Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Post-Development and System-Wide Monitoring of Rodent Populations – Spring 2016

April 2018

Work conducted under LCR MSCP Work Tasks D10 and F3

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

Federal Participant Group

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

Arizona Participant Group

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

Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

California Participant Group

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

Nevada Participant Group

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

Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
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Conservation Participant Group

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

Lower Colorado River Multi-Species Conservation Program

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ACRONYMS AND ABBREVIATIONS

km	kilometer(s)
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
MEFF	mobile electronic field form

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ABSTRACT

The Bureau of Reclamation is the lead agency for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). Implementing the LCR MSCP will create at least 8,132 acres of new habitat (5,940 acres of Fremont cottonwood-Goodding's willow [*Populus fremontii-Salix gooddingii*], 1,320 acres of honey mesquite [*Prosopis glandulosa*], 512 acres of marsh, and 360 acres of backwater) for 26 covered species, including the Colorado River cotton rat (*Sigmodon arizonae plenus*) and Yuma hispid cotton rat (*Sigmodon hispidus eremicus*). The *sobrinus* subspecies of the desert pocket mouse (*Chaetodipus penicillatus*) is being evaluated to determine if it should be added as a covered species. The presence of Colorado River cotton rats, Yuma hispid cotton rats, and desert pocket mice at existing habitat along the lower Colorado River and at LCR MSCP conservation areas was monitored under Work Task D10 (System Monitoring of Rodent Populations) and Work Task F3 (Small Mammal Colonialization of Conservation Areas). Trapping was conducted in eight conservation areas and three system-wide survey sites during spring 2016. Five Colorado River cotton rat captures were recorded at conservation areas, and none were captured during system-wide surveys. Four Yuma hispid cotton rats were captured in conservation areas, and six were captured during system-wide surveys. Eighteen desert pocket mice were captured in conservation areas, and three were captured during system-wide surveys. A genetic analysis was not conducted, so it is not known if these mice were of the *sobrinus* subspecies.

INTRODUCTION

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a partnership of Federal and non-Federal stakeholders that was created to respond to the need to balance the use of lower Colorado River (LCR) water resources and the conservation of native species and their habitats in compliance with the Endangered Species Act. It is a long-term (50-year) plan to conserve at least 26 species along the LCR from Lake Mead to the Southerly International Boundary with Mexico through implementation of a Habitat Conservation Plan. Implementation of the LCR MSCP began in October 2005. Implementing the LCR MSCP will create at least 8,132 acres of new habitat (5,940 acres of Fremont cottonwood-Goodding's willow [*Populus fremontii-Salix gooddingii*] [hereafter cottonwood-willow], 1,320 acres of honey mesquite [*Prosopis glandulosa*], 512 acres of marsh, and 360 acres of backwater).

Twenty-six Federal or State-listed candidate and sensitive species and their associated habitats, ranging from aquatic and wetland habitats to riparian and upland areas, are covered under the LCR MSCP. These include the Colorado River cotton rat (*Sigmodon arizonae plenus*) and Yuma hispid cotton rat (*Sigmodon hispidus eremicus*). The *sobrinus* subspecies of the desert pocket mouse (*Chaetodipus penicillatus*) is being evaluated to determine if it should be added as a covered species.

Within the LCR MSCP habitat creation goals, 125 acres of habitat are to be created for Colorado River cotton rats, and 76 acres are to be created for Yuma hispid cotton rats. It is currently believed that the ranges of these two cotton rat species do not overlap. Those captured south of the Trigo and Chocolate Mountains in the area of the Imperial National Wildlife Refuge and south of the Yuma, Arizona, area to date are Yuma hispid cotton rats. Those captured north of the aforementioned mountain ranges to date are Colorado River cotton rats. The northernmost historic records of Colorado River cotton rats are from an area just south of Laughlin, Nevada (Hall 1946; Bradley 1966). Colorado River cotton rats were captured in 2012 at the Big Bend Conservation Area, marking the first record of the species in Nevada since 1966.

The desert pocket mouse occurs in creosote bush (*Larrea tridentata*) and xeric riparian communities of the Southwest, from Baja California, Mexico in the South and southeastern California, southern Nevada, and extreme southwest Utah in the North. The range of the *sobrinus* subspecies is not well documented, but it is believed to be within Clark County, Nevada, and may be present farther south. The desert pocket mice caught during the 2016 small mammal surveys were not evaluated to determine whether or not they were of the *sobrinus* subspecies.

The Bureau of Reclamation is increasing its understanding of restoration science through an adaptive management approach; therefore, monitoring of habitat creation/restoration sites is crucial. Species presence at existing habitat along

the LCR and at LCR MSCP conservation areas is being monitored under Work Task D10 (System Monitoring of Rodent Populations) and Work Task F3 (Small Mammal Colonialization of Conservation Areas). In addition, Work Task C27 (Small Mammal Population Studies) was conducted to identify distribution, genetics, and habitat requirements and to establish monitoring protocols for the covered small mammal species.

METHODS

Sherman live traps (3 x 3.75 x 12 inches) were placed non-randomly in areas with the highest likelihood of encountering the cotton rat species, which generally consist of a dense understory of grasses and/or shrubs alongside or beneath an overhead cover of forbs and low-growing woody species (Work Task C27) (Goertz 1964). In general, if the overall trapping area is fairly homogenous, with appropriately dense vegetation structure, the trapping grid begins on a corner or edge. If a distinctly denser vegetation area is found within an otherwise more open area, the trapping grid will begin in the denser habitat patch. These surveys are focused on determining the presence of cotton rat species. All other captures are incidental to the main focus, and the methods were not designed to estimate abundance; therefore, the numbers of individuals of each species (including Colorado River cotton rats and Yuma hispid cotton rats) reported here are rough indices that do not provide reliable means of analyzing population trends.

Sherman live traps are triggered by an animal stepping on a pressure plate that then closes a trap door behind it. Traps were baited with a mixture of oats, peanut butter, and vanilla. A small handful of cotton was also added to each trap to provide insulating cover for any animal trapped overnight. The traps were set 1 to 2 hours before sunset and pulled within 1 to 2 hours of sunrise during the warmer months to minimize heating of the traps during the trapping period.

When the habitat patch allowed, traps were set out in a grid of at least three transects approximately 50 feet (15 meters) apart. Each transect consisted of at least five trap stations spaced approximately 33 feet (10 meters) apart. Trap spacing is estimated with pacing and is not measured exactly; it may vary if the more densely vegetated areas are dispersed across the trapping area.

When the habitat patch with the highest density vegetation was more linear, transects were not set in a grid system. If only a single linear stretch of habitat was trapped, a single transect was set along the edge of the habitat patch. This usually meant that the transect was much longer than in the typical grid system (15 or more trap stations).

The approximate location of each trap was recorded, and the traps were collected the following morning using a Trimble Juno Global Positioning System unit running a mobile electronic field form (MEFF) using the software Terrasync.

Each transect was labeled by a letter, and each trap was numbered. For example, the first trap station of the first transect of a grid would be labeled A-1, and if there were two traps at that location, they were designated as trap A-1-a and A-1-b. Data were entered by hand on paper data sheets and electronically on the Global Positioning System unit using the MEFF.

Captured animals were either viewed inside the trap or transferred into a clear plastic bag and identified to species. The animals were identified using the Mammals of California field guide (Jameson and Peeters 2004), the Kays and Wilson field guide (2002), and the expertise of LCR MSCP personnel that had more than 3 years of experience conducting surveys. Cotton rats were given an age class based on three general size classes (juvenile, subadult, and adult). The age classes of the cotton rats were determined based on the general size of an individual using the experience of LCR MSCP personnel present during the survey. Gender was also determined for cotton rats. All other species were only given an age class of either juvenile or adult, and gender was not determined. Measurements were taken, if needed, for identification. A MEFF was used to record information on all animals captured, whether they were marked, where in the grid they were captured, the location of the grid, and what the dominant ground cover vegetation was in the trapping area. All of the exact same data were also recorded on a paper data sheet as backup. All animals were released back into the trapping area once identification was made. Traps in which an animal had been captured were washed in a bleach water solution and then rinsed in plain water and set out to dry after each trapping day.

STUDY AREAS

Trapping was conducted in eight LCR MSCP conservation areas and three system-wide survey sites within Reaches 2–7 (figure 1).

LCR MSCP Conservation Areas

Big Bend Conservation Area

The Big Bend Conservation Area is located in Nevada 5 miles (8 kilometers [km]) south of Laughlin, Nevada, along the Needles Highway (figure 1). The site is within Reach 3. It includes 15 acres of backwater as well as 15 acres of habitat comprised of a marshy strip of cattails (*Typha* spp.) leading into a drier strip of arrowweed (*Pluchea sericea*) and mule fat (*Baccharis salicifolia*) (figure 2). The majority of the small mammal captures were located at the interface of a grassy area comprised of dallisgrass (*Paspalum dilatum*) and bushy bluestem (*Andropogon glomeratus*) with the upland shrubs.

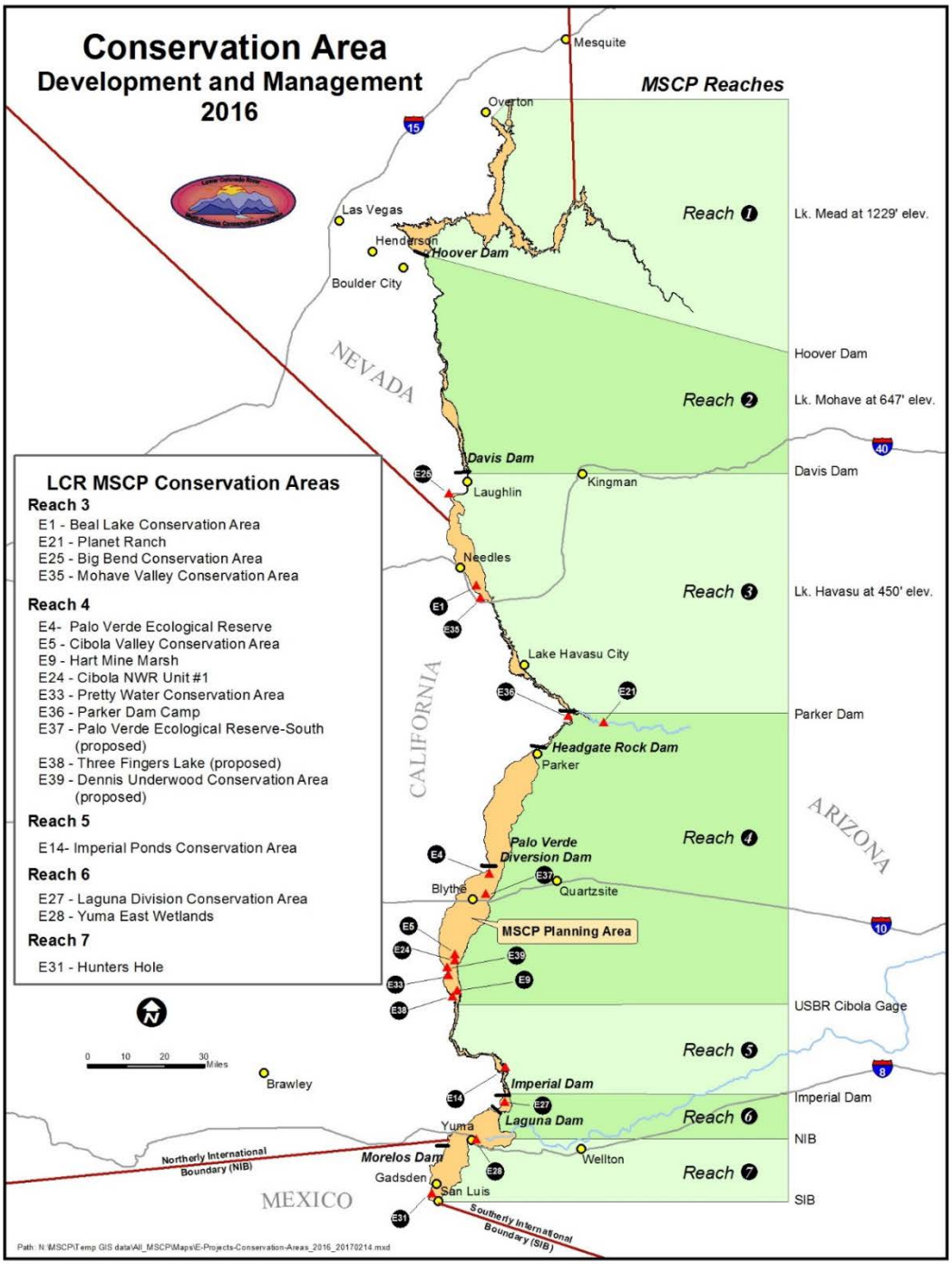


Figure 1.—Habitat conservation areas.

