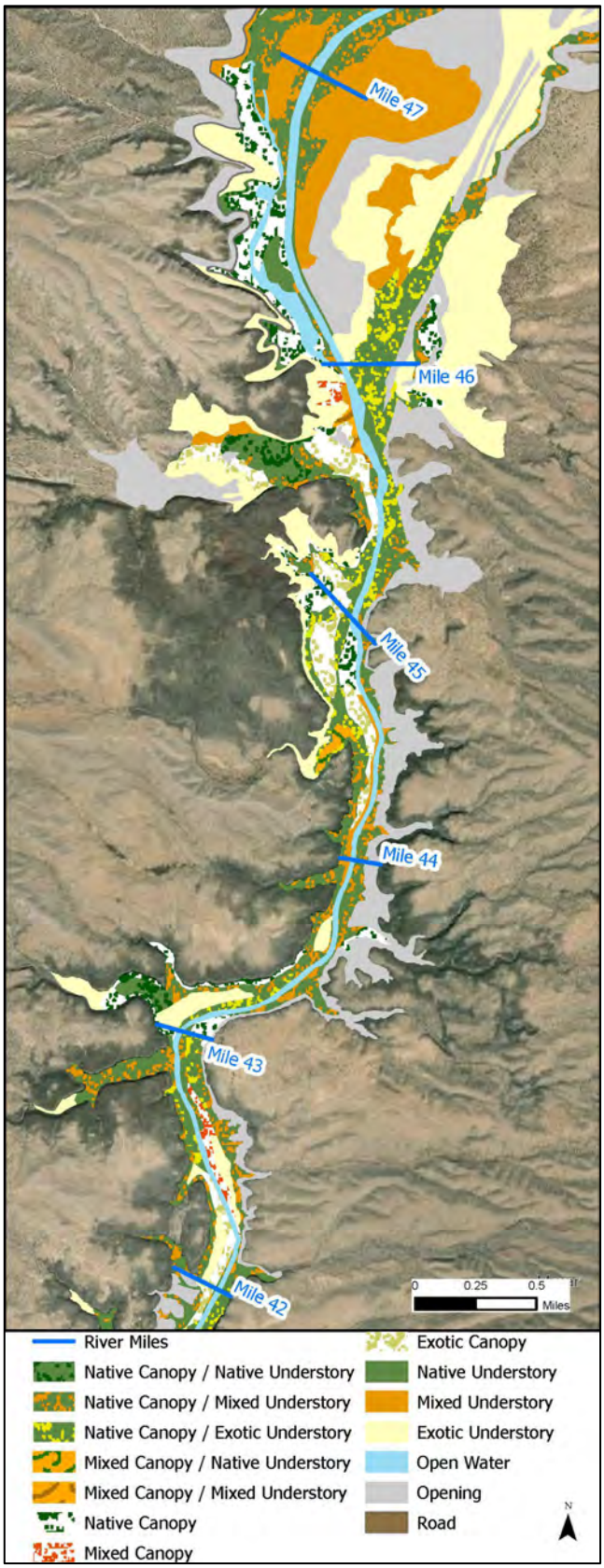
River Miles 47 to 50



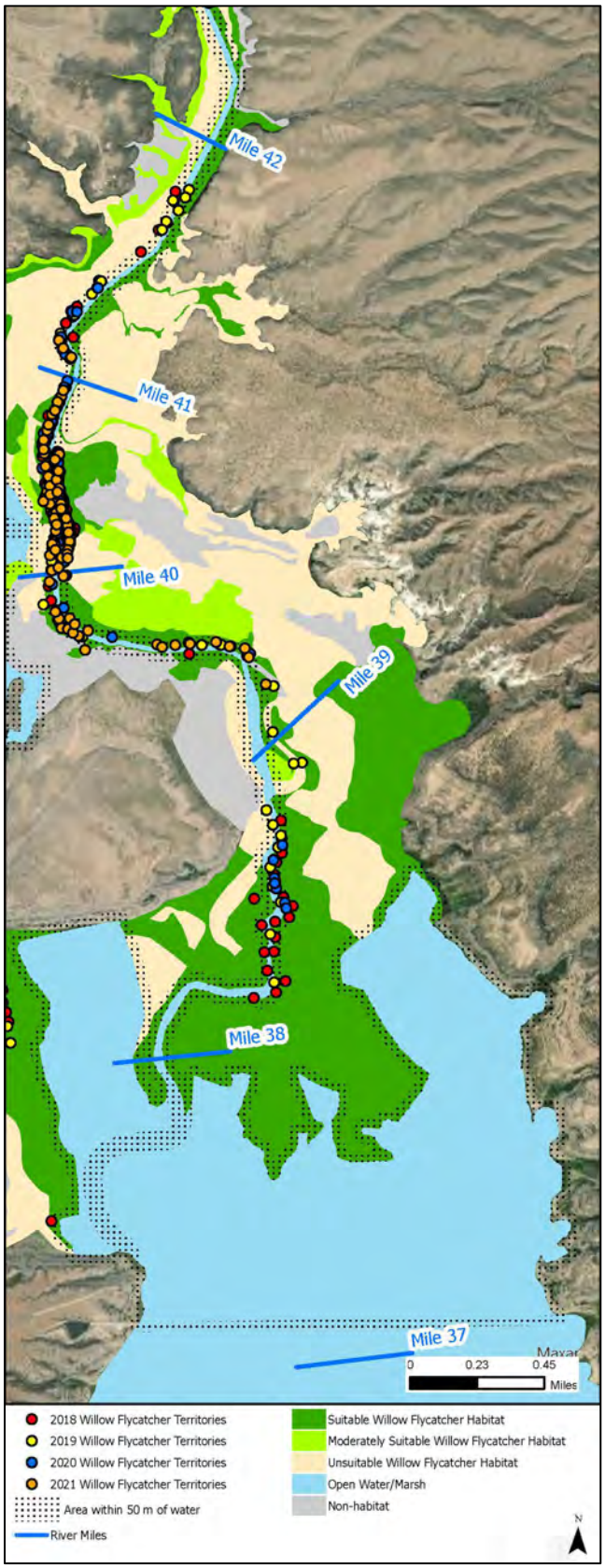


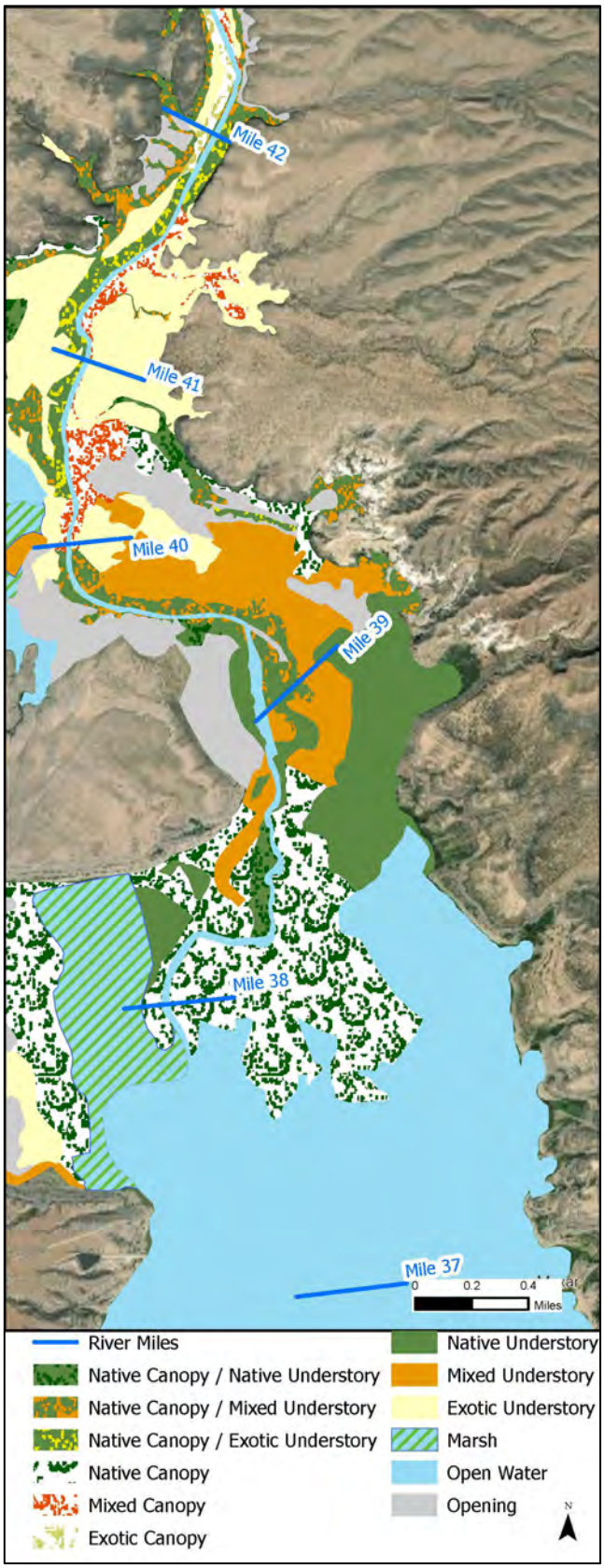
River Miles 42 to 47



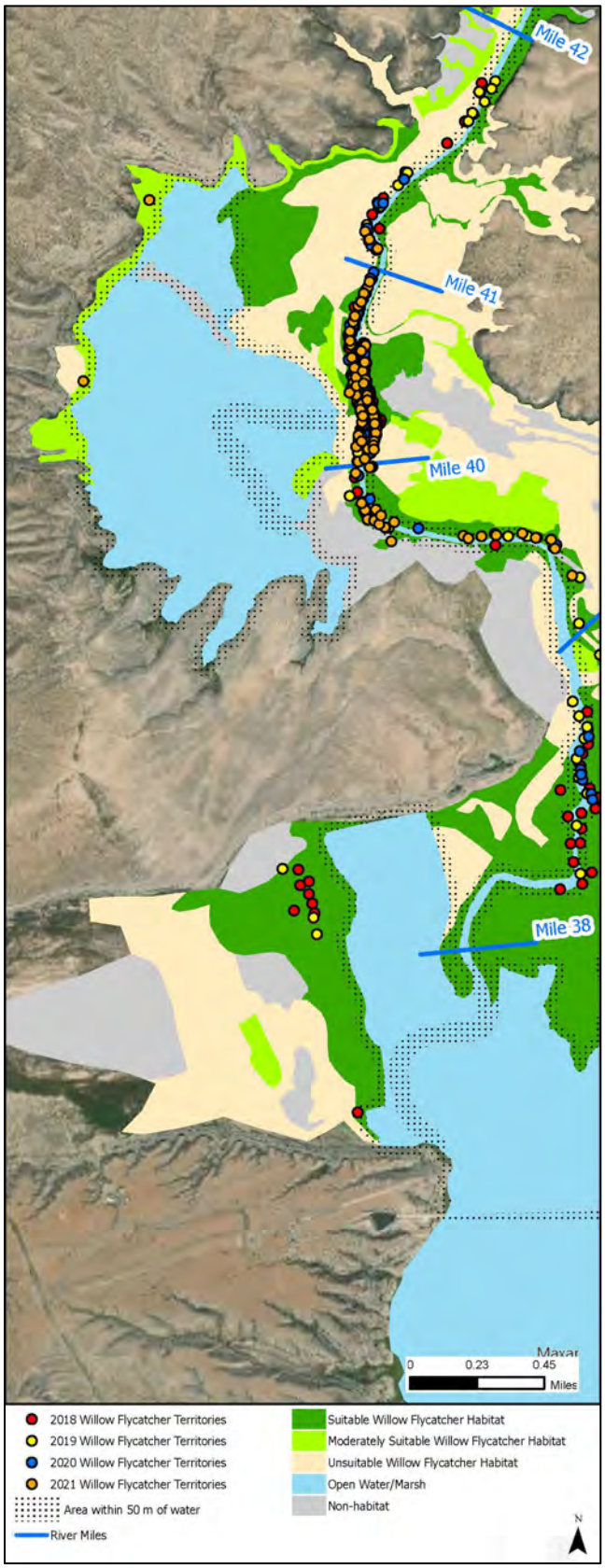


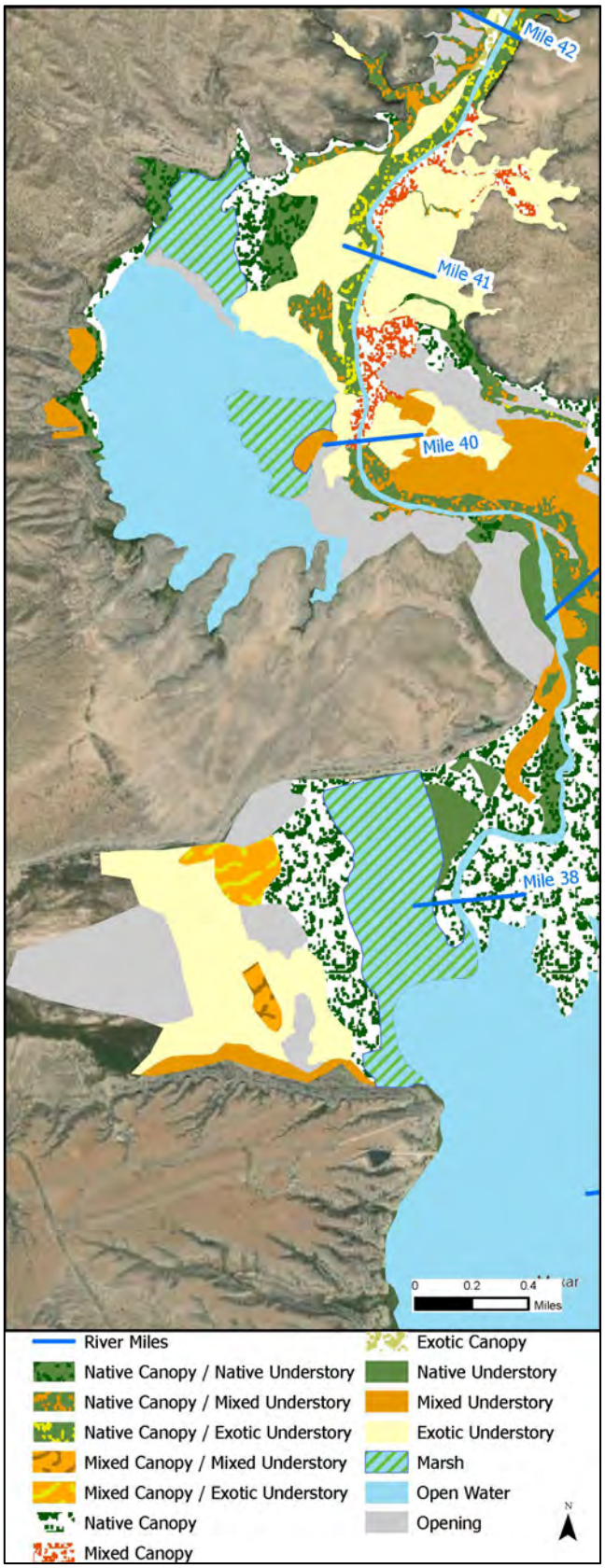
River Miles 37 to 42 East





River Miles 37 to 42 West





Appendix B

Hink and Ohmart Vegetation Types Classified in 2021 with Acreage, Suitability, and Reach