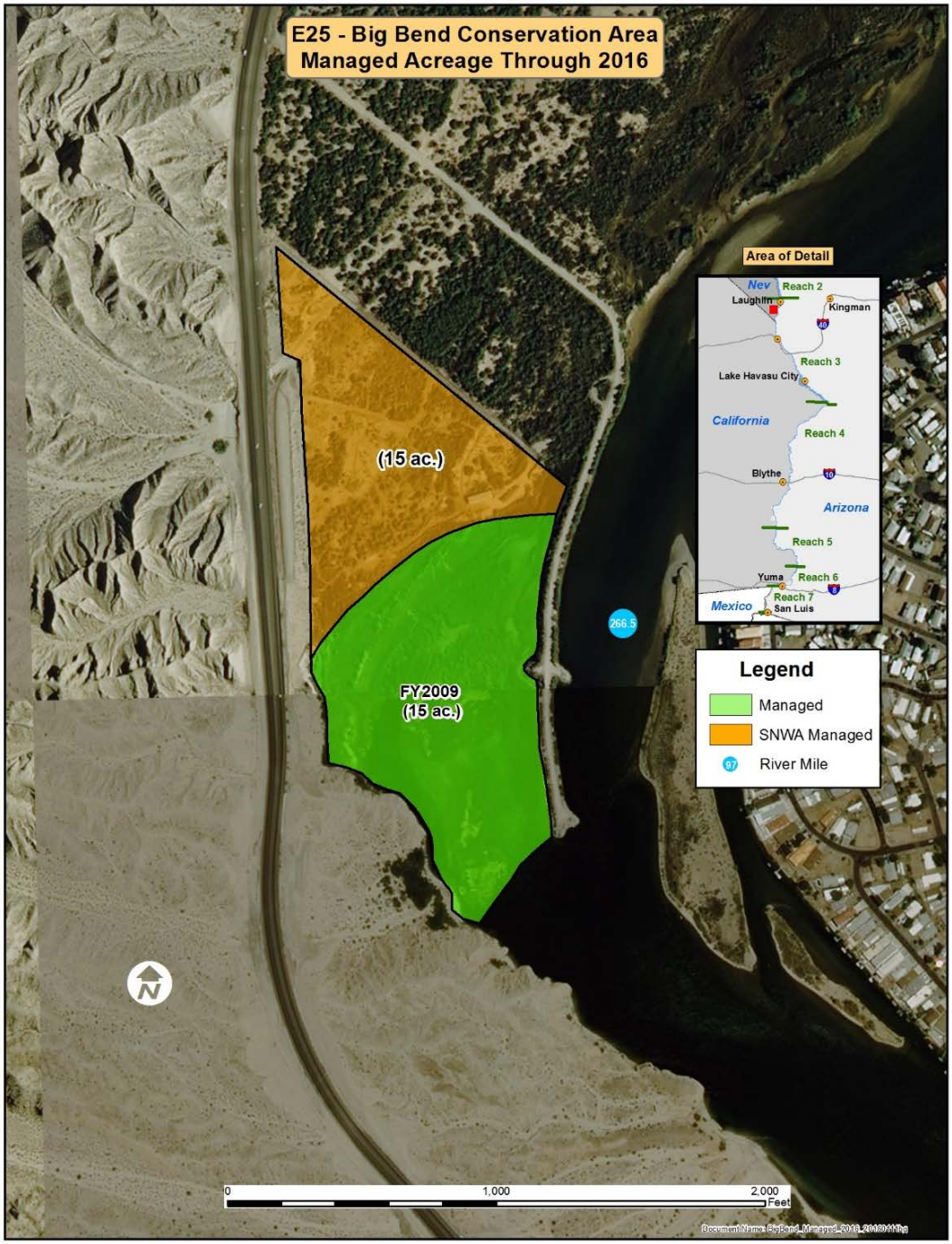
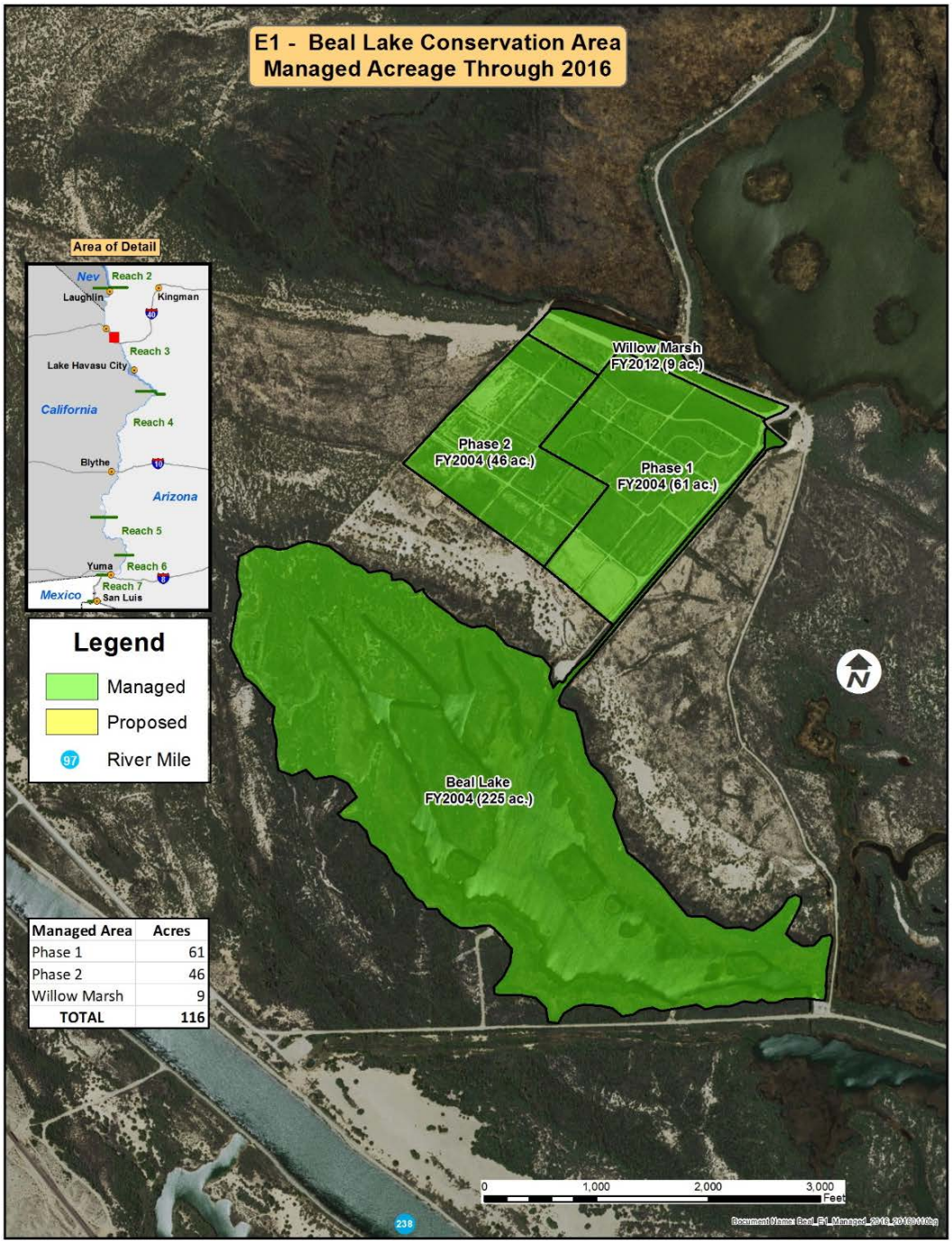


Figure 2.—Big Bend Conservation Area managed acres through 2016.

Beal Lake Conservation Area

The Beal Lake Conservation Area is 100 acres adjacent to Beal Lake and Topock Marsh, inside the Havasu National Wildlife Refuge on the Arizona side of the Colorado River (see figure 1). The site is within Reach 3. It is a two-phase habitat creation project that was initiated in spring 2003 (figure 3). The site was planted with Fremont cottonwood, Goodding's willow, coyote willow (*Salix exigua*), honey mesquite, and screwbean mesquite (*Prosopis pubescens*). Currently, the site contains areas of all these tree species. Arrowweed and some baccharis (*Baccharis* spp.) have begun to fill in the open areas and edges of most of the plots in the site.

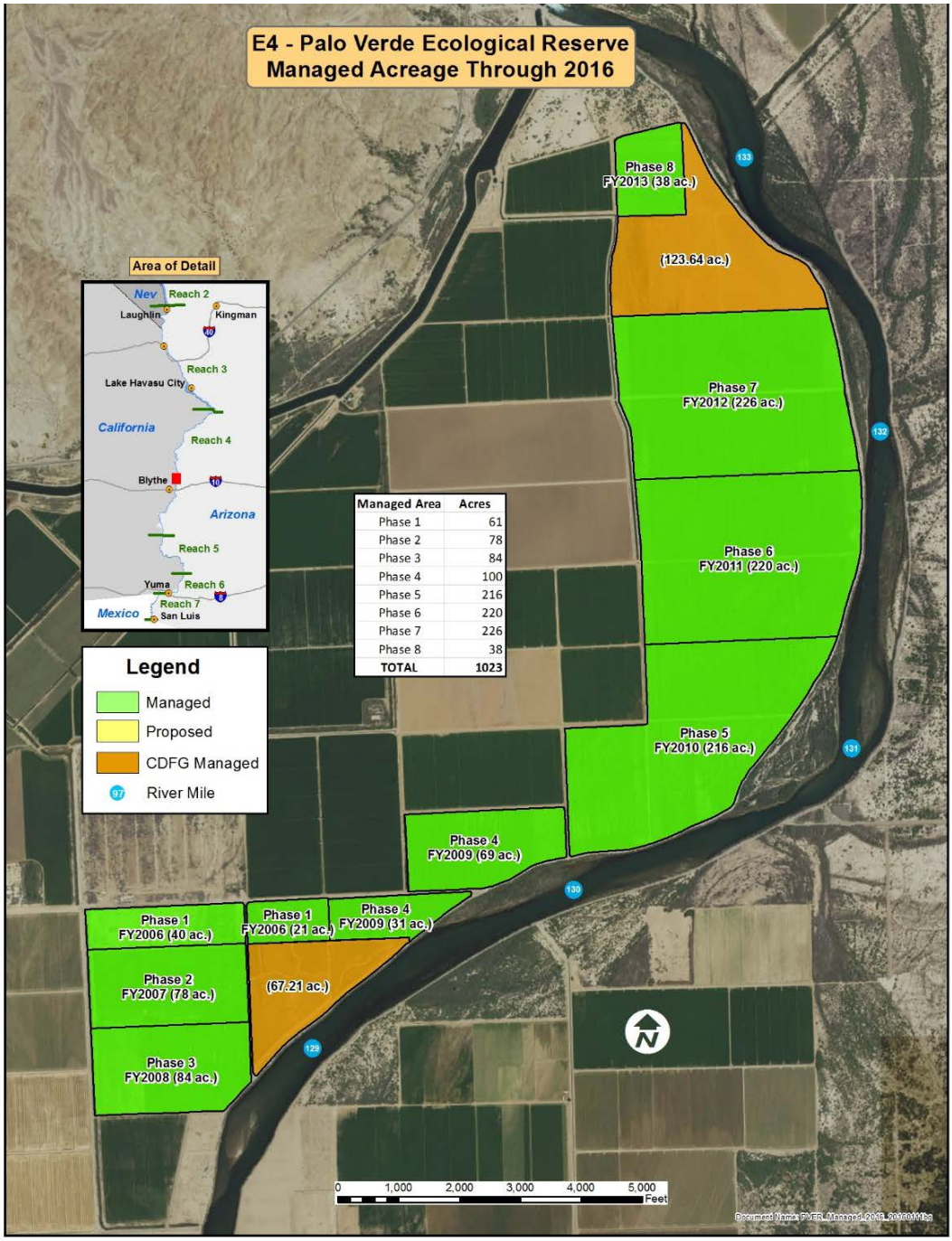


Managed Area	Acres
Phase 1	61
Phase 2	46
Willow Marsh	9
TOTAL	**116**

Figure 3.—Beal Lake Conservation Area managed acres through 2016.

Palo Verde Ecological Reserve

The Palo Verde Ecological Reserve is a conservation area located 5 miles (8 km) north of Blythe, California, along the California side of the Colorado River (see figure 1). The site is within Reach 4. It encompasses 1,300 acres. The acreages are separated into nine different phases, with one phase planted every year through 2014 (figure 4). In spring 2006, a 31-acre nursery (Phase 1) was planted. In spring 2007, Phase 2 was planted with 80 acres of Fremont cottonwood, Goodding's willow, coyote willow, and other riparian plants. Phase 3 was planted in spring 2008 and is also planted with cottonwood-willow habitat types. Phase 4 was planted in 2009 and contains mostly cottonwood-willow, with one plot of honey mesquite and a mix of native grasses. Phases 5, 6, and 7 were planted in 2010, 2011, and 2012, respectively, with cottonwood-willow habitat. Phase 8 was planted in 2013 with 38 acres of honey mesquite and quailbush (*Atriplex lentiformis*) habitat.



Managed Area	Acres
Phase 1	61
Phase 2	78
Phase 3	84
Phase 4	100
Phase 5	216
Phase 6	220
Phase 7	226
Phase 8	38
TOTAL	1023

Figure 4.—Palo Verde Ecological Reserve managed acres through 2016.

Cibola Valley Conservation Area

The Cibola Valley Conservation Area is located in Arizona adjacent to the Colorado River, approximately 15 miles (24 km) south of Blythe, California (see figure 1). The site is within Reach 4. It will encompass about 1,235 acres when completed. Three phases included the planting of Fremont cottonwood, Goodding's willow, coyote willow, and other riparian plant species. Phase 1 was planted in spring 2006 and contains a 22-acre nursery and a 64-acre area of cottonwood-willow habitat. Phase 3 was planted in spring 2007 and contains over 80 acres of cottonwood-willow planted in different combinations (figure 5). Phase 3 also includes 11 acres of baccharis mixed with some cottonwood-willow. Phase 2 was planted in spring 2008. Most of Phase 2 is planted with cottonwood-willow habitat, with one small area of honey mesquite and quailbush. Phase 4 was planted in 2009 with honey mesquite and quailbush. Phase 5 was planted in 2010 with 71 acres of honey mesquite and quailbush. Phase 6 was planted in 2011 with 89 acres of honey mesquite and quailbush.

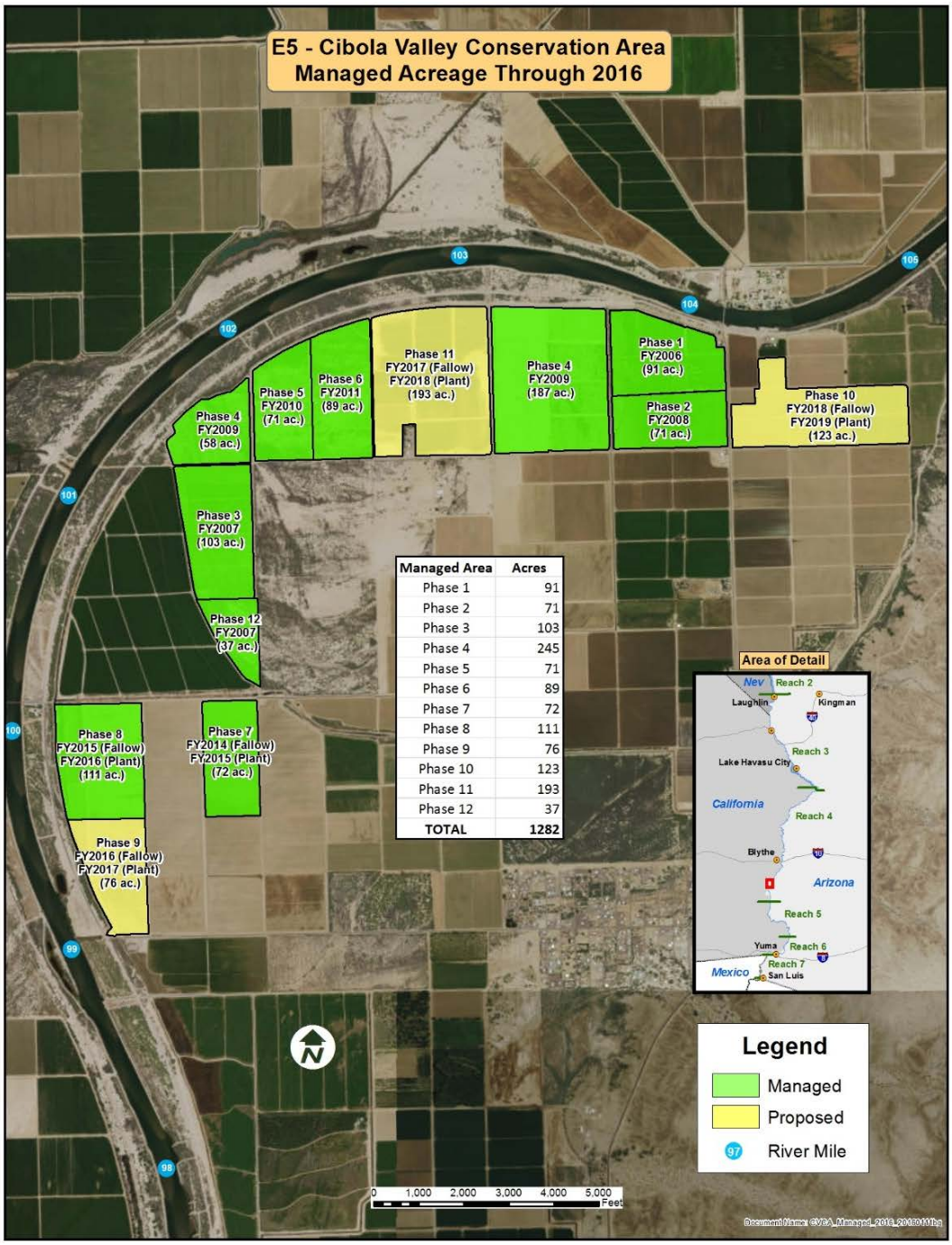


Figure 5.—Cibola Valley Conservation Area managed acres through 2016.

Cibola National Wildlife Refuge Unit #1 Conservation Area

The Cibola National Wildlife Refuge is located approximately 30 miles (48 km) south of Blythe, California, along 12 miles (19 km) of the LCR in Arizona and California (see figure 1). The site is within Reach 4. The Cibola National Wildlife Refuge is divided into six management units, of which the Cibola National Wildlife Refuge Unit #1 Conservation Area comprises approximately 949 acres (figure 6). The Nature Trail was planted in 1999 with 34 acres of cottonwood-willow and honey mesquite habitat. The central portion of the site is a mix of dense Johnsongrass (*Sorghum halepense*) and baccharis. The Cottonwood Genetics field was planted in 2007 with Fremont cottonwood as part of a Northern Arizona University study. It has a sparse canopy structure, and dense patches of Johnsongrass have come into the open areas.

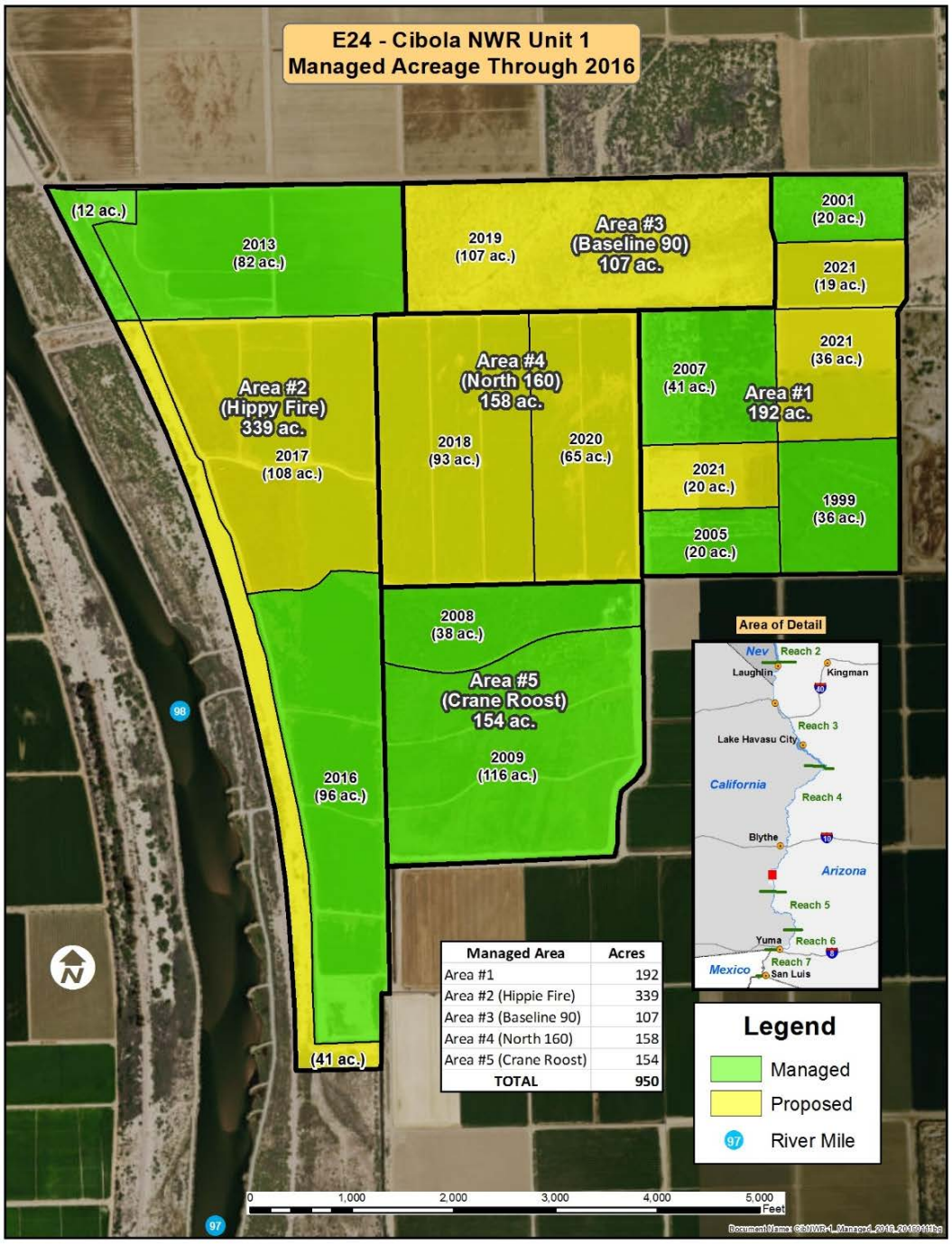
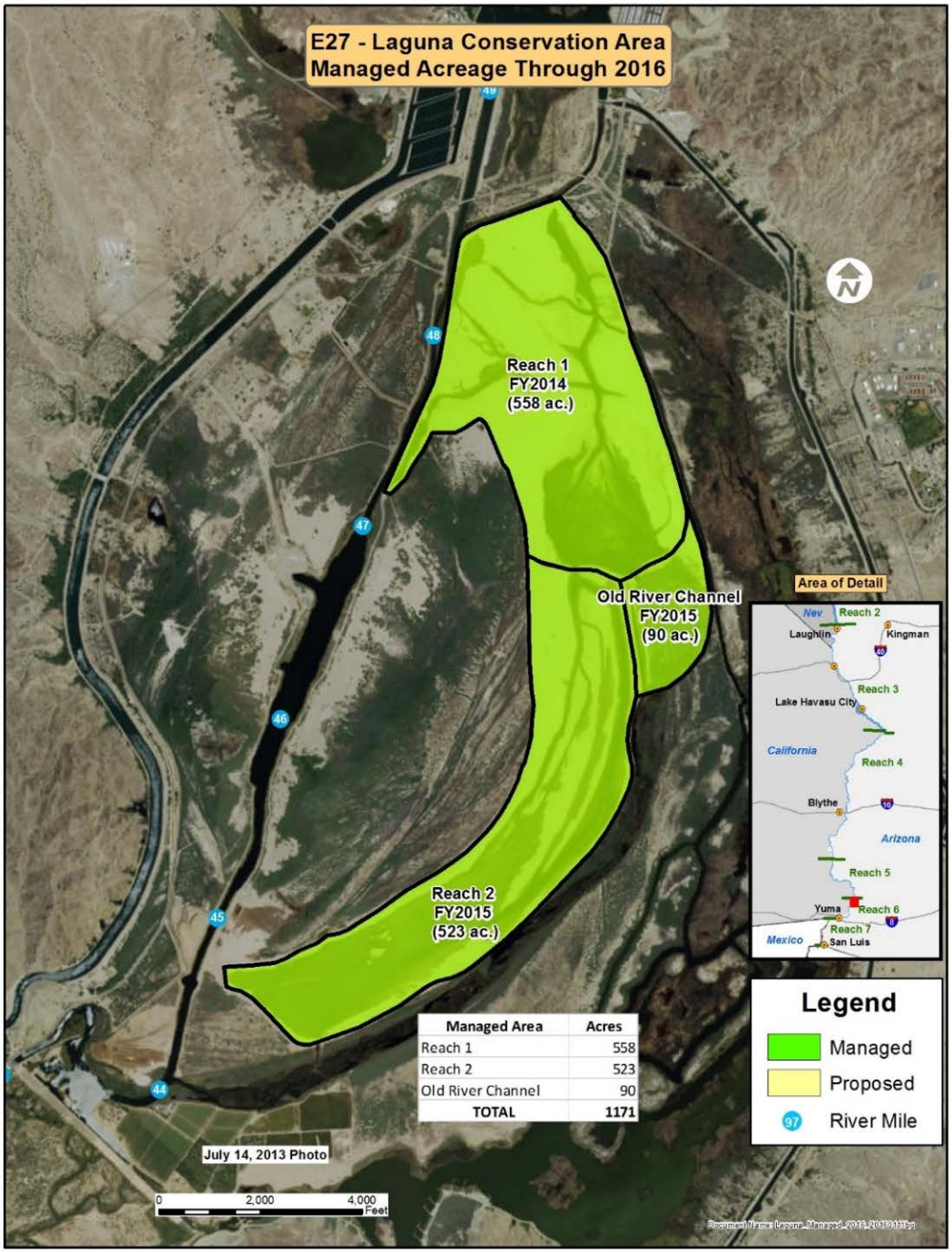