Reach	H&O Class 2021	Acres	SWFL suitability
Belen	C/C-SC3	7.8	U
	C/CW1	9.0	U
	C/CW1d	106.5	M
	C/CW3	158.9	U
	C/CW3d	38.8	M
	C/CW-B3d	4.5	M
	C/CW-RO1	2.9	U
	C/CW-RO1d	15.2	M
	C/CW-RO-NMO1	24.4	U
	C/CW-SC1	19.3	U
	C/CW-SC1d	62.1	M
	C/CW-SC3	12.4	U
	C/CW-SC3d	17.3	M
	C/CW-SC-RO1d	10.2	M
	C/CW-TW1	4.8	U
	C/CW-TW1d	28.2	M
	C/CW-TW3	18.6	U
	C/NMO1d	11.2	U
	C/NMO-B1d	22.4	U
	C/RO1	32.2	U
	C/RO1d	81.0	U
	C/RO-CW1d	19.6	M
	C/RO-MB-SC1	30.1	U
	C/RO-NMO1	16.8	U
	C/RO-NMO1d	10.3	U
	C/RO-SC1d	141.7	U
	C/RO-SC-NMO1d	73.0	U
	C/SC1	206.0	U
	C/SC1d	147.4	U
	C/SC3	57.9	U
	C/SC3d	65.4	U
	C/SC-CW1d	31.9	M
	C/SC-NMO1d	53.9	U
	C/SC-RO1	40.1	U
	C/SC-RO1d	311.8	U
	C/SC-RO3	20.9	U
	C/SC-SBM1	23.0	U
	C/SC-SBM3	95.6	U
	C/SC-SE1	13.6	U
	C/SC-SE-NMO1d	24.3	U
	C/TW-SC1	6.3	U
	C/TW-SC1d	3.8	M
	C/TW-SC-RO1d	16.6	M
	C2	362.2	U