Figure 6.—Cibola National Wildlife Refuge Unit #1 Conservation Area managed acres through 2016.

Laguna Division Conservation Area

The Laguna Division Conservation Area is located 20 miles north of Yuma, Arizona, between Imperial Dam and Laguna Dam. The site is within Reach 6. It covers 1,100 acres, straddling the California/Arizona State boundary. The Laguna Division Conservation Area comprises approximately 200 acres of open water and marsh, 430 acres of cottonwood-willow, and 400 acres of honey mesquite habitat. Planting was completed in 2016.

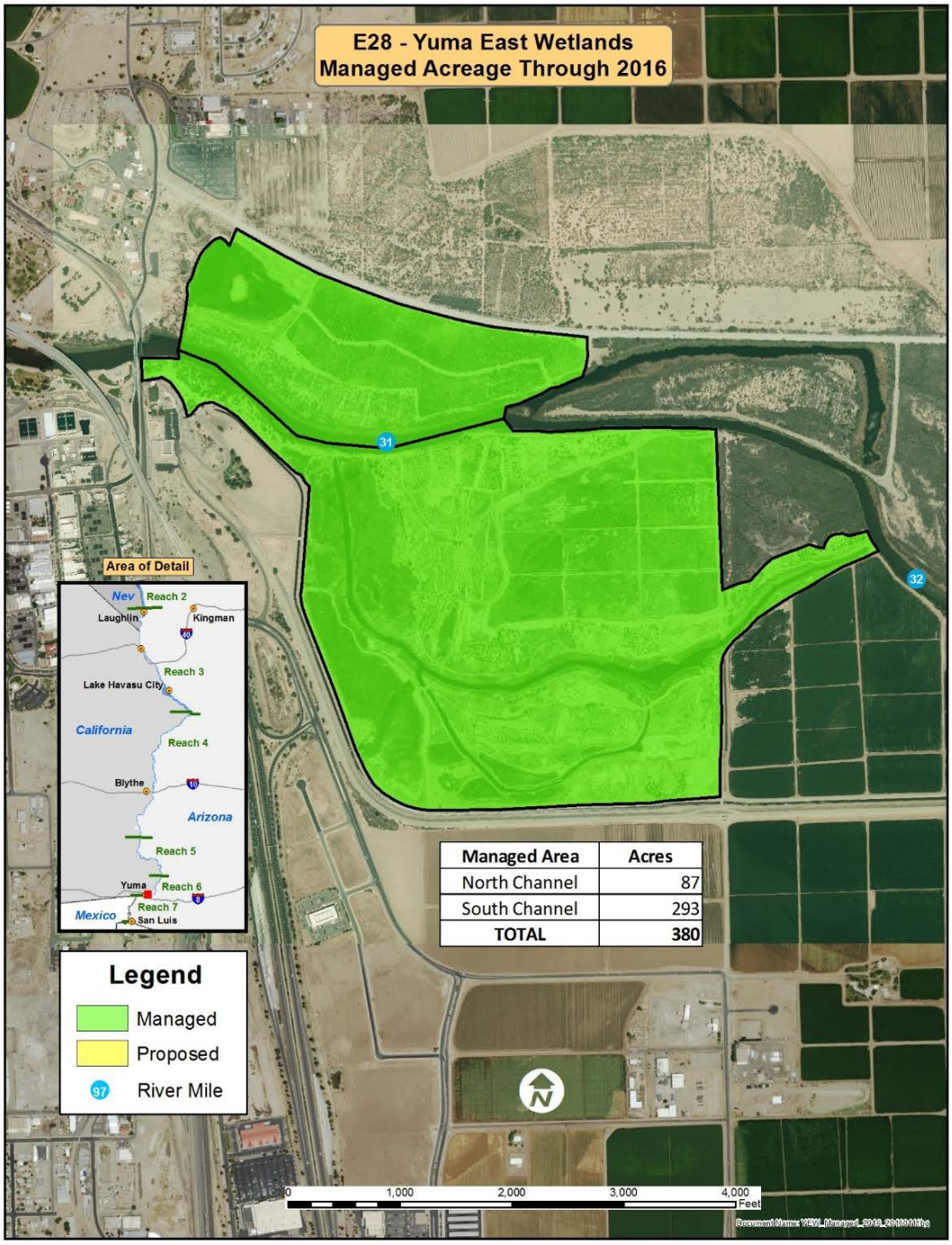


Managed Area	Acres
Reach 1	558
Reach 2	523
Old River Channel	90
TOTAL	1171

Figure 7.—Laguna Division Conservation Area managed acres through 2016.

Yuma East Wetlands

Yuma East Wetlands is a 392-acre conservation area consisting of lands owned by the Quechan Indian Tribe, the city of Yuma, and the Arizona Game and Fish Department. The site is within Reach 6. The site is located within the city of Yuma, Arizona (see figure 1). Habitat restoration activities began in Yuma East Wetlands in 2004. The majority of the planting took place in 2009, including 115 acres of cottonwood-willow habitat, 102 acres of marsh habitat, and 175 acres of honey mesquite habitat (figure 8). In 2013, the LCR MSCP entered into a partnership with the Quechan Indian Tribe, the city of Yuma, the Arizona Game and Fish Commission, and the Yuma Crossing National Heritage Area to support the long-term management of the site. In 2014, the bankline portion of the site was cleared of invasive vegetation and replanted with native vegetation. The site contains many open canopy areas that allow for a healthy variety of shrub and grass species necessary for Yuma hispid cotton rat colonization.



Managed Area	Acres
North Channel	87
South Channel	293
TOTAL	**380**

Figure 8.—Yuma East Wetlands managed acres through 2016.

Hunters Hole

Hunters Hole is a conservation area located near the community of San Luis, 18 miles (29 km) south of Yuma, Arizona (see figure 1). The site is within Reach 7. It was added to the LCR MSCP in 2011. The site was planted in spring 2012 with approximately 44 acres of habitat (figure 9) in three cover types: cottonwood-willow, honey mesquite, and marsh.

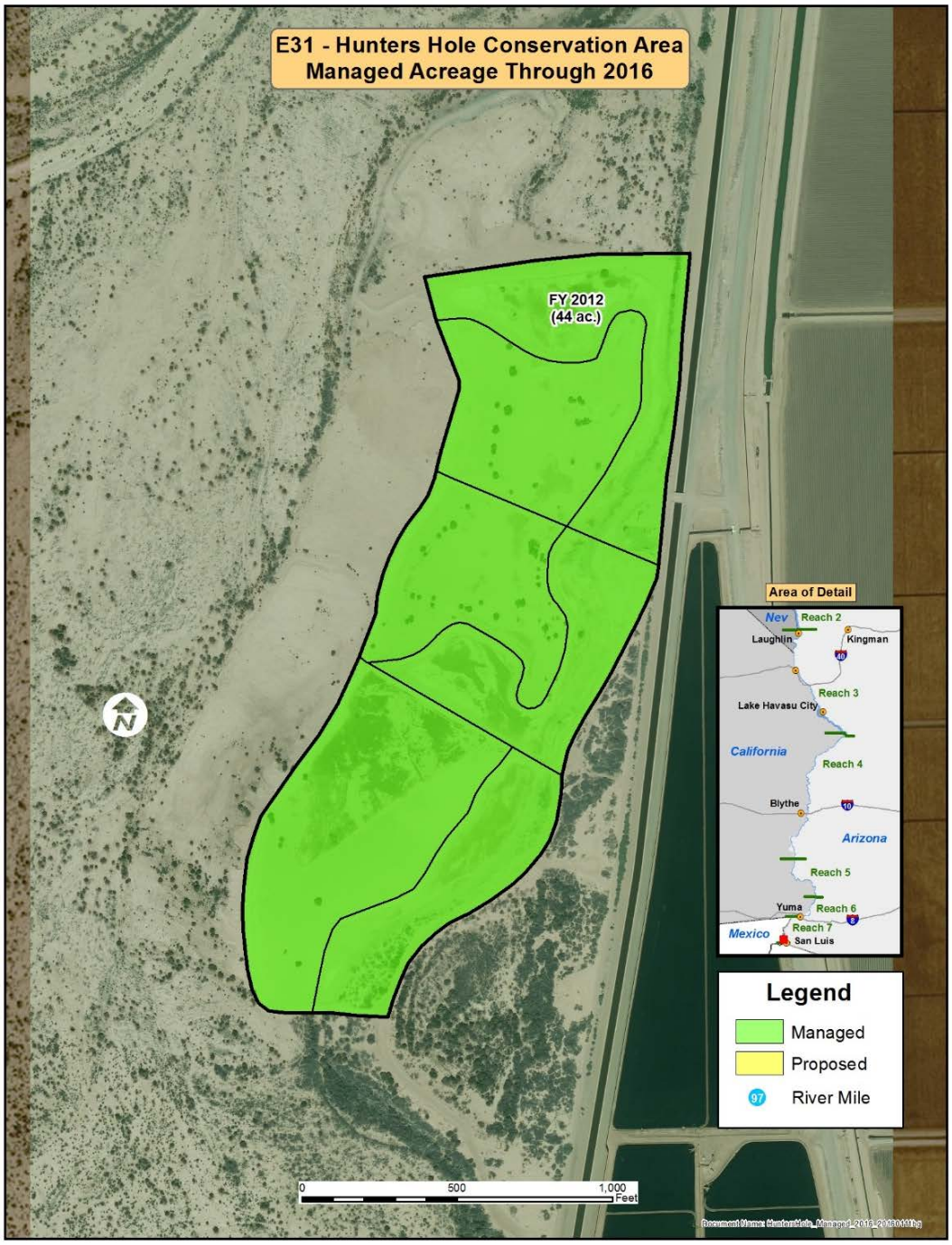


Figure 9.—Hunters Hole managed acres through 2016.

RESULTS

Conservation Areas

Big Bend Conservation Area

Trapping occurred along the interface of a grassy area comprised of dallisgrass and bushy bluestem with baccharis. Spring trapping (figure 10) produced captures of both LCR MSCP species, with three Colorado River cotton rats and one desert pocket mouse (likely of the *sobrinus* subspecies based on range) being captured in 1 night of trapping (table 1).

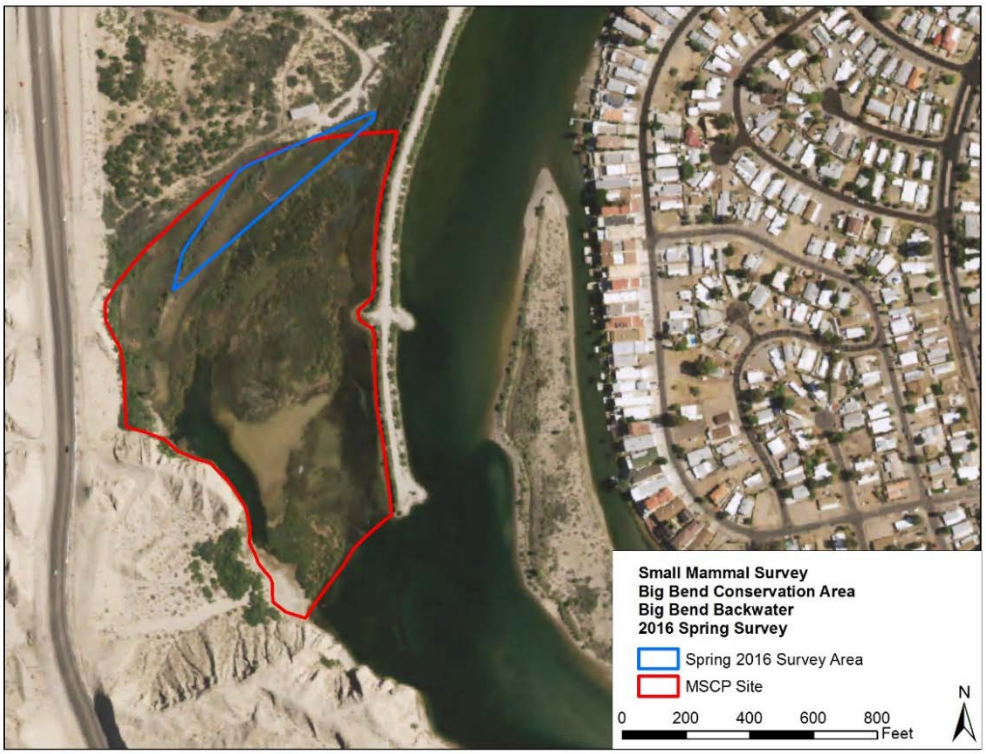


Figure 10.—Big Bend Conservation Area survey polygon.

Table 1.—Big Bend Conservation Area captures

Species	Spring 2016 (March 11, 2016)
Colorado river cotton rat (*Sigmodon arizonae*)	3
Desert pocket mouse (*Chaetodipus penicillatus*)	1
Cactus mouse (*Peromyscus eremicus*)	7
Harvest mouse (*Reithrodontomys megalotis*)	9
House mouse (*Mus musculus*)	2
Spotted skunk (*Spirogale gracilis*)	1
White-throated wood rat (*Neotoma albigula*)	2
Total captures	25
Traps/nights	60/1

Beal Lake Conservation Area

Trapping occurred in the Beal Lake Conservation Area within a narrow patch of arrowweed with patches of various grass species with potentially suitable structure for Colorado River cotton rats. In recent years, the patch has narrowed, becoming increasingly dominated by arrowweed. Spring trapping (figure 11) produced no Colorado River cotton rats and one desert pocket mouse (possibly of the *sobrinus* subspecies based on range) captured over 1 night (table 2).

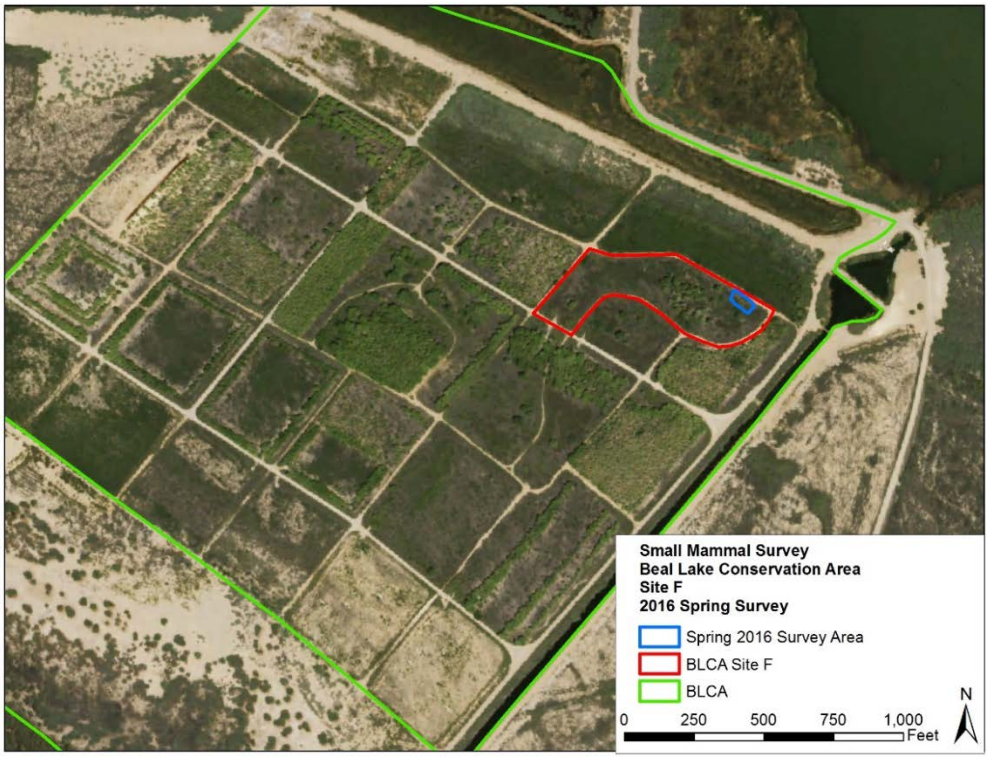


Figure 11.—Beal Lake Conservation Area survey polygon.

Table 2.—Beal Lake Conservation Area captures

Species	Spring 2016 (April 8, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	1
Cactus mouse (*Peromyscus eremicus*)	2
Total captures	3
Traps/nights	60/1

Palo Verde Ecological Reserve

This site consists of multiple planting phases with a variety of habitat types. All of the areas trapped contained a grass and/or shrub component. Two phases were trapped. Phase 4 was planted with honey mesquite and quailbush and is now intermixed with Bermudagrass (*Cynodon dactylon*) and other grasses and forbs. Phase 5 was planted with honey mesquite, alkali sacaton (*Sporobolus airoides*), and blue grama (*Bouteloua gracilis*), though the trapping area is now a mix of alkali sacaton and Bermudagrass in various densities. Trapping occurred in Phase 4 (figure 12) and Phase 5 (figure 13). Spring trapping sessions produced no Colorado River cotton rats or desert pocket mice (subspecies unknown) over 1 night of trapping (tables 3 and 4).

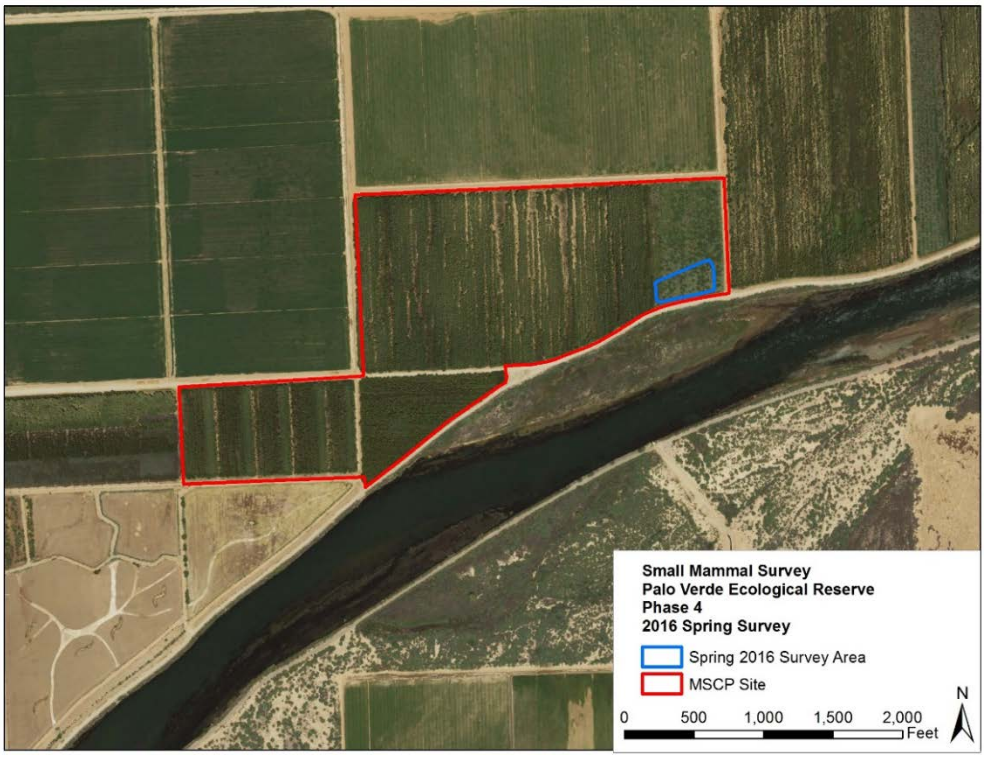


Figure 12.—Palo Verde Ecological Reserve Phase 4 survey polygon.

Table 3.—Palo Verde Ecological Reserve Phase 4 captures

Species	Spring 2016 (March 4, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Cactus mouse (*Peromyscus eremicus*)	12
Harvest mouse (*Reithrodontomys megalotis*)	2
Total captures	14
Traps/nights	60/1

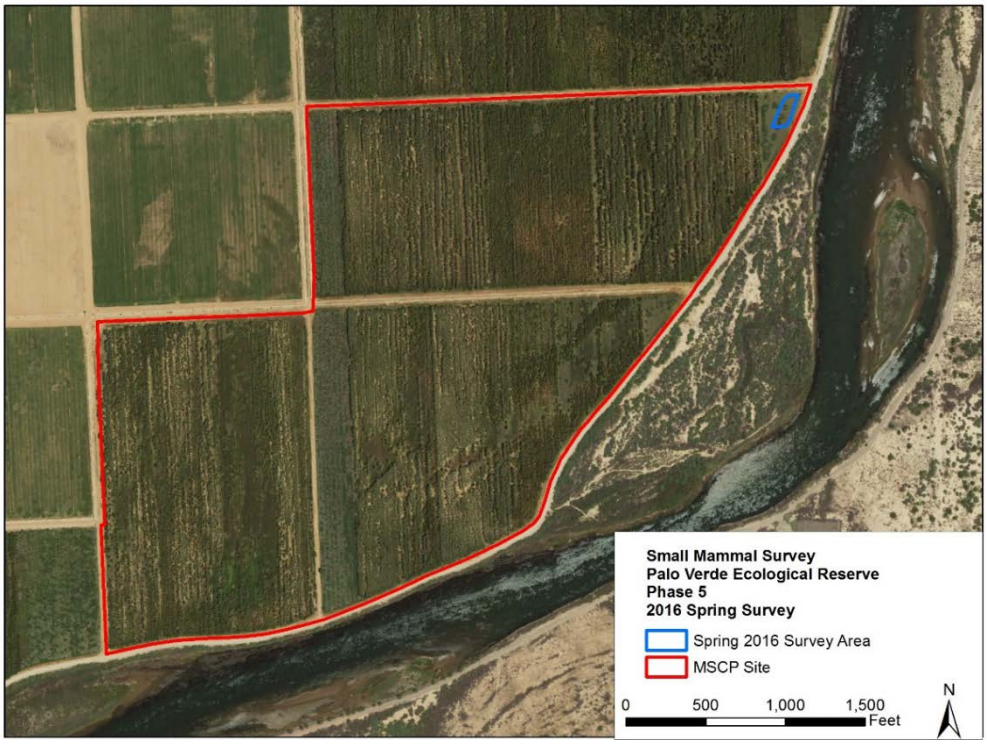


Figure 13.—Palo Verde Ecological Reserve Phase 5 survey polygon.

Table 4.—Palo Verde Ecological Reserve Phase 5 captures

Species	Spring 2016 (March 4, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	0
House mouse (*Mus musculus*)	1
Total captures	1
Traps/nights	60/1

Cibola Valley Conservation Area

Three phases of the Cibola Valley Conservation Area were trapped: Phases 2, 3, and 4. The Phase 2 trapping area consisted of dense areas of senesced shrubs with some live quailbush and Bermudagrass (figure 14). Phase 3 consisted of patchy arrowweed and sparse alkali sacaton (figure 15). Phase 4 was a mix of honey mesquite and quailbush plantings within deep furrows that became interspersed with various shrubs, forbs, and grasses (figure 16). One Colorado River cotton rat and two desert pocket mice were captured in Phase 2 (table 5). No Colorado River cotton rats or desert pocket mice were captured in Phase 3 (table 6). No Colorado River cotton rat and 12 desert pocket mice (subspecies unknown) were captured in Phase 4 (table 7), with 1 night of trapping being conducted in each phase.