Reach	H&O Class 2021	Acres	SWFL suitability
Belen (cont.)	C2d	968.0	U
	C4	83.3	U
	C4d	15.2	U
	C-CW-SE/CW3d	3.5	U
	C-MB4	4.0	U
	C-MB4d	32.1	M
	C-RO/CW3d	29.4	M
	C-RO/CW-SC3	5.6	U
	C-RO/CW-SC3d	30.3	M
	C-RO/SC3	28.2	U
	C-RO/SC-B3	21.9	U
	C-RO4	21.8	U
	C-RO-MB4d	3.6	M
	C-SC/SC3d	2.4	U
	C-SC4	7.7	U
	C-SC-RO4	38.0	U
	C-SC-SE/CW3d	4.0	U
	C-SE/RO1	1.4	U
	C-SE4	6.4	U
	C-TW/CW3	31.5	M
	C-TW/CW3d	33.3	S
	C-TW/SC-B3	19.6	M
	C-TW/TW-CW-SC3	1.3	M
	C-TW-RO/CW3	15.8	U
	CW/CW-TW3d	24.2	S
	CW4d	12.3	S
	CW5	139.4	S
	CW5d	253.5	S
	CW6	6.5	U
	CW6d	14.9	U
	CW-C4d	1.4	S
	CW-C5d	19.6	M
	CW-C-SC5	5.0	M
	CW-C-SC6	4.3	U
	CW-SC/SC-CW3d	1.9	S
	CW-SC5	66.5	M
	CW-SC5d	19.8	S
	CW-SC-RO5	9.8	M
	CW-SC-RO5d	1.6	M
	CW-SC-SE5d	12.9	U
	CW-SE5	17.2	U
	CW-TH6d	4.8	U
	CW-TW5	9.0	S
	CW-TW5d	0.9	S

Reach	H&O Class 2021	Acres	SWFL suitability
Belen (cont.)	MB/SC-RO3d	10.1	U
	MB4d	14.7	U
	MB-SC4d	6.9	M
	MB-SC-RO4d	10.8	M
	MB-SC-RO-SE4d	11.1	U
	MH	13.2	N
	MS	8.9	N
	RO/C-SC3	10.5	U
	RO/CW3d	10.0	M
	RO4	19.7	U
	RO4d	57.5	U
	RO5	3.2	U
	RO5d	6.2	U
	RO-CW-SC5	1.6	U
	RO-MB/RO-SC3	8.9	U
	RO-SC/CW3	2.5	U
	RO-SC4	8.3	U
	RO-SC4d	13.6	M
	RO-SC5d	2.5	U
	RO-SE/CW3	16.1	U
	RO-SE4	8.4	U
	RO-TW4	21.3	U
	RO-TW-SC4	6.6	U
	SC4	54.4	U
	SC4d	55.8	U
	SC5	134.3	U
	SC5dt	13.5	U
	SC-CW5	4.6	M
	SC-CW-B5	2.2	U
	SC-NMO5	12.6	U
	SC-RO/CW-SC-RO3d	6.8	M
	SC-RO/SC3	5.2	U
	SC-RO/SC3d	9.4	U
	SC-RO/SC-RO3d	27.2	U
	SC-RO4	54.2	U
	SC-RO4d	135.1	M
	SC-RO5	139.0	U
	SC-RO5d	87.8	U
	SC-SE/SC-CW3	3.3	U
	SC-SE4	7.7	U
	SC-SE4d	16.4	U
	SC-SE5	8.1	U
	SC-TW-RO4d	7.9	M
	SE-MB/SC-MB3d	10.3	U

Reach	H&O Class 2021	Acres	SWFL suitability
Belen (cont.)	SE-MB2d	2.5	U
	SE-RO/CW3d	2.6	U
	SE-TW4	14.5	U
	TH6	2.8	U
	TW4	2.5	S
	TW-C/CW3d	9.7	S
	TW-C/CW-TW3d	8.4	S
	TW-C-CW/CW3d	20.2	S
	TW-C-MB4	6.0	M
	TW-C-RO/CW3	12.1	M
	TW-C-RO/CW-RO3	4.3	M
	TW-C-RO/NM0-CW3d	4.0	U
	TW-C-RO/SC3	6.0	M
	TW-C-RO/TW-SC-WB3	16.6	U
	TW-C-RO4	71.4	M
	TW-C-SC-RO4d	28.1	S
	TW-MB/CW3d	2.3	S
	TW-MB-RO4d	6.4	S
	TW-MB-SE/SC-RO3d	6.1	U
	TW-RO/SC-B3d	66.6	S
	TW-RO/TW-CW-RO3	10.0	M
	TW-RO4d	2.2	S
	TW-SC-SE4	3.5	U
	WB6	10.4	U
	WB6d	4.6	U

Reach	H&O Class 2021	Acres	SWFL suitability
Bosque del Apache	C/B-SC1d	23.2	U
	C/CW1d	1.1	M
	C/CW3d	47.4	M
	C/CW-SC1	17.7	U
	C/CW-SC1d	164.4	M
	C/CW-SC3d	27.6	M
	C/CW-SC-B1	21.5	U
	C/CW-SC-B1d	30.7	M
	C/CW-SC-B3	8.8	U
	C/SC1d	520.9	U
	C/SC-B1	12.1	U
	C/SC-B1d	169.0	U
	C/SC-CW1	20.1	U
	C/SC-CW1d	207.1	M
	C/SC-CW3	10.9	U
	C/SC-NMO1d	2.6	U
	C/SC-RO1d	52.0	U
	C/TW-C1	14.0	U
	C2	24.0	U
	C2d	299.8	U
	C5	4.4	U
	C-RO/SC-RO3d	17.4	U
	C-RO4d	14.7	M
	C-SC/SC-B3	29.0	U
	C-SC-B5	6.7	U
	C-TW/SC3	36.0	U
	C-TW/SC-TW3d	16.1	S
	C-TW5	109.6	U
	CW4d	1.6	S
	CW5	13.0	S
	CW5d	58.9	S
	CW-B5d	0.3	M
	CW-SC5	53.0	M
	CW-SC5d	18.2	S
	CW-SC-B5	76.6	M
	CW-SC-B6	13.7	U
	HMS-ATX-WB6	10.3	U
	RO4	8.4	U
	SC/CW-C3	28.2	U
	SC/SC3d	43.4	U
	SC/SC-CW3	6.5	U
	SC4	46.4	U
	SC4d	73.3	U

Reach	H&O Class 2021	Acres	SWFL suitability
Bosque del Apache (cont.)	SC5	303.6	U
	SC5d	16.4	U
	SC5dt	139.2	U
	SC-B5	45.4	U
	SC-B6	65.8	U
	SC-B-CW5	29.4	U
	SC-CW5	31.0	M
	SC-CW5d	9.9	S
	SC-HMS5	23.9	U
	SC-RO/CW-TW-B3	7.5	U
	SC-RO6	14.5	U
	TW-C/B3	41.5	U
	TW-C/SC3	4.8	M
	TW-C-RO4	53.0	M
	TW-C-SC/SC-B3	11.1	M
	TW-SC4	8.7	M