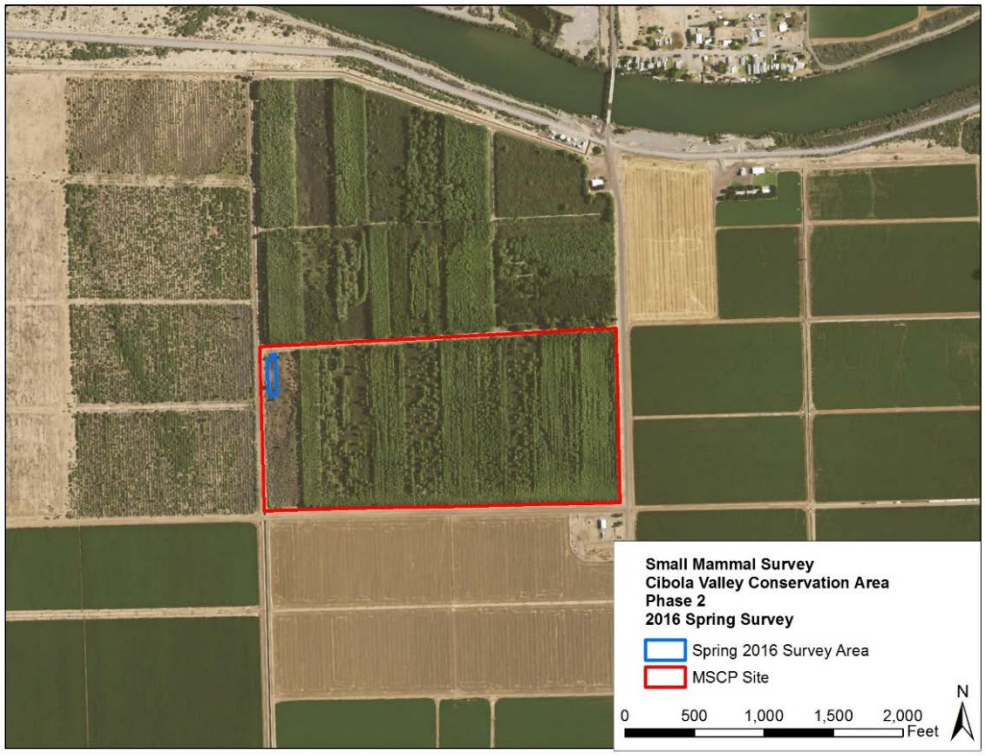


Figure 14.—Cibola Valley Conservation Area Phase 2 survey polygon.

Table 5.—Cibola Valley Conservation Area Phase 2 captures

Species	Spring 2016 (March 2, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	1
Desert pocket mouse (*Chaetodipus penicillatus*)	2
Cactus mouse (*Peromyscus eremicus*)	3
Harvest mouse (*Reithrodontomys megalotis*)	1
White-throated wood rat (*Neotoma albigula*)	1
Total captures	8
Traps/nights	60/1

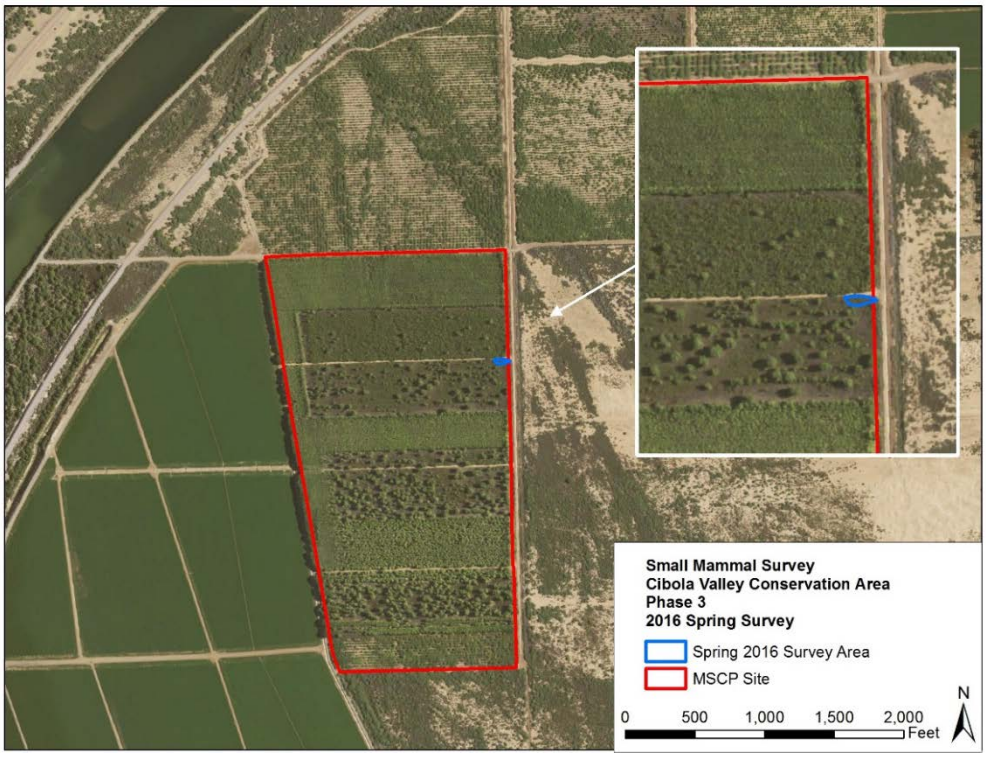


Figure 15.—Cibola Valley Conservation Area Phase 3 survey polygon.

Table 6.—Cibola Valley Conservation Area Phase 3 captures

Species	Spring 2016 (March 2, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Cactus mouse (*Peromyscus eremicus*)	3
Botta's pocket gopher (*Thomomys bottae*)	1
Harvest mouse (*Reithrodontomys megalotis*)	1
Total captures	5
Traps/nights	40/1

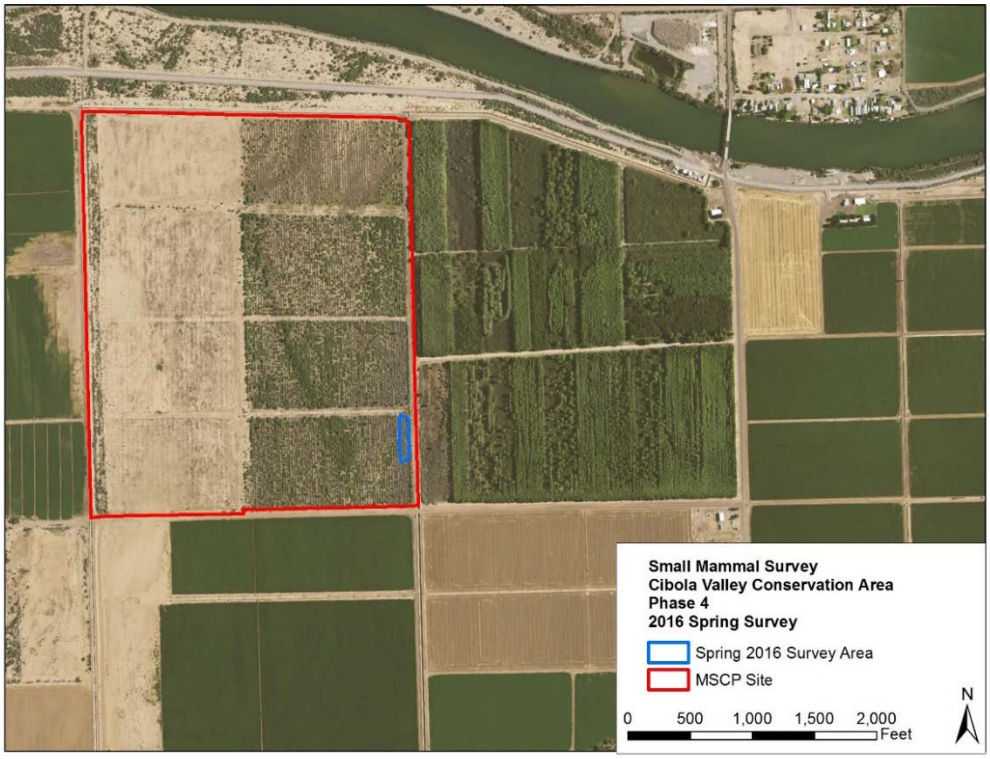


Figure 16.—Cibola Valley Conservation Area Phase 4 survey polygon.

Table 7.—Cibola Valley Conservation Area Phase 4 captures

Species	Spring 2016 (March 2, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	12
Cactus mouse (*Peromyscus eremicus*)	5
Deer mouse (*Peromyscus maniculatus*)	2
Harvest mouse (*Reithrodontomys megalotis*)	2
White-throated wood rat (*Neotoma albigula*)	1
Total captures	22
Traps/nights	40/1

Cibola National Wildlife Refuge Unit #1 Conservation Area

Surveys within the Cibola National Wildlife Refuge Unit #1 Conservation Area occurred in two areas: the Cottonwood Genetics field (figure 17) and the Hippy Fire area (figure 18). Trapping in the Cottonwood Genetics field occurred in a more open homogenous area of Johnsongrass. Trapping in the Hippy Fire area occurred in sparse alkali sacaton and Bermudagrass. No Colorado River cotton rats or desert pocket mice were captured in the Cottonwood Genetics field (table 8). One Colorado River cotton rat and no desert pocket mice were captured in the Hippy Fire area (table 9).

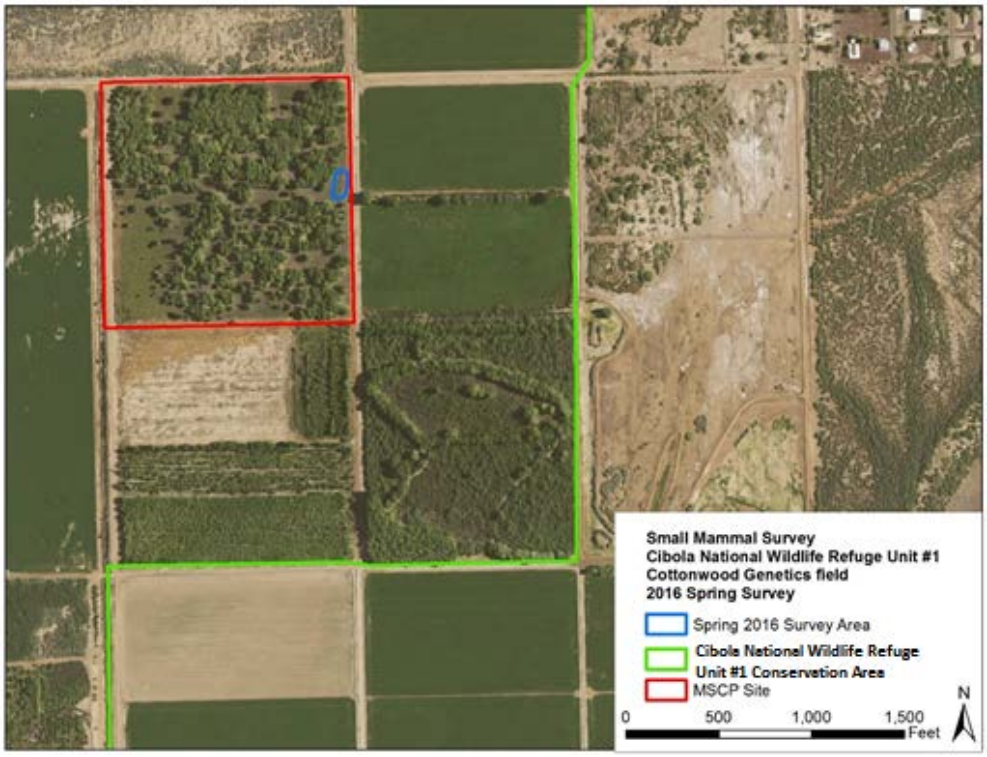


Figure 17.—Cibola National Wildlife Refuge Unit #1 Conservation Area Cottonwood Genetics field survey polygon.

Table 8.—Cibola National Wildlife Refuge Unit #1 Conservation Area Cottonwood Genetics field captures

Species	Spring 2016 (March 3, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Harvest mouse (*Reithrodontomys megalotis*)	4
Total captures	4
Traps/nights	90/1

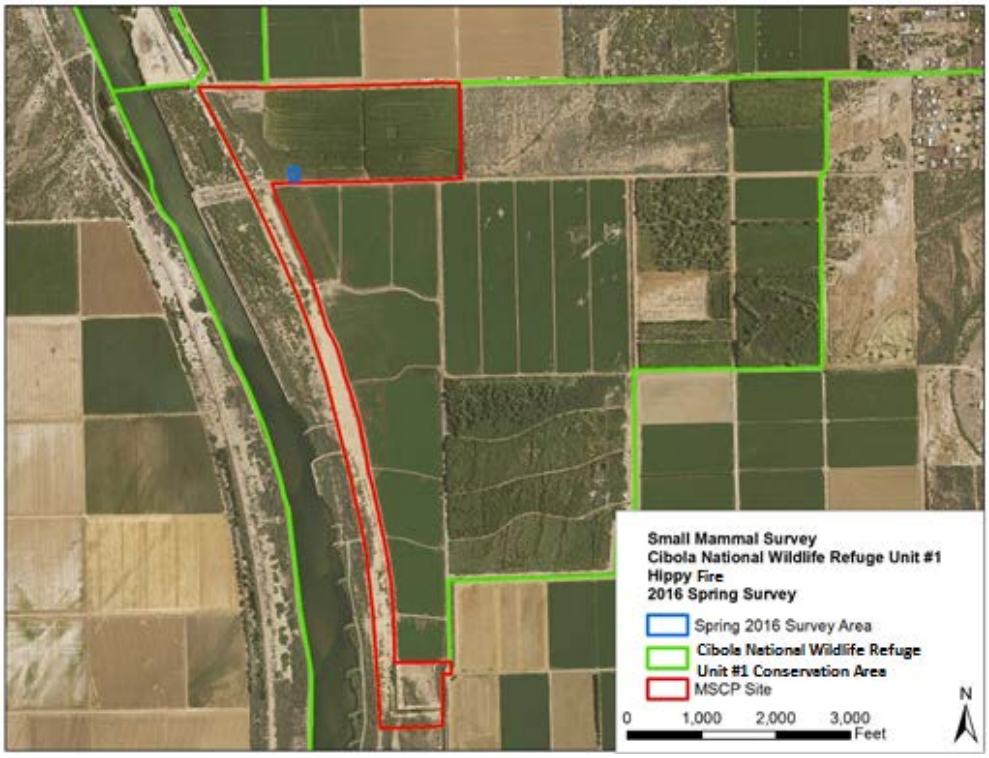


Figure 18.—Cibola National Wildlife Refuge Unit #1 Conservation Area Hippy Fire survey polygon.

Table 9.—Cibola National Wildlife Refuge Unit #1 Hippy Fire captures

Species	Spring 2016 (March 3, 2016)
Colorado river cotton rat (*Sigmodon arizonae plenus*)	1
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Total captures	1
Traps/nights	80/1

Laguna Division Conservation Area

Trapping occurred in two areas within the Laguna Division Conservation Area (figure 19). The trapping areas were comprised of sparse alkali sacaton and arrowweed. A total of 100 traps set over 1 night produced two desert pocket mice (subspecies unknown) (table 10). No Yuma hispid cotton rats were encountered.

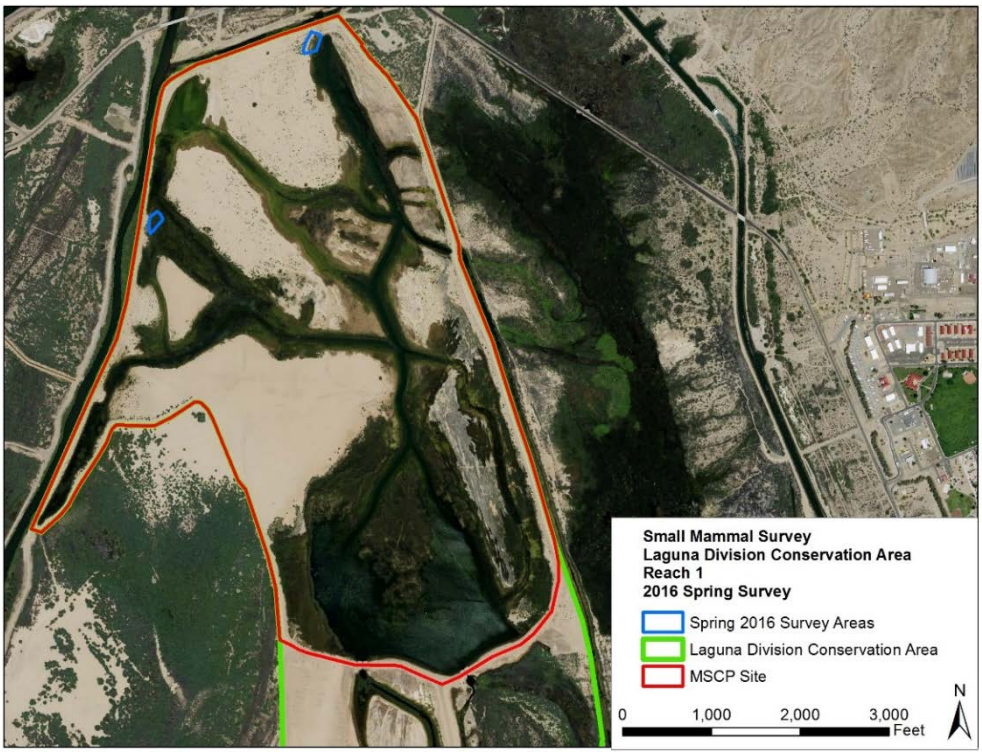


Figure19.—Laguna Division Conservation Area survey polygon.

Table 10.—Laguna Division Conservation Area captures

Species	Spring 2016 (March 16, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	2
Cactus mouse (*Peromyscus eremicus*)	2
Harvest mouse (*Reithrodontomys megalotus*)	1
Total captures	5
Traps/nights	100/1

Yuma East Wetlands

Surveys occurred in Cell C (figure 20) in Yuma East Wetlands. The trapping area consisted of a mix of alkali sacaton and baccharis and some honey mesquite plantings. The survey produced two Yuma hispid cotton rats and no desert pocket mice (table 11).

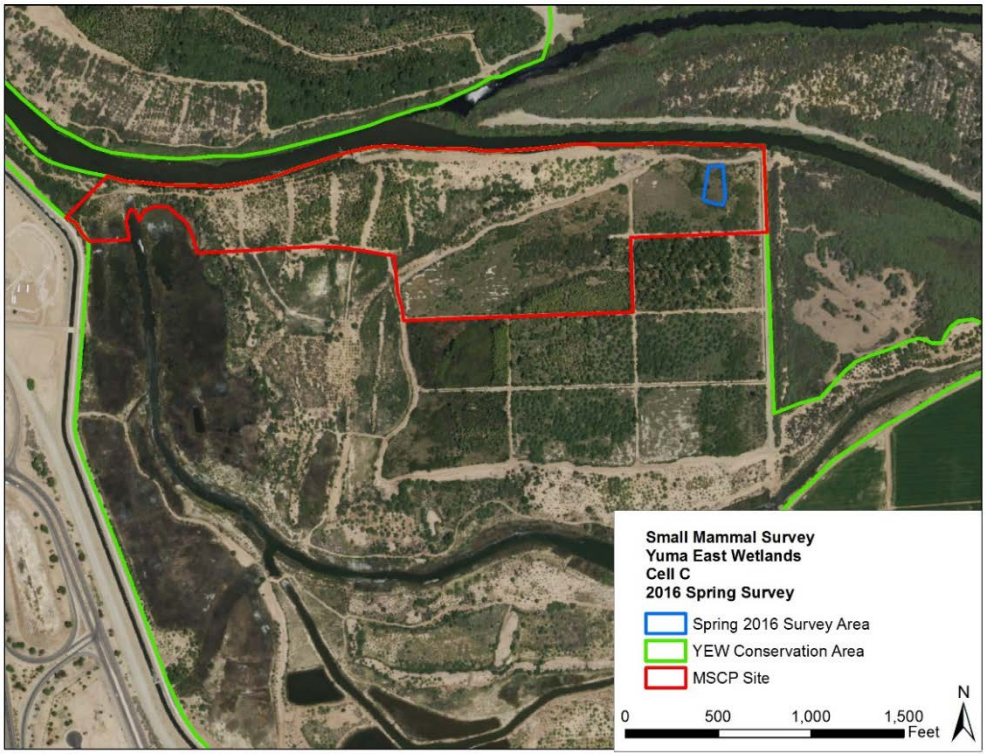


Figure 20.—Yuma East Wetlands Cell C survey polygon.

Table 11.—Yuma East Wetlands Cell C captures

Species	Spring 2016 (March 17, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	2
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Total captures	2
Traps/nights	60/1

Hunters Hole

Surveys occurred in Cell 2 (figure 21) and Cell 3 (figure 22) in Hunters Hole. The trapping areas were planted with Fremont cottonwood, Goodding's willow, coyote willow, and honey mesquite, along with alkali sacaton and blue grama. Both trapping areas were dominated by grasses, and in Cell 3, baccharis had also become established in moderately dense amounts. Spring surveys produced two Yuma hispid cotton rats and no desert pocket mice (tables 12 and 13).

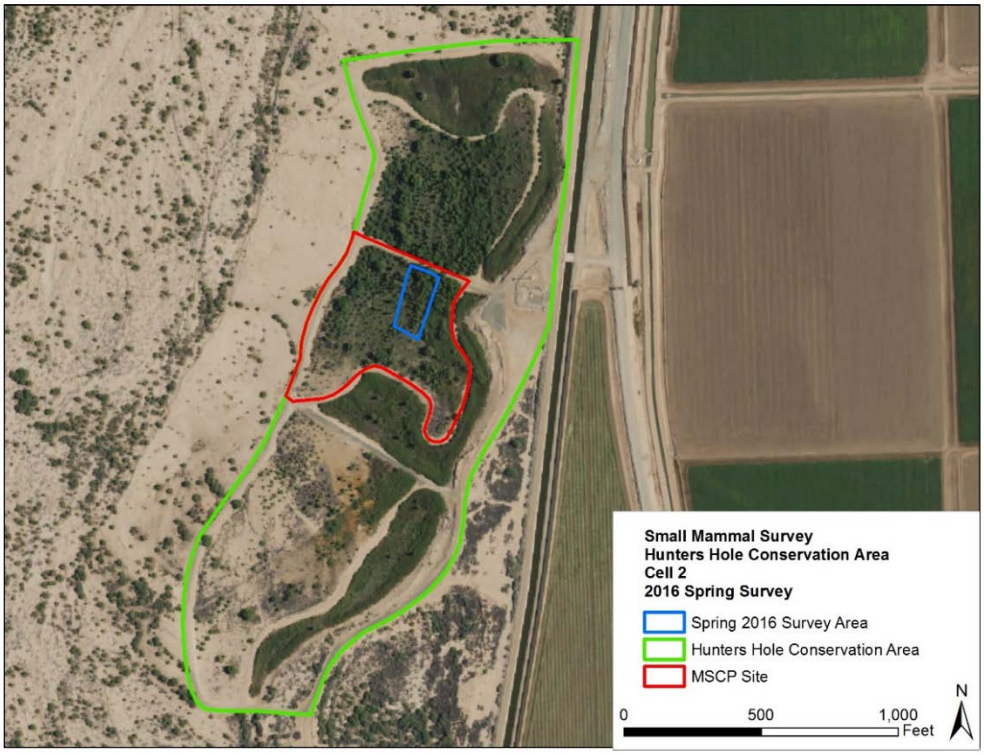


Figure 21.—Hunters Hole Cell 2 survey polygon.