Reach	H&O Class 2021	Acres	SWFL suitability
Escondida	C/B-RO1d	29.2	U
	C/CW-SC1d	13.0	M
	C/CW-SC-B1d	34.9	M
	C/NMO1d	43.7	U
	C/NMO-B1	34.3	U
	C/RO-SC1d	21.5	U
	C/SC1	21.4	U
	C/SC1d	135.4	U
	C/SC-B1d	9.7	U
	C/SC-CW3	5.3	U
	C/SC-NM01d	6.8	U
	C/SC-NMO1	24.0	U
	C/SC-NMO1d	26.9	U
	C/SC-NMO-B1	13.5	U
	C/SC-NMO-SBM1	38.0	U
	C/SC-RO1d	70.9	U
	C/SC-RO-NMO-SBM1	4.7	U
	C/SC-SBM1d	28.6	U
	C2	147.9	U
	C2d	100.9	U
	C-RO/CW-RO-B3d	32.8	M
	C-RO/CW-SC-B3	8.1	U
	C-RO/CW-SC-B3d	25.2	M
	C-RO/CW-SC-SBM-B3d	31.4	U
	C-RO/SC-B3	9.4	U
	C-RO/SC-NMO3d	21.4	U
	C-RO/SC-SBM-B3	6.6	U
	C-RO2	4.8	U
	C-RO4	82.7	U
	C-SE/SC3	8.9	U
	C-TW/CW-SC-NMO1	4.3	U
	C-TW-RO/SC-CW3	18.6	U
	C-TW-RO4	9.5	U
	CW-RO5d	9.6	M
	CW-SC5	16.6	M
	CW-SC-B5	85.9	M
	NMO5	4.3	U
	NMO-SC5d	7.1	U
	RO/B-CW3d	11.0	M
	RO/B-CW-SC3d	8.1	M
	RO/B-NMO3	18.4	U
	RO/CW3d	2.6	M
	RO/RO-SC3d	60.1	U
	RO/SC3	95.7	U

Reach	H&O Class 2021	Acres	SWFL suitability
Escondida (cont.)	RO/SC3d	2.2	U
	RO/SC-B3d	17.6	U
	RO/SC-CW3d	12.8	M
	RO/SC-NMO-SBM3d	13.5	U
	RO/SC-RO3	12.7	U
	RO-C/CW-B3	4.6	U
	RO-SBM-SC5	25.2	U
	RO-SC/SC3	13.2	U
	RO-SC/SC3d	21.8	U
	RO-SC/SC-NMO-B3	2.6	U
	RO-SC4	25.9	U
	RO-SC4d	10.9	M
	RO-SC5	10.8	U
	RO-SC5d	13.8	U
	RO-TW-C/SC-CW-RO3d	10.1	M
	RO-TW-CW4d	67.6	M
	SC/CW-SC-NMO3d	33.6	U
	SC/SC3	162.5	U
	SC/SC3d	17.3	U
	SC/SC-NMO3d	77.2	U
	SC4d	110.9	U
	SC5	802.5	U
	SC5d	658.1	U
	SC5dt	202.1	U
	SC-ATX6	69.3	U
	SC-B5	104.9	U
	SC-CW5	12.2	M
	SC-CW5	9.4	M
	SC-CW5d	10.6	S
	SC-NMO5	11.9	U
	SC-NMO5d	7.5	U
	SC-NMO-B5d	13.2	U
	SC-RO/SC-RO3d	31.2	U
	SC-RO4d	4.6	M
	SC-RO5	29.0	U
	SC-RO5d	8.3	U
	SC-SBM5	75.6	U
	SC-SBM5d	10.4	U
	SC-SBM-B5	41.8	U
	SC-SE/SC-B3	4.0	U
	SE-RO-SC/SC-CW3	29.2	U
	TW/SC3	27.4	M
	TW-C/SC-NMO3d	24.7	U
	TW-C-RO/CW-SC-B3d	20.1	S

Reach	H&O Class 2021	Acres	SWFL suitability
Escondida (cont.)	TW-C-RO/SC-B3	12.2	M
	TW-RO/SC-NMO3d	42.4	U
	TW-RO-SE/CW-SC3	13.4	U
	TW-SC4d	1.3	S

Reach	H&O Class 2021	Acres	SWFL suitability
San Acacia	ATX6	13.4	U
	B-SC5	26.5	U
	C/C-SBM1	41.9	U
	C/NMO-B1d	8.8	U
	C/NMO-SC1	11.9	U
	C/NMO-SC1d	38.5	U
	C/NMO-SC-SBM1d	3.5	U
	C/RO1d	77.3	U
	C/RO3d	17.3	U
	C/RO-SBM1d	14.3	U
	C/SBM3d	42.4	U
	C/SC1	25.5	U
	C/SC1	151.1	U
	C/SC1d	62.8	U
	C/SC-B1	22.1	U
	C/SC-NMO1	77.8	U
	C/SC-NMO1d	3.8	U
	C/SC-RO1	9.4	U
	C/SC-RO-SBM3	15.6	U
	C/SC-SBM1	101.8	U
	C/SC-SBM1d	6.3	U
	C/SC-SBM3	12.7	U
	C/SC-SBM-NMO1	53.2	U
	C2	2.1	U
	C4	64.6	U
	C5	18.8	U
	C-RO/B-CW3d	10.1	M
	C-RO/CW3	8.1	U
	C-RO/CW3d	7.8	M
	C-RO/CW-B3	3.0	U
	C-RO/CW-B3d	8.0	M
	C-RO/CW-RO-B3d	12.6	M
	C-RO/CW-SC3	9.3	U
	C-RO/CW-SC3d	1.9	M
	C-RO/SC-HMS-NMO3	5.8	U
	C-RO/SC-SBM3	43.5	U
	C-RO4	17.0	U
	C-RO4d	10.8	M
	C-RO4d	95.7	M
	C-TW/SC-NMO3d	17.1	U
	C-TW-RO/CW-SC-HMS3	5.4	U
	CW5	4.1	S
	CW-C4d	1.5	S
	CW-RO-SBM5d	2.6	U

Reach	H&O Class 2021	Acres	SWFL suitability
San Acacia (cont.)	CW-SC-B5d	5.4	M
	RO/CW3d	8.9	M
	RO4d	1.8	U
	RO-C/CW3d	3.3	M
	RO-C4d	55.0	M
	SC4d	43.2	U
	SC5	349.7	U
	SC5d	208.3	U
	SC5dt	160.9	U
	SC-B5	505.7	U
	SC-CW-B5	24.8	U
	SC-HMS5	57.9	U
	SC-NMO5d	34.5	U
	SC-SBM5	184.4	U
	SC-SBM-HMS5	13.1	U
	SC-TW-C5	18.0	U
	SC-WB6	10.5	U
	TW-C-RO/CW-SC3d	64.0	S
	TW-C-RO/CW-SC-B3	1.6	M
	TW-C-RO/CW-SC-B3d	6.4	S
	TW-C-SC/SC-NMO3	22.0	U
	C/CW-B1	13.0	U
	C/CW-SC-B1	2.6	U

Reach	H&O Class 2021	Acres	SWFL suitability
San Marcial	ATX-HMS-WB5	44.8	U
	B6	29.0	U
	B-TW5	49.6	U
	B-WB6	62.9	U
	C/ATX1	13.3	U
	C/B-CW1d	4.6	M
	C/CAT-CW-SC3d	17.4	M
	C/CAT-SC3d	9.9	U
	C/C-CW3d	11.4	M
	C/CW1d	20.8	M
	C/CW3	6.1	U
	C/CW-SC1d	6.4	M
	C/CW-SC3	20.2	U
	C/CW-TW1	3.3	U
	C/CW-TW-B1d	1.8	M
	C/HMS-B3	7.5	U
	C/SC1d	69.3	U
	C/SC3	14.3	U
	C/SC3d	33.8	U
	C/SC-B1d	20.0	U
	C/SC-B3	66.9	U
	C/SC-B3d	9.0	U
	C/SC-CW1	10.0	U
	C/SC-CW1d	3.5	M
	C/SC-HMS1	4.7	U
	C/SC-HMS3	4.3	U
	C/SC-RO1	17.6	U
	C/SC-SBM-B1	19.2	U
	C/SC-TW1d	25.8	M
	C/SC-TW3	30.4	U
	C/TW-C1	16.4	U
	C/TW-CW1d	15.7	M
	C/TW-CW-B1d	3.7	M
	C/TW-HMS-B1	9.1	U
	C/TW-SC1d	8.5	M
	C/TW-SC3	8.2	U
	C/TW-SC-B1d	8.9	M
	C/TW-SC-HMS-B1d	2.6	U
	C2	182.1	U
	C2d	177.8	U
	C4	135.4	U
	C4d	97.7	U
	C5	22.1	U
	CAT-CW5	12.2	M

Reach	H&O Class 2021	Acres	SWFL suitability
San Marcial (cont.)	CAT-CW5d	63.0	S
	CAT-TW-C5d	5.5	M
	CAT-TW-CW5d	24.7	S
	C-SC/CW-SC-B3	5.5	U
	C-SC5	40.6	U
	C-TW/B1	10.7	U
	C-TW/B3	9.9	U
	C-TW/CAT-SC-B3	101.5	M
	C-TW/CAT-SC-B3d	25.4	S
	C-TW/CW1d	24.2	M
	C-TW/CW-B3	26.4	M
	C-TW/CW-CAT3d	3.0	S
	C-TW/CW-SC1d	14.5	M
	C-TW/SC1d	87.0	U
	C-TW/SC3	4.6	U
	C-TW/SC-CW1d	40.9	M
	C-TW/SC-CW3d	2.5	S
	C-TW/SC-HMS-B1	30.5	U
	C-TW/SC-RO1d	11.9	U
	C-TW/SC-TW3	9.7	M
	C-TW/TW-B3d	6.6	S
	C-TW/TW-CW-B1d	43.0	M
	C-TW/TW-CW-SC1d	51.0	M
	C-TW/TW-RO1	10.6	U
	C-TW/TW-SC1	88.4	U
	C-TW/TW-SC-B1d	82.2	M
	C-TW2	38.0	U
	C-TW2d	365.2	U
	C-TW4	32.4	U
	C-TW4d	12.6	M
	C-TW5	6.1	U
	CW5	4.6	S
	CW5d	18.3	S
	CW6	22.2	U
	CW-C5	3.8	M
	CW-CAT5d	13.9	S
	CW-C-B5d	19.6	M
	CW-SC5	15.6	M
	CW-SC5d	15.4	S
	CW-SC6	15.6	U
	CW-SC-B5	36.9	M
	CW-TW4d	1.1	S
	CW-TW5	8.9	S

Reach	H&O Class 2021	Acres	SWFL suitability
San Marcial (cont.)	CW-TW5d	16.8	S
	CW-TW-C5d	20.5	M
	HMS5	15.3	U
	HMS-ATX6	23.1	U
	MH	913.8	N
	RO4d	3.1	U
	SC/B3	15.8	U
	SC/SC3	53.3	U
	SC/SC3d	10.4	U
	SC/SC-CAT3	18.3	U
	SC4	587.6	U
	SC4d	38.8	U
	SC5	2301.2	U
	SC5d	1841.4	U
	SC5dt	547.2	U
	SC6	302.7	U
	SC-B6	16.0	U
	SC-C/CW3	2.8	U
	SC-C4	51.7	U
	SC-CAT5	5.5	U
	SC-C-CW5	1.2	U
	SC-CW5	44.3	M
	SC-HMS5	1.6	U
	SC-RO-B5	87.2	U
	SC-SBM-B5	33.9	U
	SC-SBM-WB5	24.6	U
	SC-TW/B3	13.2	U
	SC-TW/CAT3d	21.0	M
	SC-TW/CW3	26.8	U
	SC-TW/SC3	50.5	U
	SC-TW4	112.1	M
	SC-TW4d	20.4	S
	SC-TW5	117.7	M
	SC-TW5d	34.5	S
	SC-TW6d	28.8	U
	SC-TW-C4	34.8	U
	SC-TW-C4d	17.0	M
	SC-TW-C5	38.7	U
	SC-WB5	724.5	U
	TW/B-TW1d	10.4	M
	TW/CAT3	6.2	S
	TW/CAT3d	24.2	S
	TW/CAT-CW1d	13.5	M

Reach	H&O Class 2021	Acres	SWFL suitability
San Marcial (cont.)	TW/CAT-SC1d	21.4	M
	TW/CW3	54.8	S
	TW/CW-RO-SC1	44.3	U
	TW/CW-SC1	17.0	U
	TW/CW-SC3	32.3	M
	TW/CW-SC3d	11.1	S
	TW/CW-SC-B1d	1.7	M
	TW/CW-TW-SC1d	1.8	M
	TW/SC1	6.4	U
	TW/SC1d	22.0	U
	TW/SC3	96.6	M
	TW/SC3d	25.4	S
	TW/SC-B1d	14.2	U
	TW/TW3	16.2	S
	TW/TW3d	11.2	S
	TW/TW-B3d	26.1	S
	TW/TW-C1	14.1	U
	TW/TW-CAT3	14.3	S
	TW/TW-C-SC3	10.5	M
	TW/TW-CW1	3.4	U
	TW/TW-CW-SC3	12.3	M
	TW/TW-CW-SC3d	9.4	S
	TW/TW-SC3d	64.3	S
	TW/TW-SC-B1	16.1	U
	TW/TW-SC-B1d	12.1	M
	TW/TW-SC-B3	71.4	M
	TW/TW-SC-B3d	39.9	S
	TW2	58.4	U
	TW2d	58.7	U
	TW4	680.7	S
	TW4d	66.6	S
	TW5	131.4	S
	TW6	63.2	U
	TW6d	14.8	U
	TW-B6d	6.9	U
	TW-C/B-SC1	25.1	U
	TW-C/CAT-CW3d	32.0	S
	TW-C/CAT-SC1d	4.3	U
	TW-C/CW3	30.5	M
	TW-C/CW-B3d	9.8	S
	TW-C/CW-CAT3	9.9	M
	TW-C/CW-SC1	12.9	U
	TW-C/CW-SC1d	19.1	M

Reach	H&O Class 2021	Acres	SWFL suitability
San Marcial (cont.)	TW-C/CW-SC3	9.2	M
	TW-C/CW-SC3d	30.0	S
	TW-C/CW-SC-B1d	17.5	M
	TW-C/CW-SC-B3	28.8	M
	TW-C/CW-SC-B3d	19.4	S
	TW-C/CW-TW3d	1.7	S
	TW-C/CW-TW-SC3	2.3	M
	TW-C/HMS1c	11.8	U
	TW-C/SC1	5.7	U
	TW-C/SC1d	5.6	U
	TW-C/SC3	139.9	M
	TW-C/SC3d	8.9	S
	TW-C/SC-B3d	20.9	S
	TW-C/SC-CAT1d	50.9	U
	TW-C/SC-CW3d	22.4	S
	TW-C/SC-SBM-B-WB3	21.6	U
	TW-C/SC-TW1	17.7	U
	TW-C/SC-TW1d	16.2	M
	TW-C/SC-TW-B1	6.1	U
	TW-C/TW-CW-B3	7.0	M
	TW-C/TW-CW-SC3	61.4	M
	TW-C/TW-CW-SC3d	11.3	S
	TW-C/TW-SC1	7.1	U
	TW-C/TW-SC1d	57.4	M
	TW-C/TW-SC-B1	7.9	U
	TW-C/TW-SC-B3	4.1	M
	TW-C/TW-SC-HMS1d	26.9	U
	TW-C2	50.9	U
	TW-C2d	114.0	U
	TW-C4	170.9	M
	TW-C4d	13.9	S
	TW-C5	25.4	M
	TW-C6	20.6	U
	TW-C-B6d	1.9	U
	TW-C-CW5	42.6	M
	TW-C-RO/TW-SC-B3	67.6	M
	TW-C-RO4	5.5	M
	TW-C-SC/SC3	64.8	M
	TW-C-SC/SCd	32.1	S
	TW-C-SC/TW-SC-B3	27.7	M
	TW-C-SC4	174.9	M
	TW-C-SC4d	48.8	S
	TW-C-SC5	60.5	M

Reach	H&O Class 2021	Acres	SWFL suitability
San Marcial (cont.)	TW-CW5	35.7	S
	TW-SC/B3d	5.8	M
	TW-SC/CW3	32.0	M
	TW-SC/CW-SC3d	26.2	S
	TW-SC/SC3	17.9	M
	TW-SC4	356.4	M
	TW-SC4d	100.9	S
	TW-SC4d	75.3	S
	TW-SC5	14.5	M
	TW-SC5d	55.1	S
	TW-SC6	20.2	U
	TW-SC6d	83.8	U
	TW-SC-ATX5	30.8	U

Reach	H&O Class 2021	Acres	SWFL suitability
Sevilleta	ATX5	134.6	U
	C/CW1	6.5	U
	C/CW1d	8.5	M
	C/CW3	3.1	U
	C/CW3d	107.6	M
	C/CW-C1d	2.5	M
	C/CW-RO1d	26.8	M
	C/CW-SC-B1d	6.3	M
	C/CW-SC-RO1d	3.7	M
	C/CW-SC-RO3d	3.9	M
	C/CW-TW3d	1.2	M
	C/CW-TW-B3d	8.1	M
	C/RO1	23.7	U
	C/RO1d	193.1	U
	C/RO3	13.8	U
	C/RO3d	6.2	U
	C/RO-B1	2.8	U
	C/RO-SC1	9.3	U
	C/RO-SC1d	22.0	U
	C/SC1d	66.4	U
	C/SC3	11.5	U
	C/SC3d	12.3	U
	C/SC-B1	4.3	U
	C/SC-B1d	15.8	U
	C/SC-NMO-B1d	28.3	U
	C/SC-RO1	49.5	U
	C/SC-RO1d	25.9	U
	C/SC-RO-NMO3	31.0	U
	C/SC-RO-SBM3	18.7	U
	C/SC-SBM1d	7.7	U
	C/SC-SBM3	28.3	U
	C/TW-SC1d	4.5	M
	C/TW-SC-B3d	2.5	M
	C/TW-SC-RO1d	6.9	M
	C/TW-SC-RO3	8.4	U
	C2	9.4	U
	C2d	199.3	U
	C4	1.9	U
	C4d	12.9	U
	C-RO/CW3d	4.4	M
	C-RO/CW-RO3	2.7	U
	C-RO/SC3d	17.0	U
	C-RO/SC-B3	16.8	U
	C-RO/SC-CW3	8.7	U

Reach	H&O Class 2021	Acres	SWFL suitability
Sevilleta (cont.)	C-RO/SC-RO3d	15.1	U
	C-RO-SC/TW-CW-SC3d	1.7	M
	C-RO-SE/CW-TW3d	1.9	U
	C-SC-RO4d	10.5	M
	C-TW/CW3	6.0	M
	C-TW-RO/SC-CW-RO3d	23.2	M
	C-TW-RO/SC-RO3d	10.4	M
	CW4d	4.1	S
	CW5	2.7	S
	CW5d	25.3	S
	CW-RO4d	5.0	S
	CW-SC5d	4.5	S
	CW-SC-B5d	1.9	M
	CW-TW5	13.6	S
	HMS-CR6	7.1	U
	MH	3.2	W
	MS	17.6	N
	RO/SC3	3.2	U
	RO/SC-RO3	6.3	U
	RO/SC-RO3d	11.1	U
	RO5	5.3	U
	RO5d	3.0	U
	RO-C/SC-CW3	4.5	U
	RO-C4d	7.4	M
	RO-SC/CW-NMO-B3d	1.9	U
	RO-SC/CW-RO3d	2.4	M
	RO-SC5	28.1	U
	RO-SC5d	19.2	U
	RO-SE/CW-SC-B3d	2.3	U
	SC/SC3d	14.9	U
	SC/TW-CW-RO3	14.1	U
	SC4d	9.1	U
	SC5	558.0	U
	SC5d	149.2	U
	SC5dt	29.9	U
	SC6	14.4	U
	SC6d	5.4	U
	SC-ATX5	17.3	U
	SC-ATX6	310.0	U
	SC-B5	2.6	U
	SC-C/SC-RO3	6.3	U
	SC-C-RO5	13.4	U
	SC-CW5	4.7	M
	SC-RO/SC3	5.7	U

Reach	H&O Class 2021	Acres	SWFL suitability
Sevilleta (cont.)	SC-RO4	10.6	U
	SC-RO4d	33.4	M
	SC-RO5	151.0	U
	SC-RO5d	8.6	U
	SC-RO-B5	1.0	U
	SC-RO-NMO5	9.5	U
	SC-SBM-B5	7.0	U
	SC-TW5	22.0	M
	TW/TW-CW-SC3d	14.2	S
	TW5d	6.4	S
	TW-C/TW-CW-C3d	2.2	S
	TW-C-RO/CW3d	2.9	S
	TW-C-RO/CW-B3	3.9	M
	TW-C-RO/CW-SC-B3d	15.1	S
	TW-C-RO/TW-CW-SC3	3.9	M
	TW-C-RO-SE/TW-CW-SC1d	5.6	U
	TW-C-SC-RO5	15.3	M
	TW-CW/CW3d	7.5	S
	TW-CW5d	1.2	S
	TW-CW-B5d	2.0	M
	TW-CW-C4d	2.5	S
	TW-CW-SC-B5	6.1	M
	TW-CW-SC-B5d	0.3	M
	WB6	5.3	U
	WB-ATX6d	5.0	U

Reach	H&O Class 2021	Acres	SWFL suitability
Tiffany	B-SC6	4.6	U
	C/C1	81.7	U
	C/CW-SC1d	4.1	M
	C/SC1d	7.3	U
	C/SC3	12.0	U
	C/SC3d	23.2	U
	C/SC-B1d	6.2	U
	C/SC-C1	10.0	U
	C/TW-SC-B1	15.3	U
	C2	11.0	U
	C2d	14.9	U
	C-SC4d	33.8	M
	C-SC5	31.3	U
	C-TW2d	40.5	U
	SC/SC3	14.7	U
	SC4	19.5	U
	SC5	654.6	U
	SC5d	28.8	U
	SC5dt	1453.0	U
	SC-C5	17.9	U
	SC-RO4	7.8	U
	SC-TW/SC3	38.1	U
	SC-TW4d	24.7	S
	SC-TW5	78.6	M
	TW4	64.8	S
	TW-C5	22.0	M
	TW-C-SC4d	6.1	S
	TW-C-SC5	90.2	M
	TW-SC5	12.4	M

PEER REVIEW DOCUMENTATION

PROJECT AND DOCUMENT INFORMATION

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Document Southwestern Willow Flycatcher Habitat Suitability 2021; Middle Rio Grande, New Mexico

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Team Leader Dave Moore

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REVIEW REQUIREMENT

Part A: Document Does Not Require Peer Review

Explain _____

Part B: Document Requires Peer Review: SCOPE OF PEER REVIEW

Peer Review restricted to the following Items/Section(s): Reviewer:

Entire document subject to review Dave Moore

REVIEW CERTIFICATION

Peer Reviewer - I have reviewed the assigned Items/Section(s) noted for the above document and believe them to be in accordance with the project requirements, standards of the profession, and Reclamation policy.

Reviewer: Dave Moore Review Date: March 2022 Signature: STANTON MOORE Digitally signed by STANTON MOORE Date: 2022.04.19 15:26:56 -06'00'

I have discussed the above document and review requirements with the Peer Reviewer and believe that this review is completed, and that the document will meet the requirements of the project.

Team Leader: Dave Moore Date: April 2022 Signature: STANTON MOORE Digitally signed by STANTON MOORE Date: 2022.04.19 15:27:24 -06'00'