Table 12.—Hunters Hole Cell 2 captures

Species	Spring 2016 (March 13, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	0
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Cactus mouse (*Peromyscus eremicus*)	1
House mouse (*Mus musculus*)	1
White-throated wood rat (*Neotoma albigula*)	1
Total captures	3
Traps/nights	60/1

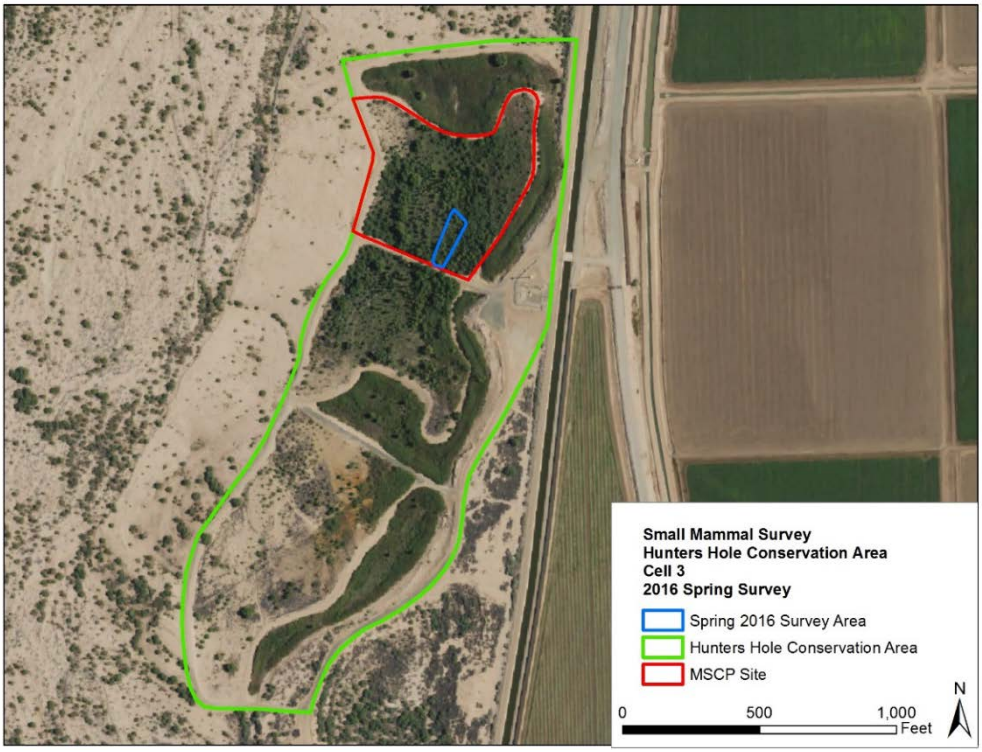


Figure 22.—Hunters Hole Cell 3 survey polygon.

Table 13.—Hunters Hole Cell 3 captures

Species	Spring 2016 (March 13, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	2
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Cactus mouse (*Peromyscus eremicus*)	2
House mouse (*Mus musculus*)	2
Total captures	6
Traps/nights	60/1

System-Wide Monitoring Sites

Imperial National Wildlife Refuge

Trapping occurred in two areas comprised of Johnsongrass and common reed (*Phragmites australis*) in the Imperial National Wildlife Refuge. The trapping areas were outside of the LCR MSCP conservation area boundary, so they were included as part of the D10 system-wide monitoring work task (figure 23). Trapping produced two Yuma hispid cotton rats and one desert pocket mouse (subspecies unknown) (table 14).

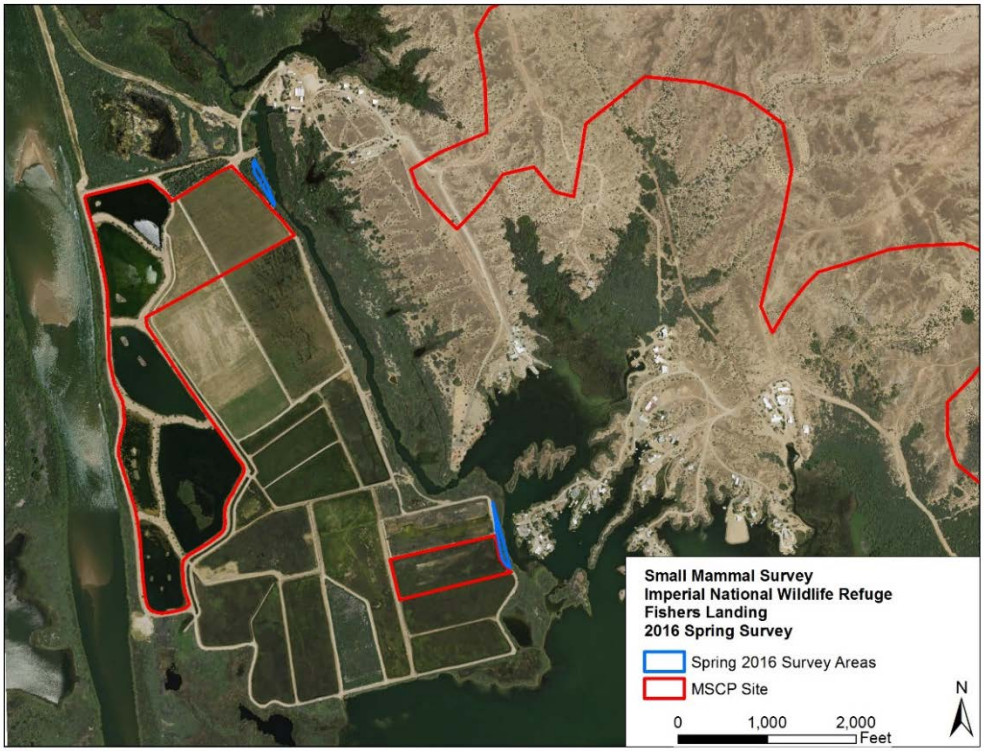


Figure 23.—Imperial National Wildlife Refuge survey polygons.

Table 14.—Imperial National Wildlife Refuge captures

Species	Spring 2016 (March 31, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	2
Desert pocket mouse (*Chaetodipus penicillatus*)	1
Cactus mouse (*Peromyscus eremicus*)	48
White-throated wood rat (*Neotoma albigula*)	2
Total captures	53
Traps/nights	120/1

Mittry Lake and the Pratt Restoration Demonstration Area

Trapping occurred in two areas near Mittry Lake and the Pratt Restoration Demonstration Area (figure 24). Trapping over 1 night with 60 traps produced one Yuma hispid cotton rat and two desert pocket mice (subspecies unknown) at Mittry Lake (table 15). Trapping at the Pratt Restoration Demonstration Area produced three Yuma hispid cotton rat and no desert pocket mice (table 16).

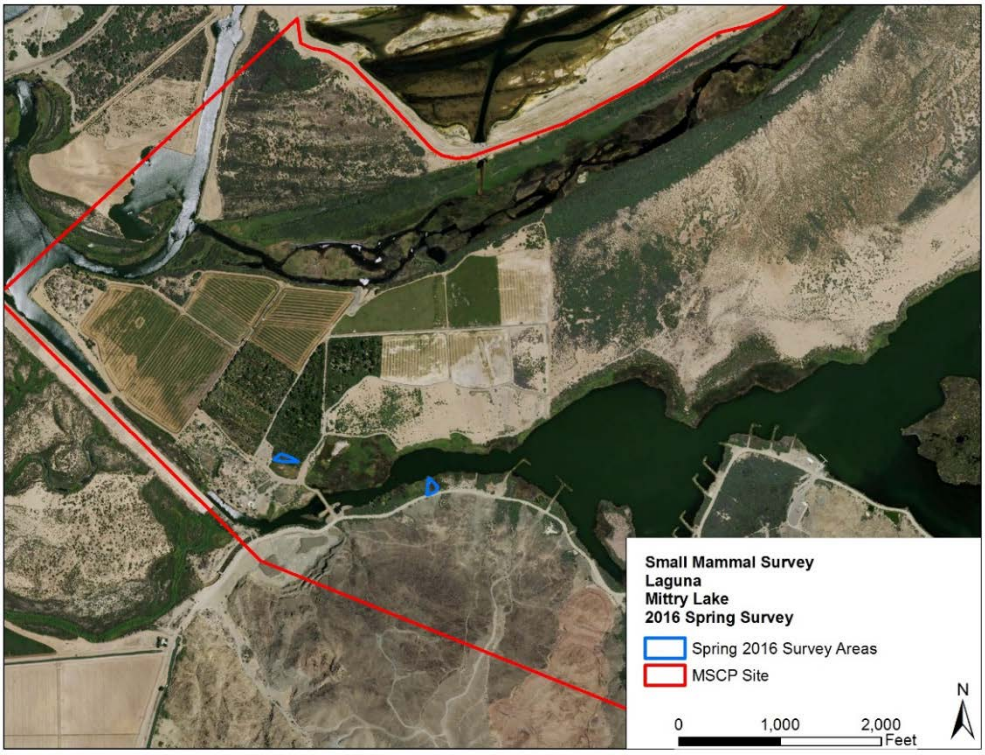


Figure 24.—Mittry Lake and Pratt Restoration Demonstration Area survey polygons.

Mittry Lake

Table 15.—Mittry Lake captures

Species	Spring 2016 (March 30, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	1
Desert pocket mouse (*Chaetodipus penicillatus*)	2
Cactus mouse (*Peromyscus eremicus*)	3
Harvest mouse (*Reithrodontomys megalotis*)	2
White-throated wood rat (*Neotoma albigula*)	1
Total captures	9
Traps/nights	60/1

Pratt Restoration Demonstration Area

Table 16.—Pratt Restoration Demonstration Area captures

Species	Spring 2016 (March 30, 2016)
Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)	3
Desert pocket mouse (*Chaetodipus penicillatus*)	0
Cactus mouse (*Peromyscus eremicus*)	3
Harvest mouse (*Reithrodontomys megalotis*)	3
White-throated wood rat (*Neotoma albigula*)	3
Total captures	12
Traps/nights	60/1

DISCUSSION

System-wide surveys resulted in Yuma hispid cotton rat captures at all sites. It is important to monitor for the continued presence of a species in the surrounding areas, as this provides a comparison to LCR MSCP restoration sites as well as an idea of overall species presence within its range. Much of the system-wide surveys to date have taken place at old restoration areas or similarly managed areas. A difficulty with system-wide surveys is finding suitable trapping habitat that is located on Federal or State land. The majority of the grassy habitat on the LCR has either been lost due to development and river alterations or to invasive species such as Bermudagrass. This leads to situations in which system-wide surveys can either take place in areas with little to no cover or likelihood of capturing LCR MSCP species, or take place in previously restored areas such as Mittry Lake and the Pratt Restoration Demonstration Area. Continued effort to locate new system-wide trapping areas will hopefully lead to more monitoring sites in future years.

Yuma hispid cotton rats were captured at Hunters Hole in 2016 as well as 2015. The site has a heterogeneous mix of grasses and shrubs conducive for cotton rats (Neiswenter 2016), and if the structure remains, further Yuma hispid cotton rat detections are expected.

Trapping at the Laguna Division Conservation Area has not yet produced any Yuma hispid cotton rat captures. The trapping areas consisted of sparsely planted alkali sacaton mixed with other shrubs/grasses. The capture of Yuma hispid cotton rats in nearby system-wide trapping areas in relatively poor quality habitat means that colonization may occur.

Only spring 2016 data were reported. This report is intended as a gap report, as previous years were reported as calendar year and will now be reported as fiscal year. The next report will include fall 2016 and spring 2017 data.

LITERATURE CITED

Bradley, W.G. 1966. Status of the cotton rat in Nevada. Journal of Mammalogy 47:349–350.

Goertz, J.W. 1964. The influence of habitat quality upon density of cotton rat populations. Ecological Monographs: 359–381.

Hall, E.R. 1946. Mammals of Nevada. University of Nevada Press, Reno and Las Vegas, Nevada.

Jameson, E.W. and H.J. Peeters. 2004. Mammals of California; California Natural History Guide No. 66. University of California Press, Berkeley and Los Angeles, California.

Kays, R.W. and D.E. Wilson. 2002. Mammals of North America. Princeton University Press, Princeton, New Jersey.

Neiswenter, S. 2016. Habitat and Population Demographics of the Colorado River Cotton Rat (*Sigmodon arizonae plenus*) Along the Lower Colorado River, 2009–2013 Final Report. Submitted to the Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada, by the School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, Nevada.

ATTACHMENT 1

Example Data Sheet

LCR MSCP Post-Development/System-Wide Monitoring
Small Mammal Presence/Absence Data Sheet

Site:_____ Date:_____

Observers:_____

# of transects in grid:_____ # of stations per transect:_____
# of traps per station:_____

Trimble filename:_____ Grid starting point UTM:_____

Direction of transect A:_____ Direction where other transects begin:_____

Transect	Station #	Species	Age	Sex	UTM of *Sigmodon*/PIT tag ID/DNA sample/other

If two traps are set per station, they are labeled 1a and 1b, 2a and 2b, etc. Measurements are only taken when needed for ID PIT tag and DNA samples (tail/ear clipping) for Colorado River cotton rats (*Sigmodon arizonae plenus*) (CRCR) and Yuma hispid cotton rats (*Sigmodon hispidus eremicus*) (YHCR). If a sample was taken previously, mark as recapture. In the title, circle whether or not this survey is for post-development or system-wide purposes.

Notes: