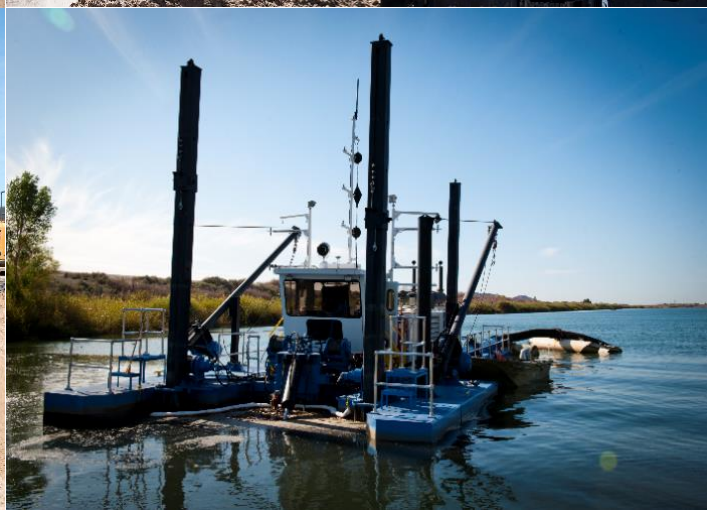
Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Final Implementation Report, Fiscal Year 2018 Work Plan and Budget, Fiscal Year 2016 Accomplishment Report



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2017

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
Chemehuevi Indian Tribe

Conservation Participant Group

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

Lower Colorado River Multi-Species Conservation Program

Final Implementation Report, Fiscal Year 2018 Work Plan and Budget, Fiscal Year 2016 Accomplishment Report

Lower Colorado River Multi-Species Conservation Program. 2017. Final Implementation Report, Fiscal Year 2018 Work Plan and Budget, Fiscal Year 2016 Accomplishment Report. Bureau of Reclamation, Boulder City, Nevada.

Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada
http://www.lcrmscp.gov

June 2017

ACRONYMS AND ABBREVIATIONS

AGFD	Arizona Game and Fish Department
AJ	Arizona Juvenile
ALS	aerial laser scanning
AMM	Avoidance and Minimization Measure
AMP	Adaptive Management Program
BBCA	Big Bend Conservation Area
BEVI	Arizona Bell's vireo (*Vireo bellii arizonae*)
Bill Williams River NWR	Bill Williams River National Wildlife Refuge
BLCA	Beal Lake Conservation Area
BLM	Bureau of Land Management
BLRA	California black rail (*Laterallus jamaicensis coturniculus*)
BO	Biological and Conference Opinion
BONY	bonytail (*Gila elegans*)
CDFW	California Department of Fish and Wildlife
CEM	conceptual ecological model
Center	Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (formerly the Dexter National Fish Hatchery & Technology Center)
CESA	California Endangered Species Act
cfs	cubic feet per second
CI	confidence interval
Cibola NWR	Cibola National Wildlife Refuge
Cibola NWR Unit #1	Cibola National Wildlife Refuge Unit #1 Conservation Area
CLNB	California leaf-nosed bat (*Macrotus californicus*)
CLRA	Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*])
Commission	California State Lands Commission
CMM	Conservation Area Management Measure
CRCR	Colorado River cotton rat (*Sigmodon arizonae plenus*)
CRTO	Colorado River toad (*Bufo alvarius* = *Incilius alvarius*)
CVCA	Cibola Valley Conservation Area
CVIDD	Cibola Valley Irrigation and Drainage District

DETO	desert tortoise (Mojave population) (*Gopherus agassizii*)
DNA	deoxyribonucleic acid
DO	dissolved oxygen
DPMO	desert pocket mouse (*Chaetodipus penicillatus sobrinus*)
DSS	Decision Support System
eDNA	environmental deoxyribonucleic acid
ELOW	elf owl (*Micrathene whitneyi*)
ESA	Endangered Species Act
FLSU	flannelmouth sucker (*Catostomus latipinnis*)
FMA	Funding and Management Agreement
FMC	Freeport Minerals Corporation
FTHL	flat-tailed horned lizard (*Phrynosoma mcalli*)
FY	fiscal year
g	gram(s)
GIFL	gilded flicker (*Colaptes chrysoides*)
GIWO	Gila woodpecker (*Melanerpes uropygialis*)
Glen Canyon Dam AMP	Glen Canyon Dam Adaptive Management Program
GPS	Global Positioning System
Havasu NWR	Havasu National Wildlife Refuge
HCP	Habitat Conservation Plan
HMF	Habitat Maintenance Fund
HUCH	humpback chub (*Gila cypha*)
Imperial NWR	Imperial National Wildlife Refuge
IPCA	Imperial Ponds Conservation Area
ISC	interim surplus criteria
kHz	kilohertz
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LDCA	Laguna Division Conservation Area
LEBI	western least bittern (*Ixobrychus exilis hesperis*)
LiDAR	light detection and ranging
LLFR	lowland leopard frog (*Rana yavapaiensis* = *Lithobates yavapaiensis*)

m	meter(s)
MAPS	Monitoring Avian Productivity and Survivorship
MEFF	mobile electronic field form
mg/L	milligrams per liter
mm	millimeter(s)
MNSW	MacNeill's sootywing skipper (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill])
Mora NFH	Mora National Fish Hatchery
MRM	Monitoring and Research Measure
mtDNA	mitochondrial deoxyribonucleic acid
MVCA	Mohave Valley Conservation Area
NDOW	Nevada Department of Wildlife
NMGS	northern Mexican gartersnake
NPS	National Park Service
Pahranagat NWR	Pahranagat National Wildlife Refuge
pH	acidity or alkalinity of a solution
PIT	passive integrated transponder
PTBB	Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens =C. townsendii townsendii*)
PVER	Palo Verde Ecological Reserve
PVER-South	Palo Verde Ecological Reserve-South
PVID	Palo Verde Irrigation District
PWCA	Pretty Water Conservation Area
RASU	razorback sucker (*Xyrauchen texanus*)
Reclamation	Bureau of Reclamation
RLFR	relict leopard frog (*Rana onca*)
RMF	Remedial Measures Fund
SDCWA	San Diego County Water Authority
SNP	single nucleotide polymorphism
SNWA	Southern Nevada Water Authority
SSA	species status assessment
STBU	sticky buckwheat (*Eriogonum viscidulum*)
SUR	submersible ultrasonic receiver
SUTA	summer tanager (*Piranga rubra*)
THMI	threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*)
TL	total length
TLS	terrestrial laser scanning

UAS	unmanned aerial system
USFWS	U.S. Fish and Wildlife Service
VEFL	vermilion flycatcher (*Pyrocephalus rubinus*)
WIFL	southwestern willow flycatcher (*Empidonax traillii extimus*)
Willow Beach NFH	Willow Beach National Fish Hatchery
WRBA	western red bat (*Lasiurus blossevilli*)
WYBA	western yellow bat (*Lasiurus xanthinus*)
YBCU	yellow-billed cuckoo (*Coccyzus americanus occidentalis*)
YCNHAC	Yuma Crossing National Heritage Area Corporation
YEW	Yuma East Wetlands
YHCR	Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)
YWAR	Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*)

Symbols

°C	degrees Celsius
>	greater than
<	less than
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
%	percent
+	plus (at least)

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PROGRAM OVERVIEW

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a partnership of Federal and non-Federal stakeholders 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 (ESA). This is a long-term (50-year) program 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 (HCP).

Under this long-term program, current water diversions and power production will be accommodated, and opportunities for future water and power development will be optimized to the extent consistent with the law. This comprehensive program addresses future Federal agency consultation needs under Section 7 of the ESA and non-Federal agency needs for endangered species incidental take authorization under Section 10 of the ESA. The LCR MSCP also allows California agencies to meet their obligations under California State law for the California Endangered Species Act (CESA).

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. Of the 26 covered species, 7 are currently listed under the Federal ESA. This program addresses the biological needs of mammals, birds, fishes, amphibians, reptiles, invertebrates, and plants.

Implementing the LCR MSCP will help create at least 8,132 acres of new habitat (5,940 acres of cottonwood-willow (*Populus fremontii-Salix gooddingii*), 1,320 acres of honey mesquite (*Prosopis glandulosa*), 512 acres of marsh, and 360 acres of backwater) and produce 660,000 subadult razorback suckers (*Xyrauchen texanus*) and 620,000 bonytail (*Gila elegans*) to augment the existing populations of these fishes in the LCR. Under the LCR MSCP, participation in the recovery programs for these fishes may include funding other appropriate activities in lieu of stocking. In addition, there is a substantial research and monitoring component to this program; a $25 million fund was established to support projects implemented by land use managers to protect and maintain existing habitat for covered species.

The estimated cost of this program, as outlined in the Funding and Management Agreement (FMA), in 2003 dollars is about $626 million, and it will be adjusted annually for inflation. The Bureau of Reclamation (Reclamation) will pay 50% of the LCR MSCP cost. The States of California, Nevada, and Arizona will pay the remaining 50%, with California paying one-half of the State total and Nevada and Arizona each paying one-quarter of the State total.

Program Implementation

On April 2 and 4, 2005, the Secretary of the Interior; representatives from Arizona, California, and Nevada; and water and power organizations in these States signed the program documents required to implement the LCR MSCP. The documents for the LCR MSCP include an environmental impact statement/environmental impact report, a biological assessment, a 2005 Biological and Conference Opinion (BO), a HCP, a Record of Decision, a FMA, an Implementation Agreement, and a Section 10 Permit. These documents can be found on the LCR MSCP Web site (www.lcrmscp.gov).

Implementation of the LCR MSCP also provides compliance for two other actions:

1. In December 2001, the U.S. Fish and Wildlife Service (USFWS) issued to Reclamation the *Biological Opinion for Interim Surplus Criteria, Secretarial Implementation Agreements, and Conservation Measures on the Lower Colorado River, Lake Mead to the Southerly International Boundary, Arizona, California and Nevada* (2001 BO). Although this is a separate compliance action, the requirements listed in the 2001 BO were integrated into the LCR MSCP and were implemented by Reclamation in conjunction with the LCR MSCP. Section 8.6 of the FMA states that implementation of the 2001 BO conservation and mitigation measures shall be credited against the requirements of the LCR MSCP in accordance with the HCP. Requirements under the 2001 BO for the Secretarial Implementation Agreements were completed in fiscal year (FY) 2008, and requirements for the interim surplus criteria (ISC) were completed on December 31, 2015.

2. On April 4, 2005, Reclamation entered into a Memorandum of Agreement with the California partners to implement the LCR MSCP in a coordinated manner to help meet the requirements of the CESA permit issued by the California Department of Fish and Wildlife (CDFW). The requirements of the CESA permit are generally consistent with the LCR MSCP Habitat Conservation Plan. A copy of the memorandum and the CESA permit are available from the California partners upon request.

As agreed to in the FMA, Reclamation is the entity responsible for implementing the LCR MSCP over its 50-year term. The FMA also calls for the establishment of a Steering Committee, currently consisting of 57 entities, to provide input and oversight functions in support of LCR MSCP implementation. The Steering Committee includes Federal and non-Federal entities, which are receiving ESA coverage through the LCR MSCP, or stakeholders interested in the environment of the LCR. A complete list of Steering Committee members can be viewed on the LCR MSCP Web site (www.lcrmscp.gov). During FY16, Chris Harris, Colorado River Board of California, served as Chair of the Steering Committee, and Perri Benemelis, Central Arizona Groundwater Replenishment District, served as Vice Chair.

Section 7.4.1 of the FMA requires Reclamation to submit an implementation report, work plan, and budget (annual report) to the Steering Committee each year, consistent with the program documents. This current annual report contains a description of conservation activities accomplished during FY16, a summary of work underway during FY17, and proposed work to be performed during FY18. It also documents research and monitoring activities undertaken in support of the LCR MSCP and incidental take for covered actions implemented during FY16. This annual report fully meets the reporting requirements outlined in Section 7.4.1 of the FMA.

LCR MSCP Funding

As outlined in the FMA, the total program cost in 2003 dollars is $626,180,000, which is split in a 50-50 cost share among Federal and non-Federal entities. Table 7-1 of the HCP outlines the annual minimum funding level before inflation. Each year, the annual program cost is adjusted for inflation based on a formula outlined in Section 8.1.1 of the FMA. Table 1-1 provides the annual contribution before inflation, a composite inflation index, and indexed annual program (Federal and non-Federal) contributions. Indexed annual program costs are calculated using the composite inflation index from 2 years prior as outlined in the FMA. A summary of required contributions received to date is provided in attachment D-1.

Table 1-1.—Federal/Non-Federal Funding Requirements for the LCR MSCP

Fiscal Year	Annual Contribution Before Inflation	Composite Inflation Index	Composite Calculation Year	Indexed Annual Program	Indexed Annual Federal	Indexed Annual Non-Federal
2006	$11,214,000	1.083	2004	$12,144,762	$6,072,381	$6,072,381
2007	$11,214,000	1.122	2005	$12,582,108	$6,291,054	$6,291,054
2008	$11,214,000	1.187	2006	$13,311,018	$6,655,509	$6,655,509
2009	$11,214,000	1.210	2007	$13,568,940	$6,784,470	$6,784,470
2010	$11,214,000	1.294	2008	$14,510,916	$7,255,458	$7,255,458
2011	$27,540,000	1.191*	2009	$32,800,140	$16,400,070	$16,400,070
2012	$27,540,000	1.210*	2010	$33,323,400	$16,661,700	$16,661,700
2013	$27,540,000	1.251*	2011	$34,452,540	$17,226,270	$17,226,270
2014	$27,540,000	1.276*	2012	$35,141,040	$17,570,520	$17,570,520
2011–14	Underfunding makeup			$7,601,040	$3,800,520	$3,800,520
2015	$27,540,000	1.358	2013	$37,399,320	$18,699,660	$18,699,660
2016	$22,164,000	1.387	2014	$30,741,468	$15,370,734	$15,370,734
2017	$22,164,000	1.393	2015	$30,874,452	$15,437,226	$15,437,226
2018	$22,164,000	1.410	2016	$31,251,240	$15,625,620	$15,625,620

* Original inflation index. The difference between the original inflation index and the revised inflation index is shown as "Underfunding makeup."

Section 8.1.2 of the FMA states that funds provided by either a Federal party or a State permittee that are in excess of the funding obligation for a specific year shall be treated as a credit against future funding obligations. Any shortage of funds provided by either a Federal party or a State permittee will be treated as a deficit to future funding obligations. Attachment D-2 provides a summary of funding credits earned and funding credits used.

FY18 Contributions and Adjustments

As outlined in table 1-1, the annual funding commitment for FY18 is $22,164,000, based on the 2003 estimate, and $31,251,240 after the final composite inflation index of 1.410 is applied. In accordance with Section 8.3 of the FMA, the Federal share of the cost for FY18 and the non-Federal share of the cost by State are shown in table 1-2. Section 8.3 of the FMA allows for adjusted non-Federal funding during the first 30 years of the program. The FY18 adjusted funding amounts for the three States are also shown in table 1-2 (amounts based on direction from the Central Arizona Water Conservation District (see attachment A).

Table 1-2.—FY18 Contribution Schedule

Funding Entity	FY18 Contributions	FY18 Adjusted Contributions
Federal	$15,625,620.00	$15,625,620.00
Non-Federal	$15,625,620.00	$15,625,620.00
California	*$7,812,810.00*	*$7,441,643.36*
Arizona	*$3,906,405.00*	*$4,648,738.28*
Nevada	*$3,906,405.00*	*$3,535,238.36*
Total	**$31,251,240.00**	**$31,251,240.00**

2001 Biological Opinion Account

A total of $6 million, plus interest, was available to Reclamation through the 2001 BO funding agreement. This funding is part of LCR MSCP contributions from the San Diego County Water Authority (SDCWA) and The Metropolitan Water District of Southern California and was used to meet the financial commitments for these entities. The mitigation requirements outlined in the 2001 BO needed to be implemented at the outset of the LCR MSCP; therefore, funding in excess of the entities' LCR MSCP annual required contribution was requested by Reclamation and resulted in funding credits in the early years of this program. In FY08, requirements under the 2001 BO specifically related to the Secretarial Implementation Agreement were completed, and all remaining funds were withdrawn. In FY09, the SDCWA started using their funding credits to meet their LCR MSCP annual contribution, and they will continue to use these

credits to meet their annual obligations until they are exhausted. The Metropolitan Water District of Southern California used their remaining credits in FY13.

Habitat Maintenance Fund

As outlined in Section 8.4.2 of the FMA, a $25-million (2003 dollars) Habitat Maintenance Fund (HMF) was developed during the first 10 years of LCR MSCP implementation to restore covered species habitats that have been degraded; a share of each State's contribution was set aside in interest-bearing accounts referred to as Habitat Maintenance Fund accounts. While each State is maintaining its own account, interest earned on these accounts will be added to the accounts for the benefit of implementing the LCR MSCP. The HMF was fully funded in FY15. A detailed accounting of the HMF is included in attachment D-3a. No funds have been withdrawn from any of the accounts to date.

Remedial Measures Fund

The HCP requires that contingency funds be set aside to pay for implementing remedial measures in the event that changed circumstances affect program conservation measures (HCP, Section 5.12.13). The amount of funding is set forth in table 7-1 of the HCP, totaling $13,270,000 (2003 dollars) to be paid from year 6 through year 25 of the LCR MSCP. On April 25, 2012, the Steering Committee passed Program Decision Document 12-001, which approved establishment of State Remedial Measures Fund accounts (RMFs). Interest earned on these accounts will be added to the accounts for implementation of remedial measures. Table 1-3 provides FY16 contributions, total funds contributed through FY16 with interest, FY17 contributions, and FY18 projected contributions. A detailed accounting of the RMF is included in attachment D-3b. No funds have been withdrawn from any of the accounts to date.

Table 1-3.—RMF

Funding Partner	FY16 Contribution	Cumulative through FY16*	FY17 Contribution	FY18 Projected Contribution
California	$552,026.00	$2,685,482.83	$554,414.00	$561,180.00
Arizona	$276,013.00	$944,722.67	$277,207.00	$280,590.00
Nevada	$276,013.00	$1,524,135.35	$277,207.00	$280,590.00
Total	$1,104,052.00	$5,154,340.85	$1,108,828.00	$1,122,360.00

* Includes interest earned.

Land and Water Fund

A Land and Water Fund has been established by Reclamation to set aside funds for acquisition of land and water resources to implement conservation measures described in the HCP. Through guidelines developed under Work Task E16, Reclamation works with interested parties to secure land and water resources. Once potential sites have been evaluated, including determining financial value through the Federal appraisal process using the U.S. Department of the Interior's designated Appraisal Services Office, land and water resources nominated by Reclamation for acquisition must be approved by the Steering Committee. The entire site selection process may extend over multiple years; therefore, this fund has been established to ensure funding will be available to complete these acquisitions. The Land and Water Fund will be limited to the total amount of funding identified in Table 7-1 of the HCP for land and water acquisition, indexed for inflation. Once land and water resources have been approved for acquisition, funds will be withdrawn from the Land and Water Fund and a work task developed. If funds set aside in the Land and Water Fund are no longer required for land or water acquisition, they may be used to implement other actions necessary for conservation measure accomplishment. Table 1-4 lists the funds set aside in the Land and Water Fund through FY16. In FY16, $8,300,000 was taken out of the fund for securing the land and water at Planet Ranch. It was anticipated that an additional $2,100,000 would be contributed in FY17. However due to Federal funding reductions, this amount may be less. It is anticipated that no funding will be contributed in FY18. A detailed accounting of the Land and Water Fund can be found in attachment D-3c.

Table 1-4.—Land and Water Fund

Funding Partner	FY16 Contribution	Cumulative through FY16	FY17 Contribution	F18 Projected Contribution
Reclamation	$4,100,000	$15,400,000	$2,100,000*	$0

* Due to Federal funding reductions, this may be less.

In-Kind Contributions

Section 8.7.4 of the FMA provides that in-kind goods or services shall be credited based on approval by the Program Manager and the Steering Committee. In October 2007, the Steering Committee passed Program Decision Document 08-001, *In-Kind Credit for Goods and Services*, which provides specific guidelines for the calculation of in-kind credit for goods and services. No in-kind contributions were provided in FY16.

California Endangered Species Act Permit

As discussed earlier in the "Program Implementation" section of this annual report, the California partners are responsible for meeting the terms of the CESA permit. While Reclamation and non-Federal entities located in Nevada and

Arizona have no legal requirement to comply with the CESA permit with respect to the LCR MSCP, Reclamation is working with the California partners in meeting their requirements.

An aspect of the Memorandum of Agreement among Reclamation and the California partners regarding LCR MSCP conservation actions for the CESA permit discusses Reclamation's commitment to implement the HCP in a manner that facilitates CESA compliance requirements. In exchange, the California partners have made land and water available at no cost in the Palo Verde Irrigation District for program purposes. Given this exchange and the overall commonality between the CESA permit and the HCP, these California-specific actions are not expected to result in additional program costs.

Proposed FY18 Program Activities and FY16 Accomplishments

The minimum funding required in the LCR MSCP documents for FY18 is $31,251,240: $15,625,620 Federal and $15,625,620 non-Federal. Reclamation is proposing an annual program budget of $33,496,740 (table 1-5).

Table 1-5.—FY18 Proposed Program Funding

Program Area	FY18 Funding
Program Administration	$1,435,380
Fish Augmentation	$2,100,000
Species Research	$2,508,000
System Monitoring	$2,575,000
Conservation Area Development and Management	$19,241,000
Post-Development Monitoring	$2,650,000
Adaptive Management Program	$1,740,000
Funding Accounts – Remedial Measures	$1,122,360.00
Public Outreach	$125,000
Total	**$33,496,740**

Table 1-6 shows the following by work task: FY16 approved estimates and actual accomplishment, cumulative program expenditures (FY04–16), FY17 approved program funding, FY18 proposed program funding, and out-year funding for FY19 and FY20. Out-year funding estimates are not adjusted for inflation because the inflation index is not calculated until 5 months prior to the start of each fiscal year. In table 1-6, current year accomplishment is shown as obligations (money that is set aside during the year for program expenses). Cumulative accomplishment is shown as expenditures (actual funding expended).

Table 1-6.—Annual Funding Matrix

Work Task	Name	FY16 Approved Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Projected Estimate[1]	FY20 Projected Estimate[1]
A	**Program Administration**							
A1	Program Administration	$1,411,966.00	$1,188,765.48	$12,135,038.47	$1,418,074.00	$1,435,380.00	$1,435,380.00	$1,435,380.00
Closed[2]	Work Tasks Pre-FY16			$130,535.22				
		$1,411,966.00	**$1,188,765.48**	**$12,265,573.69**	**$1,418,074.00**	**$1,435,380.00**	**$1,435,380.00**	**$1,435,380.00**
B	**Fish Augmentation**							
B1	Lake Mohave Razorback Sucker Larvae Collections	$200,000.00	$216,932.74	$2,354,070.71	$215,000.00	$215,000.00	$215,000.00	$215,000.00
B2	Willow Beach National Fish Hatchery	$325,000.00	$309,156.64	$3,717,532.47	$325,000.00	$325,000.00	$325,000.00	$325,000.00
B3	Achii Hanyo Native Fish Rearing Facility	$275,000.00	$269,149.88	$1,397,143.77	$50,000.00	$170,000.00	$170,000.00	$170,000.00
B4	Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico	$260,000.00	$253,146.40	$2,298,809.76	$260,000.00	$260,000.00	$260,000.00	$260,000.00
B5	Bubbling Ponds Fish Hatchery	$315,000.00	$731,953.63	$3,074,634.70	$330,000.00	$330,000.00	$330,000.00	$330,000.00
B6	Lake Mead Fish Hatchery	$240,000.00	$241,051.09	$908,017.26	$325,000.00	$400,000.00	$400,000.00	$400,000.00
B7	Lakeside Rearing Ponds	$200,000.00	$149,862.21	$2,213,025.03	$200,000.00	$200,000.00	$200,000.00	$200,000.00
B8	Fish Tagging Equipment	$135,000.00	$140,133.31	$1,044,308.39	$135,000.00	$135,000.00	$135,000.00	$135,000.00
B12	Maintenance of Alternate Bonytail Broodstock	$50,000.00	$70,499.86	$30,123.36	$65,000.00	$65,000.00	$65,000.00	$65,000.00
Closed[2]	Work Tasks Pre-FY16	50,000.00[3]	$62.19	$987,445.58	$0.00			
		$2,050,000.00	**$2,381,947.95**	**$18,025,111.03**	**$1,905,000.00**	**$2,100,000.00**	**$2,100,000.00**	**$2,100,000.00**
C	**Species Research**							
C2	Sticky Buckwheat and Threecorner Milkvetch Conservation	$11,000.00	$11,311.51	$125,268.10	$11,000.00	$11,000.00	$11,000.00	$11,000.00
C14	Humpback Chub Program Support	$57,000.00	$0.00	$287,987.11	$57,000.00	$57,000.00	$57,000.00	$57,000.00
C24	Avian Species Habitat Requirements	$270,000.00	$302,717.48	$2,035,390.61	$340,000.00	$150,000.00	$0.00	$0.00
C25	Imperial Ponds Native Fish Research	$200,000.00	$197,068.70	$1,801,003.62	$200,000.00	$0.00	$0.00	$0.00
C27	Small Mammal Population Studies	$40,000.00	$801.21	$451,966.09	$0.00	$0.00	$0.00	$0.00
C31	Razorback Sucker Genetic Diversity Assessment	$160,000.00	$148,968.92	$759,189.23	$160,000.00	$160,000.00	$0.00	$0.00

Table 1-6.—Annual Funding Matrix

Work Task	Name	FY16 Approved Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Projected Estimate[1]	FY20 Projected Estimate[1]
C32	Determination of Salinity, Temperature, pH, and Oxygen Limits for Bonytail and Razorback Suckers	$110,000.00	$99,638.94	$790,595.91	$110,000.00	$0.00	$0.00	$0,00
C40	Genetic and Demographic Studies to Inform Conversation Management of Razorback Suckers and Bonytail in Off-Channel Habitats	$275,000.00	$274,332.93	$928,617.03	$300,000.00	$415,000.00	$0.00	$0.00
C43	Population Demographics and Habitat Use of the California Leaf-Nosed Bat, a Genetic Evaluation	$40,000.00	$39,374.35	$157,220.76	$0.00	$0.00	$0.00	$0.00
C52	Gilded Flicker Riparian Habitat Use and Seasonal Movement Research	$300,000.00	$151,012.21	$632,616.85	$300,000.00	$0.00	$0.00	$0.00
C53	Sonic Telemetry of Juvenile Flannelmouth Suckers in Reach 3	$120,000.00	$112,896.35	$533,775.74	$100,000.00	$40,000.00	$0.00	$0.00
C59	Selenium Monitoring in Created Backwater and Marsh Habitats	$200,000.00	$167,129.76	$141,782.16	$160,000.00	$160,000.00	$160,000.00	$160,000.00
C60	Habitat Manipulation	$225,000.00	$11.05	$197,396.83	$175,000.00	$175,000.00	$175,000.00	$175,000.00
C61	Evaluation of Alternative Stocking Methods for Fish Augmentation	$200,000.00	$175,395.05	$373,555.34	$300,000.00	$300,000.00	$0.00	$0.00
C62	Lowland Leopard Frog and Colorado River Toad Habitat and Ecology Study	$150,000.00	$147,788.13	$417,310.00	$25,000.00	$0.00	$0.00	$0.00
C63	Evaluation of Habitat Features that May Influence Success of Razorback Suckers and Bonytail in Backwater Environments	$135,000.00	$90,290.50	$193,042.01	$150,000.00	$150,000.00	$0.00	$0.00
C64	Post-Stocking Movement, Distribution, and Habitat Use of Razorback Suckers and Bonytail	$700,000.00	$656,351.17	$1,043,666.57	$750,000.00	$750,000.00	$750,000.00	$750,000.00
C65	Evaluation of Immediate Post-Stocking Survival of Razorback Suckers and Bonytail	$120,000.00	$99,329.26	$105,056.43	$120,000.00	$120,000.00	$0.00	$0.00
C66	Marsh Bird Water Depth Analysis	$100,000.00	$83,717.80	$83,717.80	$100,000.00	$20,000.00	$0.00	$0.00
Closed[2]	Work Tasks Pre-FY16		$3,411.87	$16,228,220.45				
		$3,413,000.00	**$2,761,547.19**	**$27,287,378.64**	**$3,358,000.00**	**$2,508,000.00**	**$1,153,000.00**	**$1,153,000.00**

Table 1-6.—Annual Funding Matrix

Work Task	Name	FY16 Approved Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Projected Estimate[1]	FY20 Projected Estimate[1]
D	**System Monitoring**							
D1	Marsh Bird Surveys	$40,000.00	$36,470.97	$326,943.84	$40,000.00	$40,000.00	$40,000.00	$40,000.00
D2	Southwestern Willow Flycatcher Presence/Absence Surveys	$750,000.00	$748,047.05	$8,382,003.83	$750,000.00	$650,000.00	$200,000.00	$200,000.00
D5	Monitoring Avian Productivity and Survivorship	$250,000.00	$234,559.10	$3,086,331.62	$250,000.00	$250,000.00	$250,000.00	$250,000.00
D6	System Monitoring for Riparian Obligate Avian Species	$150,000.00	$152,057.03	$2,614,069.00	$480,000.00	$480,000.00	$480,000.00	$400,000.00
D7	Yellow-Billed Cuckoo Presence/ Absence Surveys	$750,000.00	$688,770.88	$6,189,007.22	$650,000.00	$50,000.00	$50,000.00	$50,000.00
D8	Razorback Sucker and Bonytail Stock Assessment	$925,000.00	$943,608.61	$6,498,562.96	$925,000.00	$925,000.00	$925,000.00	$925,000.00
D9	System Monitoring and Research of Covered Bat Species	$390,000.00	$379,451.91	$2,140,764.49	$140,000.00	$140,000.00	$140,000.00	$140,000.00
D10	System Monitoring of Rodent Populations	$40,000.00	$44,452.69	$256,679.43	$40,000.00	$40,000.00	$40,000.00	$40,000.00
D12	Lowland Leopard Frog and Colorado River Toad Surveys	$35,000.00	$31,285.23	$468,420.78	$35,000.00	$0.00	$0.00	$0.00
Closed[2]	Work Tasks Pre-FY16			$1,298,090.77				
		$3,330,000.00	**$3,258,703.47**	**$31,260,873.94**	**$3,310,000.00**	**$2,575,000.00**	**$2,125,000.00**	**$2,045,000.00**
E	**Conservation Area Development and Management**							
E1	Beal Lake Conservation Area	$400,000.00	$209,035.87	$4,195,989.41	$250,000.00	$250,000.00	$250,000.00	$250,000.00
E4	Palo Verde Ecological Reserve	$500,000.00	$449,393.91	$9,745,551.58	$600,000.00	$600,000.00	$500,000.00	$500,000.00
E5	Cibola Valley Conservation Area	$750,000.00	$661,721.39	$11,979,224.50	$800,000.00	$850,000.00	$850,000.00	$600,000.00
E9	Hart Mine Marsh	$250,000.00	$293,218.97	$7,177,352.88	$250,000.00	$250,000.00	$200,000.00	$200,000.00
E13	McAllister Lake	$0.00	$0.00	$127,336.82	$50,000.00	$400,000.00	$400,000.00	$50,000.00
E14	Imperial Ponds Conservation Area	$1,500,000.00	$403,637.91	$10,008,947.04	$1,450,000.00	$1,450,000.00	$350,000.00	$350,000.00
E16	Conservation Area Site Selection	$1,300,000.00	$785,451.33	$3,725,596.44	$700,000.00	$700,000.00	$300,000.00	$200,000.00
E17	Topock Marsh Pumping	$1,000.00	$0.00	$1,245,076.45	$1,000.00	$1,000.00	$1,000.00	$1,000.00
E18	Law Enforcement and Fire Suppression	$250,000.00	$179,921.81	$1,705,400.26	$250,000.00	$200,000.00	$200,000.00	$200,000.00
E21	Planet Ranch	$10,340,000.00	$10,548,669.63	$9,716,678.45	$2,000,000.00	$3,000,000.00	$4,000,000.00	$4,000,000.00

Table 1-6.—Annual Funding Matrix

Work Task	Name	FY16 Approved Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Projected Estimate[1]	FY20 Projected Estimate[1]
E24	Cibola National Wildlife Refuge Unit #1 Conservation Area	$700,000.00	$843,168.99	$5,164,417.08	$750,000.00	$750,000.00	$800,000.00	$800,000.00
E25	Big Bend Conservation Area	$30,000.00	$12,101.05	$1,201,369.25	$30,000.00	$20,000.00	$20,000.00	$20,000.00
E27	Laguna Division Conservation Area	$900,000.00	$846,914.71	$27,247,180.05	$200,000.00	$150,000.00	$100,000.00	$100,000.00
E28	Yuma East Wetlands	$1,200,000.00	$318,447.52	$2,106,375.48	$450,000.00	$300,000.00	$250,000.00	$250,000.00
E31	Hunters Hole	$65,000.00	$42,096.23	$458,252.49	$60,000.00	$30,000.00	$30,000.00	$30,000.00
E33	Pretty Water Conservation Area	$450,000.00	$322,214.66	$1,518,900.69	$150,000.00	$40,000.00	$30,000.00	$20,000.00
E34	Salinity and Soil Moisture Monitoring Network	$500,000.00	$123,672.64	$256,831.66	$0.00	$0.00	$0.00	$0.00
E35	Mohave Valley Conservation Area	$1,250,000.00	$158,178.28	$561,810.94	$5,500,000.00	$3,500,000.00	$1,750,000.00	$160,000.00
E36	Parker Dam Camp	$0.00	$0.00	$0.00	$100,000.00	$50,000.00	$20,000.00	$20,000.00
E37	Palo Verde Ecological Reserve-South	$0.00	$0.00	$0.00	$200,000.00	$500,000.00	$1,000,000.00	$1,000,000.00
E38	Three Fingers Lake	$0.00	$0.00	$0.00	$200,000.00	$200,000.00	$4,000,000.00	$4,000,000.00
E39	Dennis Underwood Conservation Area	$0.00	$0.00	$0.00	$0.00	$6,000,000.00	$500,000.00	$500,000.00
Closed[2]	Work Tasks Pre-FY16			$5,274,791.93				
		$20,386,000.00	**$16,197,844.90**	**$103,417,083.40**	**$13,991,000.00**	**$19,241,000.00**	**$15,551,000.00**	**$13,251,000.00**
F	**Post-Development Monitoring**							
F1	Habitat Monitoring at Conservation Areas	$450,000.00	$471,224.34	$4,820,512.99	$950,000.00	$850,000.00	$850,000.00	$850,000.00
F2	Avian Use of Conservation Areas	$220,000.00	$273,682.73	$1,921,937.38	$350,000.00	$350,000.00	$350,000.00	$350,000.00
F3	Small Mammal Colonization of Conservation Areas	$65,000.00	$63,377.64	$489,264.67	$65,000.00	$65,000.00	$65,000.00	$65,000.00
F4	Covered Bat Species Monitoring at Conservation Areas	$150,000.00	$36,810.41	$1,090,611.17	$150,000.00	$80,000.00	$80,000.00	$80,000.00
F5	Post-Development Monitoring of Fish at Conservation Areas	$250,000.00	$241,313.96	$1,760,785.26	$250,000.00	$500,000.00	$500,000.00	$500,000.00
F6	Post-Development Monitoring of MacNeill's Sootywing Skippers at Conservation Areas	$80,000.00	$49,043.49	$502,356.79	$80,000.00	$40,000.00	$40,000.00	$40,000.00
F7	Marsh Bird Monitoring at Conservation Areas	$30,000.00	$23,225.44	$101,592.12	$40,000.00	$40,000.00	$40,000.00	$40,000.00
F8	Reptile and Amphibian Monitoring at Conservation Area	$0.00	$0.00	$0.00	$0.00	$25,000.00	$25,000.00	$25,000.00

Table 1-6.—Annual Funding Matrix

Work Task	Name	FY16 Approved Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Projected Estimate[1]	FY20 Projected Estimate[1]
F9	Post-Development Southwestern Willow Flycatcher Presence/Absence Surveys	$0.00	$0.00	$0.00	$0.00	$100,000.00	$400,000.00	$400,000.00
F10	Post-Development Yellow-billed Cuckoo Presence/Absence Surveys	$0.00	$0.00	$0.00	$0.00	$600,000.00	$600,000.00	$600,000.00
		$1,245,000.00	**$1,158,678.01**	**$10,687,060.38**	**$1,885,000.00**	**$2,650,000.00**	**$2,950,000.00**	**$2,950,000.00**
G	**Adaptive Management Program**							
G1	Data Management	$1,000,000.00	$919,025.71	$5,401,408.48	$1,000,000.00	$1,000,000.00	$1,000,000.00	$750,000.00
G3	Adaptive Management Research Projects	$300,000.00	$190,240.44	$2,652,788.91	$300,000.00	$300,000.00	$300,000.00	$300,000.00
G4	Science/Adaptive Management Strategy	$600,000.00	$420,190.00	$1,449,317.62	$400,000.00	$400,000.00	$400,000.00	$400,000.00
G6	Conceptual Ecological Models	$40,000.00	$27,482.43	$3,359.07	$40,000.00	$40,000.00	$40,000.00	$40,000.00
		$1,940,000.00	**$1,556,938.58**	**$9,506,874.08**	**$1,740,000.00**	**$1,740,000.00**	**$1,740,000.00**	**$1,490,000.00**
H	**Funding Accounts**							
H1[4]	Habitat Maintenance Fund	$0.00	$0.00	$32,466,770.00	$0.00	$0.00	$0.00	$0.00
H2	Remedial Measures Fund	$1,104,052.00	$1,104,052.00	$5,098,647.38	$1,108,828.00	$1,122,360.00	$1,122,360.00	$1,122,360.00
		$1,104,052.00	**$1,104,052.00**	**$37,565,417.38**	**$1,108,828.00**	**$1,122,360.00**	**$1,122,360.00**	**$1,122,360.00**
I	**Public Outreach**							
I1	Public Outreach	$100,000.00	$106,930.04	$605,934.97	$125,000.00	$125,000.00	$125,000.00	$125,000.00
Closed	Work Tasks Pre-FY16			$61,059.68				
		$100,000.00	**$106,930.04**	**$666,994.65**	**$125,000.00**	**$125,000.00**	**$125,000.00**	**$125,000.00**
	Program Total:	**$34,980,018.00**	**$29,715,407.62**	**$250,682,367.19**	**$28,840,902.00**	**$33,496,740.00**	**$28,301,740.00**	**$25,671,740.00**

[1] FY19 and FY20 numbers are not adjusted for inflation.
[2] Closed work tasks are shown in attachment D-4.
[3] Work Task B11 closed in FY16.
[4] H1 cumulative habitat maintenance amount does not include interest.

In accordance with the FMA, a description of the work is being presented to the Steering Committee to ensure that no disputes exist and that the description will subsequently be presented to the USFWS to ensure that the work is consistent with the HCP.

Reclamation's goal is to fully implement the LCR MSCP in a biologically effective, cost-efficient, and transparent manner. During FY18, should Reclamation determine that a specific work task cannot be undertaken, funds identified for that specific work task will be redirected and used for the following purposes: (1) funding another work task approved through this document, (2) increasing the funding for a work task that is expected to require funding in FY19 or FY20, (3) providing more than the minimum funding required to the RMF, or (4) beginning activities associated with any changed circumstances as defined in Section 5.12.3 of the HCP, should any occur.

In FY16, Reclamation estimated work tasks totaling $34,980,018.00. Actual LCR MSCP accomplishment (obligations) for FY16 was $29,715,407.62. Actual accomplishment was less than the minimum accomplishment due to delays in the replacement of the water delivery canal at the Imperial Ponds Conservation Area (IPCA), the replacement of the north channel pumps at Yuma East Wetlands (YEW), and the start of construction at the Mohave Valley Conservation Area (MVCA). In accordance with the FMA, Reclamation incurred a funding debit of $666,351.00 for FY16 (attachment D-2e). Cumulative program accomplishment (expenditures) through FY16 was $250,682,367.19 (attachment D-4).

Compliance Reporting

LCR MSCP

As required in the FMA, the following information is included in this annual report:

1. *A running tabulation of habitat created or restored under the LCR MSCP*

   To meet species habitat creation requirements, goals are provided in the HCP for habitat creation based on land cover types. These land cover types are described using the Anderson and Ohmart vegetation classification system. In total, 8,132 acres of cottonwood-willow, honey mesquite, marsh, and backwater land cover types are directed to be designed and created under the LCR MSCP. This is the minimum amount of land cover type to be created to meet species habitat requirements. Table 1-7 shows how much land cover by type has been created at each conservation area. Total land cover established through FY16 is 5,452 acres.

Table 1-7.—Conservation Area Land Cover Type

Land Cover Type	Management Unit	Established Acres FY16	Established Acres Total
Cottonwood-willow	E1 Beal Lake Conservation Area (Arizona)	0	116
	E4 Palo Verde Ecological Reserve (California)	0	945
	E5 Cibola Valley Conservation Area (Arizona)	111	376
	E21 Planet Ranch Conservation Area (Arizona)	396	396
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area (Arizona)	96	461
	E27 Laguna Division Conservation Area (California and Arizona)	0	1,129
	E28 Yuma East Wetlands (Arizona)	0	183
	E31 Hunters Hole (Arizona)	0	44
Total		**603**	**3,650**
Honey Mesquite	E4 Palo Verde Ecological Reserve (California)	0	78
	E5 Cibola Valley Conservation Area (Arizona)	0	477
	E27 Laguna Division Conservation Area (California and Arizona)	0	42
	E28 Yuma East Wetlands (Arizona)	0	103
	E33 Pretty Water Conservation Area (California)	0	566
	E36 Parker Dam Camp	80	80
Total		**80**	**1,346**
Marsh			
	E9 Hart Mine Marsh (Arizona)	0	255
	E14 Imperial Ponds Conservation Area (Arizona)	0	12
	E28 Yuma East Wetlands (Arizona)	0	94
Total		**0**	**361**
Backwater	E14 Imperial Ponds Conservation Area (Arizona)	0	80
	E25 Big Bend Conservation Area (Nevada)	0	15
Total		**0**	**95**
	TOTAL	**683**	**5,452**

The HCP specifies that created land cover types will be designed in an integrated mosaic and managed for more than one covered species, including habitat elements for each species. The HCP contains habitat creation conservation measures for 20 of the 26 species. Table 1-8 shows the total creditable acres for each species habitat creation conservation measure by conservation area.

The creditable acres established exceed species habitat creation conservation measure requirements for WRBA2, WYBA3, CRCR2, YHCR2, ELOW1, GIWO1, SUTA1, and MNSW2.

Table 1-8.—Conservation Area by Species Habitat Creation Conservation Measures

Species Habitat Creation Conservation Measures (Required Acres)	Management Unit	Creditable Acres FY16	Creditable Acres Total	Percent of Acres Creditable by Species Conservation Measure
CLRA1 (512 acres)	E9 Hart Mine Marsh	0	255	
	E14 Imperial Ponds Conservation Area	0	12	
	E28 Yuma East Wetlands	28[1]	94	
Total		**28**	**361**	**71%**
WIFL1 (4,050 acres)	E1 Beal Lake Conservation Area	0[2]	0	
	E4 Palo Verde Ecological Reserve	0	945	
	E5 Cibola Valley Conservation Area	0[2]	0	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	0[2]	0	
Total		**0**	**945**	**23%**
BONY2 (360 acres)	E14 Imperial Ponds Conservation Area	0[3]	0	
	E25 Big Bend Conservation Area	0	15	
Total		**0**	**15**	**4%**
RASU2 (360 acres)	E14 Imperial Ponds Conservation Area	0[3]	0	
	E25 Big Bend Conservation Area	0	15	
Total		**0**	**15**	**4%**
WRBA2 (765 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	304	1,023	
	E5 Cibola Valley Conservation Area	0	670	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	0	271	
	E36 Parker Dam Camp	80	80	
Total		**384**	**2,160[4]**	**> 100%**
WYBA3 (765 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	304	1,023	
	E5 Cibola Valley Conservation Area	0	670	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	0	271	
	E36 Parker Dam Camp	80	80	
Total		**384**	**2,160[4]**	**> 100%**
CRCR2 (125 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	0	1,023	
	E5 Cibola Valley Conservation Area	0	670	
	E9 Hart Mine Marsh	0	255	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	94	365	
	E36 Parker Dam Camp	80	80	
Total		**174**	**2,509[4]**	**> 100%**
YHCR2 (76 acres)	E28 Yuma East Wetlands	0	183	
Total		**0**	**183[4]**	**> 100%**

Table 1-8.—Conservation Area by Species Habitat Creation Conservation Measures

Species Habitat Creation Conservation Measures (Required Acres)	Management Unit	Creditable Acres FY16	Creditable Acres Total	Percent of Acres Creditable by Species Conservation Measure
LEBI1 (512 acres)	E9 Hart Mine Marsh	0	255	
	E14 Imperial Ponds Conservation Area	0	12	
	E28 Yuma East Wetlands	28[1]	94	
Total		**28**	**361**	**71%**
BLRA1 (130 acres)	E9 Hart Mine Marsh	0[5]	0	
	E14 Imperial Ponds Conservation Area	0	12	
	E28 Yuma East Wetlands	28[1]	94	
Total		**28**	**106**	**82%**
YBCU1 (4,050 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	0	945	
	E5 Cibola Valley Conservation Area	0	265	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	94	365	
	E28 Yuma East Wetlands	0	183	
Total		**94**	**1,874**	**46%**
ELOW1 (1,784 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	226	985	
	E5 Cibola Valley Conservation Area	0	670	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	0	270	
	E36 Parker Dam Camp	80	80	
Total		**306**	**2,121[4]**	**> 100%**
GIFL1 (4,050 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	226	945	
	E5 Cibola Valley Conservation Area	0	265	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	94	364	
	E28 Yuma East Wetlands	0	183	
Total		**320**	**1,873**	**46%**
GIWO1 (1,702 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	0	945	
	E5 Cibola Valley Conservation Area	0	265	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	20	364	
	E28 Yuma East Wetlands	0	183	
Total		**20**	**1,873[4]**	**> 100%**

Table 1-8.—Conservation Area by Species Habitat Creation Conservation Measures

Species Habitat Creation Conservation Measures (Required Acres)	Management Unit	Creditable Acres FY16	Creditable Acres Total	Percent of Acres Creditable by Species Conservation Measure
VEFL1 (5,208 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	0	985	
	E5 Cibola Valley Conservation Area	0	670	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	20	365	
	E28 Yuma East Wetlands	0	286[1]	
	E36 Parker Dam Camp	80	80	
Total		**100**	**2,502**	**48%**
BEVI1 (2,983 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	0	1,023	
	E5 Cibola Valley Conservation Area	0	670	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	175	365	
	E28 Yuma East Wetlands	0	286[1]	
	E36 Parker Dam Camp	80	80	
Total		**254**	**2,540**	**85%**
YWAR1 (4,050 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	0	945	
	E5 Cibola Valley Conservation Area	0	265	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	20	365	
	E28Yuma East Wetlands	0	183	
Total		**20**	**1,874**	**46%**
SUTA1 (602 acres)	E1 Beal Lake Conservation Area	0	116	
	E4 Palo Verde Ecological Reserve	446	945	
	E5 Cibola Valley Conservation Area	0	265	
	E24 Cibola National Wildlife Refuge Unit #1 Conservation Area	0	271	
	E28 Yuma East Wetlands	0	183	
Total		**446**	**1,780[4]**	**> 100%**
FLSU1 (85 acres)	E25 Big Bend Conservation Area	0	15	
Total		**0**	**15**	**18%**
MNSW2 (222 acres)	E4 Palo Verde Ecological Reserve	0	40	
	E5 Cibola Valley Conservation Area	0	405	
Total		**0**	**445[4]**	**> 100%**

[1] Yuma East Wetlands – The habitat at Yuma East Wetlands was re-evaluated during FY16, resulting in the marsh land cover type changing from 66 acres to 94 acres and the honey mesquite land cover type changing from 131 acres to 103 acres.

[2] WIFL1 – Although these conservation areas provide the appropriate structure type (cottonwood-willow I–IV) as defined in WIFL1, Reclamation is in the process of gathering the appropriate hydrologic data to determine saturated soils, moist soils, or slow-moving water at each of those conservation areas. During FY15, hydrologic data were collected at the Palo Verde Ecological Reserve (PVER), and it was determined that the PVER does meet both structure type and moist soils requirements. Once this has been determined at the other conservation areas, they will be evaluated.

[3] BONY2 and RASU2 – Reclamation and the USFWS have completed a 5-year management strategy, which calls for stocking native fishes in FY17. Acres will be considered creditable at that time.

[4] The total for creditable acres established exceeds the species habitat creation conservation measure requirements. For many species, creditable acres established beyond conservation measure requirements is due to habitat creation efforts for other species.

[5] BLRA1 – Reclamation is in the process of determining the land and water interface and the method for delineating California blackrail (*Laterallus jamaicensis coturniculus*) marsh habitat at < 1 inch deep. Once this has been determined, Hart Mine Marsh will be evaluated.

2. *A running tabulation and description of all conservation measures that have been completed from the commencement of the LCR MSCP to the date of the report*

   Tables 1-9a–c provide a summary of fish repatriation. Table 1-10 provides a matrix showing the work tasks and their related conservation measures. Attachment E lists the technical reports that were published in FY16.

3. *A description of any take known to have occurred during the previous budget period*

   In accordance with FMA Section 7.4.1(F), any incidental take known to have occurred during LCR MSCP implementation in FY16 is reported in attachment B. The USFWS Section 10 Permit and the 2005 BO authorize incidental take resulting from the conduct of Federal covered actions and non-Federal covered activities, and Reclamation's implementation of the HCP, as long as conservation measures and avoidance and minimization measures are in place. Due to the wide range and scope of this program, surrogate measures were used in the program compliance documents to quantify impacts. These same surrogates were used to determine the types and levels of any incidental take known to have occurred in FY16. As described in the 2005 BO, the surrogate measures for incidental take are:

   Flow-Related

   Total loss of suitable habitat for covered species that use cottonwood-willow, marsh, and backwaters resulting from the changes in points of diversions, extension of the interim surplus guidelines, and implementation of the shortage criteria.

   As total habitat loss is calculated for all of these actions, take is being documented as the amount and type of covered actions and activities being implemented.

   Non-Flow-Related

   Acreage or miles of habitats affected by non-flow-related actions.

   Other Non-Flow-Related (Continuing Actions)

   Acreage or miles of facilities affected by maintenance actions.

Creation of Restoration Sites

Affected habitat acreage for the covered species with the understanding that, during creation of higher-value habitat, there may be harassment of individuals.

Attachment B summarizes the surrogate measures for incidental take for Federal flow-related actions, Federal non-flow-related actions, and non-Federal activities. Non-Federal flow-related activities are included as part of the Federal flow-related actions.

Table 1-9a.—Summary of Fish Augmentation Conservation Measure RASU5

Reach	Number of Razorback Suckers, FY16	Total Number of Razorback Suckers
2	7,898	121,002
Total	**7,898**	**121,002**

Table 1-9b.—Summary of Fish Augmentation Conservation Measure RASU3

Reach	Number of Razorback Suckers, FY16	Total Number of Razorback Suckers
3	6,105	79,118
4 and 5	6,005	86,593
Total	**12,110**	**165,711**

Table 1-9c.—Summary of Fish Augmentation Conservation Measure BONY3

Reach	Number of Bonytail, FY16	Bonytail Program
2	913[1]	913[1]
3	1,522[2]	49,965
4 and 5	1,289[2]	25,773
Total	**3,724**	**76,651**

[1] Bonytail stocking in Reach 2 commenced in FY16 as part of a pilot study.

[2] Lower numbers of bonytail were stocked into Reaches 3, 4, and 5 due to weather-related growth issues and changes in year-class management of bonytail stocks at the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (formerly the Dexter National Fish Hatchery & Technology Center). Additional bonytail will be stocked into these reaches in subsequent years to compensate for low FY16 numbers.

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Yuma Clapper Rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*])	CLRA1	Create habitat, 512 acres	C3 E9 E14 E16 E21 E26 E27 E28 E34 F2 F7 G1 G4	E9 E14 E16 E21 E26 E27 E28 E34 E38 F2 F7 G1 G4 G6	E9 E14 E16 E21 E26 E27 E28 E34 E38 F2 F7 G1 G4 G6
	CLRA2	Maintain existing important habitat	C3 G1 G4 H1	G1 G4 G6 H1	G1 G4 G6 H1
	MRM1	Define habitat characteristics	C3 C24 D1 E21 F2 F7 G1 G4	C24 C66 D1 E21 F2 F7 G1 G4 G6	C24 C66 D1 E21 F2 F7 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C59 D1 F1 F2 F7 G1 G4	C24 C59 C60 C66 D1 F1 F2 F7 G1 G4 G6	C24 C59 C60 C66 D1 F1 F2 F7 G1 G4 G6
	MRM5	Monitor selenium levels in backwater	C59	C59	C59
	CMM1	Reduce risk of loss to wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	WIFL1	Create habitat, 4,050 acres	C3 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 E39 G1 G4 G6
	WIFL2	Maintain existing important habitat	C3 D2 D3 D4 E21 F1 G1 G4 H1	D2 D4 E21 F1 G1 G4 G6 H1	D2 D4 E21 F1 G1 G4 G6 H1
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 D2 D3 D4 D5 D6 E21 F2 G1 G4	C24 C42 D2 D4 D5 D6 E21 F2 G1 G4 G6	C24 D2 D4 D5 D6 E21 F2 F9 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C24 C55 C60 D2 D3 D4 D5 D6 F1 F2 G1 G4	C24 C55 C60 D2 D5 D6 F1 F2 G1 G4 G6	C24 C60 D2 D5 D6 F1 F2 F9 G1 G4 G6
	MRM4	Brown-headed cowbird (*Molothrus ater*) evaluation	D2 G1 G4	D2 G1 G4	D2 F9 G1 G4
	CMM1	Reduce risk of loss to wildfire	C55 E18 G1 G4	C55 E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4
Desert Tortoise (Mojave population) (*Gopherus agassizii*)	**DETO1**	**Acquire, protect 230 acres – Completed**			
	DETO2	Avoid impacts on individuals and burrows	C3 G1 G4	G1 G4	G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Bonytail (*Gila elegans*)	BONY1	Coordinate conservation efforts with the USFWS and recovery programs	A1	A1	A1
	BONY2	Create 360 acres of bonytail habitat	C3 C25 C30 C32 C40 E2 E14 E15 E16 E25 E26 E32 E34 G1 G4	C25 C32 C40 E1 E14 E15 E16 E25 E26 E32 E34 E38 G1 G4 G6	C25 C32 C40 E1 E14 E15 E16 E25 E26 E32 E34 E38 G1 G4 G6
	BONY3	Rear/stock 620,000: 5,000 subadults per year for 40 years at Lake Mohave 4,000 subadults per year for 50 years from Davis Dam to Parker Dam 4,000 subadults per year – experimental augmentation from Parker Dam to Imperial Dam for 10 consecutive years 4,000 subadults per year from Parker Dam to Imperial Dam for 45 years	C30 C32 C41 C46 C47 C56 C61 C64 G1 G4	B2 B3 B4 B6 B7 B8 B12 C32 C61 C63 C64 C65 G1 G4 G6	B2 B3 B4 B6 B7 B8 B12 C32 C61 C63 C64 C65 G1 G4 G6
	BONY4	Develop (if necessary) additional rearing capacity	B2 B3 B4 B7 B8 C30 C46 C47 C49 C61 G1 G4	B2 B3 B4 B6 B7 B8 B12 C47 C49 C61 C64 C65 G1 G4	B2 B3 B4 B6 B7 B8 B12 C61 C64 C65 G1 G4
	BONY5	Monitor, research, and adaptively manage augmentations and created habitat	B7 B8 C23 C30 C32 C40 C44 C46 C47 C56 C59 C61 C63 C64 D8 F5 G1 G4	B7 B8 C32 C40 C47 C56 C59 C61 C63 C64 C65 D8 F5 G1 G4 G6	B7 B8 C32 C40 C59 C61 C63 C64 C65 D8 F5 G1 G4 G6
	MRM5	Monitor selenium levels in backwater	C59 G1 G4	C59 G1 G4	C59 G1 G4
Humpback Chub (*Gila cypha*)	HUCH1	$500,000 to existing programs	C14 G1	B4 G1	B4 G1

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Razorback Sucker (*Xyrauchen texanus*)	RASU1	Coordinate conservation efforts with the USFWS and recovery programs	A1	A1	A1
	RASU2	Create 360 acres of razorback sucker habitat	C3 C25 C30 C31 C32 C40 E2 E14 E15 E16 E25 E26 E32 E34 G1 G4	C25 C31 C32 C40 E1 E14 E15 E16 E25 E26 E32 E34 E38 G1 G4 G6	C25 C31 C32 C40 E1 E14 E15 E16 E25 E26 E32 E34 E38 G1 G4 G6
	RASU3	Rear/stock 660,000: 6,000 subadults per year for 10 years from Davis Dam to Parker Dam and 6,000 subadults per year for 10 years from Parker Dam to Imperial Dam 6,000 subadults per year for 45 years from Davis Dam to Parker Dam 6,000 subadults per year for 45 years from Parker Dam to Imperial Dam	B1 B2 B3 B4 B5 B6 B7 B8 B11 C26 C30 C31 C32 C33 C46 C48 C56 C61 C63 C64 G1 G4	B1 B2 B3 B4 B5 B6 B7 B8 C31 C32 C61 C63 C64 C65 G1 G4 G6	B1 B2 B3 B4 B5 B6 B7 B8 C31 C32 C61 C63 C64 C65 G1 G4 G6
	RASU4	Develop (if necessary) additional rearing capacity	B2 B3 B4 B5 B6 B7 B8 B11 C10 C26 C30 C46 C48 C64 G1 G4	B2 B3 B4 B5 B6 B7 B8 C10 C64 C65 G1 G4	B2 B3 B4 B5 B6 B7 B8 C64 C65 G1 G4
	RASU5	Support ongoing Lake Mohave conservation efforts	B1 B2 B7 B8 C30 C31 C32 C41 C61 G1 G4	B1 B2 B7 B8 C31 C32 C61 C63 G1 G4	B1 B2 B7 B8 C31 C32 C61 C63 G1 G4
	RASU6	Monitor, research, and adaptively manage augmentations and created habitat	B2 B7 B8 B11 C8 C23 C30 C31 C32 C33 C40 C44 C46 C56 C57 C59 C61 C63 D8 F5 G1 G4	B7 B8 C31 C32 C40 C59 C61 C63 C64 C65 D8 F5 G1 G4 G6	B7 B8 C31 C32 C40 C59 C61 C63 C64 C65 D8 F5 G1 G4 G6
	RASU7	Funding for ongoing Reclamation/Southern Nevada Water Authority Lake Mead studies	B6 B11 C13 G1 G4	B6 G1 G4	B6 G1 G4
	RASU8	Continue razorback sucker conservation measure identified in the 2001 BO	B1 B6 B11 C26 C30 G1 G4	B1 B6 G1 G4	B1 B6 G1 G4
	MRM5	Monitor selenium levels in backwater	C59 G1 G4	C59 G1 G4	C59 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Western Red Bat (*Lasiurus blossevilli*)	WRBA1	Status/habitat surveys	C3 D9 F4 G1 G4	D9 F4 G1 G4	D9 F4 G1 G4
	WRBA2	**Create 765 acres – Creditable acres established exceed requirement**	C3 D9 E1 E3 E4 E5 E8 E16 E21 E24 E33 E34 G1 G4	D9 E1 E4 E5 E8 E16 E21 E24 E33 E34 E36 E37 G1 G4	D9 E1 E4 E5 E8 E16 E21 E24 E33 E34 E36 E37 E39 G1 G4
	MRM1	Define habitat characteristics	C3 C5 C35 D9 E21 F4 G1 G4	C35 E21 F4 G1 G4 G6	E21 F4 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 F1 F4 G1 G4	F1 F4 G1 G4 G6	F1 F4 G1 G4 G6
	CMM1	Reduce risk of loss of habitat to wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire			
Western Yellow Bat (*Lasiurus xanthinus*)	WYBA1	Conduct surveys for species distribution	C3 D9 G1 G4	D9 G1 G4	D9 G1 G4
	WYBA2	Avoid removal of roost trees (palms)	E16 F4 G1 G4	E16 F4 G1 G4	E16 F4 G1 G4
	WYBA3	**Create 765 acres – Creditable acres established exceed requirement**	C3 D9 E1 E3 E4 E5 E8 E21 E24 E33 E34 F4 G1 G4	D9 E1 E4 E5 E8 E21 E24 E33 E34 E37 F4 G1 G4 G6	D9 E1 E4 E5 E8 E21 E24 E33 E34 E37 E39 F4 G1 G4 G6
	MRM1	Define habitat characteristics	C3 C5 C35 D9 E21 F4 G1 G4	C35 D9 E21 F4 G1 G4 G6	D9 E21 F4 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 F1 F4 G1 G4	F1 F4 G1 G4 G6	F1 F4 G1 G4 G6
	CMM1	Reduce risk of loss of habitat to wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire			
Desert Pocket Mouse| (*Chaetodipus penicillatus sobrinus*)	DPMO1	Locate occupied habitat and restore disturbed habitat	C3 F3 G1 G4	D10 F3 G1 G4	D10 F3 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Colorado River Cotton Rat (*Sigmodon arizonae plenus*)	CRCR1	Status/habitat surveys – define habitat first 5 years	C3 C27 F3 G1 G4	F3 G1 G4	F3 G1 G4
	CRCR2	**Create 125 acres – Creditable acres established exceed requirement**	C3 C54 E9 E16 E21 E34 G1 G4	C54 E9 E16 E21 E34 E38 G1 G4	E9 E16 E21 E34 E38 G1 G4
	MRM2	Monitor and adaptively manage created habitat	C3 C54 C60 F1 F3 G1 G4	C54 C60 D10 F1 F3 G1 G4 G6	C60 D10 F1 F3 G1 G4 G6
	CMM1	Reduce risk of loss of habitat to wildfire	C54 E18 G1 G4	C54 E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire			
Yuma Hispid Cotton Rat (*Sigmodon hispidus eremicus*)	YHCR1	Status/habitat surveys – define habitat first 5 years	C3 C27 G1 G4	G1 G4	G1 G4
	YHCR2	**Create 76 acres – Creditable acres established exceed requirement**	C3 C54 E16 E27 E28 E34 G1 G4	C54 E16 E27 E28 E34 G1 G4	E16 E27 E28 E34 G1 G4
	MRM2	Monitor and adaptively manage created habitat	C3 C54 C60 F1 F3 G1 G4	C54 C60 D10 F1 F3 G1 G4 G6	C60 D10 F1 F3 G1 G4 G6
	CMM1	Reduce risk of loss of habitat to wildfire	C54 E18 G1 G4	C54 E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire			
Western Least Bittern *Ixobrychus exilis hesperis*)	LEBI1	Create 512 acres	C3 E9 E14 E16 E21 E26 E27 E28 E34 F7 G1 G4	E9 E14 E16 E21 E26 E27 E28 E34 E38 F7 G1 G4	E9 E14 E16 E21 E26 E27 E28 E34 E38 F7 G1 G4
	MRM1	Define habitat characteristics	C3 C24 D1 E21 F2 F7 G1 G4	C24 C66 D1 E21 F2 F7 G1 G4 G6	C24 C66 D1 E21 F2 F7 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 D1 F1 F2 F7 G1 G4	C24 C66 D1 F1 F2 F7 G1 G4 G6	C24 C66 D1 F1 F2 F7 G1 G4 G6
	MRM5	Monitor selenium levels	C59	C59	C59
	CMM1	Reduce risk of loss of habitat affected by wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
California Black Rail (*Laterallus jamaicensis coturniculus*)	BLRA1	Create 130 acres	C3 E14 E16 E26 E27 E28 E34 F7 G1 G4	C60 E14 E16 E26 E27 E28 E34 E38 F7 G1 G4 G6	C60 E14 E16 E26 E27 E28 E34 E38 F7 G1 G4 G6
	BLRA2	Maintain existing occupied habitat	C3 G1 G4 H1	G1 G4 H1	G1 G4 H1
	MRM1	Define habitat characteristics	C3 C24 D1 F2 G1 G4	C24 C66 D1 F2 G1 G4 G6	C24 C66 D1 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C59 D1 F1 F2 G1 G4	C24 C59 C66 D1 F1 F2 G1 G4 G6	C24 C59 C66 D1 F1 F2 G1 G4 G6
	MRM5	Monitor selenium levels	C59	C59	C59
	CMM1	Reduce risk of loss of habitat affected by wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4
Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	YBCU1	Create 4,050 acres	C3 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 E39 G1 G4 G6
	YBCU2	Maintain existing habitat	C3 D7 E21 G1 G4 H1	D7 E21 G1 G4 H1	D7 E21 G1 G4 H1
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 D5 D6 D7 E21 F2 G1 G4	C24 D5 D6 D7 E21 F2 G1 G4 G6	C24 D5 D6 D7 E21 F2 F10 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 C60 D5 D6 D7 F1 F2 G1 G4	C24 C55 C60 D5 D6 D7 F1 F2 G1 G4 G6	C24 C55 C60 D5 D6 D7 F1 F2 F10 G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E18 G1 G4	C55 E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Elf Owl (*Micrathene whitneyi*)	**ELOW1**	**Create 1,784 acres in Reaches 3–5 – Creditable acres established exceed requirement**	C3 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 E36 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 E36 E37 E39 G1 G4 G6
	ELOW2	Install elf owl boxes before Gila woodpeckers (*Melanerpes uropygialis*) established	C3 G1 G4	G1 G4	G1 G4
	MRM1	Define habitat characteristics	C3 C24 C36 C37 C42 D5 D6 E21 F2 G1 G4	C24 D5 D6 E21 F2 G1 G4 G6	C24 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 D5 D6 F1 F2	C24 D5 D6 F1 F2 G6	C24 D5 D6 F1 F2 G6
	MRM3	Research nest competition of European starlings (*Sturnus vulgaris*)	C3 G1 G4	G1 G4 G6	G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4
Gilded Flicker (*Colaptes chrysoides*)	GIFL1	Create 4,050 acres in Reaches 3–7	C3 C52 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4	C52 E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 G1 G4 G6	C52 E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 E39 G1 G4 G6
	GIFL2	Install artificial snags until vegetation has matured			
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 C52 D5 D6 E21 F2 G1 G4	C24 C52 D5 D6 E21 F2 G1 G4 G6	C24 C52 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 D5 D6 F1 F2 G1 G4	C24 D5 D6 F1 F2 G1 G4 G6	C24 D5 D6 F1 F2 G1 G4 G6
	MRM3	Research nest competition of European starlings	C3 G1 G4	G1 G4 G6	G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Gila Woodpecker (*Melanerpes uropygialis*)	**GIWO1**	**Create 1,702 acres in Reaches 3–6 – Creditable acres established exceed requirement**	C3 E3 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4	E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 G1 G4 G6	E4 E5 E8 E16 E21 E24 E27 E28 E34 E37 E39 G1 G4 G6
	GIWO2	Install artificial snags			
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 D5 D6 E21 F2 G1 G4	C24 D5 D6 E21 F2 G1 G4 G6	C24 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 D5 D6 F1 F2 G1 G4	C24 D5 D6 F1 F2 G1 G4 G6	C24 D5 D6 F1 F2 G1 G4 G6
	MRM3	Research nest competition of European starlings	C3 G1 G4	G1 G4 G6	G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4
Vermilion Flycatcher (*Pyrocephalus rubinus*)	VEFL1	Create 5,208 acres	C3 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 E36 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 E36 E37 E39 G1 G4 G6
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 C51 D5 D6 E21 F2 G1 G4	C24 D5 D6 E21 F2 G1 G4 G6	C24 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C51 C55 C60 D5 D6 F1 F2 G1 G4	C24 C60 D5 D6 F1 F2 G1 G4 G6	C24 C60 D5 D6 F1 F2 G1 G4 G6
	MRM4	Brown-headed cowbird evaluation			
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Arizona Bell's Vireo (*Vireo bellii arizonae*)	BEVI1	Create 2,983 acres	C3 C5 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E24 E27 E28 E33 E34 E37 E39 G1 G4 G6
	MRM1	Define habitat characteristics	C3 C37 C42 D5 D6 E21 F2 G1 G4	C42 D5 D6 E21 F2 G1 G4 G6	C24 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 D5 D6 F1 F2 G1 G4	C24 C55 D5 D6 F1 F2 G1 G4 G6	C24 C55 D5 D6 F1 F2 G1 G4 G6
	MRM4	Brown-headed cowbird evaluation			
Sonoran Yellow Warbler (*Dendroica petechia sonorana* = *Setophaga petechia sonorana*)	YWAR1	Create 4,050 acres	C3 E1 E3 E4 E5 E8 E16 E21 E27 E28 E34 G1 G4	E1 E4 E5 E8 E16 E21 E27 E28 E34 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E27 E28 E34 E37 E39 G1 G4 G6
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 D5 D6 E21 F2 G1 G4	C24 D5 D6 E21 F2 G1 G4 G6	C24 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 C60 D5 D6 F1 F2 G1 G4	C24 D5 D6 F1 F2 G1 G4 G6	C24 D5 D6 F1 F2 G1 G4 G6
	MRM4	Brown-headed cowbird evaluation			
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Summer Tanager (*Piranga rubra*)	**SUTA1**	**Create 602 acres – Creditable acres established exceed requirement**	C3 E1 E3 E4 E5 E8 E16 E21 E27 E28 E34 G1 G4	E1 E4 E5 E8 E16 E21 E27 E28 E34 E37 G1 G4 G6	E1 E4 E5 E8 E16 E21 E27 E28 E34 E37 E39 G1 G4 G6
	MRM1	Define habitat characteristics	C3 C5 C24 C37 C42 D5 D6 E21 F2 G1 G4	C24 D5 D6 E21 F2 G1 G4 G6	C24 D5 D6 E21 F2 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 C24 C55 D5 D6 F1 F2 G1 G4	C24 D5 D6 F1 F2 G1 G4 G6	C24 D5 D6 F1 F2 G1 G4 G6
	MRM4	Brown-headed cowbird evaluation			
	CMM1	Reduce risk of loss of habitat affected by wildfire	C55 E28 G1 G4	E28 G1 G4	E28 G1 G4
	CMM2	Replace created habitat affected by wildfire	F2 G1 G4	F2 G1 G4	F2 G1 G4
Flat-tailed Horned Lizard (*Phrynosoma mcalli*)	**FTHL1**	**Acquire and protect 230 acres – Completed**			
	FTHL2	Implement conservation measures to avoid take	C3 E30 G1 G4	G1 G4	G1 G4
Relict Leopard Frog (*Rana onca)*	**RLFR1**	**$10,000 per year for 10 years to conservation program – Completed**			
Flannelmouth Sucker (*Catostomus latipinnis*)	FLSU1	85 acres – Reach 3	C3 C53 E15 E16 E25 E32 E34 G1 G4	C53 E16 E25 E32 E34 G1 G4 G6	C53 E16 E25 E32 E34 G1 G4 G6
	FLSU2	**$80,000 per year for 5 years – Completed**			
	FLSU3	Develop management needs/strategies	C15 C53 G1 G4	C53 G1 G4	C53 G1 G4
	MRM2	Monitor and adaptively manage created habitat	C3 C59 G1 G4	C59 G1 G4 G6	C59 G1 G4 G6
	MRM5	Monitor selenium levels in backwaters	C59 G1 G4	C59 G1 G4	C59 G1 G4

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
MacNeill's Sootywing Skipper (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill])	MNSW1	Status surveys/habitat – define habitat first 5 years	C3 F6 G1 G4	C3 F6 G1 G4	F6 G1 G4
	MNSW2	**Create 222 acres – Creditable acres established exceed requirement**	C3 E1 E3 E4 E5 E16 E21 E34 G1 G4	C3 E1 E3 E4 E5 E16 E21 E34 G1 G4	E1 E4 E5 E16 E21 E34 E37 E39 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 F1 F6 G1 G4	C3 F1 F6 G1 G4	F1 F6 G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4 G6
	CMM2	Replace created habitat affected by wildfire			
Sticky Buckwheat (*Eriogonum viscidulum*)	STBU1	$10,000 per year until 2030 to conservation program	C2 G1	C2 G1	C2 G1
Threecorner Milkvetch (*Astragalus geyeri* var. *triquetrus*)	THMI1	$10,000 per year until 2030 to conservation program	C2 G1	C2 G1	C2 G1
California Leaf-nosed Bat (*Macrotus californicus*)	CLNB1	Distribution surveys	C3 C34 D9 G1 G4	C3 C34 D9 G1 G4	D9 G1 G4 G6
	CLNB2	Create habitat near roost sites (priority when creating cottonwood-willow and honey mesquite habitat for other species)	C3 C34 E1 E3 E4 E5 E8 E16 E21 E24 E34 G1 G4	C3 C34 E1 E3 E4 E5 E8 E16 E21 E24 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E34 G1 G4 G6
	MRM1	Define habitat characteristics	C3 C5 D9 E21 F4 G1 G4	C3 C5 D9 E21 F4 G1 G4	D9 E21 F4 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 F4 G1 G4	C3 F4 G1 G4	F4 G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habit affected by wildfire			

Table 1-10.—Status of Conservation Measures

Species/Habitat/Action	Code	Description	FY16 Approved	FY17 Approved	FY18 Proposed
Pale Townsend's Big-eared Bat (*Corynorhinus townsendii pallescens* = *Plecotus townsendii pallescens* = *C. townsendii townsendii*)	PTBB1	Distribution surveys	C3 D9 G1 G4	C3 D9 G1 G4	D9 G1 G4
	PTBB2	Create habitat near roost sites	C3 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4	C3 E1 E3 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4	E1 E4 E5 E8 E16 E21 E24 E27 E28 E34 G1 G4 G6
	MRM1	Determine habitat characteristics	C3 C5 D9 E21 F4 G1 G4	C3 C5 D9 E21 F4 G1 G4	D9 E21 F4 G1 G4 G6
	MRM2	Monitor and adaptively manage created habitat	C3 F4 G1 G4	C3 F4 G1 G4	F4 G1 G4 G6
	CMM1	Reduce risk of loss of habitat affected by wildfire	E18 G1 G4	E18 G1 G4	E18 G1 G4
	CMM2	Replace created habitat affected by wildfire			
Colorado River Toad (*Bufo alvarius* = *Incilius alvarius*)	CRTO1	Distribution surveys, habitat affinity, limiting factors	C3 C62 D12 G1 G4	C3 C62 D12 G1 G4	F8 G1 G4 G6
	CRTO2	Protect existing occupied habitat	C3 C62 G1 G4 H1	C3 C62 G1 G4 H1	C62 G1 G4 H1
	CRTO3	Research to establish in unoccupied habitat	C3 C62 G1 G4	C3 C62 G1 G4	C62 G1 G4
Lowland Leopard Frog (*Rana yavapaiensis* = *Lithobates yavapaiensis*)	LLFR1	Distribution surveys, habitat affinity, limiting factors	C3 C62 D12 G1 G4	C3 C62 D12 G1 G4	C62 D12 F8 G1 G4 G6
	LLFR2	Protect existing occupied habitat	C3 C62 G1 G4 H1	C3 C62 G1 G4 H1	C62 G1 G4 H1
	LLFR3	Research to establish in unoccupied habitat	C3 C62 G1 G4	C3 C62 G1 G4	C62 G1 G4
Other					
Topock Marsh Pumping	**AMM2**	**Avoid flow-related impacts on covered species – Completed**	E17	E17	E17
Law Enforcement and Fire Suppression	CMM1	Reduce effects of fire and vandalism on created habitats	E18	E18	E18

4. *Any recommendation made by the USFWS or any State wildlife agency regarding the LCR MSCP*

   The July 12, 2016, consistency letter from the USFWS for the *Final Implementation Report, Fiscal Year 2017 Work Plan and Budget, Fiscal Year 2015 Accomplishment Report* is included in attachment C. Also included in attachment C is the February 1, 2017, letter from the USFWS approving Minor Modification Program Decision Document 16-001.

5. *Approval or rejection of any minor modification described in Section 14.1 of the Implementation Agreement*

   The Steering Committee approved Program Decision Document 16-001 on April 27, 2016, for a minor modification to the FMA, Section 7.3.2, and the Steering Committee Bylaws, Section 2.2, to revise membership language within the Steering Committee participant groups.

2001 Biological Opinion

In addition to fulfilling the requirements in the LCR MSCP Habitat Conservation Plan, the work plans also satisfied conservation measures required in the 2001 BO. The requirements listed in the 2001 BO were integrated into this program and implemented by Reclamation in conjunction with the LCR MSCP. According to the Record of Decision signed on January 16, 2001, the ISC expired on December 31, 2015. Requirements under the 2001 BO specifically related to the Secretarial Implementation Agreements were completed in FY08. Monitoring under Conservation Measure 4, Tier 1a, was to continue until 5 years after implementation of all water transfers covered under the 2001 BO. A review of the current monitoring program, including the methodology and results from the first 5 years, was completed, and a decision was made to discontinue this monitoring. A concurrence letter was received from the USFWS on August 14, 2012. Requirements under the 2001 BO specifically related to the ISC were completed when the ISC expired on December 31, 2015. Continuation of the ISC beyond December 31, 2015, is a covered action of the LCR MSCP.

California Endangered Species Act Permit

In conjunction with Federal ESA coverage, California State law requires CESA permitting for California activities. The California partners applied for and received a CESA Incidental Take Permit pursuant to California Department of Fish and Game Code Sections 2081(a) and 2081(b). The California partners negotiated the terms of the CESA permit with the CDFW to be compatible with the LCR MSCP. The CESA permit provides compliance only for California partners. The LCR MSCP conservation activities fulfill the requirements of the CESA permit; however, certain CESA permit requirements are more specific in

relationship to location or timing. All other CESA permit requirements are otherwise the same as those for the LCR MSCP. By meeting LCR MSCP requirements in FY16, CESA program requirements were also met for FY16.

Listed below are the CESA requirements that are more detailed than those in the LCR MSCP Habitat Conservation Plan:

1. Requirements for various types of coordination with the CDFW during identification, development, construction, and maintenance of habitat created or restored within the State of California under the LCR MSCP.

2. Various reporting requirements to be made to the CDFW, including annual status reports and notifications.

3. Riparian, marsh, and backwater replacement plans are to be submitted to the CDFW for approval of riparian and marsh habitat creation and restoration within the State of California under the LCR MSCP.

4. Monitoring, research, and adaptive management plans for the replacement habitat created or restored under the LCR MSCP within the State of California are to be submitted to the CDFW for approval.

5. Locations of all habitats replaced or restored in the State of California under the LCR MSCP must be approved by the CDFW.

6. A minimum of 2,614 acres of the LCR MSCP riparian replacement habitat is to be located in the State of California, including 1,566 acres of cottonwood-willow and 1,048 acres of honey mesquite.

7. A minimum of 240 acres of LCR MSCP marsh habitat is to be created or restored within the State of California, including 170 acres for Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) and 70 acres for California black rail (*Laterallus jamaicensis coturniculus*). The acreage shall also support at least 58 acres of Colorado River cotton rat (*Sigmodon arizonae plenus*) habitat.

8. A minimum of 194 acres of LCR MSCP backwater habitat is to be created or restored within the State of California.

9. Habitat created within the State of California will be protected in perpetuity.

10. An endowment fee of $295 per acre (in 2005 dollars) will be provided to the CDFW for each acre of habitat that is transferred to them in Fee Title at the time of transfer.

11. A total of 270,000 razorback suckers and 200,000 bonytail of at least 12 inches in length will be stocked into Reaches 4 and 5.

Through FY16, 86,593 razorback suckers and 25,773 bonytail (305 millimeters or greater in total length [TL]) have been stocked into Reaches 4 and 5 (see tables 1-9b–c.). Since the start of the LCR MSCP, 112,366 native fishes have been stocked into Reaches 4 and 5 of the LCR in California.

Through FY16, 1,023 acres of cottonwood-willow and honey mesquite land cover types met all requirements for riparian replacement habitat under the CESA permit.

OVERVIEW OF WORK TASKS

Fish Augmentation, Monitoring, and Research

Monitoring and Research of Terrestrial, Riparian, and Marsh Habitats and Associated Covered Species

Conservation Area Development, Maintenance, and Adaptive Management

FISH AUGMENTATION, MONITORING, AND RESEARCH

As described in the HCP, 17 conservation measures for 4 native fish species will be implemented under the LCR MSCP: 8 conservation measures for the razorback sucker, 5 for the bonytail, 3 for the flannelmouth sucker (*Catostomus latipinnis*), and 1 for the humpback chub (*Gila cypha*). These conservation measures are addressed through the numerous work plans presented in this report. A brief summary of the work completed, ongoing activities, and proposed future work is provided below.

The work accomplished in support of native fishes is divided into six sections: Fish Augmentation (Section B), Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E) (covered in the "Conservation Area Development, Maintenance, and Adaptive Management" overview), Post-Development Monitoring (Section F), and Adaptive Management Program (Section G). Each of these sections has an important relationship to the other sections. In general, fish augmentation and species habitat goals tend to drive the efforts described in other sections. Under Section C, information on how to more efficiently augment native fish populations (Section B) and how to build effective habitats for native fishes (Section E) is provided. Under Section F, feedback on the relative success of these created habitats is provided and may also provide data to make adaptive management recommendations (Section G). Section D may also identify areas in which additional research is needed (Section C). The general progression of these work tasks is as follows: Valuable information gained from research (Section C) becomes incorporated into a regular process or protocol in augmentation activities (fish handling protocol, stocking technique, etc.), habitat creation (appropriate water depth, substrates, etc.), or management regimes (maintaining particular levels of water quality, water levels, etc.) through the adaptive management process (Section G). When research-based monitoring, which has been conducted during the development of a conservation area (under Section C), evolves into a standardized set of protocols and the development phase of that conservation area is complete, this monitoring may continue as part of Section F. Similarly, a monitoring regime that is implemented within the system as part of research investigations may eventually become covered under Section D. The level of frequency and intensity of this additional monitoring may be reduced as appropriate to meet the goals of the Sections D and F work tasks. A number of these specific work task progressions are detailed in the sections below.

Fish Augmentation (Section B)

The goal of the LCR MSCP Fish Augmentation Program is to provide the effort to stock 660,000 subadult razorback suckers and 620,000 subadult

bonytail for reintroduction into the Colorado River over a 50-year period. Between 2005 and the end of FY16, 242,362 native fishes have been stocked toward completing this goal. This includes 165,711 razorback suckers that have been stocked into Reaches 3–5 (RASU3) and 76,651 bonytail that have been stocked into Reaches 2–5 (BONY3). In addition, 121,002 razorback suckers have been stocked into Reach 2 during this period in support of maintaining a genetic refuge in Lake Mohave (RASU5) (see tables 1-9a–c). This rate of stocking is expected to meet augmentation program goals.

To obtain sufficient numbers of young fishes for grow-out and eventual stocking, an adult broodstock for each species must be maintained by the LCR MSCP. The adult razorback sucker population in Lake Mohave is the most genetically diverse among razorback sucker populations and is the primary broodstock for this species. Under the LCR MSCP, offspring are captured from this stock directly from the lake and are reared at the Willow Beach National Fish Hatchery (Willow Beach NFH) in Arizona. The fish are then stocked into the LCR. A second broodstock of razorback suckers, developed by the USFWS from Lake Mohave offspring, is maintained at the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (formerly the Dexter National Fish Hatchery & Technology Center) (Center). Additional fish rearing capacity is located at the Achii Hanyo Native Fish Rearing Facility (Arizona), Lake Mead Fish Hatchery (Nevada), Overton Wildlife Management Area (Nevada), and the Bubbling Ponds Fish Hatchery (Arizona). In 2007, the exotic quagga mussel (*Dreissena bugensis*) was found in Lake Mead. To ensure that quagga mussels do not gain access to the Bubbling Ponds Fish Hatchery, razorback sucker larvae are being provided to the hatchery from the Center's broodstock.

The Center maintains the only bonytail broodstock in the world (the parents of these fish also came from Lake Mohave). A genetic management plan for this stock has been developed by the USFWS and is in effect. LCR MSCP funding is provided to the Center to (1) support the maintenance of this broodstock, (2) hatch out bonytail, and (3) deliver the young to grow-out facilities. A second bonytail broodstock has been developed by the USFWS and is intended to be moved in FY16 to the Mora National Fish Hatchery in Mora, New Mexico. The second broodstock is intended to be used as a refuge population (not for additional bonytail production) at this time. Its purpose is to provide a backup to guard against any potential catastrophic event (disease, etc.) that may limit production or loss of the genetic stock of the bonytail broodstock maintained at the Center.

FY16 Accomplishments

Fish production levels were similar to those in FY15. Production goals are still on track to be ramped up in FY19–30. Bonytail stocking numbers were lower than expected for FY16 primarily due to weather-related factors that resulted in slower growth rates of bonytail at the Center. Bonytail stocking rates are expected to meet goals for each reach of the Colorado River in subsequent years.

Production in FY16–18 will continue to focus on providing fish for meeting augmentation goals. Stocked native fishes have been found to persist in some reaches of the LCR, but because research and monitoring information has indicated that post-stocking survival is still low, augmentation research needs to focus on improving post-stocking survival. Therefore, long-term research that targets improvements in augmentation effectiveness has continued in FY16. This research has continued in order to focus on two areas of the augmentation program: (1) stocking/handling techniques and (2) stocking more "fit" fishes. Investigations of stocking/handling techniques involve comparing the survival of fishes stocked during the day versus at night, at different locations, during different seasons, different batch sizes, and at larger stocking sizes. Studies being conducted to improve fish fitness as a way to improve post-stocking survival include flow conditioning fish to improve physical attributes and training fish to recognize and avoid predators. Because of low initial recontact rates of stocked fishes, these treatments will need to be tracked for several years before data can be used to detect trends. Some of these specific augmentation research efforts and accomplishments are detailed in "Species Research (Section C)" below.

Funds were obligated in FY16 to assist with major infrastructure repairs at the Bubbling Ponds Fish Hatchery. The pipeline that conveys water from the Bubbling Ponds spring source to the hatchery is in critical disrepair. If the line fails, there would be no water available for the hatchery ponds where razorback sucker are reared for the LCR MSCP.

The Overton Wildlife Management Area work task (B11) (closed) was merged with Work Task B6 (Lake Mead Fish Hatchery) in FY16. Any future activities or costs associated with the use of the Overton Wildlife Management Area for rearing fish for the LCR MSCP will be documented under Work Task B6.

Fish augmentation work tasks were presented in "Fish Augmentation (Section B)." Key accomplishments for FY16 include:

- Successful capture of 18,050 wild razorback sucker larvae from Lake Mohave (B1).

- Tagging and stocking of 7,898 razorback suckers from the Willow Beach NFH (B2). This number includes fish stocked into Reach 2 lakeside rearing ponds.

- Tagging and stocking of 2,511 razorback suckers and 825 bonytail from the Achii Hanyo Native Fish Rearing Facility (B3). These numbers represent fishes that were stocked in December 2015 (FY16).

- Tagging and stocking of 1,986 bonytail from the Center and maintenance of the bonytail broodstock that is held at this facility (B4).

- Transfer of 1,267 bonytail to the Mora National Fish Hatchery (B12) to serve as an alternate bonytail broodstock (refuge population).

- Transfer of 65,000 larval razorback suckers to the Bubbling Ponds Fish Hatchery from the Center (B4).

- Tagging and stocking 7,487 razorback suckers from the Bubbling Ponds Fish Hatchery (B5).

- The Lake Mead Fish Hatchery (B6) received 121 razorback suckers from Lake Mead and 3,400 larvae and 3,000 fingerling razorback suckers from Lake Mohave. The Lake Mead Fish Hatchery also received approximately 5,000 fingerling bonytail from the Center during FY16.

- Stocking 351 razorback suckers into lakeside rearing ponds (B7).

FY17 Activities

Fish augmentation actions currently underway in FY17 are similar to those conducted in FY16. Some notable exceptions are include below.

An outbreak of Ich (*Ichthyophthirius multifiliis*) occurred in October 2016 (FY17) at the Willow Beach NFH. Ich is a protozoan ectoparasite that feeds on the skin and gill tissues of fishes, causing irritation and damage, and it can commonly lead to death. The hatchery began immediate treatments to combat the disease, but it spread rapidly, resulting in high mortality of almost all the year-classes of razorback suckers on station. Approximately 32,000 razorback suckers died, leaving approximately 13,500 razorback suckers on station.

The loss of this number of fish will have immediate effects on FY17 fish augmentation numbers for razorback suckers and will likely have impacts on the fish program for several years into the future. Immediate effects in FY17 will be to stocking numbers for Lake Mohave (B2) and the Lake Mohave lakeside rearing ponds (B7). Razorback suckers reared at the Willow Beach NFH are primarily directed to Lake Mohave to augment the genetic diversity of the razorback sucker broodstock; fish are stocked into Lake Mohave to supplement the adult population in the lake as well as into the lakeside rearing ponds along Lake Mohave to produce larger adult fish for eventual stocking into Lake Mohave.

The LCR MSCP will redirect stocking to balance the stocking goals across the LCR to ensure that augmentation goals for all reaches can still be met. Lake Mohave will receive razorback suckers in FY17 from other sources, although this number will still be far less than was expected for Lake Mohave in FY17. Some fish that were originally planned for other reaches (particularly targeting larger fish) will be redirected to Lake Mohave. These fish will still be

Lake Mohave origin razorback suckers and will include those reared at the Lake Mead Fish Hatchery (B6) and at Achii Hanyo Native Fish Rearing Facility (B3). To allow for these razorback suckers to be stocked into Lake Mohave, experimental stocking regimes in Reaches 4 and 5 will be suspended for FY17. The additional fish will be redirected to Reach 3 to make up for the Lake Mead Fish Hatchery and Achii Hanyo Native Fish Rearing Station fish that have been redirected to support stocking into Lake Mohave. Overall, stocking in the LCR in FY17 is still expected to come close to reaching the population augmentation goals for razorback suckers in all reaches. There will likely still be some impacts to individual research projects, especially those in which razorback sucker research was expected for fish stocked into Lake Mohave (portions of Work Task C61) in FY17. Research in future years may also be affected.

Measures are underway to rebuild the stocks of razorback suckers at the Willow Beach NFH and to supplement additional hatcheries to provide additional razorback sucker production in future years. To accomplish this, additional razorback sucker larvae will be collected in FY17. The Lake Mead Fish Hatchery will dedicate additional rearing space for razorback suckers to provide additional fish for meeting the augmentation goals of future years. The Achii Hanyo Native Fish Rearing Facility will rear additional razorback suckers to meet program goals.

Additional rearing space is necessary to meet increased program stocking requirements (experimental stocking in Reaches 3, 4, and 5) and to have additional resiliency in the fish augmentation program for contingencies such as major disease outbreaks. Some grow-out capabilities are expected at Planet Ranch; however, that conservation area will not be able to support any immediate needs or cover these major unexpected events. Other options are currently being investigated to help provide this increased capacity.

The LCR MSCP is working with the Willow Beach NFH to identify any potential remedies, improvements, or techniques that could reduce the probability of future disease outbreaks and/or severity of impacts. There will always be disease potential, so there is no guarantee that additional efforts will be 100% effective.

- The Willow Beach NFH WB is reviewing all hatchery protocols and standard operating procedures. Any updates, clarifications, or revisions will be made after that assessment has been completed.

- The Willow Beach NFH has identified additional potential vectors for contamination.

- The Willow Beach NFH has begun to implement some precautionary additional measures to reduce vectors for contamination where applicable.

- The LCR MSCP is coordinating a meeting with hatcheries that produce native fishes for the program. The intent of this meeting is for fish culturists to share knowledge and techniques as well as identify and develop some additional measures that may be implemented to reduce the likelihood and severity of disease outbreaks. Any technologies or solutions proposed at the meeting will be further researched for appropriateness/applicability for the site and situation, and potential effectiveness and cost benefits will be assessed.

- The LCR MSCP may support implementing improvements or remedies at the Willow Beach NFH.

The Willow Beach NFH will work toward meeting the current rearing strategy of 8,000 razorback suckers with an average length of > 400 millimeters TL available per year. Based on the fish remaining on station, approximately 2,000 may be available for repatriation into Lake Mohave in FY18.

Production numbers at the Center in FY16 are expected to be approximately 10,000 bonytail. The facility will continue to supply bonytail fingerlings to the Lake Mead Fish Hatchery and the Achii Hanyo Native Fish Rearing Facility and fingerling razorback suckers to the Bubbling Ponds Fish Hatchery.

The Lake Mead Fish Hatchery is expected to produce approximately 2,000 razorback suckers toward annual augmentation goals. It will continue to expand razorback sucker production, for a goal of 6,000 per year expected in FY18–19, and it will also expand bonytail production, with a target number of 4,000 in FY18–19. This will likely require a number of infrastructure upgrades to the hatchery and a corresponding increase in budget expenditures (B6) in FY17 and out-years.

A number of bonytail donated from the Wahweap State Fish Hatchery in FY14 are expected to reach stocking size by FY17; the number of fish and stocking location is yet to be determined. Experimental stocking may commence in FY17–18 if there is a sufficient number (8,000) of stockable-sized bonytail. Some of these fish may also be used in experiments such as those for conditioning or habitat selection. Some of these fish may also be used in pilot stocking (research under Work Task C64) of bonytail, which commenced in Reach 2 in FY16.

Research (Section C) continues to focus on improving post-stocking survival of razorback suckers and bonytail. To ascertain if fish conditioning translates to improved survival, implementing experimental stocking treatments using the conditioned fishes will continue. If these treatments show improvements to the post-stocking survival of stocked native fishes and are cost effective, they may be implemented as regular stocking practices.

Proposed FY18 Activities

Routine fish augmentation plans for FY18 will repeat the activities conducted in previous years of the program and are described in Work Tasks B1–B8 and B12. Fish rearing facility infrastructure repairs, improvements, and expansion may be necessary to secure current production and to meet increases in augmentation goals for FY19. Potential locations will be evaluated based on feasibility and cost effectiveness.

Experimental stocking of both razorback suckers and bonytail in Reaches 4 and 5 may commence in FY18. This action will require an additional 6,000 razorback suckers and 4,000 bonytail per year to be stocked into these reaches for a period of 10 years.

Species Research (Section C)

Research is being conducted on covered fish species and their habitats to (1) inform selection and application of conservation techniques, (2) document successful implementation of conservation measures, and (3) develop alternatives to conservation actions that prove ineffective through the Adaptive Management Program (AMP), which will allow researchers to quantify existing knowledge, identify data gaps, and design and implement species research to fill these data gaps. Conceptual ecological models (CEMs) have been developed for razorback suckers, bonytail, and flannelmouth suckers (under Work Task G4) and will assist in further identifying these data gaps and help to prioritize and redefine research topics.

FY16 Accomplishments

Fish research work tasks presented in this section detail the accomplishments for FY16. Much of the research performed under Section C represents long-term research studies. In many cases, research under Section C has been ongoing; several years of recontact data may be necessary to adequately detect trends. Some of the more significant findings from FY16 were:

Fish Augmentation and Distribution Research

- Ongoing work in Reach 2 conducted under Work Task C64 indicated that sonic-tagged razorback suckers routinely move between lake zones, often traveling more than 30 miles within relatively short periods of time (5 days – 2 months). Active contacts provided information regarding seasonal habitat use, with fish using deeper, mid-channel habitat in late spring and summer and shallow inshore habitat in late fall. In the same study using sonic-tagged bonytail, the results were somewhat different. Tracking of these fish was more difficult despite similar efforts, and initial contact rates were low. Both active and passive contacts suggested that

post-stocking survival of bonytail was lower than the sonic-tagged razorback suckers and that movements of bonytail from the initial stocking location were much more restricted than those of razorback suckers.

- Ongoing research in FY16 from Work Task C63 continues to suggest that bonytail will select cavities as concealment. Observations from cavity trials conducted at the Lake Mead Fish Hatchery indicated that bonytail at first avoided artificial cavity boxes place into raceways. After an acclimation period of approximately 30 days, nearly all the bonytail in the raceway selected the cavity box with the smallest orifice and remained within this box except during feeding.

- Scanning of known bird roosts immediately following stocking events under Work Task C65 continued in FY16. Continuous avian scanning for 10 days following a December 2015 release of bonytail resulted in the detection of 24 tags, which was 2.53% of the stocked fish. Scanning following the May release of bonytail detected seven tags (1%) consumed by avian predators. Scanning in combination with game cameras from September through May confirmed predation by three species (osprey (*Pandion haliaetus*), cormorant (*Phalacrocorax auritus*), and great blue heron (*Ardea herodias*). This study confirms that bird predation on stocked fishes is occurring. Although the percentage of confirmed initial post-stocking predation appears low, sampling efforts are likely underrepresenting bird predation mortality. The bird roost scanners are limited in number and can only detect tags in birds who recently consumed fishes and who landed on the roost scanners during that period. Evidence of bird predation on fishes from previously releases (roost-scanned passive integrated transponder [PIT] tags) suggests that bird predation may be continuous on stocked fishes. Additional longer-term scanning efforts will be necessary to suggest if continuous bird predation is occurring. These data will also help inform a bioenergetics model (also being developed under Work Task C65) that will provide a more quantitative assessment of the potential magnitude and variability of bird predation on stocked fishes.

General Species Research

- Research conducted under Work Task C32 during FY16 focused on evaluating threshold dissolved oxygen (DO) concentrations for fingerling razorback sucker survival. Fingerling razorback suckers were exposed to DO concentrations of 2 to 7.5 milligrams per liter (mg/L) in three replicate treatments at 25 and 30 degrees Celsius. Survival was evaluated at 72 hours and after 20 days of exposure. The results from the 25-degree Celsius trial indicate that the lower DO limit for razorback sucker fingerlings may be below 2 mg/L with short-term exposure times at this temperature. Limited mortality (3%) was observed during the 20-day trial period, with all mortality occurring in the 2-mg/L treatment group.

FY17 Activities

Research in FY17 will continue to focus on post-stocking survival, genetics, and habitat use and needs of native fishes. Much of this work represents ongoing long-term efforts. Because recontact rates for stocked fishes are low, multi-year studies are typically needed to adequately assess stocking treatment effects.

Low numbers (approximately 1,000) of razorback suckers are expected to be stocked into Lake Mohave in FY17 due to a catastrophic outbreak of Ich at the Willow Beach NFH. All razorback suckers being stocked into Lake Mohave in FY17 will be fin clipped prior to release to provide a tissue sample for genetic analyses. This will help inform the feasibility of fin clipping at the time of tagging and its potential value. Any of the razorback suckers stocked into Lake Mohave in FY17 that are contacted in the future with a remote PIT scanner will already have genetic information associated with that fish's repatriation file.

Research work tasks that assess the genetics for razorback suckers and bonytail will continue. Because Lake Mohave is being managed as the broodstock for razorback sucker genetic studies along the LCR, some degree of long-term genetic monitoring will be necessary to appropriately inform conservation efforts for the duration of the program. This is also true for other river reaches, as well as for created backwater habitats, although the intensity of this monitoring effort will likely vary depending on location. Genetic monitoring of backwaters will be necessary to describe the long-term dynamics from a genetics sustainability standpoint and may require directed research to help inform management of native fish populations. As part of an effort to transition these research investigations into regular monitoring, some changes will be implemented regarding how genetic material is gathered to help improve data collection and help suggest long-term genetic monitoring needs. To assist in this effort, an initial independent review of the current genetic monitoring program used by the LCR MSCP was completed in FY16. This review provided a number of more specific questions that will be part of a more in-depth evaluation of genetic requirements for the LCR MSCP that will be carried out under the Adaptive Management Program (Section G) in FY17–18.

Part of the work initiated under Work Task C40 will be moved to the IPCA. Razorback suckers and bonytail of known genetic makeup will be stocked into the Imperial ponds in FY17. In addition, bird predation research will be conducted at the Imperial ponds simultaneously to assess the relative impact of piscivorous birds on native fishes stocked into non-native fish predator-free environments. Data from this research will also be used to refine and further develop a bioenergetics model for bird predation (C65).

Routine fisheries sampling and water quality monitoring will continue at the Imperial ponds (C25) in FY17. The data obtained will be used to support other ongoing research efforts (C40 and C65) at the Imperial ponds. Water quality monitoring data will be used to monitor the effectiveness of the water delivery schedule (implemented in FY16) for maintaining water quality parameters for native fishes. Work Task C25 will close at the end of FY17, and these regular monitoring efforts will be covered under Work Task F5 in future years.

Alternate stocking treatments will also continue to be evaluated in FY17, as will flow-conditioning research and predator avoidance trials (C61). Assessments of riverine habitat use (C64) by razorback suckers and bonytail and habitat features important in backwater creation (C63) are ongoing. Field investigations of immediate post-stocking mortality (C65) will also continue in FY17.

Previous research findings that have identified ways of improving fish propagation and culturing will be incorporated into regular practices whenever possible and practical. No new Species Research (Section C) work tasks are beginning in FY17.

Proposed FY18 Activities

The efforts in FY18 will continue to focus on three major research goals: (1) identifying areas where native fishes show persistence and capitalizing on these areas for future stocking and research efforts, (2) providing information to improve post-stocking survival, and (3) identifying important habitat and life history needs to help inform backwater creation. Research to be conducted under Work task C64 will help identify areas of persistence and will provide a means to monitor post-stocking treatments (C61) for their effect on survival. Investigations will continue under Work Task C63 in order to identify habitat features important to native fishes. Research of life history requirements will continue in FY17 under Work Task C32 and will again focus on identifying water quality thresholds for native fishes. Genetic research will continue in FY18 in order to provide guidance for long-term management of both the Lake Mohave genetic broodstock and created backwater populations.

A number of Section C work tasks will close at the end of FY18. It is expected that some of the research under these work task will be completed and that questions have been answered adequately enough to inform management decisions. Study results will either warrant the implementation of new practices or will indicate that further investment in the research or implementation of new practices would not be worthwhile. In some cases, a portion of the sampling conducted under a research work task will be continued as a monitoring effort under Section D or Section F. Long-term study results may also be covered under a different Section C work task. The following work tasks are expected to be closed in FY18:

- *Work Tasks C31 (Razorback Sucker Genetic Diversity Assessment) and C40 (Genetic and Demographic Studies to Inform Conversation Management of Razorback Suckers and Bonytail in Off-Channel Habitats*): Genetics research conducted under these work tasks will provide the necessary information to build and inform a genetics monitoring program that is implemented at the appropriate level for the LCR MSCP. Future genetics monitoring efforts for the LCR and LCR MSCP created backwater habitats will be carried out under system monitoring (Section D) after FY18.

- *Work Task C32 – Determination of Salinity, Temperature, pH, and Oxygen Limits for Bonytail and Razorback Suck*ers: Research conducted on water quality thresholds for native fishes has provided guidance for water quality management of LCR MSCP created backwaters. This work task will be closed on FY18. If additional water quality research needs are identified in the future, the work task will be reopened.

- *Work Task C61 –Evaluation of Alternative Stocking Methods for Fish Augmentation*: Research on stocking and conditioning treatments for natives fishes will be completed in FY18. Development and initial assessment will have been completed to the point in which their expected effectiveness will inform implementation each of these treatments. Long-term assessment of these treatments in terms of differences in post-stocking survival in the LCR will be recorded through subsequent years' recapture data provided by Work Tasks C64 and D8.

- *Work Task C63 – Evaluation of Habitat Features that May Influence Success of Razorback Suckers and Bonytail in Backwater Environments*: Refinements in configurations and initial testing/deployment of artificial habitats will be completed in FY18. Differences in long-term post-stocking survival will be assessed under Work Task F5 for artificial habitats deployed at created backwaters and under Work Task C64 for artificial habitats deployed at other stocking location within the LCR.

- *Work Task C65 – Evaluation of Immediate Post-Stocking Survival of Razorback Suckers and Bonytail*: Assessments of immediate post-stocking mortality will be completed in FY18. Handling stress impacts on stocking mortality will be evaluated to establish when the additional measures will need to be employed during handling and transport of stocked native fishes. Bird predation research, including the development of a bioenergetics model, will be completed in FY18. Data from this research will provide the relative magnitude of impact that piscivorous birds are having on stocked native fishes and may suggest alternate strategies (stocking in seasons with lower bird abundance) to minimize these impacts. Any changes in these protocols or practices will be assessed and implemented through the adaptive management process (Section G). Long-term assessments of

the effectiveness of these changes will be recorded through subsequent years' recapture data provided under Work Tasks C64 and D8.

System Monitoring (Section D)

System-wide monitoring is conducted on existing populations of covered fish species to determine their population status, distribution, density, migration, productivity, and other ecologically important parameters. System-wide monitoring for razorback suckers and bonytail is covered under Work Task D8. Monitoring data for flannelmouth suckers were included in the research actions covered under Work Task C15 (closed). Additional flannelmouth sucker monitoring data will continue to be collected to support Conservation Measure FLSU3 and will be accomplished simultaneously through monitoring efforts under Work Tasks C64, D8, and F5.

FY16 Accomplishments

Multi-agency, lake-wide fish surveys were conducted on Lakes Mead, Mohave, and Havasu and on the river reaches between these reservoirs. Surveys were completed using nets and electrofishing boats.

Research studies conducted in each reach contributed additional fishery status information.

Population estimates for razorback suckers reported in FY16 are provided in table 1-11. These population estimates are currently calculated differently for each reach based on their particular situation. Reach 1 (Lake Mead) population estimates are calculated based on a mark-recapture estimator using multi-year netting captures only. The remaining reaches (Reaches 2–5) use PIT scanning to provide the population estimates reported in table 1-11. In all reaches, the population estimates use a mark-recapture estimator, which requires that a set of fish be marked and recaptured during a designated period. The actual population estimate is for the time period preceding the reporting date (FY16) and is based on the mark-recapture period (table 1-11).

Table 1-11.—Population estimate for razorback suckers by LCR MSCP river reach in FY16

Reach	Mark-Recapture Period	Razorback Sucker Population Estimate
Reach 1 (Lake Mead)	07/01/2014 to 06/30/2016	418
Reach 2 (Lake Mohave)	03/01/2015 to 08/31/2016	3,656
Reach 3	11/01/2015 to 08/31/2016	4,923
Reaches 4 and 5	N/A*	N/A*

* Insufficient numbers of captures were available to provide a population estimate for this reach.

Monitoring of the Lake Mead adult razorback sucker population continued in FY16. Trammel netting conducted during the spawning season resulted in the capture of 74 razorback suckers: 4 from Las Vegas Bay, 35 from Echo Bay, 28 from the Muddy River/Virgin River inflow, and 7 from the Colorado River inflow area. Of the 74 razorback suckers captured, 39 were recaptured fish. The remaining razorback suckers captured were untagged and presumed to be wild-spawned fish. The increase in captures in FY16 to generate a population estimate was due in part to additional sampling efforts conducted by the LCR MSCP. The ages of wild razorback suckers captured from long-term monitoring areas in FY16 ranged from 5 to 14 years old. The razorback sucker population in Lake Mead was estimated at 418 individuals (95% confidence interval from 327 to 559) for the 2014–16 data collection period (see table 1-11). Larvae and juvenile fish were observed along with active spawning in four separate areas in the lake. No bonytail were contacted in FY16, and they are considered absent from Reach 1.

A total of 7,898 razorback suckers were successfully repatriated into Lake Mohave in FY16. A total of 913 bonytail were also released into Lake Mohave, 39 of which were sonic tagged as part of ongoing research being carried out under Work Task C64.

Annual razorback sucker roundups were conducted in December and March. During these efforts, 118 razorback suckers were captured using trammel nets. Additionally, electrofishing was conducted in the river section of Lake Mohave above the Willow Beach National Fish Hatchery, with 11 razorback suckers captured. The use of remote sensing was also continued. In FY16, 230,658 remote-sensing PIT tag contacts were recorded in the main sampling areas. After duplicate PIT tags contacted were removed from analyses, 3,244 unique PIT tags were contacted in 36,944 hours of scan time during FY16.

Based on 2015–16 remote PIT scanning data, the Lake Mohave repatriate population was estimated at 3,656 individuals (95% confidence interval from 3,418 to 3,912). The population estimate is slightly higher than the FY15 estimated population of 3,505 repatriated razorback suckers (2014–15 remote PIT scanning data).

All survey methods conducted in Reach 3 in FY16 resulted in 3,027 unique razorback suckers, 292 bonytail, and 62 flannelmouth sucker contacts (16 scans and 46 captures). Reach 3 had a razorback sucker population estimate of 4,923, which was a slight increase in the estimate of 4,795. Bonytail contacts using PIT scanning are still rare in this reach and typically only occur for the first several months post-release.

A total of 6,005 razorback suckers and 1,289 bonytail were stocked into Reaches 4 and 5 during FY16; all fish were released with a PIT tag. In Reach 4, monthly PIT tag scanning surveys were initiated in October 2015. Remote PIT scanners scanned for a collective 9,675.3 hours and resulted in nearly 350 unique razorback sucker contacts and 40 unique bonytail contacts. Overall recontacts of stocked fishes are low in these reaches, and population estimates were not calculated due to the low number of contacts. Additional investigation of post-stocking distribution and survival in these reaches is being conducted under Work Task C64.

A study comparing the traditional use of trammel netting versus using remotely deployed PIT scanners during the March razorback roundup continued. No inference should be drawn until this longer-term comparison is complete, but preliminary data continue to show that remote PIT scanners can provide greater numbers of overall contacts and commonly greater numbers of unique contacts per unit of effort.

FY17 Activities

Monitoring data will be collected for Reaches 1–5. Information will be gleaned from ongoing fish research activities as well as through fish monitoring field work. Field work will include collecting larvae, trammel netting, electrofishing, remote sensing of PIT-tagged fish, and active and passive tracking of sonic-tagged fish. Monitoring will be conducted in Reaches 4 and 5, with an emphasis on remote sensing in available backwater locations, particularly in areas where previous contacts of native fishes were made.

Proposed FY18 Activities

Monitoring will continue in all reaches as previously outlined, and participation in multi-agency field surveys will proceed. Monitoring efforts will continue to rely on and expand the use of remote PIT scanning technology, as this technology has proven effective in increasing both contact probabilities and precision in population estimates. The use of both sonic and radio telemetry tags is expected to be expanded in Reaches 4 and 5 to help identify additional locations where native fishes might persist in these reaches.

Post-Development Monitoring (Section F)

Post-development monitoring will be conducted at each conservation area following completion of habitat creation activities in order to evaluate both the maturation of the site as it develops into covered species habitat and the use of the habitat by the covered species. Under Work Task F5, funding is provided to support post-development monitoring of the Beal Lake Conservation Area

(BLCA) and the Big Bend Conservation Area (BBCA). Monitoring of the Imperial ponds is being covered under Work Task C25, as operational procedures for the ponds are still under development.

FY16 Accomplishments

The water quality of Beal Lake was monitored throughout the backwater using permanently deployed multi-parameter instruments in FY16. Low levels of DO and high temperatures were observed locally but not lake-wide. Conductivity has decreased to nearly 2,200 microsiemens per centimeter, and the water surface elevation increased by approximately 1 foot following wedge-wire screen maintenance. Zooplankton and phytoplankton results continue to show relatively low levels of plankton biomass. No golden algae have been detected in Beal Lake since May 2013. No fish activities were conducted at Beal Lake due to the lack of native fishes in the ponds since 2013.

Routine monitoring at the BBCA continued in FY16; netting resulted in the capture of zero razorback suckers, zero flannelmouth suckers, and one bonytail. Remote PIT scanning resulted in the contact of two razorback suckers, zero flannelmouth suckers, and one bonytail. Both bonytail were from a September 2015 release in Laughlin Lagoon. These are the first bonytail contacted since routine monitoring was initiated in FY13. Larval razorback suckers and flannelmouth suckers were captured at rates lower than FY15, but they were similar to the years prior to FY15. A permanent remote PIT scanner was installed in the summer of FY16 with limited success; improvements to this scanner will be made in FY17. Water quality parameters remained within thresholds for all native fishes.

FY17 Activities

Monitoring activities of Beal Lake will be focused on water quality and plankton, with limited fish monitoring. Golden algae sampling will continue throughout the year. A plan was drafted for future fisheries monitoring projects at Beal Lake. Due to the redistribution of stocked razorback suckers as a result of the Ich outbreak at the Willow Beach NFH, these projects may be delayed until adequate numbers of fishes are available for stocking in the lake.

The BBCA will be monitored at a level similar to that in FY16. Semipermanent remote PIT scanners will be deployed in an effort to increase scanning contacts for all species.

Proposed FY18 Activities

Fisheries monitoring efforts at conservation areas are expected to be similar to that in FY17. Future plans for Beal Lake depend on the ability to address and manage water quality issues, particularly golden algae.

BBCA activities will be similar to those of the previous year and will include trammel netting, remote PIT scanning, larval surveys, and water quality monitoring.

Adaptive Management Program (Section G)

Under the Adaptive Management Program, uncertainties encountered during implementation of the conservation measures outlined in the HCP will be addressed. The program has three central components: (1) gauging the effectiveness of existing conservation measures, (2) proposing alternative or modified conservation measures as needed, and (3) addressing changed and unforeseen circumstances.

The *Final Science Strategy* details the AMP process for the research and monitoring programs at the project and programmatic levels. A 5-year planning cycle has been identified to allow for the receipt of new information, the analysis of that information, and the incorporation of the new information into the design or direction of future work tasks. The 5-year planning cycle will allow for a review of past activities and the setting of priorities for the next 5-year cycle. The *Final Five-Year Monitoring and Research Priorities for the Lower Colorado River Multi-Species Conservation Program: 2013–2017* report was completed in FY12.

Implementation of the AMP to address uncertainties, evaluate the effectiveness of research and monitoring activities, and improve management is allocated under Work Task G4. Data management (G1) is an integral component of any conservation program, including the LCR MSCP. Funds are allocated for designing a data management system capable of tracking all information needed in the decisionmaking process. Funding allocated under Work Task G3 to begin research studies identified as priorities, when applicable, will continue.

The current needs under the AMP involve data collection and organization so that the information can be readily accessed and used to inform management decisions. Native fish stocking and tagging data developed by the LCR MSCP are maintained in an electronic database. Another need is a toolbox of evaluation techniques that can gauge the effectiveness of conservation measures as they are completed. Work Task G3 will allow for the development of these tools. Funds allocated from this work task are used to initiate reconnaissance-level investigations. If more research is needed, the work is written up as a separate research study and submitted for funding under “Species Research (Section C)” above.

Fishery program activities under the LCR MSCP are coordinated with other recovery actions (Upper Colorado River Endangered Fish Recovery Program, San Juan River Basin Recovery Implementation Program, and Glen Canyon Dam

Adaptive Management Program) through annual participation in meetings and presentations to research and management groups. These groups include local chapters of the American Fisheries Society, the Colorado River Aquatic Biologists, the Lake Mead Work Group, the Lake Mohave Native Fish Work Group, and the Lower Colorado River Native Fish Work Group.

Fisheries research investigations that are initiated through Work Task G3 can include periphery research that may be discreet and answer a simple question with no future commitments, be an additional part of a larger research effort captured under an existing work task, or lay the foundation for research to be conducted in a new work task.

FY16 Accomplishments

Funds were contributed from Work Task G3 in FY16 for a cooperative adaptive management effort with the Upper Colorado River Basin recovery programs (Upper Colorado River Endangered Fish Recovery Program, San Juan River Basin Recovery Implementation Program, and Glen Canyon Dam Adaptive Management Program) to develop a species status assessment (SSA) for razorback suckers. The purpose of the SSA is to characterize the species' current status, future condition, and long-term viability to the extent possible using existing data, expert, and currently available information under various scenarios and timeframes. The SSA will provide key information that can be used to help generate a 5-year status review (or other documents) by the USFWS for assessing the species' status with respect to the ESA.

Part of an independent review of the LCR MSCP genetics program indicated that the genetic markers used for assessing razorback sucker genetics since the start of the program were outdated. In response, FY16 funds were obligated from Work Task G3 to fund the first year of this project looking to identify potential markers (single nucleotide polymorphisms [SNPs]) for sex determination and identification of parentage in razorback suckers. This process is expected to yield 600 million sequences and more than 5,000 SNPs. Once sequences have been obtained, analyses will be used to identify (1) SNPs specifically associated with sex determination and (2) SNPs that are of sufficient variability for use in parentage analysis.

FY17 Activities

During this fiscal year, an expanded independent review of specific fisheries genetic research and monitoring activities will be initiated. It is expected to provide specific recommendations regarding the appropriate level of effort and long-term needs for monitoring razorback sucker genetics in Lake Mohave as well as the other LCR reaches and created backwater habitats as required to satisfy LCR MSCP goals.

During FY17, fish research and monitoring projects will continue to be evaluated for changes in the LCR MSCP data management process, which includes development of program-wide standards for data collection, documentation of data collection processes in the field, and automating data collection using mobile devices. Data dictionaries or mobile electronic field forms (MEFFs) continue to be developed for fish projects on a priority basis. Spatial fish detections from system-wide monitoring activities on Lake Mohave continue to be analyzed. Recommendations for inclusion of standardized localities are expected to continue during this fiscal year. Maintenance of the fish augmentation database will continue.

Proposed FY18 Activities

In FY18, technical, independent, and peer reviews of fisheries projects, as part of the adaptive management process, will continue under the AMP (G4). CEMs will be used in the adaptive management process to prioritize future research and monitoring as well as inform management actions. LCR MSCP database structure development and the creation of MEFFs will continue, with other data modules being constructed on a priority basis. Funding is available for emerging research needs under Work Task G3.

MONITORING AND RESEARCH OF TERRESTRIAL, RIPARIAN, AND MARSH HABITATS AND ASSOCIATED COVERED SPECIES

As described in the HCP, conservation measures for 22 covered and 5 evaluation wildlife species that rely on terrestrial, riparian, and marsh habitat will be implemented under the LCR MSCP. These conservation measures are addressed through the numerous work tasks presented in this report. A brief summary of the work completed, ongoing activities, and proposed future work is provided below.

The work accomplished in support of terrestrial wildlife and plants is divided into five sections: Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E) (covered in the "Conservation Area Development, Maintenance, and Adaptive Management" overview), Post-Development Monitoring (Section F), and Adaptive Management Program (Section G). Each of these sections has an important relationship to the other sections.

A habitat-based approach for the conservation of covered species is used under the LCR MSCP. It involves the maintenance of existing habitat and the development and management of habitats that are created under the program (Section E), which requires knowledge of the key environmental characteristics (vegetation and abiotic) important for each species. Species' populations are also monitored to determine if and to what extent they are using the habitat (Section F) and includes monitoring to evaluate the ongoing status of covered species and their habitats in the LCR MSCP planning area (Section D).

For some species, fundamental information is lacking, and research projects (Section C) are implemented to fill those gaps. This research includes developing effective methods to detect species and monitor populations as well as identifying important characteristics of their habitat. For other species, research focuses on the types and frequency of management activities required to maintain functional habitats over the 50-year term of the LCR MSCP (Sections C and G).

Species Research (Section C)

Research is being conducted on covered wildlife species and their habitats to (1) inform the selection and application of conservation techniques, (2) document successful implementation of conservation measures, and (3) develop alternatives to conservation actions that prove ineffective. This strategy will allow for

quantification of existing knowledge and the identification of data gaps. Species research projects will be designed to fill data gaps that will inform implementation of the conservation measures.

The LCR MSCP conservation measures direct that habitat characteristics should be characterized for 21 species either under Conservation Measure MRM1, species-specific conservation measures requiring distribution and/or habitat surveys (CRCR1, YHCR1, MNSW1, CRTO1, and LLFR1), or species-specific conservation measures requiring the creation and management of covered species habitat. These species include:

- Arizona Bell's vireo (*Vireo bellii arizonae*)
- California black rail (*Laterallus jamaicensis coturniculus*)
- California leaf-nosed bat (*Macrotus californicus*)
- Colorado River cotton rat (*Sigmodon arizonae plenus*)
- Colorado River toad (*Bufo alvarius = Incilius alvarius*)
- Elf owl (*Micrathene whitneyi*)
- Gila woodpecker (*Melanerpes uropygialis*)
- Gilded flicker (*Colaptes chrysoides*)
- Lowland leopard frog (*Rana yavapaiensis = Lithobates yavapaiensis*)
- MacNeill's sootywing skipper (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill])
- Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii*)
- Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*)
- Southwestern willow flycatcher (*Empidonax traillii extimus*)
- Summer tanager (*Piranga rubra*)

- Vermilion flycatcher (*Pyrocephalus rubinus*)
- Western least bittern (*Ixobrychus exilis hesperis*)
- Western red bat (*Lasiurus blossevilli*)
- Western yellow bat (*Lasiurus xanthinus*)
- Yellow-billed cuckoo (*Coccyzus americanus occidentalis*)
- Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*])
- Yuma hispid cotton rat (*Sigmodon hispidus eremicus*)

Species research work tasks focus on key priorities set in the *Five-year Monitoring and Research Priorities for the Lower Colorado River Multi-Species Conservation Program (2013–2017)* report.

FY16 Accomplishments

In 2016, the LCR MSCP implemented 7 research projects focused on 11 terrestrial covered and evaluation species. This research was concentrated on developing effective survey methods, assessing population size and habitat connectivity through genetic analyses, and measuring characteristics of habitats to determine the components that are critical to support these species.

Prior to FY16, methods to detect covered and evaluation species with known levels of accuracy were identified and approved for many LCR MSCP terrestrial species. In FY16, research continued in order to improve detection methods for the elf owl (C24), gilded flicker (*Colaptes chrysoides*) (C52), and the lowland leopard frog (*Rana yavapaiensis* = *Lithobates yavapaiensis*) and Colorado River toad (C62).

- *Work Task C24* – Avian Species Habitat Requirements: Field work continued in order to test the elf owl's responsiveness to call-playback at short distances (50–250 meters [m]) in obstructed habitats, record their use of riparian habitats, and, on a broad scale, document what type of riparian habitat elf owls are using. This study was needed because, under previous surveys for the elf owl along the LCR, only one was detected near Blankenship Bend during a 2-year period.

- *Work Task C52 – Gilded Flicker Riparian Habitat Use and Seasonal Movement Research*: Testing continued in order to capture and track gilded flickers and gather additional information on their breeding chronology. Exploratory surveys were conducted at 20 study areas along the LCR and in Arizona to locate gilded flicker populations in riparian habitat to be studied in FY17. This study was initiated to improve survey detections of gilded flickers, as few have been recorded during LCR MSCP bird surveys, and to learn more about their habitat characteristics.

- *Work Task C62* – Lowland Leopard Frog and Colorado River Toad Habitat and Ecology Study: Field work continued in order to locate occupied breeding habitat of Colorado River toads at study sites within the Bill Williams River watershed, and along the Aqua Fria River and Verde River watersheds, as a sufficient sample size of sites was not available along the Bill Williams River. Monitoring for the Colorado River toad was completed in the fall of FY16, with no additional egg masses found. The methods used for detecting egg masses were effective for lowland leopard frogs and Colorado River toads. Surface water was not always available at the study sites, so breeding was limited.

The genetics study to characterize California leaf-nosed bat populations at roost sites was completed in FY16 (C43). There were 18 haplotypes identified across the range, with 5 haplotypes present in the samples taken from the LCR, and 3 haplotypes unique to the bats captured along the river. Genotypic clustering analyses of 6 microsatellite loci across 87 individuals from 19 localities inferred that there are 2 genetic groups present in the species range, with none being unique to the LCR and surrounding areas.

Habitat characteristics in areas occupied by covered and evaluation species were studied under three work tasks to determine the components that are critical to support breeding populations. Research focused on the Colorado River cotton rat, Yuma hispid cotton rat, and desert pocket mouse (*Chaetodipus penicillatus*) (C27), lowland leopard frog and Colorado River toad (C62), and the California black rail and Yuma clapper rail (C66).

- *Work Task C27 – Small Mammal Population Studies*: The study to identify the distributional range, genetic differentiation, and habitat use of the covered and evaluation small mammal species was completed. The Colorado River cotton rat and Yuma hispid cotton rat mark-recapture/ habitat study was completed. Genetic markers for the Colorado River cotton rat, Yuma hispid cotton rat, and desert pocket mouse were identified and can be used in the future to differentiate the species of animals captured along the LCR. Habitat was characterized, and data suggest that Colorado River and Yuma hispid cotton rats need dense herbaceous vegetation at least 0.5 m in height; it is presumed to provide cover for their activities and to protect them from predators. The project was closed in FY16.

- *Work Task C62* – Lowland Leopard Frog and Colorado River Toad Habitat and Ecology Study: Monitoring for the Colorado River toad was completed in the fall of FY16, with no additional egg masses found. Lowland leopard frog and Colorado River toad breeding habitat was characterized using data from egg masses detected in FY14–15. Habitat data were collected where egg masses were detected, including the location, associated vegetation, water depth, water temperature, egg mass dimensions, pH, air temperature, and distance to cover and land. Sufficient lowland leopard frog egg and breeding habitat data were collected in FY15 for analyses; therefore, egg mass searches were not needed in FY16.

- *Work Task C66 – Marsh Bird Water Depth Analysis*: A study was conducted to analyze existing data to identify the range of water depths in Yuma clapper rail and California black rail breeding sites throughout the breeding season to identify the ranges of daily, monthly, and annual water depth variability that has occurred. In FY16, a literature review was conducted, and Yuma clapper rail data and water gage data in Topock Gorge were analyzed. The tentative results indicate that Yuma clapper rail breeding areas in Topock Gorge have greater than 12 inches of water depth changes throughout the breeding season and that year and month more strongly explain the changes in Yuma clapper rail occupancy than water depth changes.

The MacNeill's sootywing skipper species account was completed in FY16.

LCR MSCP funds were provided to the National Park Service (NPS) at the Lake Mead National Recreation Area to support implementation of conservation measures for sticky buckwheat (*Eriogonum viscidulum*) and threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*) (C2) in accordance with Conservation Measures STBU1 and THMI1. Sticky buckwheat and threecorner milkvetch population monitoring and invasive species control activities were conducted to protect the populations at the Lake Mead National Recreation Area (supported by Work Task C2 funds).

The following research projects were closed in FY16:

1. *Work Task C27 – Small Mammal Population Studies*: The study to identify the distributional range, genetic differentiation, and habitat use of the covered and evaluation small mammal species was completed.

2. *Work Task C43 – Population Demographics and Habitat Use of the California Leaf-Nosed Bat, a Genetic Evaluation*: Data analyses were completed for the genetics of the California leaf-nosed bat.

FY17 Activities

Research will be conducted at locations occupied by LCR MSCP covered and evaluation species to fill gaps in knowledge. Section C work tasks will continue to focus on:

1. Developing effective methods to detect covered and evaluation species with known levels of accuracy. Studies will continue on the elf owl (C24), gilded flicker (C52), and the lowland leopard frog and Colorado River toad (C62).

2. Evaluating habitat use in areas occupied by covered and evaluation species to determine the components that are critical to support breeding populations. Research will focus on the elf owl (C24), Yuma clapper rail and California black rail (C66), and the lowland leopard frog and Colorado River toad (C62).

3. Implementing conservation measures for sticky buckwheat and threecorner milkvetch (C2) in accordance with Conservation Measures STBU1 and THMI1. The LCR MSCP will provide funds to the NPS at the Lake Mead National Recreation Area to support existing conservation activities.

The following projects are scheduled to be completed in FY17:

1. *Work Task C52 – Gilded Flicker Riparian Habitat Use and Seasonal Movement Research:* Testing of survey methods will be conducted at the Quartzsite study area and selected riparian areas. Presence survey protocols and biologist training methods will be finalized, an updated species natural history will be prepared, and reports will be finalized.

2. *Work Task C62* – Lowland Leopard Frog and Colorado River Toad Habitat and Ecology Study: Field testing of the methods used in the study will be completed, and a comparison of the methods will be prepared.

In addition, in FY17, accomplishments will be reviewed to identify if additional research is needed. If additional research needs are identified, new work tasks will be initiated.

Proposed FY18 Activities

Research will be conducted at locations occupied by LCR MSCP covered and evaluation species to fill gaps in knowledge. Section C work tasks will continue to focus on:

1. Developing effective methods to detect covered and evaluation species with known levels of accuracy for the elf owl (C24).

2. Evaluating habitat use in areas occupied by covered and evaluation species to identify habitat characteristics that may be critical to support breeding populations. Research will focus on the elf owl (C24), and the California black rail and Yuma clapper rail (C66).

3. Implementing conservation measures for sticky buckwheat and threecorner milkvetch (C2) in accordance with Conservation Measures STBU1 and THMI1. The LCR MSCP will provide funds to the NPS at the Lake Mead National Recreation Area to support existing conservation activities.

The following projects are scheduled to be completed in FY18:

1. *Work Task C24* – Avian Species Habitat Requirements: The study will test the elf owl's responsiveness to call-playback at short distances (50–250 m) in obstructed habitats, record their use of riparian habitats, and, on a broad scale, document what type of riparian habitat elf owls are using.

2. *Work Task C66 – Marsh Bird Water Depth Analysis:* The study will continue in order to analyze existing data so the range of water depths in Yuma clapper rail and California black rail breeding sites throughout the breeding season can be identified as well as the ranges of daily, monthly, and annual variability that has occurred where California black rails were present during the breeding season.

In addition, in FY18, accomplishments will be reviewed in order to identify additional research needs. If research needs are identified, new work tasks will be initiated.

System Monitoring (Section D)

System-wide monitoring is being conducted to evaluate the ongoing status of covered species and their habitats in the LCR MSCP planning area. Information from these projects provides context to population abundance and incidental observations of covered species on conservation areas.

System-wide monitoring for terrestrial and marsh species was planned to be implemented annually early in program implementation and then with decreasing intensity over the 50-year term of the LCR MSCP as data gaps are filled and as additional conservation areas are developed. In FY14–16, existing literature and program data were reviewed to identify if any efforts could be reduced, as

sufficient knowledge had been gathered, or if the efforts should be focused to inform specific needs. Post-development monitoring has shown that many covered species are using the land covers types on the conservation areas without the need for additional research to inform habitat creation methods. Bat acoustic and capture monitoring (D9) was assessed, and it was found that by limiting data collection to June – August every year, the covered and evaluation bat species could still be detected with acceptable levels of accuracy. This resulted in a 2-month reduction in monitoring. Monitoring of yellow-billed cuckoos (*Coccyzus americanus occidentalis*) (D7) was also assessed. The data show that yellow-billed cuckoos have colonized many LCR MSCP conservation areas and that breeding is occurring and young are fledging and returning the following year. As a result, in FY16, monitoring focused on documenting presence and breeding. This level of analysis will continue in FY17 and FY18. System-wide monitoring objectives will be defined, and system-wide, post-development monitoring and any remaining research efforts will be divided into separate work tasks for FY18.

FY16 Accomplishments

Under the LCR MSCP, system-wide monitoring of marsh birds, southwestern willow flycatchers (*Empidonax traillii extimus*), yellow-billed cuckoos, bats, rodents, lowland leopard frogs, Colorado River toads, avian productivity, and riparian birds along the LCR and adjacent river systems continued.

Marsh bird surveys (D1) were conducted at Topock Gorge and the upper reaches of Lake Havasu during March, April, and May 2016 in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. All three covered species were encountered: 37 Yuma clapper rail detections in March, 70 in April, and 65 in May; 20 western least bittern (*Ixobrychus exilis hesperis*) detections in March, 41 in April, and 73 in May; 1 California black rail detection in March, 0 in April, and 2 in May.

Presence surveys for the southwestern willow flycatcher (D2) were conducted at 92 sites along the LCR and its tributaries in FY16. System-wide surveys were conducted at the Pahranagat National Wildlife Refuge (Pahranagat NWR) Meadow Valley Wash, Muddy River, Topock Marsh, Bill Williams River National Wildlife Refuge (Bill Williams River NWR), and Alamo Lake. Life history studies were conducted at 42 sites and included banding, nest monitoring, habitat threat analyses, and microclimate analyses. A total of 153 resident (observed after migration has ended) or breeding southwestern willow flycatchers were detected, and 97 territories were identified within the following 10 study areas: Key Pittman, Pahranagat NWR, River Ranch, Meadow Valley Wash, Muddy River, Warm Springs, Topock Marsh, Bill Williams River NWR, the Palo Verde Ecological Reserve (PVER), and Alamo Lake. Seventy-one of those territories were confirmed to have breeding southwestern willow flycatchers. In FY16, 30 previously unbanded adults and 55 nestling southwestern willow flycatchers were captured and color banded. Sixteen adults banded in previous years were recaptured, an additional 50 adults banded in previous years were

redetected, and 19 individuals were redetected but did not have their color combinations confirmed. The results of observations of southwestern willow flycatchers at conservation areas conducted under Work Task D2 are discussed under "Post-Development Monitoring (Section F)" below.

System-wide monitoring for the yellow-billed cuckoo (D7) was not conducted in FY16, as nesting continues to occur primarily on LCR MSCP conservation areas. In 2016, three of seven yellow-billed cuckoos captured and fitted with Global Positioning System (GPS) tags in 2015 were recaptured at the PVER; therefore, additional surveys to locate birds with GPS transmitters off the conservation areas was not required. An additional 38 new adults, 4 juveniles, and 26 other previously banded adults were captured during mist netting. Of the three recaptured birds fitted with GPS tags in 2015, two still wore their harnesses with attached GPS tags, and their spatial data were successfully retrieved. These data, combined with data from three other birds tracked over the previous year, support a fall migration route for this population following the west coasts of Mexico and Central America. The new data also lend support for wintering grounds for this population in the Gran Chaco region of northern Argentina and southern Bolivia. Work Task D7 also included post-development monitoring at LCR MSCP conservation areas. Those results are discussed under "Post-Development Monitoring (Section F)" below.

Multi-species survey protocols have been developed to monitor other avian species covered under the LCR MSCP. Under Work Task D5, intensive site-specific data were collected on avian species using a standardized protocol, which enabled a comparison of species occurrence trends along the LCR with those throughout North America. Data collected were reported to the Institute for Bird Populations as part of their national bird monitoring effort. Data were also used on a site-specific level to provide insight on bird use within LCR MSCP conservation areas. Banding was conducted at two conservation areas using the Monitoring Avian Productivity and Survivorship (MAPS) protocol. During the breeding season, there were 202 captures at the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1) and 136 total captures at the BLCA. The covered species detected here are also being documented under post-development riparian bird surveys (F2), southwestern willow flycatcher surveys (D2), and yellow-billed cuckoo surveys (D7).

Under Work Task D6, the 2011–15 population trends and habitat use of riparian bird species throughout the LCR MSCP planning area and offsite conservation areas was prepared. An evaluation of the monitoring protocol was initiated to clarify the monitoring questions the data will inform and to improve the accuracy of monitoring methods. No system-wide surveys were conducted in FY16. System-wide surveys will resume after evaluation of the monitoring protocol was initiated to clarify the monitoring questions the data will inform and to improve the accuracy of monitoring

methods. Surveys were conducted on LCR MSCP conservation areas in FY16 under Work Task F2. Those results are discussed under "Post-Development Monitoring (Section F)" below.

Under Work Task D9, acoustic monitoring, mine outflight counts, and a foraging distance study of California leaf-nosed bats and pale Townsend's big-eared bats continued. The five permanent acoustic monitoring stations were operated from June – August to detect bat presence. In addition, a summary analysis of acoustic data collected along the LCR between 2002 and 2007 was prepared. California leaf-nosed and pale Townsend's big-eared bat roost outflight counts were conducted in nine mines along the LCR during winter. Based on the roost outflight counts, populations at these roosts continue to appear stable. There will be sufficient system-wide mine outflight baseline data after winter FY16 to inform conservation area analysis; therefore, roost outflight counts will no longer be necessary on an annual basis. To close out this effort, an inventory of all bats banded at mines and foraging habitat along the LCR from 1958–2016 was compiled. In FY16, preliminary data from the foraging distance study documented that California leaf-nosed bats flew at least 10.3 miles between roost and foraging areas (the margins of agricultural fields), and females were recorded flying a minimum of 8.7 miles. Although these distances are reported as straight lines, bats flew much further on indirect paths between roosting and foraging areas: one bat flew a minimum travel distance of 50 miles during the 4.5 hours it was tracked. From these preliminary results, it is clear that California leaf-nosed bats are capable of flying more than 5 miles between roost sites and foraging habitat provided by conservation areas, although they do not always utilize the conservation areas for foraging, instead choosing to forage along washes and agricultural areas.

Surveys were conducted to document the presence of covered rodent populations (D10) in selected areas of suitable habitat at Pintail Slough in the Havasu National Wildlife Refuge, Imperial National Wildlife Refuge outside the IPCA, Mittry Lake near the Laguna Division Conservation Area (LDCA), and the Pratt Agricultural Lease near Yuma, Arizona. One Colorado River cotton rat and four desert pocket mice were captured at Pintail Slough. Two Yuma hispid cotton rats were captured at the Imperial National Wildlife Refuge, one at Mittry Lake, and three at the Pratt Agricultural Lease. System-wide monitoring objectives for 2017–27 were defined.

System-wide monitoring also continued for the lowland leopard frog and Colorado River toad (D12). Presence surveys for Colorado River toads were conducted using visual encounter surveys, call-playback surveys, minnow trap surveys, digital automated recorders, and environmental deoxyribonucleic acid (eDNA). All audio recording devices were checked monthly. Analyses of audio files from all calling amphibians are ongoing. Results of eDNA collection conducted along the Bill Williams River indicated the presence of lowland leopard frog and Colorado River Toad deoxyribonucleic acid (DNA) in the majority of samples.

FY17 Activities

System-wide monitoring of marsh birds, southwestern willow flycatchers, yellow-billed cuckoos, bats, rodents, lowland leopard frogs, Colorado River toads, and avian productivity will continue along the LCR and adjacent river systems.

Marsh bird surveys (D1) will be conducted along the LCR in Topock Gorge and the upper reaches of Lake Havasu during March, April, and May as part of a multi-agency, system-wide monitoring effort in coordination with the USFWS.

Presence surveys for the southwestern willow flycatcher (D2) will be conducted along the LCR, Bill Williams River, Alamo Lake, lower Gila River, Pahranagat NWR, Key Pittman, Meadow Valley Wash, Warm Springs, and Muddy River in southern Nevada. Life history studies will be conducted at the Pahranagat NWR, Key Pittman, Meadow Valley Wash, Warm Springs, Muddy River, the Bill Williams River NWR, Alamo Lake, and Topock Marsh. Activities will include banding, nest monitoring, and microclimate analyses. Surveys will not be conducted on the Virgin River in FY17. The monitoring objectives will be reviewed in light of the results from FY08–16, and changes will be made, if necessary, to focus the monitoring methods to inform habitat creation design and management and to monitor southwestern willow flycatcher occupancy at conservation areas. The results of this evaluation may be incorporated into future protocols, and a 10-year monitoring plan will be developed.

Yellow-billed cuckoo (D7) presence surveys will continue at LCR MSCP conservation areas but will not be conducted in system-wide existing habitat in FY17, as nesting continues to occur primarily on LCR MSCP conservation areas. Call-playback surveys will be conducted only at conservation areas with cottonwood and willow at least 2 years old. Followup nesting surveys to detect breeding will be conducted at conservation areas where breeding has yet to be documented. Work Task D7 also included post-development monitoring at LCR MSCP conservation areas.

Some multi-species surveys used to monitor other avian species covered under the LCR MSCP will continue in FY17. Under Work Task D5, the MAPS banding stations will continue to operate at Cibola NWR Unit #1 and the BLCA during the breeding season. Color banding of LCR MSCP covered species will continue to be implemented to evaluate the recapture rate.

System-wide breeding bird surveys (D6) will not be conducted in FY17. The protocol will be reviewed, and changes will be made, if necessary, to improve the accuracy of the monitoring methods and to focus the sampling on collecting the presence and trend data needed to inform the program. A 10-year monitoring plan will be developed. System-wide surveys will resume in FY19.

The five permanent bat acoustic monitoring stations will continue to operate in FY17 (D9). Data will be collected and analyzed for covered and evaluation

species presence during the summer peak activity period. Station data from the five non-LCR MSCP managed sites will be analyzed together with the stations located at LCR MSCP conservation areas (F4) as a single acoustic monitoring network to document trends in LCR MSCP species activity levels across the program area. Archived acoustic data will be organized, analyzed, and compiled so that it may be entered into the LCR MSCP database. The foraging distance study of California leaf-nosed bats and pale Townsend's big-eared bats will be completed.

Surveys will be conducted to detect the presence of Colorado River cotton rats and Yuma hispid cotton rats within selected areas that have potential habitat along the LCR outside LCR MSCP conservation areas (D10). If potential habitat is discovered in areas that can inform LCR MSCP habitat creation, monitoring may be conducted to document their presence.

System-wide monitoring is also continuing for the lowland leopard frog and Colorado River toad (D12). Sampling method testing will continue in spring for the lowland leopard frog and summer for the Colorado River toad. An analysis of the monitoring protocols for the Colorado River toad will be prepared to inform future presence monitoring efforts.

Proposed FY18 Activities

System-wide monitoring of marsh birds, southwestern willow flycatcher, bats, rodent populations, lowland leopard frogs, Colorado River toads, and avian productivity along the LCR and adjacent river systems will continue in FY18.

Marsh bird surveys (D1) will be conducted along the LCR in Topock Gorge and the upper reaches of Lake Havasu during March, April, and May as part of a multi-agency, system-wide monitoring effort in coordination with the USFWS.

System-wide surveys for southwestern willow flycatchers will be conducted along the LCR and lower Bill Williams River. This will include surveys on the portion of the river below the Cibola National Wildlife Refuge (Cibola NWR) to the Northerly International Border with Mexico, which are conducted once every 3 years. Monitoring may include life history studies at the Bill Williams River NWR, Alamo Lake, and Topock Marsh; nest monitoring; and microclimate analyses. System-wide (D2), post-development monitoring (F9) and any remaining research efforts will be divided into separate work tasks for FY18. The results of this evaluation may be incorporated into future protocols, and a 10-year monitoring plan will be developed.

System-wide yellow-billed cuckoo (D7) presence surveys will be conducted at several system-wide sites along the LCR where yellow-billed-cuckoos have previously been detected breeding to determine if they are still present. Birds banded in previous years may be resighted, and nests may be found incidentally to

these activities. System-wide (D7), post-development monitoring (F10) and any remaining research efforts will be divided into separate work tasks for FY18. The results of this evaluation may be incorporated into future protocols, and a 10-year monitoring plan will be developed.

Multi-species surveys to monitor additional avian species covered under the LCR MSCP will continue. Under Work Task D5, collection of natural history data on avian species utilizing restoration sites will continue. System-wide breeding bird surveys under Work Task D6 will resume in FY19. The protocols will be updated, as needed, following the evaluation in FY16–17.

The five permanent acoustic monitoring stations will continue to operate, and data will be analyzed for covered and evaluation species presence during the summer peak activity period (D9). Data will be collected and analyzed for covered and evaluation species presence during the summer peak activity period. Station data from the five non-LCR MSCP managed sites will be analyzed together with the LCR MSCP conservation area stations (F4) as a single acoustic monitoring network to document trends in LCR MSCP species activity levels across the program area. Bat captures may be conducted to validate covered species presence and the acoustic detections. Standardization and consolidation of data and development of MEFFs for bat monitoring activities will continue. System-wide monitoring objectives will be defined, and a 10-year monitoring plan will be developed for FY18–28. Monitoring frequency and sample size are expected to decrease in FY18 in order to shift effort to monitoring additional conservation area acreage.

System-wide surveys (D10) will be conducted to detect the presence of the Colorado River cotton rat and Yuma hispid cotton rat within selected areas that have potential habitat along the LCR outside LCR MSCP conservation areas.

Post-Development Monitoring (Section F)

Extensive monitoring of created habitats is necessary to evaluate the implementation and effectiveness of habitat creation projects. To accomplish this task, pre-development monitoring is conducted to document baseline conditions prior to habitat creation. After habitat creation has been initiated, post-development monitoring for biotic and abiotic habitat characteristics is conducted to document implementation success and to record both the maturation of the site as it develops into covered species habitat and the use of the habitat by the covered species.

FY16 Accomplishments

In FY16, post-development monitoring for LCR MSCP covered species use was conducted at 10 conservation areas (table 1-12). In general, habitat

Table 1-12.—LCR MSCP Covered Species Post-Development Monitoring in FY16

Conservation Area	Marsh Birds	Southwestern Willow Flycatcher	Yellow-billed Cuckoo	Other Riparian Birds	Bats	Small Mammals	MacNeill's Sootywing Skipper
Beal Lake Conservation Area	X	X	X	X	X	X	X
Big Bend Conservation Area	X	NS	NS	NS	NS	X	X
Cibola National Wildlife Refuge Unit #1 Conservation Area	NS	X	X	X	X	X	NS
Cibola Valley Conservation Area	NS	X	X	X	X	X	X
Hart Mine Marsh	X	NS	NS	NS	NS	NS	X
Hunters Hole	NS*	X	NS	X	X	X	X
Imperial National Wildlife Refuge	X	NS	NS	NS	NS	NS	NS
Laguna Division Conservation Area	X	X	X	X	NS	X	NS
Palo Verde Ecological Reserve	NS	X	X	X	X	X	X
Yuma East Wetlands	X	X	X	X	X	X	NS

X = surveyed, NS = not surveyed, and * = the marsh at Hunters Hole has transitioned from marsh to willow.

creation projects are created to establish land cover types with the intent that the vegetation is managed for covered species. To evaluate the effectiveness in providing these habitat requirements (F1), pre- and post-development monitoring was conducted for targeted covered species, including avian species (F2), small mammals (F3), bats (F4), insects (F6), and marsh birds (F7). Post-development monitoring was also conducted at LCR MSCP conservation areas for southwestern willow flycatchers (D2) and yellow-billed cuckoos (D7) under system-wide work tasks. In addition to the covered species post-development monitoring that took place during FY16, long-term vegetation monitoring was conducted at all conservation areas using light detection and ranging (LiDAR) technology. These data were processed and analyzed using methods developed under Work Task C60. Conservation area vegetation will be evaluated on a periodic basis to ensure that the habitat is meeting species' requirements. This evaluation used several metrics that are being developed under Work Task C60 that describe vegetation structure throughout the canopy with the ability to identify structural diversity and successional growth stages.

One resident southwestern willow flycatcher was observed at LCR MSCP conservation areas in FY16 (D2). It was detected at PVER Phase 4 in the same general area on seven consecutive visits from May 31 to June 14. The resident

southwestern willow flycatcher was observed defending a territory and engaged in lengthy songs, which were not solicited by call-playback. This was a different individual than the one observed at the PVER in FY15. This is the second time a resident southwestern willow flycatcher has been detected by the LCR MSCP south of Parker Dam since 2003 when the LCR survey protocol was revised to more accurately identify southwestern willow flycatchers from other migrant willow flycatchers (*Empidonax traillii*). Work Task D2 also included system-wide monitoring discussed in "System Monitoring (Section D)" above.

Post-development monitoring for the yellow-billed cuckoo (D7) continued in FY16 with presence surveys at the BLCA, the PVER, the Cibola Valley Conservation Area (CVCA), Cibola NWR Unit #1, the LDCA, and YEW, and attempts were made to locate birds fitted with GPS units in previous years in order to retrieve their migration data. A total of 56 confirmed breeding territories and 46 nests were detected. There were 50 confirmed breeding territories and 41 nests at the PVER (Phases 4–7), 1 confirmed territory and 1 nest at the CVCA (Phase 1), and 5 confirmed territories and 4 nests at Cibola NWR Unit #1 (Crane Roost). Newly planted areas surveyed for the first time in 2016 included the Hippy Fire site at Cibola NWR Unit #1 and the LDCA. Breeding status was "possible" at both sites due to detection frequency and timing, but breeding was not confirmed. In 2016, three of seven yellow-billed cuckoos captured and fitted with GPS tags in 2015 were recaptured at the PVER. An additional 38 new adults, 4 juveniles, and 26 other previously banded adults were captured during mist netting. Of the three recaptured birds fitted with GPS tags in 2015, two still wore their harnesses with attached GPS tags, and their spatial data were successfully retrieved.

Three LCR MSCP listed species were captured and color banded during the MAPS season (D5). There were two Arizona Bell's vireos, seven summer tanagers (*Piranga rubra*), and four Sonoran yellow warblers at the BLCA and three yellow warblers at Cibola NWR Unit #1. Two yellow warblers were recaptured, after being initially captured in a previous year, at the BLCA. One had been captured and color banded in 2015 and the other in 2013. There were four listed LCR MSCP species that were resighted at MAPS stations. One vermilion flycatcher (*Pyrocephalus rubinus*) was resighted at Cibola NWR Unit #1 that was captured in 2015. This bird was a female, and photo documentation was taken of this bird on a nest. Three summer tanagers were resighted at the BLCA; the birds were first captured in 2011, 2014, and 2015. One Bell's vireo was resighted at the BLCA that was captured in 2014. Two yellow warblers were resighted at the BLCA that were first captured in 2010 and 2013. The covered species detected here are also being documented under post-development riparian bird surveys (F2), southwestern willow flycatcher surveys (D2), and yellow-billed cuckoo surveys (D7).

Under Work Task D6, a multi-species protocol and sample plan were used to document long-term population trends and habitat use of riparian bird species

throughout the LCR MSCP planning area and offsite conservation areas. In FY16, 80 plots were surveyed for riparian birds (D6) on conservation areas, recording 155 species, including LCR MSCP covered bird species and other territorial riparian breeding birds:

- BLCA – There were 103 pairs of territorial breeding birds comprising 18 species detected. These included eight pairs of Sonoran yellow warbler, 15 pairs of Arizona Bell's vireos, and three pairs of summer tanagers.

- Cibola NWR Unit #1 – There were 166 pairs of territorial breeding birds comprising 26 species detected. These included one pair of Arizona Bell's vireos, two pairs of summer tanagers, and one pair of vermilion flycatchers.

- CVCA – There were 214 pairs of territorial breeding birds comprising 20 species detected. These included three pairs of Sonoran yellow warblers and one pair of summer tanagers.

- PVER – There were 403 pairs of territorial breeding birds comprising 26 species detected. These included six pairs of Sonoran yellow warblers, one pair of Arizona Bell's vireos, and six pairs of summer tanagers.

- YEW – There were 188 pairs of territorial breeding birds comprising 25 species detected. These included two pairs of Sonoran yellow warblers and one pair of Gila woodpeckers.

- Hunters Hole – There were 16 pairs of territorial breeding birds comprising 10 species detected. This included one pair of Sonoran yellow warblers.

Live trapping surveys to detect Colorado River cotton rats and Yuma hispid cotton rats were conducted in fall 2015 and spring 2016. Surveys were conducted at the BBCA, the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, the LDCA, YEW, and Hunters Hole to detect the presence of cotton rats. Colorado River cotton rats were captured at the BBCA, the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, and the LDCA; none were captured at the BLCA. Yuma hispid cotton rats were captured at YEW and Hunters Hole, a first for Hunters Hole. The first trapping of the LDCA occurred. One night of pre-development monitoring was conducted at the MVCA, and desert pocket mice were captured. The subspecies of these pocket mice were not determined.

Bat presence was monitored at conservation areas (F4). Acoustic monitoring was conducted the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, YEW, and Hunters Hole. Data will be analyzed in FY17. Capture surveys were conducted at five LCR MSCP conservation areas (BLCA, PVER, CVCA,

Cibola NWR Unit #1, and YEW). One pale Townsend big-eared bat and seven California leaf-nosed bats were captured at the BLCA. One western red bat (*Lasiurus blossevilli*), two western yellow bats (*Lasiurus xanthinus*), and three California leaf-nosed bats were captured at the PVER. Six western red bats, two western yellow bats, and two California leaf-nosed bats were captured at the CVCA. Three California leaf-nosed bats were captured at Cibola NWR Unit #1. Three pale Townsend big-eared bats and 33 California leaf-nosed bats were captured at Planet Ranch. Two California leaf-nosed bats were captured at YEW.

MacNeill's sootywing skippers were monitored (F6) at the BBCA, the BLCA, the CVCA, the PVER (Phases 1, 4, and 6), Cibola NWR Unit #1, and Hart Mine Marsh. They were detected at the BLCA, the CVCA, the PVER (Phases 1, 4, and 6), Cibola NWR Unit #1, and Hart Mine Marsh; none were detected at the BBCA.

Marsh bird surveys were conducted at the BBCA, the BLCA, Hart Mine Marsh, the LDCA, Field 18 in the IPCA, and YEW. Western least bitterns were detected at the BLCA, Hart Mine Marsh, the IPCA, the LDCA, and YEW. Yuma clapper rails were detected at the BLCA (both at Beal Lake and Willow Marsh), Hart Mine Marsh, the IPCA in Field 18, and YEW. One California black rail was detected at the IPCA in Field 18 on the April 21 survey. This was the only detection of a California black rail at a conservation area in FY16.

FY17 Activities

Post-development monitoring for LCR MSCP covered species continues to be conducted at conservation areas to evaluate how effective the program has been in providing the habitat requirements (F1) in conservation areas. Activities will focus on southwestern willow flycatchers (D2), yellow-billed cuckoos (D7), avian species (F2), small mammals (F3), bats (F4), insects (F6), and marsh birds (F7).

Pre-development surveys will be conducted for any new conservation areas as needed. MAPS banding stations (D5) will continue to operate at Cibola NWR Unit #1 and the BLCA during the 2017 breeding season.

Long-term vegetation monitoring continues in FY17 using LiDAR technology (F1). Data are being processed and analyzed to provide metrics for vegetation structure analyses.

FY18 Proposed Activities

Post-development monitoring for LCR MSCP covered species will be conducted at conservation areas to evaluate how effective the program has been in providing the habitat requirements (F1) in conservation areas. Activities will focus on southwestern willow flycatchers (F9), yellow-billed cuckoos (F10), avian species (F2), small mammals (F3), bats (F4), insects (F6), and marsh birds (F7). MAPS

banding stations (D5) will continue to operate at Cibola NWR Unit #1 and the BLCA during the FY18 breeding season. Pre-development surveys will be conducted for any new conservation areas.

Long-term vegetation monitoring will continue in FY18 using LiDAR technology (F1). Data will be processed and analyzed to provide metrics for vegetation structure analyses.

Three new work tasks will open in FY18. Post-development monitoring for northern Mexican gartersnakes (*Thamnophis eques megalops*), lowland leopard frogs and Colorado River toads (F8) will be started to fund presence surveys for northern Mexican gartersnakes and their prey (including lowland leopard frogs and Colorado River toads) at marsh habitat sites and adjacent cottonwood-willow habitat where northern Mexican gartersnakes may be present. Post-development monitoring for southwestern willow flycatchers will be moved from Work Task D2 to Work Task F9 to better track monitoring costs and accomplishments. In addition, post-development monitoring for yellow-billed cuckoos will be moved from Work Task D7 to Work Task F10 to better track monitoring costs and accomplishments.

Adaptive Management Program (Section G)

Under the Adaptive Management Program, uncertainties encountered during implementation of the conservation measures outlined in the HCP will be addressed. The program has three central components: (1) gauging the effectiveness of existing conservation measures, (2) proposing alternative or modified conservation measures as needed, and (3) addressing changed and unforeseen circumstances.

The *Final Science Strategy* details the AMP process for the research and monitoring programs at project and programmatic levels. A 5-year planning cycle has been identified to allow for the receipt of new information, the analysis of that information, and the incorporation of the new information into the design or direction of future work tasks. The 5-year planning cycle will allow for a review of past activities and the setting of priorities for the next 5-year cycle. The *Final Five-Year Monitoring and Research Priorities for the Lower Colorado River Multi-Species Conservation Program: 2013–2017* report was completed in FY12.

Implementation of the AMP to address uncertainties, evaluate the effectiveness of research and monitoring activities, and improve management is allocated under Work Task G4. Data management (G1) is an integral component of any conservation program, including the LCR MSCP. Funds are allocated to design a data management system capable of tracking all information needed in the decisionmaking process. Funding allocated under Work Task G3 to begin research studies identified as priorities, when applicable, will continue.

FY16 Accomplishments

CEMs for the following species were finalized: Arizona Bell's vireo, bonytail, California black rail, Colorado River cotton rat, elf owl, flannelmouth sucker, Gila woodpecker, gilded flicker, MacNeill's sootywing skipper, southwestern willow flycatcher, Sonoran yellow warbler, summer tanager, vermilion flycatcher, western least bittern, western red bat, western yellow bat, yellow-billed cuckoo, Yuma clapper rail, and Yuma hispid cotton rat. All CEMs were posted on the LCR MSCP Web site in FY16.

The data standardization protocols developed in previous years continued to be applied to all collection and storage of data for species and their habitat. Automated and electronic data collection techniques were used where appropriate to reduce errors and to improve workflow efficiencies using MEFFs. Database module development and management continued in FY16 for the southwestern willow flycatcher (D2 and F2), yellow-billed cuckoo (D7 and F2), amphibians (C62 and D12), small mammals (D10 and F3), bat surveys and research (D9 and F4), elf owl (C24), MacNeill's sootywing skipper (F6), and general riparian birds (D6 and F2). MEFFs were created (or updated) and tested for the same projects except for general riparian birds (D6 and F2), which use a different electronic data collection method.

A scientific peer review was conducted for approximately 30 reports that were subsequently posted on the LCR MSCP Web site in FY16. These reviews were accomplished through the peer review process, which ensures that all research and monitoring complies with the LCR MSCP science strategy and the U.S. Department of the Interior Code of Scientific and Scholarly Conduct. This process also ensures that research and monitoring meets the needs of the LCR MSCP as outlined in the HCP and other program documents.

The LCR MSCP completed reviews on study plan designs and statistical analyses, and made changes to the LCR MSCP technical and scientific writing standards. When appropriate, this information was shared with external partners to assist in their research, monitoring, and report writing activities.

FY17 Activities

The data collection processes continue to be updated and/or maintained, and MEFFs are being evaluated, developed, updated (and/or maintained), and tested for the following projects: the southwestern willow flycatcher (D2 and F2), yellow-billed cuckoo (D7 and F2), amphibians (C62 and D12), small mammals (D10 and F3), bat surveys and research (D9 and F4), elf owl (C24), and MacNeill's sootywing skipper (F6).

Field data collection alternatives are being evaluated in order to take advantage of more efficient and versatile hardware and software technologies. Once these alternatives are identified, limited field testing will begin on projects that are

currently using MEFFs for field data collection. These technologies might also be tested on projects that currently use other field data collection techniques (marsh bird surveys [D1 and F7]).

An independent evaluation of all data management processes is being conducted during FY17. The overall goal of this exercise is to provide the necessary information to develop a digital information management system that will allow the LCR MSCP to make informed management decisions throughout the life of the program.

Research and monitoring activities continue to be reviewed and evaluated internally as well as through independent, external reviewers. During FY17, an evaluation of the system-wide riparian bird monitoring protocol will be completed. A new 5-year research and monitoring priorities report will be drafted using information from the CEMs completed in FY16.

Funding is available for emerging research needs under Work Task G3.

FY18 Proposed Activities

In FY18, technical, independent, and peer reviews of wildlife projects and habitat monitoring will continue under the AMP. The new 5-year research and monitoring priorities report initiated in FY17 will be finalized. This report will describe the current knowledge of covered species, establish the monitoring and research priorities for the next 5-year period (2018–22), and describe potential challenges that may inhibit successful implementation of the conservation measures.

Existing MEFFS will continue to be updated or converted to one of the alternative field data collection techniques identified in FY17. Projects not using a standardized electronic field data collection method will be upgraded to use one of these methods.

Information gathered from the data management evaluation taking place during FY17 will be used to further data management tasks with the overall goal of developing an information management system that meets the LCR MSCP's science and adaptive management needs and provides the tools for interpretation of data to make informed management decisions.

Funding will be available for emerging research needs under Work Task G3.

CONSERVATION AREA DEVELOPMENT, MAINTENANCE, AND ADAPTIVE MANAGEMENT

A major component of the LCR MSCP is the creation and management of habitat. Conservation Area Development and Management (Section E) addresses the identification, selection, development, and management of created habitat and any restoration research being conducted. In general, habitat creation projects target land cover types with the intent that the vegetation is managed for or developed into a species-specific habitat for covered species.

Conservation Area Development and Management (Section E)

Cottonwood-willow, honey mesquite, marsh, and backwater are the predominant land cover types to be created under the LCR MSCP. For terrestrial and marsh land cover types, trees, shrubs, and ground cover are typically planted or seeded to create the desired type. For backwater land cover types, which include open water and associated emergent marsh, the habitat is defined by the evaluation of the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy populations of fishes and other species associated with backwaters. Maturation and management of the land cover types ultimately create the habitat.

As described in the HCP, habitat creation goals of the LCR MSCP include establishing:

1. 5,940 acres of cottonwood-willow
2. 1,320 acres of honey mesquite
3. 512 acres of marsh
4. 360 acres of backwater

   8,132 total acres

To the extent practicable based on site conditions, cottonwood-willow, honey mesquite, marsh, and backwaters will each be restored in proximity to other land cover types to create integrated mosaics of habitat that approximate the relationships among aquatic and terrestrial communities historically present along the LCR flood plain. The selection process is described in the *Draft Guidelines for the Screening and Evaluation of Potential Conservation Areas*, which is available on the LCR MSCP Web site (www.lcrmscp.gov). These conservation areas are discrete areas of conserved habitats managed as a single unit under the LCR MSCP. Conservation areas include LCR MSCP created habitats as well as buffer areas and other lands that may be included in the conservation area design.

Conservation areas developed primarily for riparian and marsh species followed a different selection and evaluation process from those established primarily for native fishes.

Conservation areas developed primarily for riparian and honey mesquite land cover types such as the PVER (E4), the CVCA (E5), and Cibola NWR Unit #1 (E24) involve the conversion of existing land cover types (such as active agricultural, fallow agricultural, and undeveloped land) to native riparian species.

Restoration research priorities were developed in accordance with the *Final Science Strategy*. The requirements included methods to cost effectively establish and manage planned land cover types while limiting growth of non-native plant species. Terrestrial restoration research projects included those under Work Tasks E1, E3 (closed), E6 (closed), E7 (closed), E8 (closed), and E34.

Conservation areas that are being developed primarily as disconnected backwaters for native fishes prioritize (1) delivery of non-native fish-free replacement water and (2) the ability to completely drain and renovate the ponds without the use of piscicides. There is also value in connected backwaters, and creation of connected backwaters is an option in Reaches 3–5. Backwaters created in Reach 3 will continue to be connected to the main stem river to address the life history requirements of the flannelmouth sucker. Restoration research priorities for backwater development are expected to include researching the screening of water to exclude non-native fishes, maintaining water quality in isolated backwaters, and controlling non-native fish species.

Developing, maintaining, and managing the appropriate habitats as dictated by the conservation measures presents several challenges. Present flow regimes of the LCR have been altered considerably from dynamic pre-development flows. Introduced and invasive species exist throughout the LCR MSCP planning area. Approaches to habitat creation must not only acknowledge the differences from historical conditions but must also be able to work effectively within the context of current conditions. In addition, existing knowledge and practices must be incorporated to take advantage of appropriate available technologies. An example of this, as applied to riparian habitat creation, is the use of agricultural technology and infrastructure to deliver water and simulate flooding events for riparian habitat creation projects.

To meet these challenges and the goals of the LCR MSCP, five components of habitat creation have been developed: (1) site identification, (2) site selection, (3) development, (4) maintenance, and (5) adaptive management of conservation areas. The following sections describe the distinctions among the components of habitat creation and how they are interconnected within the context of an adaptive management approach.

Site Identification and Selection

A logical process for identifying and selecting locations for habitat creation projects contributes to the overall success of the LCR MSCP. In general, ideal sites are those that have the greatest potential for successfully achieving the desired habitat in the most cost-effective manner. Although this objective appears obvious, it is obscured by a number of variables that can affect both cost-effective development and habitat success: (1) logistical – site accessibility, available infrastructure, and availability of sufficient resources (water); (2) physical – depth to groundwater, soil texture and chemistry, water quality, and eutrophic stage; and (3) administrative – potential impacts to other species or habitats, permitting requirements, and landowner/partner support. This represents only a portion of the known variables that must be considered when identifying and selecting sites, as unforeseen factors can contribute to greater costs and may limit success in habitat creation. As the LCR MSCP proceeds, this newly acquired knowledge will be incorporated into the site selection processes. Appropriate adaptations are being made through the AMP to properly address and apply newly acquired information, allowing for a more accurate assessment of development costs and success potential for future habitat creation projects.

FY16 Accomplishments

New Conservation Areas

Parker Dam Camp: The conservation area was established, and a Memorandum of Understanding between the LCR MSCP and the Lower Colorado Dams Office was signed.

Proposed Conservation Areas

The following potential conservation areas, primarily in California, were evaluated and the findings brought back to the Steering Committee:

Palo Verde Ecological Reserve-South (PVER-South): An expansion of the acquired property to include a remnant meander that would have allowed connection back to the Colorado River has ended without the acquisition of any land; therefore, the conservation area will be developed as cottonwood-willow and honey mesquite and will no longer have a marsh and backwater component. PVER-South will become an official conservation area in FY17 and will be tracked under Work Task E37.

Three Fingers Lake: Three Fingers Lake was identified during a workshop with representatives of the California parties as having the potential to provide both backwater and marsh land cover types for the LCR MSCP. The lake is located on the Cibola NWR within the State of California on lands owned by the USFWS. Multiple options for creation of a conservation area were discussed with

stakeholders. An agreement in principle has been reached among the USFWS, CDFW, and the LCR MSCP to develop the area as a conservation area. Starting in FY17, accomplishments will be tracked under Work Task E38.

Potential Conservation Areas

Davis Lake: Davis Lake was identified during a workshop with representatives of California parties as having the potential for creation of a shallow marsh similar in size to Hart Mine Marsh. The remnant lake is located on the Cibola NWR within the State of California on lands owned by the USFWS. LiDAR data were collected to help determine whether to proceed with this potential conservation area; however, no decision was made in FY16.

Backwaters and Marsh within Reach 4: Reach 4 has the highest potential for establishment of marshes and backwaters in California based on the needs of the LCR MSCP. Increased efforts to identify these areas on lands withdrawn by Reclamation, typically between the bank line and levee, are ongoing.

Topock Marsh Inlet Canal: An opportunity may exist to create a connected backwater in Reach 3 using the former Topock Marsh Inlet Canal. However, prior to any technical investigations, land ownership needs to be verified, so a survey was initiated in FY16.

Figure 1-1 depicts the geographical distribution of 14 established conservation areas as well as 3 proposed conservation areas (PVER-South, Three Fingers Lake, and Dennis Underwood Conservation Area). Figures 1-2 through 1-15 depict each conservation area. Acreage proposed for development, but not yet restored, is shown in yellow. Acreage already restored or stabilized is considered managed and is shown in green. Lands managed by the LCR MSCP partners are shown in brown.

FY17 Activities

Coordination with resource agencies will continue. The need for additional cadastral surveys is being discussed to define land ownership prior to evaluating properties for consideration as new conservation areas. Installation of groundwater monitoring wells and collection of river data to support selection of backwater and marsh sites is planned.

Proposed Conservation Areas

Dennis Underwood Conservation Area: An agreement in principle has been reached with the landowner, the Metropolitan Water District of Southern California, to use up to 635 acres for development of cottonwood-willow and honey mesquite land cover types. A land and water resolution must still be approved by the LCR MSCP Steering Committee before this project can be listed

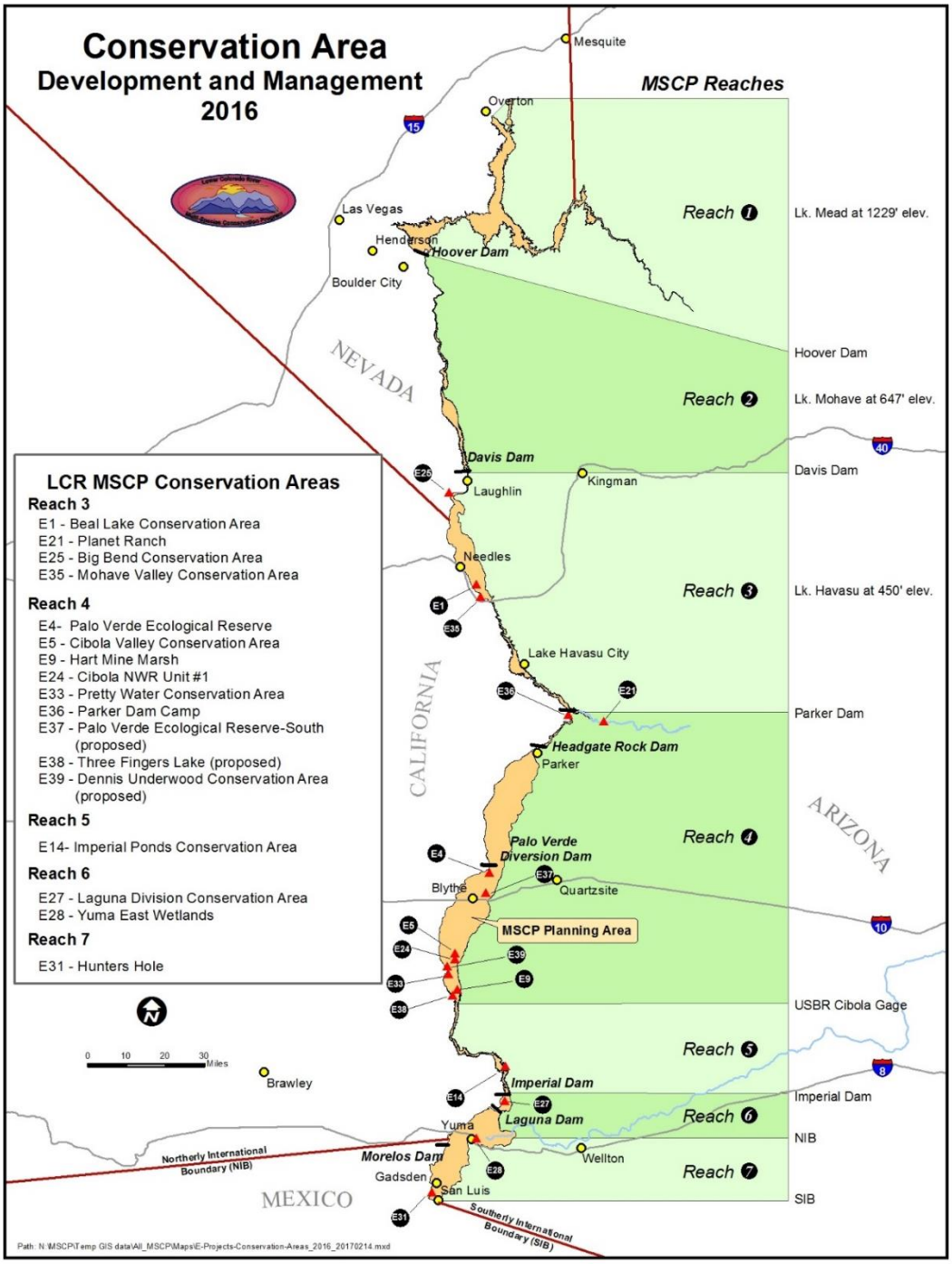
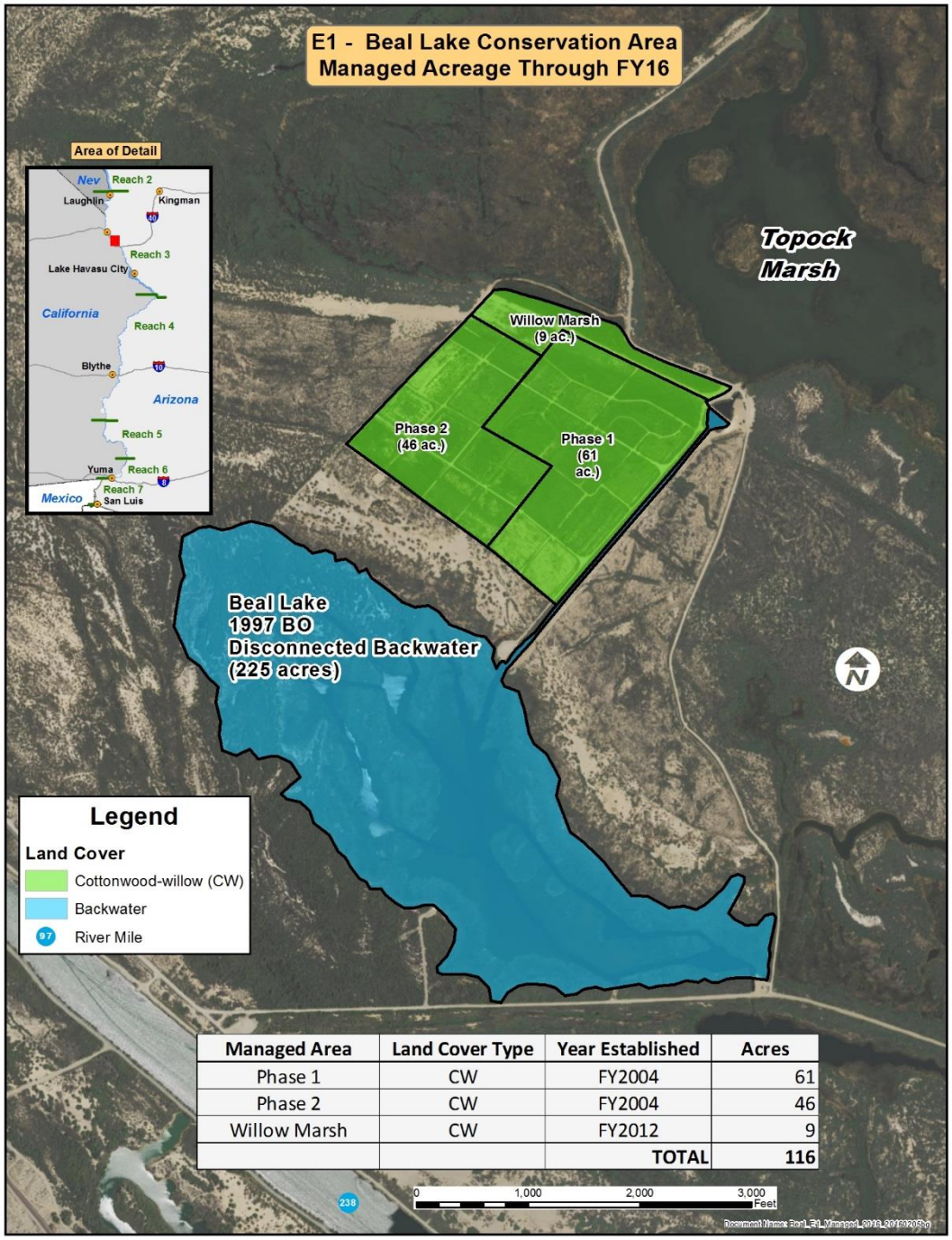
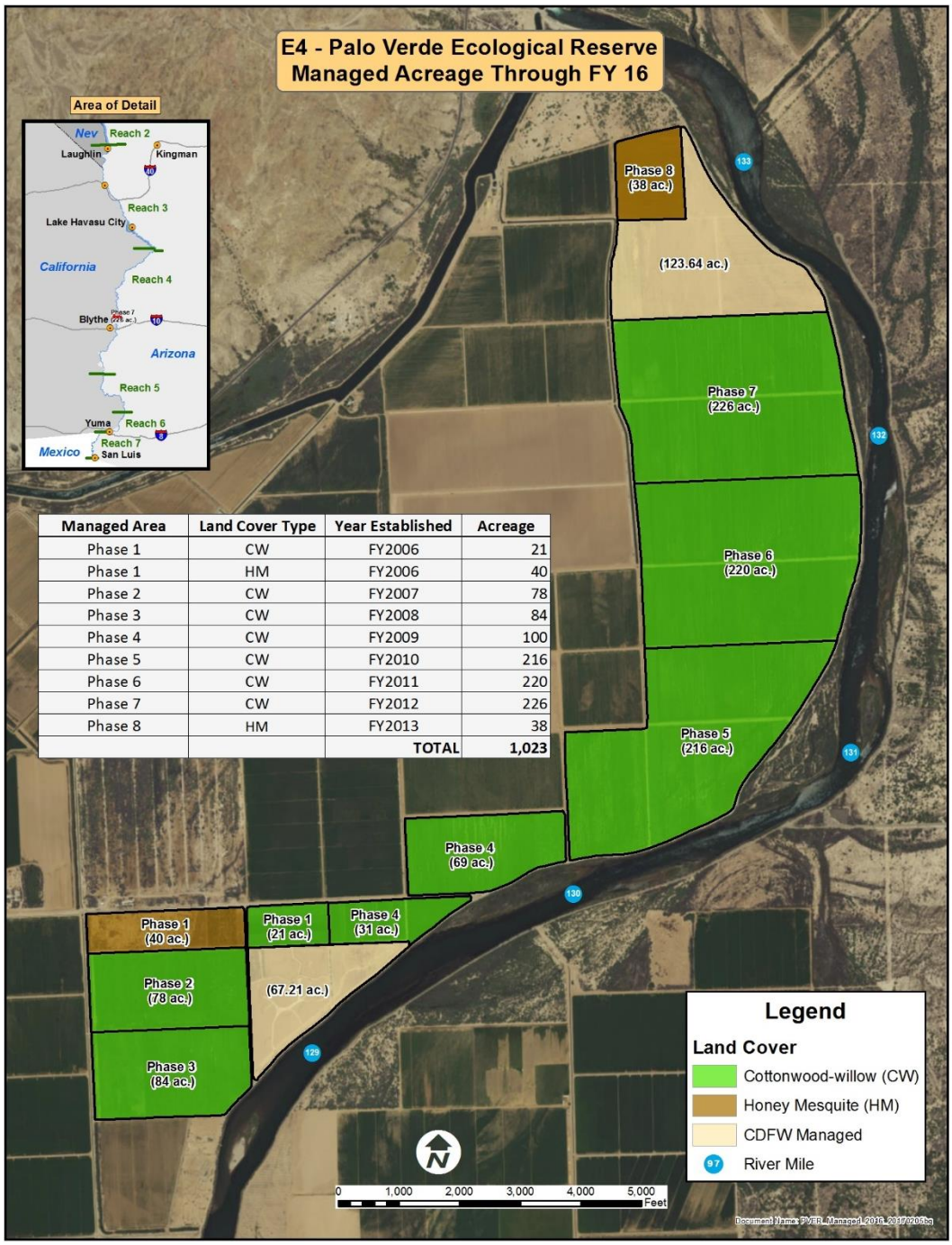


Figure 1-1.—Conservation area development and management, 2016.



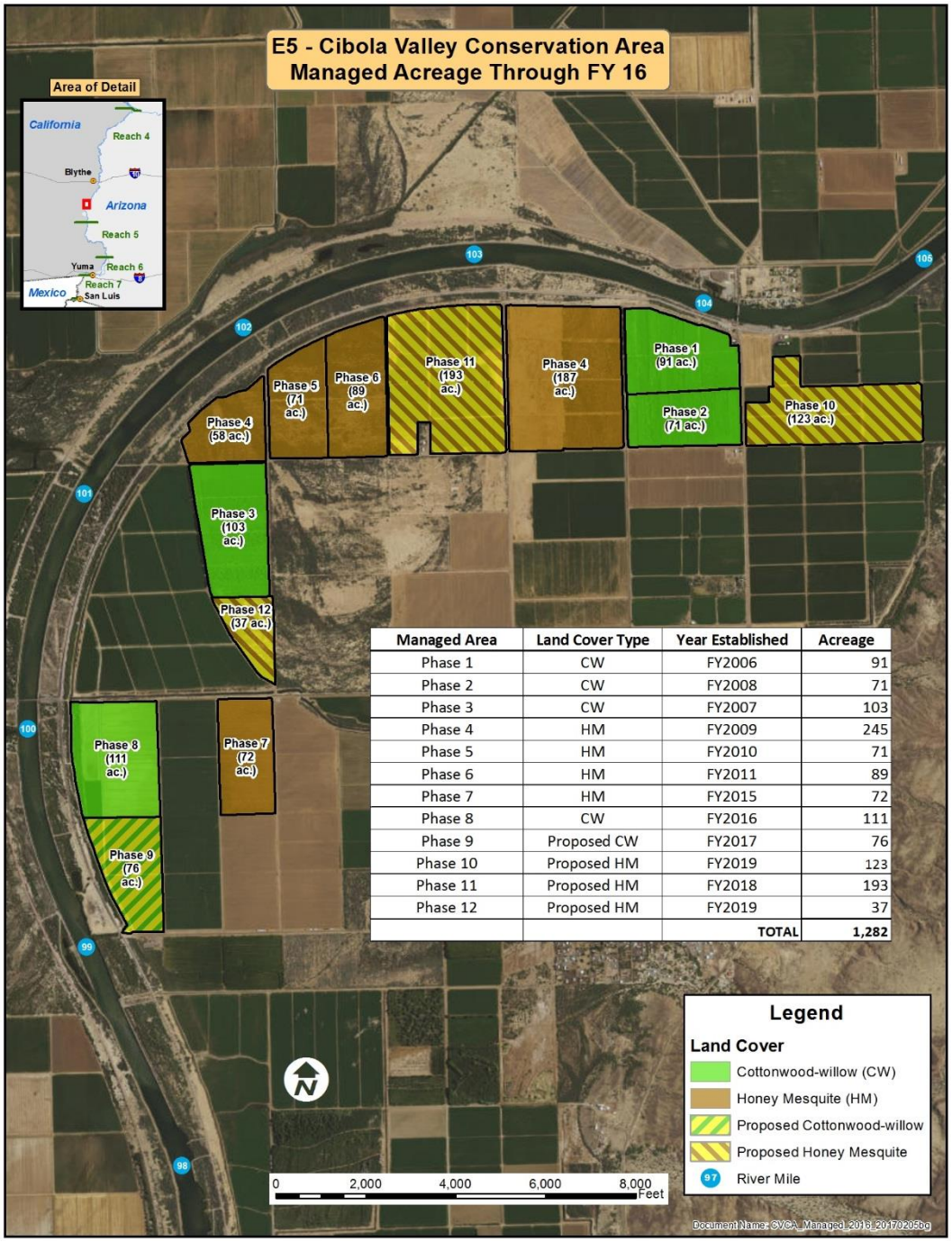
Managed Area	Land Cover Type	Year Established	Acres
Phase 1	CW	FY2004	61
Phase 2	CW	FY2004	46
Willow Marsh	CW	FY2012	9
		TOTAL	116

Figure 1-2.—E1 – Beal Lake Conservation Area managed acreage through FY16.



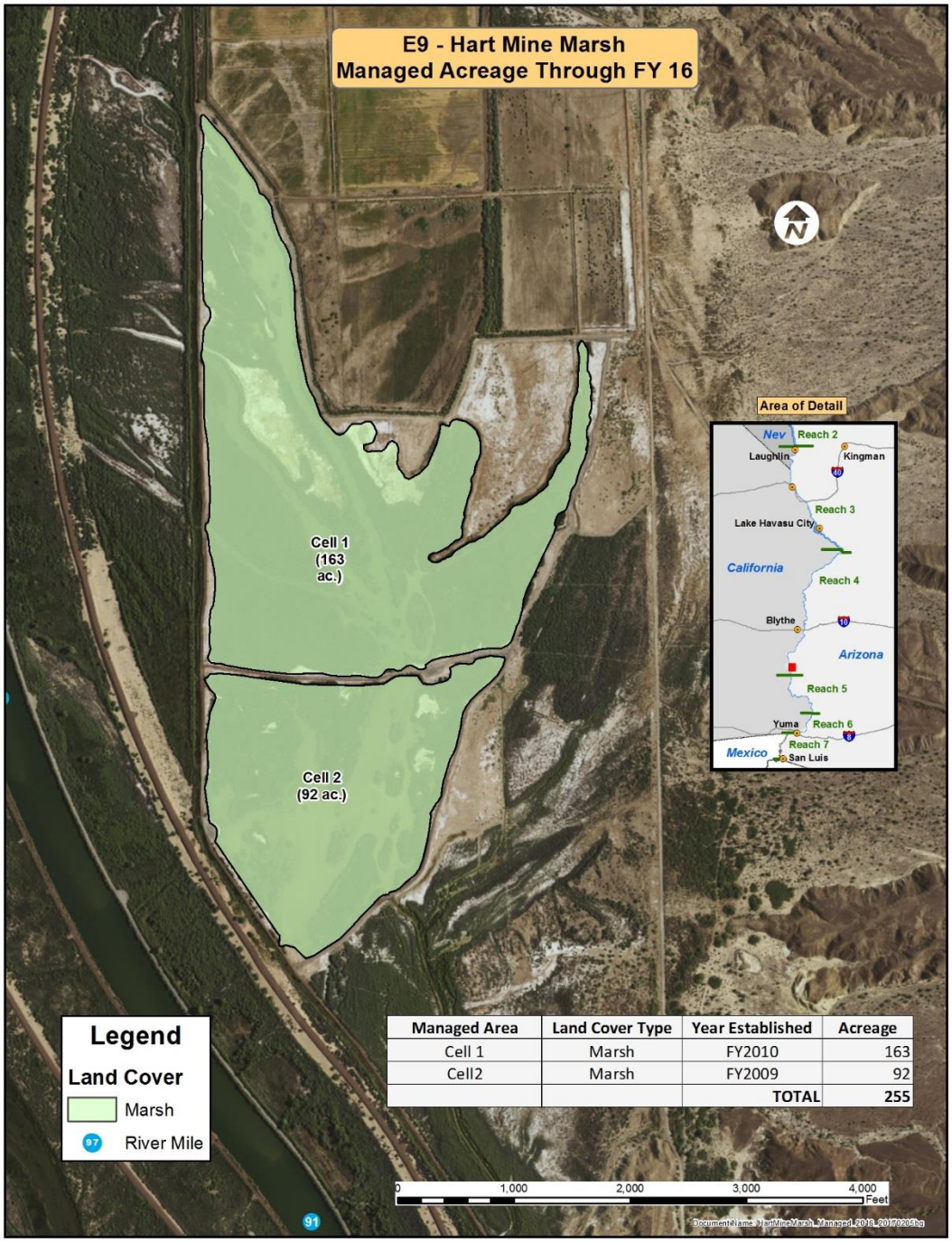
Managed Area	Land Cover Type	Year Established	Acreage
Phase 1	CW	FY2006	21
Phase 1	HM	FY2006	40
Phase 2	CW	FY2007	78
Phase 3	CW	FY2008	84
Phase 4	CW	FY2009	100
Phase 5	CW	FY2010	216
Phase 6	CW	FY2011	220
Phase 7	CW	FY2012	226
Phase 8	HM	FY2013	38
		TOTAL	1,023

Figure 1-3.—E4 – Palo Verde Ecological Reserve managed acreage through FY16.



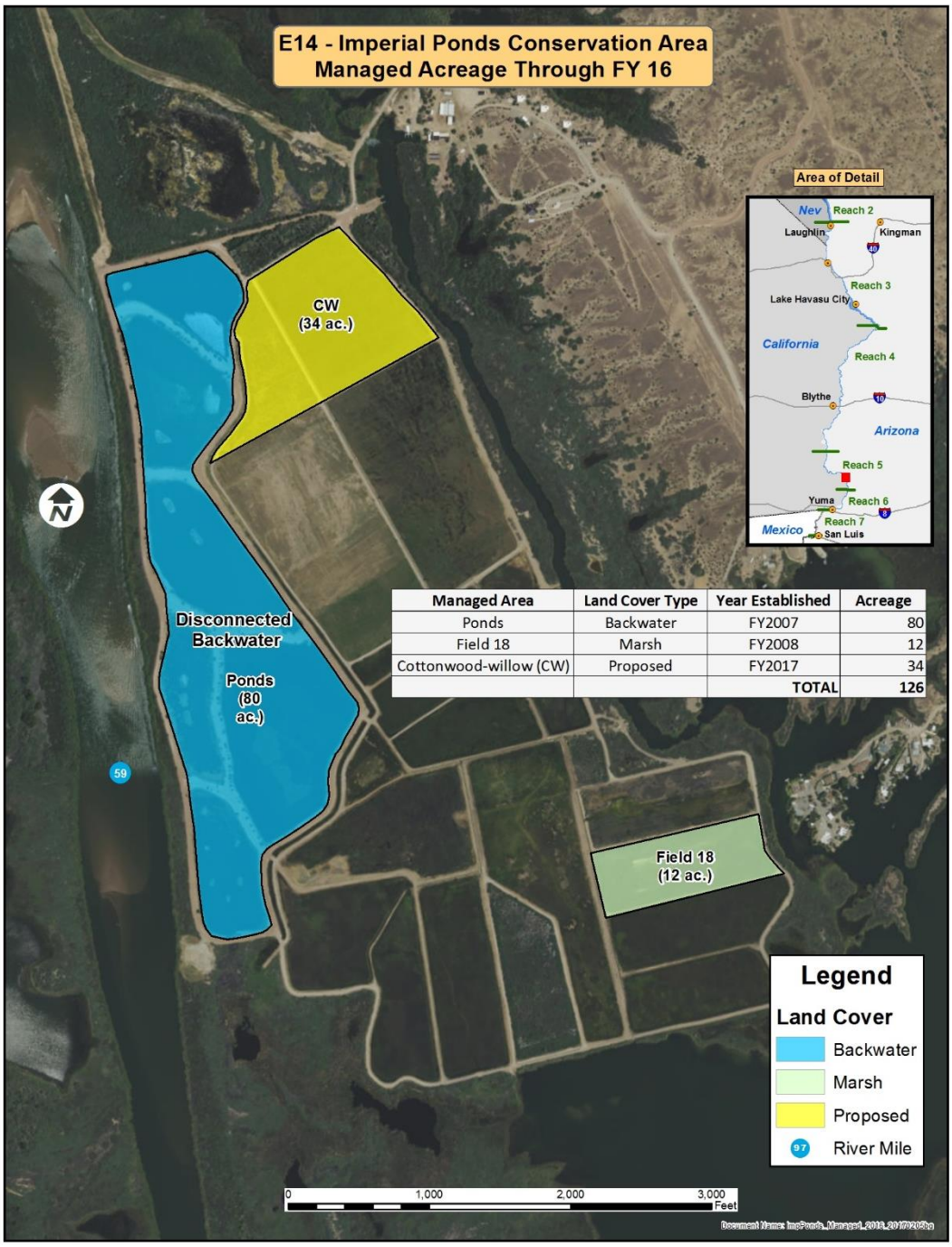
Managed Area	Land Cover Type	Year Established	Acreage
Phase 1	CW	FY2006	91
Phase 2	CW	FY2008	71
Phase 3	CW	FY2007	103
Phase 4	HM	FY2009	245
Phase 5	HM	FY2010	71
Phase 6	HM	FY2011	89
Phase 7	HM	FY2015	72
Phase 8	CW	FY2016	111
Phase 9	Proposed CW	FY2017	76
Phase 10	Proposed HM	FY2019	123
Phase 11	Proposed HM	FY2018	193
Phase 12	Proposed HM	FY2019	37
		TOTAL	1,282

Figure 1-4.—E5 – Cibola Valley Conservation Area managed acreage through FY16.



Managed Area	Land Cover Type	Year Established	Acreage
Cell 1	Marsh	FY2010	163
Cell2	Marsh	FY2009	92
		TOTAL	255

Figure 1-5.—E9 – Hart Mine Marsh managed acreage through FY16.



Managed Area	Land Cover Type	Year Established	Acreage
Ponds	Backwater	FY2007	80
Field 18	Marsh	FY2008	12
Cottonwood-willow (CW)	Proposed	FY2017	34
		TOTAL	126

Figure 1-6.—E14 – Imperial Ponds Conservation Area managed acreage through FY16.

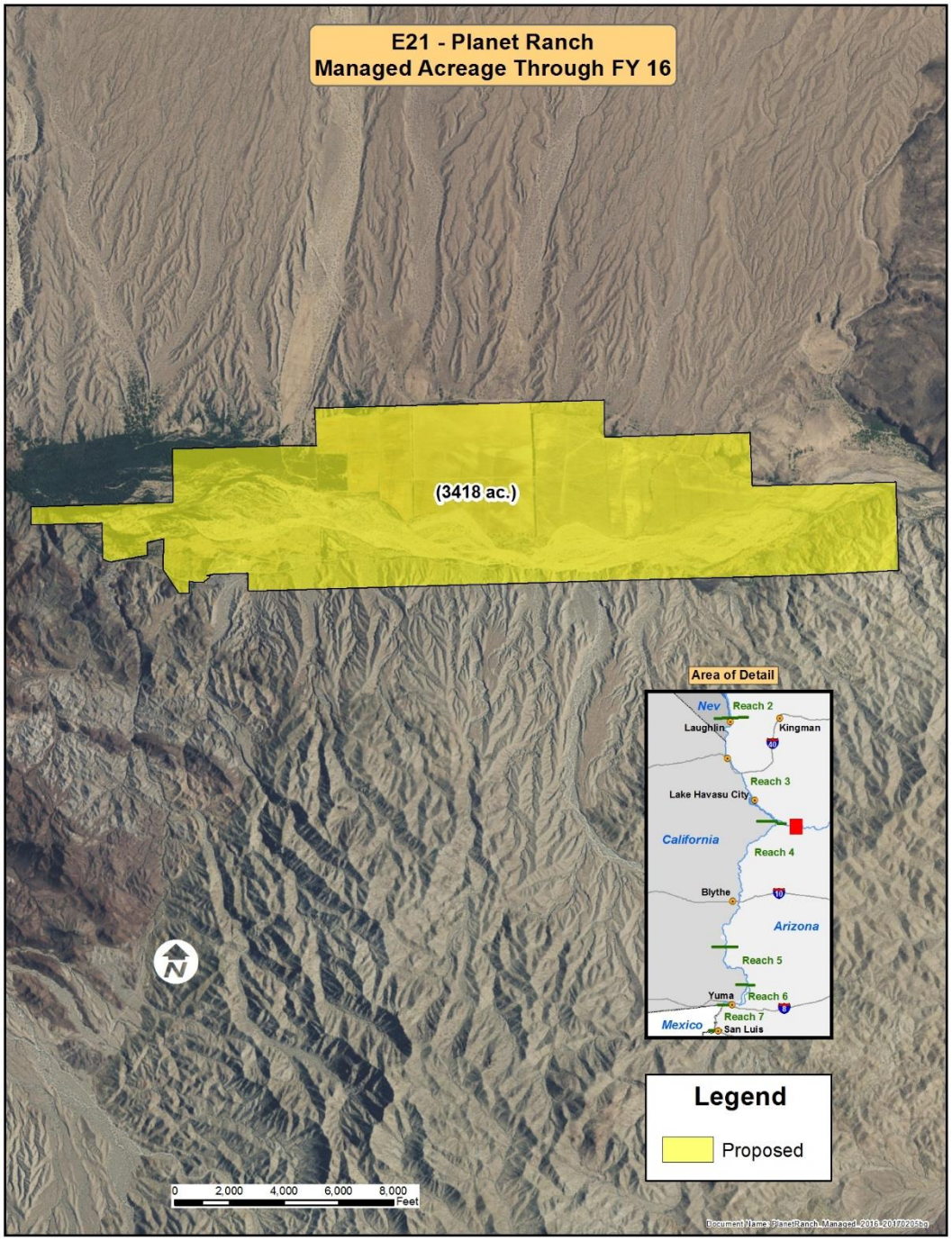
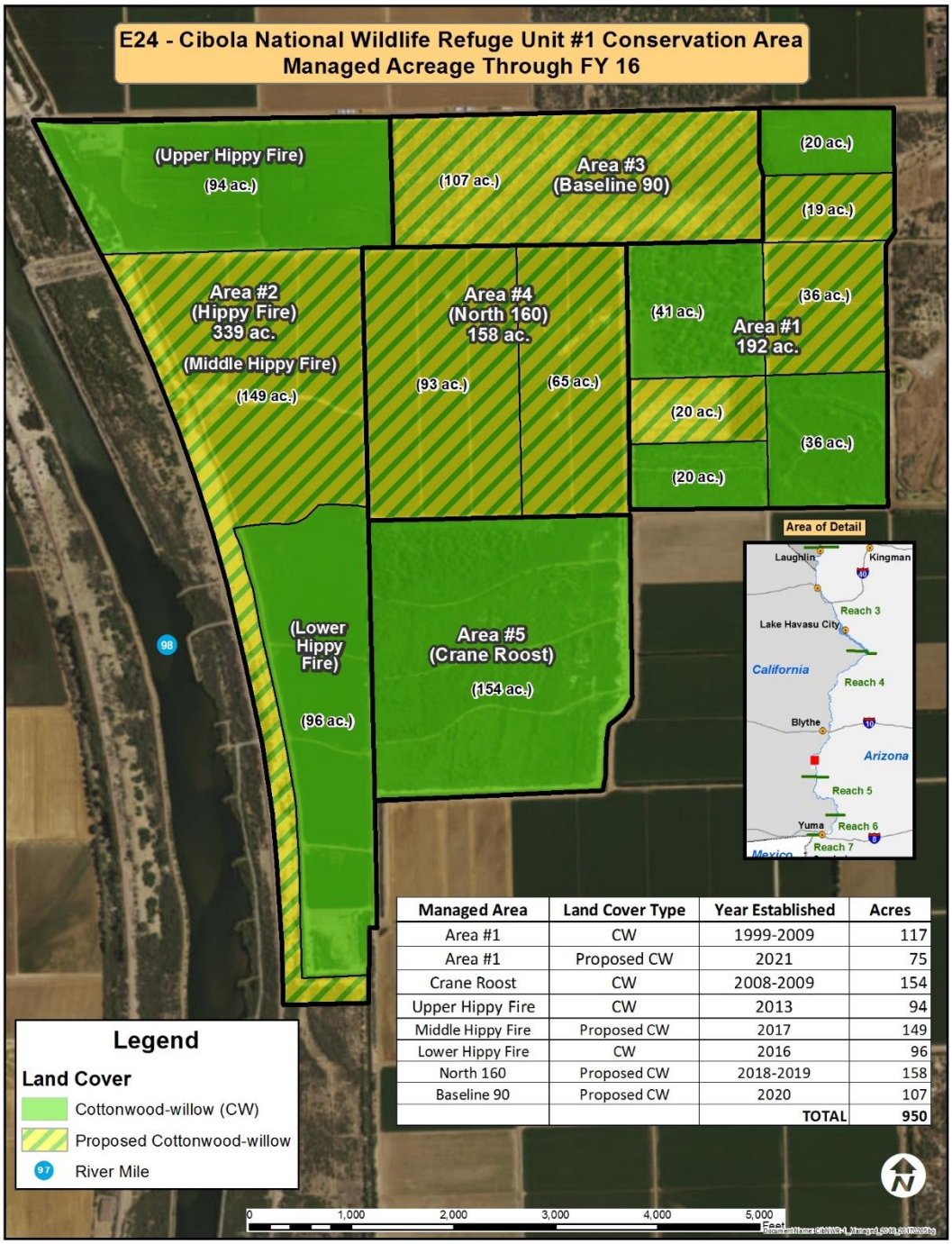


Figure 1-7.—E21 – Planet Ranch managed acreage through FY16.



Managed Area	Land Cover Type	Year Established	Acres
Area #1	CW	1999-2009	117
Area #1	Proposed CW	2021	75
Crane Roost	CW	2008-2009	154
Upper Hippy Fire	CW	2013	94
Middle Hippy Fire	Proposed CW	2017	149
Lower Hippy Fire	CW	2016	96
North 160	Proposed CW	2018-2019	158
Baseline 90	Proposed CW	2020	107
		TOTAL	950

Figure 1-8.—E24 – Cibola National Wildlife Refuge Unit #1 Conservation Area managed acreage through FY16.

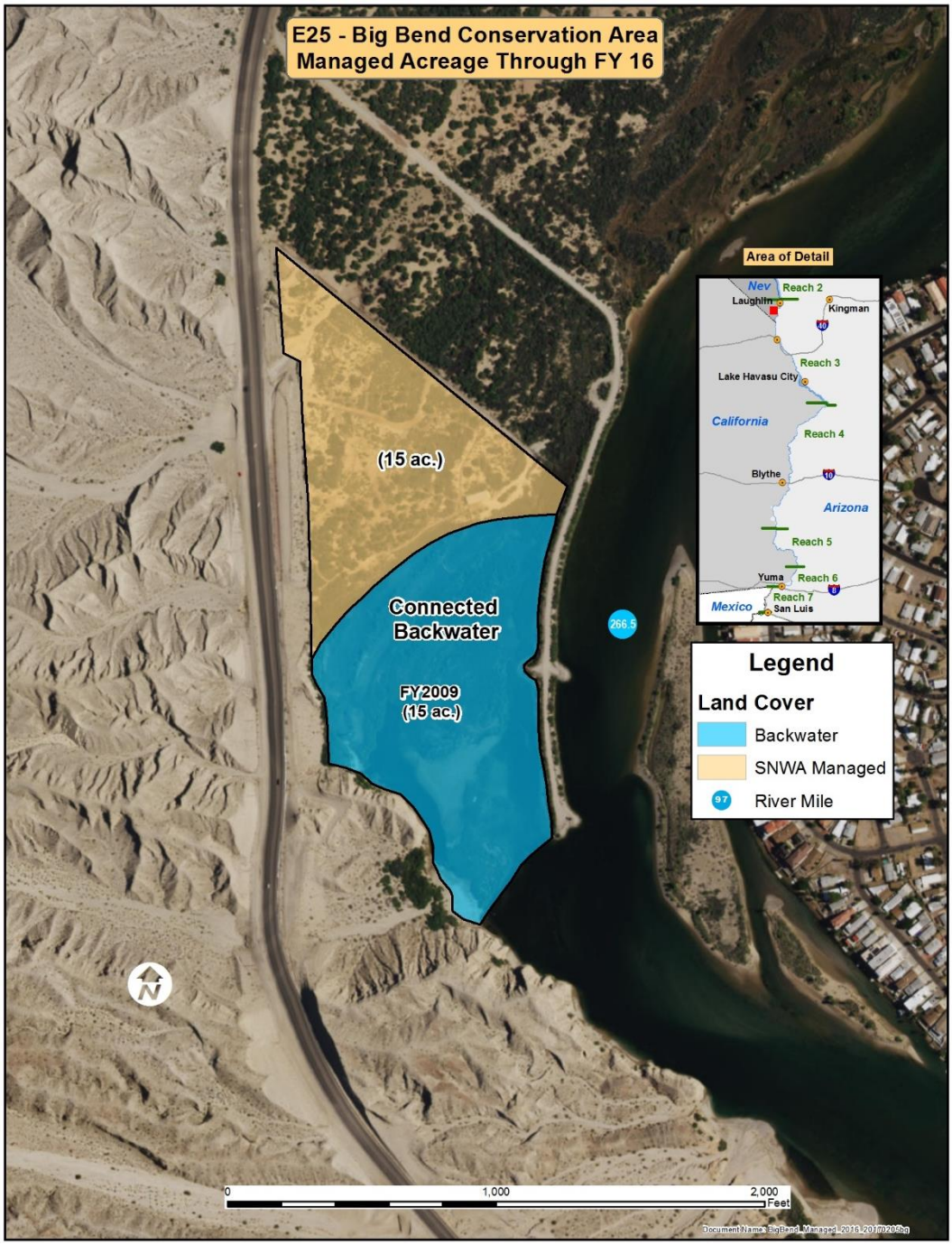
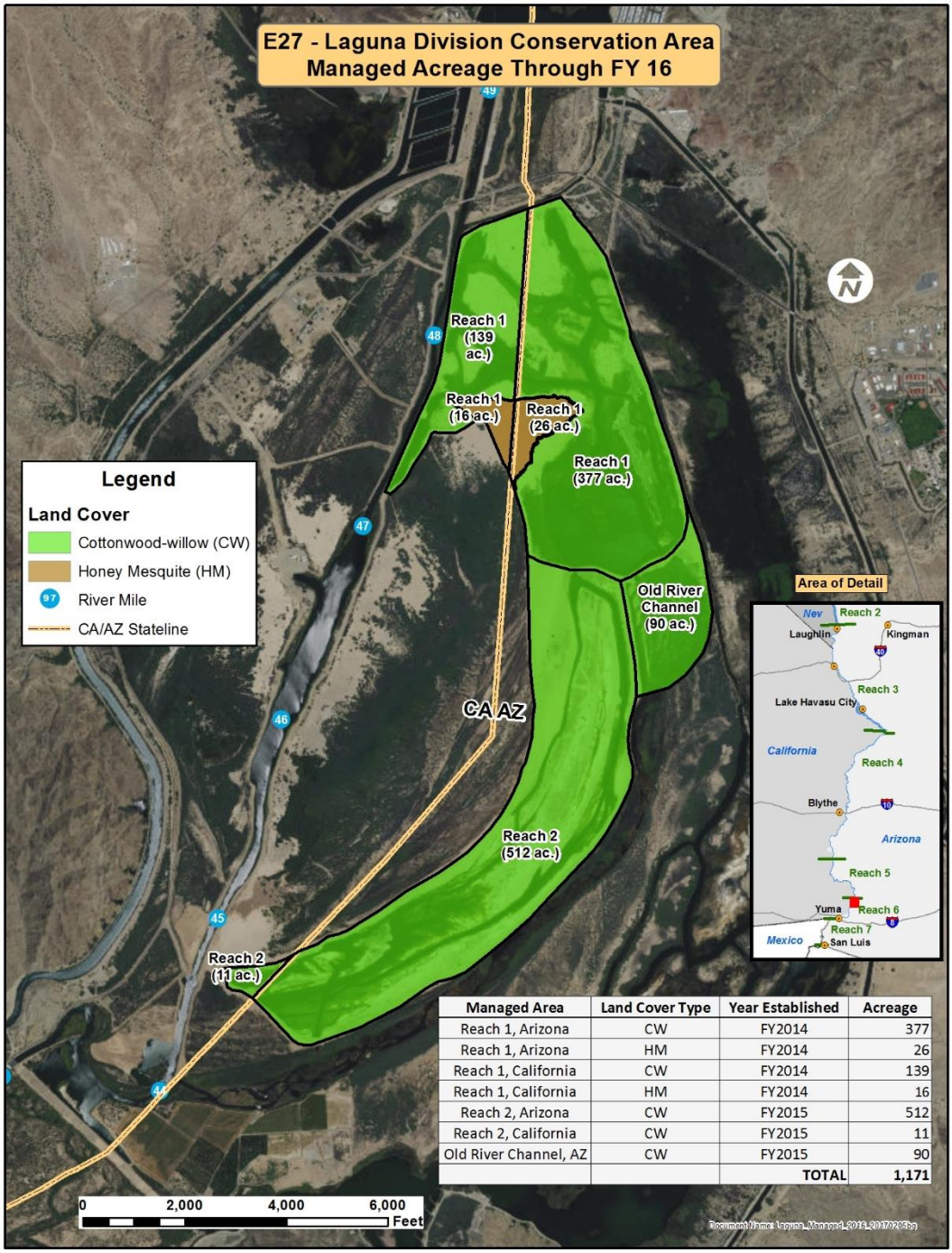
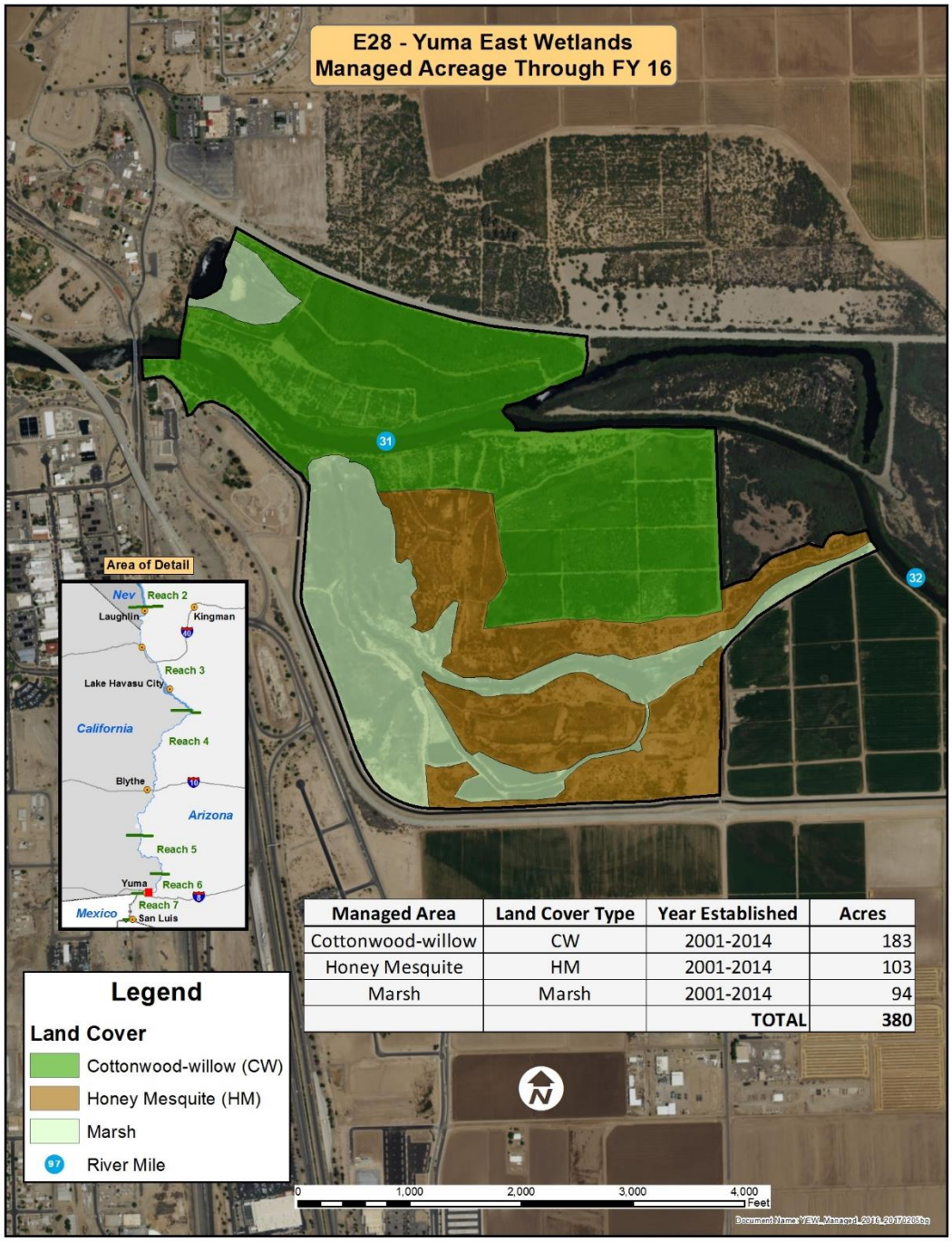


Figure 1-9.—E25 – Big Bend Conservation Area managed acreage through FY16.



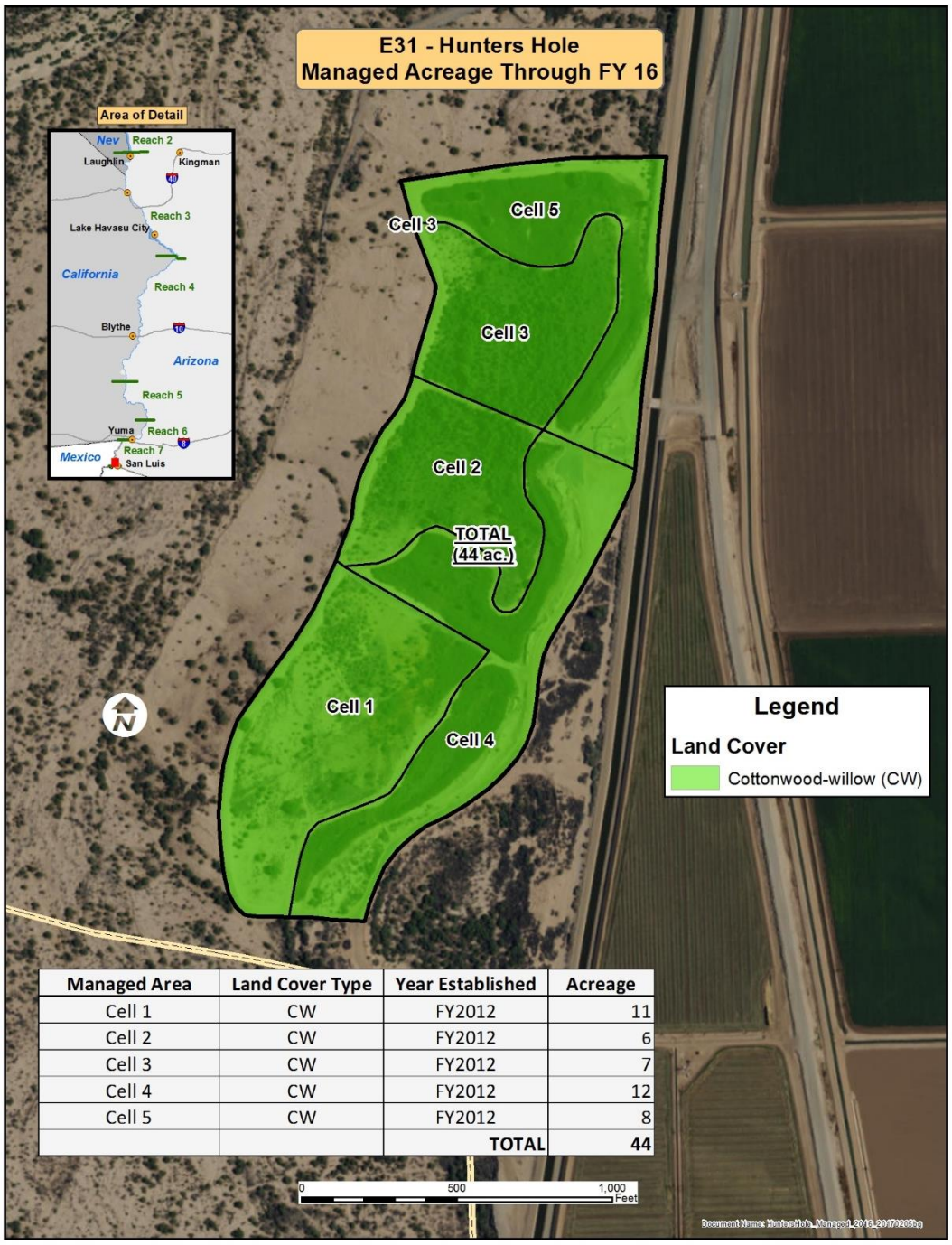
Managed Area	Land Cover Type	Year Established	Acreage
Reach 1, Arizona	CW	FY2014	377
Reach 1, Arizona	HM	FY2014	26
Reach 1, California	CW	FY2014	139
Reach 1, California	HM	FY2014	16
Reach 2, Arizona	CW	FY2015	512
Reach 2, California	CW	FY2015	11
Old River Channel, AZ	CW	FY2015	90
		TOTAL	1,171

Figure 1-10.—E27 – Laguna Division Conservation Area managed acreage through FY16.



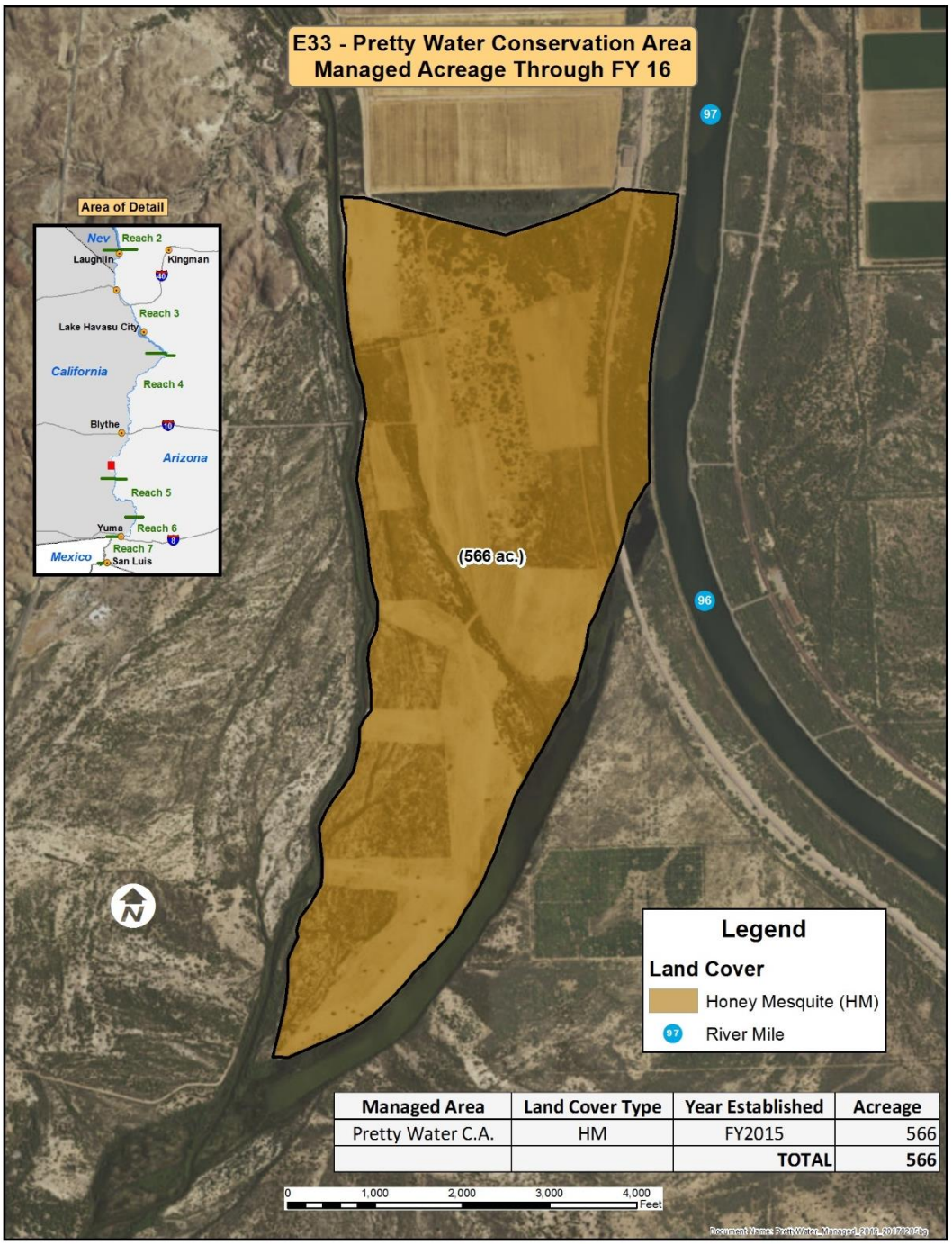
Managed Area	Land Cover Type	Year Established	Acres
Cottonwood-willow	CW	2001-2014	183
Honey Mesquite	HM	2001-2014	103
Marsh	Marsh	2001-2014	94
		TOTAL	**380**

Figure 1-11.—E28 – Yuma East Wetlands managed acreage through FY16.



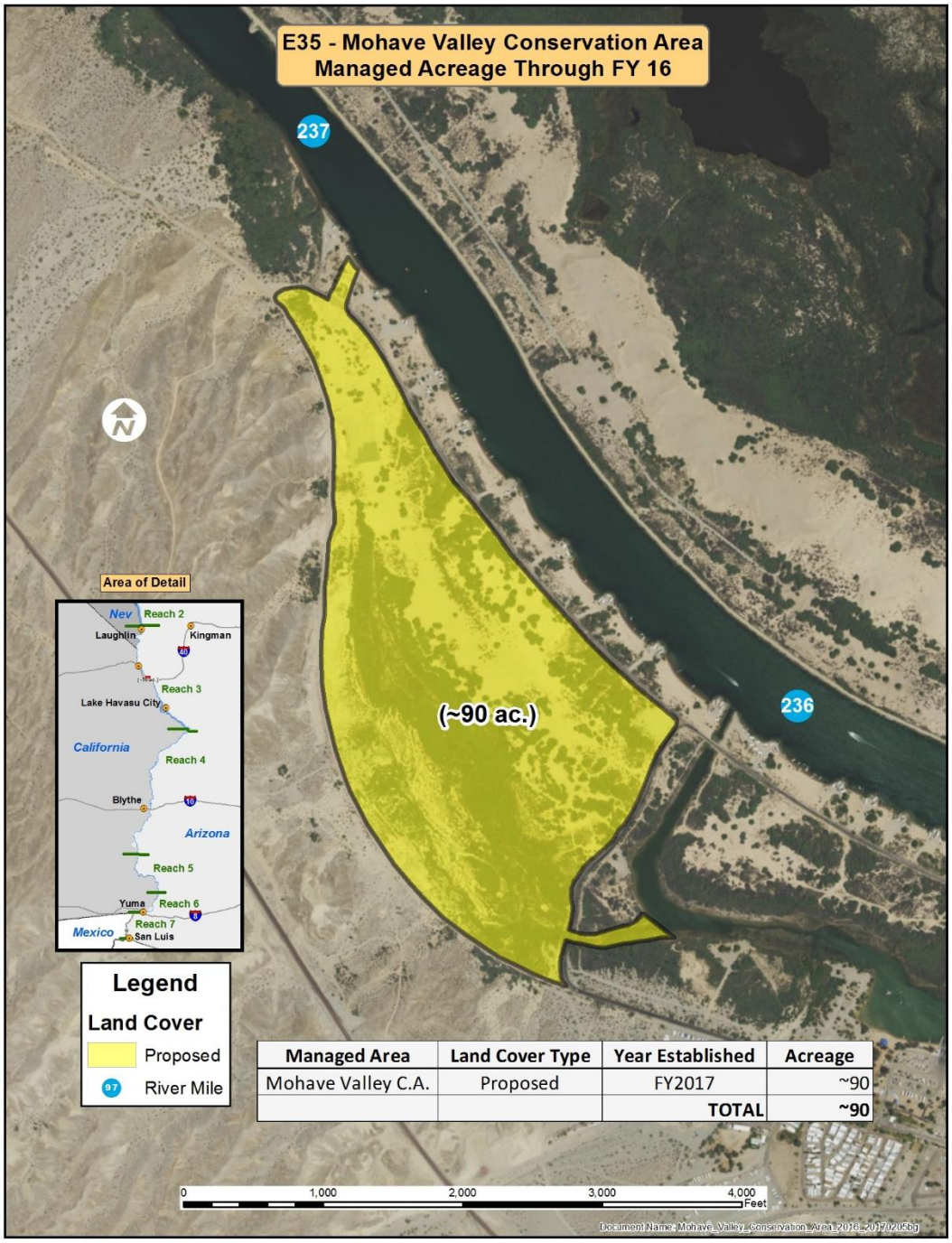
Managed Area	Land Cover Type	Year Established	Acreage
Cell 1	CW	FY2012	11
Cell 2	CW	FY2012	6
Cell 3	CW	FY2012	7
Cell 4	CW	FY2012	12
Cell 5	CW	FY2012	8
		TOTAL	**44**

Figure 1-12.—E31 – Hunters Hole managed acreage through FY16.



Managed Area	Land Cover Type	Year Established	Acreage
Pretty Water C.A.	HM	FY2015	566
		TOTAL	566

Figure 1-13.—E33 – Pretty Water Conservation Area managed acreage through FY16.



Managed Area	Land Cover Type	Year Established	Acreage
Mohave Valley C.A.	Proposed	FY2017	~90
		TOTAL	~90

Figure 1-14.—E35 – Mohave Valley Conservation Area managed acreage through FY16.

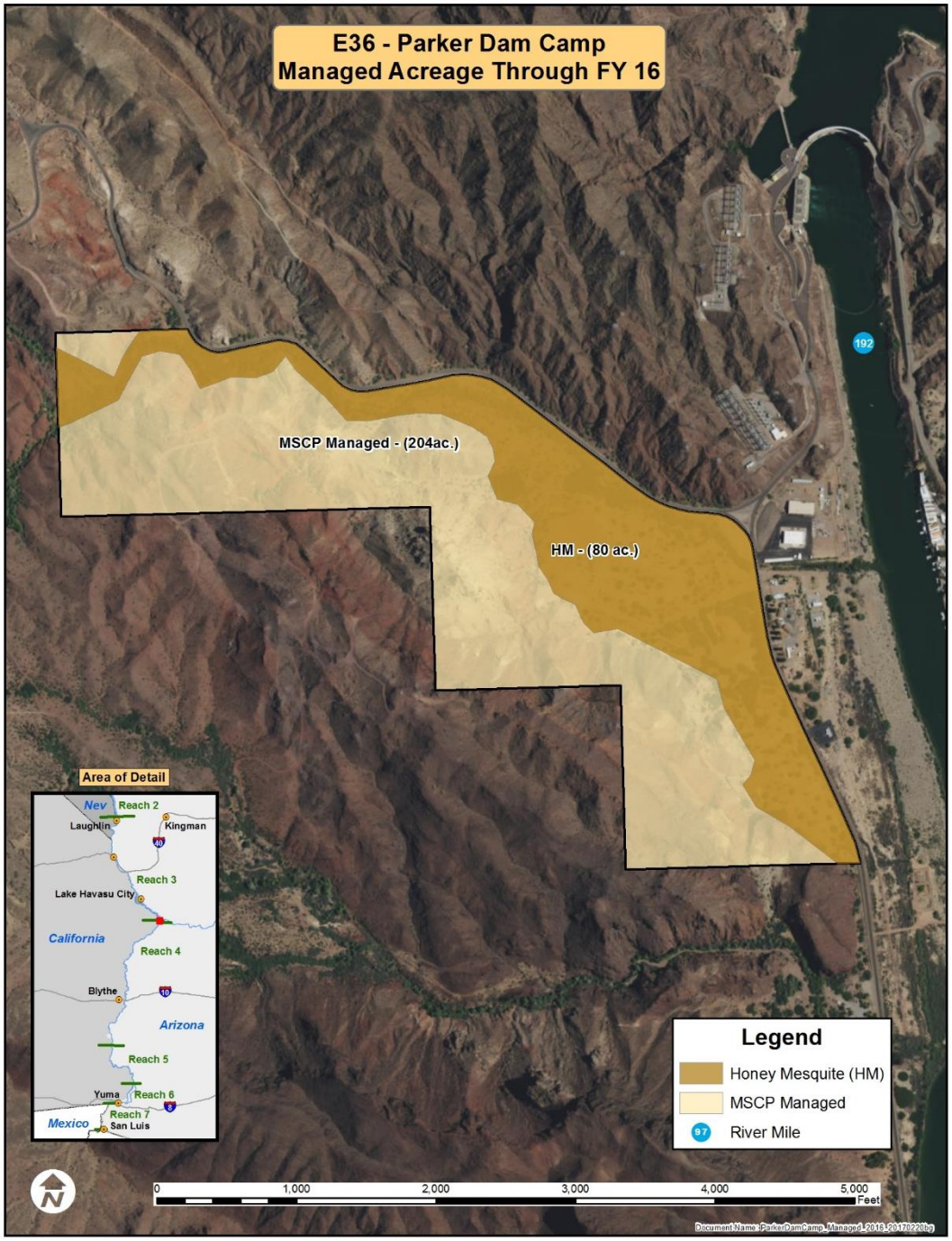


Figure 1-15.—E36 – Parker Dam Camp managed acreage through FY16.

as a LCR MSCP conservation area. The conservation area is located south of Blythe, within the Palo Verde Irrigation District and within the State of California. Initial investigations were conducted under Work Task E16 and included an evaluation of available soils data and a conceptual layout for restoration. Prior to the drafting of a land and water resolution, the property will be appraised through the Office of Evaluation Services.

Potential Conservation Areas

Backwaters and Marsh within Reaches 4 and 6: Investigations of areas on which to create backwaters or marshes have expanded into Reach 6. Reaches 4 and 6 have land available for establishment of marshes and backwaters in California. Preliminary restoration concepts for potential conservation areas are being developed, land status is being determined, and both river data and groundwater information are being collected.

Davis Lake: No additional investigations are anticipated at this time.

Topock Marsh Inlet Canal: The cadastral survey is underway to determine land ownership. The survey has required extensive records research, field verification, placement of monuments, and discussion with multiple partners; therefore, a restoration concept is not anticipated until at least FY18.

FY18 Proposed Activities

Proposed Conservation Areas

Dennis Underwood Conservation Area: It is anticipated that a land and water resolution will be presented to the LCR MSCP Steering Committee to approve the Dennis Underwood Conservation Area. Obligations would be tracked under Work Task E39.

Potential Conservation Areas

Coordination with resource agencies will continue in order to identify and establish the remaining conservation areas necessary to complete the habitat creation requirements of the program. Over 5,000 acres of land cover types have already been established. New conservation areas are needed to complete the marsh and backwater CESA permit commitments in California. Less than 1,000 acres of cottonwood-willow still need to be established in either Arizona, California, or Nevada.

Development and Maintenance

Habitat development and maintenance are strongly connected. Created habitat is achieved through the process of development, establishment, and modification of a site as well as growth (maturation) of the land cover type. Subsequent

management of that land cover type either maintains the specific requirements necessary for that created habitat or moves that land cover type toward achievement of those specific habitat requirements.

Habitats, both aquatic and terrestrial, are dynamic. They are better described as a continuum rather than a stage of development or succession. By using knowledge gained from research, demonstrations, and experience, sites with the greatest potential for success can be identified, and the most effective designs and approaches can be employed to create the targeted cover type.

In the context of current conditions, achieving the desired habitat under the LCR MSCP calls for establishing and managing for a snapshot in time and ecological succession, which may require actively creating disturbances to reset or maintain the land cover type in the proper seral stage (in the case of some riparian habitat). For a backwater, it may involve removing organic matter from the bottom surface to reduce biological oxygen demand and maintaining acceptable levels of water quality. In any case, habitat creation does not necessarily end with the establishment of the proper vegetation type or isolation of a backwater.

Over the course of identifying and selecting sites, conducting research studies and demonstration projects, and developing and managing created land cover types, information is gathered that may help to better understand these processes. This feedback, in turn, may serve to modify site selection or establishment approaches for future projects. The information can also reveal program needs not previously anticipated. For example, during collections for Work Task E7 (closed), it became apparent that establishment of native plant nurseries would be needed to supply an adequate source of cuttings for future large-scale propagation and establishment of riparian vegetation. A centralized location with an easily accessible supply of riparian species would also reduce the time and costs associated with collection. These nurseries were incorporated into the phased development plans for Work Tasks E4 and E5.

Each site, whether identified as a marsh, backwater, honey mesquite, or cottonwood-willow cover type, will have its own set of site-specific challenges to overcome.

The HCP includes tentative schedules for development of all four land cover types, with a final end date for habitat creation of 2036. However, the funding described in the HCP reflects an end date of 2026 for habitat creation, assuming efficient habitat creation techniques are identified during the first few years of implementation. To balance available resources and ensure progress is being made to complete the habitat requirements under the LCR MSCP, habitat creation is expected to be complete in 2026 in conformance with the funding schedule. Since funding estimates are based on 5-year periods, habitat creation includes both long-term planning and a selection of projects to implement within the next 5 years, which allows time for planning, site evaluation, coordination with partners, design, permitting, and sequencing into the program.

Five-Year Projection: For 2016–21, restoration has occurred or is expected to occur at (1) Cibola NWR Unit #1, (2) the CVCA, (3) the MVCA, (4) Planet Ranch, (5) PVER-South, (6) Parker Dam Camp, (7) Three Fingers Lake, and (8) the Dennis Underwood Conservation Area. However, the LCR MSCP is flexible enough to take advantage of other restoration opportunities and utilizes the work plan (annual report) to refine short-term restoration projections.

FY16 Accomplishments

The focus of development in FY16 was completion of the planting of cottonwood-willow at Phase 8 of the CVCA, planting of cottonwood-willow at lower Hippy Fire at Cibola NWR Unit #1, and the acquisition and securing of water rights at Planet Ranch.

Cibola Valley Conservation Area

Phase 8 was planted and established 111 acres of cottonwood-willow. Of the available 1,282 acres, 376 acres of cottonwood-willows and 477 acres of honey mesquite have been established. Annual plantings are projected, with complete development projected of the CVCA in 2019.

Cibola National Wildlife Refuge Unit #1 Conservation Area

The lower Hippy Fire area was planted and established 98 acres of cottonwood-willow. Of the available 950 acres, 463 acres of cottonwood-willows have been established. Annual plantings are projected, with complete development projected of Cibola NWR Unit #1 in 2020.

Planet Ranch

To ensure the viability of water rights associated with this property, over 1,200 acres of alfalfa (*Medicago sativa*) were grown as pasture from December 16, 2015, through December 15, 2016. Water usage, when combined with acreage being farmed, documented the beneficial use of water on the property.

The acquisition of Planet Ranch involved multiple partners and included both the sever and transfer of water rights as well as a portion of existing water rights remaining in the valley. As a result, the program gained 396 acres of creditable cottonwood-willow habitat downstream on the Bill Williams River NWR because groundwater that could be consumed in the basin will now remain in the basin to support riparian habitat. In return, the program made the commitment to promote recruitment of cottonwood-willow during releases from Alamo Dam for this section of the refuge.

A workshop focused on isolated backwater construction and management was held. As a product of the workshop, the backwaters to be created would be a mix of refugia ponds and smaller grow-out ponds.

The total number of acres managed by land cover type and by reach and State on established conservation areas is shown in tables 1-13 and 1-14. The LCR MSCP, through FY16, has 9,946 acres (table 1-13) of land available for the program, of which 9,630 acres are being actively managed. Not all acreage can or will be converted into either of the four land cover types due to resource limitations or the habitat creation needs of the program.

Table 1-13.—Managed Acres by Conservation Area Through FY16

Conservation Area	Established Land Cover Types	Managed Acreage	Available Lands
Beal Lake Conservation Area (Arizona)	116	116	116
Big Bend Conservation Area (Nevada)	15	15	15
Cibola National Wildlife Refuge Unit #1 Conservation Area (Arizona)	461	950	950
Cibola Valley Conservation Area (Arizona)	853	966	1,282
Hart Mine Marsh (Arizona)	255	255	255
Hunters Hole (Arizona)	44	44	44
Imperial Ponds Conservation Area (Arizona)	92	126	126
Laguna Division Conservation Area (Arizona and California)	1,171	1,171	1,171
Palo Verde Ecological Reserve (California)	1,023	1,023	1,023
Parker Dam Camp (California)	80	204	204
Planet Ranch Conservation Area (Arizona)	396	3,814	3814
Pretty Water Conservation Area (California)	566	566	566
Yuma East Wetlands (Arizona)	380	380	380
Total	**5,452**	**9,630**	**9,946**

Of the 9,630 acres being actively managed by the LCR MSCP, the four land cover types have been established on approximately 5,452 acres. Acreages at conservation areas still in the planning phase, or for which there were no signed Land Use Agreements in FY16, such as the MVCA, PVER-South, Three Fingers Lake, and the Dennis Underwood Conservation Area, are not included in the tables 1-13 or 1-14 at this time. The MVCA acreage of approximately 90 acres will be included when construction is complete.

Table 1-14.—Land Cover Type by Reach and State Through FY16

	Cottonwood-Willow	Honey Mesquite	Marsh	Backwaters	TOTAL
Arizona					
Reaches 1 and 2	0	0	0	0	0
Reach 3	512	0	0	0	512
Reach 4	837	477	255	0	1,569
Reach 5	0	0	12	80	92
Reach 6	1,162	129	94	0	1,385
Reach 7	44	0	0	0	44
Total	**2,555**	**606**	**361**	**80**	**3,602**
California					
Reaches 1 and 2	0	0	0	0	0
Reach 3	0	0	0	0	0
Reach 4	945	724	0	0	1,669
Reach 5	0	0	0	0	0
Reach 6	150	16	0	0	166
Reach 7	N/A	N/A	N/A	N/A	N/A
Total	**1,095**	**740**	**0**	**0**	**1,835**
Nevada					
Reaches 1 and 2	0	0	0	0	0
Reach 3	0	0	0	15	15
Reaches 4–7	N/A	N/A	N/A	N/A	N/A
Total	**0**	**0**	**0**	**15**	**15**
TOTAL	**3,650**	**1,346**	**361**	**95**	**5,452**

FY17 Activities

Planting at the CVCA and Cibola NWR Unit #1 and the start of construction at the MVCA are planned. With the successful close of escrow of Planet Ranch, securing water rights was the first priority. Planning for stabilization and development of Planet Ranch has begun.

Cibola Valley Conservation Area

Planting of Phase 9 with the cottonwood-willow land cover type is expected to increase the established acreage at this conservation area by 76 acres. Annual plantings are projected, with complete development projected of the CVCA in 2019.

Cibola National Wildlife Refuge Unit #1 Conservation Area

Planting of portions of the middle Hippy Fire area with cottonwood-willow is expected to increase the established land cover types at this conservation area by 149 acres. Annual plantings are projected, with complete development projected of Cibola NWR Unit #1 in 2020.

Mohave Valley Conservation Area

Clearing and the start of excavation of approximately 1,200,000 cubic yards of material began in January 2017. Completion in 2018–19 is expected to result in the establishment of approximately 90 acres of all four land cover types, with a goal of 50 acres of backwater.

Planet Ranch

To ensure the viability of water rights associated with this property, over 1,200 acres of alfalfa are being grown as pasture from December 16, 2016, through December 15, 2017.

Permitting and refinement of the Restoration Development and Monitoring Plan, including design work on specific areas of development, will be initiated. Minor construction or upgrading of facilities, such as at the maintenance shop, to support development and long-term management are anticipated.

Reclamation participation on the Bill Williams River Corridor Steering Committee will continue. Converting lands from private ownership to a resource agency provides additional flexibility in the release of water from Alamo Dam. Lands secured within the active flood plain, as well as lands downstream on the Federal refuge, benefit from releases from both normal as well as high flow releases from the dam and can be conducted without affecting these former privately owned lands. However, during the period of time when development is occurring, it will be requested that high flow events be held to a minimum. The

intent of high flows are understood and supported, and the LCR MSCP has been coordinating with both the USFWS and the U.S. Army Corps of Engineers on potential high flow events.

FY18 Proposed Activities

Planting of cottonwood-willow and honey mesquite will continue at the CVCA and Cibola NWR Unit #1 along with construction at the MVCA. Development of Planet Ranch will also continue.

Cibola Valley Conservation Area

Planting of Phase 10 with honey mesquite is expected to increase the established land cover types at this conservation area by 123 acres. Annual plantings are projected, with complete development projected of the CVCA in 2019.

Cibola National Wildlife Refuge Unit #1 Conservation Area

Planting of cottonwood-willow in the North 160 is expected to increase the established land cover types at this conservation area by 158 acres. Annual plantings are scheduled, with complete development projected of Cibola NWR Unit #1 in 2020.

Mohave Valley Conservation Area

Land-based excavation, dredging, and contouring of this conservation area to create a backwater for native fishes within California will continue.

Planet Ranch

Construction will be initiated. Water usage will no longer be tracked, and farming will be discontinued. A permanent Federal presence is expected to be onsite.

Dennis Underwood Conservation Area

Management of this conservation area is anticipated pending approval by the Steering Committee. A restoration development and monitoring plan will be drafted.

Adaptive Management Program (Section G)

Restoration research and demonstration projects help supply new information to adaptively manage habitat creation projects, making them more effective in

meeting species-specific habitat requirements and managing costs to meet those requirements. In general, adaptive management research projects are those that have specific research questions and are supported by a robust, replicated study design in which some level of analysis can be conducted and inferences made. These projects may include, but are not limited to, research directed at habitat development to meet species needs, improving vegetation growth and survival, testing alternate propagation and habitat establishment techniques, habitat manipulation, determining habitat creation potential at identified sites based on current ecological functions, and evaluating technologies to assist in meeting specific habitat requirements.

Work tasks can address specific research questions or use demonstration projects to assess a particular technique to determine whether the technique might be feasible and effective. Demonstration projects are designed to evaluate techniques, effectiveness, and cost efficiency. These projects may have vegetation that matures into a land cover type that meets the specific criteria for created habitat for the covered species. Until that time, these projects will be referred to as research or demonstration projects. Both of these types of investigations increase knowledge of habitat creation and will be used to inform management and future selection and implementation of habitat creation projects.

FY16 Accomplishments

Soil and Groundwater Salinity Monitoring Network

The monitoring locations established under Work Task E34 were established for research and demonstration purposes. Now that the research and demonstration phase has been completed (FY16), future maintenance and expansion of the monitoring network will be covered under Work Task F1. Existing and future monitoring locations will be operated and maintained throughout the life of the LCR MSCP to ensure that data are available to inform management decisions for the long term. In addition to providing data for the successful management of vegetation, this work task has also provided data for Work Tasks C60 and F1. The collection of data under Work Task E34 for Work Tasks C60 and F1 reduces the duplication of data collection efforts and provides necessary data for these other work tasks to fulfill their objectives.

A preliminary soil moisture monitoring effort was initiated in FY15 as the first step in establishing the larger salinity and soil moisture network. The purpose of this effort was twofold: (1) to collect data to determine the temporal and spatial distribution of surface soil moisture at non-LCR MSCP southwestern willow flycatcher-occupied sites (Rockhouse Riparian Demonstration Project near Roosevelt Lake, Arizona, and three survey areas [new for FY16] on the Middle Rio Grande in New Mexico) and at an established LCR MSCP conservation area that has only had southwestern willow flycatcher detections in recent years (one in 2015 and one in 2016) and (2) to provide background information for expanding the soil moisture network across all LCR MSCP conservation areas.

Specific objectives included (1) establishing the necessary standards and protocols, (2) identifying equipment and instrument needs for expanding the network, (3) identifying the level of effort needed for expanding the network, and (4) identifying potential issues that may arise while expanding the network. These objectives were fulfilled in FY16 and will provide the necessary information to expand this network to additional conservation areas.

These data will be used to make habitat management decisions related to (1) the soil moisture needs for avian habitat requirements and (2) vegetation health requirements – sufficient soil moisture to meet evapotranspiration needs and maintain soil and groundwater salinity levels within established thresholds.

Habitat Manipulation

Several covered avian species require habitat with early- to mid-successional stages of native riparian trees. In natural systems where periodic flooding is a component of the system, portions of the habitat can be periodically disturbed and reset to earlier successional stages and associated structural diversity. The LCR MSCP riparian conservation areas are planted densely in order to reduce invasive species competition with native species and to provide habitat for covered avian species. Over time, some of the LCR MSCP riparian habitat creation sites may grow out of suitable habitat for some covered species unless management actions are taken.

Without the disturbance events that were once more common in the historic river hydrograph, direct manipulation of portions of these conservation areas may be required. Information collected will be used to perform assessments and provide protocols to inform deliberate habitat manipulations to enhance structural diversity and to produce the appropriate serial stages of habitat for covered species.

Aerial laser scanning (ALS) and terrestrial laser scanning (TLS) data were processed and analyzed during FY16. These data were collected in FY15 using the vegetation monitoring protocol developed during FY15, which was based on information from the CEMs and past foliage height diversity measurements. The data were collected in a non-LCR MSCP southwestern willow flycatcher-occupied site (Rockhouse Riparian Demonstration Project near Roosevelt Lake, Arizona) and at the PVER.

This initial analysis compared these two sites to evaluate the habitat suitability for the southwestern willow flycatcher since the Rockhouse Riparian Demonstration Project has had evidence of southwestern willow flycatcher breeding since 2010, while only two southwestern willow flycatchers have been detected at the PVER to date (one in 2015 and one in 2016). The analysis showed some differences in vegetation structure between the two sites, but since it included only one southwestern willow flycatcher-occupied site, additional southwestern willow

flycatcher-occupied sites will be analyzed before any recommendations or conclusions regarding habitat manipulation are made. This comparison was achieved through the development of several metrics that describe the vegetation structure throughout the canopy with the ability to identify structural diversity and successional growth stages.

The analysis also concluded that ALS data were sufficient to describe riparian forest habitat required by the vegetation monitoring needs of the LCR MSCP. The added detail provided by the TLS technique was not necessary, and the advantages of the ALS technique far outweighed any advantage provided by TLS.

A literature review to gather information to better manage marsh habitats was finalized. The literature review identified management techniques that could be implemented at LCR MSCP conservation areas that contained marsh land cover types.

FY17 Activities

Soil and Groundwater Salinity Monitoring Network

A scope of work is being drafted under Work Task F1 using the protocols developed and the lessons learned under Work Task E34. The scope of work will include a schedule that will be based on priority, targeting the higher priority (high soil salinity and higher southwestern willow flycatcher potential) areas first. The scope of work will also identify the parameters to be collected at each conservation area since this will be dictated by site conditions (i.e., salinity will not be monitored if there is a low risk for soil salinization).

Habitat Manipulation

The methods developed in FY16 to process and analyze ALS data to describe vegetation structure are being automated to facilitate future processing. Once the automated procedure is complete, ALS data collected at LCR MSCP conservation areas (with cottonwood-willow land cover type) and southwestern willow flycatcher-occupied sites throughout the Southwest United States will be processed and analyzed. The data from the southwestern willow flycatcher-occupied sites will be used to develop ranges for each of the vegetation metrics. The LCR MSCP conservation areas will then be evaluated against these ranges to make recommendations on whether some level of habitat manipulation is warranted or not. In addition to the assessment for southwestern willow flycatcher habitat suitability, vegetation structural diversity assessments will also be performed to identify conservation areas with low structural diversity and/or those with later successional stages of growth.

One of the marsh habitat manipulation techniques identified in the literature review will be tested at Hart Mine Marsh. Mechanical disturbance will be performed at the site during FY17, and vegetation response data will be collected

using unmanned aerial systems equipped with multispectral and photographic sensors. The sensors will be used to create three-dimensional models of the vegetation that describe structure and species composition. The results of this test will help determine whether or not this management technique should be included in the long-term marsh habitat manipulation toolbox.

FY18 Proposed Activities

Soil and Groundwater Salinity Monitoring Network

Instrumentation will be installed at several conservation areas as part of the salinity and soil moisture monitoring network under Work Task F1 using the scope of work being developed in FY17. Data collected are expected to track and support the long-term health and survival of established land cover types. Over the course of 5–7 years, the monitoring network will be expanded to address the needs of all conservation areas. However, given the site-specific nature of each site, the monitoring network will not be uniform; it will reflect the actual site conditions, and higher priority (high soil salinity and higher southwestern willow flycatcher potential) areas will be targeted first.

Habitat Manipulation

ALS data will continue to be acquired in FY18 and will be processed and analyzed using the techniques developed in FY17. The long-term monitoring under this research work task will help inform the LCR MSCP about what level of active habitat manipulation is necessary. If habitat manipulation is deemed necessary, appropriate riparian forest habitat manipulation techniques will be identified. Habitat manipulation tests at select LCR MSCP conservation areas will be considered, with the goal of evaluating techniques for inclusion in the long-term riparian forest habitat manipulation toolbox.

Vegetation response monitoring will continue at Hart Mine Marsh using data acquired with unmanned aerial systems. This monitoring will continue to inform the LCR MSCP about whether mechanical disturbance should continue to be included in the long-term marsh habitat manipulation toolbox. Additional marsh habitat manipulation techniques will also be considered.

Restoration research in future years may focus on (1) the efficient use of Colorado River water, (2) ensuring moist soil conditions are maintained when necessary and practical, (3) planting and/or seeding techniques, and (4) the protection and long-term management of conservation areas for covered species.

WORK TASKS – SECTION A

Program Administration

Work Task A1: Program Administration

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,411,966	$1,188,765.48	$12,135,038.47	$1,418,074	$1,435,380	$1,435,380	$1,435,380

Contact: John Swett, (702) 293-8555, jswett@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Program administration

Conservation Measures: N/A

Location: N/A

Purpose: Program administration

Connections with Other Work Tasks (Past and Future): N/A

Project Description: Under this work task, senior staff and administration receive support to manage implementation of the LCR MSCP. The Program Manager directs functions and activities associated with implementation of the Habitat Conservation Plan to ensure completion of activities in accordance with the program documents.

Previous Activities: The LCR MSCP Office was established in the Bureau of Reclamation's Lower Colorado Region (Boulder City, Nevada) in 2005. The Steering Committee was established in accordance with the Funding and Management Agreement, and the bylaws for the Steering Committee were approved.

FY16 Accomplishments: Under Work Task A1 for FY16, management of the LCR MSCP continued. Ongoing administrative activities included financial, human resources, and other support for the program. The Steering Committee met on October 28, 2015 and April 27, 2016. At the October 28th meeting, the Steering Committee approved the Fish Augmentation Plan 2015–2020. At the April 27th meeting, the Steering Committee approved a minor modification to the Funding and Management Agreement. A technical work group conference call was held in April 2016 to review upcoming actions of the committee. The *Final*

Implementation Report, Fiscal Year 2017 Work Plan and Budget, Fiscal Year 2015 Accomplishment Report was prepared. Financial tracking of the program continued, and the annual financial work group meeting was held.

FY17 Activities: Under Work Task A1 for FY17, management of the LCR MSCP will continue. Ongoing administration activities will include financial, human resources, and other support for the program. Coordination with the Steering Committee continued with meetings held on October 26, 2016, and April 26, 2017. Technical work group meetings will be held 1 month prior to these dates to review upcoming actions of the Steering Committee. The *Draft Implementation Report, Fiscal Year 2018 Work Plan and Budget, Fiscal Year 2016 Accomplishment Report* was prepared. Financial tracking for the program will continue, and the annual financial work group meeting will be held. The process for adding the northern Mexican gartersnake (*Thamnophis eques megalops*) to the covered species list will be initiated.

Proposed FY18 Activities: Under Work Task A1 for FY18, management of the LCR MSCP will continue. Ongoing administration activities will include financial, human resources, and other support for the program. Coordination with the Steering Committee will continue with biannual Steering Committee meetings, specific work group meetings, and email announcements. The *Final Implementation Report, Fiscal Year 2019 Work Plan and Budget, Fiscal Year 2017 Accomplishment Report* will be prepared. Financial tracking of the program will continue, and the annual financial work group meeting will be held.

Pertinent Reports: The *Final Implementation Report, Fiscal Year 2017 Work Plan and Budget, Fiscal Year 2015 Accomplishment Report* is posted on the LCR MSCP Web site. The *Final Implementation Report, Fiscal Year 2018 Work Plan and Budget, Fiscal Year 2016 Accomplishment Report* will also be posted upon completion.

WORK TASKS – SECTION B

Fish Augmentation

Work Task B1: Lake Mohave Razorback Sucker Larvae Collections

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$200,000	$216,932.74	$2,354,070.71	$215,000	$215,000	$215,000	$215,000

Contact: Patricia Delrose, (702) 293-8202, pdelrose@usbr.gov

Start Date: FY04

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: RASU3, RASU5, and RASU8

Location: Reach 2, Lake Mohave, Arizona/Nevada

Purpose: To develop the razorback sucker (*Xyrauchen texanus*) broodstock in Lake Mohave, maintain the broodstock, and harvest offspring for rearing as needed for the LCR MSCP Fish Augmentation Program

Connections with Other Work Tasks (Past and Future): Work Tasks B2, B3, B4, B5, B6, and B7 are related to this work task, as the razorback suckers to be reared under these work tasks originate from Lake Mohave. Other research related to larvae collection, handling, and genetics include Work Tasks C30 (closed), C31, and C40.

Project Description: The razorback sucker broodstock in Lake Mohave provides a level of genetic diversity found nowhere else in the world. Under this project, wild-born razorback sucker larvae from Lake Mohave are captured and delivered to the Willow Beach National Fish Hatchery (Willow Beach NFH) for initial rearing. The work involved under this work task includes surveys to locate spawning groups, nighttime larvae collection, and maintaining the boat fleet and field station at Cottonwood Cove. Larvae are captured one at a time, making this a labor-intensive program.

Work normally commences in January and extends into late April or early May. Equipment is delivered to and staged at Cottonwood Cove where a field station is established. The lake's shoreline is surveyed, and locations of spawning aggregations of razorback suckers are recorded. Razorback sucker larvae attracted to submerged lights suspended from boats are captured by net and

counted. The larvae are transferred to the Willow Beach NFH, by either boat or vehicle, where they are logged in by date received, number collected, and location. This work task is repeated 3 to 4 nights per week through mid-to-late April. Research under Work Task C31 has helped to define larvae collection protocols. In order to represent the high genetic diversity of razorback sucker larvae used for rearing, collection efforts will continue to be distributed both temporally across the spawning season and spatially among the known spawning areas on Lake Mohave.

Previous Activities: This work task is part of a program started by the Lake Mohave Native Fish Work Group in 1989 to rebuild the adult stock of razorback suckers in Lake Mohave so that these fish could be used as brood fish for razorback sucker conservation and recovery. A portion of the larvae collected is used to sustain the broodstock, and the remaining larvae are reared for release into Reaches 2–5 to accomplish the augmentation goals of the program. In 2007, an invasive species, quagga mussels (*Dreissena bugensis*), were found within the Lake Mead National Recreational Area, which includes Lake Mohave. To avoid transferring this species into other waters where they currently do not exist, larvae are no longer transported outside the lower Colorado River to the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico, or the Bubbling Ponds Fish Hatchery. Therefore, there is no longer a connection with Work Tasks B4 or B5.

FY16 Accomplishments: A target of 18,000 larvae was established for FY16 in coordination with the Lake Mohave Native Fish Work Group. This quantity was established to provide the appropriate number of larvae for the new rearing strategy at the Willow Beach NFH. Of these larvae, 14,607 were reserved for rearing at the Willow Beach NFH, and the remaining were reserved for rearing at the Lake Mead Fish Hatchery.

A total of 18,050 wild larvae were collected from four areas of Lake Mohave. The Willow Beach NFH received 14,607 larvae for further grow-out. The remaining 3,443 were delivered to the Lake Mead Fish Hatchery for further grow-out. The contribution from each zone of Lake Mohave by month of capture is presented in table 1.

Table 1.—Larval Razorback Suckers Collected from Lake Mohave, 2016*

Location	January	February	March	April	May	Total
Nine Mile	0	1,670	2,823	618	0	5,111
Tequila	150	1,800	2,290	762	0	5,002
Yuma	300	2,100	2,464	628	0	5,492
Above Owl Point	0	928	598	919	0	2,445
Total	**450**	**6,498**	**8,175**	**2,927**	**0**	**18,050**

* Larvae collection numbers should be considered approximations. Larvae are collected by hand and counted during collection; however, exact counts of larvae are not verified.

Remote passive integrated transponder scanners were placed throughout the spawning areas to assess the population of fish spawning at each location. Telemetry tags have also been used on adult stocked fish in an attempt to find new spawning areas.

FY17 Activities: A target of 33,000 larvae was established for FY17 in coordination with the Lake Mohave Native Fish Work Group. The increase in the larval collection goal for FY17 is to prepare for future razorback sucker augmentation goals, rebuild fish stocks due to losses at the Willow Beach NFH in early FY17, and provide contingencies for other unforeseen events. Distribution of the 33,000 larvae is as follows: 3,500 larvae will be delivered to the Lake Mead Fish Hatchery for further grow-out, and the Willow Beach NFH will receive 20,500 larvae. Of these, 15,000 larvae will remain on station for rearing. Once 5,500 of these larval fish at the Willow Beach NFH have reached fingerling size, they will be transferred to the Lake Mead Fish Hatchery for continued rearing. The remaining 9,000 larvae collected from Lake Mohave will be delivered to the Achii Hanyo Native Fish Rearing Facility for rearing. As part of the effort to better represent larvae collections from the Lake Mohave riverine subpopulation, up to 5,000 of the larval goal of 33,000 will be collected from areas upstream of the Willow Beach NFH. Increasing the collection effort in this area may provide a better representation of the total genetic makeup of razorback suckers within the Lake Mohave system.

The projected increase in the budget estimate for FY17 is attributed to the implementation of additional safety measures associated with collecting larvae as well as the increased effort needed to achieve FY17 larval goals, which includes the use of check-in/check-out protocols with National Park Service radio dispatch to ensure nighttime crews get off the water safely. Additional resources may be necessary to achieve the increased larval goals for FY17. These increased efforts may result in exceeding the approved FY17 budget estimate.

Proposed FY18 Activities: Razorback sucker larvae collections will continue. The target level for FY18 is expected to be 25,000–30,000 larvae.

Pertinent Reports: The status report titled *Five-Year Summary of Razorback Sucker (Xyrauchen texanus) Larval Collections on Lake Mohave: 2010–2014* will be posted on the LCR MSCP Web site upon completion.

Work Task B2: Willow Beach National Fish Hatchery

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$325,000	$309,156.64	$3,717,532.47	$325,000	$325,000	$325,000	$325,000

Contact: Ty Wolters, (702) 293-8463, twolters@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: BONY3, BONY4, RASU3, RASU4, and RASU5

Location: Reach 2, Willow Beach, Arizona

Purpose: To annually contribute razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) to the LCR MSCP Fish Augmentation Program

Connections with Other Work Tasks (Past and Future): The Willow Beach National Fish Hatchery (Willow Beach NFH) receives larval razorback suckers under Work Task B1 and bonytail under Work Task B4. Some of these fishes are transferred to the Achii Hanyo Native Fish Rearing Facility (B3) for rearing. Some fishery research actions described in Species Research (Section C) have occurred at the Willow Beach NFH, including Work Tasks C10 (closed) and C30 (closed).

Project Description: The Willow Beach NFH is managed by the U.S. Fish and Wildlife Service. The hatchery receives program funding to rear razorback suckers and bonytail for the LCR MSCP Fish Augmentation Program. There are three primary tasks at this hatchery:

1. **Receive fish to be reared.** The Willow Beach NFH annually receives wild razorback sucker larvae collected from Lake Mohave and fingerling bonytail (25–75 millimeters [mm] total length [TL]) from the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (B4).

2. **Provide fish to other hatcheries.** Initially, the Willow Beach NFH was to provide fingerling razorback suckers to the Bubbling Ponds Fish Hatchery to be further reared and ultimately stocked into Reaches 3–5, provide fingerling razorback suckers from wild-caught larvae to the

Southwestern Native Aquatic Resources and Recovery Center for further rearing and eventual repatriation into Lake Mohave, and provide juvenile bonytail and razorback suckers to the Achii Hanyo Native Fish Rearing Facility for further rearing and ultimately for stocking into Reaches 3–5. Due to quagga mussel (*Dreissena bugensis*) infestations, the Willow Beach NFH is only delivering fishes to the Achii Hanyo Native Fish Rearing Facility and the Lake Mead Fish Hatchery.

3. **Annually rear razorback suckers for release into the lower Colorado River.** The Willow Beach NFH will rear 8,000 subadult razorback suckers for stocking into Reaches 2–5 and, in addition, rear up to 1,000 razorback suckers greater than 400 mm TL for repatriation into Lake Mohave. All razorback suckers stocked into Reaches 2 and 3 will be a minimum of 300 mm TL. All razorback suckers stocked into Reaches 4 and 5 will be a minimum of 305 mm TL.

Previous Activities: This cold-water hatchery began operation in 1962 to produce rainbow trout (*Oncorhynchus mykiss*) for recreational fishing. Between 1994 and 1997, the U.S. Fish and Wildlife Service and the Bureau of Reclamation cooperatively added solar heating systems to the hatchery, converting 50% of its rearing capacity to warm-water fish production. Each year since 1996, the hatchery has received wild razorback sucker larvae, reared juvenile razorback suckers, and repatriated fish back into Lake Mohave.

During January 2007, the exotic quagga mussel was discovered in Lake Mead and was subsequently found at the Willow Beach NFH. No razorback suckers were delivered to waters outside the lower Colorado River corridor. Quagga mussels have not severely impacted the maintenance or operation of the Willow Beach NFH; however, they continue to have an impact on the delivery of fishes.

FY16 Accomplishments: The rearing strategy at the Willow Beach NFH was changed in FY15 in an attempt to produce larger (400 mm TL average size) fish for stocking into Lake Mohave. This change was made to improve post-stocking survival of razorback suckers stocked into Lake Mohave and to ultimately increase the adult population of the lake. This strategy continued in FY16.

During FY16, 18,050 razorback sucker larvae were received from Lake Mohave, 451 razorback sucker juveniles were stocked to lakeside rearing ponds (B7), and 7,447 razorback suckers of at least 300 mm TL were repatriated into Lake Mohave (Reach 2). A total of 14,705 year-class 2013 razorback suckers, 9,043 year-class 2014 razorback suckers, and 21,030 year-class 2014 razorback suckers were on station at the start of FY16. A total of 15,000 bonytail fry were received from the Southwestern Native Aquatic Resources and Recovery Center and transferred to the Achii Hanyo Native Fish Rearing Facility (B3) for further grow-out. New filtering material was installed in the recirculation systems

within the raceways dedicated to razorback sucker production. New screens were built to accommodate the new filtering material. The majority of funds were for salary and consumable materials (fish feed, medicines, chemicals, etc.).

FY17 Activities: Early in FY17, an outbreak of the parasite Ich (*Ichthyophthirius multifiliis*) was discovered at the Willow Beach NFH. The infestation moved quickly through all the razorback sucker raceways on station and resulted in high mortality of nearly every year-class. Prior to the outbreak, the numbers of razorback suckers on station totaled over 46,000 fish (table 1).

Table 1.—Year-Class and Number of Razorback Suckers on Station at the Willow Beach NFH Early in FY17 Before and After the Outbreak of Ich

Year-Class	Number prior to Ich outbreak	Number Remaining
2013	10,403	0
2014	15,111	3,500
2015	10,224	0
2016	10,542	10,000

Following the outbreak of Ich, the Willow Beach NFH reported losses of over 32,000 razorback suckers. Approximately 13,500 fish remained on station after the outbreak and included approximately 3,500 razorback suckers in the 2014 year-class and approximately 10,000 razorback suckers in the 2016 year-class (see table 1).

Approximately 300 razorback suckers from the 2014 year-class were stocked into the lakeside backwaters on Lake Mohave in support of ongoing research projects. All of these razorback suckers were fin clipped for genetic samples and passive integrated transponder tagged prior to stocking in backwaters. No additional razorback suckers from the Willow Beach NFH are expected to be stocked in FY17.

The Willow Beach NFH will receive razorback sucker larvae from Lake Mohave in FY17 and will continue to rear and distribute the razorback suckers. No bonytail will be reared at the Willow Beach NFH in FY17.

A project was completed to improve flow rates for well number 3. It included drilling through the existing well to add an additional 100 feet and changing the pump and motor to use the available water.

Proposed FY18 Activities: The Willow Beach NFH will continue to receive razorback sucker larvae from Lake Mohave and rear and distribute razorback suckers for the LCR MSCP Fish Augmentation Program. Bonytail may be temporarily housed at the Willow Beach NFH before transfer to other facilities.

Pertinent Reports: Annual administrative reports are available upon request.

Work Task B3: Achii Hanyo Native Fish Rearing Facility

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$275,000	$269,149.88	$1,397,143.77	$50,000	$170,000	$170,000	$170,000

Contact: Ty Wolters, (702) 293-8463, twolters@usbr.gov

Start Date: FY04

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: BONY3, BONY4, RASU3, and RASU4

Location: Reach 4, Colorado River Indian Tribe Reservation, Parker, Arizona

Purpose: To support operation and maintenance of fish rearing facilities in order to annually contribute razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) to the LCR MSCP Fish Augmentation Program for stocking into Reaches 2–5 of the lower Colorado River (LCR)

Connections with Other Work Tasks (Past and Future): This project is related to Work Tasks B2 and B4, as fish from both the Willow Beach National Fish Hatchery (Willow Beach NFH) and the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center), may be transferred to the Achii Hanyo Native Fish Rearing Facility. Additionally, fish research for razorback suckers and bonytail may be accomplished at this station.

Project Description: This project supports both the development and maintenance of the Achii Hanyo Native Fish Rearing Facility. This station is used for the production of razorback suckers and bonytail for release into Reaches 3–5 of the LCR to meet a portion of the augmentation goals of the LCR MSCP and as a grow-out station for razorback suckers (Lake Mohave origin larvae transferred from the Willow Beach NFH) and bonytail (supplied from the Center). The numbers of razorback suckers and bonytail reared at this station are adjusted in response to stocking needs and space limitations at other facilities. Funds are used for staff salaries, station operation and maintenance, fish feed and chemicals, and fish distribution.

This station is located on the Colorado River Indian Tribe Reservation, near Parker, Arizona. There are nine earthen ponds that receive Colorado River water from an irrigation canal. A metal building was constructed to house 4 flow-through raceways and 3 circular tanks; in addition, 12 circular tanks are housed under an outside canopy, and there is 1 large, outside research tank.

Fish rearing operations are seasonal, producing one crop per year. Bonytail are brought in from the Center in winter. In most cases, these fish are first held at the Willow Beach NFH before being transferred to the Achii Hanyo Native Fish Rearing Facility. Fish are fed through spring and summer. In fall, the ponds are drained, and fish are harvested, tagged, and stocked. Fish under target size (less than 300 millimeters total length) are returned to a pond for continued rearing. New fish are then brought on station, and the process is repeated.

Previous Activities: In cooperation with the U.S. Fish and Wildlife Service, upgrades to this station have occurred since FY04. The work completed includes the construction of a metal tank house and fiberglass fish tanks, an office, a feed storage room, and restrooms; electrical upgrades; aeration system upgrades for fish tanks in the tank house; and the purchase of a backup generator.

FY16 Accomplishments: At the start of the year, 2,309 bonytail of the 2012 year-class, 20,529 bonytail of the 2014 year-class, 677 razorback suckers of the 2011 year-class and 3,195 razorback suckers of the 2012 year-class were on station. In December 2015, fishes were harvested and tagged, 139 razorback suckers were stocked into Reach 3, 2,372 razorback suckers were stocked into Reach 4, and 825 bonytail were stocked into Reach 3.

In FY16, ponds 1, 2, and 5 were drained and dried out in order to make improvements. The levy between ponds 1 and 2 was widened, and all ponds were reshaped, disked, and packed. The water intake area was rebuilt to prevent erosion from the incoming water. A new canal intake screen was installed. The old chain-link fence surrounding the station was removed and replaced, and two new gates were installed at the south entrance. A new toolshed was purchased to replace the old wornout unit. New electrical conduit and wire was installed in the Quonset building.

FY17 Activities: In December 2016, 1,685 bonytail from Achii Hanyo Native Fish Rearing Facility were stocked into Reach 3 of the LCR at Laughlin Lagoon. In addition, 885 razorback suckers were stocked into the LCR: 617 in Reach 2 at Cottonwood Cove and 268 in Reach 3 at Topock Marsh.

A change in rearing will commence in FY17. Losses of razorback suckers at the Willow Beach NFH due to the outbreak of the parasite Ich (*Ichthyophthirius multifiliis*) prompted the need for additional numbers of razorback suckers for the LCR MSCP augmentation program in future years. As part of this response, a portion of the rearing space previously designated for bonytail will be used to rear

additional razorback suckers. Approximately 9,000 razorback sucker larvae collected in Lake Mohave will be transferred to the Achii Hanyo Native Fish Rearing Facility in FY17.

Bonytail will be brought on station from the Center either as larvae or fingerlings to support bonytail production goals. Delivery of approximately 10,000 bonytail from the Center is expected in late winter.

Four ponds will be dried, disked, and graded to aid future harvests. All levee roads will be graded, and another layer of rock will be added. Bird deterrents will be installed on all ponds.

Funds to accomplish FY17 activities were obligated with FY16 funds. Obligating 2 years of funds reduces administrative costs and allows for flexibility at the station. The FY17 estimated budget has been reduced accordingly.

Proposed FY18 Activities: Bonytail left on station from FY17 will be reared to target size, and fingerling bonytail will be delivered from either the Willow Beach NFH or the Center. The plan is to increase production of razorback suckers at the Achii Hanyo Native Fish Rearing Facility to supplement those being repatriated into Lake Mohave due to the loss of available fishes from the outbreak of Ich at the Willow Beach NFH.

Pertinent Reports: Annual administrative reports are available upon request.

Work Task B4: Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$260,000	$253,146.40	$2,298,809.76	$260,000	$260,000	$260,000	$260,000

Contact: Ty Wolters, (702) 293-8463, twolters@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: BONY3, BONY4, HUCH1, RASU3, and RASU4

Location: Dexter, New Mexico

Purpose: To support operation and maintenance at the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center), support maintenance of the bonytail (*Gila elegans*) broodstock, and annually provide razorback suckers (*Xyrauchen texanus*) and bonytail for the LCR MSCP Fish Augmentation Program

Connections with Other Work Tasks (Past and Future): This work task is related to Work Tasks B2, B3, and B5, as fish from the Center will be delivered to the Willow Beach National Fish Hatchery (Willow Beach NFH), Achii Hanyo Native Fish Rearing Facility, and the Bubbling Ponds Fish Hatchery. Fish rearing research activities may also be conducted at the Center similar to work outlined in Work Tasks C10 (closed), C11 (closed), C14, and C30 (closed). A humpback chub (*Gila cypha*) refugium has been established at the Center as a safeguard in case of catastrophic events in the wild (C14).

Project Description: The Center is managed and operated by the U.S. Fish and Wildlife Service. It maintains one of only two refuge populations of bonytail in the world and has the only broodstock maintained and managed for bonytail production. The Center also retains a backup broodstock of razorback suckers. Funds provided will be used to maintain an extant broodstock, annually produce fingerling bonytail for distribution to other hatcheries, and to annually rear bonytail for distribution within Reaches 2–5. The Center plans to target a

305 millimeters (mm) total length (TL) for all bonytail stocked in FY16–18; however, fishes with TLs of 300 mm or larger may be stocked into Reach 3, while fishes stocked into Reaches 4 and 5 will be 305 mm TL or larger.

Previous Activities: The Bureau of Reclamation and the U.S. Fish and Wildlife Service have past and ongoing Interagency Agreements to support rearing and research for razorback suckers and bonytail at the Center. Beginning in FY14, the Center was not required to provide subadult razorback suckers for stocking into the lower Colorado River (LCR). The space made available by this action is being devoted to increased production of bonytail for the LCR MSCP.

FY16 Accomplishments:

Bonytail: The Center maintained 1,812 adult bonytail as broodstock that comprised six year-classes of Lake Mohave origin fish. In addition, 1,267 fish from the 2012–14 year-classes were transferred to the Mora National Fish Hatchery to be maintained as a backup broodstock and refuge population. An additional 1,000 bonytail were reared while building the broodstock for the Mora National Fish Hatchery, and ultimately these fish were added to the Center's inventory, bringing the total adult bonytail broodstock to 2,812 for FY16. Approximately 40,100 bonytail were maintained on station for future stocking (table 1).

Table 1.—Year-Class and Number of Bonytail Suckers on Station at the Center in FY16

Year-Class	Number
2012	8,000
2013	8,000
2014	19,100
2015	5,000

The Center harvested, tagged (with passive integrated transponders), hauled, and stocked 697 subadult bonytail (300+ mm TL) into Reach 3 and 1,289 subadult bonytail (305+ mm TL) into Reach 4. The Center hormonally induced the fish to spawn and hand-stripped eggs from 24 adult bonytail females, producing 351,600 eggs. Over 74,000 egg, larval, and juvenile bonytail were transferred to other stations for grow-out and research during FY16.

Razorback Suckers: The Center maintained a broodstock of 998 adult razorback suckers that comprised nine year-classes of Lake Mohave origin fish. Adult broodfish were hormonally induced to spawn; the eggs were hand-stripped from 18 adult razorback sucker females, producing 342,600 eggs. Approximately 65,000 razorback sucker larvae were transferred to the Bubbling Ponds Fish Hatchery and the Aquatic Research and Conservation Center at Bubbling Ponds

for grow-out and future stocking into the lower Colorado River. Approximately 1,000 subadult fish were maintained for use in a flow conditioning study to be conducted in FY17.

FY17 Activities: The bonytail broodstock will be maintained, and the hatchery will produce approximately 100,000 larvae or fingerling bonytail for distribution to the Willow Beach NFH, Achii Hanyo Native Fish Rearing Facility, Lake Mead Fish Hatchery, and the Aquatic Research and Conservation Center at Bubbling Ponds. The Center will rear 12,000–13,000 bonytail to 305 mm TL in FY17 for distribution within the lower Colorado River. Between October 2016 and January 2017, 691 bonytail were stocked into Reach 3, and 4,456 bonytail were stocked into Reach 4.

Proposed FY18 Activities: The bonytail broodstock will be maintained. Up to 100,000 larvae or fingerling bonytail will be produced for distribution to various rearing/research facilities, including the Aquatic Research and Conservation Center at Bubbling Ponds, Lake Mead Fish Hatchery, Willow Beach NFH, and the Achii Hanyo Native Fish Rearing Facility. Approximately 12,000–13,000 bonytail will be reared to 305 mm TL for distribution within Reaches 2–5.

Pertinent Reports: Annual administrative reports are available upon request.

Work Task B5: Bubbling Ponds Fish Hatchery

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$315,000	$731,953.63	$3,074,634.70	$330,000	$330,000	$330,000	$330,000

Contact: Ty Wolters, (702) 293-8463, twolters@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: RASU3 and RASU4

Location: Cornville, Arizona

Purpose: To operate and maintain the fish rearing facility and annually contribute razorback suckers (*Xyrauchen texanus*) to the LCR MSCP Fish Augmentation Program

Connections with Other Work Tasks (Past and Future): Activities at the Bubbling Ponds Fish Hatchery are related to Work Task B4; the hatchery receives razorback suckers from the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center). A portion of the fish rearing and predator-conditioning research activities outlined in Work Tasks C10 (closed) and C11 (closed) were conducted at the research center (Aquatic Research and Conservation Center at Bubbling Ponds) associated with this hatchery.

Project Description: The Bubbling Ponds Fish Hatchery is managed and operated by the Arizona Game and Fish Department. This is a warm-water rearing facility that is supplied by a continuous, year-round, 10-cubic-feet-per-second spring flow of 68-degree Fahrenheit water. The facility has 10 acres of production ponds, a workshop, a storage shed, a small laboratory, and sufficient fish distribution equipment to meet the delivery requirements of the LCR MSCP. Program funds provide for salaries, fish feed and supplies, facility operation and maintenance, and delivery of fish. Production goals are 12,000 razorback suckers of 305 millimeters minimum total length for release into Reaches 3–5.

Previous Activities: Prior to the LCR MSCP, 70,000 razorback suckers were successfully reared at the Bubbling Ponds Fish Hatchery and delivered to the lower Colorado River as required by two Biological Opinions (1997 and 2001).

FY16 Accomplishments: A total of 60,000 fry were received for rearing from the Center in April. During FY16, 7,487 razorback suckers were harvested, tagged (with passive integrated transponders), and stocked into the lower Colorado River. A total of 3,854 razorback suckers were stocked into Lake Havasu (Reach 3), and 3,633 were stocked below Parker Dam (Reach 4).

Funding was provided for replacing the spring source pipeline that supplies water to the Bubbling Ponds Fish Hatchery. The work is expected to be conducted in FY17–18. This water supply infrastructure is currently in critical disrepair and, without replacement, may threaten the water supply to the hatchery. Approximately $300,000 of LCR MSCP funds will be used for this repair. The Arizona Game and Fish Department will provide additional funds necessary to cover any remaining costs for the replacement of this pipeline. Minor infrastructures repairs, upgrades, and equipment purchases are also planned, and corresponding budget obligations for FY16 reflect these additional expenditures.

FY17 Activities: The Bubbling Ponds Fish Hatchery began in FY17 with approximately 90,000 razorback suckers on station (table 1).

Table 1.—Razorback Sucker Year-Class and Corresponding Number of Fish on Station at the Bubbling Ponds Fish Hatchery at the Start of FY17

Year-Class	Number
2013	1,900
2014	17,000
2015	21,100
2016	50,000

All razorback suckers were supplied by the Center (as fry or fingerlings). Most fish are expected to reach target size in 2017 and 2018.

Regulatory compliance activities will be completed for the spring source pipeline replacement project. To cover these additional costs, expenditures are expected to exceed the projected FY17 budget.

Proposed FY18 Activities: Razorback sucker larvae will continue to be received from the Center. Razorback suckers from the 2015, 2016, and 2017 year-classes will continue to be reared. Approximately 12,000 razorback suckers greater than 305 millimeters total length are expected to be produced at the Bubbling Ponds Fish Hatchery for the LCR MSCP in FY18. Annual administrative progress reports for FY18 activities and production numbers will also be provided by the hatchery.

Pertinent Reports: Annual administrative reports are available upon request.

Work Task B6: Lake Mead Fish Hatchery

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$240,000	$241,051.09	$908,017.26	$325,000	$400,000	$400,000	$400,000

Contact: Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: BONY3, BONY4, FLSU2, RASU3, RASU4, RASU5, RASU7, and RASU8

Location: Reach 1, Lake Mead, Boulder City, Nevada

Purpose: To support Lake Mead razorback sucker (*Xyrauchen texanus*) studies and contribute bonytail (*Gila elegans*) and razorback suckers to the LCR MSCP Fish Augmentation Program

Connections with Other Work Tasks (Past and Future): Activities at the Lake Mead Fish Hatchery contribute to other LCR MSCP work tasks. This includes closed work tasks, including B11, C13, C39, and C49, as well as ongoing work tasks: C41 (closed), C53, C57 (closed), C61, and D8.

Project Description: The Lake Mead Fish Hatchery is managed and operated by the Nevada Department of Wildlife (NDOW). The LCR MSCP and the NDOW are cooperatively rearing both bonytail and razorback suckers at this facility in support of the LCR MSCP Fish Augmentation Program. Bonytail for this work task are produced and supplied by the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center), and razorback suckers are wild-caught individuals from Lakes Mead and Mohave. Funds from this work task are provided for the salaries, equipment, feed, and chemicals necessary to rear these fish. Fish produced through this work task will be used to support research and augmentation in Reaches 1–5.

Previous Activities: A number of infrastructure and facilities improvements were made to the Lake Mead Fish Hatchery prior to 2007 to accommodate native fish production for the LCR MSCP. Since 2007, larval and fingerling razorback suckers, from Lakes Mead and Mohave, have been brought into the Lake Mead

Fish Hatchery for rearing. Subsequently, these fish have been transferred to ponds at the Overton Wildlife Management Area for additional grow-out, used for Lake Mead research and monitoring projects, and stocked into Lake Mohave. Additional rearing space was made available at the hatchery in 2012 in continued support of the LCR MSCP Fish Augmentation Program. This additional space has allowed for a greater number of native fishes to be kept on station and is currently being used to rear razorback suckers, flannelmouth suckers (*Catostomus latipinnis*), and bonytail. Prior to 2014, adult bonytail had only been held on station for short durations. The Lake Mead Fish Hatchery received an estimated 35,000 bonytail from the Wahweap State Fish Hatchery in December 2013, marking the first time that this species has been reared at the facility. The additional rearing capacity now available at the Lake Mead Fish Hatchery will continue to be necessary in future years when the number of fishes stocked annually into Reaches 3–5 is expected to increase.

FY16 Accomplishments: During FY16, the Lake Mead Fish Hatchery continued rearing the approximately 20,000 bonytail and 16,000 razorback suckers that were on station from previous years. The Lake Mead Fish Hatchery received approximately 5,000 fingerling bonytail during FY16, bringing the total number of bonytail on station to approximately 25,000. The hatchery's razorback sucker stocks were also augmented in FY16, with an additional 121 razorback sucker larvae from Lake Mead, 3,400 razorback sucker larvae from Lake Mohave, and approximately 3,000 razorback sucker fingerlings also from Lake Mohave. No flannelmouth suckers were brought on station during FY16.

A number of stockings occurred during FY16 in support of ongoing LCR MSCP work task activities. These stockings have been organized by river reach and include their associated work tasks where applicable. A total of 17 razorback suckers were stocked into Reach 1 during FY16 in support of ongoing research. These fish included 7 sonic-tagged juvenile razorback suckers released in order to investigate habitat use and seasonal movements of immature razorback suckers in Lake Mead (C57 [closed]), and 10 sonic-tagged adult razorback suckers released into the lower Grand Canyon in support of Work Task D8. A total of 1,244 bonytail were stocked into Reach 2 during FY16. Approximately 300 were stocked into Davis Cove in support of research continuing under Work Task C63. The remaining 900 were stocked into Lake Mohave as part of a sonic telemetry study being conducted under Work Task C64. The final stocking in FY16 occurred in Reach 3. A total of 2,006 razorback suckers were stocked in order to investigate latent mortality and relative survival and dispersal of fish stocked using soft release techniques (C65). Only minimal stockings of Lake Mohave razorback suckers occurred during FY16. It was anticipated that five hundred 500-millimeter razorback suckers would be stocked into Reach 2 by the end of FY16; however, this stocking is now scheduled for the first quarter of FY17.

In addition to rearing and stocking fish, the NDOW also continued making improvements to the hatchery. An electrical upgrade was completed in FY16, which will now allow for simultaneous flow conditioning of native fishes in up to 10 raceways. It is anticipated that the hatchery will begin pre-stocking flow conditioning of native fishes in early FY17. The Lake Mead Fish Hatchery also began preparations in FY16 to expand razorback sucker production by 4,000 fish per year, with the goal of producing 6,000 fish per year by FY18–19. Additionally, the hatchery was able to dedicate a single raceway for low-density rearing of adult bonytail that will provide the LCR MSCP with larger specimens for use in ongoing and future sonic telemetry studies. At the end of FY16, over 40,000 native fishes from multiple year-classes remained on station at the Lake Mead Fish Hatchery. These fish will be stocked or made available for research purposes as needs are identified.

FY17 Activities: The NDOW will continue to operate the Lake Mead Fish Hatchery for bonytail and razorback sucker production and flannelmouth sucker research. Continuing operations will include grow-out and stocking of native fishes from the 2011–17 year-classes and capturing and rearing of up to 500 wild-caught razorback sucker larvae from Lake Mead. Hatchery production will include the use of the Overton Wildlife Management Area ponds (B11, closed) and will be reported under this work task. This consolidation of work tasks, and the additional fishes that will be brought on station this year, both contributed to the increase in the approved budget for FY17. It is also anticipated that the hatchery will stock approximately 4,000 bonytail and 4,000 razorback suckers toward fish augmentation goals in FY17.

The NDOW has agreed to increase its rearing capacity for razorback suckers in response to the losses the Willow Beach National Fish Hatchery experienced due to the Ich (*Ichthyophthirius multifiliis*) parasite outbreak in early FY17. The Lake Mead Fish Hatchery will receive approximately 3,500 razorback sucker larvae (increased from 3,000) from Lake Mohave and up to 5,500 additional fingerling Lake Mohave razorback suckers from the Willow Beach National Fish Hatchery. In addition, the Lake Mead Fish Hatchery will receive up to 6,000 additional fingerling bonytail from the Center for rearing to stocking size. As a result of these increased fish numbers, additional expenditures will be necessary for expansion of the larval rearing portion of the hatchery as well as to compensate for additional fishes on station in subsequent years. These expenditures will include those for additional electrical upgrades, fish food, chemicals, supplies, and staff time.

Proposed FY18 Activities: Rearing and stocking of native fishes from previous year-classes will continue. The Lake Mead Fish Hatchery will also receive and rear up to 9,000 additional razorback suckers from Lake Mohave and 6,000 additional fingerling bonytail from the Center. Adult and subadult Lake Mead razorback suckers will be delivered to the Overton Wildlife Management Area and additional off-channel grow-out sites as necessary.

Expansion of the rearing capacity at Lake Mead Fish Hatchery to a total output of 6,000 subadult razorback suckers and 4,000 bonytail per year is expected to result in substantial increases in costs, including those for feed, electrical and associated pumping costs, chemicals, supplies, and staff time. These increases are reflected in the proposed budget for FY18.

Pertinent Reports: Annual administrative reports are available upon request.

Work Task B7: Lakeside Rearing Ponds

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$200,000	$149,862.21	$2,213,025.03	$200,000	$200,000	$200,000	$200,000

Contact: Eric Loomis, (702) 293-8519, eloomis@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Maintain fish rearing capability, provide razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) to the LCR MSCP Fish Augmentation Program, and accomplish species research

Conservation Measures: BONY3, BONY4, BONY5, RASU3, RASU4, RASU5, and RASU6

Location: Reach 2, Lake Mohave, Arizona/Nevada

Purpose: To operate and maintain fish grow-out areas along the Lake Mohave shoreline to contribute to razorback sucker broodstock development

Connections with Other Work Tasks (Past and Future): Activities are related to Work Tasks B2 and B4, as fish for grow-out ponds come from the Willow Beach National Fish Hatchery (Willow Beach NFH) and the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico. In addition, some of the fish rearing research activities outlined in Work Tasks C34 (closed), C40, C44 (closed), and C63 may be conducted at these ponds.

Project Description: Lake Mohave is operated by the Bureau of Reclamation (Reclamation) as a reregulation reservoir. It fluctuates annually within a 15-foot vertical range, filling by mid-May and lowering to an annual minimum in October. Wave actions redistribute sediment deposits from desert washes and shape these deposits into sandbars or natural berms. In some areas, these sandbars isolate the lower portions of the desert washes from the lake proper, and when the lake is at full pool, lakeside ponds form at many of these washes. Reclamation and its partners in the Lake Mohave Native Fish Work Group have been using these lakeside ponds since 1992 as rearing and grow-out areas for razorback suckers and bonytail. The ponds are stocked with juvenile fishes as the reservoir fills (typically stocked in late January). The LCR MSCP monitors and

manages the ponds throughout the growing season. This work includes periodic monitoring of plankton production, removal of weeds and debris, population monitoring through the use of remote sensing technologies, and routine monitoring of physical, chemical, and biological parameters. The ponds are normally harvested in fall as the lake elevation declines. The fishes from these ponds are then released back into Lake Mohave. The LCR MSCP anticipates the need for these ponds to support razorback sucker and bonytail conservation through FY55.

Previous Activities: These ponds have been in use since 1992, and nearly 33,000 razorback suckers have been reared and repatriated into Lake Mohave. In an effort to expedite development of the razorback sucker broodstock, the target size for repatriation was increased to 500 millimeters (mm) total length (TL) during 2007. Since this new target size went into effect, the ponds have been managed to rear larger-sized fish for the LCR MSCP. Typically, razorback suckers in excess of 300 mm TL are stocked into the ponds and then harvested in spring and/or fall. Beginning in 2012, surplus in situ spawned fish were harvested and fin clipped and/or passive integrated transponder (PIT) tagged and transferred to Reach 3 below Davis Dam.

FY16 Accomplishments: Four backwaters were stocked at the beginning of the year with juvenile razorback suckers. These fish were originally collected from Lake Mohave as larvae and then reared at the Willow Beach NFH. All fish were stocked at a size of at least 300 mm TL to be consistent with the minimum release target length. All males were stocked into Willow backwater to assess reproductive behavior on growth. Aquatic dye treatments were attempted in the Arizona Juvenile (AJ) backwater to reduce submerged plant growth that inhibited harvest efforts in past years. While all stockings of the Lake Mohave backwaters were supported work under Work Task B7, several of the backwaters were also used to conduct concurrent species research work tasks. Specifically, the North Chemehuevi and Willow backwaters were stocked solely in support of Work Task B7. The AJ and Dandy backwaters were stocked as part of Work Task C40. These backwaters received 99, 50, 102, and 100 razorback suckers, respectively, for a total of 351 razorback suckers stocked into Lake Mohave backwaters in FY16 (table 1).

In FY16, 87 razorback suckers were harvested from all the previously stocked backwaters and repatriated into Lake Mohave. The mean TL for all backwater fish during this harvest was 455 mm, with a range of 429–468 mm (table 1). These fish were all from the 2013 year-class. All fish were PIT tagged prior to initial stocking into the backwaters; however, harvested fish were rescanned at the time of harvest, and a new tag was inserted if the original PIT tag was not detected. The AJ backwater was compromised by a flood event that occurred in April 2016 that connected the backwater directly to Lake Mohave. An unknown number of untagged razorback suckers were released into the lake from the AJ backwater after this event.

Table 1.—2016 Stocked Adult Razorback Suckers Repatriated into Lake Mohave from Lakeside Rearing Ponds

Backwater		Number Stocked		Mean TL at Stocking (mm)		Number Harvested		Mean TL at Harvest (mm)		Percent Harvested from 2016 Stocking
Willow		50		370		34		429		68.0
Dandy		100		382		33		467		33.0
Arizona Juvenile*		102		380		0		N/A		0.0
North Chemehuevi		99		382		20		468		20.2
Total or Overall Mean Value	**Total**	**351**	**Mean**	**380**	**Total**	**87**	**Mean**	**455**	**Mean**	**24.8**

* The Arizona Juvenile backwater berm was breeched in April 2016. The total number of fish that escaped is unknown.

A breakdown of backwater-harvested fish for FY16 is as follows: 15 stocked adult razorback suckers (mean TL = 552) were netted from the Yuma Cove backwater in May 2016, and an additional 29 razorback sucker recruits from prior stockings were also harvested from the Yuma Cove backwater (mean TL = 455). All newly captured recruits received a PIT tag, and genetic (tissue) samples were collected as part of Work Task C40. All fish were returned to the Yuma Cove backwater. Six in situ-produced fish with a range of 280–310 mm (recruits from reproduction) captured from the Dandy backwater were PIT tagged and transferred to Reach 3. Table 1 lists the numbers of fish repatriated into Lake Mohave from the 2016 harvest, excluding the Yuma Cove and Davis backwaters.

A total of 400 year-class 2012 adult bonytail provided by the Southwestern Native Aquatic Resources and Recovery Center were stocked in equal proportions in the North Nine Mile and Nevada Egg backwaters in 2016 as part of Work Task C40. None of the adults in Nevada Egg and North Nine Mile backwaters were harvested in 2016.

Harvest efforts can be variable from year to year depending on fish survival and other contributing factors. Total harvest numbers were low in FY16, and no fish were harvested from the AJ backwater due to the berm breach.

FY16 obligations were less than anticipated, as labor costs were covered under ongoing research tasks (C40 and C63) and partners provided in-kind participation for backwater maintenance.

FY17 Activities: Lakeside ponds are again being used for razorback sucker broodstock maintenance and development. Genetic and demographic data related to Work Task C40 in the AJ, Yuma, and Dandy backwaters will continue to be gathered, and in situ voluntarily spawned fish will continue to be harvested and released into downstream locations in Reach 3 below Davis Dam.

The North Nine Mile and Nevada Egg backwaters will not be stocked with bonytail in FY17; instead, Nevada Egg backwater will be stocked with 50 razorback suckers in support of Work Task B7. The Willow Beach NFH will provide the fish for these stockings.

Remote sensing technology will continue to be expanded to all fish-stocked backwaters in the form of continuous PIT tag scanning from the time of initial stocking until the final harvest. Data collected from continuous population monitoring through remote sensing will be used to address variability in survival rates both spatially and temporally.

Stocking densities will be reduced in FY17 based on the limited number of available fishes from the Willow Beach NFH due to the outbreak of the parasite Ich (*Ichthyophthirius multifiliis)* at that facility in early FY17. The AJ and Dandy backwaters will be stocked with 100 individuals each in support of activities associated with Work Task C40. The Nevada Egg and Willow backwaters will each receive 50 razorback suckers. The Davis, North Nine Mile, and North Chemehuevi backwaters will not be stocked in FY17. Sex ratios in the Willow and Nevada Egg backwaters will be manipulated to evaluate the role reproductive behavior has on growth in these closed-system environments. Additionally, the Nevada Egg backwater will be treated with an aquatic dye, as needed, to reduce submerged vegetation and surface algal mats. The Yuma Cove backwater will not be augmented in FY17 based on monitoring activities associated with Work Task C40.

Proposed FY18 Activities: Lakeside ponds along the shoreline of Lake Mohave will be operated and maintained for native fishes. Stocking densities will continue at approximately 100 individuals per location. Experimental stocking regimes will continue to be explored in the current non-research Davis, Nevada Egg, North Nine Mile, North Chemehuevi, and Willow backwaters. All ponds will be monitored regularly to ensure survivorship is maximized during the grow-out phase prior to repatriation. Continuous proactive measures will need to be implemented to ensure backwater habitats are free of surface algal mats and dense submerged vegetation that has likely impacted the water quality of various ponds in past years. Voluntarily spawned fish from backwaters will continue to be transported downstream from Davis Dam.

Pertinent Reports: N/A

Work Task B8: Fish Tagging Equipment

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$135,000	$140,133.31	$1,044,308.39	$135,000	$135,000	$135,000	$135,000

Contact: Jon Nelson, (702) 293-8046, jnelson@usbr.gov

Start Date: FY04

Expected Duration: FY55

Long-Term Goal: Acquire and maintain a supply of fish-tagging materials and equipment for marking fishes to be released for research and augmentation stockings

Conservation Measures: BONY3, BONY4, BONY5, RASU3, RASU4, RASU5, and RASU6

Location: N/A

Purpose: To mark fishes released into the lower Colorado River (LCR) for identification purposes to assess survival and distribution

Connections with Other Work Tasks (Past and Future): Activities are related to all work tasks that result in fish stocking for augmentation, fish research, and fish monitoring.

Project Description: Under the LCR MSCP, more than 1.2 million native fishes will be reared and stocked into the LCR. Fishes will be marked to assess distribution and survival and for effective research and decisionmaking. Funds provide for both tagging materials and detection equipment needed during monitoring and research. The Bureau of Reclamation anticipates the need for fish tags and tagging equipment throughout the life of the program.

Previous Activities: Fishes released into the LCR have been tagged with 400-kilohertz (kHz) passive integrated transponder (PIT) tags (Lakes Mead and Mohave, Reaches 1 and 2), 125-kHz PIT tags (Davis Dam to Parker Dam, Reach 3), and wire tags (Davis Dam to Imperial Dam, Reaches 3, 4, and 5). Recaptured fish below Parker Dam have been retagged with 125-kHz PIT tags. In addition, both radio tags and sonic tags have been implanted in fishes used for research on Lakes Mead, Mohave, and Havasu. Fin clipping and floy tags have been used for short-term survival studies in some rearing and grow-out ponds.

In 2006, the LCR MSCP began using 134.2-kHz frequency PIT tags. These tags have a greater detection range than the previously used tags (12 versus 2 inches away from fish) and allow for testing and deployment of remote listening stations within spawning areas and other locations along the LCR. Purchase of the PIT tags, tag readers, and antennae began in 2006.

FY16 Accomplishments: PIT tags, tagging equipment, and tag readers were purchased as needed to mark fishes for monitoring and research. A total of 21,354 razorback suckers and 9,346 bonytail were PIT tagged and released into the LCR during FY16. These reported numbers of tagged fishes represent the total number of fishes implanted with tags and not the number of fishes repatriated and credited under the LCR MSCP Fish Augmentation Program. They include fishes used for research, smaller volunteer spawned fishes that have been translocated into other areas, and fish that have been retagged due to tag loss or replacement of older frequency tags.

FY17 Activities: PIT tags, tagging equipment, and tag readers will be purchased as needed to mark fishes for monitoring and research. The budget estimates reflect the increased fish number goals and the need for additional supplies and equipment to support ongoing tagging and remote sensing research and monitoring efforts.

Proposed FY18 Activities: PIT tags, tagging equipment, and tag readers will continue to be purchased as needed to mark fishes for monitoring and research.

Pertinent Reports: N/A

Work Task B12: Maintenance of Alternate Bonytail Broodstock

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$50,000	$70,499.86	$30,123.36	$65,000	$65,000	$65,000	$65,000

Contact: Ty Wolters, (702) 293-8463, twolters@usbr.gov

Start Date: FY16

Expected Duration: FY55

Long-Term Goal: Fish augmentation

Conservation Measures: BONY3 and BONY4

Location: Mora National Fish Hatchery (Mora NFH), Mora, New Mexico

Purpose: To support maintenance of the alternate bonytail (*Gila elegans*) broodstock.

Connections with Other Work Tasks (Past and Future): N/A

Project Description: Bonytail are federally listed as endangered under the Endangered Species Act; they are considered functionally extirpated from their historical range, and their persistence in the Colorado River Basin now relies entirely on stocking. Prior to 2016, the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center), maintained the only bonytail broodstock in the world. To guard against a catastrophic event and to secure the species' genetics, a second broodstock was developed and moved to the Mora NFH in March 2016. The maintenance of the current broodstock has provided the source of all the bonytail for the LCR MSCP Fish Augmentation Program. The LCR MSCP will benefit by having a redundant location to safeguard this species against future events that may limit the ability to meet program augmentation goals.

This work task will partially support the relocation and maintenance of the second bonytail broodstock developed by the Center. The budget estimates will reflect the LCR MSCP cost share in the relocation and maintenance of the new broodstock.

Previous Activities: In 2011, a multi-agency meeting was held to prioritize the creation of new refuge populations for Colorado River fishes to prevent loss of

species due to catastrophic events. Given that the only broodstock population of bonytail was maintained at a single facility, and the lack of a wild population to provide founders for a new population, bonytail were placed at the top of the list. The Center developed the alternate bonytail broodstock during FY12–14.

A review team was formed in FY15 to select the location of the alternate broodstock based on criteria developed by the Center. A recommendation was made in FY15 to relocate the alternate bonytail broodstock to another facility. The U.S. Fish and Wildlife Service has indicated that this new broodstock is not intended to provide additional production fishes to any conservation/ recovery programs in the near future and would function as a "refuge population" to provide redundancy for securing and conserving the genetics of this species.

FY16 Accomplishments: The alternate bonytail broodstock was relocated to the Mora NFH in March 2016. A total of 1,267 bonytail from the 2012–14 year-classes make up the alternate broodstock. A new 5-year agreement was completed to help cover the costs of relocating and maintaining this alternate broodstock. The budget costs are a reflection of the funding to be provided to the Mora NFH plus administrative costs to oversee the agreement.

FY17 Activities: Funds will be supplied to the Mora NFH to help cover the costs of relocating and maintaining this alternate bonytail broodstock. The increase in the proposed budget for FY17 is more representative of the true cost of this broodstock maintenance. This cost may vary depending on contributions made through other recovery and conservation programs.

Proposed FY18 Activities: Funding will be provided to help support the maintenance of the alternate bonytail broodstock at the Mora NFH. The cost may vary depending on contributions made through other recovery and conservation programs.

Pertinent Reports: N/A

WORK TASKS – SECTION C

Species Research

Work Task C2: Sticky Buckwheat and Threecorner Milkvetch Conservation

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$11,000	$11,311.51	$125,268.10	$11,000	$11,000	$11,000	$11,000

Contact: Mary Ellen Chavez, (702) 293-8233, mchavez@usbr.gov

Start Date: FY06

Expected Duration: FY30

Long-Term Goal: Support existing conservation programs for covered plant species

Conservation Measures: STBU1 and THMI1

Location: Reach 1, Nevada

Purpose: To provide funding to support existing conservation programs for sticky buckwheat (*Eriogonum viscidulum*) and threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*)

Connections with Other Work Tasks (Past and Future): These are stand-alone conservation measures as described in the LCR MSCP Habitat Conservation Plan.

Project Description: Sticky buckwheat and threecorner milkvetch are covered species within the LCR MSCP. Funding in the amount of $10,000 per year will be provided for an ongoing conservation program or to another entity approved by the U.S. Fish and Wildlife Service (USFWS) to implement conservation activities for these two plant species. Funding may be advanced for up to 5 years, depending on availability, to keep administrative costs at a minimum.

Previous Activities: From 2008 to 2016, the National Park Service (NPS) monitored select populations of sticky buckwheat and threecorner milkvetch within the Lake Mead National Recreation Area. Monitoring included presence/absence surveys from 2008 to 2016 and invasive weed removal in 2013 to 2016 at select sites.

A minor modification to the conservation measures for both plants was approved by the USFWS on January 4, 2011, following approval by the

Steering Committee. The language was changed to state that funding would go "to an ongoing conservation program or other entity approved by the USFWS to implement conservation activities for the threecorner milkvetch and sticky buckwheat."

FY16 Accomplishments: Conservation activities for these two plant species was supported under the LCR MSCP in accordance with the NPS' *Lake Mead National Recreation Area Resource Stewardship Strategy, November 2014*. Threecorner milkvetch populations at Sandy Cove were monitored. A total of 189 of the 473 plots surveyed contained threecorner milkvetch, with 3,865 plants recorded overall. Additional habitat surveys documented 8 threecorner milkvetch plants at Lime Cove in a 7-acre survey area and 107 plants at Middle Point in a 6-acre survey area. Sticky buckwheat populations located at Lime Cove were monitored. A total of 145 sticky buckwheat plants were documented. Additional habitat surveys documented 120 sticky buckwheat plants at Lime Cove in a 7-acre survey area. Invasive Sahara mustard (*Brassica tournefortii*) weeds were removed from 26 acres of the dunes/sandy areas and surrounding beaches at Sandy Cove and Lime Cove.

FY17 Activities: Funds in the amount of $10,000 will be transferred to the NPS per the above-described agreement to implement conservation activities for sticky buckwheat and threecorner milkvetch. An annual report will be provided to the Bureau of Reclamation that summarizes the achievements made toward the conservation goals for these two plant species.

Proposed FY18 Activities: Funds in the amount of $10,000 will be transferred to the NPS per the above-described agreement to implement conservation activities for sticky buckwheat and threecorner milkvetch. An annual report will be provided to the Bureau of Reclamation that summarizes the achievements made toward the conservation goals for these two plant species.

Pertinent Reports: The report titled *Surveys of Threecorner Milkvetch (Astragalus geyeri* var. *triquetrus) and Sticky Buckwheat (Eriogonum viscidulum) in Fiscal Year 2016 – Lake Mead National Recreation Area* is posted on the LCR MSCP Web site.

Work Task C14: Humpback Chub Program Support

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$57,000	$0	$287,987.11	$57,000	$57,000	$57,000	$57,000

Contact: Ty Wolters, (702) 293-8463, twolters@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Support humpback chub (*Gila cypha*) conservation

Conservation Measures: HUCH1

Location: Grand Canyon, Arizona; Willow Beach, Arizona; Dexter, New Mexico

Purpose: To provide support for the Glen Canyon Dam Adaptive Management Program (Glen Canyon Dam AMP) to conserve the humpback chub

Connections with Other Work Tasks (Past and Future): This work task is connected to Work Tasks B2 and B4, as money will be transferred to the U.S. Fish and Wildlife Service (USFWS) through an agreement for activities at the Willow Beach National Fish Hatchery and the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center).

Project Description: A total of $500,000 over the life of the LCR MSCP (50 years) will be provided for the Glen Canyon Dam AMP, or other programs approved by the USFWS, to support implementation of planned, but unfunded, humpback chub conservation measures.

Previous Activities: A refuge population/captive broodstock of Grand Canyon humpback chubs was established at the Center during FY12–14. During FY14 and FY15, the Center successfully maintained 1,024 humpback chubs from the Little Colorado River, Grand Canyon.

Approximately one-half of the overall $500,000 commitment has been spent funding broodstock development in addition to the previous support of humpback chub initiatives of the Glen Canyon Dam AMP. The remaining funds will be allocated when the Glen Canyon Dam AMP, in coordination with the USFWS, identifies appropriate maintenance activities or research needs for the funds.

FY16 Accomplishments: The humpback chub refuge stock was inventoried on August 22, 2016, and found to have 99% survival. No research or support needs were provided during FY16.

FY17 Activities: Support will continue for humpback chub conservation in coordination with the USFWS and the Glen Canyon Dam AMP. Remaining funds will be spent according to research needs as agreed to among all cooperating agencies.

Proposed FY18 Activities: Support will continue for humpback chub conservation in coordination with the USFWS and the Glen Canyon Dam AMP. Remaining funds will be spent according to research needs as agreed to among all cooperating agencies.

Pertinent Reports: Progress reports are available upon request.

Work Task C24: Avian Species Habitat Requirements

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$270,000	$302,717.48	$2,035,390.61	$340,000	$150,000	$0	$0

Contact: Beth Sabin, (702) 293-8435, lsabin@usbr.gov

Start Date: FY08

Expected Duration: FY18

Long-Term Goal: Identify covered bird species' habitat characteristics to inform conservation area management

Conservation Measures: MRM1 and MRM2 (BEVI, BLRA, CLRA, ELOW, GIFL, GIWO, LEBI, SUTA, VEFL, WIFL, YBCU, and YWAR)

Location: Reaches 1–7 from Lake Mead to the Southerly International Boundary with Mexico, Bill Williams River, and other river systems in Arizona

Purpose: The purpose of this work task is to evaluate the habitat requirements of covered marsh and riparian bird species, including the Arizona Bell's vireo (*Vireo bellii arizonae*), California black rail (*Laterallus jamaicensis coturniculus*), elf owl (*Micrathene whitneyi*), gilded flicker (*Colaptes chrysoid*), Gila woodpecker (*Melanerpes uropygialis*), Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), southwestern willow flycatcher (*Empidonax traillii extimus*), summer tanager (*Piranga rubra*), vermilion flycatcher (*Pyrocephalus rubinus)*, western least bittern (*Ixobrychus exilis hesperis*) yellow-billed cuckoo (*Coccyzus americanus occidentalis*), and Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]). Conservation measures within the Habitat Conservation Plan call for research to better identify habitat requirements (Monitoring and Research Measure 1 [MRM1]) and to manage habitat of covered bird species (MRM2). The research under this work task fulfills those goals. Research questions will be focused on habitat elements that can be managed at the conservation areas. Conservation measures to create habitat exist for each of the above species; knowledge of their habitat requirements will assist in habitat creation.

Connections with Other Work Tasks (Past and Future): Information gained from this work task will be used to conduct pre- and post-monitoring at conservation areas (Section F) that target covered bird species and system-wide

monitoring of avian species (Section D). Information gained from this work task will be incorporated into Conservation Area Development and Management (Section E) work tasks and adaptive management (Section G).

Project Description: A requirement under the LCR MSCP is the creation of a minimum of 512 acres of marsh habitat for three covered marsh bird species. All 512 marsh acres should provide habitat for the Yuma clapper rail and western least bittern, while 130 acres will provide habitat for the California black rail. The Habitat Conservation Plan requires the creation of a minimum of 5,940 acres of cottonwood-willow (*Populus fremontii-Salix gooddingii*) habitat and 1,320 acres of honey mesquite (*Prosopis glandulosa*) habitat for nine covered riparian obligate bird species. Studies will be conducted to evaluate the habitat elements of covered bird species that can be managed at habitat conservation areas: Arizona Bell's vireo, California black rail, elf owl, Gila woodpecker, gilded flicker, Sonoran yellow warbler, summer tanager, vermilion flycatcher, western least bittern, and Yuma clapper rail. Habitat characteristics for the southwestern willow flycatcher (D2), yellow-billed cuckoo (D7) and the gilded flicker (C52) are covered under separate work tasks.

Previous Activities:

Yellow-billed cuckoo: A Geographic Information System-based model of yellow-billed cuckoo breeding habitat was developed.

Arizona Bell's vireo, Gila woodpecker, Sonoran yellow warbler, and summer tanager: From FY08 to FY14, habitat data were collected and summarized. This included collection of vegetation measurements to detect vegetation differences where birds did and did not nest. An audit of the data from FY11 to FY14 was conducted to verify its completeness and quality.

Restoration of managed marsh units to benefit California black rail and other marsh birds: In 2009, vegetation surveys were conducted, water depth data were monitored at wells, and biweekly marsh bird surveys for California black rails, Yuma clapper rails, and western least bitterns were conducted throughout the breeding season at the Imperial National Wildlife Refuge in Fields 16 and 18. In 2011, a final report was prepared, giving recommendations on the creation of marshes for both Yuma clapper rails and California black rails. Further research on marsh bird habitat requirements will be conducted under Work Tasks C60 and C66.

Elf owl: A study was initiated in FY14 to refine the survey methods for elf owls in dense habitat and estimate the general habitat characteristics of occupied riparian habitat to inform nest box placement and management of conservation areas. Surveys were conducted to locate elf owls in order to confirm that they use riparian habitat, identify birds that could be used to test the accuracy of the call-playback survey method in dense riparian conditions, and identify nesting territories to inform where nest boxes should be installed on conservation areas.

In FY15, approximately 550 elf owls were detected in all 9 major Arizona watersheds and in mesic riparian vegetation in 7 of the watersheds. Generalized linear mixed models were developed to investigate the importance of riparian vegetation to elf owls and assess whether certain environmental characteristics could explain the locations of this subspecies.

FY16 Accomplishments:

Elf owl: Surveys were conducted to locate elf owl breeding pairs in or near riparian habitat at four study areas along the Santa Cruz watershed (Cienega Creek, Posta Quemada Canyon, Rincon Creek, and Tumamoc Hill Washes), one study area along Arivaca Creek in the Buenos Aires National Wildlife Refuge, and three study areas along the Bill Williams River watershed (Bill Williams River, Santa Maria River, and Date Creek). Call-playback discovery surveys, emergence surveys, radio telemetry surveys, nest searching, and territory surveys were used to confirm that pairs were breeding. A total of 89 elf owl pairs were confirmed breeding.

Responsiveness surveys were conducted during the first 3 hours after sunset at distances of 50 meters (m), 100 m, 150 m, 200 m, and 250 m from confirmed breeding individuals in obstructed conditions in five vegetation volume categories: 5–20%, 21–40 %, 41–60%, 61–80%, and > 80%. A total of 54 nests were found. The height and species of the nest tree or cactus, the cavity height, and the cavity orientation were recorded for each nest, and photographs were taken of the nest tree and surrounding habitat. The core territory was delineated for breeding pairs when individuals were observed at enough locations during radio telemetry surveys, territory surveys, nest searching, or emergence surveys.

Habitat assessments were conducted for all 89 confirmed pairs in a 75-m radius around the nest; if the nest was not found, the activity center was used instead. Vegetation patches of the six community types (mesic riparian, xeric riparian, exotic riparian, desert woodland, desert shrubland, and arborescent desert scrub) within each home range or fixed radius circle were delineated. Lower midstory volume, midstory volume, height of canopy, canopy cover, number of saguaros (*Carnegiea gigantea*) and snags, distance to riparian habitat, and riparian habitat width were estimated within each home range or fixed-radius circle.

FY17 Activities:

Elf owl: Elf owl surveys will continue in FY17. Call-playback discovery surveys, radio telemetry surveys, territory surveys, nest searching, and emergence surveys will be used to confirm that pairs are breeding and to find nests. Responsiveness surveys will be conducted on confirmed breeding individuals in obstructed conditions. The tree or cactus height, tree or cactus species, cavity height, and cavity orientation will be recorded, and photographs around the nest will be taken when nests are found. The core territory will be delineated for breeding pairs where individuals were observed at enough locations during radio

telemetry surveys, territory surveys, nest searching, or emergence surveys. Habitat assessments will be conducted for each pair where breeding was confirmed within fixed-radius circles and delineated home ranges.

Proposed FY18 Activities:

Elf owl: Field work will be completed, and the project report will be finalized. Discussions will take place on future management direction based on the results of this study.

Pertinent Reports: The annual reports will be posted on the LCR MSCP Web site upon completion.

Work Task C25: Imperial Ponds Native Fish Research

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$200,000	$197,068.70	$1,801,003.62	$200,000	$0	$0	$0

Contact: Jeff Lantow, (702) 293-8557, Jlantow@usbr.gov

Start Date: FY08

Expected Duration: FY17

Long-Term Goal: Inform management and provide ways to improve created backwaters through species research

Conservation Measures: BONY2 and RASU2

Location: Reach 5, Imperial National Wildlife Refuge, Arizona

Purpose: To evaluate six ponds created as backwater habitats at the Imperial National Wildlife Refuge in order to assess the efficacy of the ponds for native fish species, specifically bonytail (*Gila elegans*) and razorback suckers (*Xyrauchen texanus*)

Connections with Other Work Tasks (Past and Future): Bonytail and razorback suckers to be stocked into the ponds are provided through Work Tasks B1–B5, and genetic monitoring in the ponds will be completed under Work Task C40. The ponds were developed under Work Task E14, and additional monitoring support will be provided through Work Task F5. Data are maintained under Work Task G1.

Project Description: The development of native fish refugia in six constructed ponds on the Imperial National Wildlife Refuge will be monitored and evaluated. Incorporated into pond construction were design features such as riprap, spawning gravels, hummocks, and increased depth, which were thought to provide suitable habitat for life cycle completion by bonytail and razorback suckers. The role and importance of each of these features toward developing self-sustaining native fish populations will be evaluated.

Previous Activities: Habitat use and population monitoring was conducted for both razorback suckers and bonytail through FY13. Populations of each species did persist with varying degrees of success. Habitat use by razorback suckers shifted across seasons, but habitat selection in any given season was different for razorback sucker populations in each pond. There were consistently more

contacts for both species at night than during the day. During summer, deep open water areas were selected by both species, and little activity was detected. Few bonytail were contacted, so habitat associations were unclear. Razorback suckers were associated with gravel spawning beds and boat ramps during the nominal spawning season that peaked in late winter/spring.

A multi-year water management study was completed in May 2013 in order to evaluate and compare water quality in Pond 1 (where regular water management was continued) with Ponds 2 through 6 (without a managed water supply). The results of this study indicated that water quality management could be achieved with respect to survival of native fishes and that the ponds can be managed with much less water than previously thought. Because of these lower demands and the desire for a non-native free water source, the water supply was switched from a surface water to a groundwater (well) source.

Beginning in FY14, native fish removal efforts were initiated in preparation for the renovation of all six ponds. In Pond 1, 86 razorback suckers were captured: 46 had previously been passive integrated transponder (PIT) tagged, and 40 had no tag data. A total of 145 bonytail were captured from Pond 1; none were PIT tagged.

In FY15, the ponds were treated with rotenone to remove all fish species. Post-renovation sampling was initiated in all ponds. No fishes were encountered during sampling of any of the ponds; however, mosquitofish (*Gambusia affinis*) were observed along the shorelines in Pond 5 during the September 2015 sampling. No water was added to the ponds following the renovation in FY15. Temperature, dissolved oxygen, and pH had similar trends.

A water management schedule has been established. Each pond received a target volume of water per month. In total, the ponds received approximately 2.5 million gallons of water from January through June and October through December, and about 5.5 million gallons from July through September. Water additions to the ponds are intended to mitigate pH and specific conductivity.

FY16 Accomplishments: Post-renovation fish monitoring was reduced to quarterly sampling as indicated in the post-renovation monitoring plan and concluded at the end of FY16. The 2 years of monitoring included 112 trammel net-nights, 403 hoop net sets, 874 minnow trap sets, and 162 larval light trap sets. Mosquitofish were captured in Pond 5, but no other fish species have been detected in any of the Imperial ponds since the renovation.

Water chemistry and water quality data, as well as zooplankton and phytoplankton samples, were collected on a quarterly basis. Water quality probes were deployed to record water quality parameters at 6-hour intervals, including temperature, pH, dissolved oxygen, and specific conductivity. All water quality

parameters remained within the ranges of acceptability for native fishes. Submersible PIT tag detection antennas were purchased and installed to support fish stockings.

A native fish stocking plan was prepared that includes a stocking timeline and potential research questions to be addressed for the Imperial ponds.

FY17 Activities: Native fish stocking and monitoring will resume in FY17. Per the native fish stocking plan, Ponds 1, 3, and 4 will be stocked with adult razorback suckers in December 2016, and adult bonytail will be released into Ponds 2, 5, and 6 in spring 2017. Each species is scheduled to be released a couple of weeks prior to their respective spawning season in an effort to maximize the number of adults available to contribute during the spawn and thus maximize genetic diversity.

Routine fisheries sampling and water quality monitoring will continue at the Imperial ponds (C25) in FY17; however, all plankton monitoring has been discontinued. Adult populations will be monitored using remote PIT scanners, and larval collections will be initiated shortly after the stocking events and persist throughout the spawning seasons. Water quality will continue to be monitored using the permanently deployed probes in each pond. The probes have been scheduled to record two readings per day (sunrise and sunset) and record the standard set of parameters (temperature, pH, dissolved oxygen, and specific conductivity).

These data will also be used to support other ongoing research efforts (C40 and C65) at the Imperial ponds. Water quality monitoring efforts at the ponds will continue in order to monitor the effectiveness of the water delivery schedule (implemented in FY16) in maintaining water quality parameters for native fishes. Work Task C25 will close at the end of FY17, and these regular monitoring efforts will be covered under Work Task F5 in future years.

Proposed FY18 Activities: This work task will be closed in FY17.

Pertinent Reports: The scopes of work are available upon request. The *Water Management Study, Imperial Ponds May 2011 through May 2013* and *Imperial Ponds Renovation Plan – 2014* reports are posted on the LCR MSCP Web site.

Work Task C27: Small Mammal Population Studies

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$40,000	$801.21	$451,966.09	$0	$0	$0	$0

Contact: Chris Dodge, (702) 293-8115, cdodge@usbr.gov

Start Date: FY08

Expected Duration: Closed in FY16

Long-Term Goal: Identify distribution, genetics, and habitat requirements as well as establish monitoring protocols for covered small mammal species

Conservation Measures: CRCR1, DPMO1, MRM1, MRM2, and YHCR1

Location: Reaches 3, 4, 6, and 7

Purpose: The purpose of this work task is to investigate distribution, genetic variability, and habitat requirements of LCR MSCP covered and evaluation small mammal species. These studies are being conducted to clarify the geographic range of the Yuma hispid cotton rat (*Sigmodon hispidus eremicus*) and the Colorado River cotton rat (*Sigmodon arizonae plenus*) along the lower Colorado River (LCR), identify ways to differentiate subspecies of the desert pocket mouse (*Chaetodipus penicillatus sobrinus*), and to describe habitat characteristics of these species.

Connections with Other Work Tasks (Past and Future): Data collected as part of Work Task F3 will be analyzed as part of the effort to determine the distribution of the two cotton rat species found along the LCR. Previous presence/absence surveys on small mammal populations were conducted under Work Task D10. This research will inform improvements to the monitoring protocol for small mammals.

Project Description: Studies will be designed to identify the distributional range, genetic differentiation, and habitat use of the covered and evaluation small mammal species. Small mammals will be trapped in various habitat types along the LCR to collect genetic samples; the samples will then be sent to a genetics laboratory for deoxyribonucleic acid (DNA) analyses. Genetic differentiation data for animals captured along the LCR will also be compared with data from animals of different subspecies located within Arizona to obtain genetic markers. These data will be used to clarify the distributional range of each species of cotton

rat and identify genetic markers that can differentiate subspecies of the desert pocket mouse within the LCR watershed. Habitat use and population demographics will be estimated with mark-recapture analyses. A population demography study will be implemented to identify habitat at Colorado River cotton rat and Yuma hispid cotton rat capture locations and establish a protocol for monitoring their presence at conservation areas.

Previous Activities: Cotton rats (*Sigmodon* sp.) were captured at seven localities along the LCR, including sites near Yuma, Arizona; the Imperial National Wildlife Refuge; the Cibola National Wildlife Refuge; the Palo Verde Ecological Reserve; and the Havasu National Wildlife Refuge. A study was initiated at the end of FY07 to determine the distributional range for the Colorado River cotton rat and Yuma hispid cotton rat, the genetic differentiation between the covered cotton rat species, and their habitat use along the LCR (D10 and F3). In FY08, the study was moved under Work Task C27 in which additional efforts were made to identify cotton rat populations, including sampling known populations along the LCR. Distribution and population genetic analyses have been conducted for these covered cotton rat species.

Population and habitat monitoring began in FY10. From FY11 to FY13, field work for a combined mark-recapture and habitat study was conducted using trapping grids that had different population densities of Colorado River cotton rats at Pintail Slough, the Cibola National Wildlife Refuge Unit #1 Conservation Area Nature Trail, and the Palo Verde Ecological Reserve. Data suggest that cotton rats need dense herbaceous vegetation at least 0.5 meter in height, as it provides an important cover for their activities and protects them from predators. Areas with this habitat structure often had better trapping success as well. These results and methods were reviewed, and protocol improvements were identified for vegetation measurements and data analyses.

Genetic samples of both species of cotton rats and the desert pocket mouse were sequenced using Next-Gen to identify genetic markers that can be used to differentiate the cotton rat species and the subspecies of the desert pocket mouse.

FY16 Accomplishments: The habitat and demography study was completed and the results published. Monitoring protocol recommendations were drafted, which included options for future post-development and system-wide monitoring of the covered small mammal species. A report summarizing the genetic analysis conducted on the small mammals was drafted, and an inventory was completed for all genetic samples acquired by the LCR MSCP.

FY16 obligations were under budget, as field work was completed ahead of schedule in FY15.

FY17 Activities: This work task was closed in FY16.

Proposed FY18 Activities: This work task was closed in FY16.

Pertinent Reports: The *Habitat and Population Demographics of the Colorado River Cotton Rat (Sigmodon arizonae plenus) Along the Lower Colorado River, 2009–2013 Final Report* is posted on the LCR MSCP Web site. The monitoring protocol and genetic reports will also be posted upon completion.

Work Task C31: Razorback Sucker Genetic Diversity Assessment

FY16 Estimate	FY16 Actual Obligations	Cumulative Accomplishment Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$160,000	$148,968.92	$759,189.23	$160,000	$160,000	$0	$0

Contact: Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

Start Date: FY09

Expected Duration: FY18

Long-Term Goal: Maintain the genetic quality of razorback suckers (*Xyrauchen texanus*) utilized by the LCR MSCP

Conservation Measures: RASU2, RASU3, RASU5, and RASU6

Location: Wayne State University, Detroit, Michigan

Purpose: To develop and maintain a genetic management program for razorback suckers

Connections with Other Work Tasks (Past and Future): This work task is related to larval razorback sucker collections (B1) and management of fish habitat restoration sites (e.g., C40, E14, and F5). Larval and adult tissue samples are collected from each reach of the LCR MSCP planning area wherever razorback suckers are captured, and this includes work accomplished under Work Tasks C13 (closed), C33 (closed), C45 (closed), C49 (closed), C64, and D8.

Project Description: The genetic structure of razorback sucker communities in reservoirs, river reaches, and off-channel habitats within the lower Colorado River will be monitored, and the various razorback sucker stocks relative to the founder population from Lake Mohave will be characterized. Under the LCR MSCP Fish Augmentation Program, the production of large numbers of fish annually will continue; these large pulses of fish have the potential to change the genetic diversity of a population in a short period of time. It is important to monitor the genetic structure of the various razorback sucker communities over many years in order to detect changes in genetic diversity as these populations mature.

Larval fish and adult fin clips will be collected and preserved from each stock during numerous annual surveys and the continuing Lake Mohave larvae

collections. These samples will be delivered to a genetics research laboratory for analyses. The results will be used to determine the genetic health of these communities, assess the effectiveness of the LCR MSCP Fish Augmentation Program, assess the effectiveness of the Lake Mohave repatriation effort, and inform management of the razorback sucker populations developing in newly constructed flood plain habitats within the LCR MSCP planning area.

Previous Activities: Samples of larvae and adult fin clips were obtained on an annual basis from multiple time periods and from various spawning areas, reservoirs, river reaches, and off-channel habitats within the LCR MSCP planning area. Deoxyribonucleic acid (DNA) was extracted and samples characterized for **mitochondrial** deoxyribonucleic acid **(**mtDNA) and microsatellite variation. Analyses of microsatellite data collected over the past 20 years are consistent with those from mtDNA, indicating that the razorback sucker conservation strategy employed in Lake Mohave is maintaining genetic diversity in the nuclear genome as well. Interpretation of the data in the context of effective numbers of breeders and size identifies the importance of increasing the population size in Lake Mohave.

FY16 Accomplishments: Within Lake Mohave, 128 fin clips and 503 larval samples were collected from the main basin and analyzed for levels of molecular variation. The findings were consistent with previous years and indicated that, in Lake Mohave, levels of molecular variation (as measured by mtDNA and microsatellites) continue to be maintained by the current management program. An additional 10 fin clips and 127 larvae were obtained from above the Willow Beach National Fish Hatchery. A comparison of larvae showed differences that may suggest little exchange between these two geographic areas of the lake; however, these differences were not statistically significant ($P = 0.051$).

From Lake Mead, 62 adult fin clips and 81 larvae were collected. Samples have been extracted, sequenced, genotyped, and analyzed using genetic software. There were no significant differences between Lakes Mohave and Mead in 2016.

From Reach 3, 116 adult fin clips and 283 larvae (9 spatial and/or temporally distinct samples) were collected. All larvae have been characterized for mtDNA variation but not microsatellites. The larval samples exhibited similar or higher levels of allelic and gene diversity than Lake Mohave, with only one sample exhibiting a significant reduction in the number of alleles expected when compared to the original Lake Mohave source population. Samples have been extracted from adults and are in the process of being characterized.

FY17 Activities: Razorback sucker genetics will continue to be assessed for the lower Colorado River through analyses of razorback sucker fin clips and larvae collected from spawning areas, reservoirs, river reaches, and off-channel habitats within the LCR MSCP planning area.

Reach 3 razorback sucker augmentation will include additional fish from the Lake Mohave gene pool. Due to this increase in the proportion of stocked razorback suckers reared from Lake Mohave origin larvae, spatial and temporal genetic monitoring efforts of larvae and adults for Reach 3 will continue and will allow for comparison with razorback sucker genetics of Lake Mohave.

Proposed FY18 Activities: The collection of larval razorback suckers and fin clips from spawning areas within the LCR MSCP planning area will continue. DNA will be extracted and samples characterized for mtDNA and microsatellite variation. Due to the small population sizes, future work will continue in order to evaluate potential problems related to the effective number of breeders. This work task will be close in FY18. Any future genetic monitoring will be conducted under system-wide monitoring (Section D).

Pertinent Reports: Annual reports for 2013–16 titled *Razorback Sucker Genetic Diversity Assessment* have been completed and will be posted on the LCR MSCP Web site upon completion.

Work Task C32: Determination of Salinity, Temperature, pH, and Oxygen Limits for Bonytail and Razorback Suckers

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$110,000	$99,638.94	$790,595.91	$110,000	$0	$0	$0

Contact: Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

Start Date: FY09

Expected Duration: FY17

Long-Term Goal: To develop and maintain high quality backwater habitats for native fishes

Conservation Measures: BONY2, BONY3, BONY5, RASU2, RASU3, RASU5, and RASU6

Location: LCR MSCP Native Fish Laboratory, Boulder City, Nevada

Purpose: To evaluate bonytail (*Gila elegans*) and razorback sucker (*Xyrauchen texanus*) early life stage thresholds of survival at varying levels of salinity, temperature, pH, and dissolved oxygen (DO)

Connections with Other Work Tasks (Past and Future): This work task began under Work Task G3 and is related to management of created fish habitat.

Project Description: Through laboratory testing, the threshold levels of various water quality parameters needed to sustain early life stages of bonytail and razorback suckers in backwater habitats developed by the LCR MSCP will be evaluated.

Previous Activities: Salinity concentrations evaluated during FY07 and FY08 indicated that upper salinity tolerances ranged from 11,000 to 12,000 microsiemens per centimeter (µS/cm) for razorback sucker eggs and from 23,000 to 27,750 µS/cm for razorback sucker larvae. From observations made during larval trials, it was documented that long-term survival may be possible at salinities as high as 23,000 µS/cm when larval razorback suckers are properly acclimated.

The results from razorback sucker egg trials indicated that the lower DO limit for this early life stage is in the 2.5 to 3 milligrams per liter (mg/L) range. The limit observed for larvae was slightly lower, with increased mortality occurring at DO concentrations near 2 mg/L. The threshold levels for successful embryo development are between pH 9 and 10. The pH threshold observed for razorback sucker larvae was slightly higher; 98% survival was observed with short-term exposure (20 days) to pH 10.

The results from both the bonytail and razorback sucker trials indicated that the upper lethal limit for these species is near pH 10 at both 20 and 30 degrees Celsius (°C). While low levels of mortality were observed at both temperatures during the first 72 hours, mortality increased to 87–93% after 20 days of exposure at 20 °C and to 83–97% after 15 days of exposure at 30 °C. Increased survival was observed in lower pH treatments; bonytail exposed to pH 9 at 20 °C displayed zero mortality over 20 days and only 8% mortality after a 15-day exposure at 30 °C. Survival was also higher for razorback suckers exposed to pH 9.5 and below.

DO concentrations indicated that the lower lethal limit for fingerling bonytail was below 2 mg/L during short-term exposure at 20 °C. Only 17% mortality was recorded for bonytail exposed to the 2-mg/L treatment for 15 days. Trials at 30 °C indicated that the lower lethal DO limit is very near 2 mg/L. Sixty-seven percent mortality was observed at 72 hours, and 100% mortality was observed at 18 days. Mortality for the remaining 30 °C treatments decreased incrementally as DO concentrations increased.

While all DO treatments (2 to approximately 8 mg/L at 20 °C) produced swim-up larvae in egg trials, percent hatch was lowest at 2 mg/L (12%), highest at 8 mg/L (57%), and fairly uniform for the remaining treatments (39–46%). Larvae exposed to DO concentrations of 2 to approximately 7.25 mg/L for 20 days resulted in survival ranging from 93–100% and from 46–85% at 20 and 25 °C, respectively.

Eggs were exposed to salinity concentrations of 1,000 to 12,500 μS/cm in triplicate at 20 °C. All treatments produced swim-up larvae, and percent hatch was similar among treatments (20–31%). Larvae were exposed to salinity concentrations of 12,500 to 20,000 μS/cm in triplicate in two separate trials run at 20 and 25 °C for 15 days. Salinity concentrations of 12,500 and 15,000 μS/cm resulted in larval mortality ranging from 4–14% at 20 °C, while observed mortality at higher salinity concentrations (17,500 and 20,000 μS/cm) ranged from 52–99%. For the 25 °C trial, mortality increased for all treatments. Larval mortality ranged from 13–70% at 12,500 μS/cm, 29–88% at 15,000 μS/cm, and from 98–100% for the remaining treatments. Larval mortality for control groups (1,000 μS/cm) was observed to be lower during both trials, ranging from 2–6% at 20 °C and 8–13% at 25 °C.

Fertilized eggs were exposed to a pH ranging from 7 to 10.5 in three replicate treatments at 20 °C until hatch was complete. The results indicate that successful development of bonytail eggs may be expected at pH levels as high as 9.5, little to no egg development should be expected at pH levels of 10 and above, and short-term survival of mesolarvae may be expected at pH levels as high as 10 at moderate temperatures.

FY16 Accomplishments: Research during this study year focused on evaluating threshold DO concentrations for fingerling razorback sucker survival. Fingerling razorback suckers were acquired from the Willow Beach National Fish Hatchery (B2) in late May and exposed to DO concentrations of 2 to 7.5 mg/L in three replicate treatments at 25 and 30 °C. Survival was evaluated at 72 hours and after 20 days of exposure.

Results from the 25 °C trial indicate that the lower DO limit for razorback sucker fingerlings may be below 2 mg/L with short-term exposure times at this temperature. Limited mortality (3%) was observed during the 20-day trial period, with all mortality occurring in the 2-mg/L treatment group. It should be noted that DO concentrations of 2 mg/L proved difficult to maintain during this trial. While the mean DO concentration was 1.94 mg/L for the three replicate treatments, concentrations did occasionally fluctuate within individual replicates and ranged from 0.99–2.56 mg/L during the 20-day trial. All observed mortality occurred in a single replicate treatment during a 48-hour period in which DO concentrations ranged from 1 to 1.5 mg/L. No mortality was observed within the remaining treatment groups.

Similar results were observed during the 30 °C trial, indicating that the lower DO limit for razorback sucker fingerlings is also near 2 mg/L at this temperature. Thirty-seven percent mortality was observed at 2 mg/L during the 20-day trial. Ten percent mortality was also observed within the 3-mg/L treatment group during this period. Mortality for the remaining treatments was less than 1%.

FY17 Activities: Research during this study year will evaluate threshold salinity concentrations for bonytail and razorback sucker fingerlings. Two multiple replicate trials, one at 25 °C and one at 30 °C, will be conducted for both species to evaluate the combined effects that salinity and temperature have on survival of this life stage. A final report on the research conducted will be prepared in FY17.

Proposed FY18 Activities: This work task will close in FY17.

Pertinent Reports: A final report will be posted on the LCR MSCP Web site upon completion.

Work Task C40: Genetic and Demographic Studies to Inform Conservation Management of Razorback Suckers and Bonytail in Off-Channel Habitats

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$275,000	$274,332.93	$928,617.03	$300,000	$ 415,000	$0	$0

Contact: Jeff Lantow (702) 293-8557, jlantow@usbr.gov

Start Date: FY10

Expected Duration: FY18

Long-Term Goal: Effective fishery management of backwater habitats developed by the LCR MSCP

Conservation Measures: RASU2, RASU6, BONY2, and BONY5

Location: Backwater habitats (Reaches 2–5)

Purpose: To quantify genetic and demographic parameters that are necessary for informed, long-term management of razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) in off-channel habitats

Connections with Other Work Tasks (Past and Future): This work task is related to Work Tasks B7, C25, C31, C56 (closed), F5, and G3.

Project Description: In Lake Mohave and elsewhere, razorback suckers and bonytail demonstrate a group spawning behavior whereby a female will spawn with multiple partners many times over a period of a few weeks. These observations led biologists to believe that all possible genetic crosses were being made during the spawn. However, analyses of adult razorback suckers placed into the Yuma Cove backwater in 1991 and 1992, along with analyses of the larval razorback suckers produced each year, showed that not all of the adults contributed genetic material to the next generation. It is possible that individual adults do not spawn every year, or that even if they do, they do not always contribute genetic material to the next generation. This hypothesis needs to be tested in order to model a population structure within these isolated habitats over subsequent generations and to predict at what frequency genetic material needs to be exchanged between habitats to maintain the diversity of the overall razorback sucker and bonytail populations within the LCR MSCP planning area.

Demographic and genetic information will be collected that will lead to recommendations to optimize long-term management of off-channel habitats for these two critically endangered fishes. Genetic data will be captured from larval, juvenile, and adult razorback suckers and bonytail from at least two replicate groups from off-channel habitats. Characterization of deoxyribonucleic acid (DNA) variation will be used to assign the parentage of individual larvae to specific adults. The data can then be compared and contrasted to (1) determine the actual number of individuals that participate in annual spawning activities, (2) census the populations, and (3) quantify patterns of survivorship.

Previous Activities: Adults, larvae, and juveniles razorback suckers have been genotyped, and multiple iterations of in situ spawning have been completed in the Arizona Juvenile (AJ), Dandy, and Yuma Cove backwaters along Lake Mohave. Collections from FY10 to FY15 were analyzed, identifying considerable variability in individual reproductive success within and especially among different lakeside ponds.

In FY14, three Lake Mohave backwater ponds were no longer being used for razorback sucker production, so they were dedicated to bonytail genetic experiments. The North Nine Mile, Nevada Egg, and Nevada Larvae backwaters were all stocked with 80 male and female adult bonytail. The Nevada Larvae backwater experienced a fishkill shortly after stocking, and it was removed from the study. However, spawning was successful in the North Nine Mile and Nevada Egg backwaters. From these backwaters, 397 and 593 genetic samples of larvae and age-0 fish samples were collected from the North Nine Mile and Nevada Egg backwaters, respectively. Parentage was determined for almost all larvae and age-0 fish samples produced within these two backwaters. Variance in reproductive success differed dramatically among backwaters. Specifically, in Nevada Egg, certain males and females contributed disproportionate numbers of progeny. High variance in reproductive success acts to reduce the genetic effective size of the population, which in turn can increase the rate at which genetic diversity is lost from the population.

In FY15, adult bonytail were again stocked into the Nevada Egg and North Nine Mile backwaters with an equal sex ratio comprising 100 males and 100 females. A total of 1,542 larvae and age-0 fish were produced in the backwaters. Parentage could be determined for 95% of the progeny; this was slightly lower than in FY14 due to the reduced genetic diversity of the broodstock used in FY15. The FY15 results indicate that genetic diversity was maintained between parents and offspring. Reproductive success was similar between the two backwaters.

FY16 Accomplishments: The number of adults stocked into the AJ and Dandy backwaters was reduced from 100 individuals of each sex to 50 for FY16. There were a number of challenges associated with the backwaters used in these studies for FY16. In the summer of FY16, a flash flood compromised the berm that separates the AJ backwater from Lake Mohave and allowed razorback

suckers to escape. Because of this breach, only 14 larvae were collected from the AJ backwater. Reproduction was limited in the Dandy backwater (six juveniles). The samples were too small to generate meaningful results. Genetic samples were also obtained from the Yuma Cove backwater: 291 larvae, 125 juveniles, and 56 previously untagged individuals. These individuals were fin clipped, and the DNA was extracted and is in the process of being genotyped.

For the razorback sucker portion of this project, much of the effort was spent analyzing data from 2010–15 and developing a comprehensive report that will be available on the LCR MSCP Web site in FY17.

The third year for bonytail backwater research was conducted in FY16. Two backwaters (North Nine Mile and Nevada Egg) were each stocked with 100 males and females. Genetic data were collected from all adults that were stocked into the backwaters. No larvae were able to be collected from North Nine Mile, but 64 young-of-year were collected in October. Larval and young-of-year samples were collected from the Nevada Egg backwater (275 and 286, respectively). Lack of contacts from the remote scanning data in the North Nine Mile backwater suggests that all adults died shortly after they were stocked. However, some of the adults had spawned before they died. Genetic analyses suggested that 23–30% of females and males contributed offspring. Consequently, genetic effective population size and genetic diversity were less in progeny from this backwater. In the Nevada Egg backwater, more than 90% of males and females contributed to offspring production. Genetic diversity was maintained between parents and progeny, and genetic effective size was high in this backwater. The results from data obtained from 2014–16 indicate that both bonytail males and females are capable of high parental contribution to resulting progeny.

FY17 Activities: The relative survival of the newly stocked razorback suckers versus the surviving razorback suckers from previous years will be monitored in the Yuma Cove backwater; in previous years, high mortality was observed in newly stocked razorback suckers, compared to "resident" razorback suckers (mostly comprised of fish from the initial stocking), which had very low mortality. Additional manipulations of this population may be required to maintain a genetically stable population. The number of individuals stocked into the AJ and Dandy backwaters will again be used to examine the impacts of density on reproductive success. FY17 is the first year this study will transition to the Imperial Ponds Conservation Area. These populations will be monitored and allowed to reproduce over multiple years with little to no interference.

The study of bonytail genetics and demographics will transition to the Imperial Ponds Conservation Area in FY17. Protocols for collections and analyses will be similar to those used at the North Nine Mile and Nevada Egg backwaters. However, the number of stocked bonytail and razorback suckers will be 150 males and 150 females for each pond. This number of stocked individuals was increased due to the ponds' larger sizes.

Work initiated under Work Task G3 during FY16 titled "Development of SNP Markers for Gender Determination, Parentage Assessment, and Population Genetics of Razorback Sucker" will be moved to Work Task C40 in FY17. Costs associated with this study were not accounted for in the FY17 estimate, so it is anticipated that the budget will exceed estimates. In FY16, potential single nucleotide polymorphism (SNP) markers for sex determination and identification of parentage in razorback suckers have been generated. Re-extraction of DNA from known males and females and their progeny will be completed using individuals previously characterized in the razorback sucker genetics backwater project (C40). This process is expected to yield 600 million sequences and more than 5,000 SNPs. Once sequences have been obtained, bioinformatic analyses will be used to identify SNPs specifically associated with sex determination and SNPs that are of sufficient variability for use in parentage analysis.

Proposed FY18 Activities: Efforts in FY18 will be similar to those in FY17. Protocols for collections and analyses will continue similar to previous years. Additional genetic tools will be used to assess the differences in parental contributions among backwaters and in an attempt to identify the factors contributing to these differences.

The draft razorback sucker genome will be assembled, and markers identified in year 1 will be mapped onto the genome. For sex determination markers, this will allow for identification of the genes linked to the sex-specific SNPs. Identifying these genes will allow the LCR MSCP to redesign more effective markers in the genes themselves. Mapping of SNP loci for parentage analyses will allow the LCR MSCP to select independent markers necessary for parentage determination. Once identified by bioinformatic analyses, SNPs will be further validated by characterizing individuals of known sex and parentage. This will require the development of a platform for screening large numbers of individuals for large numbers of loci in a cost-effective and efficient manner. Once validated, these markers will be ready for general use and may be applied to all genetic samples.

This work task will be closed in FY18. Any future genetic monitoring will be conducted under system-wide monitoring (Section D).

Pertinent Reports: A comprehensive report (2010 – 2015) covering the backwater work for razorback suckers is in draft and will be posted on the LCR MSCP Web site upon completion. The 2014 and 2015 bonytail reports titled *Genetic and Demographic Studies to Guide Conservation Management of Bonytail in Off-Channel Habitats* are complete and will be also posted.

Work Task C43: Population Demographics and Habitat Use of the California Leaf-Nosed Bat, a Genetic Evaluation

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$40,000	$39,374.35	$157,220.76	$0	$0	$0	$0

Contact: Chris Dodge, (702) 293 8115, cdodge@usbr.gov

Start Date: FY11

Expected Duration: Closed in FY16

Long-Term Goal: Assess the population demographics and habitat use of the California leaf-nosed bat (*Macrotus californicus*)

Conservation Measures: CLNB1 and CLNB2

Location: Reaches 3–5

Purpose: The purpose of this work task is to investigate the genetic variation in California leaf-nosed bats at roost sites along the lower Colorado River (LCR) to inform program managers about the connectivity of the species' populations. This will include an analysis of the genetic history of California leaf-nosed bats along the LCR watershed and adjacent areas, including geographic structuring, evolutionary history, and other population demographic parameters.

Connections with Other Work Tasks (Past and Future): A portion of the roost site data and tissue samples analyzed were collected under Work Tasks D9 and F4.

Project Description: The genetics of California leaf-nosed bats along the LCR will be described. Genetic samples from each of the known roost sites near the LCR and from individuals captured during system-wide monitoring will be collected, and deoxyribonucleic acid (DNA) sequencing and microsatellite analyses will be performed. This will document the genetic structuring of bats at roost sites and allow for various population analyses, including the connectivity of the species' populations and level of rarity, as well as demographic parameters to be estimated such as population size, previous population expansion or contraction, and dispersal among roosts, which may suggest which roost sites or areas along the river the bats netted at LCR MSCP conservation areas are coming from.

Previous Activities: Genetic samples and mitochondrial sequencing for samples collected prior to FY12 were conducted under Work Task G3. Additional samples were collected at roosts. A total of 917 base pairs of the mitochondrial cytochrome B gene were sequenced, and these sequences were used to create haplotype networks and neighbor joining trees to explore diversity and relatedness among roosts. Microsatellite-enriched whole genome data for six individuals were received from the genome sequencing laboratory. The data were combined across the six individuals to identify possible population genetic patterns in the genetic samples from 91 individuals.

FY16 Accomplishments: Genetic analyses were completed. The cytochrome *b* mitochondrial sequences from 99 individuals from 17 localities along the LCR, the Southwestern United States, Baja California, and northern Mexico were used to create haplotype networks and neighbor joining trees to explore diversity and relatedness among roosts. There were 18 haplotypes identified across the range, with 5 haplotypes present in the samples taken from the LCR and 3 haplotypes unique to the river. Genotypic clustering analyses of 6 microsatellite loci across 87 individuals from 19 localities were conducted.

The results indicated that there are two genetic groups present in the species range, with none being unique to the LCR and surrounding areas, and low levels of genetic variation in the northern range of the species, which is typical of animals residing at an edge of a species' range or a recent range expansion.

FY17 Activities: The work task was closed in FY16.

Proposed FY18 Activities: The work task was closed in FY16.

Pertinent Reports: The *Genetic Characterization of Macrotus californicus Populations along the Lower Colorado River – 2016 Annual Report* is posted on the LCR MSCP Web site. The final report will also be posted upon completion.

Work Task C52: Gilded Flicker Riparian Habitat Use and Seasonal Movement Research

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$300,000	$151,012.21	$632,616.85	$300,000	$0	$0	$0

Contact: Mary Ellen Chavez, (702) 293-8475, mchavez@usbr.gov

Start Date: FY12

Expected Duration: FY17

Long-Term Goal: Evaluate the current distribution and abundance of gilded flickers (*Colaptes chrysoides*) on the lower Colorado River by conducting species-specific, non-random surveys

Conservation Measures: GIFL1 and MRM1

Location: The LCR MSCP planning area and other areas in Arizona where gilded flickers are located

Purpose: The purposes of this work task are to (1) evaluate year-round habitat use, seasonal movements, and size of the breeding home range of the gilded flicker, (2) observe how often gilded flickers are using riparian habitat as nesting or roosting cavities, and (3) identify approximate dates of pair formation, incubation, nestling, and fledgling stages.

Connections with Other Work Tasks (Past and Future): Information obtained through this work task will be used during post-development monitoring of habitat conservation areas (F2) and system-wide surveys (D6).

Project Description: Surveys conducted under the LCR MSCP have not resulted in the detection of gilded flickers breeding in riparian habitats within the LCR MSCP planning area. However, there have been incidental observations of gilded flickers using the riparian habitat in this area as family groups during the fall and winter months and occasionally during the summer months.

Additional research and monitoring is needed to understand how and when the gilded flicker is most likely to use riparian habitats within its range to improve the effectiveness of surveys and confirm their habitat characteristics. This study will help (1) estimate time periods of breeding and post-breeding stages and document breeding season behaviors to help interpret results of sightings, (2) document

gilded flicker travel distances during and after nesting season to document if it is possible that birds nesting in saguaro (*Carnegiea gigantea*) habitats may also use disconnected riparian habitats, and (3) define habitat use by the gilded flicker during the breeding and non-breeding seasons.

Previous Activities: The species profile and annotated bibliography were updated, and historical and recent records were examined for detections within the LCR MSCP planning area and along the Bill Williams River. In FY12, preliminary surveys were conducted to locate breeding gilded flickers within the LCR MSCP planning area and adjacent areas. Areas where gilded flickers were observed include a family group in honey mesquite (*Prosopis glandulosa*) habitat along the Bill Williams River north of Mineral Wash Road; a pair of gilded flickers at McIntyre Park in Blythe, California; an incidental sighting of a gilded flicker at Yuma East Wetlands; and numerous gilded flickers readily detected in the saguaro habitat adjacent to the LCR MSCP planning area in Arizona.

In FY13–15, a study was conducted to document the breeding chronology, seasonal movement and breeding home range size, and year-round habitat use of the gilded flicker and test existing methods to document species movements. Capture and radio telemetry tracking methods were tested, and information on the breeding chronology, behaviors and vocalizations during pair formation, nesting, and family group formations of the gilded flicker was collected at an upland ephemeral wash study area that was selected south of Quartzsite, Arizona. Different year-round tracking techniques were employed to compare effectiveness and cost, including backpack and retrix-mounted radio telemetry and Global Positioning System (GPS) locators; the GPS locator tracking method was least successful. Techniques and equipment were studied for effectiveness on adult males and females and juveniles. To document the timing of the different breeding stages, active nest cavities were monitored on a regular basis until nestlings fledged. Juvenile habitat use, average home range size, and behavior while in family group formation were also studied.

FY16 Accomplishments: In FY16, the study continued at the study site south of Quartzsite, Arizona. The previous studied territories and adjacent nesting habitat was monitored to recapture the males who were fitted with GPS transmitters in FY14. They were not relocated. Solo and paired gilded flickers, as well as active nest cavities and family groups, were monitored, and vocalizations during different activities and time periods throughout the year were documented.

Exploratory surveys were conducted at 20 sites throughout the lower Colorado River and western Arizona to identify gilded flickers in riparian habitat to be studied in FY17.

Territory monitoring could not be conducted in FY16 because gilded flickers were not located in riparian habitat. This resulted in less obligations.

FY17 Activities: Exploratory surveys will continue in riparian areas in order to locate a sufficient number of gilded flickers to test the new survey methods and confirm if gilded flicker behaviors and vocalizations in upland habitats occur in riparian areas. Testing of survey methods will be conducted at the Quartzsite, Arizona, study area and selected riparian areas. Presence survey methods and biologist training methods will be finalized, an updated species natural history will be prepared, and reports will be finalized.

Proposed FY18 Activities: This work task will be closed in FY17.

Pertinent Reports: The report titled *Development of Appropriate Radio Telemetry Techniques for Gilded Flickers (Colaptes chrysoides) in Western Arizona, 2013* is posted on the LCR MSCP Web site. The 2014 and 2015 annual reports will also be posted upon completion.

Work Task C53: Sonic Telemetry of Juvenile Flannelmouth Suckers in Reach 3

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$120,000	$112,896.35	$533,775.74	$100,000	$40,000	$0	$0

Contact: Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

Start Date: FY12

Expected Duration: FY18

Long-Term Goal: Support flannelmouth sucker (*Catostomus latipinnis*) conservation

Conservation Measures: FLSU1 and FLSU3

Location: Reach 3, Arizona/Nevada/California

Purpose: To evaluate juvenile flannelmouth sucker habitat selection and use in Reach 3 and provide recommendations to enhance juvenile flannelmouth sucker habitats as a requirement of LCR MSCP habitat creation goals

Connections with Other Work Tasks (Past and Future): Work conducted under this task is related to Work Tasks C15 (closed) and C45 (closed).

Project Description: Flannelmouth suckers were reintroduced into the Colorado River below Davis Dam by the Arizona Game and Fish Department in 1976 by transfer of fish captured at the confluence of the Colorado and Paria Rivers at Lee's Ferry, Arizona. This stock has persisted for three decades and now represents the only known population of this native species in the Colorado River downstream from Davis Dam.

Five years of research on this population of flannelmouth suckers was completed under the LCR MSCP. All life stages of this species were contacted, and telemetry of adults provided insight on the movements and habitat use of adult flannelmouth suckers. Inference may be limited, as only nine juvenile flannelmouth suckers > 100 millimeters and < 350 millimeters total length were contacted during this study. Similar difficulties contacting juveniles were encountered during studies undertaken by the U.S. Geological Survey in the 20 river miles above Lake Havasu, but it was found that, while flannelmouth sucker contacts were rare, the majority (85%) of flannelmouth suckers captured

consisted of these smaller size classes. The habitats used by these younger fish will be better defined and will add to the current knowledge base for this species in Reach 3.

Previous Activities: A surrogate population of flannelmouth suckers from the Colorado River at the Lake Mead inflow was used to initiate telemetry work in FY13. In March 2013, 20 subadult fish were surgically implanted with a 90-day sonic transmitter, held at the Lake Mead Fish Hatchery and observed until determined healthy, then released downstream from Laughlin, Nevada. Active tracking using boats and manually controlled receivers was initiated immediately following release accompanied by submersible ultrasonic receivers (SURs) to help determine fish locations. Fish were tracked and habitat data recorded until mid-June. Fish proved difficult to track with manual equipment, and the majority of detections was from SURs. Seven fish were either mortalities or never detected, and the majority of active tags (10 of 13) was only detected by SURs. Fish were detected in a mix of backwater and riverine habitats.

Work in FY14 was similar to that in FY13 but included the tagging of 30 subadult flannelmouth suckers with sonic transmitters and an additional 8 with 100-day radio transmitters. The increased number of tagged fish, more SURs, and the use of radio tags resulted in an increase in manual tracking detections of fish during the field season. Sonic and radio tags were both effective, and habitat data were collected on 5 radio- and 13 sonic-tagged fish. In lower turbidity environments (i.e., main channel and select backwaters), fish were associated with stands of bulrush (*Schoenoplectus americanus*). Fish remained concealed during daylight hours and moved out during the evenings and night, presumably to forage, and then returned to similar locations each day. This association with emergent vegetation was not seen in habitats with higher turbidity; fish in these environments remained stationary in the open water of the backwater. Multiple fish were detected for extended periods of time within the backwater at the Big Bend Conservation Area.

Efforts in FY15 were similar to those in 2014; 30 subadult flannelmouth suckers were surgically implanted with 90-day sonic tags, and 12 were implanted with 100-day low-frequency radio transmitters. All tagged fish (sonic and radio) were released into Laughlin Lagoon in late April 2015. Manual tracking and deployment of SURs was initiated immediately following release of the SURs to help determine fish locations. Tracking and habitat data collections continued until late July. Sonic and radio tags were both effective, and habitat data were collected on 5 radio- and 18 sonic-tagged fish. Detections indicated that habitat use in turbid and low turbidity environments was similar to data from previous years. In addition, active tracking indicated that fish were moving around in open water in backwaters at night and were tracked up to a mile upstream and downstream from the Laughlin Lagoon entrance in the river channel. Fish would

return to similar locations of bulrush stands by daybreak. Three fish moved from Laughlin Lagoon to the Big Bend Conservation Area and spent from 1–3 weeks in the backwater.

FY16 Accomplishments: Efforts in FY16 shifted to the lower half of Reach 3 into the large backwater/marsh habitats found in the 20 river miles immediately upstream of Lake Havasu in Topock Gorge. Age-0 flannelmouth suckers have been detected in seine hauls within this area, and subadults have sporadically been captured during other research and monitoring. Based on recent telemetry research and available habitats, this section of the river presumably serves as nursery habitat for the Reach 3 flannelmouth sucker population. Subadult flannelmouth sucker surrogates were again collected from the Lake Mead inflow. Thirty of these were surgically implanted with 90-day sonic tags, and 12 were implanted with 100-day low-frequency radio transmitters. An initial release of 10 radio- and 18 sonic-tagged fish into the Pulpit Rock backwater took place in early March. A second release into Trampas Wash included 2 radio- and 12 sonic-tagged fish in mid-April. Manual tracking and deployment of SURs was initiated immediately following release of the fish to help determine their locations. Tracking and habitat data collections continued biweekly until late June. Sonic and radio tags were both effective in this lower stretch of the river. Habitat data were collected on four radio and seven sonic-tagged fish. Active tracking and SURs indicated that the majority of movements in channel and backwater habitats was at night, and fish would return to bulrush stands during daylight hours.

FY17 Activities: Activities will be similar to those in FY16; however, manual tracking activities will take place from late night into early morning in an attempt to increase detections of fish in open water habitats and track them to their daytime habitats where they remain in cover throughout the day.

Proposed FY18 Activities: Activities will be similar to those in FY17; specifics may vary depending on FY17 results.

This work task will be closed in FY18.

Pertinent Reports: A summary report will be posted on the LCR MSCP Web site upon completion.

Work Task C59: Selenium Monitoring in Created Backwater and Marsh Habitats

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$200,000	$167,129.76	$141,782.16	$160,000	$160,000	$160,000	$160,000

Contact: Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

Start Date: FY13

Expected Duration: FY25

Long-Term Goal: To develop a long-term selenium monitoring plan for the LCR MSCP

Conservation Measures: MRM2 and MRM5 (BLRA, BONY, CLRA, and RASU)

Location: Big Bend Conservation Area (BBCA), Hart Mine Marsh, and the Imperial Ponds Conservation Area

Purpose: To evaluate the selenium levels within created backwater and marsh habitats and establish a selenium monitoring plan as required by the Habitat Conservation Plan

Connections with Other Work Tasks (Past and Future): Monitoring for selenium will be conducted for habitat created through Conservation Area Development and Management (Section E) work tasks (E1, E9, E14, E15 [closed], E16, E25, E27, and E28) and will be incorporated into Post-Development Monitoring (Section F) work tasks (F1, F3, F5, and F7).

Project Description: As described in the Habitat Conservation Plan conservation measures, 512 acres of marsh and 360 acres of backwaters are being developed under the LCR MSCP as part of its habitat creation goals. These created habitats will be monitored over the 50-year term of the program to ensure that they maintain their function for all associated covered species. Sampling efforts will be implemented or continued at designated project sites for the purpose of determining the baseline or changes in selenium concentrations. The initial sampling phase is expected to provide a representative baseline sample and assessment of variability across each site. Once this information is known, a long-term selenium monitoring plan can be recommended for each specific conservation area to be carried out under the appropriate Post-Development

Monitoring (Section F) work task. This baseline sampling phase may be established through a 1- or 2-year approach. If initial levels of detected selenium are well below thresholds of concern, a long-term selenium monitoring plan may be developed that requires less sampling over time. If there is some concern regarding the initial levels of selenium, second-year followup sampling may be conducted to ascertain the relative rate of accumulation of selenium so that a more appropriate long-term monitoring plan can be established. A multi-year sampling protocol will be developed to provide a larger dataset on which management decisions can be based through the adaptive management process. Subsequent years' sampling may be reduced as appropriate, and the frequency and levels of sampling intensity are expected to vary from site to site. Accordingly, annual expenditures are also expected to vary based on these levels of effort. As new conservation areas are developed, this exploratory sampling phase will continue to be accomplished under this work task.

Previous Activities: Sampling sites were identified in FY14 and included the BBCA, Hart Mine Marsh, and the Imperial National Wildlife Refuge (Imperial NWR). Selenium monitoring was initiated in FY15 with the collection of water and substrate samples from the BBCA, Hart Mine Marsh, and the Imperial NWR. It was determined from the results of the analyses of water samples from the Imperial NWR that the levels of dissolved selenium were below threshold water quality standards for fishes and wildlife. Selenium concentrations were elevated in individual samples from the BBCA and Hart Mine Marsh, but the remaining samples contained concentrations below detection limits. It was determined from the results of the analyses of sediment samples from all three sites that the reported total selenium concentrations below detectable levels.

In addition to the three sites identified above, a fourth site was also sampled to collect baseline data for the reopening of Work Task E13. Water, substrate, plankton, and whole body fish samples were collected from McAllister Lake during FY15. Analyses of water and periphyton samples determined selenium concentrations to be well below threshold standards for fishes and wildlife. Selenium concentrations were highest in sediment, plankton, and particularly in fish tissue samples, indicating a potential concern for accumulation. The selenium levels in McAllister Lake will need to be monitored into the future.

FY16 Accomplishments: Selenium monitoring continued in FY16 with the collection of water samples from the BBCA, Hart Mine Marsh, Imperial NWR, and McAllister Lake. Analyses of water samples focused on determining concentrations of dissolved selenium, selenite, and selenate found within the water column at each site. Analyses from the Imperial NWR determined that current levels of all three analytes are well below threshold water quality standards for fishes and wildlife. Similar results were observed at Hart Mine Marsh and McAllister Lake, with dissolved selenium concentrations below 0.4 micrograms per liter (µg/L) and selenite and selenate concentrations below 0.1 µg/L. The BBCA had the highest reported concentration of dissolved

selenium (1.2 µg/L), and selenite and selenite concentrations similar to those found at Hart Mine Marsh (0.1 µg/L); however, both of these concentrations are still below threshold water quality standards for fishes and wildlife.

In addition to field work conducted in FY16, an Interagency Agreement with the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office was also completed, which will allow for continued selenium monitoring of created backwater and marsh habitat through FY21. Under this agreement, quarterly sampling events will occur during each project year. It is anticipated that multiple sample types will be collected during each event, which may include water, sediment, plankton, macroinvertebrates, and/or fish tissue samples. Collection of this more inclusive suite of sample types will likely provide a better understanding of potential impacts to covered species present at LCR MSCP project areas.

FY17 Activities: Selenium monitoring will continue with quarterly sampling events at up to five LCR MSCP conservation areas. Laboratory analyses of the full sample suite will be compared to selenium thresholds suggested by the U.S. Fish and Wildlife Service for aquatic species, and quarterly activity reports will summarize data as they become available. An annual report will be prepared following receipt of all laboratory analyses.

Proposed FY18 Activities: Selenium monitoring will continue at identified LCR MSCP conservation areas. Specific work proposed will be similar to the previous year and will include collecting samples from each site, analyzing collected samples, comparing extant selenium levels to known thresholds, and summarizing data. Additional sites may also be included for pre- and/or post-development sampling as they are identified. Individual site evaluations will be conducted for each new site in order to determine sampling locations, number of samples, and expected level of effort.

Pertinent Reports: An annual report will be prepared following the FY17 study year.

Work Task C60: Habitat Manipulation

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$225,000	$11.05	$197,396.83	$175,000	$175,000	$175,000	$175,000

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY13

Expected Duration: FY20

Long-Term Goal: Develop cost-effective management techniques and determine the timing and extent of management actions necessary for maintaining structural diversity in riparian habitats

Conservation Measures: BLRA1, CLRA1, LEBI1, MRM2, WIFL, and YBCU

Location: All current and future riparian LCR MSCP conservation areas

Purpose: The purposes of this work task are to identify riparian habitat areas in need of structural diversity enhancement and develop protocols to manage LCR MSCP habitat creation sites. The intent is to use the results of this research to appropriately manage the successional stages of riparian habitat that are required by several covered riparian avian species and thereby meet established management guidelines.

Connections with Other Work Tasks (Past and Future): Research and monitoring data obtained from Work Tasks D1, D2, D3 (closed), E34, F1, F2, F7, G3, and G4 are used.

Project Description: The LCR MSCP riparian habitat creation sites are planted densely in order to reduce invasive species competition with native species and provide habitat for covered avian species. In natural systems where periodic flooding is a component of the system, habitat can be periodically disturbed and "reset" to earlier successional stages and increased structural diversity. Several covered avian species require as habitat early to mid-successional stages of native riparian trees. Over time, some of the LCR MSCP riparian habitat creation sites may grow beyond suitable habitat for some covered species unless management actions are taken.

Without the disturbance events that were once more common in the historic river hydrograph, direct manipulation of portions of these conservation areas may be required. Information will be provided to not only perform assessments but to provide protocols, which will guide the deliberate manipulation of these habitats to enhance structural diversity and produce the appropriate seral stages for covered species.

The objectives of the riparian study are to:

1. Provide a protocol for assessing areas for structural diversity and target areas that may require enhancement to meet management objectives. This will typically result in identifying areas that have at least 8 years of growth and that comprise more monotypic stands of riparian trees; however, the protocols that are developed may indicate longer or shorter durations based on measures of structural diversity.

2. Provide a protocol to guide cost-effective and appropriate manipulations of identified riparian habitats in order to reset portions of these areas to the earlier successional stages. Protocols that may be established could include, but are not limited to, locations within stands for thinning, numbers or percent of trees per stand to be removed, height at which trees should be cut to encourage stump sprouting, and potential for in-planting in thinned areas to encourage species diversity as well as longer-term structural diversity.

3. Evaluate the timing and extent of manipulation necessary for maintaining multi-successional riparian habitat at the appropriate scale. Based on the collected data from this research, potential areas and the extent of manipulation for future areas may be predicted so that proper timing and budgeting for management can be more controlled and proactive. The funds for actual management action of conservation areas will be provided through each specific conservation area's work plan.

Changes in the hydrologic regime along the lower Colorado River have reduced the likelihood of marsh habitat being refreshed though active periods of flooding and removal of the vegetation structure. The covered marsh bird species thrive in marshes that function with ephemeral flooding and resetting of the habitat. Without flooding, active restoration and management of these marsh habitats is expected throughout the life of the LCR MSCP. The current literature suggests that burning of the marshes' decadent dry material allows for new habitat to emerge.

The objectives of the marsh study are to:

1. Provide a protocol for assessing areas at various spatial scales that are no longer providing habitat for the covered marsh birds

2. Provide a protocol to guide cost-effective and appropriate manipulations of marsh in order to reset portions of these areas to the earlier successional stages

3. Evaluate the timing and extent of the manipulation necessary for maintaining a mosaic of a functioning marsh

Previous Activities: A literature review was completed on riparian stand thinning/manipulations to determine the best approaches for achieving the desired habitat structure and to determine the measured parameters needed to indicate success. The best approaches for assessing habitat diversity in different structure types were tested to identify study sites with low structural diversity and/or those with later successional stages of growth. A supplemental literature review was conducted on the habitat requirements and limitations of the southwestern willow flycatcher (*Empidonax traillii extimus*) and yellow-billed cuckoo (*Coccyzus americanus occidentalis*). The addition of species habitat parameters was needed to assist in defining what vegetation parameters could be manipulated.

Following the literature review, two strategies using light detection and ranging (LiDAR) were investigated to assess structural diversity: (1) field-based methods (terrestrial laser scanning [TLS]) and (2) airborne-based methods (aerial laser scanning [ALS]). Both methods were used to identify vegetation strata and their relative heights at a site within a plot. Additionally, statistical tools were developed to assess the diversity of this vegetation data at multiple spatial scales (e.g., plot, patch, restoration area, etc.).

FY16 Accomplishments: ALS and TLS data collected during FY15 were processed and analyzed. The processing and analysis methods were developed to provide a repeatable procedure resulting in scalable metrics that described the vegetation structure of both created and existing habitat. Two sites were used for this analysis: the Palo Verde Ecological Reserve and the Rockhouse Riparian Demonstration Project. The goal of this initial analysis was to compare these two sites to evaluate the habitat suitability for southwestern willow flycatchers since the Rockhouse Riparian Demonstration Project has had evidence of them breeding since 2010, while only two southwestern willow flycatchers have been detected at the Palo Verde Ecological Reserve to date (one in 2015 and one in 2016). The analysis showed some differences in vegetation structure between the two sites, but since it included only one southwestern willow flycatcher-occupied site, additional southwestern willow flycatcher-occupied sites will be analyzed before any recommendations or conclusions regarding habitat manipulation are made.

The analysis did conclude that ALS data were sufficient for evaluating riparian forest vegetation to meet LCR MSCP needs; the added detail provided by TLS was not needed and did not warrant the additional level of effort associated with this technique.

The literature review to gather information to better manage marsh habitats was finalized. The literature review identified management techniques that could be implemented at LCR MSCP conservation areas that contained marsh land cover types. Preliminary planning to implement some of these techniques was undertaken.

Obligations were less than approved because work was completed using prior year's obligations and portions of the work were completed under Work Tasks F1 (LiDAR data acquisition) and G1 (data management activities).

FY17 Activities: The methods developed in FY16 to process and analyze ALS data to describe vegetation structure are being automated to facilitate future processing. Once the automated procedure is complete, ALS data collected at LCR MSCP conservation areas (with cottonwood-willow [*Populus fremontii-Salix gooddingii*] land cover type) and southwestern willow flycatcher-occupied sites throughout the Southwestern United States will be processed and analyzed. The data from the southwestern willow flycatcher-occupied sites will be used to develop ranges for each of the vegetation metrics. LCR MSCP conservation areas will then be evaluated against these ranges to make recommendations on whether some level of habitat manipulation is warranted or not.

One of the marsh habitat manipulation techniques identified in the literature review will be tested at Hart Mine Marsh in cooperation with the U.S. Fish and Wildlife Service. Mechanical disturbance will be performed at Hart Mine Marsh during FY17, and vegetation response data will be collected using unmanned aerial systems equipped with multispectral and photographic sensors. The sensors will be used to create three-dimensional models of the vegetation that describe structure and species composition. The results of this test will help determine whether or not this management technique should be included in the long-term marsh habitat manipulation toolbox.

Proposed FY18 Activities: ALS data will continue to be acquired in FY18 under Work Task F1 and will be processed and analyzed using the techniques developed in FY17. The long-term monitoring under this research work task will help inform the LCR MSCP about the level of active habitat manipulation that is necessary. If habitat manipulation is deemed necessary, the Habitat Conservation Plan and the literature review conducted under this work task will be consulted to identify appropriate riparian forest habitat manipulation techniques. Initial planning and design will be conducted to implement habitat manipulation tests at select LCR MSCP conservation areas. The goal of these tests will be to evaluate techniques for inclusion in the long-term riparian forest habitat manipulation toolbox.

Vegetation response monitoring will continue at Hart Mine Marsh using data acquired with unmanned aerial systems. This monitoring will continue to inform the LCR MSCP on whether mechanical disturbance should continue to be

included in the long-term marsh habitat manipulation toolbox. Additional marsh habitat manipulation techniques will be evaluated, and if appropriate, field tests will be planned and designed to evaluate their inclusion in the long-term marsh habitat manipulation toolbox.

Pertinent Reports: The report titled *Integrating Terrestrial Laser Scanning (TLS) and Aerial Laser Scanning (ALS) to Describe Physiognomic Vegetation Structure in Riparian Forests* and *Options for Managing Emergent Wetlands as Marsh Bird Habitat along the Lower Colorado River* will be posted on the LCR MSCP Web site upon completion.

Work Task C61: Evaluation of Alternative Stocking Methods for Fish Augmentation

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$200,000	$175,395.05	$373,555.34	$300,000	$300,000	$0	$0

Contact: Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

Start Date: FY14

Expected Duration: FY18

Long-Term Goal: Maintain the effectiveness of the LCR MSCP Fish Augmentation Program

Conservation Measures: BONY3, BONY5, RASU3, RASU5, and RASU6

Location: The lower Colorado River within the LCR MSCP planning area, including reservoirs and connected channels from Lake Mead downstream to Imperial Dam

Purpose: To evaluate the effects that alternative stocking methods have on the survival of razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) stocked within the LCR MSCP planning area

Connections with Other Work Tasks (Past and Future): Related work tasks include B2, B3, B4, B5, B6, C10 (closed), C11 (closed), C26 (closed), C31, C33 (closed), C39 (closed), C46 (closed), C63, C64, D8, and G3. In FY15, Work Tasks C10 and C11 were incorporated into this work task due to similarities in purpose, scope, and out-year implementation. Specific activities will be detailed in this work task, and the proposed fiscal year budgets will reflect the work that is to be undertaken. In FY16, documentation of soft release experiments was moved from Work Task C65 to Work Task C61. Because soft release research is essentially a type of stocking treatment and aims to assess long term survival through recontact probabilities, it is more appropriately covered under Work Task C61.

Project Description: Extensive monitoring of Colorado River native fishes is a commitment of the LCR MSCP, and in accordance with the Habitat Conservation Plan, several monitoring and research elements have been included as part of the LCR MSCP Fish Augmentation Program. Two of these research elements will be addressed, including (1) understanding and minimizing adverse

effects of stocking and (2) understanding post-stocking distribution and survival. Alternative stocking methods will be evaluated for razorback suckers and bonytail within the LCR MSCP Fish Augmentation Program boundaries and may include stocking during different seasons, stocking at night, stocking cohorts of various quantities, and stocking at specific locations. These alternative methods will generally be evaluated through multiple iterations of paired stockings, with one group representing the more traditional stocking and one representing the alternative method being investigated.

In addition to these alternative stocking methods, fishes reared by alternative means may also be evaluated through these efforts. These treatments will then be used to test whether different types of conditioning will translate to improved survival of stocked fishes. To test the effectiveness of these alternate rearing treatments, stockings would be completed in paired groups and may include fishes that have been either flow conditioned or trained to recognize predators. Information regarding post-stocking distribution and survival will be obtained through ongoing research and monitoring work tasks (C64 and D8). As information on these stockings becomes available, different combinations of these alternative stocking methods and treatments may also be evaluated.

Previous Activities: Previous research related to this work task was conducted under Work Task C26 (closed) in FY09–11. Feeding rates, efficiency of food conversion, growth, swimming performance, and physical condition of razorback suckers reared in flowing raceways at the Lake Mead Fish Hatchery were evaluated. The results from multiple iterations of this research showed that razorback suckers reared at the highest velocity flows evaluated, 38 and 39 centimeters per second, exhibited the most growth, highest food conversion efficiency, and best swimming performance. Additional rearing of native fishes under flowing conditions will be conducted as part of the current work task, and future monitoring efforts will be used to evaluate how the benefits of this rearing strategy relate to post-stocking survival of native fishes.

A total of 37,723 razorback suckers were repatriated into Lake Mohave during FY13–15 as 18 paired cohorts released in day and night stocking events. All efforts associated with these stocking events were captured under Work Task B2. Approximately 2% of FY13 and 0.4% of FY14 releases had been captured or contacted through monitoring efforts at the end of FY15, with little difference observed between day or night releases. Additional capture and contact data for FY13–15 cohorts will be obtained through future-year monitoring efforts and evaluated under this work task to determine the effectiveness or benefit of night stockings as compared to traditional day stocking events.

A portion of FY14 funding was also obligated to upgrade the electrical capabilities at the Lake Mead Fish Hatchery in preparation of future flow-conditioning efforts. This upgrade will support the operation of submersible

propeller pumps, which will allow for controlled flow in ten 30-foot raceways. Monitoring data from flow-conditioned and static-reared cohorts will be analyzed under this work task to evaluate differential survival.

FY16 Accomplishments:

Razorback sucker capture and contact data collected through ongoing monitoring efforts were analyzed during FY16 to evaluate the results from previous year day/night paired releases. Through FY16, approximately 2.3% of FY13, < 1% of FY14, and 1% of FY15 releases had been captured or contacted through monitoring efforts. These figures represent similar contact rates as those observed for traditional stockings; however, while little difference has been observed between fishes contacted from FY13 and FY15 day or night releases, approximately 62% of contacts from FY14 releases represent fishes stocked at night. Lake Mohave monitoring data collected through Work Task D8 have demonstrated that stocked fishes are often not contacted for up to 3 years post-release. Current data continue to support this observation, as an additional 110 fishes from FY13–15 were contacted for the first time in FY16. For this reason, these cohorts will continue to be tracked in future years, as it may require multiple years of data to evaluate this alternative stocking method.

FY16 was the first of three study years in which the survival of razorback suckers stocked into Lake Mohave was compared using cohorts of different quantities. Approximately 7,000 razorback suckers were stocked at 4 locations over a 3-week period, with each location receiving a different-sized cohort of fish (250, 500, or 1,000) each week. The total number of razorback suckers stocked at each location was the same; however, cohort stockings were staggered so that no more than two locations received the same number of fish during any one week. Capture and contact data for these cohorts were collected under this and other work tasks throughout the year. Through the end of FY16, < 1% of stocked fish had been captured or contacted. These cohorts will continue to be tracked in future years, and capture and contact data will continue to be analyzed as they become available through monitoring efforts.

Predator avoidance trials also continued at the six mesocosm ponds at the Valle Vista Golf Course in Kingman, Arizona. A chemical liner was applied to the two holding ponds to prevent water loss. Conditioning frequency research trials began with bonytail and largemouth bass (*Micropterus salmoides*). Data from one pond could not be used because of potential bias that was caused by young-of-the-year largemouth bass that were spawned in the pond. Preliminary data acquired from the studies conducted at other ponds suggested a higher survival rate for the fishes conditioned to avoid predators.

Soft release treatments for razorback suckers were initiated in three backwaters within Topock Gorge of Reach 3. These treatments consisted of fishes being released in paired cohorts of 400 to 600 fish. One cohort was released into a netted off portion of a selected backwater and held for 72 hours, and the other

cohort was released directly into the backwater and allowed to disperse without restrictions. Telemetered fish were released with each group, and remote passive integrated transponder tag scanning was conducted to look at immediate dispersal. Relative survival will be evaluated after several years of contact data have been collected.

FY17 Activities: Due to the razorback sucker losses experienced at Willow Beach National Fish Hatchery as a result of the parasite Ich (*Ichthyophthirius multifiliis*) outbreak in in early FY17, and the resulting lack of available fish to be stocked, comparative survival of razorback suckers stocked in cohorts of different quantities in Lake Mohave was postponed. These treatments will be evaluated in future years as fish become available.

Paired stockings of flow-conditioned and static-reared razorback suckers/bonytail will occur in FY17. Fish will be reared at the Lake Mead Fish Hatchery and released in Reach 2 or 3. The cohort sizes may be small during this initial study year due to the unavailability of suitably sized fish; however, they are expected to increase in future years as additional fish are brought on station. Capture and contact data for these cohorts will be collected through ongoing monitoring.

The last conditioning frequency research trials were completed at the six mesocosm ponds at the Valle Vista Golf Course in Kingman, Arizona, in early FY17. The mixed predator trials began but were also compromised when one dead largemouth bass was discovered in each of the five test ponds. It was suspected that someone was illegally stocking bass and fishing in these ponds during nighttime hours. Mixed predator trials will resume in spring 2017. Additional signs will be posted around the ponds, and a community outreach program will be conducted to raise awareness regarding this research in hopes of preventing fishing and stocking activities in the ponds during the trials periods.

Soft release treatments of razorback suckers will continue in order to assess the effect on long-term survival (probability of recontact) of fishes that are held for 3 days in a netted off section of a selected backwater compared to fishes released without being held. These soft releases should allow the fish recovery and acclimation time following the stresses of handling and hauling. This work will be accomplished using paired releases at three locations within Reach 3.

Proposed FY18 Activities: The potential benefits of alternative stocking methods will continue to be analyzed using capture and contact data from fishes stocked during previous years. Paired stockings of flow-conditioned and static-reared native fishes will also continue.

The predator avoidance study at the Valle Vista Golf Course will recommence in late FY17 and run through FY18, and it will focus on additional mesocosm-based post-conditioning survival trials with razorback suckers exposed to a number of different predators. Other alternatives to traditional stocking will be evaluated

during the year, and potential opportunities to implement these alternatives will be assessed as fish become available. Soft release treatments of razorback suckers will continue through FY18.

Longer-term monitoring of these treatments will be assessed through data derived from passive integrated transponder scanning recontacts. This recontact information will be acquired through the research and monitoring efforts conducted under Work Tasks C64 and D8 after FY18. Comparisons of relative recontact rates of treatment versus controlled fish in paired releases will suggest the effectiveness of each treatment with respect to its ability to improve post-stocking survival of both razorback suckers and bonytail.

This work task will be closed in FY18.

Pertinent Reports: The report titled *Razorback Sucker and Bonytail Chub Predator Recognition* is posted on the LCR MSCP Web site.

Work Task C62: Lowland Leopard Frog and Colorado River Toad Habitat and Ecology Study

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$150,000	$147,788.13	$417,310.00	$25,000	$0	$0	$0

Contact: Barbara Raulston, (702) 293-8396, braulston@usbr.gov

Start Date: FY14

Expected Duration: FY17

Long-Term Goal: To gather data on the ecology and habitat of the lowland leopard frog (*Rana yavapaiensis* = *Lithobates yavapaiensis*) and Colorado River toad (*Bufo alvarius* = *Incilius alvarius*) to evaluate the feasibility of implementing a pilot introduction into unoccupied habitat

Conservation Measures: CRTO1, CRTO2, CRTO3, LLFR1, LLFR2, and LLFR3

Location: LCR MSCP planning area and the Bill Williams River, Agua Fria River, and Verde River watersheds

Purpose: The purpose of this work task is to document lowland leopard frog and Colorado River toad habitat characteristics and measurable ecological factors that may limit each species' distribution. This will inform future decisions on the feasibility of establishing lowland leopard frogs and Colorado River toads in an unoccupied habitat.

Connections with Other Work Tasks (Past and Future): Preliminary data collected under Work Task D12 will be expanded upon in this study.

Project Description: Surveys for lowland leopard frogs and Colorado River toads in the past have located very few populations in the LCR MSCP planning area, and habitat requirements are not well documented. Surveys for both species will be conducted to find breeding areas and document egg mass locations and measurable habitat parameters at breeding sites. Habitat parameters may include the presence of non-native predators, minimum and maximum water depth and temperature, substrate type (e.g., gravel and sand), water temperature, pH, turbidity, stream discharge, and vegetation composition. As the Bill Williams

River is the only known occupied area for either species within the LCR MSCP planning area, other similar river systems may be surveyed so the sample size will be statistically robust to support research findings.

Previous Activities: Field work began in July 2014 to locate occupied breeding habitat for the Colorado River toad within the Bill Williams River, Agua Fria River, and Verde River watersheds. Breeding was confirmed in all three watersheds, with the majority occurring at Adobe Dam in the Agua Fria River watershed. Lowland leopard frog surveys began in FY15 along the Bill Williams River and the Big Sandy River within the Bill Williams River watershed and historical locations along the Agua Fria and Verde Rivers. Sufficient lowland leopard frog egg masses and breeding habitat data were collected in FY15, so further egg mass searches for this species were not required. Egg masses for Colorado River toad were found in FY14 but not in FY15.

FY16 Accomplishments: Monitoring for the Colorado River toad was completed in fall 2016, with no additional egg masses found; therefore, Colorado River toad breeding habitat was characterized for the FY16 annual report with data from 19 egg masses detected in FY14.

FY17 Activities: Data analyses and the final report will be completed in June. The work task will close in September.

Proposed FY18 Activities: This work task was closed in FY17.

Pertinent Reports: The *Ecology and Breeding Habitat of Colorado River Toads – 2015 Annual Report* will be posted on the LCR MSCP Web site upon completion.

Work Task C63: Evaluation of Habitat Features that May Influence Success of Razorback Suckers and Bonytail in Backwater Environments

FY16 Estimate	FY16 Actual Obligations	Cumulative Accomplishment Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$135,000	$90,290.50	$193,042.01	$150,000	$150,000	$0	$0

Contact: Jeff Anderson, (702) 293-8216, jranderson@usbr.gov

Start Date: FY15

Expected Duration: FY18

Long-Term Goal: To inform future design and management of created backwater habitats

Conservation Measures: BONY3, BONY5, RASU3, RASU5, and RASU6

Location: Reaches 2–5

Purpose: To provide information on how natural and artificial habitat features are used by razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) and their relative importance for influencing survival and long-term success

Connections with Other Work Tasks (Past and Future): This work task represents the merger of two previously funded work tasks: C41 (closed) and C58 (closed). This work task is related to all work tasks in Fish Augmentation (Section B) that provide razorback suckers and bonytail for augmentation stocking, specifically Work Tasks B7, C23 (closed), and F5. The results of investigations that occur under this work task may indicate that future stocking treatments will need to be tested (C61) or modified (Section B work tasks).

Project Description: The activities covered under this work task both consolidate and build on the work that has been undertaken and accomplished under Work Tasks C41 (closed) and C58 (closed). The combination of these work tasks represented a logical merger because of their similarities in scope and intent and potential overlap in ongoing experimental investigations.

Habitat features are important to success (growth, survival, and reproduction) of fishes in aquatic environments. In particular, structural features such as submerged woody debris, reefs, rock cavities, and submerged vegetation can provide cover for multiple life stages of fishes. Cover allows fishes to hide and

rest and can be vital to survival by allowing them to avoid predation through both concealment and direct protection. The types of features (both artificially constructed and those that are existing/natural) that may be used by native fishes will be investigated. The use of other forms of cover, such as aquatic vegetation and turbidity, may also be investigated to determine which of these types of features plays a more important role as cover for razorback suckers and bonytail. These features may be important, especially in created backwater environments where they may not be present or may not be in sufficient quantities, to promote the success of these species. By including these features in created backwaters, both immediate and long-term survival and success may improve. This work task was created to:

- Inform managers of habitat structures to include when designing and creating backwaters

- Help improve existing created backwaters by providing options for adding structural elements (both "natural" and artificial) to afford adequate cover

- Potentially assist in improving post-stocking survival by suggesting stocking sites with adequate cover or adding features to stocking locations to provide cover from predatory fish and/or piscivorous birds

Previous Activities: Detailed accounts of work and accomplishments covered under Work Tasks C41 (closed) and C58 (closed) have been reported under these tasks and in their associated technical reports. This work included monitoring the use of artificial habitat features in Davis Cove (on Lake Mohave) by both razorback suckers and bonytail. Investigations have also been ongoing to characterize the existing riprap shoreline at High Levee Pond because of documented frequent use of its cavities by bonytail. Preliminary investigations suggested that bonytail regularly used both artificial (constructed and installed) and more "natural" existing structures (riprap) as cover. No difference has been detected in the use of these features by razorback suckers, and this suggested that this species may use other forms of cover; aquatic vegetation and/or turbidity have been speculated as potential cover used by razorback suckers.

FY15 cavity trials for bonytail at the Lake Mead Fish Hatchery suggested a higher frequency in selection of a structure with the 50-millimeter-diameter cavity (smallest cavity opening offered). The hatchery noted that bonytail took about 30 days to get acclimated to the structure before entering. After acclimating, the hatchery observed the bonytail entering the structure and using it almost exclusively, venturing out rarely except to feed.

Artificial habitat selection trials were conducted at Davis Cove to assess the selection of 4-inch drainage pipe by bonytail. The results from 11 weeks of comparing scanning data from pipe habitat and no artificial habitat (control)

suggest there was no difference in use. The diameter of the pipe used as artificial habitat may have been too small for the bonytail that were stocked into Davis Cove.

Data collection ceased at Davis Cove when dissolved oxygen (DO) crashed to lethal levels in parts of the cove in the fall of FY16. Therefore, data were not available to conduct analyses.

FY16 Accomplishments: Investigations at Davis Cove resumed on October 19, 2015. Three scanning intervals were conducted between October 19 and December 7, 2015, to establish a population estimate for razorback suckers and bonytail that may have survived the low DO levels that were detected on September 4, 2015.

On February 10, 2016, 328 passive integrated transponder (PIT)-tagged bonytail were stocked into Davis Cove. The mean total length and weight of bonytail were 215 millimeters and 89 grams, respectively. Habitat containing PIT tag scanning equipment and PIT tag scanning equipment with no habitat (control) pairings were monitored at four sites within Davis Cove. Scanning intervals lasted between 5 and 7 days and were completed three times between April 7 and May 26, 2016. Over the three scanning intervals, the number of razorback suckers and bonytail contacted was six and eight, respectively. These numbers suggested that the bonytail population had fallen to numbers too low to provide any practical habitat use data. Restocking Davis Cove at that time with PIT-tagged bonytail was not possible due high temperatures, so habitat testing was moved to the Lake Mead Fish Hatchery. This change in location also provided a more controlled setting in terms of water quality and consistent control treatments.

On July 19, 2016, two bundles of drainage pipe, one 3-inch diameter and one 4-inch diameter, were placed in a raceway at the Lake Mead Fish Hatchery that contained about 450 bonytail measuring 300–340 millimeters in total length. Each bundle consisted of 10 pipes measuring 5 feet long and contained no scanning equipment. The bundles were monitored visually over 2 months after deployment. Bonytail were noted to occupy the space under and around the pipe bundles, but only three were seen inside of one of the pipes.

FY17 Activities: Investigations of the selection and use of artificial structures by razorback suckers and bonytail will continue in FY17 at the Lake Mead Fish Hatchery. Cavities with similar 3- and 4-inch-diameter openings will be tested with bonytail. Alternative structures will be tested with razorback suckers. If razorback suckers and bonytail in the hatchery inhabit these structures more than they do open water, then they may select the same structures at future stocking locations such as the Imperial Ponds Conservation Area and Beal Lake. These structures could provide fish cover from piscivorous and avian predation at these sites.

Proposed FY18 Activities: Stocked razorback suckers and bonytail will be acclimated to the habitat while in the hatchery and then released within the same habitat onsite. Razorback sucker and bonytail survival will be monitored.

This work task will be closed in FY18.

Pertinent Reports: All findings and statistical analyses will be presented in the report titled *Evaluation of Habitat Features that may Influence Success of Razorback Sucker and Bonytail in Backwater Environments: 2016*, and it will be posted on the LCR MSCP Web site upon completion.

Work Task C64: Post-Stocking Movement, Distribution, and Habitat Use of Razorback Suckers and Bonytail

FY16 Estimate	FY16 Actual Obligations	Cumulative Accomplishment Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$700,000	$656,351.17	$1,043,666.57	$750,000	$750,000	$750,000	$750,000

Contact: Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

Start Date: FY15

Expected Duration: FY27

Long-Term Goal: To maintain an effective LCR MSCP Fish Augmentation Program

Conservation Measures: BONY3, BONY 4, BONY5, RASU3, RASU4, and RASU6

Location: Reaches 2–5

Purpose: To provide information on the movement, distribution, and habitat use of stocked razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*) and to use this information to set up an appropriate monitoring network to suggest potential stocking locations and track post-stocking survival

Connections with Other Work Tasks (Past and Future): This work task represents the merger of three previously funded work tasks: C39 (closed), C45 (closed), and C49 (closed). The intent of this combination was to capture the activities with similar purposes and scope into a consolidated, multi-reach effort for both razorback suckers and bonytail. This work task is related to Work Tasks B2, B3, B4, and B6, all of which provide razorback suckers and bonytail for augmentation stocking and may also build on information gained in Reach 1 through Work Tasks C13 (closed) and C57 (closed). Information collected under this work task will be added to the database used to complete Work Task D8. Information obtained from C8 (closed) and C61 will be used in this study. Funds from Work Task G3 were provided in FY14 to accomplish preliminary work in Reach 2 that will be covered by this work task in FY15.

Project Description: The activities covered under this work task both consolidate and build on the work that has been undertaken and accomplished under closed Work Tasks C39, C45, and C49. The approaches used to identify appropriate stocking locations throughout Reaches 2–5 will be formalized, which will be accomplished through pilot releases of tagged fishes to identify dispersal and movement of individuals or groups. Information on preliminary post-stocking habitat selection and use and survival will be provided and can then be used to (1) establish a more appropriate monitoring network in terms of where to locate remote sensing equipment or other sampling gear with higher probabilities for contacts, (2) indicate locations that may be better suited for stocking fishes, and (3) possibly identify additional aggregations of native fishes.

The networks that are established under this work task will also provide monitoring information on the effectiveness of different stocking treatments (conducted under Work Task C61) as well as longer-term information on survival, habitat use, and movement of native fishes in these reaches. Eventually, these established long-term monitoring networks may be used for system-wide monitoring and would be covered under Work Task D8.

Previous Activities: Detailed accounts of work and accomplishments covered under closed Work Tasks C39, C45, and C49 have been reported under these tasks and in their associated technical reports. They include the tracking and monitoring of stocked razorback suckers and bonytail in specific areas in Reaches 3 and 4. Post-stocking movement and habitat use have been documented, and post-stocking survival estimates have been developed for razorback suckers and/or bonytail in these reaches.

Reach 2 (Lake Mohave): A sonic telemetry study was initiated in FY15 with the stocking of 19 adult razorback suckers into Lake Mohave. Razorback suckers were tracked monthly, and 25 submersible ultrasonic receivers were deployed, allowing for continuous surveillance throughout the year. Fish movements and habitat use were identified through analyses of active and passive contacts. Tracking of this cohort of fish will continue through FY17, coinciding with the expected duration of sonic tag battery life.

Reach 3: Habitat use of razorback suckers was studied in eight backwaters and the lower Colorado River from Park Moabi downstream to the Lake Havasu delta (previously conducted under Work Task C39). During the 5 years of trammel netting and 3 years of remote passive integrated transponder (PIT) scanning, both trammel nets and PIT scanners predominantly contacted recently released fish (< 3 years).

Of the eight backwaters being monitored, razorback sucker catch per unit effort for trammel nets and PIT scanners was on average seven times higher in Park Moabi. Water quality (primarily temperature) and the composition of aquatic vegetation were identified as the greatest distinguishing factor in Park Moabi.

Bonytail survival, distribution, and habitat use were assessed at two different locations in FY15: the Bill Williams River in fall 2014 and Park Moabi in spring 2015. Information was obtained through the use of sonic telemetry and remote PIT scanning. The Bill Williams River release site continued to result in low recontacts for bonytail; only 1 of 19 telemetered fish was active after 1 month. Remote PIT scanning data from these two locations showed high contact rates within the first weeks post-release followed by rapid decreases in contact rates in subsequent weeks.

Reach 4 and 5: Monthly PIT tag scanning surveys and a single netting survey below Palo Verde Diversion Dam were completed in FY15. Bonytail were only contacted within months of their release, and razorback suckers were most frequently contacted in the A-10 upper backwater. Only a single razorback sucker was contacted in Reach 5 during FY15. It was in a side channel on the California side, about 0.80 river mile downstream from Ferguson Lake.

FY16 Accomplishments: Accomplishments for this work task have been summarized by river reach.

Reach 2 (Lake Mohave): Tracking of sonic-tagged razorback suckers continued in FY16 through monthly monitoring trips. Passive and active tracking allowed for the identification of both large-scale movements and the use of specific habitats at various locations. Based on passive contacts, razorback suckers were observed to routinely transition among lake zones, often traveling more than 30 miles within relatively short periods of time (5 days – 2 months). Active contacts provided information regarding seasonal habitat use, with fish using deeper, mid-channel habitat in late spring and summer and shallow inshore habitat in late fall.

Nineteen bonytail were obtained from the Lake Mead Fish Hatchery (B6), implanted with 9-month sonic tags, and released into Lake Mohave with a cohort of approximately 400 PIT-tagged bonytail based on similar efforts in early FY16. These fish were released at Arrowhead Cove, a site where bonytail were historically captured. Active tracking was conducted intensively for 6 weeks after release to maintain contact with these fish; however, despite these intensive efforts, approximately one-half of these fish became difficult to locate within the first 3 weeks. Contacts with these fish steadily declined through winter, but an increase in activity was observed in late spring and summer. At the conclusion of the 9-month study period (when sonic tag batteries were expected to fail), seven fish were confirmed as mortalities, eight had an unknown status, and four remained active.

An additional 20 sonic-tagged bonytail were released into Lake Mohave in April 2016 in order to continue to monitor fish within the lake. These fish were released with a cohort of 500 PIT-tagged bonytail and stocked in two locations, Arrowhead and Yuma Coves. Monitoring of these fish followed the same general

format as the previous stocking, with short-term intensive tracking followed by monthly tracking trips. Low recontact rates were observed immediately following stockings. Only 8 of 20 fish were contacted via active or passive tracking 1 month after stockings. At the conclusion of this 9-month study period, 8 fish were confirmed as mortalities, 12 had an unknown status, and 3 were not contacted at any time during the study period.

Reach 3: Due to flannelmouth sucker (*Catostomus latipinnis*) and razorback sucker observations in Laughlin Lagoon, bonytail telemetry and PIT scanning was initiated. This release also included radio-tagged fishes to help describe the fate of fishes lost within the study area. Twenty-four bonytail were implanted with telemetry tags (12 sonic tagged and 12 radio tagged). By the end of the 12-week study, 13 of these fish were confirmed mortalities. Two of the radio tags were found out of the water, and two sonic tags were detected beneath a known cormorant (*Phalacrocorax auritus*) roosting site below Davis Dam. The 11 remaining tags were lost within the study area (no indication of emigration), which may also indicate removal from the study area by avian predators.

Actively tracked bonytail were found associated with bulrush habitats 15% of the time. This was the highest association with any habitat type for all actively tracked fish. PIT scanning indicated some level of survival in Laughlin Lagoon based on the detection of 13 bonytail that were stocked 3 months prior to the beginning of this study. Nevertheless, unique PIT tag detections from the first week to the second week dropped 30% at Laughlin Lagoon, compared to a 60% drop observed in Park Moabi and a 90% decline in detections recorded at other release sites based on similar scanning efforts at all locations.

Reaches 4 and 5: In Reach 4, monthly PIT tag scanning surveys were initiated in October 2015. Remote PIT scanners scanned for 9,675.3 hours and resulted in nearly 350 unique razorback sucker contacts and 40 unique bonytail contacts. Native fishes were scanned in nearly every backwater in the area and throughout the main channel. All of the bonytail originated from a single release on September 23, 2015; 29 were detected in October, 12 were detected in November, and then 3 more were detected through January. The majority of razorback suckers recontacted originated from three stocking events from April 2015 through February 2016. There were also 13 fish recontacted that were released prior to 2015, 10 of which were from 2007.

Four scanning trips were completed in Reach 5 for a total of 1,978.8 scanning hours. Zero fish were contacted during the scanning events, and after 2 years of PIT scanning, only a single fish has been contacted on a PIT scanner in Reach 5.

FY17 Activities: The budget estimates reflect the projected costs for FY17 as part of the continuation of work from combined closed Work Tasks C39, C45, and C49 plus the additional work described below for Reaches 2, 4, and 5.

Reach 2 (Lake Mohave): Twenty bonytail will be obtained from the Lake Mead Fish Hatchery, implanted with 9-month sonic tags, and released into Lake Mohave in January. These fish will be stocked with a cohort of approximately 500 fish. An additional 15 razorback suckers will also be obtained from the Lake Mead Fish Hatchery, implanted with 3-year sonic tags, and released with 2 cohorts of 250 fish. Intensive active tracking will be conducted immediately following stocking. Less intensive active tracking and continuous passive tracking will continue throughout FY17.

Sonic-tagged razorback suckers released in FY15 will also continue to be tracked as part of this effort, as this work can be performed concurrently and will help to maximize resources and the use of acquired equipment. Tracking of razorback suckers will be used to evaluate movement patterns, seasonal habitat use or preference, and spawning site fidelity. Contacts with sonic-tagged razorback suckers will also be used to inform sampling locations for ongoing monitoring efforts.

Reach 3: Regular monitoring of razorback suckers, bonytail, and flannelmouth suckers in Reach 3 will be covered under Work Task D8 in FY17.

Reaches 4 and 5: Monthly scanning surveys will continue in Reach 4, and these will include a greater emphasis on locating any potential riverine spawning aggregates. Sonic telemetry of hatchery-released razorback suckers and bonytail will be initiated in December 2016. Scanning locations will be dictated based on the distribution of the telemetered fishes. If available, additional adult razorback suckers will be captured from the river and implanted with sonic tags in order to aid in the detection of spawning aggregates in the river. No scanning will occur in Reach 5 unless the distribution of sonic-tagged fishes suggests that a substantial amount of stocked fishes are dispersing into this reach and forming spawning aggregates.

Proposed FY18 Activities: Proposed activities for this work task have been summarized by river reach. Paired experimental releases of razorback suckers and bonytail exposed to predator avoidance conditioning and non-conditioned fish will be initiated at a location to be determined. Intensive monitoring is expected to commence along with the increased yearly experimental stocking numbers of razorback suckers and bonytail in these reaches. Monitoring efforts under Work Task C64 will be reduced in Reach 3 until the hatcheries rearing capacity is sufficient to allow for the increased experimental stocking rates to commence. Overall increases in expenditures are expected due to the size, complexity, and accessibility issues involved in conducting work in Reaches 4 and 5.

Reach 2: Sonic-tagged razorback sucker monitoring will continue. Continued releases of sonic-tagged bonytail may also occur.

Reach 3: No work is scheduled in this reach in FY18.

Reach 4: Surveys and monitoring efforts will continue in FY18. All data will be used to inform managers of potentially favorable release locations and relative survival in Reach 4.

Reach 5: Surveys will be limited unless the distribution of sonic-tagged fishes from Reach 4 suggests that a substantial amount of stocked fishes are dispersing into this reach and forming spawning aggregates.

Pertinent Reports: A report summarizing the Reach 3 bonytail work from 2013 to 2016 is completed and will be posted on the LCR MSCP Web site.

Work Task C65: Evaluation of Immediate Post-Stocking Survival of Razorback Suckers and Bonytail

FY16 Estimate	FY16 Actual Obligations	Cumulative Accomplishment Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$120,000	$99,329.26	$105,056.43	$120,000	$120,000	$0	$0

Contact: Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

Start Date: FY15

Expected Duration: FY18

Long-Term Goal: To maintain an effective LCR MSCP Fish Augmentation Program

Conservation Measures: BONY3, BONY4, BONY5, RASU3, RASU4, and RASU6

Location: Reaches 2–5

Purpose: To identify the most important sources of immediate post-stocking mortality and to inform managers of how to best target and prioritize solutions

Connections with Other Work Tasks (Past and Future): This work task is related to Work Tasks B2, B3, B4, C10 (closed), C11 (closed), C25, C46 (closed), and C61. Preliminary planning, acquisition of materials, and study design development occurred in FY14 with funds from Work Task G3. In FY16, documentation of soft release experiments was moved to Work Task C61. Because soft release research is essentially a type of stocking treatment and aims to assess long-term survival through recontact probabilities, it is more appropriately covered under Work Task C61.

Project Description: Observations from past stocking events have indicated relatively high and immediate post-stocking mortality of razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*). This pattern appears more commonly in backwater situations and occurs even in instances where no or low numbers of predatory fishes are present and where water quality parameters should not be a source of mortality. Transport and handling stress and predation by piscivorous birds have been suspected as causes of this low survival. Only anecdotal evidence exists to support the speculation that piscivorous birds are the

major cause of this mortality, and although handling and transport stress have been measured for stocked fishes, little evidence exists that connects this stress to actual latent mortality.

This work task builds directly on the knowledge gained from Work Task C46 (closed) and takes the next step from observing stress indicators in stocked fishes to investigating how they translates into actual latent post-stocking mortality. This work may involve holding a subset of stocked fishes in a protected area for observation and recording survival rates after 24, 48, and 72 hours. Longer durations may also be explored if deemed necessary. A subsample of these fishes may also have their blood tested for levels of stress-indicating compounds.

In addition, a bioenergetics model of piscivorous bird predation will be further developed and tested, and observational studies may be employed to help calibrate the model. These studies may include performing counts of confirmed feeding of piscivorous birds on stocked razorback suckers and bonytail. This model is intended to help inform managers of the relative pressure that bird predation may be having on stocked native fishes.

Data collected during this study will be used to assess the effect of stocking treatments relative to stress-related mortality, bird predation, or other factors that may be accounting for immediate post-stocking mortality and will allow managers to better prioritize and target solutions, like those being tested under Work Task C61, or find new ways to improve survival of stocked fishes by identifying what factors are the greatest sources of immediate mortality.

Previous Activities: This was a new start in FY15. Previous activities have been conducted under Work Task G3 and included the development of a protocol and study plan to assess latent mortality of stocked fishes. The development of a bioenergetics model was initiated in FY14. The purpose of the model was to suggest the potential pressure that available piscivorous birds could exert on stocked fishes.

Latent mortality within the first 72 hours following stocking of razorback suckers in Reach 2 was evaluated. No mortality was observed in the first 72 hours of stocking within the subsample of fish that was held at the stocking location.

In FY15, preliminary efforts were initiated under Work Task G3 to document bird predation on native fishes using remote passive integrated transponder (PIT) tag scanners. Scanning was initiated in Laughlin Lagoon following a bonytail release in September 2015. Scanners were deployed on the tops of poles out of the water within the stocking area where cormorants (*Phalacrocorax auritus*) were

regularly observed. Game cameras were attached to the scanners to document bird usage and to correlate any PIT tag contacts with a particular species of bird. Two PIT tags were detected on multiple scanners within 24 hours post-release, and photo corroboration confirmed that the fishes were consumed by cormorants. Additional scanning beneath the known roost sites in the lagoon documented 23 stationary tags that are assumed to be from deceased fishes. These tags were from fishes which had been released throughout the LCR MSCP planning area, and some were from fishes released as early as 2003.

The energy content (measured in calories) of razorback suckers and bonytail was planned to be collected and assessed in FY15; however, specialized equipment was not available.

FY16 Accomplishments: Scanning of known bird roosts immediately following stocking events continued in FY16. Continuous avian scanning for 10 days following a December 2015 release of bonytail resulted in the detection of 24 tags, which was 2.53% of the stocked fishes. Scanning following the May release of bonytail detected seven tags (1%) consumed by avian predators. Bird activity was noticeably different during the May trial due to local temperatures. Scanning in combination with game cameras from September through May confirmed predation by three species: osprey (*Pandion haliaetus*), cormorant, and great blue heron (*Ardea herodias*). This study confirms that bird predation on stocked fishes is occurring. Although the percentage of confirmed initial post-stocking predation appears low, sampling efforts are likely underrepresenting bird predation mortality. The bird roost scanners are limited in number and can only detect tags in birds that recently consumed fishes and who landed on the roost scanners during that period. Evidence of bird predation on fishes from previously releases (roost-scanned PIT tags) suggests that bird predation may be continuous on stocked fishes. Over time, these small percent of mortalities attributed to bird predation could lead to a substantially larger number of predated fishes. Additional longer-term scanning efforts will be necessary to suggest if continuous bird predation is occurring. These data will also help inform a bioenergetics model that will provide a more quantitative assessment of the potential magnitude and variability of bird predation on stocked fishes. A study plan was completed and includes post-release bird scanning directed at refining the parameters needed for bioenergetics modeling.

Latent mortality trials were continued in FY16 with a modification to the original study protocol for simplified data analyses and to be consistent with the current literature's critical stress response period. The latent mortality holding period was reduced to three replicates for one 48-hour time period. Three trials were conducted in FY16, and the results are presented in table 1.

Table 1.—Latent Mortality Results – Date, Species, Rearing Origin, Stocking Location, Number of Test Fish, and Number of Mortalities After 48 Hours of Holding (Post-Stocking) in FY16

Date	Species	Rearing Origin	Stocking Location	Number of fish tested	Number of mortalities
4/30/2016	Razorback sucker	Bubbling Ponds Fish Hatchery	Park Moabi	36	6[1]
05/19/2016	Bonytail	Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico	Laughlin Lagoon	28	0[2]
12/07/16	Bonytail	Achii Hanyo Native Fish Rearing Facility	Laughlin Lagoon	24	0

[1] The condition of these fish was noted to be poor at the time of harvest, so these mortalities may not be attributable to transport or stocking stress; two mortalities were recorded at the hatchery, and one was recorded during transit to the stocking location.

[2] Eight fish escaped from one of the net pens during this trial. These fish were not counted as mortalities, but it is unknown how long they were held in the net pen.

FY17 Activities: Additional bird predation trials have been initiated in order to continue to refine the bioenergetics model. This work will accompany several native fish stocking events and primarily those scheduled for the Imperial Ponds Conservation Area.

Latent mortality trials will continue in FY17 concurrent with fish stocking events whenever possible. The locations will be determined based on local conditions and species of fishes stocked.

Proposed FY18 Activities: Avian predation work will continue as needed in order to complete the bioenergetics model. Paired cohorts of soft releases will continue for the third year, and data will be analyzed to determine if there are any differences in survival.

Based on results from previous years, latent mortality trials may continue in FY18 concurrent with fish stocking events whenever possible. The locations will be determined based on local conditions and species of fishes stocked. A summary report of these results will be provided at the end FY18.

This work task will be closed in FY18.

Pertinent Reports: N/A

Work Task C66: Marsh Bird Water Depth Analysis

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$100,000	$83,717.80	$83,717.80	$100,000	$20,000	$0	$0

Contact: Chris Dodge, (702) 293-8115, cdodge@usbr.gov

Start Date: FY16

Expected Duration: FY18

Long-Term Goal: Define marsh water depth requirements for covered marsh birds

Conservation Measures: MRM1 and MRM2 (BLRA, CLRA, and LEBI)

Location: LCR MSCP project area

Purpose: To identify the range of acceptable water depths in California black rail (*Laterallus jamaicensis coturniculus*), western least bittern (*Ixobrychus exilis hesperis*), and Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) breeding sites and ranges of acceptable daily, monthly, and annual variability

Connections with Other Work Tasks (Past and Future): Marsh bird habitat was studied previously under Work Task C24. The first year of funding was provided through Work Task G3.

Project Description: The Habitat Conservation Plan requires the creation of a minimum of 512 acres of marsh habitat for three LCR MSCP covered marsh bird species. All 512 marsh acres should have water depths no greater than 12 inches to provide habitat for Yuma clapper rails and western least bitterns, while 130 acres of marsh is required with water depths no greater than 1 inch to provide habitat for California black rails.

Water depths in California black rail and Yuma clapper rail existing breeding sites along the lower Colorado River will be evaluated. Data will be analyzed to identify the range of water depths in California black rail and Yuma clapper rail breeding sites throughout the breeding season and to identify the ranges of daily, monthly, and annual variability that can occur and still have successful breeding.

Previous Activities: This is a new start in FY16.

FY16 Accomplishments: Yuma clapper rail breeding data from 52 monitoring points and existing daily river gauge data collected from FY06–14 in Topock Gorge and Topock Marsh were compiled and analyzed. Detections of Yuma clapper rails at each monitoring point during the three surveys conducted each year (known occupancy) were compared to the range of water depth fluctuation occurring during that monitoring period to determine whether presence of Yuma clapper rails was influenced by water level fluctuations in each survey period. The data were analyzed using occupancy modeling techniques in Program Presence (Version 9.0). Models were compared using Akaike's information criterion. The results did not support the hypothesis that the per-period levels of water fluctuation as recorded in Topock Gorge affect the presence of Yuma clapper rails, and nesting occurred each year with greater than 12-inch fluctuations in water depth. There is very strong evidence that detectability of Yuma clapper rails varies by year and survey period.

FY17 Activities: Existing water depth measurements and California black rail breeding data will be compiled and analyzed. Detections of California black rails at each monitoring point during the three surveys conducted each year (known occupancy) will be compared to the range of water depth fluctuations occurring during that monitoring period. Occupancy modeling will be conducted to evaluate the relationship between the probability of the monitoring points being occupied by California black rails during the breeding season and fluctuations in water depth.

Proposed FY18 Activities: The *Marsh Bird Water Depth Analysis Final Report* will be finalized.

This work task will be closed in FY18.

Pertinent Reports: The *Marsh Bird Water Depth Analysis 2016 Progress Report* will be posted on the LCR MSCP Web site upon completion.

WORK TASKS – SECTION D

System Monitoring

Work Task D1: Marsh Bird Surveys

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$40,000	$36,470.97	$326,943.84	$40,000	$40,000	$40,000	$40,000

Contact: Joe Kahl, (702) 293-8568, jkahl@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: System monitoring for marsh birds

Conservation Measures: MRM1 and MRM2 (LEBI, CLRA, and BLRA)

Location: Reach 3, Havasu National Wildlife Refuge, Arizona and California

Purpose: The purpose of this work task is to monitor Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]), California black rails (*Laterallus jamaicensis coturniculus*), and western least bitterns (*Ixobrychus exilis hesperis*) along a designated reach of the lower Colorado River as part of the interagency system monitoring program. The information obtained through this task may be used in managing marsh bird habitat creation areas.

Connections with Other Work Tasks (Past and Future): Data obtained from Work Task F7 may also be used in the marsh bird system monitoring program described in this work task. The protocol developed for this work task will also be used for Work Task F7.

Project Description: Marsh bird surveys will be conducted in coordination with the U.S. Fish and Wildlife Service (USFWS) as part of a multi-agency, system-wide monitoring effort that has been ongoing annually since 1980. LCR MSCP surveys are conducted along the lower Colorado River between the I-40 Bridge, near Needles, California, and Lake Havasu, including Topock Gorge in the Havasu National Wildlife Refuge.

Prior to implementation of the LCR MSCP, a study was conducted to determine whether Yuma clapper rail surveys could be expanded to a multi-species protocol without compromising their detection rates. Information obtained from this study has produced a multi-species protocol for marsh birds, including the LCR MSCP covered species (Yuma clapper rails, California black rails, and

western least bitterns). Marsh bird surveys, utilizing the multi-species protocol, will continue at designated survey points in order to track detections of covered species.

Previous Activities: The Bureau of Reclamation has monitored Yuma clapper rails within Topock Gorge since 1996 in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort.

FY16 Accomplishments: Marsh bird surveys were conducted between the I-40 Bridge, near Needles, California, and Lake Havasu during March, April, and May 2016 in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. All three covered species were encountered: 37 Yuma clapper rail detections in March, 70 in April, and 65 in May; 20 western least bittern detections in March, 41 in April, and 73 in May; 1 California black rail detection in March, 0 in April, and 2 in May. Data were compiled and entered into the Avian Knowledge Network database.

FY17 Activities: Marsh bird surveys will be conducted in Topock Gorge and the upper reaches of Lake Havasu using the multi-species marsh bird survey protocol in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. Surveys may also be conducted at the Havasu National Wildlife Refuge as needed. Data will be submitted to the USFWS. Information obtained through this work task may be used in planning future marsh bird habitat creation activities and research projects.

Proposed FY18 Activities: Marsh bird surveys will be conducted in Topock Gorge, the upper reaches of Lake Havasu, and other sites using the multi-species marsh bird survey protocol in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. Data will be submitted to the USFWS. Information obtained through this work task may be used in planning future marsh bird habitat creation activities and research projects.

Pertinent Reports: The report titled *Marsh Bird Surveys – 2016* will be posted on the LCR MSCP Web site upon completion.

Work Task D2: Southwestern Willow Flycatcher Presence/Absence Surveys

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$750,000	$748,047.05	$8,382,003.83	$750,000	$650,000	$200,000	$200,000

Contact: Chris Dodge, (702) 293-8115, cdodge@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: System monitoring and post-development monitoring of southwestern willow flycatchers (*Empidonax traillii extimus*) (FY16–17) and system monitoring of southwestern willow flycatchers (FY18–55)

Conservation Measures: MRM1, MRM2, and MRM4 (WIFL)

Location: Reaches 1–7 along the lower Colorado River (LCR), southern Nevada, lower Bill Williams River, lower Gila River, and the Virgin River between the Virgin River Gorge and Lake Mead. Life history study sites are located along (1) the Virgin River at Mesquite, Nevada, (2) the Virgin River, near Mormon Mesa, Nevada, (3) Topock Marsh on the Havasu National Wildlife Refuge, Arizona, and (4) the Bill Williams River watershed, Arizona.

Purpose: To monitor southwestern willow flycatcher populations along the LCR from the Grand Canyon to the Southerly International Boundary with Mexico, describe demographics, and identify riparian habitat characteristics in locations occupied by the species

Connections with Other Work Tasks (Past and Future): Closed Work Task D3 provided information on southwestern willow flycatcher population numbers and demographics along the LCR. Monitoring of southwestern willow flycatchers will be split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D2 and post-development monitoring conducted under Work Task F9.

Project Description: Presence surveys are conducted along the LCR from the Southerly International Boundary with Mexico to southern Nevada, including the lower Virgin River, lower Bill Williams River, and the lower Gila River. Life history studies are conducted at known breeding areas.

Previous Activities: Presence surveys and life history studies for southwestern willow flycatchers have been conducted along the LCR since 1996.

FY16 Accomplishments: Presence surveys for southwestern willow flycatchers were conducted at 92 sites along the LCR and its tributaries in FY16, and life history studies were conducted at 42 sites. All LCR MSCP conservation areas were surveyed. System-wide surveys were conducted at Alamo Lake, the Bill Williams River National Wildlife Refuge (Bill Williams River NWR), Meadow Valley Wash, Muddy River, the Pahranagat National Wildlife Refuge, and Topock Marsh. Surveys were not conducted on the Virgin River due to safety concerns, so efforts were for a third year redirected to Alamo Lake, Arizona, to increase the amount of demographic data collected. Life history study activities included banding, nest monitoring, habitat threat analyses, and microclimate analyses.

A total of 153 southwestern willow flycatchers were detected at 69 of the 92 sites during presence surveys, and 97 territories were documented (table 1). Surveyors confirmed that southwestern willow flycatchers were resident or breeding at 42 of the sites (within 10 study areas): Alamo Lake, the Bill Williams River NWR, Key Pittman, Meadow Valley Wash, Muddy River, the Pahranagat NWR, the Palo Verde Ecological Reserve, River Ranch, Topock Marsh, and Warm Springs (table 2).

Table 1.—Southwestern Willow Flycatcher Detections

Detection	Number
Total resident adults detected	**153**
New captures banded	30
Observed but not banded	76
Banded in previous year and recaptured in FY15	16
Banded in previous year and redetected but not recaptured	50
Bird band confirmed – bird identity known	96
Bird band not confirmed – bird identity unknown	19
Total territories	**97**
Number of confirmed breeding territories	71
Pair with no nest found	2
Unpaired individuals	24
Total nestlings banded	**55**

Table 2.—Study Areas Where Resident Adult Southwestern Willow Flycatchers were Observed

Study Area	Number of Residents
Alamo Lake	75
Bill Williams River NWR	13
Key Pittman	22
Meadow Valley Wash	7
Muddy River	4
Pahranagat NWR	23
Palo Verde Ecological Reserve	1
River Ranch	2
Topock Marsh	6
Warm Springs	1
Total	**153**

One resident southwestern willow flycatcher was observed at LCR MSCP conservation areas in FY16. It was detected at Palo Verde Ecological Reserve Phase 2 in the same general area from June 5 to June 14. The resident was observed defending a territory and engaged in lengthy songs, which were not solicited by call-playback. This is the second year in a row a resident southwestern willow flycatcher has been detected at the Palo Verde Ecological Reserve. In FY15, the resident bird was in phase 4 and was a different individual than the resident bird in FY16.

One willow flycatcher was observed at the Beal Lake Conservation Area on June 28, but no breeding evidence or band was observed; therefore, it could not be confirmed as a southwestern willow flycatcher.

In FY16, life history studies were conducted at Key Pittman, the Pahranagat NWR, Meadow Valley Wash, Muddy River, Warm Springs, Topock Marsh, the Bill Williams River NWR, and Alamo Lake. Attempts were made to identify, capture, and band all southwestern willow flycatcher adults and nestlings. A total of 30 adult southwestern willow flycatchers were banded, and 50 banded birds from previous years were detected (see table 1).

Nest success was calculated for 91 southwestern willow flycatcher nests that contained flycatcher eggs (table 3). Depredation was the major cause of nest failure (59%). Brown-headed cowbird (*Molothrus ater*) brood parasitism was observed in 1 (1%) of the 91 nests with eggs and nestlings.

Table 3.—Southwestern Willow Flycatcher Nest Success

Detection	Number of Adults
Nest successful and fledged young	35 (39%)
Nest failed	54 (59%)
Nest found empty (no indication of whether the young survived)	2 (2%)

Capture and redetections were compared between FY15 and FY16 at sites monitored in both years (table 4). The distance between yearly sightings for these southwestern willow flycatchers (adults and juveniles) ranged between 0.3 and 227 miles, with a median of 7.5 miles for adults and 0.8 mile for juveniles.

Table 4.—Southwestern Willow Flycatcher Captures and Redetections in FY16 of Birds from FY15 and Previous Years

Age	FY15	Detected Again in FY16	Detected in Different Study Area than Previous Year
Resident adults	88	49 (56%)	3 (6%)
Juveniles	71	11 (15%)	5 (45%)

In 2016, the Bureau of Reclamation continued to develop the southwestern flycatcher portion of the LCR MSCP database; an initial structure was created.

FY17 Activities: Presence surveys for southwestern willow flycatchers will be conducted along the LCR, lower Bill Williams River, and other riparian areas in southern Nevada. Life history studies will be conducted at the riparian areas in southern Nevada, the Bill Williams River NWR, Alamo Lake, and Topock Marsh. Activities will include banding, nest monitoring, and microclimate analyses. Surveys will not be conducted on the Virgin River in 2017. The database developed for the southwestern willow flycatcher studies will be tested using the 2016 dataset. After the data test, the data collected from 2017 field season will be entered into the database. Through this process, the database will be refined and finalized for use in future years. The system-wide and conservation area monitoring locations and the intensity of monitoring (presence surveys and life history studies such as nest monitoring, and microclimate analyses) will be determined for FY18–22.

Proposed FY18 Activities: Surveys for southwestern willow flycatchers will be conducted along the LCR and lower Bill Williams River. This will include surveys on the portion of the river below the Cibola National Wildlife Refuge to the Northerly International Border with Mexico, and they will be conducted once

every 3 years. Monitoring may include life history studies at the Bill Williams River NWR, Alamo Lake, and Topock Marsh, nest monitoring, and microclimate analyses.

Pertinent Reports: The *Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the Lower Colorado River and Tributaries, 2015 Annual Report* is posted on the LCR MSCP Web site. The 2016 annual report will also be posted upon completion.

Work Task D5: Monitoring Avian Productivity and Survivorship

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$250,000	$234,559.10	$3,086,331.62	$250,000	$250,000	$250,000	$250,000

Contact: Chris Dodge, (702) 293-8115, cdodge@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: System monitoring for avian covered species by conducting intensive monitoring of habitat creation sites and sites that typify current conditions along the lower Colorado River (LCR)

Conservation Measures: MRM1 and MRM2 (BEVI, ELOW, GIFL, GIWO, SUTA, VEFL, WIFL, YBCU, and YWAR)

Location: Reach 3, Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge, Arizona; and Reach 4, Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1).

Purpose: To collect intensive, site-specific data on avian species' demographics, physical condition, species composition and diversity, and site persistence at existing and created habitat sites

Connections with Other Work Tasks (Past and Future): Data from this work task are used in conjunction with data collected from the system-wide bird monitoring program (D6) to monitor overall bird use of the LCR. Data collected at Monitoring Avian Productivity and Survivorship (MAPS) banding stations located at habitat creation sites may also be used for post-development monitoring.

Project Description: Under this work task, conservation areas and existing habitat sites along the LCR that represent typical avian riparian habitat will be monitored. Banding allows for the collection of detailed information about avian species' use patterns and demographics, and this site-specific data can be used to characterize habitats and monitor habitat use, population trends, and demographics of avian species along the LCR.

Avian populations throughout the United States, Canada, and Mexico are monitored using the MAPS protocol. Long-term population trend data are collected by conducting intensive banding throughout breeding seasons. Data collected are analyzed by the Institute for Bird Populations, and long-term population trends are determined on a regional and continental level, as the larger database has increased statistical power that cannot be economically duplicated at a site-specific level.

The Bureau of Reclamation established a MAPS banding station at the Cibola NWR Unit #1 Nature Trail in 2002 prior to LCR MSCP implementation. In 2005, an additional station was established on the Havasu National Wildlife Refuge, at the New South Dike, and in mixed cottonwood-saltcedar (*Populus fremontii-Tamarix ramosissima*) habitats. These sites provided data from different reaches of the LCR and from different habitat types to allow for comparisons among areas more typically found along the LCR and habitat creation sites like the LCR MSCP conservation areas.

The Institute for Bird Populations recommends netting birds at MAPS banding stations a minimum of 5 years to acquire site-specific data. After 5 years, each site will be evaluated and a decision made to continue, discontinue, or move the station to a new location.

Previous Activities: MAPS banding along the LCR has been conducted during different seasons since 2000 to provide information on habitat use by birds during the breeding and non-breeding seasons. Color banding target species such as Bell's vireo (*Vireo bellii*), yellow warbler (*Setophaga petechia*), and summer tanager (*Piranga rubra*) was initiated in August 2008 at the banding sites to monitor site persistence during the breeding and winter banding seasons.

FY16 Accomplishments: Banding was conducted at the BLCA and Cibola NWR Unit #1 during summer using the MAPS protocol. Banding was conducted once during every 10-day banding period for 5 hours a day, beginning 1/2 hour before sunrise. During the breeding season, there were 202 captures at Cibola NWR Unit #1 and 136 total captures at the BLCA.

Three LCR MSCP listed species were captured and color banded during the MAPS season. There were two Bell's vireo, seven summer tanagers, and four yellow warblers at the BLCA and three yellow warblers at Cibola NWR Unit #1.

Two yellow warblers were recaptured after being initially captured in a previous year at the BLCA. One had been captured and color banded in 2015 and the other in 2013. There were four listed LCR MSCP species that were resighted at MAPS stations. One vermilion flycatcher (*Pyrocephalus rubinus*) was resighted at Cibola NWR Unit #1 that was captured in 2015. This bird was a female, and photo documentation was taken of this bird on a nest. Three summer tanagers were resighted at the BLCA; the birds were first captured in 2011, 2014, and

2015. One Bell's vireo was resighted at the BLCA that was captured in 2014. Two yellow warblers were resighted at the BLCA that were first captured in 2010 and 2013.

One migrant willow flycatcher (*Empidonax traillii*) was banded at Cibola NWR Unit #1 on May 3, one was heard on May 24, and one was heard on June 4. Yellow-billed cuckoos (*Coccyzus americanus occidentalis*) were heard at Cibola NWR Unit #1 from June 8 through July 28 and at the BLCA on June 16 and June 28. No yellow-billed cuckoos were banded during MAPS sessions or MAPS summer target netting in FY16.

FY17 Activities: MAPS banding stations will continue to operate at Cibola NWR Unit #1 and the BLCA during the FY17 breeding season. Color banding of LCR MSCP covered species will continue to be implemented to increase the effective recapture rate. A visual identification of a color-banded bird qualifies as a recapture for statistical purposes. The evaluation will continue in order to identify if the information gathered from the MAPS banding stations is meeting LCR MSCP system-wide and conservation area monitoring needs. If the MAPS stations meet monitoring needs, the sampling intensity (number of stations) will be evaluated.

Proposed FY18 Activities: Breeding season monitoring will continue in FY18 based on the recommendations from the project evaluation.

Pertinent Reports: The *2016 MAPS Summary Banding Report* will be posted on the LCR MSCP Web site upon completion.

Work Task D6: System Monitoring for Riparian Obligate Avian Species

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$150,000	$152,057.03	$2,614,069.00	$480,000	$ 480,000	$480,000	$400,000

Contact: Beth Sabin, (702) 293-8435, lsabin@usbr.gov

Start Date: FY06

Expected Duration: FY55

Long-Term Goal: System monitoring for avian covered species

Conservation Measures: MRM1 and MRM2 (BEVI, ELOW, GIWO, SUTA, VEFL, and YWAR)

Location: LCR MSCP planning area and the Bill Williams River

Purpose: To monitor riparian obligate avian species covered under the LCR MSCP in order to document the current population abundance, long-term population trends, habitat use, and distribution within the LCR MSCP planning area and the Bill Williams River

Connections with Other Work Tasks (Past and Future): Data collected during post-development monitoring of habitat conservation areas (F2) may also be used under this work task. Information obtained through this work task will also be used in association with Work Task C24 to help define habitat requirements for riparian obligate bird species and Work Tasks D2 (southwestern willow flycatcher [*Empidonax traillii extimus*]) and D7 (yellow-billed cuckoo [*Coccyzus americanus occidentalis*]) that monitor single avian species. Information obtained through Work Tasks C24, C36 (closed), and C52 will be used to monitor elf owl (*Micrathene whitneyi*) and gilded flicker (*Colaptes chrysoides*) breeding populations within the LCR MSCP planning area.

Project Description: Riparian habitat along the lower Colorado River and the Bill Williams River below Alamo Dam will be monitored for Arizona Bell's vireo (*Vireo bellii arizonae*), elf owl, Gila woodpecker (*Melanerpes uropygialis*), gilded flicker, Sonoran yellow warbler (*Dendroica petechia sonorana* = *Setophaga petechia sonorana*), summer tanager (*Piranga rubra*), and vermilion flycatcher (*Pyrocephalus rubinus*). It is inefficient to monitor all covered species individually throughout the entire LCR MSCP planning area. Many bird

populations can be monitored effectively using multi-species survey protocols. Arizona Bell's vireos, Gila woodpeckers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers will be monitored together using standard breeding bird survey methods. Elf owls will be monitored using a species-specific call-playback method. The presence and breeding of the covered species will be documented and analyzed to estimate species' distribution and abundance throughout the lower Colorado and Bill Williams Rivers.

Previous Activities: In FY05–06, surveys for Arizona Bell's vireos, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers were conducted using random point-count transects. A double sampling rapid/intensive area search protocol, which provided density estimates of the six focal species and other common species within the study area, was initiated in FY07. Surveys using this protocol were conducted in the riparian habitat of the lower Colorado and Bill Williams Rivers from FY07 to FY15.

Of the six covered species surveyed under this protocol, Arizona Bell's vireos and Sonoran yellow warblers have had the largest population sizes within the study area. Summer tanagers and Gila woodpeckers have been present within the study area, and vermilion flycatchers and gilded flickers have been rarely detected. Gilded flickers have only been detected breeding along the Bill Williams River east of Planet Ranch, and they use the riparian areas as foraging habitat.

Elf owls were monitored during the breeding season from FY08 to FY10. Each year, surveys were conducted at 21 survey sites and 45 single call stations in suitable habitat within the LCR MSCP planning area. Only one elf owl was detected near Blankenship Bend during that 3-year period.

Monitoring methods were evaluated in order to improve accuracy and reduce monitoring costs. Elf owl surveys were stopped after the FY10 season, and an evaluation of the protocol was initiated under Work Tasks C24 and C36 (closed). In FY12, the double sampling rapid/intensive area search protocol was improved: 2 weeks were added to the beginning of the field season to more accurately estimate the population of early-nesting species, field crew training was improved, and some processes, such as data entry and analyses, were automated.

In addition, an analysis was conducted from FY11 to FY13 to test the assumption that estimation is unbiased during the intensive area search surveys used to monitor Arizona Bell's vireos, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers. Twenty-four plots were surveyed using intensive surveys and an enhanced intensive survey. Comparing the survey types across all species, on average, enhanced intensive sampling (complete count) produced 11.2, or 16.5%, additional territories compared to standard intensive sampling. There are many biological reasons that could account for this, including onset of breeding, migration arrival time, detectability throughout the season, territory size, breeding habitat, behavior, and parental care.

Through the intensive and enhanced intensive effort surveys, new life history information was acquired for many of the riparian species in the project area, including a better understanding of arrival and departure times for migrants, unique calls and songs not previously documented, second clutches and renesting attempts, and a better understanding of territory sizes and partial territories.

Inconsistencies were found in the 2011–14 population estimates and confidence intervals calculated with the DS statistical software program. Equations were programmed into SAS, a commercial statistical program, and population estimates and confidence intervals for 2011–15 were recalculated for the summary report.

FY16 Accomplishments: Data and record management activities continued, and the 2011–15 summary report was drafted. No system-wide surveys were conducted in FY16. An evaluation of the monitoring protocol was initiated to clarify the monitoring questions the data will inform and to improve the accuracy of monitoring methods.

FY17 Activities: System-wide surveys will not be conducted in FY17. The 2011–15 summary report will be finalized, and data and record management activities will continue. The evaluation of the monitoring protocol for Work Tasks D6 and F2 will continue to ensure that monitoring methods and statistical analyses are meeting the LCR MSCP objectives and budgetary targets for the next 10 years. A 10-year monitoring plan will be developed.

FY17 expenditures are expected to be less than approved, as system-wide surveys will not be conducted.

Proposed FY18 Activities: The 10-year monitoring plan will be completed with updated protocols. A performance work statement for system-wide monitoring will be prepared, and data and record management activities will continue. System-wide monitoring will resume in FY19, and funding is expected to be obligated in FY18.

Pertinent Reports: The report titled *Lower Colorado River Riparian Bird Surveys, 2014* is posted on the LCR MSCP Web site. The 2105 annual report and 2011–2015 summary report will also be posted upon completion.

Work Task D7: Yellow-billed Cuckoo Presence/ Absence Surveys

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$750,000	$688,770.88	$6,189,007.22	$650,000	$50,000	$50,000	$50,000

Contact: Barbara Raulston, (702) 293-8396, braulston@usbr.gov

Start Date: FY06

Expected Duration: FY55

Long-Term Goal: System-wide and post-development monitoring for yellow-billed cuckoos (*Coccyzus americanus occident*) (FY06–17) and system-wide monitoring for yellow-billed cuckoos (FY18–55)

Conservation Measures: MRM1 and MRM2 (YBCU)

Location: Protocol level surveys are conducted in suitable habitat within the LCR MSCP planning area

Purpose: To conduct surveys to monitor existing yellow-billed cuckoo populations along the lower Colorado River from the Grand Canyon to the Southerly International Boundary with Mexico and monitor long-term trends

Connections with Other Work Tasks (Past and Future): Under Work Task C37 (closed), the hydrologic conditions preferred by southwestern willow flycatchers (*Empidonax traillii extimus*) and yellow-billed cuckoos have been measured. Monitoring of yellow-billed cuckoos will be split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D7 and post-development monitoring conducted under Work Task F10.

Project Description: Yellow-billed cuckoos use cottonwood-willow (*Populus fremontii-Salix gooddingii*) habitat and may act as an umbrella species for other covered avian species that use these habitats. A standardized survey protocol (issued by the U.S. Fish and Wildlife Service on April 22, 2015) will be used to determine the presence of yellow-billed cuckoos at conservation areas consisting of cottonwood-willow habitat at least 2 years old.

Previous Activities: Yellow-billed cuckoo life history and monitoring studies began in FY06. Prior to the creation of riparian habitats by the LCR MSCP, the only large breeding population of yellow-billed cuckoos was on the Bill Williams

River National Wildlife Refuge, with a few scattered pairs elsewhere along the lower Colorado River. The wide-ranging behavior and lack of strict territory boundaries of yellow-billed cuckoos precludes the confirmation of nesting with surveys alone. Instead, criteria (timing, location, and persistence of all detected yellow-billed cuckoos) defining "possible," "probable," and "confirmed" nesting have been developed based on survey results and observed behaviors of this species. Confirmed breeding of yellow-billed cuckoos has been documented at the Palo Verde Ecological Reserve every year beginning in 2009, with nesting also confirmed at the Cibola Valley Conservation Area (2008–14), the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1) (2010–12, 2014, and 2015), and at the Beal Lake Conservation Area (2010, 2011, and 2015). Nesting activity has been documented late into September at the *Salix gooddingii*. In FY16, the level of effort and scope of the project were reduced. Intensive nest monitoring and capture and banding of birds to document activities of specific individuals will no longer be conducted, as successful breeding and nesting have been documented within LCR MSCP created habitats, and birds have continued to use the habitats for multiple years. Call-playback surveys will be conducted only at conservation areas with cottonwood-willow habitat at least 2 years old.

FY16 Accomplishments: Surveys were conducted at all LCR MSCP conservation areas with cottonwood-willow habitat. Some birds previously fitted with tracking equipment were captured, the equipment removed, and the data downloaded. System-wide areas were not monitored in FY16, as nesting continued to occur primarily on LCR MSCP conservation areas. Followup visits to determine breeding status were conducted at conservation areas where breeding has yet to be documented. Birds banded in previous years were resighted incidentally to these activities. The monitoring objectives were reviewed in light of the results from FY07 to FY16, and changes were made to focus the monitoring on informing habitat creation and management and on monitoring yellow-billed cuckoo occupancy at conservation areas.

A total of 56 confirmed breeding territories and 46 nests and an additional 18 probable and 53 possible breeding territories were detected in FY16. There were 50 confirmed breeding territories and 41 nests at the Palo Verde Ecological Reserve (Phases 4–7), 1 confirmed territory and 1 nest at the Cibola Valley Conservation Area (Phase 1), and 5 confirmed territories and 4 nests at Cibola NWR Unit #1 (Crane Roost). Newly planted areas surveyed for the first time in 2016 included the upper Hippy Fire site at Cibola NWR Unit #1 and the Laguna Division Conservation Area. The breeding status was "possible" at both sites due to detection frequency and timing, but breeding was not confirmed.

In FY16, three of seven yellow-billed cuckoos captured and fitted with Global Positioning System (GPS) tags in FY15 were recaptured. An additional 38 new adults, 4 juveniles, and 26 other previously banded adults were captured during mist netting. Of the three recaptured birds fitted with GPS tags in FY15, two still wore their harnesses with attached GPS tags, and their spatial data were

successfully retrieved. These data, combined with data from three other birds tracked over the previous year, support a fall migration route for this population following the west coasts of Mexico and Central America. The new data also lend support for wintering grounds for this population in the Gran Chaco region of northern Argentina and southern Bolivia.

FY17 Activities: Call-playback surveys will be conducted at conservation areas planted with cottonwood-willow habitat at least 2 years old. Followup surveys to detect breeding will be conducted at conservation areas where breeding has yet to be documented. Birds banded in previous years may be resighted, and nests may be found incidentally to these activities. A 10-year monitoring plan will be developed.

Proposed FY18 Activities: Call-playback surveys will be conducted at several system-wide sites along the lower Colorado River where yellow-billed-cuckoos have previously been detected breeding to determine if they are still present. Birds banded in previous years may be resighted, and nests may be found incidentally to these activities.

Pertinent Reports: The *Yellow-billed Cuckoo Distribution, Abundance, and Habitat Use on the Lower Colorado River and Tributaries, 2014 Annual Report* and the *Yellow-billed Cuckoo Distribution, Abundance, and Habitat Use on the Lower Colorado River and Tributaries, 2015 Annual Report* have been posted on the LCR MSCP Web site as well as the summary report covering this work between 2008 and 2012. The annual report for 2016 will also be posted upon completion.

Work Task D8: Razorback Sucker and Bonytail Stock Assessment

FY16 Estimate	F16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$925,000	$943,608.61	$6,498,562.96	$925,000	$925,000	$925,000	$925,000

Contact: Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Conduct long-term system monitoring of razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*)

Conservation Measures: BONY5 and RASU6

Location: The lower Colorado River within the LCR MSCP planning area, including reservoirs and connected channels, from Lake Mead downstream to Imperial Dam

Purpose: To supplement and maintain sufficient knowledge and understanding of razorback sucker and bonytail populations within the LCR MSCP planning area in order to have an effective Adaptive Management Program

Connections with Other Work Tasks (Past and Future): Monitoring data for razorback suckers and bonytail have been or will be gleaned from work accomplished under Work Tasks C8 (closed), C12 (closed), C13 (closed), C15 (closed), F5, and G3.

Project Description: Under this work task, razorback sucker and bonytail population and distribution data will be collected and organized to maintain up-to-date, system-wide, stock assessments for these species. Data acquisition work is accomplished by one of two strategies: (1) gleaning information from ongoing fish monitoring and fish research activities and (2) direct data collection through field surveys within the LCR MSCP planning area not covered under other work tasks. Additionally, as short-term research activities are completed under separate work tasks, a portion of those activities may transition into or be included as part of ongoing, long-term monitoring projects under this work task.

Work routinely includes trammel netting and electrofishing, but visual surveys are also periodically conducted as well as surveys using specialized equipment and

techniques (e.g., scuba divers, underwater photography, and video recordings). Funding described under this work task provides for all costs associated with conducting field surveys, including salaries, travel, and materials necessary to accomplish this work. Funding for monitoring agreements, gleaning, or capturing data from ongoing research actions and monitoring programs; transfer of the data into record archives; and organizing the data into a cohesive report is also provided under this work task.

Previous Activities: In cooperation with the Arizona Game and Fish Department and Nevada Department of Wildlife, fall fish surveys on Lake Mead have been conducted since 1999. The Bureau of Reclamation has also participated in interagency cooperative Native Fish Roundups on Lake Mohave since 1987 and on Lake Havasu (including the river reach below Davis Dam) since 1999. This participation has continued under the LCR MSCP, beginning in 2005, when the program was implemented. Additional monitoring of native fish populations outside of these annual events has also been conducted under this work task as short-term research activities have transitioned into long-term monitoring projects.

FY16 Accomplishments: Accomplishments for this work task have been summarized by river reach.

Reach 1 (Lake Mead): In cooperation with the Arizona Game and Fish Department and Nevada Department of Wildlife, annual fall gill net surveys of Lake Mead were conducted. Participating agencies were responsible for sampling Boulder Basin, Virgin Basin, Temple Basin, Gregg Basin, and the Overton Arm. The LCR MSCP captured 325 fish representing 10 different species from the Virgin and Temple Basins. No native fish species were contacted.

Wild-born razorback sucker larvae collection took place at all major spawning sites (Las Vegas Bay, Echo Bay, and the Muddy River/Virgin River inflow) over the course of the spawning season. A total of 1,167 larvae were captured, with 367 larvae from Las Vegas Bay, 737 larvae from Echo Bay, and 63 larvae from the Muddy River/Virgin River inflow area. An additional 14 larvae were also collected in the Colorado River inflow area during subsequent sampling. The majority of larvae collected through this effort was returned to the lake following each sampling period, as razorback sucker larval abundance was primarily used only as a means of identifying spawning locations during the FY16 field season. A small subset of these larvae were taken to the Lake Mead Fish Hatchery for grow-out and future genetic analyses. These fish will be returned to the lake as juveniles in FY17.

Monitoring of the Lake Mead adult razorback sucker population also continued in FY16. Ten sonic-tagged fish were contacted throughout the year using active (manual tracking) and passive (stationary submersible ultrasonic receivers) telemetry. Monitoring sonic-tagged fish provided the general location of

razorback sucker populations, the location of spawning sites, habitat association data within the long-term monitoring study area, and lake-wide and seasonal movement patterns within and among spawning areas. Trammel netting conducted during the spawning season resulted in the capture of 74 razorback suckers: 4 from Las Vegas Bay, 35 from Echo Bay, 28 from the Muddy River/Virgin River inflow, and 7 from the Colorado River inflow area. Of the 74 razorback suckers captured, 39 were recaptured fish. The remaining razorback suckers captured were untagged and presumed to be wild-spawned fish. The capture of 74 razorback suckers during the FY16 field season was an increase from the 18 captured during the previous year. The increase in the number of razorback suckers captured was due, in part, to the increased sampling effort in FY16, which was conducted to generate a population estimate. The FY16 razorback sucker population in Lake Mead was estimated at 418 individuals (95% confidence interval [CI] from 327 to 559). Aging information was also obtained from 31 razorback suckers during the 2016 study year, bringing the total number of razorback suckers aged as part of the long-term monitoring program to 509. The ages of wild razorback suckers captured from long-term monitoring areas in 2016 ranged from 5 to 14 years old.

Reach 2 (Lake Mohave): A total of 7,898 razorback suckers were successfully repatriated into Lake Mohave in FY16. A total of 913 bonytail were also released in Lake Mohave, 39 of which were sonic tagged as part of ongoing research being carried out under Work Task C64.

Annual razorback sucker roundups were conducted in December and March. During these efforts, 118 razorback suckers were captured using trammel nets. Additionally, electrofishing was conducted in the river section of Lake Mohave above the Willow Beach National Fish Hatchery in June, July, and August (11 razorback suckers captured). The use of remote sensing, which was expanded in 2011 to include the lotic portion of Lake Mohave upstream of the Willow Beach National Fish Hatchery, was also continued. Continued improvements in remote passive integrated transponder (PIT) tag antenna design have allowed for sampling in the high flow conditions of that reach, thereby contacting a large number of razorback suckers that had been previously undetected through other sampling methods.

In FY16, 230,666 remote-sensing PIT tag contacts were recorded in the main sampling areas. In the river section of Lake Mohave above the Willow Beach National Fish Hatchery, 7,370 hours of scan time resulted in 10,862 total contacts representing 1,544 unique PIT tags. In the basin section of Lake Mohave, an effort of 29,574 hours of scan time resulted in 219,796 contacts representing 1,859 unique PIT tags. After duplicate PIT tags contacted in both lake sections were removed from analyses, 3,128 unique fish were contacted in 36,944 hours of scan time during FY16. This is slightly higher than the 3,059 PIT tags contacted in 23,008 hours of scan time in 2015 and a 17% increase in unique contacts made in 2014 (2,777 PIT tags contacted in 8,844 hours of scan time).

The razorback sucker population in Lake Mohave was estimated from two data sources in FY16: (1) trammel net capture data obtained during the annual, multi-agency March roundup and (2) remote PIT scanning data collected during the sample year. Based on trammel net data from the FY16 field season, the repatriate population estimate for the basin section of Lake Mohave was 1,707 (95% CI from 603 to 3,897). This estimate represented less than 1% of the total number of repatriates released into Reach 2 as of March 1, 2015. Based on 2015–16 remote PIT scanning, the Lake Mohave repatriate population was estimated at 3,656 individuals (95% CI from 3,418 to 3,912) lake-wide. Subpopulation estimates using zone-specific scanning were also calculated and estimated the basin (River Miles 13–29) population at 1,947 (95% CI from 1,761 to 2,151) and the river (River Mile 43–63) population at 2,158 (95% CI from 1,960 to 2,377).

Reach 3 (Lake Havasu): A total of 6,105 razorback suckers and 1,522 bonytail were released into Reach 3 during FY16; all fish were released with a PIT tag.

Capture/contact data were acquired through Work Tasks C53, C64, F5, ongoing multi-agency native fish roundups, and from other annual surveys conducted by LCR MSCP partners. A fall and spring netting survey was conducted throughout Topock Gorge and lower Lake Havasu. Bonytail contacts are still rare and typically only occur for the first several weeks to months post-release.

In an effort to identify new aggregations of razorback suckers, multiple electrofishing surveys were conducted this year from Davis Dam through Topock Gorge. The majority of razorback suckers were captured at previously known spawning sites in Laughlin, Nevada, and Needles, California. However, fish were captured and documented in other locations at higher numbers than in the past. New spawning aggregates were found near known spawning sites in Laughlin and Needles and indicated an overall expansion of the previously known spawning sites. The two most prominent new sites were near the California/ Nevada border and below the Needles Bridge. The Reach 3 population estimate has doubled in the past decade, and it is anticipated that the fish will continue to redistribute into new areas. Based on the species composition and relative numbers of captures, the non-native fish community in these locations did not appear to be substantially different than in previous years.

All survey methods conducted in Reach 3 in FY16 resulted in 3,027 unique razorback sucker, 292 bonytail, and 62 flannelmouth sucker (*Catostomus latipinnis*) contacts (16 scans and 46 captures). Reach 3 had a razorback sucker population estimate of 4,923 (95% CI from 4,652 to 5,209), which was a slight increase in the estimate from FY15 of 4,795. Bonytail contacts using PIT scanning are still rare in this reach and typically only occur for the first several months post-release.

Reaches 4 and 5 (Parker Dam to Imperial Dam): A total of 6,005 razorback suckers and 1,289 bonytail were stocked into Reaches 4 and 5 during FY16; all fishes were released with a PIT tag.

In Reach 4, monthly PIT tag scanning surveys were initiated in October 2015. Remote PIT scanners scanned for a collective 9,675.3 hours and resulted in nearly 350 unique razorback sucker contacts and 40 unique bonytail contacts. Native fishes were scanned in nearly every backwater in the area and throughout the main channel. All of the bonytail originated from a single release on September 23, 2015. Twenty-nine were detected in October, 12 in November, and then 3 more through January. The majority of razorback suckers originated from three stocking events from April 2015 through February 2016. There were 13 fish detected from stocking events prior to 2015; 10 of the 13 were released in 2007.

Four scanning trips were completed in Reach 5 and collectively scanned for 1,978.8 hours. No fishes were contacted during any of the scanning events, and after 2 years of scanning, only a single fish has been contacted in Reach 5.

FY17 Activities: Monitoring data will be collected for Reaches 1–5. Information will be gleaned from ongoing fish research activities as well as through fish monitoring field work. Field work will include trammel netting, electrofishing, remote sensing of PIT-tagged fishes, and active and passive tracking of sonic-tagged fishes.

Monitoring efforts, including the expanded use of scanners and electrofishing, will be increased for Reaches 4 and 5 below Palo Verde Diversion Dam. These results will be used to inform future stocking locations and additional directed research under Work Tasks C64 and C65.

Proposed FY18 Activities: Monitoring efforts will continue in all river reaches as previously outlined, and participation in multi-agency field surveys will continue. As research-based work tasks are completed in Reaches 1–5, gaps in native fish community sampling data are expected. Efforts under Work Task D8 will fill a portion of these gaps by maintaining the appropriate level of system-wide monitoring of native fishes in the lower Colorado River for the life of the program. An evaluation of the razorback sucker and bonytail sampling design will be initiated after receiving the results of the genetic review (G4).

Pertinent Reports: The reports titled *Razorback Sucker Studies on Lake Mead, Nevada and Arizona 2015–2016 Final Annual Report*; *Demographics and Monitoring of Repatriated Razorback Sucker in Lake Mohave 2016—Annual Report*; *Comparative Survival of Repatriated Razorback Sucker in Lower Colorado River Reach 3 – 2014 Annual Report*; *Comparative Survival of Repatriated Razorback Sucker in Lower Colorado River Reach 3 – 2015 Annual Report*; and *Movements of Sonic Tagged Razorback Suckers Between Davis and Parker Dams (Lake Havasu) Final Report* will be posted on the LCR MSCP Web site following review.

Work Task D9: System Monitoring and Research of Covered Bat Species

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$390,000	$379,451.91	$2,140,764.49	$140,000	$140,000	$140,000	$140,000

Contact: Carrie Ronning, (702) 293-8106, cronning@usbr.gov

Start Date: FY04

Expected Duration: FY55

Long-Term Goal: System-wide monitoring and species research will be conducted for LCR MSCP bat species to monitor distribution and evaluate habitat implementation success (FY04–17), and system-wide monitoring and species research will be conducted for LCR MSCP bat species to monitor their distribution (FY18–55).

Conservation Measures: MRM1 (CLNB, PTBB, WRBA, and WYBA), WRBA1, and WYBA1

Location: System-wide along the lower Colorado River (LCR) below Hoover Dam

Purpose: To conduct system-wide monitoring of covered bat species to document their habitat use

Connections with Other Work Tasks (Past and Future): System-wide monitoring data will be used in conjunction with post-development monitoring (F4) to document habitat use of covered bat species.

Project Description: Several survey techniques will be used to detect the presence of covered and evaluation bat species. Acoustic surveys will be used to document their presence in existing riparian habitats. Roost surveys will be conducted to track bat populations and to survey species such as the pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii*) and California leaf-nosed bat (*Macrotus californicus*), which are not readily detected by acoustic technology. Individual bats will be captured using techniques such as mist netting to obtain reference calls for bat identification and to verify reproductive status.

Previous Activities: An LCR bat monitoring protocol was produced to assist in the development of a system-wide distribution and demography monitoring plan for covered bat species. A system-wide acoustic monitoring program was implemented that coordinated the collection and analyses of acoustic bat data for system-wide monitoring of the LCR. Five permanent acoustic monitoring stations along the river collected data on bat species presence at the monitoring sites (year round through FY14 and from June – August annually starting in FY15). In FY14–15, a foraging distance study was conducted that used radio tracking techniques to estimate how far pale Townsend's big-eared and California leaf-nosed bats and would forage from their roosts to clarify the distances between roosts and conservation areas in Conservation Measures PTBB2 and CLNB2. California leaf-nosed bats were radio tracked from a mine near Palo Verde, California, in February and August to determine how far they would forage from known roosts during winter and summer. Preliminary data suggest that California leaf-nosed bats have the ability to travel up to and possibly more than 10 miles to forage on a given night during the winter season.

FY16 Accomplishments: The five permanent acoustic monitoring stations were operated from June – August to detect bat presence. The FY16 data will be analyzed in FY17.

California leaf-nosed bat roost outflight counts were conducted at nine mines during the winter season. They were recorded at the Homestake Mine in Nevada; Jackpot Mine, Hart Mine, and the Rio Vista Mine in Arizona; and the California Mine, Mountaineer Mine, Stonehouse Mine, 3C Mine, and Senator Mine in California. The Mountaineer Mine also contained pale Townsend's big eared bats. Based on the data collected since 2005, it has been determined that there is sufficient system-wide roost outflight baseline data to inform conservation area analyses; therefore, roost outflight counts will no longer be necessary on an annual basis. This completed the baseline data collection effort.

An inventory of all bats banded at mines and foraging habitat along the LCR from 1958–2016 was compiled. A summary analysis of acoustic data collected along the LCR between 2002 and 2007 was prepared.

The foraging distance study of pale Townsend's big-eared and California leaf-nosed bats along the LCR continued in FY16 to determine how far these species are capable of traveling between roosts and foraging areas. The results from a limited sample of radio-tracked bats in straight-line distances showed California leaf-nosed male bats flew at least 10.3 miles between roost and foraging areas (the margins of agricultural fields), and females were recorded flying a minimum of 8.7 miles. Bats captured at the Cibola Valley Conservation Area and the Cibola National Wildlife Refuge Unit #1 Conservation Area were tracked 7 and 9 miles back to the Hart Mine for roosting, and bats exiting Hart Mine followed washes relatively directly to the Cibola National Wildlife Refuge Unit #1 Conservation

Area and the Cibola Valley Conservation Area. Two bats captured at the Palo Verde Ecological Reserve were tracked approximately 7.6 miles to an area of multiple mine openings near the Goodman Wash in the Dome Rock Mountains. Although these distances are reported as straight lines, bats flew much further on indirect paths between roosting and foraging areas: one bat flew a minimum travel distance of 50 miles during the 4.5 hours it was tracked. From these preliminary results, it is clear that California leaf-nosed bats are capable of flying more than 5 miles between roost sites and foraging habitat provided by conservation areas, although they do not always utilize the conservation areas for foraging, instead choosing to forage along washes and agricultural areas.

Capture surveys were conducted at the ʻAhakhav Tribal Preserve once a month from June – August. A total of 199 bats of 10 species were captured, including one western yellow bat (*Lasiurus xanthinus*) and nine California leaf-nosed bats.

FY17 Activities: The five permanent acoustic monitoring stations will continue to operate. Data will be collected and analyzed for covered and evaluation species presence during the summer peak activity periods. Station data from the five non-LCR MSCP managed sites will be analyzed together with the LCR MSCP conservation area stations (F4) as a single acoustic monitoring network to document trends in LCR MSCP species activity levels across the program area. The FY15–16 data analysis will be completed. Archived acoustic data will be organized, analyzed, and compiled so that it may be entered into a single database.

The foraging distance study of California leaf-nosed and pale Townsend's big-eared bats will be completed. The roost outflight count, 1958–2016 banding inventory, and 2002–07 acoustic analysis reports will be finalized.

Standardization and consolidation of data and development of mobile electronic field forms for bat monitoring activities will continue. System-wide monitoring objectives will be defined and a monitoring plan developed for FY18–28. Costs in FY17 are expected to decrease for this work task, as efforts will be shifted to monitoring additional conservation area acreage under post-development monitoring (F4).

Proposed FY18 Activities: The five permanent acoustic monitoring stations will continue to operate, and data will be analyzed for covered and evaluation species presence during the summer peak activity periods. Data will also be analyzed using the conservation area stations. Bat captures may be conducted to validate the presence of covered and evaluation species.

Pertinent Reports: The report titled *2015 System-Wide Acoustic Monitoring of LCR MSCP Bat Species* is been posted on the LCR MSCP Web site. Other bat monitoring reports will also be posted upon completion.

Work Task D10: System Monitoring of Rodent Populations

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$40,000	$44,452.69	$256,679.43	$40,000	$40,000	$40,000	$40,000

Contact: Jeff Hill, (702) 293-8163, jhill@usbr.gov

Start Date: FY11

Expected Duration: FY55

Long-Term Goal: System-wide monitoring to document the presence of possible source populations of LCR MSCP covered rodents along the lower Colorado River (LCR)

Conservation Measures: AMM1, AMM6, MRM2, DPMO1, CRCR1, CRCR2, YHCR1, and YHCR2

Location: System-wide along the LCR, including the Bill Williams River

Purpose: The purpose of this work task is to conduct presence surveys of Colorado River cotton rats (*Sigmodon arizonae plenus*), Yuma hispid cotton rats (*Sigmodon hispidus eremicus*), and desert pocket mice (*Chaetodipus penicillatus sobrinus*) within existing habitat along the LCR.

Connections with Other Work Tasks (Past and Future): System-wide monitoring will be used in conjunction with post-development monitoring (F3) and small mammal research (C27) to document habitat at capture locations.

Project Description: Surveys will be conducted to detect the presence of Colorado River cotton rats, Yuma hispid cotton rats, and desert pocket mice within selected areas that have potential habitat along the LCR outside LCR MSCP conservation areas. Surveys may be conducted in the extreme edges of each species' range in an attempt to document the outer limits of their respective distributions within the LCR MSCP planning area.

Previous Activities: Presence surveys were conducted in potential Colorado River and Yuma hispid cotton rat habitat within the LCR MSCP planning area from FY11 to FY15 to document each species' range and to collect genetic samples.

Colorado River cotton rats were detected in Reaches 3–4, and Yuma hispid cotton rats were detected in Reaches 6–7. Desert pocket mice were detected at many survey areas, but the subspecies cannot be determined.

FY16 Accomplishments: Small mammal live trapping surveys were conducted within previously occupied locations to document the presence of Colorado River and Yuma hispid cotton rats. The areas surveyed included Pintail Slough in the Havasu National Wildlife Refuge, the Imperial National Wildlife Refuge outside the Imperial Ponds Conservation Area, Mittry Lake near the Laguna Division Conservation Area, and the Pratt Agricultural Lease near Yuma, Arizona. One Colorado River cotton rat and four desert pocket mice were captured at Pintail Slough. Two Yuma hispid cotton rats were captured at the Imperial National Wildlife Refuge – one at Mittry Lake and three at the Pratt Agricultural Lease.

FY17 Activities: System-wide surveys will be conducted to detect the presence of Colorado River cotton rats and Yuma hispid cotton rats within selected areas that have potential habitats along the LCR outside LCR MSCP conservation areas. System-wide monitoring objectives for 2017–27 will be defined to determine the sampling design and level of effort. If potential habitats are discovered in areas that can inform LCR MSCP habitat creation, monitoring may be conducted to document Colorado River and Yuma hispid cotton rat presence.

Proposed FY18 Activities: Rodent presence surveys will be conducted to meet system-wide monitoring objectives throughout the LCR system.

Pertinent Reports: The report titled *Post-Development and System Monitoring of Rodent Populations: 2012–2014* is posted on the LCR MSCP Web site. The FY15 and FY16 reports will also be posted upon completion.

Work Task D12: Lowland Leopard Frog and Colorado River Toad Surveys

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$35,000	$31,285.23	$468,420.78	$35,000	$0	$0	$0

Contact: Barbara Raulston, (702) 293-8396, braulston@usbr.gov

Start Date: FY10

Expected Duration: FY17

Long-Term Goal: To document the existing populations of lowland leopard frogs (*Rana yavapaiensis = Lithobates yavapaiensis*) and Colorado River toads (*Bufo alvarius = Incilius alvarius*) along the lower Colorado River (LCR) and understand their habitat requirements

Conservation Measures: CRTO1 and LLFR1

Location: Within Reaches 3–7 of the LCR MSCP planning area and the Bill Williams River

Purpose: To better define the distribution, habitat requirements, and factors limiting the distribution of lowland leopard frogs and Colorado River toads using a system-wide monitoring approach

Connections with Other Work Tasks (Past and Future): Populations that are found during system-wide surveys may be included in in the habitat study conducted under Work Task C62.

Project Description: System-wide surveys for lowland leopard frogs and Colorado River toads will be conducted along the LCR and the Bill Williams River. It is unknown if any populations still exist along the LCR. Lowland leopard frogs have been observed on the Bill Williams River, and surveys will help determine the distribution of this population. Habitat characteristics will also be gathered in conjunction with surveys where the presence of either species is confirmed.

Previous Activities: In FY11, 139 locations along the LCR and the Bill Williams River were surveyed. Neither species was documented on the main stem LCR. No lowland leopard frogs were found at Planet Ranch, but six Colorado River toads were found. Lowland leopard frogs and Colorado River

toads were found on the Bill Williams River, east of Planet Ranch, in FY12 and FY13. In FY14, a survey methodology study was implemented to evaluate different survey methods: visual encounter surveys, visual encounter surveys with an audio broadcast call/response component, funnel trap arrays, environmental deoxyribonucleic acid (eDNA) sampling, and digital automated recorder recordings. Analyses to compare the detection rates of each survey method are ongoing. A cost-corrected detection probability was developed to account for both the amount of effort required to survey and the probability of detecting an animal. Based on those two criteria, the detection probability suggested that the visual encounter survey with an audio broadcast call/response component was the most cost-effective method for detecting lowland leopard frogs. This method was also the most cost effective for detecting Colorado River toads, but other concerns, such as labor needs and equipment costs, will determine which method is the best for a given application.

FY16 Accomplishments: Surveys were implemented in February to compare the effectiveness of methods. In July, during surveys for Colorado River toads, no surface water or indications of recent flow were observed, and it was apparent that no significant monsoon events had reached the areas of the Bill Williams River monitored. All audio recording devices were checked monthly and removed in the first week of October. Analyses of audio files from all calling amphibians are ongoing. Results of eDNA collection conducted in February along the Bill Williams River were received in September and indicated the presence of lowland leopard frog and Colorado River toad deoxyribonucleic acid (DNA) in the majority of the samples.

Proposed FY17 Activities: Data analyses and the final report will be completed. The final report will include an analysis of the effectiveness of the monitoring methods and costs of detecting lowland leopard frogs and Colorado River toads using these methods.

This work task will be closed in FY17.

Proposed FY18 Activities: This work task was closed in FY17.

Pertinent Reports: The FY15 and FY16 annual report will be posted on the LCR MSCP Web site upon completion.

WORK TASKS – SECTION E

Conservation Area Development and Management

Work Task E1: Beal Lake Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$400,000	$209,035.87	$4,195,989.41	$250,000	$250,000	$250,000	$250,000

Contact: Laken Anderson, (702) 293-8153, landerson@usbr.gov

Start Date: FY04

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, BONY2, ELOW1, GIFL1, GIWO1, MNSW2, MNSW2, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 3, Havasu National Wildlife Refuge, Arizona, 0.5 mile east of River Miles 238 and 239

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Work Tasks E1 and E2 (closed) have been combined into the Beal Lake Conservation Area (BLCA). Vegetation and species monitoring are being addressed under Section F work tasks. Portions of restoration research at the BLCA have been funded under Work Task G3.

Project Description: Beal Lake was 225 acres of shallow, low-quality aquatic habitat that was dredged in 2001 and stocked with native fishes. Management of the lake is a continuation of the commitment to construct habitat for native fishes under the 1997 Biological and Conference Opinion. Continued maintenance and management obligations for the lake, as well as research and development of the backwater as native fish habitat, were subsumed by LCR MSCP in 2005. Experimentation and restoration of the adjacent riparian area began in 2001. Three distinct planting efforts have been completed and resulted in 116 acres of the cottonwood-willow (*Populus fremontii-Salix gooddingii*) cover type. In 2010, the Beal Lake riparian (E1) and backwater (E2 [closed]) work tasks were combined when the Steering Committee formally adopted the work tasks as the Beal Lake Conservation Area. The conservation

area includes both the 225-acre backwater and 116 acres of cottonwood-willow habitat, including a mosaic of cottonwood-willow, honey mesquite (*Prosopis glandulosa*), and marsh.

Annual Maintenance and Management:

Riparian: Irrigation is provided to the riparian fields from March through mid-September using a diesel-driven pump and a series of alfalfa valves, which deliver water to individual cells. The system requires onsite personnel to fuel, start, and maintain the pump as well as manually open and close the alfalfa valves. The marsh receives surface water from Topock Marsh through a gravity flow connection but can also be managed with the diesel-driven pump. Access roads through the conservation area are bladed and maintained with type-2 road base.

Beal Lake: Maintenance and manual cleaning of the screens that allow surface flows to move from Topock Marsh into Beal Lake occurs biweekly from March to mid-September. Water surface elevations within Beal Lake and Topock Marsh are monitored using the established gauging stations, which can be accessed remotely. A series of water control structures, which has been installed to allow connection to or isolation of Beal Lake from Topock Marsh, requires annual maintenance. Using these structures, the lake can also be drawn down for fisheries or salinity management using either a dewatering system installed at the south end of the lake or the diesel-driven pump.

Previous Activities:

Riparian: The riparian area has been irrigated and managed since 2001.

Beal Lake: Previous native fish stockings have maintained a population of approximately 100 razorback suckers (*Xyrauchen texanus*). However, golden algae were confirmed within Beal Lake following a fishkill in February 2013. There were no detections of any fishes using electrofishing or remote passive integrated transponder scanning surveys for several months following the toxic algae event. By mid-summer, young-of-year largemouth bass (*Micropterus salmoides*) were observed in the backwater. The backwater was hydrologically isolated from Topock Marsh following the fishkill; this closure resulted in a rapid increase in specific conductivity, which approached 11,000 microsiemens per centimeter in FY14. Since 2013, native fishes have not been contacted in the lake, and native fish stockings have not yet resumed. The lake is monitored monthly, and no algae have been detected since May 2013.

FY16 Accomplishments:

Maintenance/Restoration/Management:

Riparian: In FY16, 964 acre-feet of water was delivered to the BLCA (116 acres). In February 2016, the 9 acres of willow marsh was flooded and flushed to manage salinity.

Beal Lake: Water surface levels were monitored using the established gauging stations. A discrepancy between the U.S. Fish and Wildlife Service gage at the South Dike and the gage in Topock Marsh adjacent to Beal Lake was noted. A survey of the staff gages in the vicinity was conducted in coordination with the Bureau of Reclamation's river operations to identify the source of the discrepancy in water surface elevations noted in December 2016. The Bureau of Reclamation is now resolving the discrepancy and determining how to properly deliver staff gage data in the future.

A drawdown of Beal Lake was conducted in February 2016, and the salinity was monitored. The drawdown was completed using the existing pump stand, which eliminated the need to bring in a large portable pump, which in return reduced obligations. During the drawdown, all eight wedge wire screens on the Beal Lake rock structure were removed and cleaned, and four were reinstalled on the upstream side. A cage to exclude small mammals was installed on the end of the culverts in the rock structure, and clean screens were reconnected on the upstream (Topock Marsh) side of the culverts. Only having screens on the upstream side and the new maintenance strategy has resulted in an almost 1-foot increase in water surface of Beal Lake.

Monitoring:

Riparian: Monitoring was conducted at the BLCA for vegetation, birds, bats, small mammals, and MacNeill's sootywing skippers (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill]).

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

Marsh bird surveys were conducted on three occasions at the wetland portions of the site. Western least bitterns (*Ixobrychus exilis hesperis*) and Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) were detected and are presumed to be breeding at the site.

Riparian bird surveys were conducted at the BLCA from April 15 to June 15, 2016, using the LCR MSCP's double sampling protocol. Arizona Bell's vireos

(*Vireo bellii arizonae*), Sonoran yellow warblers (*Dendroica petechia sonorana = Setophaga petechia sonorana*), and summer tanagers (*Piranga rubra*) were confirmed breeding. Avian mist netting following the Monitoring Avian Productivity and Survivorship (MAPS) protocol was conducted from early May to early August. Arizona Bell's vireos, Sonoran yellow warblers, and summer tanagers were captured and color banded. In addition, Arizona Bell's vireos, Sonoran yellow warblers, and summer tanagers were resighted. Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys were conducted, and no resident or breeding individuals were detected. Yellow-billed cuckoo (*Coccyzus americanus occidentalis*) surveys were conducted between late June and early August. Yellow-billed cuckoos were detected, and breeding was probable.

The BLCA was mist netted for bats once per month from June to August. California leaf-nosed bats (*Macrotus californicus*) and pale Townsend's big-eared bats (*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii*) were captured. A long-term acoustic bat station was used in order to record data on LCR MSCP bat species. These data will be analyzed in FY17.

Small mammal trapping was conducted in fall and spring. No Colorado River cotton rats (*Sigmodon arizonae plenus*) were detected, but desert pocket mice (*Chaetodipus penicillatus*) were captured (possibly the *sobrinus* subspecies).

Surveys were conducted for MacNeill's sootywing skippers (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]) and presence was confirmed.

Beal Lake: The water quality at Beal Lake was monitored throughout the backwater using permanently deployed multi-parameter instruments. Low levels of dissolved oxygen and high temperatures were observed locally but not lake-wide. Conductivity has decreased to nearly 2,200 microsiemens per centimeter following screen maintenance. Zooplankton and phytoplankton results continue to show relatively low levels of plankton biomass. No golden algae have been detected in Beal Lake since May 2013. No fish activities were conducted at Beal Lake due to the lack of native fishes in the ponds since 2013.

FY17 Activities:

Maintenance/Restoration/Management:

Riparian: Riparian fields will be irrigated from March through September. No construction, restoration, or new management activities are planned within the riparian fields of the BLCA.

Beal Lake: In February 2017, the wedge wire screens along the rock structure were removed and replaced with clean screens to improve water flow into Beal Lake. This activity will be conducted annually.

Monitoring:

Riparian Fields: Vegetation data will be collected using LiDAR remote sensing techniques. Marsh bird surveys will be conducted in March, April, and May. General bird surveys will be conducted from April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat capture surveys and acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Beal Lake: Monitoring activities at Beal Lake will be focused on water quality and research related to the interactions of native and non-native fish species. Areas of the backwater will be partitioned and stocked with equal numbers of razorback suckers; one-half of the partitioned areas will have non-native fishes removed, and the other half will not. Short-term survival will be monitored using remote passive integrated transponder scanners. Golden algae sampling will continue in spring when conditions are the most favorable for the algae.

Proposed FY18 Activities:

Maintenance/Restoration/Management:

Riparian: Riparian fields will be irrigated from March through September. No construction, restoration, or new management activities are planned within the riparian fields of the BLCA.

Beal Lake: Maintenance, cleaning, and rotation of the wedge wire screens within the unlined ditch are anticipated. Beginning in FY18, permitting and environmental compliance for the proposed dredging of Beal Lake is expected to begin. The dredging will help provide deeper areas within the lake for native fishes to seek thermal refuge and escape from predation. Dredge material quantities will be verified, and the location of the spoil piles will be determined after coordinating with the Havasu National Wildlife Refuge. Dredging will be delayed.

Monitoring:

Riparian: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. Marsh bird surveys will be conducted in March, April, and May. General bird surveys will be conducted from April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Beal Lake: The activities from FY17 will continue into this year. Native fish research projects at Beal Lake will be identified and initiated. Research may continue to focus on the interactions with non-native fishes or the impact of piscivorous bird predation in the lake.

Pertinent Reports: The *2016 Beal Lake Conservation Area Annual Report* will be posted on the LCR MSCP Web site once integration of the data collected throughout the calendar year is complete.

Work Task E4: Palo Verde Ecological Reserve

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$500,000	$449,393.91	$9,745,551.58	$600,000	$600,000	$500,000	$500,000

Contact: Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 4, River Miles 129–133, California

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation and species monitoring are being addressed under Section C and Section F work tasks.

Project Description: The Palo Verde Ecological Reserve (PVER) encompasses more than 1,300 acres. This property has been made available for LCR MSCP habitat restoration activities by the California Department of Fish and Wildlife. Development of the project is intended to satisfy both the LCR MSCP Habitat Conservation Plan requirements and California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06.

The eastern boundary of the property (more than 4 miles) is adjacent to the Colorado River; the western boundary is adjacent to active agricultural fields. The PVER has an extensive infrastructure consisting of miles of lined irrigation ditches, roads, and a pump. Each year, a portion of the active crop acreage was taken out of production to develop the next phase of native habitat. The intent was to create as much riparian habitat as practical. Generally, all phases at the PVER are targeted for southwestern willow flycatchers (*Empidonax traillii extimus*), yellow-billed cuckoos (Coccyzus americanus occidentalis), and other covered species. The final phase was planted in FY13. The Palo Verde Irrigation District (PVID) provides water to the PVER. Since the California Department of

Fish and Wildlife manages a portion of the PVER for their purposes, the costs associated with irrigation, electricity, and water is proportional to the amount of acreage that has been converted to habitat.

Riparian planting has resulted in the establishment of 945 acres of cottonwood-willow (*Populus fremontii-Salix gooddingii*) and 78 acres of honey mesquite (*Prosopis glandulosa*), which are both managed for LCR MSCP covered species.

Annual Maintenance and Management: A local farmer diverts and irrigates the various phases based on site conditions and species planted. This provides local knowledge of weather and farming practices, which are applied to the management of the conservation area. The farmer and his employees are an onsite presence and provide early recognition of issues or concerns. The farmer is also responsible for assessing the water needs of the trees and, in coordination with the PVID and the LCR MSCP, orders and delivers the water. Removal of vegetation along the roadside and ditches is typically performed quarterly to reduce the potential of wildfires in conjunction with maintenance of the irrigation canals, gates, and roads.

The annual costs associated with operating the PVER within the PVID, such as water taxes, water tolls, electrical power utility bills, and assessments for district operation, are included in the annual maintenance costs.

Riparian Fields: Water is ordered through and provided by the PVID. At the PVER, two pump platforms deliver water to individual phases through J and K Canals. Checks, which are small borders placed within a given field, allow for flooding of only a portion of a field and provide additional flexibility to create and maintain standing water or saturated soil areas for covered species. Irrigation occurs throughout the year and is expected throughout the life of the LCR MSCP.

Previous Activities: Over 1.8 million native trees and shrubs have been established on 1,023 acres at the PVER. Native trees have been irrigated and managed since 2006. The replacement of an existing pump with two 30-cubic-foot-per-second electric irrigation pumps, installation of delivery pipes and a pump stand, and an electrical upgrade were completed in January 2015

FY16 Accomplishments:

Maintenance/Restoration/Management: The PVER is fully developed and has transitioned from development into maintenance and monitoring. Annual management and maintenance was conducted through the year as described above.

Monitoring: Monitoring was conducted at the PVER for vegetation, birds, bats, small mammals, and MacNeill's sootywing skippers (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill]).

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

Riparian bird surveys were conducted at the PVER from April 15 to June 15, 2016, using the LCR MSCP double sampling protocol. Sonoran yellow warblers (*Dendroica petechia sonorana = Setophaga petechia sonorana*), summer tanagers (*Piranga rubra*), and Arizona Bell's vireos (*Vireo bellii arizonae*) were detected breeding at the site. Southwestern willow flycatcher surveys were conducted, and a resident southwestern willow flycatcher was detected in Phase 2 between June 5 and June 14, but there was no evidence of breeding. Yellow-billed cuckoo surveys were conducted between late June and early August. Yellow-billed cuckoos were detected in Phases 1–7, and nesting was confirmed in Phases 4–7.

The PVER was mist netted for bats once per month in June, July, and August. Western red bats (*Lasiurus blossevilli*), western yellow bats (*Lasiurus xanthinus*), and California leaf-nosed bats (*Macrotus californicus*) were captured. In conjunction with the bat capture surveys, the two established long-term acoustic bat stations were used to help detect LCR MSCP bat species. These data are still being analyzed.

Small mammal trapping was conducted in fall and spring. Colorado River cotton rats (*Sigmodon arizonae plenus*) were captured.

Surveys were conducted for MacNeill's sootywing skippers in FY16. Individuals were detected in March in Phases 1, 4, and 6.

FY17 Activities:

Maintenance/Restoration/Management: Annual management and maintenance of the created habitat is ongoing.

The methods used to report irrigation quantities at the PVER did not provide an accurate representation of water usage. The PVID will be providing water order data monthly to the LCR MSCP; using these data will increase the accuracy of water usage at each phase of the site.

Irrigation at the PVER was discontinued from November 2016 through January 2017 because the trees were dormant and irrigation was not needed for salinity management. This change brings the PVER in line with other conservation areas, as the PVER was the only conservation area that received irrigation during winter months. In addition to this winter outage, all checks planted with honey mesquite will no longer receive irrigation, as their roots have reached groundwater, unless future conditions dictate watering should be resumed. The exception is the honey mesquite habitat in Phase 8 where volunteer

cottonwoods have become established. An irrigation management study plan will be developed to determine how cottonwood health and productivity will be affected by a decrease in applied water with an eventual cessation of all irrigation.

Monitoring: Vegetation data will be collected using LiDAR remote sensing techniques. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat capture surveys and acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Proposed FY18 Activities:

Maintenance/Restoration/Management: Irrigation and management of the PVER will continue on the same schedule until data become available that indicate adjustments are needed. The LCR MSCP will implement the irrigation management study plan.

Monitoring: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Pertinent Reports: The *2016 Palo Verde Ecological Reserve Annual Report* will be posted on the LCR MSCP Web site upon completion.

Work Task E5: Cibola Valley Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$750,000	$661,721.39	$11,979,224.50	$800,000	$850,000	$850,000	$600,000

Contact: Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 4, River Miles 99–104, Arizona

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation and species monitoring are being addressed under Work Tasks F1–F4 and F6.

Project Description: In 2007, 1,309 acres of land serviced by the Cibola Valley Irrigation and Drainage District (CVIDD) were secured by the LCR MSCP, and the Cibola Valley Conservation Area (CVCA) was established. The Arizona Game and Fish Department (AGFD) acquired the CVCA in September 2007 through a multi-organizational agreement involving the AGFD, the Bureau of Reclamation, the Mohave County Water Authority, The Conservation Fund, and the Hopi Tribe. Through these agreements, the AGFD acquired the CVCA's fee title and water entitlements. The acreage for LCR MSCP covered species is managed by the LCR MSCP.

The CVCA is located in southwestern La Paz County, Arizona, about 15 miles south of Blythe, California. The valley encompasses the land inside an engineered bend of the lower Colorado River and a remnant oxbow on the west side of the river (Palo Verde Oxbow). Seven phases have been restored with native vegetation, and the remainder is farmed for cotton (*Gossypium* spp.) and alfalfa (*Medicago sativa*). The area is bordered to the south by the Cibola National Wildlife Refuge and on the east by unimproved land under the

jurisdiction of the Bureau of Land Management. The river forms the north and west boundaries, except for the Palo Verde Oxbow, from River Miles 98.8 to 104.9.

Annual Maintenance and Management: Water is ordered through and provided by the CVIDD. A local farmer diverts and irrigates the various phases based on site conditions and species planted. This provides local knowledge of weather and farming practices, which are applied to the management of the CVCA. The farmer and his employees are an onsite presence and provide early recognition of issues or concerns. The farmer is also responsible for assessing the water needs of the trees and, in coordination with the CVIDD and the LCR MSCP, orders and delivers the water. Removal of vegetation along the roadside and ditches is typically performed quarterly to reduce the potential of wildfires in conjunction with maintenance of the irrigation canals, gates, and roads.

The annual costs associated with operating the CVCA within the CVIDD, such as water taxes, water tolls, electrical power utility bills, and assessments for district operation, are included in the annual maintenance costs.

Cottonwood-Willow (*Populus fremontii-Salix gooddingii*): Checks, which are small borders placed within a given field, allow for flooding of only a portion of a field. These provide additional flexibility to create and maintain standing water or saturated soil areas for covered species. Irrigation occurs throughout the year and is expected throughout the life of the LCR MSCP.

Honey Mesquite (*Prosopis glandulosa*): For honey mesquite, water is only used for establishment. Irrigation during establishment is done by creating deep furrows and planting only within the furrows. Typically, irrigation is concluded within 2 to 3 years when the roots have reached the groundwater table.

Previous Activities: Through FY15, 742 acres of cottonwood-willow and honey mesquite have been established in Phases 1–7 and are being managed for LCR MSCP covered species.

FY16 Accomplishments: In the spring of FY16, Phase 8, consisting of 111 acres, was planted with a mix of cottonwood, willow, honey mesquite, and other riparian shrub and grass species. The trees for the FY17 planting of Phase 9 (76 acres) were purchased in FY16.

Maintenance/Restoration/Management: Management, maintenance, irrigation, and monitoring of the established habitat created over the past 10 years continued. Established phases developed as cottonwood-willow (Phase 1, 2, and 3) continued

to be irrigated. Irrigation on Phase 7 continued through 2016. Phase 8 was irrigated using furrows in the honey mesquite planting and flood irrigation in the cottonwood-willow checks.

No major construction or repairs were needed on the irrigation canals within the CVCA; however, an inventory was completed, and areas were identified for repair/replacement. Sections of canals that were identified as needing repair during the inventory will be scheduled for repair or replacement in conjunction with other conservation areas. Minor canal repair was completed as necessary.

The Farmers Bridge Fire occurred on March 17, 2016. Less than 50 acres were burned within Phase 1. The fire burned mainly the stand understory and caused little to no long-term damage to the established land cover. Suppression of the fire was aided by the CVIDD, which began flooding the fields shortly after the fire began. No replanting or additional restoration is required.

Monitoring: Monitoring was conducted at the CVCA for vegetation, birds, bats, small mammals, and MacNeill's sootywing skippers (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]).

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

Riparian bird surveys were conducted at the CVCA from April 15 to June 15, 2016, using the LCR MSCP double sampling protocol. Sonoran yellow warblers (*Dendroica petechia sonorana = Setophaga petechia sonorana*) and summer tanagers (*Piranga rubra*) were detected breeding at the site. Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys were conducted, and no resident or breeding individuals were detected. Yellow-billed cuckoo (*Coccyzus americanus occidentalis*) surveys were conducted between late June and early August; they were detected in Phases 1, 2, and 3, and one nest was found in Phase 1.

The CVCA was mist netted for bats once per month in June, July, and August. Western yellow bats (*Lasiurus xanthinus*), western red bats (*Lasiurus blossevilli*), and California leaf-nosed bats (*Macrotus californicus*) were captured. In conjunction with the bat capture surveys, the established long-term acoustic bat station was used to detect LCR MSCP bat species. These data are still being analyzed.

Small mammal trapping was conducted in fall and spring. Colorado River cotton rats (*Sigmodon arizonae plenus*) were captured.

MacNeill's sootywing skippers were detected in March and July in Phase 4.

FY17 Activities: The planting of Phase 9 (cottonwood-willow land cover type) is scheduled for late March or early April 2017 and will include a mix of cottonwood, willow, honey mesquite, and other riparian shrub and grass species to create a mosaic of low- and high-density riparian habitat. The Restoration Development and Monitoring Plan for the planting of Phases 10 and 11 will be completed. The plants for Phase 11 (193 acres) will be ordered in FY17 to allow time for propagation, and the planting will take place in FY18.

Maintenance/Restoration/Management: Regular management, maintenance, irrigation, and monitoring will continue. Irrigation will be provided to Phases 1, 2, and 3 (cottonwood-willow) and to Phase 8. Phase 9 will be watered regularly after planting is complete.

Monitoring: Vegetation data will be collected using LiDAR remote sensing techniques. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat capture surveys and acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Proposed FY18 Activities:

Maintenance/Restoration/Management: Regular management, maintenance, irrigation, and monitoring will continue. Irrigation will be provided to Phases 1, 2, 3, 8 and 9 (cottonwood-willow). The plants for Phase 10 (123 acres) will be ordered in FY18 to allow time for propagation, and the planting will take place in FY19. Field preparation will begin in FY18 for planting Phase 11.

Monitoring: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Pertinent Reports: The *2016 Cibola Valley Conservation Area Annual Report* will be posted on the LCR MSCP Web site once integration of the data collected throughout the calendar year is complete.

Work Task E9: Hart Mine Marsh

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$250,000	$293,218.97	$7,177,352.88	$250,000	$250,000	$200,000	$200,000

Contact: Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BLRA1, CLRA1, CRCR2, and LEBI1

Location: Reach 4, Cibola National Wildlife Refuge, River Mile 92, Arizona

Purpose: To create and manage marsh habitat for Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]), western least bitterns (*Ixobrychus exilis hesperis*), California black rails (*Laterallus jamaicensis coturniculus*), and Colorado River cotton rats (*Sigmodon arizonae plenus*)

Connections with Other Work Tasks (Past and Future): Vegetation and species monitoring are being addressed under Work Tasks F1–F4 and F7.

Project Description: Hart Mine Marsh was a decadent marsh located on the Cibola National Wildlife Refuge that was restored and expanded to create functional habitat for covered species. This was accomplished by the installation of control structures to manage water levels, providing sources of higher-quality surface water flows, making physical changes to the site's topography, and by planting and supporting native wetland and marsh vegetation. The approach was to remove a substantial amount of existing saltcedar (*Tamarix ramosissima*) from the site, deepen areas of existing open water, contour areas adjacent to those deeper areas, and manage water at the higher elevations to promote and sustain marsh cover type vegetation and wetland functions. The creation of habitat included both the establishment of native plants and management of water levels to meet management guidelines for integrating emergent vegetation and open water at varying depths into a mosaic of marsh habitats.

Annual Maintenance and Management: The primary source of water for Hart Mine Marsh is drainage water from fields in Farm Unit #1 on the

Cibola National Wildlife Refuge, which is delivered through Arnett Ditch into the marsh. However, Colorado River water can also be pumped and delivered either into Arnett Ditch or directly into the marsh. The increased management flexibility of the two sources of water, along with a series of water control structures, allow for stable water level management as well as the ability to manage salinity. Water deliveries are used to maintain static water levels during marsh bird nesting season and for flushing of the marsh in winter to manage salinity.

Vegetation maintenance at the marsh employs an integrated pest management approach that use both manual (hand pulling) and chemical (herbicide) treatment of invasive species, including saltcedar, phragmites (*Phragmites australis*), and five-hook bassia (*Bassia hyssopifolia*).

The annual costs associated with operating the marsh include operation and maintenance of the water control structures, maintenance of the pumping system and electrical costs, invasive and non-native vegetation control, and road maintenance.

Previous Activities: In FY09, the first phase of construction was completed and resulted in 92 acres of marsh. In FY10, Phase 2 of construction was completed and resulted in the creation of an additional 163 acres of marsh, for a total of 255 acres.

FY16 Accomplishments:

Maintenance/Restoration/Management: The majority of the activities that occurred in FY16 was for management, maintenance, and monitoring of the established marsh.

Minor construction activities in FY16 included upgrades to the water control infrastructure. Frequently used canal gates were retrofitted (new headrails and stems installed) so that they can be exercised (raised and lowered) with a gas-powered or electric actuator. The retrofit and upgrade allowed for more efficient use of labor resources and will also allow the gates to be exercised on a more frequent basis.

Arnett Ditch conveys water from both the Colorado River and the agricultural fields north of Hart Mine Marsh, to the marsh, and eventually drains back into the Colorado River. Cattails (*Typha* spp.) had overgrown the drain, and the entire length of the drain to the west of Hart Mine Marsh was cleared in cooperation with the Cibola National Wildlife Refuge and resulted in the increased obligations.

Pump Stand Replacement: The pump stand is in a shallow section of the river; sediment transport and entrainment modeling was completed to refine the design.

Planning of the design for the pump stand replacement will continue, as work is anticipated to be completed in FY18. Replacement of the pump stand was provided by the U.S. Fish and Wildlife Service.

Monitoring: Monitoring was conducted at Hart Mine Marsh for vegetation, marsh birds, and MacNeill's sootywing skippers (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill]).

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

Marsh bird surveys were conducted on three occasions at the wetland portions of the site. Western least bitterns and Yuma clapper rails were detected and are presumed to be breeding at the site. California black rails were not detected.

Surveys were conducted for MacNeill's sootywing skippers in 2016. Adults and eggs were detected in March.

FY17 Activities:

Maintenance/Restoration/Management: Management and monitoring of Hart Mine Marsh will continue.

Pump Stand Replacement: The preliminary design, including addressing sediment intake at this site, will be completed. Replacement pumps and high-density polyethylene piping have been purchased.

Monitoring: Marsh bird surveys will be conducted March, April, and May. Vegetation data will be collected using LiDAR remote sensing techniques.

Proposed FY18 Activities:

Maintenance/Restoration/Management: Management and monitoring of Hart Mine Marsh will continue. No construction, restoration, or changes to the marsh management area anticipated.

Pump Stand Replacement: The pump stand replacement is scheduled for FY18 using funds provided by U.S. Fish and Wildlife Service.

Monitoring: Marsh bird surveys will be conducted in March, April, and May. Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond.

Pertinent Reports: The *2016 Hart Mine Marsh Conservation Area Annual Report* will be posted on the LCR MSCP Web site once integration of the data collected throughout the calendar year is complete.

Work Task E13: McAllister Lake

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$127,336.82	$50,000	$400,000	$400,000	$50,000

Contact: Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

Start Date: FY05 (closed in FY07; reopen in FY17)

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BONY2 and RASU2

Location: Reach 5, Imperial National Wildlife Refuge (Imperial NWR)

Purpose: To evaluate a method of water quality improvement and maintenance by dewatering McAllister Lake and inducing groundwater recharge to manage salinity

Connections with Other Work Tasks (Past and Future): Monitoring of native fishes is being addressed under Work Task F5.

Project Description: McAllister Lake is a shallow, approximately 40-acre, isolated flood plain lake located on the Imperial NWR. Management of the lake is a continuation of the commitment to construct habitat for native fishes under the 1997 Biological and Conference Opinion (BO). Continued maintenance and management obligations of McAllister Lake, as well as research and development of the backwater as native fish habitat, were subsumed by the LCR MSCP in 2005.

McAllister Lake was identified under Reasonable and Prudent Alternative Number 3 in the 1997 BO as a backwater to be developed and managed for native fishes. The intent is to make improvements to the backwater, including the design and construction of a pumping system to exchange water within the lake to manage salinity and other water quality parameters at levels suitable for supporting native fishes.

A pumping station will be placed on a constructed berm between McAllister Lake proper and the western lobe of the lake. The creation of this earthen berm would protect the lake proper section of McAllister Lake from potential river flooding

events. By using borrowed material from both McAllister Lake proper and the western lobe, an additional benefit of the construction of this earthen berm would be localized deepening in these pump-out areas. These deeper areas may, in turn, provide thermal refuge for native fishes. They could also potentially increase the subsurface hydraulic connection to the adjacent Colorado River, which could help to enhance water quality and water exchange efficiency. The excavation of these areas may also remove sediments with high biological oxygen demand, as identified by previous research, further improving water quality in both sections of the lake. The water exchange provided by the periodic operation of the pumping system may dampen accumulation rates of selenium within the lake. It is anticipated that operating a pumping system at this remote location will likely require installation of either a solar- or diesel-powered pumping system.

If the proposed development is not implemented and the pumping system is not installed due to incompatibilities with Imperial NWR missions, discussions with the U.S. Fish and Wildlife Service (USFWS), the Imperial NWR, and Refuge Complex Managers, as well as the USFWS Arizona Ecological Services Field Office, will commence. If it is decided that the work task should be closed, all commitments to McAllister Lake under the 1997 BO will have been satisfied. Likewise, if long-term development and management efforts at McAllister Lake prove to be ineffective in providing adequate conditions for supporting native fish populations, or result in regular management actions that are not sustainable or consistent with Imperial NWR missions, discussions may commence with the USFWS, the Imperial NWR, and Refuge Complex Managers as well as the USFWS Arizona Ecological Services Field Office. Again, if the work task is closed, based on the decisions from these discussions, all commitments to McAllister Lake under the 1997 BO will have been satisfied in accordance with the March 16, 2016, memorandum from the USFWS.

Previous Activities: The Bureau of Reclamation initiated a series of experimental pump-tests during FY03 and FY04, which dewatered the lake to about one-fourth of its normal volume. Before, during, and after these tests, a variety of environmental data were collected to measure the lake's response to the pumping and the consistency of the groundwater supply through the river aquifer. These pump tests were conducted from December 2002 through March 2004, during the fall and winter months only, to avoid potential impacts to Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]). The lake was left unmanaged during FY05. Monitoring was continued in order to assess how quickly the lake's water quality would degrade if pumping was stopped; the level of degradation would indicate the required pumping frequency needed to maintain sufficient water quality to support native fishes. After an approximately 18-month period with no pumping, salinity levels (measured as specific conductance) increased from approximately 4,000 to approximately 10,000 microsiemens per centimeter.

The results from these investigations suggested that salinity levels could be reduced through pumping and subsequent induced subsurface recharge but that regular water management (flushing) of the lake would be necessary to maintain desired salinity ranges. Some additional concerns were raised regarding managing McAllister Lake for native fishes, including the detection of heavy metals (arsenic and mercury) and seasonal low levels of dissolved oxygen. In FY07, all development and research activities at the lake were suspended in order to assess newly initiated research pertaining to water quality thresholds for native fishes and to decide the value of additional proposed limnologic research investigations. The suspension of activity allowed time to develop a conceptual approach for the lake that would allow for potential mitigation of the challenges previously identified and to provide sustainable management options to benefit native fishes.

In FY15, sampling for arsenic, mercury, and selenium was conducted under Work Task C59. Samples of water, substrate, and biota were collected and analyzed to provide better resolution in suggesting the potential of bioaccumulation for native fishes stocked into McAllister Lake. The results were interpreted by the USFWS's Environmental Contaminants Office. The levels of selenium were elevated in mosquitofish (*Gambusia affinis*) tissue and will likely require a plan for long-term selenium monitoring. Concentrations of arsenic, mercury, and selenium in water and substrate were well below the Arizona water quality standards threshold for concern. Concentrations of arsenic and mercury in tissue samples were also well below the Arizona water quality standards threshold for concern.

The LCR MSCP and the USFWS Arizona Ecological Services Field Offices agreed that efforts to implement the proposed plan for restoration and management of McAllister Lake should move forward and that Work Task E13 should be reopened. Development will occur in a step-wise fashion in order to adequately consider the potential challenges of this site.

FY16 Accomplishments: This work task was reopened in FY17.

FY17 Activities: The LCR MSCP met with the USFWS (Imperial NWR and Refuge Complex Managers as well as the USFWS Arizona Ecological Services Field Office) for approval of the conceptual design and selection of a pumping station. The above-mentioned parties agreed on the conceptual design, but requested additional information prior to making a decision on a pumping station.

The LCR MSCP evaluated both solar- and diesel-driven pumping systems. The options addressed both a permanently installed continuous pumping system and a seasonal, removable pumping system. The continuous pumping system would remove water at a lower rate over a longer period of time, whereas the seasonal pumping system would pump at a higher rate for a shorter period of time. Both systems would target a water exchange of about 62 acre-feet. During the FY04

study, using a diesel-driven pump, this level of water exchange took about 49 hours. The solar system would be a low-rate pumping system requiring 22 to 47 days to remove the same volume of water. There was concern that the longer pumping schedule may not yield similar results as the FY03 and FY04 high flow studies. The USFWS requested testing a low-rate system prior to making a decision.

A diesel-driven pumping system will be in operation during January and February of FY17. In January of FY17, an initial drawdown of about 62 acre-feet will occur, followed by a 14-day recharge. A second drawdown will occur in January/February of FY17 to remove about 62 acre-feet of water or until reaching a water elevation where the pump is inoperable. Monitoring specific conductivity levels will occur prior to and following the drawdown.

Completion of an engineering design and shop drawings for the separation of the western lobe from the main body of McAllister Lake is expected. Environmental compliance and permitting will be initiated once the design is complete.

Obligations will be higher than anticipated due to testing a low-rate pumping system to inform the final decision on a pumping system.

Proposed FY18 Activities: Evaluation of a lower-rate dewatering method is anticipated. A diesel-driven pump will operate at a pumping volume of about 1,200 gallons per minute between 6 to 8 hours per day for about 40 days to simulate solar capabilities. Results will determine if a low- or high-exchange-rate pumping system or a combination of both is the best option at this site.

Construction activities will begin upon completion of the dewatering study, environmental compliance, and permitting.

Pertinent Reports: Annual reports will be posted on the LCR MSCP Web site upon completion.

Work Task E14: Imperial Ponds Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,500,000	$403,637.91	$10,008,947.04	$1,450,000	$1,450,000	$350,000	$350,000

Contact: Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, BLRA1, BONY2, CLRA1, ELOW1, GIFL1, GIWO1, LEBI1, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 5, Imperial National Wildlife Refuge, River Mile 59, Arizona

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation, species research, and monitoring is being conducted under Work Tasks C25, D9, and F1–F5. Fishery-related research is conducted under Work Task C25.

Project Description: The Imperial Ponds Conservation Area is an integrated mosaic of native land cover types, including disconnected backwaters, cottonwood-willow (*Populus fremontii-Salix gooddingii*), and marsh. It is situated within the Martinez Lake Management Unit (previously identified as an Intensive Management Area) of the Imperial National Wildlife Refuge, an area of focused management for sensitive wildlife species, including native fishes, marsh birds, neotropical migratory birds, and migratory waterfowl.

Previous Activities:

Backwaters: Six backwaters have been constructed to provide approximately 80 surface acres of habitat for bonytail (*Gila elegans*) and razorback suckers (*Xyrauchen texanus*). Lower Colorado River water was supplied to the backwaters by a pump fitted with a wedge wire screen system. The screen had a slot size of 0.05 millimeter that was designed to prevent passage of fish eggs and larvae into the backwaters. An in situ evaluation of the screen was completed

under Work Task G3. The results indicated that fish eggs and larvae of multiple species were passing through the screen. In response to the results, the pump was shut off in summer 2009, and water was supplied to all the backwaters using a single groundwater well. A water management study was initiated in May 2011 and was completed in 2013 to evaluate the water quality in Pond 1 (where regular water management was continued) and Ponds 2–6 (without a managed water supply). A trends analysis from the physico-chemical profiles indicated that the temperature was increasing over time in all six ponds; however, it appeared to be increasing at a slightly higher rate in Pond 1. The pH levels also appeared to increase over time, with differences being observed among ponds. The values of pH commonly exceeded a set standard of 9.0 in Ponds 2–6 in the summers of 2011 and 2012. The pH levels were lowest in Pond 1. Dissolved oxygen levels did not appear to be a cause for concern in an absence of water management. Specific conductivity levels showed a gradual increase over time in all ponds. A second well was installed onsite to supply water to the ponds in FY14. The new well both increased the volume of water that could be delivered to the ponds and provided redundancy in case one well became inoperable.

Annual maintenance and management of the ponds: Two groundwater wells supply water to all six ponds. Each pond receives approximately 8.50 acre-feet per month, except during July through September when the water volume increases to 17 acre-feet of water per month, for a total of 773 acre-feet for the year. Annual costs included those for electricity for the well, maintenance of the pumps and valves to direct water delivery, and boat ramp maintenance.

Riparian: Field leveling and irrigation system installation for the area were completed in FY08. Soil salinity is managed through irrigation of a cover crop.

Marsh: A 12-acre marsh unit was created at Field 18 in the southeast corner of the Imperial National Wildlife Refuge. This field was cleared in winter of 2007–08 and was converted into a bulrush-dominated marsh managed for rail species. The irrigation cycle is based on an adjacent field, Field 16, which was created and is managed for Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) and California black rails (*Laterallus jamaicensis coturniculus*). The marsh has been managed for LCR MSCP covered species since 2008, and both Yuma clapper rails and California black rails have been detected on Field 18.

Annual maintenance and management of marsh and cottonwood-willow: Irrigation water for both the riparian area as well as the managed marsh complex is received from a pump platform, which is located in the Martinez Lake inlet channel. Annual costs associated with operation and maintenance of these areas include costs associated with the electrical power utility bill, pump maintenance, invasive and non-native weed control, road maintenance, and the labor to open and close the gates along the canal.

FY16 Accomplishments:

Maintenance/restoration/management: Materials needed for future infrastructure upgrades were procured. A hydraulic model was developed and tested to assist in the replacement of the existing canal system. Two replacement designs have been developed and are expected to be presented to the Imperial National Wildlife Refuge in FY17. Expenditures were less than approved due to the delay in the canal replacement project.

Backwaters: No native fishes were stocked into the backwaters. Mosquitofish (*Gambusia affinis*) were observed in Pond 5, and one was captured in a light trap.

A water management schedule has been established that recommends approximately 773 acre-feet of water be delivered to the ponds. Approximately 755 acre-feet were delivered to the ponds in FY16.

Riparian: Irrigation was supplied from February through September to maintain a cover crop to manage salinity. No additional restoration or monitoring was performed on the 34 acres of the future cottonwood-willow field.

Monitoring:

Backwaters: Post-renovation fish monitoring was reduced to quarterly sampling, as indicated in the post-renovation monitoring plan, and concluded at the end of FY16. The 2 years of monitoring included 112 trammel net nights, 403 hoop net sets, 874 minnow trap sets, and 162 larval light trap sets. Mosquitofish were captured in Pond 5, but no other fish species has been detected in any of the Imperial ponds since the renovation.

Water chemistry and water quality data, as well as zooplankton and phytoplankton samples, were collected on a quarterly basis. Water quality probes were deployed to record water quality parameters at 6-hour intervals, including temperature, pH, dissolved oxygen, and specific conductivity. All water quality parameters remained within the ranges of acceptability for native fishes. Submersible passive integrated transponder (PIT) tag detection antennas were purchased and installed to support fish stockings.

A native fish stocking plan was prepared that includes a stocking timeline and potential research questions to be addressed for the Imperial ponds.

Marsh: Marsh bird surveys were conducted by the U.S. Fish and Wildlife Service at the ponds and on Field 18. Yuma clapper rails were detected during both surveys in April on Field 18, and California black rails were detected on Field 18 during the last survey in April. No covered marsh birds were detected at the ponds.

Riparian: Small mammal trapping was conducted near Field 18 as part of system-wide monitoring. In March, a Yuma hispid cotton rat (*Sigmodon hispidus eremicus*) was captured.

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

FY17 Activities:

Maintenance/restoration/management: Onsite maintenance, utility payments, and water management for the site will continue. The design for the replacement of the concrete-lined canal for the delivery of water into the fields will be selected. The funding set aside for the canal improvements will not be obligated in FY17.

Electrical power system upgrades will be completed in FY17. The upgrades will provide 50-ampere, 110-volt service to each pond. The power will allow for future automation of valves, electronic flow meters, improved water quality monitoring, and automated PIT tag scanning.

Backwaters: Water will be supplied to the ponds following the water management schedule. Electric will be run to each pond for the installation of a permanent submersible PIT tag antenna. Post-renovation monitoring is being completed under Work Task C25.

Riparian: The fields will be irrigated to manage salinity in the soils. A Restoration Development and Monitoring Plan for the 34 acres of riparian habitat will be updated.

Marsh: The 12-acre marsh created in Field 18 will continue to be managed for marsh covered species.

Monitoring: Monitoring will continue in FY17 similar to previous efforts for fishes and marsh birds. Vegetation data will be collected in FY17 using LiDAR remote sensing techniques.

Proposed FY18 Activities:

Maintenance/restoration/management: Onsite maintenance, utility payments, and water management for the site will continue. Replacement of the concrete-lined canal for the delivery of water into the riparian fields and marsh complex will begin.

Backwaters: Boat ramps and riprap shorelines will be maintained. The automated watering schedule for all six ponds will continue to be used.

Riparian: Trees will be purchased for planting following replacement of the irrigation canal. The fields will be planted once the irrigation canal is replaced and soil salinity monitoring is completed.

Marsh: The 12-acre marsh created in Field 18 will continue to be managed for marsh covered species.

Monitoring: Monitoring will continue in FY18 similar to previous efforts for fish and marsh birds. MacNeill's sootywing skipper (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill]) surveys will be conducted in spring and summer if riparian habitat is created. Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond.

Pertinent Reports: The *2016 Imperial Ponds Conservation Area Annual Report* will be posted on the LCR MSCP Web site once integration of the data collected throughout the calendar year is complete.

Work Task E16: Conservation Area Site Selection

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,300,000	$785,451.33	$3,725,596.44	$700,000	$700,000	$300,000	$200,000

Contact: Terry Murphy, (702) 293-8140, tmurphy@usbr.gov

Start Date: FY05

Expected Duration: FY25

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, BLRA1, BONY2, CLNB2, CLRA1, CRCR2, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, MNSW2, PTBB2, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA2, YBCU1, YHCR2, and YWAR1

Location: Reaches 1–7, Arizona, California, and Nevada

Purpose: To identify, visit, evaluate, prioritize, and recommend potential conservation areas to the Steering Committee for development under the habitat creation requirements of the LCR MSCP

Connections with Other Work Tasks (Past and Future): The process developed under this work task will inform the selection of future conservation area sites to be developed under Conservation Area Development and Management (Section E) work tasks.

Project Description: The Bureau of Reclamation (Reclamation) will work with landowners to secure an interest in land and water resources sufficient to create and maintain LCR MSCP habitats. It is anticipated that willing landowners will enter into a long-term commitment for the 50-year term of the program.

When developing a financial value for subject lands and water, Reclamation must administer a Federal appraisal using the U.S. Department of the Interior's designated Appraisal Services Office. The cost of appraisal services is captured under the Work Task E16 budget.

After new sites are evaluated and prioritized, Reclamation will get concurrence from the Steering Committee to go forward with the new conservation areas either through the site selection process or, if acquisition is required, through a land and water resolution.

This approval allows Reclamation to move forward with the new site and prepare specific Restoration Development and Monitoring Plans that inform implementation of the conservation area.

In FY14, backwater site selection previously tracked under Work Task E15 (closed) was combined with this work task. This reflects the change in the process to select backwaters and allows integration of multiple land cover types on a conservation area in which the primary purpose is the creation of a backwater.

Previous Activities: Guidelines have been developed to describe the process of working with interested parties to identify sites for screening and evaluation as potential conservation areas. Through FY15, 12 conservation areas have been established.

FY16 Accomplishments: Coordination with resource agencies and attendance at planning meetings was similar to that of previous years. Obligations were less than the approved budget due to the lack of backwater areas to be evaluated this fiscal year. The evaluation of backwaters typically includes collection of topographic information, soil borings, installation of monitoring wells, and collection of river data as wells as groundwater and surface modeling.

New Conservation Areas:

Parker Dam Camp: A Memorandum of Understanding between the LCR MSCP and the Lower Colorado Dams Office was signed.

Proposed Conservation Areas:

Palo Verde Ecological Reserve-South (*PVER-South*)*:* An expansion of the acquired property to include a remnant meander that would have allowed connection back to the Colorado River has ended without the acquisition of any land; therefore, the conservation area will be developed as cottonwood-willow (*Populus fremontii-Salix gooddingii*) and honey mesquite (*Prosopis glandulosa*) and will no longer have a marsh and backwater component. PVER-South will become a formal conservation area in FY17 and will be tracked under Work Task E37. A Restoration Development and Monitoring Plan will be drafted and discussed with the landowner (California Department of Fish and Wildlife).

Three Fingers Lake: Three Fingers Lake was identified during a workshop with representatives of the California parties as having the potential to provide both backwater and marsh land cover types for the LCR MSCP. The lake is located on the Cibola National Wildlife Refuge within the State of California on lands owned by the U.S. Fish and Wildlife Service. Multiple options for creation of a conservation area were discussed with stakeholders. An agreement in principle

has been reached between the U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, and the LCR MSCP to develop the area as a conservation area. Starting in FY17, accomplishments will be tracked under Work Task E38.

Potential Conservation Areas:

Davis Lake: Davis Lake was identified during a workshop with representatives of California parties as having the potential for creation of a shallow marsh similar in size to Hart Mine Marsh. The remnant lake is located on the Cibola National Wildlife Refuge within the State of California on lands owned by the U.S. Fish and Wildlife Service. Light detection and ranging (LiDAR) data were collected to help determine whether to proceed with this potential conservation area; however, no decision was made in FY16.

Backwaters and Marsh within Reach 4: Reach 4 has the highest potential for establishment of marshes and backwaters in California based on the needs of the LCR MSCP. Increased efforts to identify these areas on lands withdrawn by Reclamation, typically between the bank line and levee, are ongoing.

Topock Marsh Inlet Canal: An opportunity may exist to create a connected backwater in Reach 3 using the former Topock Marsh Inlet Canal. However, prior to any technical investigations, landownership needs to be verified, so a survey was initiated in FY16.

FY17 Proposed Activities: Coordination with resource agencies will continue. The need for additional cadastral surveys is being discussed to define landownership prior to evaluating properties for consideration as new conservation areas. Installation of groundwater monitoring wells and collection of river data to support selection of backwater and marsh sites are planned.

Proposed Conservation Areas:

Dennis Underwood Conservation Area: An agreement in principle has been reached with the landowner, the Metropolitan Water District, to utilize up to 635 acres for development of cottonwood-willow and honey mesquite. This conservation area is located south of Blythe, California, within the Palo Verde Irrigation District. Initial investigations included an evaluation of available soils data and a conceptual layout for restoration. Prior to the drafting of a land and water resolution, the property will be appraised through the Office of Evaluation Services.

Potential Conservation Areas:

Backwaters and Marsh within Reach 4 and 6: Investigations of areas on which to create backwaters or marshes have expanded into Reach 6. Reaches 4 and 6 have land available for establishment of marshes and backwaters in California. Preliminary restoration concepts for potential conservation areas are being developed, land status is being determined, and both river and groundwater data are being collected.

Davis Lake: No additional investigations are anticipated at this time.

Topock Marsh Inlet Canal: The cadastral survey is underway to determine land ownership. The survey has required extensive records research, field verification, placement of monuments, and discussion with multiple partners; therefore, a restoration concept is not anticipated until at least FY18.

FY18 Proposed Activities: Coordination efforts with resource agencies will continue in order to identify the remaining conservation areas necessary to complete the habitat creation requirements of the LCR MSCP.

Dennis Underwood Conservation Area: If approved by the Steering Committee through a land and water resolution to officially become a conservation area, obligations will be tracked under Work Task E39.

Pertinent Reports: N/A

Work Task E17: Topock Marsh Pumping

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,000	$0	$1,245,076.45	$1,000	$1,000	$1,000	$1,000

Contact: Jeremy Brooks, (702) 293-8257, jjbrooks@usbr.gov

Start Date: FY06

Expected Duration: FY25

Long-Term Goal: Avoid impacts from flow-related covered activities on covered species habitats at Topock Marsh

Conservation Measures: AMM2

Location: Reach 3, Havasu National Wildlife Refuge, River Miles 235–244, Arizona

Purpose: To avoid the impacts of flow-related covered actions on covered species habitats at Topock Marsh by constructing a reliable and manageable water control structure that ensures water delivery off the main stem of the Colorado River by gravitational diversion or pumping

Connections with Other Work Tasks (Past and Future): N/A

Project Description: Topock Marsh has been identified as habitat for Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) and southwestern willow flycatchers (*Empidonax traillii extimus*). At times, flow-related activities could lower the river stage and reduce gravity diversions of water from the Colorado River to the marsh. The U.S. Fish and Wildlife Service (USFWS) proposed construction of an inlet canal (Fire Break Canal) that diverts water by gravity, combined with pumping, to deliver water to the marsh even when river elevations are low.

Previous Activities: In early 2010, $1 million was committed under the LCR MSCP toward the construction of Fire Break Canal, which improved the delivery of water to Topock Marsh by greatly reducing transmission losses that occurred when using the old, unlined inlet canal. In return for the monetary contribution, the USFWS concurred that the LCR MSCP had met its construction obligations under Avoidance and Minimization Measure 2 (AMM2).

At the LCR MSCP Steering Committee meeting held on April 28, 2010, the decision was made to provide the USFWS with all the operation and maintenance funds, also required under AMM2, in a lump sum of $2.55 million during FY12. Lump sum funding was made to the USFWS in March 2012. The final USFWS letter stating that no further action was required by the LCR MSCP to meet the commitments stated in AMM2 was received on July 2, 2012. Additional funding from the Habitat Maintenance Fund (HMF) will be required to complete the infrastructure improvements.

The USFWS concurred with the use of the HMF and AMM2 funds for this purpose, and an agreement to move forward was formalized. AMM2 funds obligated under an interagency agreement were subsequently deobligated. Key components of the agreement included: all commitments under AMM2 will remain fulfilled; all AMM2 funds will be expended prior to utilization of the HMF; prior to construction activities, the USFWS and the LCR MSCP will enter into an agreement to use the HMF, which will detail the long-term roles and responsibilities of both agencies and marsh management objectives.

FY16 Accomplishments: In FY16, discussions with the USFWS Arizona Ecological Services Field Office and the USFWS Region 2 Regional Office continued regarding leveraging the remaining AMM2 funds, approximately $2.1 million, on the infrastructure improvements at Topock Marsh.

A Decision Support System (DSS) was completed using funds obligated in previous fiscal years in order to determine seasonal target elevations for Topock Marsh based upon species requirements. The information provided by the DSS is being used, in combination with collected survey and river stage data, to determine the amount of water required to meet proposed elevation targets for Topock Marsh. The primary water delivery method is through gravity diversions from the main stem of the river. However, the river stage is not high enough to allow for gravity diversion prior to the desired marsh bird nesting season. The intent of the DSS is to provide a tool to estimate water delivery requirements and the effect of the water surface on various species. The engineering review will help determine the capacity of the existing gravity system and the size of the pumps needed for the volume of water that is necessary to reach the desired water surface elevation prior to marsh bird nesting. Approximately $100,000 was obligated in FY16 for the preliminary engineering review.

FY17 Activities: Engineering evaluations at Topock Marsh continue. The Bureau of Reclamation and the USFWS will use the engineering analysis to determine the feasibility of managing Topock Marsh for different amounts of habitat and target elevation options. The LCR MSCP will provide limited coordination and general support of these activities but will not directly implement the project.

Proposed FY18 Activities: Engineering design will begin.

Pertinent Reports: N/A

Work Task E18: Law Enforcement and Fire Suppression

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$250,000	$179,921.81	$1,705,400.26	$250,000	$200,000	$200,000	$200,000

Contact: Jeremy Brooks, (702) 293-8257, jjbrooks@usbr.gov

Start Date: FY06

Expected Duration: FY55

Long-Term Goal: Protect created habitat

Conservation Measures: CMM1

Location: Reaches 1–7

Purpose: To provide law enforcement and fire suppression in support of habitat created by the LCR MSCP

Connections with Other Work Tasks (Past and Future): Law enforcement and fire suppression are integral management components for all habitats created through Conservation Area Development and Management (Section E) work tasks.

Project Description: A law enforcement and fire protection effort for created habitat is funded under this work task. The Bureau of Land Management (BLM), U.S. Fish and Wildlife Service, Arizona Game and Fish Department, California Department of Fish and Wildlife, Nevada Department of Wildlife, Bureau of Indian Affairs, CAL-Fire, and other agencies conduct law enforcement and firefighting activities on the river. Law enforcement and fire suppression strategies have been developed at the programmatic level for each individual conservation area. As new conservation areas are incorporated into the LCR MSCP, site-specific law, fire, and access plans will be developed to help reduce fire and other risks.

Previous Activities: The BLM Colorado River District Office, based in Lake Havasu, Arizona, has been responsible for handling fire- and law-related activities for conservation areas on both State and Bureau of Reclamation lands. Conservation areas located on Federal refuges are managed for wildland fire and law enforcement by the U.S. Fish and Wildlife Service.

The BLM also conducts planning, coordination, monitoring, outreach, risk assessments, site mapping, and site inspections activities. Inspections are intended to proactively identify and address potential wildland fire management issues, and recommendations are discussed with the landowner and the LCR MSCP. These recommendations help identify high risk areas, areas in need of fuel reduction, damage to infrastructure, and management of visitor use areas.

FY16 Accomplishments: Work with local fire and law agencies in support of the law and fire management activities continued in FY16. Activities included patrols, monitoring, planning, site visits, coordination meetings, and attendance at agency staff meetings.

In FY16, law enforcement activities included more than 150 patrols of LCR MSCP conservation areas and the issuance of 4 minor citations and tickets. Fire suppression efforts were required at the Cibola Valley Conservation Area and the Mohave Valley Conservation Area. These fires are briefly described below:

> *Cibola Valley Conservation Area*: The Farmers Bridge Fire occurred on March 17, 2016. Less than 50 acres were burned within Phase 1. The fire burned mainly the stand understory and caused little to no long-term damage to the established land cover. Suppression of the fire was aided by the Cibola Valley Irrigation District, which began flooding the fields shortly after the fire began. No replanting or additional restoration is required.
>
> *Mohave Valley Conservation Area*: The Topock Fire started on April 6, 2016, and primarily burned land within Arizona on the Havasu National Wildlife Refuge (2,232 acres). However, the fire jumped the river and burned approximately 46 acres of the Mohave Valley Conservation Area. Since the site was scheduled for clearing in FY17, the fire did not impact the development of the conservation area.

FY17 Activities: In support of LCR MSCP conservation areas, coordination with law and fire agencies will continue through the Interagency Agreements with the BLM. Funding will continue to be allocated to the BLM for law enforcement and fire management activities, including patrols, fire prevention, activity reporting, site visits, coordination meetings, and other related activities. Law, fire, and access plans will be developed or updated for the Laguna Division Conservation Area and Planet Ranch.

Proposed FY18 Activities: BLM law and fire personnel will continue with proactive patrols similar to those in prior years. Site-specific fire management and law enforcement plans will be developed and/or updated for the Palo Verde Ecological Reserve, the Cibola Valley Conservation Area, the Big Bend Conservation Area, and Hunters Hole.

Pertinent Reports: N/A

Work Task E21: Planet Ranch

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$10,340,000*	$10,548,669.63	$9,716,678.45	$2,000,000	$3,000,000	$4,000,000	$4,000,000

* Includes an $8,300,000 land and water acquisition approved by the Steering Committee.

Contact: Keith Hannon, (702) 293-8166, khannon@usbr.gov

Start Date: FY05 (closed in FY05; reopened in FY09)

Expected Duration: FY55

Long-Term Goal: Habitat creation and management

Conservation Measures: BEVI1, BONY2, BONY3, CLRA1, CRCR2, ELOW1, GIFL1, GIWO1, LEB1, MNSW2, RASU2, RASU3, SUTA1, VEFL1, WIFL1, WIFL2, WRBA2, WYBA3, YBCU1, YBCU2, and YWAR1

Location: Reach 3, Bill Williams River, 11 miles east of River Mile 190, Arizona

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Costs associated with a Federal land and water appraisal conducted in FY08 were captured under Work Task E16. Work Task E21 was closed at the end of FY05 but was reopened in FY09 to track expenditures during negotiations.

Project Description: Planet Ranch encompasses approximately 8,400 acres, of which approximately 2,400 acres had previously been farmed for alfalfa (*Medicago sativa*). In 2008, the Steering Committee approved a land and water resolution, which authorized the Bureau of Reclamation (Reclamation) to enter into negotiations to secure approximately 3,418 acres of land and 5,549 acre-feet of water per year from the Freeport Minerals Corporation (FMC). Legislation directing the Secretary of the Interior to enter in an agreement for the acquisition of Planet Ranch was signed in December 2014. Program Decision Document 15-002, which allowed Reclamation to enter into a lease for the land and water, was approved by the Steering Committee on April 22, 2015. The sum of $8,300,000 to secure this land and water was determined through the Federal appraisal process.

The Arizona Game and Fish Commission received title for the land and water rights through a donation from the FMC in December 2015. The lease between Reclamation and the FMC was transferred as part of the donation agreement.

The intent of the acquisition is to secure the river corridor and develop the property as a conservation area. Creditable acreage includes (1) active restoration of all four land cover types within the property boundary where feasible, (2) passive restoration within the active Bill Williams River channel on the property, and (3) downstream credit on the Bill Williams River National Wildlife Refuge (Bill Williams River NWR). The current restoration concept for active restoration includes isolated backwaters for native fishes, including active grow-out ponds and disconnected backwaters. These areas will be integrated into a mosaic with cottonwood-willow (*Populus fremontii-Salix gooddingii*) and honey mesquite (*Prosopis glandulosa*). An additional 396 acres of cottonwood-willow trees downstream on the Bill Williams River NWR will also be afforded protection by securing the Planet Ranch property and are also creditable to the LCR MSCP.

The conservation area includes the entire 3,418 acres of land. However, the ranch west of the main north/south access road (approximately 660 acres) and some acreage east of the main north/south access road, defined as reserved under the lease amendment, would be managed for LCR MSCP covered species.

The ranch east of the main north/south access road (approximately 2,758 acres) would not be managed for LCR MSCP covered species. These lands would be managed by the Arizona Game and Fish Department, with the exception of any lands shown as reserved for LCR MSCP purposes in the lease amendment.

A tentative schedule of activities includes (1) farming approximately 1,100 acres to secure water rights in FY16 and FY17, (2) planning for restoration and ground stabilization, including a workshop to incorporate information from native fish experts in FY16, (3) drafting of a Restoration Development and Monitoring Plan, permitting, and design in FY17, and (4) infrastructure improvements, pond construction, ground stabilization on farmed areas, and restoration of cottonwood-willow between FY18 and FY21. A Land Use Agreement will be developed to further define roles and responsibilities, including public access.

Previous Activities: Regulatory compliance activities required under the National Environmental Policy Act, the Endangered Species Act, and the National Historic Preservation Act were completed for the acquisition of Planet Ranch. Native American consultation and a Class I Cultural Survey as prescribed in Section 106 of the National Historic Preservation Act were completed in FY11.

FY16 Accomplishments: On December 15, 2015, escrow closed, landownership, and associated water rights were deeded to the Arizona Game and

Fish Commission, and Planet Ranch officially became a conservation area. The purchase price for the lease was $8,300,000 for 3,418 acres of land and 5,549 acre-feet of water per year.

The acquisition of Planet Ranch involved multiple partners and included both the sever and transfer of some water rights from Planet Ranch to secure water rights for existing uses in other areas as well as leaving a portion of existing water rights in Planet Valley. As a result, 396 acres of cottonwood-willow habitat downstream from Planet Ranch on the Bill Williams River NWR were protected and credited toward completion of conservation measures because groundwater that could have been consumed for other purposes will now remain in the basin to support this downstream habitat. In return, the program made the commitment to promote recruitment of cottonwood-willow during releases from Alamo Dam for this section of the refuge.

To ensure the viability of water rights associated with the property, approximately 1,200 acres were aerially and ground seeded with alfalfa, which was grown as pasture from December 16, 2015, through December 15, 2016. Water use was tracked through totalizing flow meters and, when combined with acreage being farmed, documents the beneficial use of water on the property. Water use and crop acreage were updated every 2 weeks. A contract farmer provided irrigation, site maintenance, as well as an onsite presence. Significant vandalism has occurred on other ranches within the watershed when no onsite presence has been maintained.

Discussions with the U.S. Fish and Wildlife Service (USFWS) to help manage the conservation area began in FY16. The USFWS is supportive of the project and, barring any unforeseen circumstances, intends to provide onsite staffing.

Significant repairs to the irrigation system were required due to the age of the irrigation infrastructure and its limited use in the past decades. A backhoe and a skidsteer loader with auger attachments were purchased.

Utilities were transferred to Reclamation. Groundwater well ownership was transferred to the Arizona Game and Fish Commission. National Environmental Policy Act compliance for development and restoration of the ranch was initiated.

A workshop to develop a conceptual plan for development and restoration was held in August 2016. The conceptual design included the creation of 71 acres of disconnected backwaters that would be developed for razorback suckers (*Xyrauchen texanus*) and bonytail (*Gila elegans*). These ponds would be approximately 5–20 acres in size and 4–12 feet deep. The design and construction of these ponds will depend on the depth to water and will likely also be lined with geotextile material. Excavated material will be placed on the edges of the refugia, creating a natural border for the pond and used to return topographic diversity to the agricultural fields. The border may be planted with

riparian species to allow habitat connectivity with the riparian corridor of the Bill Williams River, to provide shade over the water's edge for native fishes, and to prevent erosion.

Ten shallow groundwater monitoring wells were permitted, drilled, and developed to track groundwater elevations in and around the proposed location of the ponds.

Monitoring: Pre-development monitoring was conducted in June and July 2016. No breeding southwestern willow flycatchers (*Empidonax traillii extimus*) were detected, although migrants were present during the survey. No yellow-billed cuckoos (*Coccyzus americanus occidentalis*) were detected during two passive listening surveys. Both species were present prior to the purchase of Planet Ranch by the FMC. Several other LCR MSCP avian species were present during informal, exploratory surveys, including the summer tanager (*Piranga rubra*), Gila woodpecker (*Melanerpes uropygialis*), vermilion flycatcher (*Pyrocephalus rubin*), Arizona Bell's vireo (*Vireo bellii arizonae*), Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), and California black rail (*Laterallus jamaicensis coturniculus*). California leaf-nosed bats (*Macrotus californicus*) and the pale Townsend's big eared bat (*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii*) were captured.

FY17 Activities: To ensure the viability of water rights associated with the property, alfalfa will continue to be grown as pasture from December 16, 2016, through December 15, 2017. Water use is tracked through totalizing flow meters and, when combined with acreage being farmed, documents the beneficial use of water on the property. Water use and crop acreage are updated every 2 weeks. A contract farmer is providing irrigation, site maintenance, as well as an onsite presence.

Environmental compliance for the construction of the ponds and other habitat features will be prepared in FY17. Upon completion of environmental compliance, minor construction and infrastructure improvements will begin and will likely include drilling of additional production groundwater wells to supply the ponds.

Releases out of Alamo Dam are the responsibility of the U.S. Army Corps of Engineers. Bill Williams River hydrologic models will be updated with new topographic and hydrologic information to provide a tool to assist future management decisions by the U.S. Army Corps of Engineers and the Bill Williams River Corridor Steering Committee regarding releases out of Alamo Dam. The model will allow for the assessment of both the current conditions as well as conditions after development and the benefits those releases may provide to the habitat in the conservation area.

A Land Use Agreement between Reclamation and the Arizona Game and Fish Department will be drafted. A Restoration Development and Monitoring Plan, which would inform development of the conservation area, will be completed.

The entrance gates along the main north-south access road through Planet Ranch were reopened to the public after 32 years of closure in January 2017; they provide a travel corridor between La Paz and Mohave Counties. Law enforcement activities will be required to limit use to this main access road.

Reclamation continues to be an active member of the Bill Williams River Corridor Steering Committee. Converting lands from private ownership to a resource agency has provided additional flexibility in the release of water from Alamo Dam. Lands secured within the active flood plain, as well as lands downstream on the Bill Williams River NWR, benefit from both normal and high flow releases from the dam. These releases can be conducted without affecting these former privately owned lands as long as releases are coordinated with activities associated with the construction of Planet Ranch. Coordination with both the USFWS and U.S. Army Corps of Engineers will continue.

Monitoring: Pre-development general bird surveys will be conducted from mid-April through June and funded under post-development work tasks (Section F) to provide migratory bird species information for environmental compliance activities associated with construction of the habitat at Planet Ranch.

Proposed FY18 Activities: It is anticipated that irrigation of the alfalfa pasture will be discontinued in December 2017. The LCR MSCP will begin habitat creation activities in FY18. The restoration will be guided by the Restoration Development and Monitoring Plan. Improvements during FY18 will focus on infrastructure improvements and preparation for pond construction.

Infrastructure improvements may include (1) realignment and extension of electrical power lines, (2) procurement and placement of modular homes for onsite staff and travel trailer hookups for construction crews, (3) construction of an equipment storage shed, and (4) installation of utilities for all improvements, including water, power, and septic.

Due to the size and complexity of Planet Ranch, several years of construction will be required for full development, with completion scheduled for late 2020 or 2021.

Monitoring: Construction compliance monitoring will be conducted as needed to minimize impacts to listed and covered species. Post-development monitoring will begin after construction is completed and appropriate habitat is present.

Pertinent Reports: N/A

Work Task E24: Cibola National Wildlife Refuge Unit #1 Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$700,000	$843,168.99	$5,164,417.08	$750,000	$750,000	$800,000	$800,000

Contact: Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

Start Date: FY07

Expected Duration: FY55

Long-Term Goal: Habitat creation and management

Conservation Measures: BEVI1, CRCR2, ELOW1, GIFL1, GIWO1, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 4, Cibola National Wildlife Refuge, 1/2 mile east of River Mile 97, Arizona

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): This work task incorporated lands under Work Tasks E6–E8 (closed), with additional adjacent acreage at the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1). Operation and maintenance of these work tasks will now be tracked under Work Task E24.

Project Description: The Bureau of Reclamation currently has a number of established projects at Cibola NWR Unit #1, which includes restoration research and demonstration projects that began as a precursor to the LCR MSCP. A 50-year Land Use Agreement was established with the U.S. Fish and Wildlife Service to restore new areas and maintain created land covers on Cibola NWR Unit #1.

Work Task E24 incorporates the existing projects and active agricultural land as well as substantial additional, undeveloped, adjacent acreage into a single conservation area. The land included in Cibola NWR Unit #1 encompasses approximately 950 acres and ranges in cover and use from agricultural fields, to partially improved land, to undeveloped land. The acreage in Cibola NWR

Unit #1 is targeted primarily for the cottonwood-willow (*Populus fremontii-Salix gooddingii*) land cover type but will also likely include a mosaic of native habitats, including wetland and riparian-upland interface areas.

The acreage in Cibola NWR Unit #1 has been categorized into five areas:

- Area #1 (193 acres) includes active agricultural fields, existing (converted agriculture) cottonwood-willow cover type, and ongoing LCR MSCP research and demonstration projects.

- Area #2 (Hippy Fire) includes 338 acres that were cleared as a result of the Hippy Fire and is scheduled for cottonwood-willow land cover.

- Areas #3 (Baseline 90) includes 107 acres of undeveloped and fallowed agricultural land. Undeveloped areas will require clearing, leveling, installation of an irrigation infrastructure, and soil conditioning before development for native riparian species.

- Area #4 (North 160) includes 158 acres and is planted with alfalfa (*Medicago sativa*) and cover crops until the area is conditioned to improve soil salinity and is scheduled for cottonwood-willow land cover.

- Area #5 (Crane Roost) includes 154 acres that have been planted with cottonwood, willow, and honey mesquite (*Prosopis glandulosa*).

Annual maintenance and management: A local farmer diverts and irrigates the various phases based on site conditions and species planted. This provides local knowledge of weather and farming practices, which are applied to the management of the conservation area. The farmer and his employees are an onsite presence and provide early recognition of issues or concerns. The farmer is also responsible for assessing the water needs of the trees and, in coordination with the Cibola National Wildlife Refuge and LCR MSCP, orders and delivers the water. Removal of vegetation along the roadside and ditches is typically performed quarterly to reduce the potential of wildfires in conjunction with maintenance of the irrigation canals, gates, and roads.

The annual costs associated with operating Cibola NWR Unit #1, such as electrical power utility bills, labor to open and close the irrigation gates, invasive and non-native vegetation control, and road maintenance, are included in the annual maintenance costs.

Checks, which are small borders placed within a given field, allow for flooding only a portion of a field. These checks provide additional flexibility to create and maintain standing water or saturated soil areas for covered species. Irrigation occurs throughout the year and is expected throughout the life of the LCR MSCP.

Previous Activities: Through FY15, 365 acres of cottonwood-willow have been established within the 950-acre site. Native trees have been irrigated and managed since 2007. Monitoring for birds, MacNeill's sootywing skippers (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]), bats, and rodents were conducted. In FY15, planning and design started for a pump stand upgrade, which will include abandoning the existing pump stand and constructing a new one.

FY16 Accomplishments:

Maintenance/restoration/management: Management, maintenance, flood irrigation, and monitoring of the established habitat created continued. Approximately 96 acres were planted with a mix of cottonwood, willow, honey mesquite, and other riparian shrub and grass species in accordance with the Restoration Development and Monitoring Plan for the lower Hippy Fire area. In FY16, plants were ordered for the middle Hippy Fire area (108 acres), and field preparation will begin in FY17 for planting in spring.

Unscheduled construction activities in FY16 included an addition of two turnouts in the lower Hippy Fire area to allow for increased flexibility of future irrigation management, which resulted in higher obligations than budgeted.

Pump Stand Replacement: Replacement pumps and pipe to replace a section of the concrete-lined canal were purchased but are not included in the obligations totals, as the funds were provided by the U.S. Fish and Wildlife Service.

Monitoring: Monitoring was conducted at Cibola NWR Unit #1 for vegetation, birds, bats, small mammals, and MacNeill's sootywing skippers.

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

The site was surveyed for riparian birds using the LCR MSCP double sampling protocol. Arizona Bell's vireos (*Vireo bellii arizonae*), summer tanagers (*Piranga rubra*), and vermilion flycatchers (*Pyrocephalus rubinus*) were detected breeding. Avian mist netting following the Monitoring Avian Productivity and Survivorship (MAPS) protocol was conducted from early May to early August. Three yellow warblers were captured and color banded. The color-banded vermilion flycatcher female from 2015 was resighted. Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys were conducted, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted and breeding was confirmed.

Cibola NWR Unit #1 was mist netted for bats once per month from June to August 2016. California leaf-nosed bats (*Macrotus californicus*) were captured.

In conjunction with the bat capture surveys, the established long-term acoustic bat station was used to detect LCR MSCP bat species from June – August. These data are still being analyzed.

Small mammal trapping was conducted in fall and spring. Colorado River cotton rats (*Sigmodon arizonae plenus*) continue to be detected at the site.

MacNeill's sootywing skipper surveys were conducted, and individuals and eggs were detected in Crane Roost.

FY17 Activities:

Maintenance/restoration/management: Management, maintenance, flood irrigation, and monitoring of the established habitat created will continue. Tree planting will occur in the spring of FY17 on the middle Hippy Fire area. Approximately 108 acres will be planted with a mix of cottonwood, willow, honey mesquite, and other riparian shrub and grass species. Plants will be ordered for the North 160 area to allow time for propagation before planting next spring.

Pump Stand Replacement: Construction of the replacement pump stand is scheduled to begin in March 2017; however, final connections and removal of the old pump stand will not occur until 2018, which will help avoid an outage during the active growing season.

Monitoring: Vegetation data will be collected using LiDAR remote sensing techniques. General bird surveys will be conducted from mid-April to mid-June. A MAPS station will be operated from May until the end of July. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat capture surveys and acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and/or spring.

Proposed FY18 Activities:

Maintenance/restoration/management: Management, maintenance, flood irrigation, and monitoring of the established habitat created will continue. About 160 acres of the North 160 area are scheduled for final field preparation and riparian planting in FY18. Final land preparation will take place in the first months of 2018, with planting scheduled for March/April 2018. The area will be planted with a mix of cottonwood-willow, honey mesquite, and other riparian shrub and grass species.

Pump Stand Replacement: Removal of the old pump stand and final connections to the new pump stand are anticipated.

Monitoring: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. General bird surveys will be conducted from mid-April to mid-June. A MAPS station will be operated from May until the end of July. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat capture surveys and acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Pertinent Reports: The *2016 Cibola NWR Unit #1 Conservation Area Annual Report*, which summarizes any planting conducted, site management, the results of monitoring, and any recommendations for future adaptive management, will be posted on the LCR MSCP Web site once integration of the data collected throughout the calendar year is complete.

Work Task E25: Big Bend Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$30,000	$12,101.05	$1,201,369.25	$30,000	$20,000	$20,000	$20,000

Contact: Laken Anderson, (702) 293-8153, landerson@usbr.gov

Start Date: FY09

Expected Duration: FY55

Long-Term Goal: Habitat protection

Conservation Measures: BONY2, RASU2, and FLSU1

Location: Reach 3, Nevada, River Mile 266.5

Purpose: To protect an existing backwater from development

Connections with Other Work Tasks (Past and Future): Marsh bird surveys are conducted under Work Task D1, while fish surveys have been conducted under multiple work tasks in Species Research (Section C) and Work Task F5.

Project Description: The Boy Scout Camp purchased by the Southern Nevada Water Authority (SNWA), combined with the adjacent backwater managed by the State of Nevada, has collectively been identified as the Big Bend Conservation Area (BBCA). This conservation area includes approximately 15 acres of backwater within the Nevada portion of the Colorado River that will be protected and approximately 15 acres of upland area adjacent to the backwater. The dry upland area was enhanced for education and outreach purposes by the SNWA at minimal cost to the LCR MSCP and was completed in concert with protection of the backwater. The properties are adjacent to and buffered by Big Bend State Park.

Past native fish monitoring efforts have indicated the presence of native fishes in and adjacent to the existing backwater. Securing the site has resulted in 15 acres of backwater habitat credit that benefits flannelmouth suckers (*Catostomus latipinnis*), razorback suckers (*Xyrauchen texanus*), and bonytail (*Gila elegans*) in Reach 3 of the LCR MSCP planning area. Reach 3 maintains the only self-sustaining population of flannelmouth suckers and has very few undeveloped backwaters, which made protection of the existing backwater a LCR MSCP priority. The Colorado River and Reach 3, in particular, are experiencing

extensive urban development. The BBCA maintains access to the river via the adjacent backwater and would have been a likely candidate for development. Securing the property for the LCR MSCP ensures the commitment of adjacent landowners and controls future development in the surrounding areas. Long-term security of the property provides protection to the backwater and allows for future restoration activities as warranted.

Previous Activities: In FY10, the Nevada Department of Wildlife received approval from the Nevada Wildlife Commission to install two buoys, which have been placed at the entrance of the backwater. Installation of the buoys fulfilled a commitment to maintain wakeless conditions in the backwater. Prior to FY13, all fisheries activities were restricted to February through May as part of ongoing flannelmouth sucker activities associated with Work Task C15 (closed). Since FY13, routine monitoring of the BBCA has been conducted monthly from February through May and has included electrofishing, trammel netting, remote passive integrated transponder (PIT) scanning, and larval light trapping in areas where there have been historical contacts of native fishes and adequate water levels to permit access for sampling. Water quality profiles were conducted during each monitoring trip and at least quarterly the remainder of the year. Through monitoring, low numbers of razorback and flannelmouth suckers continued to be contacted, including larvae of both species and an occasional flannelmouth sucker subadult. The backwater has a direct surface connection to the lower Colorado River; consequently, water quality parameters mirror that of the river. Marsh bird and small mammal surveys were conducted annually.

FY16 Accomplishments:

Maintenance/restoration/management: No maintenance activities were conducted in 2016.

Two bathymetric surveys were conducted in 2016 as part of BBCA backwater monitoring. The first survey completed in November 2015 used traditional land surveying methods. The second bathymetric survey was conducted using light detection and ranging (LiDAR) remote sensing techniques. The purpose of these surveys is to provide elevation data, which will be used to monitor sediment deposition. The two survey methods were compared for accuracy and cost. The LiDAR survey was considerably more cost and time effective than the traditional land surveying method. Accuracy for both survey methods was within tenths of a foot. It was determined that annual LiDAR surveys are the best method for sediment monitoring at the BBCA.

In September 2016, a storm event swept debris over the Needles Highway and into the BBCA, damaging the SNWA's security fence and refilling the culverts with sediment. Clark County is responsible for clearing the culverts, and the SNWA is responsible for repairing the BBCA fence.

Monitoring: Routine fisheries monitoring at the BBCA continued in FY16; netting resulted in the capture of zero razorback suckers, zero flannelmouth suckers, and one bonytail. Remote PIT scanning resulted in the contact of two razorback suckers, zero flannelmouth suckers, and one bonytail. Both bonytail were from a September 2015 release in Laughlin Lagoon. These are the first bonytail contacted since routine monitoring was initiated in FY13. Larval razorback suckers and flannelmouth suckers were captured at rates lower than in FY15, but they were similar to the years prior to FY15. A permanent remote PIT scanner was installed in the summer of FY16 with limited success; improvements to this scanning station will be made in FY17. Water quality parameters remained within thresholds for all native fishes.

Vegetation and bathymetric data were collected using LiDAR remote sensing techniques.

Marsh bird surveys were conducted on three occasions at the wetland portions of the site. No covered species were detected.

Small mammal trapping was conducted in fall and spring. Colorado River cotton rats (*Sigmodon arizonae plenus*) and desert pocket mice (*Chaetodipus penicillatus sobrinus*) were captured (most likely the *sobrinus subspecies)*.

Surveys were conducted for MacNeill's sootywing skippers (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]). No individuals or eggs were detected. Quailbush (*Atriplex lentiformis*) habitat is very limited.

FY17 Activities:

Maintenance/restoration/management: Routine maintenance activities will be conducted.

One bathymetric LiDAR remote sensing survey is scheduled to be conducted in 2017 to continue BBCA backwater management monitoring. The purpose of these annual surveys is to provide elevation data, which will be used to monitor sediment deposition.

Monitoring: The BBCA will be monitored at a level similar to that in FY16. Semipermanent remote PIT scanners will be deployed in an effort to increase scanning contacts for all species. Vegetation data will be collected using LiDAR remote sensing techniques. Marsh bird surveys will be conducted during March, April, and May at the four established survey points. Small mammal trapping will be conducted in fall and/or spring. Surveys for MacNeill's sootywing skippers will be conducted once to assess if habitat is present. If habitat is present, surveys will be conducted in March, April, May, and July.

Proposed FY18 Activities:

Maintenance/restoration/management: Annual bathymetric LiDAR surveys will continue at the BBCA. Routine maintenance activities will be conducted.

Monitoring: Fisheries monitoring will be conducted at a level and interval similar to previous years. Monitoring trips will include larval light trapping, remote PIT scanning, and trammel netting. Water quality profiles will be performed during each monitoring event and quarterly outside of the monitoring period. Vegetation monitoring will be conducted in FY18 using LiDAR remote sensing techniques. Marsh bird surveys will be conducted during March, April, and May at the four established survey points. Small mammal trapping will be conducted in fall and/or spring. Surveys for MacNeill's sootywing skippers will be conducted once to assess if habitat is present. If habitat is present, surveys will be conducted in March, April, May, and July.

Pertinent Reports: The *2016 Big Bend Conservation Area Annual Report* will be posted on the LCR MSCP Web site once integration of the data collected throughout the calendar year is complete.

Work Task E27: Laguna Division Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$900,000	$846,914.71	$27,247,180.05	$200,000	$150,000	$100,000	$100,000

Contact: Arien Chavez, (702) 293-8138, amchavez@usbr.gov

Start Date: FY10

Expected Duration: FY55

Long-Term Goal: Habitat creation and management

Conservation Measures: BEVI1, ELOW1, GIFL1, GIWO1, SUTA1, VEFL1, WIFL1, YHCR2, YBCU1, and YWAR1

Location: Reach 6, Federal lands, River Miles 43–49, California and Arizona

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation and species monitoring are being addressed under Work Tasks F1–F4 and F7.

Project Description: The Laguna Division, River Miles 43–49, was identified as having the potential for large-scale riparian and marsh restoration and enhancement. In 2007, the Laguna Division Planning Group was formed to identify potential restoration projects within the division.

The Laguna Division Planning Group consists of representatives from the following organizations:

- Arizona Game and Fish Department
- Arizona Department of Water Resources
- California Department of Fish and Wildlife
- Pacific Institute
- U.S. Fish and Wildlife Service
- Bureau of Land Management
- Bureau of Reclamation

The undeveloped ground, which was shaped to become the Laguna Division Conservation Area (LDCA), was a relatively wide, undeveloped area with a series of low linear depressions, which are remnants of former river meanders. This project was designed to create marsh and riparian land cover types by shaping and

contouring multiple meandering channels. These land cover types would be maintained with a maximum base flow of 100 cubic feet per second (cfs) from the Gila Gravity Canal sluicing gates. Open water areas have been created in the form of linear excavations aligned with historic river meanders east of lands identified as future stockpiling areas for dredged silt removed from the river (Laguna settling basin). To minimize earthwork, cuts and fills follow the existing topography where feasible. Adjacent terraces are graded to allow flooding and promote the establishment of native riparian species. Water control structures have been designed to manage water levels. Native vegetation will receive water by raising and lowering the water surface.

Operation of the LDCA is coordinated through the Bureau of Reclamation's Water Operations Group. The LDCA has been used to store excess flows through this coordinated effort. When excess flows are anticipated, the water control structures at the LDCA can be adjusted in order to accommodate a portion of the excess flow. These flows can be returned back to the Colorado River.

Annual maintenance and management: The LDCA was designed and constructed to minimize annual operation and maintenance costs. Water is diverted at Imperial Dam (LDCA Headworks) and delivered by gravity to Cell 1. Approximately 100-cfs flows through the site 24 hours a day, 7 days a week. There are no pumps used at the LDCA. Annually, the intake structure is closed and inspected. The inspection includes both normal maintenance, a review of the cathodic protection system, and pressure washing of the structure. The water control structures are serviced and inspected twice a year. Water delivery into and out of the LDCA are logged and can be accessed remotely. The annual costs for operation and maintenance of the LDCA include road grading.

Previous Activities:

Maintenance/restoration/management: Inlet modifications to the point of diversion at the Gila Gravity Canal sluicing gates were made to allow for up to a 100-cfs flow capacity. The diversion pipe system has been engineered to allow for maximum management flexibility, including diverting the entire flow to the Mittry Lake Wildlife Area, the LDCA, or the historic river channel. Approximately 4,000 feet of 48-inch high-density polyethylene pipe was installed in 2011–12.

Clearing and contouring of Reach 1 (over 500 acres) began in fall 2011 and was completed in 2012. The newly created topography of Reach 1 was verified by using light detection and ranging (LiDAR) remote sensing techniques, which was used to create contour mapping.

Clearing and contouring activities in Reach 2 began in summer 2012 and were completed in April 2014 (over 500 acres). Approximately 50,000 cubic

yards of soil were moved per shift in order to contour the site according to the grading plan. In all, approximately 3,400,000 cubic yards of earthen material were excavated.

Over 800,000 marsh plants were planted on approximately 150 acres in Reach 1 during August and September 2013. Cottonwood-willow (*Populus fremontii-Salix gooddingii*) and honey mesquite (*Prosopis glandulosa*) planting of Reach 1 commenced in February 2014 and finished in April 2014. Marsh planting of Reach 2 took place in May 2014. Over 1 million trees and plants were planted in spring 2014.

Monitoring: The land adjacent to the LDCA has been surveyed for many years by the Arizona Game and Fish Department for marsh birds, including Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]), California black rails (*Laterallus jamaicensis coturniculus*), and western least bitterns (*Ixobrychus exilis hesperis*), all of which are LCR MSCP covered species. All three of these species are present within the adjacent wetland/marsh area during breeding seasons. Surveying of marsh birds continued until work began at the site and resumed once habitat was suitable.

FY16 Accomplishments:

Maintenance/restoration/management: Post and cable fencing was installed along the perimeter of Reach 1 in order to protect native vegetation from damage by motorized vehicles. Control of invasive plant species for Reach 1 has been discontinued; however, control of invasive and non-native plant species for Reach 2 continued. The water control infrastructure was maintained throughout the year via regular inspections and preventive maintenance.

A final construction report was completed and documents the entire chronology of the project from design to construction completion.

Monitoring: Monitoring was conducted at the LDCA for vegetation and birds.

Vegetation data were collected in FY16 using LiDAR remote sensing techniques.

Marsh bird surveys were conducted on three occasions at the wetland portions of the site. Western least bitterns were detected during all three survey periods. Yuma clapper rails and California black rails were not detected.

Riparian bird surveys were conducted at the LDCA from April 15 to June 15, 2016, using the LCR MSCP's double sampling protocol. Sonoran yellow warblers (*Dendroica petechia sonorana = Setophaga petechia sonorana*) and Arizona Bell's vireos (*Vireo bellii arizonae*) were detected as

breeding at the site. Yellow-billed cuckoo (*Coccyzus americanus occidentalis*) surveys were conducted between late June and early August in the northern reach of the site, and there were three detections and one possible breeder at the site.

FY17 Activities:

Maintenance/restoration/management: Access, law enforcement, and fire suppression at the LDCA are regulated by the Bureau of Land Management. Control of invasive plant species on the entire conservation area has ceased. The water control infrastructure is being maintained via regular inspections and preventive maintenance.

Cathodic Protection Inspection: The Laguna inlet structure (LDCA headworks) is constructed of several different types of metals. A cathodic protection system, installed in the 1950s, is in place on the upstream steel sluice gates of Imperial Dam. The new sluice gates on the downstream side of the inlet structure have a sacrificial anode in place. Inspection of the cathodic protection system for the LDCA headworks is scheduled for March 2017. The inspection is typically conducted every 2 years and includes maintenance on the slip meter and pressure washing of the vault.

Monitoring: Vegetation data will be collected using LiDAR remote sensing techniques. Monitoring for marsh birds will continue in suitable habitat. General bird surveys will be conducted from mid-April to June. Single species surveys for southwestern willow flycatchers (*Empidonax traillii extimus*) and yellow-billed cuckoos will be conducted during their respective breeding seasons where appropriate habitat is available.

Proposed FY18 Activities:

Maintenance/restoration/management: Access, law enforcement, and fire suppression at the LDCA will be regulated by the Bureau of Land Management. Control of invasive plant species is not anticipated. The water control infrastructure will be maintained throughout the year via regular inspections and preventive maintenance.

Monitoring: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. Monitoring for marsh birds will continue in suitable habitat. General bird surveys will be conducted from mid-April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons where appropriate habitat is available.

Pertinent Reports: The 2016 annual site report will be posted on the LCR MSCP Web site upon completion.

Work Task E28: Yuma East Wetlands

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,200,000	$318,447.52	$2,106,375.48	$450,000	$300,000	$250,000	$250,000

Contact: Jeremy Brooks, (702) 293-8157, jjbrooks@usbr.gov

Start Date: FY10

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, BLRA1, CLRA1, GIFL1, GIWO1, LEBI1, SUTA1, VEFL1, WIFL1, YHCR2, YBCU1, and YWAR1

Location: Reach 6, Arizona, River Mile 31

Purpose: To maintain restored land cover types that benefit LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation and species monitoring are being addressed under Work Tasks F1–F4.

Project Description: In 2000, the city of Yuma and the Quechan Indian Tribe collaborated to analyze the potential of restoring the local wetlands along the Colorado River by removing overgrown non-native species. Approximately 380 acres have been restored to create a mosaic of marsh, mesquite (*Prosposis* spp.), and cottonwood-willow (*Populus fremontii-Salix gooddingii*). The project is located in Yuma, Arizona, on city of Yuma, Quechan Indian Tribe, and Arizona Game and Fish Department lands. In coordination with these partners and the Yuma Crossing National Heritage Area Corporation (YCNHAC), a 501(c)3 non-profit organization responsible for managing day-to-day operations, 70% of the funding will be provided by the LCR MSCP to support the long-term operation and maintenance of created habitats and adaptive management actions that benefit species covered under the LCR MSCP Habitat Conservation Plan. Infrequent but substantial capital improvements may also occur and will be in addition to annual operating costs.

Yuma East Wetlands (YEW) is fully developed and has transitioned from development to maintenance and monitoring. The 380-acre conservation area,

including the open water portions of the Colorado River, is classified as 183 acres of cottonwood-willow, 103 acres of honey mesquite (*Prosopis glandulosa*), and 94 acres of marsh.

Annual maintenance and management: The work associated with the operation and maintenance of YEW is described in the Yuma East Wetlands Annual Management Plan. The plan is developed collaboratively among, and concurred to by, all stakeholders prior to obligation of funding. The document describes the scope of work, budget, and responsibilities of all parties and is limited to recurring operation and maintenance activities. Funding for 70% of the annual operation and maintenance budget is provided by the LCR MSCP, while the remaining 30% is provided by the site stakeholders.

Annual operation and maintenance activities anticipated throughout the life of the program include flood irrigation of the north channel and AHA fields, pump maintenance and repair, minor repair of infrastructure, removal of invasive and non-native plant species, and general site maintenance such as road grading.

Previous Activities: In FY13, the Quechan Indian Tribe, Arizona Game and Fish Department, city of Yuma, the YCNHAC, and the Bureau of Reclamation agreed to the terms and conditions in the multi-party Land Use Agreement. The agreement was signed in late FY13 after review by the Steering Committee. Monitoring began in FY13.

FY16 Accomplishments:

Maintenance/restoration/management: YEW was operated and maintained in accordance with the work identified in the site-specific FY16 Yuma East Wetlands Annual Management Plan.

The FY17 Yuma East Wetlands Annual Management Plan was developed. The approach to site management was significantly modified from prior years, as tasks funded by the LCR MSCP were limited to those necessary to manage land cover types for the covered species. Modifications included elimination of honey mesquite drip irrigation, including costs associated with maintenance of drip irrigation pumps; refinement of flood irrigation cycles from a year-round schedule to the months of March through September; and a reduction in onsite labor. These changes will result in a significant reduction to operating costs in future years.

Efforts also included preliminary work toward the development of a long-term management plan. The plan will address management practices and the short/long-term needs of infrastructure required to manage created land cover. In addition, opportunities were evaluated relating to development of a reliable water source for the south channel.

Since execution of the Land Use Agreement, the conservation area's north channel pump has failed and has been replaced or rebuilt on a number of occasions. A 20-cubic-foot-per second pump was originally installed by the YCNHAC to support the north channel riparian area. In December 2013, it was replaced after suffering a catastrophic failure. This failure was caused by cavitation due to sedimentation from the river. In response, a loaner pump, rated at 10 cubic feet per second, was installed. The loaner pump also suffered a catastrophic failure in January 2016. This failure was also identified to be caused by cavitation due to sedimentation from the river. In FY16, another loaner pump, rated at 6 cubic feet per second, was secured and installed at the site.

Funding to replace the north channel pump was budgeted in 2016. This effort was delayed in response to the January failure and to provide stakeholders with time to reconsider the flawed pump design. This directly impacted FY16 expenditures and resulted in lower than anticipated costs.

Monitoring: Monitoring was conducted at YEW for vegetation, birds, small mammals, and bats.

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

Marsh bird surveys were conducted on three occasions at the wetland portions of the site. Western least bitterns (*Ixobrychus exilis hesperis*) and Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) were detected and are presumed to be breeding at the site.

The site was surveyed for riparian birds using the LCR MSCP double sampling protocol. Sonoran yellow warblers (*Dendroica petechia sonorana = Setophaga petechia sonorana*) and Gila woodpeckers (*Melanerpes uropygialis*) were detected breeding at the site. Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys were also conducted, and no resident or breeding individuals were detected. Yellow-billed cuckoo (*Coccyzus americanus occidentalis*) surveys were conducted, and there were five detections and one possible breeder at the site.

An established long-term acoustic bat station was used to detect LCR MSCP covered and evaluation bat species. The data will be analyzed in FY17. California leaf-nosed bats (*Macrotus californicus*) were captured during capture surveys for a California leaf-nosed bat tracking study (Work Task D9). Annual summer capture surveys were not conducted in FY16, as capture efforts were reduced to conservation areas in Reaches 3–5.

Small mammal trapping was conducted in fall and spring. Yuma hispid cotton rats (*Sigmodon hispidus eremicus*) continue to be detected at the site and are the most common subspecies of small mammals captured.

FY17 Activities:

Maintenance/restoration/management: YEW will be operated and maintained in accordance with the work identified in the FY17 Yuma East Wetlands Annual Management Plan. The FY18 annual management plan will be developed with the site stakeholders in spring 2017.

The remaining priorities include finalization of a draft long-term management plan, redesign and replacement of the north channel pump, and continued evaluation of opportunities related to providing a reliable water source for the south channel.

A plan to install flow meters on the AHA and north channel pumps, as required in the Land Use Agreement, has been developed and forwarded to stakeholders for review but is being delayed until the ongoing pump issues are resolved. In the interim, discrete flow measurements will be taken with a portable instrument. An Excel spreadsheet was created to simplify tracking of water usage and water accounting.

Monitoring: Vegetation data will be collected using LiDAR remote sensing techniques. Marsh bird surveys will be conducted in March and April. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer.

Proposed FY18 Activities: YEW is expected to be operated and maintained in accordance with the work identified in the FY18 Yuma East Wetlands Annual Management Plan. The FY19 annual management plan will be developed with the site stakeholders in spring 2018.

In FY18, it is anticipated that the north channel pump will be replaced, the remaining flow meters will be installed, and a long-term management plan will be finalized. Efforts will continue in order to identify a cost-effective solution to provide a reliable water source that allows for management of water surface elevations within the south channel marsh.

Monitoring: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. Marsh bird surveys will be conducted in March and April. General bird surveys will be conducted from mid-April to mid-June.

Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer.

Pertinent Reports: The 2016 annual site report will be posted on the LCR MSCP Web site upon completion.

Work Task E31: Hunters Hole

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$65,000	$42,096.23	$458,252.49	$60,000	$30,000	$30,000	$30,000

Contact: Jeremy Brooks, (702) 293-8157, jjbrooks@usbr.gov

Start Date: FY11

Expected Duration: FY55

Long-Term Goal: Habitat creation and maintenance

Conservation Measures: BEVI1, GIFL1, GIWO1, SUTA1, VEFL1, WIFL1, YBCU1, YHCR2, and YWAR1

Location: Reach 7, Arizona, River Mile 2.5

Purpose: To create and maintain land cover types and support site improvements that benefit LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation and species monitoring are being addressed under Work Tasks F1–F7.

Project Description: **Hunters Hole is located** within Reach 7 of the LCR MSCP planning area, in Arizona, approximately 3 miles north of the Southerly International Boundary with Mexico. Hunters Hole once consisted of a series of interconnected ponds with adjacent marsh and a few stands of cottonwood-willow (*Populus fremontii-Salix gooddingii*). Water levels were maintained by groundwater, irrigation drain flows, and by a groundwater well. Over time, the site degraded, and most of the habitat was lost due to declining water levels, establishment of invasive plant species, and wildfires. Officials from State, local, Tribal, and Federal agencies joined together in an effort to restore the area while increasing public safety and border security. The LCR MSCP assumed management of Hunters Hole as a conservation area with 44 acres of cottonwood-willow land cover. The LCR MSCP has an agreement with the U.S. Border Patrol concerning access to the conservation area.

Annual Maintenance and Management: Irrigation is provided by a groundwater well through a series of automated valves and delivered to five cells within the conservation area. The entire irrigation system is managed remotely, including operation of the well. Irrigation cycles are run every 3 weeks

from February through November. The annual costs associated with operating this conservation area include those for maintenance of the pumps and valves, electrical power utility bills, road grading, and periodic inspections.

Previous Activities: This conservation area has been irrigated and managed since 2012. Monitoring began in 2013.

FY16 Accomplishments:

Maintenance/restoration/management: Hunters Hole is fully developed and was irrigated and managed throughout the year for LCR MSCP covered species. Fifteen irrigation cycles were run during the 2016 calendar year. Irrigation cycles, water use, and costs were monitored in a continuing effort to run the site as efficiently as possible. No significant management action was taken, and no significant issues arose at the site during FY16.

Monitoring: Monitoring was conducted at Hunters Hole for vegetation, birds, bats, and small mammals.

Vegetation data were collected in FY16 using light detection and ranging (LiDAR) remote sensing techniques.

Riparian bird surveys were conducted at Hunters Hole from April 15 to June 15, 2016, using the LCR MSCP double sampling protocol. Sonoran yellow warblers (*Dendroica petechia sonorana = Setophaga petechia sonorana*) were detected as residents at the site.

Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys were conducted. Migrant flycatchers (*Empidonax traillii*) were detected on the first survey in May, but no breeding or resident birds were detected.

Yellow-billed cuckoo (*Coccyzus americanus occidentalis*) surveys were conducted, and no birds were detected.

The established long-term acoustic bat station was used to detect LCR MSCP bat species. Western red bats (*Lasiurus blossevilli*), western yellow bats (*Lasiurus xanthinus*), and pale Townsend's big-eared bats (*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii*) were detected at Hunters Hole.

Small mammal trapping was conducted in fall and spring. Yuma hispid cotton rats (*Sigmodon hispidus eremicus*) were captured at the site on both occasions.

FY17 Activities:

Maintenance/restoration/management: Hunters Hole is operated on an automated irrigation system. This conservation area will be irrigated and managed throughout the year for LCR MSCP covered species. No construction, restoration, or changes to management activities are planned.

Monitoring: Vegetation data will be collected using LiDAR remote sensing techniques. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Proposed FY18 Activities:

Maintenance/restoration/management: Hunters Hole is operated on an automated irrigation system. This conservation area is expected to be irrigated and managed throughout the year for LCR MSCP covered species. No construction, restoration, or changes to management activities are planned.

Monitoring: Information from LiDAR vegetation data collected during FY14–17 will be used to determine the schedule for vegetation monitoring data collection for FY18 and beyond. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

Pertinent Reports: The *2016 Hunters Hole Conservation Area Annual Report* will be posted on the LCR MSCP Web site upon completion.

Work Task E33: Pretty Water Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$450,000	$322,214.66	$1,518,900.69	$150,000	$40,000	$30,000	$20,000

Contact: Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

Start Date: FY13

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, ELOW1, VEFL1, WRBA2, and WYBA3

Location: Reach 4, Cibola National Wildlife Refuge, River Miles 95–97, California

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): This work task was identified under Work Task E16.

Project Description: The Pretty Water Conservation Area (PWCA) (previously referred to as the Shark's Tooth Conservation Area) consists of approximately 566 acres on the Cibola National Wildlife Refuge, located in California between River Miles 95 and 97. On July 17, 2006, lightning ignited a fire on the refuge that burned approximately 4,600 acres of saltcedar (*Tamarix* spp.) intermixed with mesquite (*Prosopis* sp.) in both California and Arizona.

The PWCA contains 566 acres of honey mesquite (*Prosopis glandulosa*), which will be managed for LCR MSCP covered species throughout the life of the program.

Annual maintenance and management: The PWCA was fully developed in FY15 and provides a honey mesquite land cover type while minimizing long-term operational and maintenance costs. Invasive plant species control may be periodically implemented. Other annual management activities will be limited to coordination with the U.S. Fish and Wildlife Service.

Previous Activities: The Restoration Development and Monitoring Plan was approved by the California Department of Fish and Wildlife in 2012. A Land Use Agreement exhibit between the LCR MSCP and the U.S. Fish and Wildlife Service was signed in 2013. In FY14, compliance and pre-construction activities were completed, and honey mesquite were ordered. The site was cleared, and 22,500 honey mesquite were planted in FY15. After planting and watering was completed, public access was re-established along the main access roads; in addition, the parking area and primitive boat ramp were regraded to previous conditions.

FY16 Accomplishments: The PWCA is fully developed, and measures to aggressively control invasive and non-native plant species are being implemented. Non-native species control was implemented after planting to allow native vegetation to mature without competition. Invasive plant species control efforts were less than anticipated, and therefore obligations were less.

Monitoring: No wildlife monitoring was conducted because the trees were not mature enough to provide habitat for covered species.

FY17 Activities: The PWCA is fully developed and is being managed for LCR MSCP covered species. Inspections will be conducted to ensure that the honey mesquite have successfully established. Invasive plant species control efforts will continue. Although it is not anticipated at this time, irrigation utilizing water trucks may occur during FY17 if deemed necessary based on the growth status of the trees and climatic conditions.

Monitoring: General bird surveys will be conducted from April – June. Vegetation data will be collected using light detection and ranging (LiDAR) remote sensing techniques. A site visit will occur to determine if there is suitable habitat for MacNeill's sootywing skippers (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]) and rodents; if there is sufficient suitable habitat, surveys for these species will be conducted.

Proposed FY18 Activities: The PWCA is fully developed and will continue to be managed for LCR MSCP covered species. Inspections will be conducted to ensure that the honey mesquite have successfully established.

Monitoring: General bird surveys will be conducted from April – June. Vegetation data may be collected using LiDAR remote sensing techniques. If there is suitable habitat, surveys for MacNeill's sootywing skippers and rodents may be conducted.

Pertinent Reports: The 2016 annual report will be posted on the LCR MSCP Web site upon completion.

Work Task E34: Salinity and Soil Moisture Monitoring Network

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$500,000	$123,672.64	$256,831.66	$0	$0	$0	$0

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY13

Expected Duration: Closed in FY16

Long-Term Goal: Restoration research to inform management actions

Conservation Measures: BEVI1, BLRA1, CLRA1, CRCR2, ELOW1, GIFL1, GIWO1, LEBI1, MNSW2, MRM1, MRM2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, andYWAR1

Location: Conservation areas and non LCR-MSCP southwestern willow flycatcher (*Empidonax traillii extimus*)-occupied sites (for comparable data)

Purpose: To monitor salinity (soil and groundwater) and soil moisture to facilitate management actions that will allow for the long-term health and survival of established land cover types on LCR MSCP conservation areas

Connections with Other Work Tasks (Past and Future): This work task was initiated with funds from Work Tasks E4, E24, F1, and G3. Data collected under this work task are also used under Work Tasks C60 and F1.

Project Description: Monitoring soil and groundwater conditions provides information about why some restoration sites establish and develop more successfully than others. In addition to informing decisions for vegetation establishment and health, research results suggest that adequate soil moisture levels are an important habitat requirement for certain covered species. The soil and groundwater monitoring network will be expanded, and monitoring efforts will be standardized across all applicable LCR MSCP conservation areas. The process of determining which phases will be monitored and to what level will occur over a period of years. The information gathered through this effort will facilitate decisions about managing soil moisture levels and saline conditions of soils and groundwater and will also ensure the long-term viability of LCR MSCP conservation areas.

The monitoring network established under this work task will be operated and maintained throughout the life of the LCR MSCP to ensure that data are available to make management decisions for the long term. In addition to providing data for the Restoration Group for the successful management of vegetation, efforts under this work task will result in information being provided for Work Tasks C60 and F1, allowing for a reduction of duplicated data collection efforts and providing necessary data to fulfill the objectives of these other work tasks.

Previous Activities: Research results from previous studies funded by Work Task G3 indicate that riparian obligate trees will use groundwater instead of applied surface water when they have reached sufficient maturity.

An extensive review of the available literature on salinity and sodicity was conducted to summarize what was already known about managing saline soil and groundwater conditions.

Efforts to measure soil moisture for recently planted riparian vegetation were initiated in 2007 by installing soil moisture devices on the Cibola National Wildlife Refuge Unit #1 Conservation Area (Nature Trail and Crane Roost), the Palo Verde Ecological Reserve (PVER) (Phases 1–5), the Cibola Valley Conservation Area (Phases 1–3), and the Beal Lake Conservation Area. These sites were operated and maintained until the vegetation was adequately established. Data collected at these sites will be used to evaluate past irrigation management of constructed restoration sites and may be used during the expansion of the monitoring network.

A soil and groundwater monitoring network was established at portions of three LCR MSCP conservation areas: the Beal Lake Conservation Area, the PVER, and the Cibola National Wildlife Refuge Unit #1 Conservation Area. Using the data collected from the three conservation areas over 2 years, a mass balance model to evaluate salt accretion/loss in soils and groundwater was developed.

A soil moisture monitoring pilot study was completed in Phase 2 of the PVER during 2010–13 under Work Task F1. The results and lessons learned from this study will be used to inform future efforts in monitoring soil moisture at existing and future conservation areas.

FY16 Accomplishments: During FY16, instrumentation was installed at three additional, non-LCR MSCP sites on the Middle Rio Grande in New Mexico as part of the preliminary effort initiated in FY15 at the PVER and Rockhouse Riparian Demonstration Site. The purpose of adding these two sites was to include southwestern willow flycatcher-occupied sites that have different vegetation or hydrologic characteristics and to increase the amount of available data. With a wider range of site characteristics and a larger dataset (both spatial and temporal), it is expected that the analyses will provide more information to make informed decisions. The two sites monitored during FY15 were maintained, and data were collected for a second season.

The protocols for the salinity and soil moisture monitoring network were finalized during FY16. The protocols synthesized input from all the studies mentioned in previous activities and from the lessons learned during the FY15 preliminary effort. The protocols developed under this work task will be utilized under Work Task F1 to expand the monitoring network to LCR MSCP conservation areas where these parameters are of concern for evaluating species' habitat requirements and maintaining vegetation health. Expansion of the network was expected to occur during FY16 under this work task, but due to delays in development of the protocol, obligations for FY16 were less than planned.

FY17 Activities: This work task was closed in FY16. Salinity and soil moisture monitoring is now covered under Work Task F1.

Proposed FY18 Activities: This work task was closed in FY16. Salinity and soil moisture monitoring is now covered under Work Task F1.

Pertinent Reports: Once a final review has been completed, the report titled *Soil and Groundwater Salinity Conditions for Lower Colorado River Multi-Species Conservation Program Habitat Creation Sites* will be posted on the LCR MSCP Web site.

Work Task E35: Mohave Valley Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,250,000	$158,178.28	$561,810.94	$5,500,000	$3,500,000	$1,750,000	$160,000

Contact: Laken Anderson, (702) 293-8153, landerson@usbr.gov

Start Date: FY15

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BONY2, FLSU1, and RASU2

Location: Reach 3, River Miles 237–238, Park Moabi Regional Park, California

Purpose: To create and manage a mosaic of land cover types to provide habitat for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): This project was identified under Work Task E16, and the design of the conservation area will also be conducted under that work task. Vegetation and species monitoring will be conducted under Work Tasks F1–F7.

Project Description: A connected backwater will be created that diverts water off the main stem of the Colorado River just below River Mile 237. Diverted flows will run through an excavated channel, enter the existing Park Moabi backwater, and converge with the river 2 miles downstream from the new point of diversion. Excavating the channel will create approximately 50 acres of backwater habitat. The footprint of this conservation area is projected at approximately 90 acres, with native land cover types lining the banks and upland slopes of the backwater accounting for the additional 40 acres. Actual acreages by land cover type will be recalculated after construction and planting are complete.

The Mohave Valley Conservation Area is located 13 miles south of Needles, California, along the Colorado River. The 149-acre property resides within the boundary of Park Moabi Regional Park. The land is owned by the California State Lands Commission (Commission) and leased to San Bernardino County. Prior to approaching the Commission and county about the backwater project, the

149-acre parcel was used as an off-highway vehicle recreational area; however, once the backwater project was presented, the county was willing to divide the property to accommodate both uses.

The project's area of impact will involve the entire 149 acres (includes areas of fill) as well as lands at the top and bottom of the parcel to connect the backwater to the main stem of the Colorado River and the Park Moabi channel. Excavated material will be used throughout the site to create the desired contour elevations, but the majority of the excavated material will be used to create terrain within the county's off-highway vehicle area.

Previous Activities: The Commission (landowner) and the county (lessee) were approached about the project in 2012. Basic, conceptual ideas about the project were presented to the Commission and the county, and discussions and lease agreement negotiations continued, but they could not move forward toward a final agreement without an official design proposal for the project.

The Bureau of Reclamation (Reclamation) completed environmental compliance, including coordination with the Commission to ensure California Environmental Quality Act permitting requirements were met.

A survey of the 149-acre parcel was conducted to establish new control points and develop elevation contours. Additionally, a temporary gauging station was installed directly across the river from the proposed inlet location so the river stage could be monitored. These data, in conjunction with site elevation data, will be used to determine the volume of material that will need to be excavated to achieve the desired depth of the backwater. A geotechnical survey was conducted in June 2014.

Riparian bird surveys were conducted in existing habitat in April and May 2015. No LCR MSCP species were detected.

FY16 Accomplishments: The design for the Mohave Valley Conservation Area was completed in December 2015. A lease was negotiated, and Reclamation was identified as the lessee of the entire149-acre property to allow for construction and the placement of fill material. After construction is completed, the lease will be amended by the Commission to reflect that Reclamation will be leasing only the footprint of the restored backwater and adjacent habitat, which is approximately 90 acres. Approvals from the U.S. Army Corps of Engineers and the California Water Board were received in early 2016.

Originally, the California Department of Fish and Wildlife (CDFW) was to enter into a lease with the Commission and, subsequently, Reclamation would enter into an agreement with CDFW. However, a decision was made between CDFW

and the Commission to allow Reclamation to sign the lease directly with the Commission, which delayed the signing of the lease and the start of construction to 2017. As a result, obligations were less than the approved budget in FY16.

Monitoring: No wildlife or fisheries monitoring was conducted.

FY17 Activities: The Commission approved the project, and a modification to the lease agreement was approved during the October 2016 Commission meeting. The Storm Water Pollution Protection Plan was submitted in December 2016 and is active through construction. Construction activities will begin in January 2017 and are estimated to continue through spring 2019. Obligations in FY17 account for the labor, land-based equipment, and materials costs, but they are anticipated to be less than approved due to the start date being pushed back to January 2017. Land-based excavation will be completed in FY17 once groundwater is reached. The dredge will complete the wet excavation portion of the project. Dredge mobilization costs are included in FY17.

Monitoring: Compliance monitoring will be conducted as needed during construction. Post-development monitoring will begin after restoration is complete and the marsh and trees are mature enough to provide habitat. No fisheries monitoring will be conducted until the backwater had been completed.

Proposed FY18 Activities: Construction activities will continue through FY18. Dredging operations are expected to begin. Plants will be ordered in spring for planting in March 2019.

Monitoring: Compliance monitoring will be conducted as needed during construction. Post-development monitoring will begin after restoration is complete and the marsh and trees are mature enough to provide habitat. No fisheries monitoring will be conducted until the backwater has been completed.

Pertinent Reports: The Restoration Development and Monitoring Plan will be posted on the LCR MSCP Web site upon completion.

Work Task E36: Parker Dam Camp

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$100,000	$50,000	$20,000	$20,000

Contact: John Swatzell (702) 293-8165, jswatzell@usbr.gov

Start Date: FY17

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, ELOW1, VEFL1, WRBA2, and WYBA3

Location: Reach 4, Bureau of Reclamation withdrawn lands, River Miles 191–192, California

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): This work task was identified and evaluated under Work Task E16.

Project Description: The Parker Dam Camp property resides just south of Parker Dam on the California side of the Colorado River between River Miles 191 and 192. The site is located approximately 25 miles southeast of Lake Havasu City, Arizona, and 17 miles upstream of Parker, Arizona.

Originally developed as employee housing for dam workers, the construction of the Parker Dam Government Camp began in 1934 to facilitate construction of Parker Dam. Once established, the property consisted of numerous residences and other buildings. Many decades after completion of the dam, in the 1990s, the Bureau of Reclamation determined that the facility was no longer required for project activities and began the process of disposing of the houses and other buildings offsite. Asphalt roads, concrete sidewalks, and sparse landscaping are all that remain of the Government town. The property is fenced off to public access on the north and east sides and is bordered by the Whipple Mountains to the south and west. The site is owned and managed by the Bureau of Reclamation.

Parker Dam Camp has been identified as excess property since it is no longer required for river or dam operations. Unless the site will be managed under the

LCR MSCP as a conservation area, the property will be made available for development for recreational purposes similar to other lands within the Parker Strip. Honey mesquite (*Prosopis glandulosa*) is becoming established on the property and has matured to be classified as a land cover type under the LCR MSCP. No additional honey mesquite planting is planned at this time. Additional land cover types may be added at a later date if necessary.

Previous Activities: A geohydrologic assessment of the property was completed in 2012 along with the *30% Design Report – MSCP Parker Dam Camp Native Fish Ponds Project*, which provided details of construction of a potential isolated backwater in 2015 under Work Task E16. During investigations of the camp as a potential LCR MSCP conservation area, the focus was originally on the creation of isolated backwaters for native fishes. Due to a number of preliminary technical and cost-benefit assessments, the site is not recommended for construction of ponds at this time.

FY16 Accomplishments: This is a new start in FY17.

FY17 Activities: An agreement was signed by the LCR MSCP and Lower Colorado Dams Office that outlined the responsibilities of each party and identified Parker Dam Camp as a LCR MSCP conservation area.

A youth crew was brought in to clean up the site and remove non-native plants. Youth crews enable the LCR MSCP to leverage funds with non-program funding and also allow for an educational opportunity for youth.

It is anticipated that FY17 obligations will be less than approved because construction and operation of a coanda screen has been put on hold.

Monitoring: General bird surveys will be conducted from May to early August. The conservation area will be surveyed for presence of quailbush (*Atriplex lentiformis*) to determine if potential habitat is present for MacNeill's sootywing skippers (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]). If suitable habitat is present, surveys will be conducted.

Proposed FY18 Activities: The small stream, located on the northern portion of the property has several exotic non-native plant species within the corridor. A plan for exotic plant removal and replacement with native vegetation will be developed. Small-scale site cleanup will occur sometime during FY18.

Monitoring: General bird surveys will be conducted from May to early August. The conservation area will be surveyed for presence of quailbush to determine if potential habitat is present for MacNeill's sootywing skippers. If suitable habitat is present, surveys will be conducted.

Pertinent Reports: The reports titled *Parker Dam Camp Geohydrologic Assessment, April 2013* and *30% Design Report – MSCP Parker Dam Camp Native Fish Ponds Project* will be posted on the LCR MSCP Web site upon completion.

Work Task E37: Palo Verde Ecological Reserve-South

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$200,000	$500,000	$1,000,000	$1,000,000

Contact: Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

Start Date: FY17

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BEVI1, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 4, River Miles 123–125, California

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation monitoring is conducted under Work Task F1, and wildlife monitoring is conducted under Work Tasks F2–F4, and F7.

Project Description: Palo Verde Ecological Reserve-South, located within the Palo Verde Irrigation District, is a 350-acre property with a mix of active agricultural fields, undeveloped ground, and portions of an old river meander. This property has been made available for LCR MSCP habitat restoration activities by the California Department of Fish and Wildlife. Development of the project is intended to satisfy both the LCR MSCP requirements and a portion of California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06.

The eastern boundary of the property is adjacent to the Colorado River, and the western boundary is adjacent to active agricultural fields and a main irrigation canal for the Palo Verde Irrigation District. Existing infrastructure, which includes lined canals, can deliver water to approximately 200 acres of active agricultural lands.

The intent of this project is to develop the property in a mosaic of land cover types using the active agricultural lands, undeveloped lands, and the former river meander. A Restoration Development and Monitoring Plan will be drafted to inform the development and monitoring of the property for LCR MSCP covered species.

Previous Activities: Identification of the property and evaluation for inclusion into the LCR MSCP were conducted under Work Task E16.

FY16 Accomplishments: This is a new start in FY17.

FY17 Activities:

Maintenance/Restoration/Management: The Restoration Development and Monitoring Plan is expected to be drafted in coordination with the California Department of Fish and Wildlife. Based on the requirements of the plan, design, permitting, and compliance will be initiated. The development schedule will be integrated with construction activities of other conservation areas.

Monitoring: Pre-development monitoring will be conducted in FY17 and funded under post-development work tasks (Section F). This will include general bird surveys from mid-April through June.

Proposed FY18 Activities:

Maintenance/Restoration/Management: Remaining permitting and compliance activities will be completed. The LCR MSCP will maintain a cover crop on the site until restoration activities are ready to begin. The Palo Verde Irrigation District will provide water to the Palo Verde Ecological Reserve and a record of diversionary amounts.

Monitoring: Pre-development monitoring will be conducted in FY18 if additional data are needed for compliance documentation.

Pertinent Reports: N/A

Work Task E38: Three Fingers Lake

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$200,000	$200,000	$4,000,000	$4,000,000

Contact: John Swatzell, (702) 293-8165, jswatzell@usbr.gov

Start Date: FY17

Expected Duration: FY55

Long-Term Goal: Habitat creation

Conservation Measures: BLRA1, BONY2, CLRA1, CRCR2, LEBI1, and RASU2

Location: Reach 4, Cibola National Wildlife Refuge, California, River Mile 90

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation monitoring is conducted under Work Tasks F1, wildlife monitoring is conducted under Work Tasks F2–F4 and F7, and fisheries monitoring is conducted under Work Task F5.

Project Description: Three Fingers Lake, located within the Cibola National Wildlife Refuge, is a 500-acre conservation area being restored to create a mosaic of backwater, marsh, honey mesquite (*Prosopis glandulosa*), and cottonwood-willow (*Populus fremontii-Salix gooddingii*) within the State of California. Development of the project is intended to satisfy both the LCR MSCP Habitat Conservation Plan requirements and a portion of California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06.

Three Fingers Lake was dredged in the late 1990s and established 24 acres of open water with a small fringe of cattail (*Typha* sp.). The surrounding landscape is dominated with invasive saltcedar (*Tamarix ramosissima*). The backwater is bounded by the old river channel to the east and Milpitas Wash to the west. It is disconnected from the old river channel by an earthen structure and a sheet pile structure. Discussions with both the U.S. Fish and Wildlife Service and the

California Department of Fish and Wildlife have resulted in a restoration concept that would open 12 acres of the backwater to the river channel and maintain 12 acres of disconnected backwater.

Three Fingers Lake is being developed as a marsh and backwater complex. Honey mesquite and cottonwood-willow would be included on the fringes but not in substantial quantities. The portion of the backwater to be opened to the old river channel requires the removal of the sheet pile structure and would include creation of marsh.

The portion of the lake that will remain disconnected from the old river channel is the focus of the restoration efforts for native fishes. The restoration concept includes reshaping and contouring of the acreage surrounding the dredged channel in combination with the creation of new channels. The new channels would be shallower, but deep enough to remain open water, and would provide avenues of fish passage into the marsh complex. To circulate water and allow for management of water surface elevations for rail species, multiple infrastructure improvements are envisioned. First, new water control structures would be built to regulate surface water flows into and out of the lake. Second, a pump would transfer water from the disconnected backwater into the connected portion of the backwater on the western edge of the property. Removal of water from the lake is the primary water circulation method. Groundwater and recharge through the water control structures would maintain the water elevation.

Previous Activities: Identification of the property and evaluation for inclusion into the LCR MSCP were conducted under Work Task E16.

FY16 Accomplishments: This is a new start in FY17.

FY17 Activities: A preliminary design has been agreed on by the U.S. Fish and Wildlife Service and by the California Department of Fish and Wildlife. The design will include connected backwaters, disconnected backwaters, and new marsh. The Restoration Development and Monitoring Plan has been drafted and was sent to the California Department of Fish and Wildlife and the U.S. Fish and Wildlife Service. Acreages of specific land cover types will be updated upon completion of the Restoration Development and Monitoring Plan. A minimum of 50 acres of backwater and 100 acres of marsh are anticipated. Site-specific compliance activities to allow for development of Three Fingers Lake are being initiated.

Monitoring: Pre-development monitoring will be conducted in FY17 and funded under post-development work tasks (Section F). This will include general bird surveys from mid-April through June. The Cibola National Wildlife Refuge will conduct marsh bird surveys, and the Bureau of Reclamation will work in cooperation with the refuge to ensure these surveys continue up to and after construction.

Proposed FY18 Activities:

Maintenance/restoration/management: Restoration design, quantity and cost estimates, compliance, and permitting are anticipated to be completed. The development schedule will be integrated with construction activities of other conservation areas but are projected to being in late FY18 or FY19.

Monitoring: Pre-development monitoring will be conducted in FY18 if additional data are needed for compliance documentation.

Pertinent Reports: N/A

Work Task E39: Dennis Underwood Conservation Area

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$0	$6,000,000	$500,000	$500,000

Contact: Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

Start Date: FY18

Expected Duration: FY55

Long-Term Goal: Habitat creation and management

Conservation Measures: BEVI1, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

Location: Reach 4, River Miles 96–99, California

Purpose: To create and manage a mosaic of native land cover types for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): Vegetation monitoring is conducted under Work Task F1, and wildlife monitoring is conducted under Work Tasks F2–F4 and F7.

Project Description: The Dennis Underwood Conservation Area is located adjacent to the north border of the Pretty Water Conservation Area. The property is located within the Palo Verde Irrigation District and owned by the Metropolitan Water District. The Metropolitan Water District has identified 635 acres of active agricultural ground for inclusion in the LCR MSCP. The development of this project will satisfy both the LCR MSCP habitat requirements and a portion of California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06. Restoration of the site includes planting both the honey mesquite (*Prosopis glandulosa*) and cottonwood-willow (*Populus fremontii-Salix gooddingii*) land cover types.

Previous Activities: This is a new start FY18.

FY16 Accomplishments: This is a new start FY18.

FY17 Activities: This is a new start in FY18.

Proposed FY18 Activities: Pending approval of the Steering Committee and passage of a land and water resolution, the LCR MSCP will secure an easement to establish the conservation area. Compensation for the use of the land and water will be made to the Metropolitan Water District based on an appraisal and the resolution. The LCR MSCP will establish a farming contract to continue farming a cover crop to prepare the ground for restoration. A Restoration Development and Monitoring Plan will be prepared for the cottonwood-willow establishment and submitted to the California Department of Fish and Wildlife for approval.

Pertinent Reports: N/A

WORK TASKS – SECTION F

Post-Development Monitoring

Work Task F1: Habitat Monitoring at Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$450,000	$471,224.34	$4,820,512.99	$950,000	$850,000	$850,000	$850,000

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Pre- and post-development monitoring

Conservation Measures: BEVI1, BLRA1, CLRA1, CRCR2, ELOW1, GIFL1, GIWO1, LEBI1, MNSW1, MRM2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, and YWAR1

Location: All LCR MSCP conservation areas

Purpose: The purpose of this work task is to provide post-development monitoring to assess the effectiveness of each conservation area. Monitoring will include biotic and abiotic components and will inform management decisions throughout the life of the LCR MSCP.

Connections with Other Work Tasks (Past and Future): Post-development habitat monitoring will be conducted at habitat creation sites detailed in the Conservation Area Development and Management (Section E) work tasks. Soil moisture data collected under Work Task E34 was used for analyses performed under this work task. All salinity and soil moisture monitoring performed under Work Task E34 will be performed under this work task starting in FY17. Data collected under this work task are also used under Work Task C60.

Project Description: Species habitat characteristics will be evaluated. Monitoring data will be used to document progress toward achieving program goals and to provide habitat data for covered species to inform management decisions.

Previous Activities: Four conservation areas were monitored in FY10 using a variety of monitoring protocols designed to provide information about vegetation composition and health from ground cover to the upper canopy. In FY11, new

protocols were developed and tested in a pilot-year study in addition to those used in FY10. The protocols included measuring variables such as density, species richness, vegetation structure, ground cover, canopy closure, distance to nearest standing water, and distance to nearest open space. Temperature and relative humidity data were also collected.

An external program review of the vegetation monitoring protocol was conducted in FY12 under Work Task G4 to evaluate if data being collected could be used to assess conservation measure accomplishment. It was found that the known variability on the sites was not detectable at various spatial scales. Recommendations were provided for adjusting the current vegetation monitoring sample design and protocols, including the method chosen for randomization of monitoring plots, the collection of various data that were not tied to management questions, and measurements that were too subjective for inclusion into decisionmaking.

In FY14, the adaptive management recommendations for vegetation monitoring were implemented. Vegetation monitoring was conducted in a spatially randomized approach, targeting areas where the vegetation structure and soils were more consistent with southwestern willow flycatcher (*Empidonax traillii extimus*) and yellow-billed cuckoo (*Coccyzus americanus occidentalis*) habitat characteristics. The Beal Lake Conservation Area, the Cibola National Wildlife Refuge Unit #1 Conservation Area, the Cibola Valley Conservation Area, the Palo Verde Ecological Reserve, and Yuma East Wetlands were monitored, collecting data on density, vegetation structure, canopy closure, and canopy height.

In FY14, long-term vegetation monitoring started being transitioned to using remote sensing techniques. This decision was based on the improvements in light detection and ranging (LiDAR) technology. LiDAR has been proven to provide more accurate representations of vegetation in forests; it can be collected quickly during the breeding season without disturbing the covered species, and it is expected to provide higher-quality data at a reduced cost.

FY16 Accomplishments: LiDAR data for all conservation areas were collected in FY16. These data were processed and analyzed using techniques developed under Work Task C60 that provide metrics describing the vegetation structure related to species' habitat requirements. In addition to the LiDAR data being collected for vegetation monitoring, bathymetric data were collected using LiDAR technology for certain conservation areas that have a significant backwater or marsh component. These data will be used for monitoring habitat changes over time related to these land cover types (e.g., sediment deposition).

Initial steps to use the LiDAR data to classify vegetation at LCR MSCP conservation areas with the Anderson and Ohmart classification system were

completed. Test versions of an automated tool were developed that will allow vegetation at multiple scales and from multiple years to be classified to monitor the growth and seral succession of existing habitat.

Soil moisture data (Work Tasks E34 and C60) will be used with LiDAR vegetation monitoring data to evaluate the habitat conditions at sites with and without observed southwestern willow flycatcher breeding. The three sites include the Rockhouse Riparian Demonstration Project (near Roosevelt Lake, Arizona), three study areas on the Middle Rio Grande in New Mexico, and the Palo Verde Ecological Reserve.

FY17 Activities: Long-term habitat monitoring is continuing in FY17. LiDAR data will be acquired to assess vegetation characteristics and will be analyzed using the tools developed under Work Task C60. Soil moisture monitoring began to be managed under this work task in FY17, and data will be used to (1) further identify the range of habitat characteristics (vegetation and soil moisture) present at areas occupied by breeding southwestern willow flycatchers, (2) assess whether adequate soil moisture is being maintained during the nesting season at conservation areas being managed for southwestern willow flycatchers, and (3) assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. A scope of work is being drafted to expand the monitoring network using the protocols developed under Work Task E34.

Vegetation monitoring techniques being analyzed under Work Task C60 may be used under this work task. This involves the use of unmanned aerial systems (UASs) to collect marsh vegetation data at Hart Mine Marsh using multispectral and photographic sensors. Depending on the results of the work being performed under Work Task C60, UAS-based monitoring may be incorporated into the long-term marsh vegetation monitoring performed under this work task.

Proposed FY18 Activities: Long-term habitat monitoring will continue in FY18 using the previously developed techniques. Using the LiDAR data collected from FY14 to FY17, a data collection schedule will be developed based on the needs for each conservation area. It is likely that LiDAR data will be collected at a higher frequency for new conservation areas, while more mature conservation areas will require less frequent data collection. Based on the results of the marsh vegetation monitoring using UAS techniques (C60), UAS-based data collection will be evaluated as a tool for habitat monitoring under this work task. If it is concluded that UAS techniques provide valuable marsh vegetation monitoring data, marsh vegetation monitoring will transition to UAS-based techniques. Due to the rapid deployment time possible using UASs, it is likely that this technique could also be used when data are required soon after a disturbance occurs (e.g., fire or flash flood).

The soil moisture and salinity monitoring network will be expanded to all conservation areas where these parameters are of concern for evaluating species'

habitat requirements and maintaining vegetation health. Data collection will continue at the three locations already being monitored. These data will continue to be used to evaluate the hydrologic requirements for southwestern willow flycatchers.

Additional remote sensing techniques and products will be evaluated based on vegetation mapping needs at LCR MSCP conservation areas. The techniques and products evaluated may also be used for system-wide monitoring purposes.

Pertinent Reports: During the development of remote sensing vegetation monitoring techniques, annual reports for FY15–17 will not be prepared. Once remote sensing monitoring techniques are finalized, the reports will then be prepared annually and posted on the LCR MSCP Web site upon completion.

Work Task F2: Avian Use of Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$220,000	$273,682.73	$1,921,937.38	$350,000	$350,000	$350,000	$350,000

Contact: Beth Sabin, (702) 293-8435, lsabin@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Conduct pre- and post-development monitoring for avian species at conservation areas

Conservation Measures: MRM1 and MRM2 (BEVI, ELOW, GIFL, GIWO, SUTA, VEFL, and YWAR)

Location: Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge, Arizona; Bill Williams Habitat Creditable Acreage, Bill Williams National Wildlife Refuge, Arizona; Planet Ranch, Arizona; Cibola Valley Conservation Area (CVCA), Arizona; the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Cibola National Wildlife Refuge, Arizona; Imperial Ponds Conservation Area, Arizona; Laguna Division Conservation Area (LDCA), Arizona; Yuma East Wetlands, Arizona; Hunters Hole, Arizona; Mohave Valley Conservation Area, California; Parker Dam Camp, California; Palo Verde Ecological Reserve (PVER), California; Palo Verde Ecological Reserve-South, California; Pretty Water Conservation Area (PWCA) California; and Three Fingers Lake, California.

Purpose: To monitor Arizona Bell's vireo (*Vireo bellii arizonae*), elf owl (*Micrathene whitneyi*), Gila woodpecker (*Melanerpes uropygialis*), gilded flicker (*Colaptes chrysoides*), Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), summer tanager (*Piranga rubra*), and vermillion flycatcher (*Pyrocephalus rubinus*) use of conservation areas

Connections with Other Work Tasks (Past and Future): Pre- and post-development avian monitoring will be conducted at conservation areas listed in "Conservation Area Development and Management (Section E)." In addition, information obtained from this work task may be used to provide data for avian system monitoring by using the same protocols established in system monitoring (D6).

Project Description: The creation of riparian habitat will benefit LCR MSCP covered avian species (Arizona Bell's vireos, elf owls, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermillion flycatchers). Conservation areas will be monitored for bird activity using the double sampling area search method, which involves intensive and rapid area searches. Data gathered will be used to document the presence of covered species at the conservation areas to inform habitat management and the creation of future conservation areas.

Previous Activities: Pre- and post-development monitoring for avian covered species has been conducted at conservation areas since FY05. Avian pre-development monitoring was conducted at the CVCA, Cibola NWR Unit #1, the Imperial Ponds Conservation Area, Hart Mine Marsh, the PVER, the PWCA, the Mohave Valley Conservation Area, and the LDCA. Post-development monitoring for avian covered species was conducted at the BLCA, Cibola NWR Unit #1, the CVCA, the PVER, Yuma East Wetlands, and Hunters Hole. The double sampling rapid and intensive area search survey protocol has been used since 2008 for pre- and post-development monitoring. From FY08 to FY10, all area search plots were surveyed using intensive area search surveys due to the small acreage of habitat in the conservation areas. In FY11 and FY12, all area search plots were surveyed with rapid area search protocols, and a subset of those area search plots was surveyed using intensive area search protocols. In FY13, three additional area search plots were established at Yuma East Wetlands and were surveyed with intensive area search surveys. Beginning in FY14, area search plots were selected with a stratified random approach because existing habitat at the conservation areas exceeded the amount of habitat that could be covered within 80-area search plots. Each year, avian use was evaluated at each conservation area and compared among conservation areas. Sonoran yellow warblers and Arizona Bell's vireos were the covered species that had the largest populations breeding at the conservation areas.

FY16 Accomplishments: Avian post-development monitoring was conducted at existing conservation areas in FY16. The following conservation areas were surveyed: the BLCA, Cibola NWR Unit #1, the CVCA, the PVER, the LDCA, Yuma East Wetlands, and Hunters Hole. Eighty area search plots on the conservation areas were surveyed using the double sampling protocol. Rapid area search surveys were conducted on all area search plots, and intensive area search surveys were conducted on a stratified random subsample of eight of those area search plots.

A total of 155 avian species were detected. LCR MSCP covered bird species and other territorial breeding birds were documented at each conservation area:

- BLCA – Three area search plots were surveyed at this conservation area. There were 103 pairs of territorial breeding birds comprising 18 species detected. These included eight pairs of Sonoran yellow warblers, 15 pairs of Arizona Bell's vireos, and three pairs of summer tanagers.

- Cibola NWR Unit #1 – Eleven area search plots were surveyed at this conservation area. There were 166 pairs of territorial breeding birds comprising 26 species detected. These included one pair of Arizona Bell's vireos, two pairs of summer tanagers, and one pair of vermilion flycatchers.

- CVCA – Sixteen area search plots were surveyed at this conservation area. There were 214 pairs of territorial breeding birds comprising 20 species detected. These included three pairs of Sonoran yellow warblers and one pair of summer tanagers.

- PVER – Twenty-five area search plots were surveyed at this conservation area. There were 403 pairs of territorial breeding birds comprising 26 species detected. These included six pairs of Sonoran yellow warblers, one pair of Arizona Bell's vireos, and six pairs of summer tanagers.

- LDCA – Eighteen area search plots were surveyed at this conservation area. There were 302 pairs of territorial birds comprising 27 species detected. These included on pair of Sonoran yellow warblers and one pair of Arizona Bell's vireos.

- Yuma East Wetlands – Six area search plots were surveyed at this conservation area. There were 188 pairs of territorial breeding birds comprising 25 species detected. These included two pairs of Sonoran yellow warblers and one pair of Gila woodpeckers.

- Hunters Hole –There were 16 pairs of territorial breeding birds comprising 10 species detected. These included one pair of Sonoran yellow warblers.

All conservation areas had numerous pairs of non-territorial breeders as well. Many species of migrants and non-breeders were detected at all conservation areas.

Data and record management activities continued. The FY16 annual report was finalized. A performance work statement was prepared for pre- and post-development monitoring occurring in FY17 and FY18. An evaluation of the monitoring plan for conservation area monitoring (F2) and system-wide monitoring (D6) was initiated to clarify the monitoring questions the data will inform and to improve the accuracy of monitoring methods.

Obligations in FY16 exceeded the approved budget; this project could not share logistical costs with system-wide monitoring (D6) surveys because they were not conducted in FY16.

FY17 Activities: Avian post-development monitoring will be conducted at conservation areas, including the BLCA, Cibola NWR Unit #1, the CVCA, the creditable acreage in the middle portion of the Bill Williams River National Wildlife Refuge, the LDCA, the PVER, the PWCA, Parker Dam Camp, Yuma East Wetlands, and Hunters Hole. Surveys will be conducted using the double sampling method. Eighty area search plots will be selected from all possible plots within the conservation areas using a stratified random approach. All plots will be surveyed with rapid surveys, and a subset of eight area search plots will be selected to be surveyed with intensive surveys using a stratified random approach.

Avian pre-development will be conducted at future conservation areas, including Palo Verde Ecological Reserve-South, Three Fingers Lake, and Planet Ranch. Data and record management activities will continue. Two annual reports will be finalized: one for pre-development monitoring and one for post-development monitoring.

An evaluation of the study design for post-development (F2) and avian monitoring system-wide (D6) will continue. The results of this evaluation will be incorporated into updated protocols, and a 10-year monitoring plan will be developed.

The project budget will increase in FY17, as pre-development surveys will require additional funds.

Proposed FY18 Activities: Avian post-development monitoring for LCR MSCP covered species will be conducted at conservation areas supporting riparian vegetation, including the BLCA, Cibola NWR Unit #1, the CVCA, creditable acreage in the middle portion of the Bill Williams River National Wildlife Refuge, the LDCA, the PVER, the PWCA, Parker Dam Camp, Yuma East Wetlands, and Hunters Hole. Data and record management activities will continue. The annual report will be finalized. The 10-year monitoring plan for conservation area monitoring (F2) and system-wide monitoring (D6) will be completed with updated protocols.

Pertinent Reports: The report titled *Lower Colorado River Riparian Bird Surveys, 2014* is posted on the LCR MSCP Web site.

Work Task F3: Small Mammal Colonization of Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$65,000	$63,377.64	$489,264.67	$65,000	$65,000	$65,000	$65,000

Contact: Jeff Hill, (702) 293-8163, jhill@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: Conduct pre- and post-development monitoring for small mammal species

Conservation Measures: CRCR1, DPMO1, MRM2 (CRCR, DPMO, and YHCR), and YHCR1

Location: Reaches 3–6; Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge; Palo Verde Ecological Reserve (PVER), California; Cibola Valley Conservation Area (CVCA), Cibola National Wildlife Refuge Unit #1 Conservation Area Nature Trail, Laguna Division Conservation Area, and Yuma East Wetlands (YEW), Arizona; Reach 7; Hunters Hole

Purpose: To monitor small mammal presence within habitat creation sites

Connections with Other Work Tasks (Past and Future): Post-development small mammal monitoring will be conducted at habitat creation sites listed in "Conservation Area Development and Management (Section E)." In addition, presence information obtained from this work task will be used under Work Task C27 to document habitat characteristics and improve small mammal monitoring methods. Protocol improvements developed under Work Task C27 will be incorporated under this work task.

Project Description: Small mammal live trapping will be conducted in conservation areas to document the presence of Colorado River cotton rats (*Sigmodon arizonae plenus*), Yuma hispid cotton rats (*Sigmodon hispidus eremicus*), and desert pocket mice (*Chaetodipus penicillatus sobrinus*).

Previous Activities: Presence live trapping surveys were conducted at habitat creation sites from FY06–15. Trapping occurred for 1–3 nights at the sites sampled each year and was conducted in vegetation anticipated to provide the

best habitat to obtain detections of Colorado River cotton rats and Yuma hispid cotton rats. As of FY15, cotton rats were captured within or adjacent to all developed conservation areas except Hunters Hole. Colorado river cotton rats were captured at the Big Bend Conservation Area (BBCA), the BLCA, the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), the CVCA, and the PVER. All cotton rats captured at YEW and the Imperial National Wildlife Refuge were Yuma hispid cotton rats. Desert pocket mice were detected at many conservation areas, but the subspecies could not be determined.

FY16 Accomplishments: Presence live trapping surveys were conducted at the BBCA, the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, YEW, the LDCA, and Hunters Hole. Colorado River cotton rats were captured at the BBCA, the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, the LDCA; none were captured at the BLCA. Yuma hispid cotton rats were captured at YEW and Hunters Hole, a first for Hunters Hole. The first trapping of the LDCA occurred. One night of pre-development monitoring was conducted at the Mohave Valley Conservation Area, and desert pocket mice were captured. The subspecies of these pocket mice were not determined.

FY17 Activities: Small mammal live trapping surveys will continue as part of the post-development monitoring efforts at the BBCA, the BLCA, Cibola NWR Unit #1, Hunters Hole, the PVER, YEW, and the LDCA to detect the presence of cotton rats.

Proposed FY18 Activities: Small mammal live trapping surveys will continue as part of the post-development monitoring efforts at the BBCA, the BLCA, Cibola NWR Unit #1, Hunters Hole, the LDCA, the PVER, and YEW.

Pertinent Reports: The report titled *Post-Development and System Monitoring of Rodent Populations: 2012–2014* is available on the LCR MSCP Web site. The FY15 and FY16 reports will also be posted upon completion.

Work Task F4: Covered Bat Species Monitoring at Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$150,000	$36,810.41	$1,090,611.17	$150,000	$80,000	$80,000	$80,000

Contact: Mary Ellen Chavez, (702) 293-8475, mchavez@usbr.gov

Start Date: FY07

Expected Duration: FY55

Long-Term Goal: Pre- and post-development monitoring of covered bat species

Conservation Measures: MRM1, MRM2 (CLNB, PTBB, WRBA, and WYBA), WRBA1, and WYBA1

Location: Reaches 3–5; Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge; Palo Verde Ecological Reserve (PVER), California; Cibola Valley Conservation Area (CVCA), the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Cibola, Arizona; and the Imperial Ponds Conservation Area, Imperial National Wildlife Refuge, Arizona. Additional conservation areas will be surveyed to document presence as needed.

Purpose: The purpose of this work task is to assess the use of conservation areas by the two LCR MSCP covered bat species (western red bat [*Lasiurus blossevilli*] and western yellow bat [*Lasiurus xanthinus*]) and the two evaluation species (pale Townsend's big-eared bat [*Corynorhinus townsendii pallescens* = *Plecotus townsendii pallescens* = *C. townsendii townsendii*]) and California leaf-nosed bat [*Macrotus californicus*]).

Connections with Other Work Tasks (Past and Future): Pre- and post-development avian monitoring will be conducted at habitat conservation areas listed in "Conservation Area Development and Management (Section E)." Information obtained through this work task, in conjunction with Work Task D9, will help determine the distribution of these species.

Project Description: Post-development monitoring for the two covered bat species (western red bat and western yellow bat) and the two evaluation species (pale Townsend's big-eared bat and California leaf-nosed bat) at conservation areas includes both acoustic and mist netting capture methods. Acoustic monitoring will be conducted at conservation areas, including the CVCA, the

PVER, Cibola NWR Unit #1, the BLCA, and the Imperial Ponds Conservation Area. These surveys utilize either active or passive acoustic detection systems to record bat echolocation calls for presence. Bats will also be captured with mist nets at these sites to acquire reference acoustic calls and to determine the age, sex, and reproductive status of the covered and evaluation bat species.

Previous Activities: Conservation areas were monitored from FY07 to FY15 using acoustic and/or capture techniques.

FY16 Accomplishments: Acoustic monitoring consisted of using long-term bat detector stations to record echolocation calls of bats every night from June – August. The stations used to collect data were at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, Yuma East Wetlands, and Hunters Hole. At the PVER and CVCA, two stations were used to cover these large conservation areas. Data will be analyzed in FY17.

Capture surveys were conducted at five LCR MSCP conservation areas (BLCA, PVER, CVCA, and Cibola NWR Unit #1) once a month from June – August, one night in June and July at Planet Ranch, and one night in February at Yuma East Wetlands. One pale Townsend big-eared bat and seven California leaf-nosed bats were captured at the BLCA. One western red bat, two western yellow bats, and three California leaf-nosed bats were captured at the PVER. Six western red bats, two western yellow bats, and two California leaf-nosed bats were captured at the CVCA. Three California leaf-nosed bats were captured at Cibola NWR Unit #1. Three pale Townsend big-eared bats and 33 California leaf-nosed bats were captured at Planet Ranch. Two California leaf-nosed bats were captured at Yuma East Wetlands.

Obligations in FY16 were less than approved in the work plan, as post-development capture surveys were reduced to Reaches 3–5 where habitat for western red bats and western yellow bats are creditable, acoustic analyses costs for FY16 were less than anticipated, and less effort was required for capturing bats at conservation areas for the telemetry study (Work Task D9).

FY17 Activities: Bat presence will continue to be monitored by using eight acoustic monitoring stations. The stations will continue to operate, and data will be analyzed, presence documented, and activity level rates calculated. Capture surveys will continue at the BLCA, the PVER, the CVCA, and Cibola NWR Unit #1.

Proposed 18 Activities: Bat presence at the conservation areas will continue to be monitored. Data will be analyzed, presence documented, and activity level rates calculated.

Pertinent Reports: Annual reports will be posted on the LCR MSCP Web site upon completion.

Work Task F5: Post-Development Monitoring of Fish at Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$250,000	$241,313.96	$1,760,785.26	$250,000	$500,000	$500,000	$500,000

Contact: Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

Start Date: FY07

Expected Duration: FY55

Long-Term Goal: Post-development monitoring

Conservation Measures: BONY5 and RASU6

Location: Backwater habitats (Reaches 3–6)

Purpose: To monitor fish use of habitat creation sites in order to provide data for the adaptive management process and to develop management guidelines for created backwater habitats

Connections with Other Work Tasks (Past and Future): Post-development monitoring will be conducted at all backwaters created under Conservation Area Development and Management (Section E) work tasks and Work Tasks C23 (closed), C31, C33 (closed), C34 (closed), C40, and C41 (closed).

Project Description: Fish and fish habitat will be monitored at conservation areas. It is anticipated that these areas will play various roles in the conservation of target fish species throughout the 50-year term of the LCR MSCP. Some habitats will be able to develop self-sustaining populations; others may become overpopulated, requiring harvest or thinning; and some will require continuous population augmentation. Most isolated fish habitats will require some stock rotation to maintain genetic diversity through time. Basic surveys of the fish population and the physical and chemical components in developed or restored habitats will be required. Fish monitoring will include trapping (hoop, fyke, and minnow traps), trammel netting, electrofishing, larvae light trapping, and ocular surveys (including scuba and snorkeling where necessary and practical). Water quality assessments will require annual measurements of temperature, oxygen, pH, and conductivity (salinity) as well as periodic monitoring of chemical makeup and selenium.

Previous Activities: Since 2006, Beal Lake has been renovated and stocked with more than 6,000 razorback suckers (*Xyrauchen texanus*) and 2,000 large bonytail (*Gila elegans*) (an additional 27,000 young-of-the-year bonytail have also been released); a limited portion of each of these stockings was marked with passive integrated transponder (PIT) tags. Non-native fishes were identified shortly after the renovation efforts. Through annual surveys, subsets of each of these stockings have been contacted, but long-term survival has been low. A more intensive monitoring effort using remote sensing was initiated in FY09 and continued through FY11. Populations of stocked razorback suckers declined rapidly within the first several months post-release and eventually leveled off near 100 individuals. Water quality has been monitored constantly with multi-parameter water quality loggers, and all parameters have remained within the known ranges of acceptability for native fishes.

In 2012, stockings were discontinued at Beal Lake, and fisheries surveys were reduced to a relative abundance and biomass estimate for all species within the backwater. The results of this survey indicated that the backwater contained at least six different species but, relative to the size of the backwater, had low overall numbers of fishes (approximately 4,000). Non-native fishes were the dominant species in the lake, accounting for almost 90% of the total fishes.

A large fishkill was observed in February 2013; water samples confirmed a golden algae bloom. Monthly golden algae monitoring was initiated immediately following its detection. No fishes were observed for several months after the event. By mid-summer, young-of-year largemouth bass (*Micropterus salmoides*) were observed in the backwater. Golden algae have not been detected in the backwater since May 2013, and the non-native fish community has rebounded since the fishkill. The backwater was isolated from Topock Marsh following the detection of golden algae in 2013; this closure resulted in a rapid increase in specific conductivity, which approached 11,000 microsiemens per centimeter in FY14. Due to changes in water delivery, it decreased to approximately 6,000 microsiemens per centimeter in FY15. No fish activities have been conducted due to the lack of native fishes since 2013.

Routine monitoring of the Big Bend Conservation Area (BBCA) has been conducted monthly from February through May and has included electrofishing, trammel netting, remote PIT scanning, and larval light trapping in areas where there have been historical contacts of native fishes and adequate water levels to permit access for sampling. Sonic- and radio-tagged flannelmouth suckers (*Catostomus latipinnis*) released locally as part of Work Task C53 have been found within the dense bulrush stands at the BBCA backwater for extended periods. Water quality profiles were conducted during each monitoring trip and at least quarterly the remainder of the year. Through monitoring, low numbers of razorback and flannelmouth suckers continued to be contacted, including larvae

of both species and an occasional flannelmouth sucker subadult. The backwater has a direct surface connection to the lower Colorado River; consequently, water quality parameters mirror that of the river.

FY16 Accomplishments: The water quality at Beal Lake was monitored throughout the backwater using permanently deployed multi-parameter instruments. Low levels of dissolved oxygen and high temperatures were observed locally but not lake-wide. Conductivity has decreased to nearly 2,200 microsiemens per centimeter following wedge-wire screen maintenance. Zooplankton and phytoplankton results continue to show relatively low levels of plankton biomass. No golden algae have been detected in Beal Lake since May 2013. No fish activities were conducted at Beal Lake due to the lack of native fishes in the ponds since 2013.

Routine monitoring at the BBCA continued in FY16; netting resulted in the capture of zero razorback suckers, zero flannelmouth suckers, and one bonytail. Remote PIT scanning resulted in the contact of two razorback suckers, zero flannelmouth suckers, and one bonytail. Both bonytail were from a September 2015 release in Laughlin Lagoon. These are the first bonytail contacted since routine monitoring was initiated in FY13. Larval razorback suckers and flannelmouth suckers were captured at rates lower than FY15, but they were similar to the years prior to FY15. A permanent remote PIT scanner was installed in the summer of FY16 with limited success; improvements to this scanning station will be made in FY17. Water quality parameters remained within thresholds for all native fishes.

FY17 Activities: Monitoring activities at Beal Lake will be focused on water quality. Golden algae sampling will continue in spring when conditions are the most favorable for the algae.

Interactions of native and non-native fish species will also be monitored if a sufficient number of razorback suckers are available for stocking in Beal Lake. Areas of the backwater will be partitioned and stocked with equal numbers of razorback suckers; one-half of the partitioned areas will have non-native fishes removed, and the other half will not. Short-term survival will be monitored using remote PIT scanners.

The BBCA will be monitored at a level similar to that in FY16. The permanent remote PIT scanning station will be improved to increase its dependability.

Proposed FY18 Activities: The activities from FY17 will continue. Monitoring may continue to focus on the interactions of non-native fishes or the impact of piscivorous bird predation in the lake.

BBCA activities will be similar to those of the previous year and will include trammel netting, remote PIT scanning, larval surveys, and water quality monitoring.

The budget will increase in FY18 when monitoring of the Imperial Ponds Conservation Area, previously conducted under Work Task C25, moves to this work task.

Pertinent Reports: The report titled *Beal Lake Species Abundance and Biomass* is complete and will be posted on the LCR MSCP Web site upon completion.

Work Task F6: Post-Development Monitoring of MacNeill's Sootywing Skippers at Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$80,000	$49,043.49	$502,356.79	$80,000	$40,000	$40,000	$40,000

Contact: Carrie Ronning, (702) 293-8106, cronning@usbr.gov

Start Date: FY09

Expected Duration: FY55

Long-Term Goal: Post-development monitoring for MacNeill's sootywing skippers (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill]) (sootywings)

Conservation Measures: MNSW2

Location: Habitat conservation areas, Reaches 3–5

Purpose: To monitor vegetation, plant quality, and populations of sootywings in habitat created for this species

Connections with Other Work Tasks (Past and Future): Habitat requirements were studied under Work Task C7 (closed)

Project Description: To monitor the presence and habitat use of sootywings in conservation areas that have the appropriate land cover type available

Previous Activities: Habitat created for sootywings at the Cibola Valley Conservation Area (CVCA) and the Palo Verde Ecological Reserve (PVER) was surveyed for adults from FY09 to FY11. In FY09 and FY10, sootywings were most abundant at CVCA Phase 4W along the road edge (> 200 adults counted) and at a separate patch in the same phase. Sootywings were rare (< 5 adults per date) or absent at other CVCA plots and at all of the PVER plots. In FY11, most observations were at PVER Phase 4 (< 5 adults per date), and none were observed in CVCA Phase 4W. Sootywing populations at the remaining CVCA and PVER plots were low or absent.

Monitoring methods were modified in FY12 and FY13. One random transect was walked in each check monthly in FY12 from April through August at CVCA Phases 2 and 3, CVCA Phase 4, CVCA Phase 5, and PVER Phases 4 and 5. In FY13, planted quailbush (*Atriplex lentiformis*) (a sootywing larval host plant)

habitat was surveyed for adult sootywings during June – September in plots at the CVCA and PVER. Sootywings were detected at the CVCA (7 in FY12 and 6 in FY13) and the PVER (13 in FY12 and 98 in FY13). They were not detected consistently throughout the season. Vegetation was monitored in FY13 to document the characteristics of host and nectar plants, including species, plant height, and width.

Methods were refined further for surveys in FY14 and provided potential habitat measurements and estimated survey time lengths to be considered in future protocols. Sootywing presence surveys were conducted at PVER Phases 4 and 6, the CVCA, and Hart Mine Marsh, and sootywings were detected at all sites. Habitat measurements included those of quailbush, nectar plant metrics, information on soil moisture, air temperature, and relative humidity. Data indicated that 1 hour of survey time at the appropriate time of day could be used to detect adult sootywings in 90% of sampled intervals.

FY16 Accomplishments: Conservation areas were surveyed for sootywing presence in March, April, May, and July in Reaches 3–5 using the same methods as in FY14 and FY15. Surveys occurred at the Big Bend Conservation Area, the Beal Lake Conservation Area, the CVCA, the PVER (Phases 1, 4, and 6), Cibola National Wildlife Refuge Unit #1 Conservation Area, and Hart Mine Marsh. Sootywings were detected at the Beal Lake Conservation Area, the CVCA, the PVER (Phases 1, 4, and 6), the Cibola National Wildlife Refuge Unit #1 Conservation Area, and Hart Mine Marsh. Site visits were conducted at the Imperial Ponds Conservation Area, but surveys were not conducted because existing habitat was not found.

Obligations in FY16 were reduced due to more efficient survey methods in FY16. Surveys were conducted to determine sootywing presence at conservation areas instead of repeated visits to document presence throughout spring and summer. If they were found, the survey effort the next month was shifted to other areas where presence had not yet been confirmed that year.

FY17 Activities: Conservation areas where no sootywings have been detected in Reaches 3–5 (Big Bend Conservation Area, Parker Dam Camp, and Pretty Water Conservation Area) will be surveyed for presence of quailbush to identify if there is potential habitat. Presence surveys for sootywings will be conducted in March, April, June, and July in each of these conservation areas in potential habitat. If sootywings are detected before the July survey, surveys in the remaining months will not be conducted. In addition, LCR MSCP legacy data for sootywings will be migrated into the LCR MSCP database.

Proposed FY18 Activities: Conservation areas in Reaches 3–5 where no sootywings have been detected will be surveyed for presence of quailbush to locate potential habitat. Conservation areas where sootywings have been previously documented in Reaches 3–5 will be surveyed every other year to

monitor continued presence of sootywings. Presence surveys for sootywings will be conducted in potential habitat during March, April, May, and July. If sootywings are detected before the July survey, surveys in the remaining months will not be conducted.

Pertinent Reports: Annual reports will be posted on the LCR MSCP Web site upon completion.

Work Task F7: Marsh Bird Monitoring at Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$30,000	$23,225.44	$101,592.12	$40,000	$40,000	$40,000	$40,000

Contact: Joe Kahl, (702) 293-8568, jkahl@usbr.gov

Start Date: FY11

Expected Duration: FY55

Long-Term Goal: Post-development monitoring for California black rails (*Laterallus jamaicensis coturniculus*), Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]), and western least bitterns (*Ixobrychus exilis hesperis*)

Conservation Measures: BLRA1, CLRA1, LEBI1, MRM1, and MRM2 (BLRA, CLRA, and LEBI)

Location: Presence surveys will be conducted at newly developed marsh habitat sites, including Hart Mine Marsh on the Cibola National Wildlife Refuge (Cibola NWR); the Imperial Ponds Conservation Area (IPCA) on the Imperial National Wildlife Refuge (Imperial NWR); the Beal Lake Conservation Area (BLCA) on the Havasu National Wildlife Refuge (Havasu NWR); the Big Bend Conservation Area (BBCA), Nevada; and Yuma East Wetlands and the Laguna Division Conservation Area (LDCA), Arizona.

Purpose: To monitor the use of created marsh habitat by covered marsh bird species

Connections with Other Work Tasks (Past and Future): System-wide marsh bird surveys have been conducted by the Bureau of Reclamation (Reclamation) on existing marsh habitat since 1996 under Work Task D1.

Project Description: Marsh bird surveys will be conducted at LCR MSCP conservation areas. The National Marsh Bird Monitoring Program protocol will be used, which involves surveying for several species, including the LCR MSCP covered marsh species, using recordings of the species' calls.

Previous Activities: Hart Mine Marsh and the IPCA were surveyed for marsh birds prior to development. Marsh bird surveys were conducted at the BBCA,

Hart Mine Marsh, the IPCA (Field 18 and the Imperial ponds), the LDCA, and Yuma East Wetlands after inclusion into the LCR MSCP. From FY05 to FY16, Reclamation partnered with U.S. Fish and Wildlife to share the costs and labor needed to conduct the surveys.

FY16 Accomplishments: Marsh bird surveys were conducted during March, April, and May at the LDCA and Yuma East Wetlands. Surveys at the BBCA, the BLCA (Beal Lake and Willow Marsh), the IPCA (Field 18 and the Imperial ponds), and Hart Mine Marsh were conducted once in March and twice in April. One California black rail was detected at Field 18 during the April 21 survey. This was the only detection of a California black rail at a conservation area.

Western Least Bittern Detections

Conservation Area	Survey 1 (March)	Survey 2 (April)	Survey 3 (April – May)
Beal Lake Conservation Area			
Beal Lake	3	12	12
Willow Marsh	0	0	0
Big Bend Conservation Area	0	0	0
Hart Mine Marsh	9	5	17
Imperial Ponds Conservation Area			
Field 18	0	0	0
Imperial Ponds	0	0	1
Laguna Division Conservation Area	2	5	8
Yuma East Wetlands	0	0	2

Yuma Clapper Rail Detections

Conservation Area	Survey 1 (March)	Survey 2 (April)	Survey 3 (April – May)
Beal Lake Conservation Area			
Beal Lake	0	4	3
Willow Marsh	0	2	0
Big Bend Conservation Area	0	0	0
Hart Mine Marsh	12	12	10
Imperial Ponds Conservation Area			
Field 18	0	4	3
Imperial Ponds	0	0	0
Laguna Division Conservation Area	0	0	0
Yuma East Wetlands	7	4	2

FY17 Activities: Marsh bird surveys will be conducted on conservation areas. These sites will include the BLCA (Beal Lake and Willow Marsh), Hart Mine Marsh on the Cibola NWR, the IPCA (Field 18 and the Imperial ponds), the BBCA, Yuma East Wetlands, and the LDCA. Surveys at Hart Mine Marsh and Field 18 and the Imperial ponds are conducted in cooperation with the U.S. Fish and Wildlife Service. Data will be entered into the LCR MSCP database and analyzed.

The budget increase starting in FY17 is due to the additional effort required to survey the expanded wetlands at the LDCA and to survey the BLCA (Beal Lake and Willow Marsh), Hart Mine Marsh on the Cibola NWR, and the IPCA (Field 18 and the Imperial ponds).

Proposed FY18 Activities: Marsh bird surveys will be conducted on conservation areas that have a marsh habitat component in sufficient acreage, vegetation type, and suitability. These sites will include the BLCA (Beal Lake and Willow Marsh), Hart Mine Marsh on the Cibola NWR, the IPCA (Field 18 and the Imperial ponds), the BBCA, Yuma East Wetlands, and the LDCA. Surveys at Hart Mine Marsh and Field 18 and the Imperial ponds are conducted in cooperation with the U.S. Fish and Wildlife Service. Data will be entered into the LCR MSCP database and analyzed.

Pertinent Reports: The results of the surveys will be reported in the annual reports for each associated restoration site as well as one report for all conservation areas, and they will be posted on the LCR MSCP Web site upon completion.

Work Task F8: Reptile and Amphibian Monitoring at Conservation Areas

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$0	$25,000	$25,000	$25,000

Contact: Carolyn Ronning, (702) 293-8106, cronning@usbr.gov

Start Date: FY18

Expected Duration: FY55

Long-Term Goal: Post-development monitoring for northern Mexican gartersnakes (*Thamnophis eques megalops*), Colorado River toads (*Bufo alvarius = Incilius alvarius*), and lowland leopard frogs (*Rana yavapaiensis = Lithobates yavapaiensis*)

Conservation Measures: AMM1 (NMGS), CRTO1, and LLFR1

Location: Presence surveys will be conducted at newly developed marsh habitat sites and adjacent cottonwood-willow (*Populus fremontii-Salix gooddingii*) habitat where northern Mexican gartersnakes may be present, including the Beal Lake Conservation Area on the Havasu National Wildlife Refuge, and Planet Ranch, Arizona.

Purpose: To monitor the use of created marsh habitat by covered reptile and amphibian species

Connections with Other Work Tasks (Past and Future): None.

Project Description: Presence surveys for northern Mexican gartersnakes and their prey (including Colorado River toads and lowland leopard frogs) will be conducted at newly developed marsh habitat sites and adjacent cottonwood-willow habitat where northern Mexican gartersnakes may be present.

Previous Activities: This is a new project start in FY18.

FY16 Accomplishments: This is a new project start in FY18.

FY17 Activities: This is a new project start in FY18.

Proposed FY18 Activities: Conduct pre-construction presence surveys for northern Mexican gartersnakes at Planet Ranch in areas with marsh habitat, adjacent cottonwood-willow habitat, and rocky areas where northern Mexican gartersnakes may be present. Conduct pre-construction surveys and monitoring, as needed, for maintenance activities at the Beal Lake Conservation Area.

Pertinent Reports: The results of the surveys will be reported in the annual reports for each associated restoration site as well as one report for all conservation areas, and they will be posted on the LCR MSCP Web site upon completion.

Work Task F9: Post-Development Southwestern Willow Flycatcher Presence/Absence Surveys

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$0	$100,000	$400,000	$400,000

Contact: Chris Dodge, (702) 293-8115, cdodge@usbr.gov

Start Date: FY18

Expected Duration: FY55

Long-Term Goal: Post-development monitoring of southwestern willow flycatchers (*Empidonax traillii extimus*)

Conservation Measures: MRM1, MRM2, and MRM4 (WIFL)

Location: Conservation areas in Reaches 1–7 along the lower Colorado River (LCR), lower Bill Williams River, and the Virgin River between Mesquite, Nevada, and Lake Mead

Purpose: To monitor southwestern willow flycatcher populations at LCR MSCP conservation areas

Connections with Other Work Tasks (Past and Future): Work Task D2 included post-development and system-wide monitoring of southwestern willow flycatcher population numbers and demographics along the LCR from FY05–17. Monitoring of southwestern willow flycatchers will be split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D2 and post-development monitoring conducted under Work Task F9.

Project Description: Presence surveys are conducted at LCR MSCP conservation areas in Reaches 1–7 along the LCR, lower Bill Williams River, and the Virgin River between Mesquite and Lake Mead.

Previous Activities: Presence surveys and life history studies for southwestern willow flycatchers have been conducted along the LCR since 1996 and since FY05 under Work Task D2.

FY16 Accomplishments: This is a new start in FY18.

FY17 Activities: This is a new start in FY18.

Proposed FY18 Activities: Surveys for southwestern willow flycatchers will be conducted at LCR MSCP conservation areas and the creditable acreage in the middle portion of the Bill Williams River National Wildlife Refuge containing cottonwood-willow (*Populus fremontii-Salix gooddingii*) land cover. If southwestern willow flycatchers are observed displaying breeding behavior, surveys will be conducted in an attempt to confirm breeding.

Pertinent Reports: N/A

Work Task F10: Post-Development Yellow-billed Cuckoo Presence/Absence Surveys

FY16 Estimates	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$0	$0	$600,000	$600,000	$600,000

Contact: Barbara Raulston, (702) 293-8396, braulston@usbr.gov

Start Date: FY18

Expected Duration: FY55

Long-Term Goal: Post-development monitoring for yellow-billed cuckoos (*Coccyzus americanus occidentalis*)

Conservation Measures: MRM1 and MRM2 (YBCU)

Location: Protocol level surveys are conducted in suitable habitat at LCR MSCP conservation areas

Purpose: To conduct surveys to monitor existing yellow-billed cuckoo populations at LCR MSCP conservation areas

Connections with Other Work Tasks (Past and Future): Yellow-billed cuckoo monitoring on LCR MSCP conservation areas was previously conducted under Work Task D7. Monitoring of yellow-billed cuckoos will be split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D7 and post-development monitoring conducted under this work task.

Project Description: Yellow-billed cuckoos use cottonwood-willow (*Populus fremontii-Salix gooddingii*) habitat and may act as an umbrella species for other covered avian species that use these habitats. A standardized survey protocol (issued by the U.S. Fish and Wildlife Service on April 22, 2015) will be used to determine the presence of yellow-billed cuckoos at conservation areas consisting of cottonwood-willow habitat at least 2 years old.

Previous Activities: This is a new start in FY18.

FY16 Accomplishments: This is a new start in FY18.

FY17 Activities: This is a new start in FY18.

Proposed FY18 Activities: Call-playback surveys will be conducted at conservation areas planted with cottonwood-willow habitat at least 2 years old. Followup surveys to detect breeding will be conducted at conservation areas where breeding has yet to be documented. Birds banded in previous years may be resighted, and nests may be found incidentally to these activities.

Pertinent Reports: N/A

WORK TASKS – SECTION G

Adaptive Management Program

Work Task G1: Data Management

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,000,000	$919,025.71	$5,401,408.48	$1,000,000	$1,000,000	$1,000,000	$750,000

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY07

Expected Duration: FY55

Long-Term Goal: Data management will be an ongoing task for species research, system monitoring, habitat creation, post-development monitoring, and habitat maintenance programs.

Conservation Measures: All

Location: Program-wide

Purpose: To develop and maintain an accessible, multi-disciplinary, spatially referenced, relational database and associated tools to consolidate, organize, document, store, and distribute scientific information related to the LCR MSCP

Connections with Other Work Tasks (Past and Future): Data management is integral for the successful completion of the work tasks undertaken: Fish Augmentation (Section B), Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E), Post-Development Monitoring (Section F), Adaptive Management Program (Section G), and Funding Accounts (Section H).

Project Description: Under this work task, the data management team manages all aspects of the LCR MSCP that are related to the database, data collection, applications development, and software management. To fully implement the program, a database management system is being developed to handle the data collected through the species research, system monitoring, habitat creation, post-development monitoring, adaptive management, and habitat maintenance programs. Database design, initial implementation, and maintenance are funded under this work task.

Previous Activities: Hardware was purchased to increase data storage for the implementation of the centralized database. The intranet/document/calendar management system was upgraded and modified to accommodate the future needs

of the LCR MSCP. Implementation of remote data collection from field data loggers began at Beal Lake for the fish program. The Native Fish Augmentation Database was maintained.

Database design and implementation of the LCR MSCP database management system was completed. Data modules for the database were acquired and phased in according to priority for implementation of the Habitat Conservation Plan. The modules consist of an application for data entry that is standardized for input into the database. On an annual phased approach, all standardized projects will be incorporated into the database.

Mobile data loggers and software for collection of data in the field were acquired. These units standardize data collection across LCR MSCP projects. Mobile electronic field forms (MEFFs)/data dictionaries for data collection were developed and are now used for most field data collection.

FY16 Accomplishments: The Native Fish Augmentation Database continued to be maintained in its current format. Initial steps to incorporate this into the LCR MSCP database began, including development of schema and initial steps for standardization of attributes. Native fish stocking data in legacy formats were evaluated, and a draft schema was developed. Test imports were performed on these data to simulate transfer into the LCR MSCP database.

Maintenance and updates to the LCR MSCP Web site continued. Field data collection devices and supporting software were maintained to support data collection activities. Acquisition of light detection and ranging (LiDAR) data and aerial imagery for selected conservation areas and system-wide areas was supported under Work Tasks C60 and F1 for FY16, while the management of these data was handled under this work task.

Data collection processes were reviewed, updated, and maintained. MEFFs were created (or updated) and tested for the following projects: the southwestern willow flycatcher (*Empidonax traillii extimus*) (D2 and F2), yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (D7 and F2), amphibians (C62 and D12), small mammals (D10 and F3), bat surveys and research (D9 and F4), elf owl (*Micrathene whitneyi*) (C24), and MacNeill's sootywing skipper (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]) (F6). Documentation for all MEFFs was created so that end-users had the necessary reference materials for proper MEFF use. Additionally, the LCR MSCP trained end-users in how to use the MEFFs for field data collection.

The LCR MSCP databases continued to be maintained and upgraded for location, species, project-related reference tables, and utility procedures to centralize processing of project data, with emphasis on the support of MEFF needs (e.g., MEFF locations, codes, etc.). Support continued to be offered for users

of desktop computer-based data entry forms, including form and code updates, data merging, internal quality queries, and assistance in the design and creation of contractor-required queries for avian system-wide surveys (D6).

Quality assurance measures for field data collection processes were maintained, with full audit trails from raw field data to final production data. MEFF data viewers were also developed or updated during FY16 in support of projects for the southwestern willow flycatcher (D2 and F2), yellow-billed cuckoo (D7 and F2), amphibians (C62 and D12), small mammals (D10 and F3), bat surveys and research (D9 and F4), elf owl (C24), and MacNeill's sootywing skipper (F6). The data viewers allowed field surveyors to view collected data in tables and perform queries shortly after field collection as part of the quality assurance process.

The use of remote and continuous data collection from data loggers continued to be developed and supported. The external data upload site was maintained in order to improve data flow and tracking.

Efforts to restructure and more effectively maintain all LCR MSCP tabular and spatial data continued in FY16. The focus of these efforts involved selecting the appropriate tools for the required tasks.

In FY16, the Bureau of Reclamation decided to transfer server administration for the collaboration software that the LCR MSCP utilizes to Denver, Colorado. This centralization effort also involved a major version upgrade. In preparation for this upgrade and centralization (to occur in FY17), the LCR MSCP took efforts to reorganize the content that is being maintained in this system with the goal of making all project information easier to find and more accessible.

FY17 Activities: Maintenance of the Native Fish Augmentation Database continues in its current format. Work continues on incorporating these data into the LCR MSCP database. Native fish stocking data in legacy formats continues to be evaluated, and the draft schema continues to be modified. Test imports continue to be performed on these data to simulate transfer into the LCR MSCP database.

The LCR MSCP Web site continues to be maintained and updated. Acquisition of LiDAR data and aerial imagery for selected conservation areas and system-wide areas is supported under Work Tasks C60 and F1 for FY17, while the management of these data is handled under this work task. Due to the storage requirements of LiDAR data, aerial imagery, and other storage-intensive data, additional storage capacity (hardware and server software) is being evaluated to ensure the integrity and availability of these data. Once an acceptable alternative is identified, steps will be taken to transfer these data to the long-term storage solution.

The data collection processes continue to be updated and/or maintained, and MEFFs are being evaluated, developed, updated (and/or maintained), and tested

for the following projects: the southwestern willow flycatcher (D2 and F2), yellow-billed cuckoo (D7 and F2), amphibians (C62 and D12), small mammals (D10 and F3), bat surveys and research (D9 and F4), elf owl (C24), and MacNeill's sootywing skipper (F6).

Field data collection alternatives are being evaluated in order to take advantage of more efficient and versatile hardware and software technologies. Once these alternatives are identified, limited field testing will begin on projects that are currently using MEFFs for field data collection. These technologies might also be tested on projects that currently use other field data collection techniques (multiple fisheries projects, breeding bird surveys [D6 and F2], and marsh bird surveys [D1 and F7]). Support for the purchase of MEFF development tools, new hardware and software technologies, Global Positioning System devices, and other supporting software continues.

An independent evaluation of all data management processes is being conducted during FY17. This evaluation has three components: (1) identify overarching framing questions to guide adaptive management and data management processes and practices, (2) identify pertinent datasets that will be used for adaptive management purposes, and (3) technical review of current data collection and management practices. The overall goal of this exercise is to provide the necessary information to develop a digital information management system that will allow the LCR MSCP to make informed management decisions throughout the life of the program.

The LCR MSCP continues to reorganize the content contained in the collaboration platform that will be upgraded and transitioned to servers in Denver. Workflows will also be developed using this platform to make internal work processes more efficient, transparent, and trackable.

Proposed FY18 Activities: Maintenance of the Native Fish Augmentation Database will continue in its current format. It is anticipated that incorporation of these data into the LCR MSCP database will take place in FY18. It is also anticipated that native fish stocking data in legacy formats will be incorporated into the LCR MSCP database in FY18. Field collection of native fish stocking data will be updated to use MEFFs or some other standardized electronic method during FY18.

Existing MEFFS will continue to be updated or converted to one of the alternative field data collection techniques identified in FY17. Projects not using a standardized electronic field data collection method will be upgraded to use one of these methods.

LiDAR data acquisition will continue to be supported under Work Task F1, but the raw data will be managed and maintained under this work task.

Database schemas and data import/conversion codes will continue to be designed or updated in support of the MEFFs for projects as appropriate. All related database documentation (e.g., schema design, MEFF to Structured Query Language data mapping, processing workflows, standard naming conventions, etc.) will be maintained or created as required. Efforts to provision software that will enable project coordinators to access LCR MSCP database tables will continue. Importation of all data into the database will continue.

Information gathered from the data management evaluation taking place during FY17 will be used to advance several tasks, including (1) developing a digital information management system that meets the LCR MSCP's science and adaptive management needs using the existing databases as a foundation, (2) developing systems for incorporating pertinent legacy data into the information management system, and (3) implementing recommendations and modifications to current data management practices (field and office based). The information management system will include tools for extraction of information from collected data that will be used to make informed management decisions.

The LCR MSCP will continue to refine the quality assurance procedures already in place. This effort includes the use of the external data upload site to upload all raw data for tracking and quality assurance.

Pertinent Reports: N/A

Work Task G3: Adaptive Management Research Projects

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$300,000	$190,240.44	$2,652,788.91	$300,000	$300,000	$300,000	$300,000

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY06

Expected Duration: FY55

Long-Term Goal: Effective conservation of native species and their habitats

Conservation Measures: All conservation measures relating to habitat creation, species research, system monitoring, and fish augmentation

Location: System-wide

Purpose: To develop tools to effectively evaluate conservation actions

Connections with Other Work Tasks (Past and Future): Research projects initiated under this work task may be continued as Species Research (Section C). Information obtained may be used for Fish Augmentation (Section B), System Monitoring (Section D), Conservation Area Development and Management (Section E), Post-Development Monitoring (Section F), or Funding Accounts (Section H) work tasks.

Project Description: The adaptive management process is an assurance that the conservation actions presented in the Habitat Conservation Plan are effectively accomplished. Tools by which the conservation actions can be measured will be developed and evaluated, and data to improve the efficacy of techniques to successfully create habitat will be provided.

The LCR MSCP will initiate priority research projects in a timely manner. For example, opportunistic research proposals (e.g., time sensitive, such as spawning or breeding-season dependent) can be considered and initiated during the funding year and then be elevated to full research or monitoring status (Section C, D, or F work tasks) the following year. Also, experimental techniques can be evaluated through research to assess their utility, and if found to be useful, they would be incorporated into monitoring activities.

Previous Activities: All previous activities were moved to other work tasks after the initial year of funding.

FY16 Accomplishments:

Contribution to Razorback Sucker Species Status Assessment (SSA): Funds were contributed for a cooperative adaptive management effort with the Upper Colorado River Basin recovery programs (Upper Colorado River Endangered Fish Recovery Program, San Juan River Basin Recovery Implementation Program, and Glen Canyon Dam Adaptive Management Program) to develop an SSA for razorback suckers. The purpose of the SSA is to characterize the species' current status, future condition, and long-term viability to the extent possible using existing data, expert, and currently available information under various scenarios and timeframes. The SSA will provide key information that can be used to help generate a 5-year status review (or other documents) by the U.S. Fish and Wildlife Service for assessing the species' status with respect to the Endangered Species Act.

Development of single nucleotide polymorphisms (SNP) markers: Part of an independent review of the LCR MSCP genetics program indicated that the genetic markers used for assessing razorback sucker genetics since the start of the program were outdated. In response, FY16 funds were obligated to fund the first year of this project, looking to identify potential markers (single nucleotide polymorphisms or SNPs) for sex determination and identification of parentage in razorback suckers. This process is expected to yield 600 million sequences and more than 5,000 SNPs. Once the sequences have been obtained, analyses will be used to identify (1) SNPs specifically associated with sex determination and (2) SNPs that are of sufficient variability for use in parentage analyses.

Construction of the draft razorback sucker genome will be initiated, with sequences generated. This will provide context of each marker, allowing for determination of the physical location of each marker. The location is important because it prevents pseudo-replication and maximizes the efficiency of markers developed. This research will be continued under Work Task C40.

FY17 Activities: Research questions identified during fish augmentation, species research, system-wide monitoring, habitat creation, and post-development monitoring will be evaluated for development into adaptive management research projects under this work task.

Proposed FY18 Activities: Research questions identified during fish augmentation, species research, system-wide monitoring, habitat creation, and post-development monitoring will be evaluated for development into adaptive management research projects under this work task.

Pertinent Reports: Reports will be posted on the LCR MSCP Web site upon completion.

Work Task G4: Science/Adaptive Management Strategy

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$600,000	$420,190.00	$1,449,317.62	$400,000	$400,000	$400,000	$400,000

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY06

Expected Duration: FY55

Long-Term Goal: To ensure successful and efficient implementation of the LCR MSCP conservation measures

Conservation Measures: All conservation measures related to habitat creation, species research, system monitoring, and fish augmentation

Location: LCR MSCP planning area

Purpose: To define the procedure for implementing the LCR MSCP using the best available science and adaptive management processes

Connections with Other Work Tasks (Past and Future): All science-based work tasks

Project Description: The Habitat Conservation Plan conservation measures were designed to meet the biological needs of 26 covered species and to benefit 5 evaluation species. A science strategy, developed in FY06, defined the processes for ensuring implementation of the LCR MSCP using the best available science, and it described a two-tier planning process to ensure effective implementation of research and monitoring actions: first, a 5-year planning cycle and, second, annual work plans covering a 3-year cycle.

Every 5 years, a plan will be developed that describes the current knowledge of covered species, establishes the monitoring and research priorities for that 5-year period, and describes potential challenges that may inhibit successful implementation of the conservation measures. During each 5-year cycle, the accumulated data from ongoing research and monitoring will be reviewed along with existing species accounts.

Additional work may be generated from the evaluation of research conducted under Work Task G3.

The LCR MSCP will participate in interagency meetings and workshops held to discuss natural resource conservation along the lower Colorado River. These meetings bring together scientists, managers, and resource users interested in the lower Colorado River ecosystem. Additional special topic workshops will be held for covered species or their habitats as needed to revisit the status of one or more of these species within the LCR MSCP planning area.

Recently completed, ongoing, and proposed research and monitoring activities will be reviewed to ensure they meet the goals and objectives of the Habitat Conservation Plan.

Previous Activities: The Science Strategy was developed in August 2006 and finalized in October 2007. Colorado River Terrestrial and Riparian Group and Colorado River Aquatic Biologists meetings were attended. The *Habitat Creation Conservation Measure Accomplishment Tracking Process* was developed for tracking conservation measure accomplishment pertaining to the habitat creation conservation measures and approved by the Steering Committee in FY12. The report titled *LCR MSCP Five-Year Monitoring and Research Priorities: 2013–2017* was completed in FY13.

On October 27, 2011, the Steering Committee approved minor modifications to five conservation measures (RASU3, BONY3, BLRA1, STBU1, and THMI1) reported in the FY11 Accomplishments Report. Reported in FY14, three minor modifications to conservation measures were approved by the Steering Committee on April 23. Research and monitoring activities provided habitat information to adjust conservation measures WRBA1, BEVI1, and CRCR2.

Independent program reviews were completed on the bat and vegetation monitoring projects.

To accommodate the need to centralize adaptive management and data management activities, the LCR MSCP Office in Boulder City, Nevada, was reorganized to include a stand-alone Adaptive Management Group in FY15. The group is responsible for ensuring that projects, such as standardization of data collection and management activities and the evaluation of conservation areas in terms of conservation measure accomplishment, meet the strategic goal of the LCR MSCP.

FY16 Accomplishments: A habitat creation accomplishment analysis was conducted to show acreage totals for each species at each conservation area where applicable. These totals can be found in table 1-9 in the “Overview” section of this document.

The Adaptive Management Group conducted a scientific peer review of approximately 30 reports, which were posted on the LCR MSCP Web site in FY16. These reviews were accomplished through the established internal and external peer review process. The peer review process ensures that all research and monitoring complies with the LCR MSCP science strategy and the U.S. Department of the Interior Code of Scientific and Scholarly Conduct. This process also ensures that research and monitoring meets the needs of the LCR MSCP as outlined in the Habitat Conservation Plan and other program documents. The LCR MSCP writer's guidelines were significantly updated during FY16, providing internal staff and external partners a clear, standard template for issuing and publishing reports.

As part of the adaptive management process, an initial independent review of the genetic research was finalized in FY16 that provided an evaluation of the current monitoring methods and recommendations for future monitoring of razorback sucker (*Xyrauchen texanus*) genetics in Lake Mohave. This initial review was performed without consulting the genetic data collected to date by the LCR MSCP; therefore, an additional, independent review has been proposed to provide more detailed recommendations for future monitoring.

The Adaptive Management Group also provided feedback and input to other LCR MSCP groups on study plan design, statistical analyses of results, and technical and scientific writing standards. When appropriate, this information was shared with external partners to assist in their research, monitoring, and report writing activities.

Obligations were less than approved due to the quantity of reports and other documents needing review being less than expected.

FY17 Activities: Research and monitoring activities continue to be reviewed and evaluated internally as well as through independent, external reviewers. The analytical methods and survey intensity for system-wide avian monitoring (D6) will be reviewed, and the vegetation classifications for avian survey plots will be updated.

In coordination with Work Task G1, an independent review of the current data management and adaptive management processes is being conducted. This review will result in the development of broad-framing questions to inform the Adaptive Management Program (AMP). During this review, LCR MSCP managers will participate in a workshop to develop these overarching framing questions that will inform the AMP.

Preparation of the LCR MSCP Five-Year Monitoring and Research Priorities Report 2018–22 will begin in FY17. This report will describe the current

knowledge of covered species, establish the monitoring and research priorities for the next 5-year period (2018–22), and describe potential challenges that may inhibit successful implementation of the conservation measures.

Based on the results from the initial, independent review of genetic research (completed in FY16) for razorback suckers, an additional review will be conducted that will use the existing genetic data. The purpose of this expanded, more detailed review is to identify the level of effort and long-term needs for monitoring fish genetics and to address any additional questions that resulted from the initial review. Once this review is complete, a pilot study may be conducted to implement the recommendations provided in the review.

Information gained from the soil moisture monitoring effort initiated in FY15 under Work Task E34 and later covered under Work Task F1 is being used to draft a scope of work for expanding the soil moisture and salinity network across all LCR MSCP conservation areas. This information will be used in the adaptive management process to answer questions related specifically to habitat being managed for southwestern willow flycatchers (*Empidonax traillii extimus*) with different vegetation or hydrologic characteristics.

With the completion of the first editions of most species-specific conceptual ecological models, analyses will be conducted to better understand the impacts of management actions on habitat created under the LCR MSCP and the relationship between these actions and their effect on covered species. Development of decision support tools will also be initiated. These tools will help model the impacts that management actions have on created habitat and the covered species. These analyses and decision support tools will first be developed for select conservation areas using all relative data to assess proposed management actions. Once the analyses are complete, development of conservation area management plans will begin.

Coordination with landowners and agency partners for development of conservation area management plans will continue based on the results from the analyses described above.

Proposed FY18 Activities: Research and monitoring activities will be reviewed and evaluated internally as well as through independent reviewers. Specific programs may include avian, small mammal, insect, fisheries, and habitat monitoring programs.

Information from the conceptual ecological models will continue to be used for analyses of current and proposed management actions. Further development of decision support tools will also continue. Information from these analyses and tools will be used to develop additional conservation area management plans. Following the concurrence of management guidelines, each conservation area management plan will be developed and implemented accordingly.

The results from the data management/adaptive management evaluation performed in FY17 will be used to further refine the guidelines of the AMP. This will include the development of data-based adaptive management thresholds and triggers, which will be evaluated for the LCR MSCP conservation areas on an established schedule and will be the basis for considering management actions based on habitat conditions or species' responses.

Pertinent Reports: N/A

Work Task G6: Conceptual Ecological Models

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$40,000	$27,482.43	$3,359.07	$40,000	$40,000	$40,000	$40,000

Contact: Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

Start Date: FY16

Expected Duration: FY55

Long-Term Goal: Species research and monitoring

Conservation Measures: BEVI1, BLRA1, BLRA2, BONY2, CLNB1, CLNB2, CLRA1, CLRA2, CRCR1, CRCR2, CRTO1, CRTO2, CRTO3, DPMO1, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, LLFR1, LLFR2, LLFR3, MNSW1, MNSW2, MRM1, MRM2, MRM3, PTBB1, PTBB2, RASU2, SUTA1, VEFL1, WIFL1, WIFL2, WRBA1, WRBA2, WYBA1, WYBA3, YBCU1, YBCU2, YHCR1, YHCR2, and YWAR1

Location: System-wide, Arizona, California, Nevada

Purpose: To assess and organize existing knowledge on each LCR MSCP covered and evaluation species to determine research, monitoring, and habitat requirements for current and future research, monitoring, habitat creation, and fish augmentation projects

Connections with Other Work Tasks (Past and Future): Previous work was done through Work Tasks C3 (closed), G3, and G4. Information collected under this work task is currently being used to develop future work tasks and research projects, design monitoring programs and habitat creation projects, and to implement the adaptive management process. Information from this work task will be used under Fish Augmentation (Section B), Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E), and Post-Development Monitoring (Section F).

Project Description: To successfully create and manage habitats for LCR MSCP covered species, conceptual ecological models (CEMs) are being developed to better direct research and monitoring efforts as well as management.

CEMs are widely recognized and utilized in natural resource management and structured decisionmaking, as they provide a clear framework for informing management actions.

CEMs integrate and organize existing knowledge concerning (1) what is known about an ecological resource, with what certainty, and the sources of this information, (2) critical areas of uncertain or conflicting science that demand resolution to better guide management planning and action, (3) crucial attributes to use while monitoring system conditions and predicting the effects of experiments, management actions, and other potential agents of change, and (4) how the characteristics of the resource are expected to change as a result of altering its shaping/controlling factors, including those resulting from management actions.

Previous Activities: New start in FY16.

FY16 Accomplishments: First editions of CEMs for the following covered species were finalized: Arizona Bell's vireo (*Vireo bellii arizonae*), bonytail (*Gila elegans*), California black rail (*Laterallus jamaicensis coturniculus*), Colorado River cotton rat (*Sigmodon arizonae plenus*), elf owl (*Micrathene whitneyi*), flannelmouth sucker (*Catostomus latipinnis*), Gila woodpecker (*Melanerpes uropygialis*), gilded flicker (*Colaptes chrysoides*), MacNeill's sootywing skipper (*Pholisora gracielae = Hesperopsis gracielae* [MacNeill]), Sonoran yellow warbler (*Dendroica petechia sonorana = Setophaga petechia sonorana*), southwestern willow flycatcher (*Empidonax traillii extimus*), summer tanager (*Piranga rubra*), vermilion flycatcher (*Pyrocephalus rubinus*), western least bittern (*Ixobrychus exilis hesperis*), western red bat (*Lasiurus blossevilli*), western yellow bat (*Lasiurus xanthinus*), yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]), and Yuma hispid cotton rat (*Sigmodon hispidus eremicus*). All of these CEMs were posted on the LCR MSCP Web site in FY16.

The species accounts updated in FY14 under Work Task C3 (closed) were finalized and published during FY16. Information from these species accounts were incorporated into the CEMs for covered species during FY16.

FY17 Activities: The CEM developed in FY14 for the razorback sucker will be updated to reflect new information about the species, and standardized text to match the new CEM format will be incorporated.

The LCR MSCP will participate in a workshop on how to use the species-specific CEMs to better understand the impacts of management actions on habitat created under the LCR MSCP and the relationship between these actions and their effect on covered species. Development of decision support tools for select

conservation areas will help model the impacts that management actions have on created habitat and the covered species. Once the analyses are complete, the CEMs will be used in the development of conservation area management plans.

CEMs for the five LCR MSCP evaluation species (Colorado River toad [*Bufo alvarius = Incilius alvarius*], lowland leopard frog [*Rana yavapaiensis = Lithobates yavapaiensis*], California leaf-nosed bat [*Macrotus californicus*], pale Townsend's big-eared bat [*Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii*], and desert pocket mouse [*Chaetodipus penicillatus sobrinus*]) will begin to be developed.

Proposed FY18 Activities: Updates to CEMs will be made as new information is received, with literature searches being performed at least once per year. The CEMs for the five LCR MSCP evaluation species will be finalized.

Pertinent Reports: CEMs were posted on the LCR MSCP Web site in FY16.

WORK TASKS – SECTION H

Funding Accounts

Work Task H1: Habitat Maintenance Fund

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16*	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$0	$0	$32,466,770.00	$0	$0	$0	$0

* Cumulative expenditures reflect total required contributions to develop the fund.

Contact: Jeremy Brooks, (702) 293-8157, jjbrooks@usbr.gov

Start Date: FY06

Expected Duration: FY55

Long-Term Goal: Maintenance of existing habitat

Conservation Measures: BLRA2, CLRA2, WIFL2, and YBCU2

Location: Lower Colorado River (Reaches 1–7)

Purpose: To maintain existing habitat areas, excluding newly created habitat within conservation areas, by implementing actions that will prevent the further degradation or loss of habitat for LCR MSCP covered species

Connections with Other Work Tasks (Past and Future): This is a stand-alone requirement as described in the LCR MSCP Habitat Conservation Plan.

Project Description: The development of a $25 million interest-bearing fund, called the Habitat Maintenance Fund (HMF), was completed over a 10-year period. The HMF will be used for maintaining habitats, which existed at the time of the signing of the Record of Decision (2005) and were suitable for LCR MSCP covered species, and which have since degraded after the LCR MSCP was initiated.

The HMF was established during the first 10 years of the LCR MSCP by the States of California, Arizona, and Nevada. Funding contributions during the initial 5 years were established at $500,000 per year, with funding contributions in years 6–10 established at $5,000,000 per year. Values are indexed to 2003 dollars and adjusted annually for inflation. All required contributions to the HMF are retained in interest-bearing accounts managed by the States of California, Arizona, and Nevada until required for use by the LCR MSCP. Current fund balances and project expenditures are detailed in attachment D-3a.

For HMF projects, the LCR MSCP serves as the funding source but will not directly implement specific projects. The lead agencies and planning participants are expected to use their own funds in the development of proposals and for participation in planning teams. Funds required to administer the HMF under the LCR MSCP will be tracked under Work Task A1.

The Habitat Conservation Plan specifies a priority for habitat and species types benefiting from projects funded through the HMF. Priority 1 for use of the fund is the protection of marsh, and specifically marsh complexes, occupied by LCR MSCP covered rail species that serve as key source populations. The four key source population areas are Topock Marsh and Topock Gorge within the Havasu National Wildlife Refuge (Reach 3), Reach 5 primarily within the Imperial National Wildlife Refuge, and Mittry Lake (Reach 6), which is located on Bureau of Reclamation withdrawn lands. The focus of the first 10 years of expenditures from the HMF (FY16–25) is to (1) improve the infrastructure to manage water levels for rail species and (2) enhance degraded rail habitat in Topock Gorge and Reach 5.

Previous Activities: Required annual funding contributions have been completed. In coordination with the U.S. Fish and Wildlife Service (USFWS) Arizona Ecological Services Field Office, planning teams comprised of representatives of appropriate resource agencies and landowners were assembled to investigate the use of the HMF to maintain Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) and California black rail (*Laterallus jamaicensis coturniculus*) key population centers at both Topock Marsh and Mittry Lake.

FY16 Accomplishments: In FY16, no funds were expended from the HMF for project purposes. The total dollar value of the HMF at the end of FY16, with interest, was $33,464,227.50.

Discussions with the USFWS Arizona Ecological Services Field Office and Region 2 Refuges Regional Office resulted in an agreement to leverage remaining Avoidance and Minimization Measure 2 (AMM2) funds (E17) of approximately $2.1 million and contributions from the HMF to complete infrastructure improvements at Topock Marsh. These efforts will allow for enhanced management of marsh levels for target species.

Preliminary discussions and planning efforts continued for a proposed project at Mittry Lake.

FY17 Activities: Project expenditures are not anticipated to occur in FY17. In coordination with the USFWS Arizona Ecological Services Field Office and planning teams, the LCR MSCP will continue to work with landowners and representatives of appropriate resource agencies to investigate opportunities and

proposals for use of the HMF to maintain key population centers at both Topock Marsh and Mittry Lake. The LCR MSCP will provide coordination and general support of these activities but will not directly implement the project.

At Mittry Lake, the landowner (Bureau of Reclamation) is anticipated to begin developing a proposal in FY17. If a project is ultimately defined and agreed upon, the Bureau of Reclamation's Yuma Area Office will be the lead for all efforts at Mittry Lake.

Proposed FY18 Activities: Planning and coordination efforts are anticipated to continue at both Topock Marsh and Mittry Lake.

Pertinent Reports: N/A

Work Task H2: Remedial Measures Fund

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16*	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$1,104,052	$1,104,052	$5,098,647.38	$1,108,828	$1,122,360	$1,122,360	$1,122,360

* Cumulative expenditures reflect total required contributions to develop the fund.

Contact: John Swett, (702) 293-8555, jswett@usbr.gov

Start Date: FY13

Expected Duration: FY55

Long-Term Goal: Remedial measures for changed circumstances

Conservation Measures: BEVI1, BLRA1, BONY2, BONY3, CLRA1, CRCR2, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, MNSW2, RASU2, RASU3, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, and YWAR1

Location: Lower Colorado River (Reaches 1–7)

Purpose: To implement remedial measures to respond to changed circumstances as necessary

Connections with Other Work Tasks (Past and Future): Any Fish Augmentation (Section B) and Conservation Area Development and Management (Section E) work tasks that may be affected by changed circumstances

Project Description: To address the potential for changed circumstances, a contingency fund was established to implement remedial measures identified in the Habitat Conservation Plan. On April 25, 2012, the Steering Committee passed Program Decision Document 12-001, which approved establishment of State interest-bearing Remedial Measure Funds. The total funds allocated to remedial measures was $13,270,000 (in 2003 dollars and indexed to inflation). Current fund balances are detailed in attachment D-3b.

In the event that changed circumstances occur, the Program Manager will implement remedial measures identified in the Habitat Conservation Plan. The measures will be implemented within the available LCR MSCP budget, including contingency funds allocated through this work task. The Program Manager will administer the Remedial Measures Fund.

Previous Activities: A Remedial Measures Fund process was established and approved by the Steering Committee in FY12.

FY16 Accomplishments: A total of $1,104,052 was deposited into three non-Federal interest-bearing accounts among Arizona, California, and Nevada. It consisted of $276,013 of funding from Arizona, $276,013 from Nevada, and $552,026 from California. The total dollar value of the RMF at the end of FY16, with interest, was $5,154,340.85. No funds have been withdrawn from the Remedial Measures Fund to date.

FY17 Activities: A total of $1,108,828 will be deposited into three non-Federal interest-bearing accounts among Arizona, California, and Nevada.

Proposed FY18 Activities: A total of $1,122,360 is expected to be deposited into three non-Federal interest-bearing accounts among Arizona, California, and Nevada.

Pertinent Reports: N/A

WORK TASKS – SECTION I

Public Outreach

Work Task I1: Public Outreach

FY16 Estimate	FY16 Actual Obligations	Cumulative Expenditures Through FY16	FY17 Approved Estimate	FY18 Proposed Estimate	FY19 Proposed Estimate	FY20 Proposed Estimate
$100,000	$106,930.04	$605,934.97	$125,000	$125,000	$125,000	$125,000

Contact: Nathan Lenon, (702) 293-8015, nlenon@usbr.gov

Start Date: FY05

Expected Duration: FY55

Long-Term Goal: To provide education and increase support for the LCR MSCP

Conservation Measures: N/A

Location: N/A

Purpose: To communicate, coordinate, and educate LCR MSCP Steering Committee members, internal and external stakeholders, and the general public about LCR MSCP implementation activities

Connections with Other Work Tasks (Past and Future): All LCR MSCP work tasks

Project Description: Under this work task, an outreach program for the LCR MSCP will be implemented. Activities are widely varied and include the creation of educational materials, participation at conferences and other public events, interaction with some school events, and coordination with youth conservation corps groups. Outreach may be specific to a project but more typically addresses the overall focus of the LCR MSCP and general conservation issues.

Previous Activities: The LCR MSCP hosted the Colorado River Terrestrial and Riparian annual meeting and participated in the Colorado River Aquatic Biologists annual meeting. These meetings provide centralized forums for scientists and resource managers to discuss current research and monitoring projects taking place on the lower Colorado River. Space is devoted within the LCR MSCP Web site to highlight both of these meetings.

A wide range of printed materials, videos, and reports has been created to explain various program features in both summary (factsheet) format as well as more

lengthy reports. Several banner displays have been created; these materials have been used extensively to promote the LCR MSCP at conferences, conservation area dedications, and other events.

FY16 Accomplishments: The LCR MSCP provided tours of conservation areas for the Water Education Foundation and partnered with the Clark County Wetlands Park on events such as "International Migratory Bird Day" and "BioBlitz" (a citizen science wildlife observation event).

LCR MSCP information was exhibited at numerous science education events throughout Las Vegas, Nevada, which included the sixth annual Las Vegas Science and Technology Festival. The LCR MSCP participated in educational events at schools in Henderson, Las Vegas, and Boulder City and hosted an exhibit booth at the Colorado River Water Users Association annual conference and the Colorado River Terrestrial and Riparian annual meeting.

The LCR MSCP received 193 hours of volunteer labor during the year. These volunteers included students from Arizona State University in Lake Havasu City and others. Volunteers participated in post-development monitoring at some sites, including bat mist netting and razorback sucker monitoring on Lake Havasu. The LCR MSCP also worked with one youth conservation corps group during FY16 at Parker Dam Camp for an 80-hour project duration. These volunteer and youth conservation corps projects helped to provide some labor for the LCR MSCP, engaged youths in conservation work, and fostered relationships among them, the community, and the program.

The LCR MSCP entered into an agreement (which is cost shared with the Boulder Canyon Operations Office) with the National Park Service (Lake Mead) to support Project WET (Water Education for Teachers) continuing education workshops. These workshops focus on explaining water science and related issues to Nevada teachers and provide information to be used in classrooms. Through this partnership and the focus on teacher education, the LCR MSCP will be able to individualize the curriculum to include information about the lower Colorado River and the LCR MSCP and also reach a larger number of students than could be reached by individual staff efforts.

FY17 Activities: The LCR MSCP is working with the National Park Service (Lake Mead) to develop a schedule and begin the Project WET (Water Education for Teachers) continuing education workshops. The workshops are expected to begin in spring 2017.

The LCR MSCP will continue to participate in annual Colorado River Water Users Association, Colorado River Aquatic Biologists, and Colorado River Terrestrial and Riparian meetings. The LCR MSCP will continue to work with partner agencies, participating in National Public Lands Day, International

Migratory Bird Day (Clark County Wetlands Park), the Las Vegas Science and Technology Festival, and other science and conservation-themed community events.

Proposed FY18 Activities: Emphasis for outreach will continue to focus on LCR MSCP stakeholder education, with interaction in local communities. The LCR MSCP will continue to support one to three large events per year, such as the Colorado River Water Users Association conference and the Las Vegas Science and Technology Festival. These activities provide opportunities to expand stakeholder and public knowledge of the LCR MSCP. Outreach to local community schools and colleges will continue, with a focus on providing volunteer opportunities when appropriate.

The LCR MSCP will to continue to promote the Project WET (Water Education for Teachers) workshops. The LCR MSCP will expand outreach as additional conservation areas are completed. This increased public awareness will help resolve potential issues over conflicting use of conservation areas.

Pertinent Reports: The 2016 annual report will be posted on the LCR MSCP Web site upon completion.

ATTACHMENTS

A Letter from Central Arizona Water Conservation District

B Description of Take

B-1: Federal Flow-Related Covered Actions and Accomplishments, Calendar Year 2016

B-2: Federal Non-Flow-Related Covered Actions and Incidental Take Summary, Fiscal Year 2016

B-3: LCR MSCP Non-Federal Covered Activities and Incidental Take Summary, Fiscal Year 2016

C Recommendations from Resource Agencies

D Financial Statement

D-1: Required Contributions
D-2: Funding Credits
- D-2a: San Diego County Water Authority
- D-2b: The Metropolitan Water District of Southern California
- D-2c: Nevada
- D-2d: Arizona
- D-2e: Bureau of Reclamation

D-3: Funding Accounts
- D-3a: Habitat Maintenance Fund
- D-3b: Remedial Measures Fund
- D-3c: Land and Water Fund

D-4: Cumulative Program Accomplishment

E Reports Published in Fiscal Year 2016

Attachment A – Letter from Central Arizona Water Conservation District

CAP
CENTRAL ARIZONA PROJECT

May 24, 2017

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The Multi-Species Conservation Program (MSCP) Non-Federal share for the Federal Fiscal Year 2018, both annually and quarterly, are shown by state below. The inflation index used is 1.410.

FY18 is year 13 of the program and the third year of Arizona's 20 year payback period.

FY 2018 Non-Federal Share (2003 $)	$11,082,000
FY 2018 Inflation Index	1.410
FY 2018 Non-Federal Share (Escalated $)	$15,625,620

FY 2018 Non-Fed	Arizona Payback	Other Work Tasks	Remedial Measures	Total Non-Fed Payment Due
Arizona	$ 742,333.28	$3,625,815.00	$ 280,590.00	$ 4,648,738.28
Nevada	(371,166.64)	3,625,815.00	280,590.00	3,535,238.36
California	(371,166.64)	7,251,630.00	561,180.00	7,441,643.36
Totals	$ 0.0	$14,503,260.00	$1,122,360.00	$15,625,620.00

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FY 2017 Quarterly Payments		Arizona Payback	Other Work Tasks	Remedial Measures	Total Non-Fed Payment Due
Arizona	Q1	$ 185,583.32	$ 906,453.75	$ 70,147.50	$1,162,184.57
	Q2	185,583.32	906,453.75	70,147.50	1,162,184.57
	Q3	185,583.32	906,453.75	70,147.50	1,162,184.57
	Q4	185,583.32	906,453.75	70,147.50	1,162,184.57
	FY Totals	$ 742,333.28	$3,625,815.00	$280,590.00	$4,648,738.28
Nevada	Q1	$ (92,791.66)	$ 906,453.75	$ 70,147.50	$ 883,809.59
	Q2	(92,791.66)	906,453.75	70,147.50	883,809.59
	Q3	(92,791.66)	906,453.75	70,147.50	883,809.59
	Q4	(92,791.66)	906,453.75	70,147.50	883,809.59
	FY Totals	$ (371,166.64)	$3,625,815.00	$280,590.00	$3,535,238.36
California	Q1	$ (92,791.66)	$1,812,907.50	$140,295.00	$1,860,410.84
	Q2	(92,791.66)	1,812,907.50	140,295.00	1,860,410.84
	Q3	(92,791.66)	1,812,907.50	140,295.00	1,860,410.84
	Q4	(92,791.66)	1,812,907.50	140,295.00	1,860,410.84
	FY Totals	$ (371,166.64)	$7,251,630.00	$561,180.00	$7,441,643.36

If you have any questions, please call or e-mail either Dana Sedig, 623-869-2148 (dsedig@cap-az.com) or myself, 623-869-2167 (tcooke@cap-az.com).

Sincerely,

Theodore Cooke
General Manager
Central Arizona Project

Attachments

Cc John Swett, MSCP Program Manager, Bureau of Reclamation
Laura Vecerina, MSCP Program Deputy Manager, Bureau of Reclamation
Douglas Dunlap, Manager-Finance and Accounting, CAP
Dana Sedig, Supervisor-Financial Operations, CAP

Section 8.1.1 - Fiscal Year 2018 Final Inflation Calculation for Lower Colorado River Multi-Species Conservation Program (Actual Indices through September 2016)

Item		Description / Formula		Values		Result
FY	=	Federal Fiscal Year Being Adjusted for Inflation		2018		2018
FY-2	=	Federal Fiscal Year for 2 years prior to Federal Fiscal Year Being Adjusted for Inflation		2016		2016
PPI Inflation Index for FY	=	Producer Price Index for Materials and Components for Const Sept FY-2 / Producer Price Index for Materials and Components for Const Sept 2002	=	230.0/ 152.1	=	1.512
Base Year for PPI	=	*Validate or change base year for PPI Index (Original index year = 1982)*	=	1982		
		Validate or change PPI index value for September 2002 according to the validated base year	=	152.1		
		Save a copy of the PPI index				
GDPIP Inflation Index for FY	=	Gross Domestic Product Implicit Price Deflator September 30, FY-2 Gross Domestic Product Implicit Price Deflator September 30, 2002		**136.344** / 104.243	=	**1.308**
Base Year for GDPIP	=	*Validate base year of GDPIP (Original index year = 2000)*	=	2009		
		Adjust published numbers for 2016 (111.648) to match base year of 2000. Adjustment formula is (111.648/81.887) X 100 = 136.344		111.648	=	136.344
		Save a copy of the GDPIP index and calcuations to adjust published numbers				
Inflation Index for FY	=	(PPI Inflation Index for FY + GDPIP inflation Index for FY)/2		(1.512+1.308)/2	=	**1.410**
Non-Federal Funding Obligation for FY	=	(5 - year Amount from Table 7-1 of HCP 2003 dollars adjusted to yearly amount)/2	=	$110,820 / 5 = $22,164 $22,164 / 2	=	$11,082
Federal Funding Obligation for FY	=	(5 - year Amount from Table 7-1 of HCP 2003 dollars adjusted to yearly amount)/2	=	$110,820 / 5 / 2	=	$11,082
Non-Federal Indexed Funding Obligation for FY	=	(Non-Federal Funding Obligation for FY) X (Inflation Index for FY)		$11,082 X 1.410	=	$15,625,620
Federal Indexed Funding Obligation for FY	=	(Federal Funding Obligation for FY) X (Inflation Index for FY)		$11,082 X 1.410	=	$15,625,620

All $ are in thousands

Individual State's share in $			
California Share - 50%	50%	$	7,812,810.00
Arizona Share - 25%	25%	$	3,906,405.00
Nevada Share - 25%	25%	$	3,906,405.00
Total Non-Federal Share		$	15,625,620.00

Arizona Payback ($10,529,550/20yrs = $526,477.50 X 1.410 =	$	742,333.28
California	$	(371,166.64)
Nevada	$	(371,166.64)

Total Non-Federal Share for FY17		
California Share	$	7,441,643.36
Arizona Share	$	4,648,738.28
Nevada Share	$	3,535,238.36
Total Non-Federal Share	$	15,625,620.00

G:\MSCP\MSCP - DTM\FY 18\MSCP Final Inflation Calc FY18.xlsx

Databases, Tables & Calculators by Subject

Change Output Options: From: 2007 To: 2017 GO

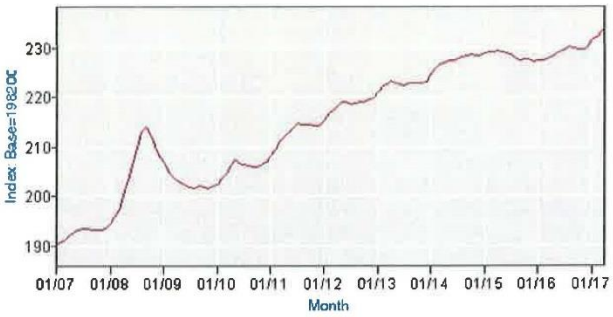
☑ include graphs ☐ include annual averages

More Formatting Options

Data extracted on: May 24, 2017 (2:44:22 PM)

PPI Commodity Data

Series Id: WPUID612
Not Seasonally Adjusted
Group: Intermediate demand by commodity type
Item: Materials and components for construction
Base Date: 198200



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Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007	190.3	190.6	191.2	192.1	192.8	193.1	193.5	193.5	193.2	193.2	193.2	193.4
2008	194.4	195.7	197.3	200.2	203.3	206.5	209.8	212.9	214.0	212.2	210.2	207.9
2009	207.0	204.8	204.2	203.2	202.8	202.0	201.9	201.5	202.0	201.9	201.7	202.0
2010	202.3	203.5	204.6	206.1	207.4	206.6	206.3	206.2	205.9	205.9	206.3	207.0
2011	208.3	209.5	210.9	212.1	212.8	213.7	214.7	214.6	214.5	214.4	214.2	214.2
2012	215.3	216.9	217.4	218.3	219.1	219.2	218.5	218.7	219.2	219.1	219.5	219.9
2013	221.2	222.2	222.7	223.4	222.9	222.6	222.4	223.0	222.9	222.9	223.0	223.1
2014	224.8	225.8	226.6	226.9	227.4	227.4	227.7	228.2	228.5	228.6	228.5	228.4
2015	229.0	229.1	229.1	229.4	229.1	229.0	228.8	228.0	227.5	227.7	227.6	227.2
2016	227.5	227.5	227.8	228.3	228.7	229.1	229.7	230.3	230.0	229.7	229.7	230.1
2017	231.4(P)	232.1(P)	233.0(P)	233.9(P)								

P : Preliminary. All indexes are subject to revision four months after original publication.

Series Id: WPSID612
Seasonally Adjusted
Group: Intermediate demand by commodity type
Item: Materials and components for construction
Base Date: 198200

Bureau of Economic Analysis

Table 1.1.9. Implicit Price Deflators for Gross Domestic Product

[Index numbers, 2009=100] Seasonally adjusted

Last Revised on: April 28, 2017 - Next Release Date May 26, 2017

Line		2015 I	2015 II	2015 III	2015 IV	2016 I	2016 II	2016 III	2016 IV
1	**Gross domestic product**	**109.310**	**109.919**	**110.253**	**110.504**	**110.630**	**111.258**	**111.648**	**112.229**
2	**Personal consumption expenditures**	**108.976**	**109.470**	**109.782**	**109.890**	**109.967**	**110.517**	**110.918**	**111.475**
3	Goods	102.731	103.045	102.807	102.144	101.110	101.302	101.084	101.455
4	Durable goods	90.988	90.837	90.236	89.818	89.624	89.049	88.132	87.423
5	Nondurable goods	108.683	109.276	109.264	108.459	106.916	107.581	107.809	108.872
6	Services	112.270	112.859	113.465	113.987	114.660	115.402	116.139	116.795
7	**Gross private domestic investment**	**106.427**	**106.352**	**106.589**	**106.786**	**106.873**	**107.315**	**107.575**	**108.130**
8	Fixed investment	106.912	106.846	107.184	107.300	107.467	108.048	108.412	108.936
9	Nonresidential	105.012	104.932	105.141	105.117	105.173	105.477	105.533	105.779
10	Structures	112.622	111.905	112.165	112.108	111.678	112.562	112.398	113.126
11	Equipment	101.255	101.265	101.286	101.301	101.367	101.393	101.657	101.576
12	Intellectual property products	105.199	105.414	105.885	105.821	106.163	106.522	106.412	106.829
13	Residential	114.895	114.878	115.709	116.355	116.936	118.537	120.054	121.621
14	Change in private inventories	---	---	---	---	---	---	---	---
15	**Net exports of goods and services**	---	---	---	---	---	---	---	---
16	Exports	107.886	107.635	106.541	105.031	103.661	104.663	105.284	105.957
17	Goods	105.848	105.371	103.808	101.725	99.070	100.498	101.098	101.539
18	Services	112.286	112.500	112.395	112.086	113.411	113.515	114.182	115.352
19	Imports	106.840	105.528	104.309	102.255	100.678	101.215	101.936	102.463
20	Goods	106.928	105.297	103.944	101.525	99.614	100.234	101.161	101.758
21	Services	106.875	107.064	106.469	106.115	106.090	106.243	106.027	106.231
22	**Government consumption expenditures and gross investment**	**111.083**	**111.680**	**111.815**	**111.833**	**111.711**	**112.461**	**113.059**	**113.642**
23	Federal	109.845	110.093	110.097	109.882	110.286	110.870	111.332	111.792
24	National defense	108.853	109.063	109.010	108.766	109.015	109.586	110.035	110.439
25	Nondefense	111.489	111.799	111.889	111.719	112.358	112.963	113.444	113.985
26	State and local	111.966	112.783	113.000	113.165	112.712	113.566	114.251	114.912

Attachment B – Acronyms and Abbreviations

AOP	Annual Operating Plan
BCPA	Boulder Canyon Project Act
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
CFR	Code of Federal Regulations
CHCID	Chandler Heights Citrus Irrigation District
CVWD	Coachella Valley Water District
Decree	Supreme Court Consolidated Decree of 2006 in *Arizona* v. *California*, 547 U.S. 150
FY	fiscal year
IBWC	International Boundary and Water Commission
ICS	intentionally created surplus
IID	Imperial Irrigation District
Interim Guidelines	*Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead*
kWh	kilowatt hours
LCWSP	Lower Colorado Water Supply Project
LROC	Long-Range Operation of Colorado River Reservoirs
M&I	municipal and industrial
maf	million acre-feet
mi	mile(s)
MWD	Metropolitan Water District of Southern California
NIB	Northerly International Boundary
NMIDD	New Magma Irrigation and Drainage District
No.	number
Reclamation	Bureau of Reclamation
RRA	Reclamation Reform Act
SDCWA	San Diego County Water Authority
SIB	Southerly International Boundary
yd^2	square yards
YMIDD	Yuma Mesa Irrigation and Drainage District

Attachment B – Description of Take

B-1: Federal Flow-Related Covered Actions and Accomplishments, Calendar Year 2016

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.2 BUREAU OF RECLAMATION				
2.2.1 Ongoing Flow-Related Actions				
2.2.1.1 Flood Control (page 2-3; Table 2-1, page 2-5)	• Prescribed flood control releases per Field Working Agreement and Water Control Manual for Lake Mead/Hoover Dam	• Timing of required releases may be varied within the month • Anticipatory flood control releases • Available flood control space in Lake Mead can be reduced to 1.5 million acre-feet (maf) August 1 to January 1 if prescribed space is available in upstream reservoirs • Management of target elevations for Lake Mohave (Davis Dam) and Lake Havasu (Parker Dam)	• None	No flood control releases were made from Lake Mead. The hourly elevation of Lake Mead provided for flood control space, which was well above the space required. In 2016, the Lake Mead elevation varied between 1071.61 and 1084.46 feet above mean sea level. Elevations at Lake Mohave and Lake Havasu were managed to target elevations.
2.2.1.2 State Apportionment and Water Contracts (page 2-5; Table 2-2, page 2-6)	• Delivery of water to water users in the United States pursuant to applicable Federal law, including the Boulder Canyon Project Act (BCPA) and the Supreme Court Consolidated Decree of 2006 in *Arizona* v. *California*, 547 U.S. 150 (Decree) • Delivery of a State's unused entitlement to a junior entitlement holder within that State on an annual basis	• Determinations and delivery of post-2016 unused apportionment water from one State to another within the Lower Basin on an annual basis	• Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree	In 2016, water deliveries were made to users in Arizona, California, and Nevada to satisfy the States' basic apportionments for delivery of Colorado River water. Arizona used 2,612,833 acre-feet, California used 4,381,098 acre-feet, and Nevada used 238,326 acre-feet. In 2016, Arizona and Nevada did not use their entire apportionments. Unused entitlement within Arizona and Nevada was made available to the junior priority holders; however, 119,506 acre-feet of Arizona's unused entitlement and 61,674 ace-feet of Nevada's unused entitlement water was left in Lake Mead. Unused entitlement water within California was delivered to the junior priority holder in that State.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.2.1.3 Annual Operations Normal, Surplus, Shortage, and Unused Apportionment (page 2-6; Table 2-3, page 2-9)	• Issuance of an Annual Operating Plan (AOP) pursuant to the Colorado River Basin Project Act • Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree • Delivery of water to Mexico pursuant to the 1944 Water Treaty • Determination of shortage conditions based on the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead* (Interim Guidelines) • Determination of surplus conditions based on the Interim Guidelines	• Revision of annual operations through the AOP, pursuant to the Long-Range Operation of Colorado River Reservoirs (LROC) within the year to reflect current hydrologic conditions • Determinations and delivery of post-2016 unused apportionment water from one State to another within the Lower Basin on an annual basis • Execution of agreements and the delivery of surplus water pursuant to the Reclamation Reform Act (RRA) and the Reclamation States Emergency Drought Relief Act • Periodic review of the LROC	• Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree	The AOP for 2016, which documented the operating tier for Lake Mead under the Interim Guidelines, was issued on January 8, 2016. Annual operations were revised through the AOP pursuant to the LROC and the Interim Guidelines to reflect current hydrologic conditions. An intentionally created surplus (ICS) surplus condition was determined for 2016. ICS was created in 2016. Water was delivered to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree. Water was delivered to Mexico pursuant to the 1944 Water Treaty. No review of the LROC was conducted in 2016.
2.2.1.4 Daily Hoover Dam Operations (Table 2-4, page 2-10)	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, deliver 1944 Water Treaty water to Mexico, and generate hydropower with these water releases	• Monthly energy targets are set prior to each month based on the best information available with respect to downstream water demands and lake elevation targets at Lakes Mohave and Havasu; energy targets may be revised during the month to meet changing water demands and other constraints (e.g., to benefit native fishes in Lake Mohave)	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States and to generate hydropower with these water releases	Water releases from Hoover Dam were made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with these water releases. Energy targets were set monthly based on the best information available with respect to downstream water demands and lake elevation targets at Lakes Mohave and Havasu. Energy targets were revised during the month (if needed) to meet changing water demands and other operational constraints.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.2.1.4 Daily Davis Dam Operations (Table 2-5, page 2-11)	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, deliver 1944 Water Treaty water to Mexico, and generate hydropower with these water releases	• Timing of releases, to a limited degree, may be varied by a few days based on available downstream storage, Lake Mohave and Lake Havasu operational constraints, downstream water requirements, and hydropower needs	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States and generate hydropower with these water releases	Water releases from Davis Dam were made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and generate hydropower with these water releases. The timing of releases was varied based on available downstream storage, operational constraints for Lakes Mohave and Havasu, downstream water requirements, and hydropower needs.
2.2.1.4 Daily Parker Dam Operations (Table 2-6, page 2-11)	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, deliver 1944 Water Treaty water to Mexico, and generate hydropower with these water releases	• Timing of releases, to a limited degree, may be varied by the hour based on hydropower needs, water requirements, or other operational constraints immediately downstream from the dam	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States and generate hydropower with these water releases	Water releases from Parker Dam were made to satisfy beneficial use requirements of entitlement holders in the United States, deliver 1944 Water Treaty water to Mexico, and generate hydropower with these water releases. The timing of releases was varied based on available downstream water requirements, hydropower needs, and other operational constraints immediately downstream from Parker Dam.
2.2.1.4 Daily Senator Wash, Imperial Dam, Laguna Dam, and Warren H. Brock Reservoir Operations (Table 2-7, page 2-11)	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, deliver 1944 Water Treaty water to Mexico, and generate hydropower with water releases for Senator Wash	• Senator Wash, Imperial Dam, and Laguna Dam operations to prevent over-deliveries, to release water to entitlement holders, for sluicing operations, to deliver a portion of the 1944 Water Treaty deliveries to Mexico, and for flood control purposes	• Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States	Water release operations from Senator Wash, Imperial and Laguna Dams, and the Warren H. Brock Reservoir were made to satisfy beneficial use requirements of entitlement holders in the United States and deliver 1944 Water Treaty water to Mexico. Water releases from Senator Wash and Imperial and Laguna Dams were made to prevent water passing to Mexico in excess of treaty requirements, to release water to entitlement holders, for sluicing operations, and to deliver a portion of the 1944 Water Treaty water deliveries to Mexico.
2.2.1.5 Electric Power Generation (page 2-11) **43 CFR Part 431 (page 2-14)**	• Operational requirements to satisfy 43 Code of Federal Regulations (CFR) Part 431 requirements	—	—	Hydroelectric power generated: • Hoover Dam: 3,666,040,669 kilowatthours (kWh) • Davis Dam: 1,142,295,000 kWh • Parker Dam: 441,258,000 kWh Operations met the requirements to satisfy 43 CFR Part 431.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.2.1.6 Lower Colorado Water Supply Project – California (page 2-15; Table 2-8, page 2-16)	• Delivery of water under executed Lower Colorado Water Supply Project (LCWSP) contracts	• The Bureau of Reclamation's (Reclamation) execution and administration of individual LCWSP contracts	• Participate in the development of, and consult in the execution of, individual contracts under the LCWSP	In 2016, 7,172 acre-feet of water was pumped by the LCWSP well field. The Imperial Irrigation District reduced its consumptive use of Colorado River water by this amount, and the water was made available for use by the LCWSP contractors, including the Metropolitan Water District of Southern California (MWD), pursuant to LCWSP Contract No. 06-XX-30-W0452, as amended, dated March 26, 2007.
2.2.1.7 1944 Water Treaty Deliveries (page 2-17; Table 2-9, page 2-20)	• Delivery of Mexico allotment (1.5 maf) pursuant to the 1944 Water Treaty and related minutes • Delivery of Mexico allotment (up to 1.7 maf) when the Secretary of the Interior determines that sufficient mainstream water is available to satisfy in excess of 7.5 maf acre-feet of consumptive use in the Lower Division States of Arizona, California, and Nevada • Delivery of Mexico allotment pursuant to the 1944 Water Treaty and related Minutes under extraordinary drought conditions • Compliance with the salinity requirements of Minute No. 242 of the 1944 Water Treaty • Delivery of emergency water to Tijuana pursuant to Minutes of the 1944 Water Treaty and contract	• Routing of water through the Yuma Division for delivery to the Northerly International Boundary (NIB) • Determination of quantity of water delivered at the Southerly International Boundary (SIB), up to 140,000 acre-feet per year • Drainage pumping and delivery of drainage return flows at NIB and SIB • Operation of variable-speed pumps and the diversion canal at SIB to reduce salinity • Execution of contracts to deliver a portion of Mexico's allotment to Tijuana pursuant to Minutes of the 1944 Water Treaty • Routing of water through the Yuma Division during flood control conditions	• Delivery of emergency water to Tijuana pursuant to Minutes of the 1944 Water Treaty and contract • Retention of a portion of the MWD's entitlement in Lake Mead to accommodate delivery of water pursuant to Minutes of the 1944 Water Treaty	A total of 1.50 maf was delivered to Mexico pursuant to the 1944 Water Treaty and related Minutes as follows: Delivery at the limitrophe = 3,065 acre-feet Delivery at SIB = 141,257 acre-feet Diversion channel discharge = 309 acre-feet Delivery at NIB = 1,355,370 acre-feet A total of 9,230 acre-feet of water passed to Mexico in excess of treaty requirements. Reclamation complied with the salinity requirements of International Boundary and Water Commission (IBWC) Minute No. 242. A total of 150,191 acre-feet of agricultural drainage return flow was bypassed pursuant to IBWC Minute No. 242. Drainage pumping and delivery of drainage return flows were made at NIB and SIB.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.2.1.8 Decree Accounting (page 2-21; Table 2-10, page 2-22)	• Annual preparation of official records of the diversion, return flow, and consumptive use of Colorado River water pursuant to Article V of the Decree	• None	• Report data for Decree accounting records	The *Colorado River Accounting and Water Use Report, Arizona, California, Nevada for Calendar Year 2016* was published on May 15, 2017. A summary of diversions, return flows, and consumptive use is provided below. The final report is available at http://www.usbr.gov/lc/region/g4000/wtracct.html **Arizona**: Diversions = 3,400,433 acre-feet Measured returns = 613,941 acre-feet Unmeasured returns = 173,659 acre-feet Consumptive use = 2,612,833 acre-feet **California**: Diversions = 4,868,599 acre-feet Measured returns = 546,839 acre-feet Unmeasured returns = 84,267 acre-feet Consumptive use = 4,381,101 acre-feet* *includes 143,608 acre-feet delivered from Warren H. Brock Reservoir **Nevada**: Diversions = 457,434 acre-feet Measured returns = 217,459 acre-feet Unmeasured returns = 1,649 acre-feet Consumptive use = 238,326 acre-feet
2.2.2 Future Flow-Related Covered Actions				
2.2.2.1 Specific Surplus and Shortage Guidelines (page 2-22; Table 2-11, page 2-24)	• Delivery of surplus water pursuant to Article II(B)(2) of the Decree • Delivery of water pursuant to Article II(B)(3) of the Decree (shortage) • Determination of shortage conditions based on criteria developed in the Interim Guidelines • Determination of surplus conditions based on criteria listed in the Interim Guidelines	• Adoption of specific post-2026 surplus guidelines • Adoption of specific post-2026 shortage guidelines	• Consult with States on development of specific post-2026 surplus guidelines or specific post-2026 shortage guidelines • Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree	No surplus water was delivered pursuant to Article II(B)(2) of the Decree. There were no reductions in deliveries pursuant to Article II(B)(3) of the Decree.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.2.2.2 Flood Release Contracts (page 2-24; Table 2-12, page 2-25)	• Delivery of water under executed flood release contracts	• Execution of contracts for water released during flood control operations	• Participate in the development of, and consult in the execution of, flood release contracts	No water deliveries were made under flood release contracts.
2.2.2.3 Changes in the Storage and Delivery of State Entitlement Waters through Various Administrative Actions (page 2-25; Table 2-13, page 2-26)	—	—	—	No administrative actions were taken to reduce the water deliveries as listed in Table 2-13 of the biological assessment.
Flow Changes Below Hoover Dam to Davis Dam (Table 2-14, after page 2-26)	—	—	—	**Reclamation Drought Response Agreement with the Fort McDowell Yavapai Nation** – 13,933 acre-feet **Pilot System Conservation Program:** • Central Arizona Water Conservation District (CAWCD) – 25,265 acre-feet • Gila River Indian Community – 10,000 acre-feet • Tohono O'odham Nation – 9,817 acre-feet • Colorado River Indian Tribes – 1,137 acre-feet • Coachella Valley Water District (CVWD) – 21 acre-feet • City of Needles – 145 acre-feet **CAWCD/Yuma Mesa Irrigation and Drainage District (YMIDD) Pilot Fallowing Program** – 7,509 acre-feet **Arizona unused apportionment left in Lake Mead** – 119,506 acre-feet **ICS:** • MWD-created ICS in Palo Verde Irrigation District – 4,888 acre-feet • Imperial Irrigation District (IID)-created ICS – 13,845 acre-feet Collectively, conservation efforts have contributed to a net decrease in flow below Hoover Dam of 206,066 acre-feet. Values are provided on a consumptive use basis.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
Flow Changes Below Davis Dam to Parker Dam (Table 2-15, after page 2-26)	—	—	—	**Reclamation Drought Response Agreement with the Fort McDowell Yavapai Nation** – 13,933 acre-feet **Pilot System Conservation Program** • CAWCD – 25,265 acre-feet • Gila River Indian Community – 10,000 acre-feet • Tohono O'odham Nation – 9,817 acre-feet • Colorado River Indian Tribes – 1,137 acre-feet • CVWD – 21 acre-feet • City of Needles – 145 acre-feet **CAWCD/YMIDD Pilot Fallowing Program** – 7,509 acre-feet **Arizona unused apportionment left in Lake Mead** – 119,506 acre-feet **ICS:** • MWD-created ICS in Palo Verde Irrigation District – 4,888 acre-feet • IID-created ICS – 13,845 acre-feet Collectively, conservation efforts have contributed to a net decrease in flow below Davis Dam of 206,066 acre-feet. Values are provided on a consumptive use basis.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
Flow Changes Below Parker Dam to Imperial Dam (Table 2-16, after page 2-26)	—	—	—	**IID Colorado River Water Delivery Agreement** • 1988 IID/MWD implementation of a Water Conservation Program Agreement – 90,374 acre-feet **IID Transferred to San Diego County Water Authority (SDCWA)** – 100,000 acre-feet **IID Extraordinary Conservation Transferred to MWD** – 56,232 acre-feet **CVWD Coachella Canal Lining Project Conservation** – 26,578 acre-feet • CVWD transferred to SDCWA – 22,078 acre-feet • CVWD transferred to MWD – 4,500 acre-feet **CAWCD/YMIDD Pilot Fallowing Program** – 7,509 acre-feet **MWD/Bard Water District Seasonal Fallowing Program** – 951 acre-feet **Pilot System Conservation Program:** • Colorado River Indian Tribes (Arizona) **–** 1,137 acre-feet • CVWD – 21 acre-feet **ICS:** • MWD-created ICS – 4,888 acre-feet • IID-created ICS – 13,845 acre-feet Collectively, conservation efforts have contributed to a net decrease in flow below Parker Dam of 369,235 acre-feet. Values are provided on a consumptive use basis.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
Water Conservation Field Services Program (page 2-27; Table 2-17, page 2-28)	• Develop water conservation program pursuant to RRA Section 210(a)	• Implementation of the Field Services Program	• Consult in the development of conservation plans pursuant to RRA Section 210(a)	All water conservation plans for the Lower Colorado Region are complete.
Unlawful Use (page 2-28; Table 2-18, page 2-30)	• BCPA requires all Colorado River water users to have a contract with the Secretary of the Interior	• Implementation of appropriate policy or rule to address unlawful use of Colorado River water • Execution of water delivery contracts with entities or individuals identified as unlawful users	• Consult with States in the development of policies or rules to address unlawful use of Colorado River water • Consult with the States on the execution of water delivery contracts with entities or individuals identified as unlawful users	The well inventory is being performed for Reclamation by the U.S. Geological Survey to identify wells that draw water directly from the lower Colorado River or pump water that would be replaced by water drawn from the lower Colorado River. A proposed guidance document is currently under development.
Unallocated Colorado River Water in Arizona, Exclusive of Central Arizona Project (CAP) (page 2-30; Table 2-19, page 2-31) **Note: Changed title from "Unallocated or Noncontract Water in Arizona, Exclusive of CAP"**	• Delivery of water pursuant to executed contracts for unallocated water in Arizona (non-CAP)	• Execution of water delivery contracts for unallocated water in Arizona (non-CAP)	• Review of water delivery contracts and consultation with Arizona on contract recommendations	Unallocated non-CAP Arizona water was delivered to the CAWCD as allowed under the CAWCD's contract with the United States. This water is unallocated because it has not yet been placed under permanent contract. The Arizona Department of Water Resources will recommend to the Secretary of the Interior the entities with which the Secretary should contract for the unallocated Arizona water upon completion of the well inventory.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
Central Arizona Project Contract Actions (page 2-31; Table 2-20, page 2-31)	• Delivery of water pursuant to executed contracts	• Completion of allocation and execution of contracts for delivery of CAP water subject to congressional direction	• Review of contracts and consultation on proposed allocation	Water was delivered to the CAP for use by CAP subcontractors and Indian Tribes in satisfaction of water delivery contracts: in the amount of 1,493,151 acre-feet. On March 17, 2016, the San Carlos Apache Tribe and the Pascua Yaqui Tribe entered into a lease for the delivery of up to 790 acre-feet of San Carlos Apache Tribe CAP water to the Pascua Yaqui Tribe during calendar year 2016. On March 23, 2016, the San Carlos Apache Tribe and the town of Gilbert entered into a lease for the delivery of 20,000 acre-feet of San Carlos Apache Tribe CAP water to the town of Gilbert during calendar year 2016. The Ak-Chin Indian Community and Del Webb Corporation entered into a lease for the delivery of 2,800 acre-feet of the Ak-Chin Indian Community's CAP water to the Del Webb Corporation during calendar year 2016. On August 30, 2016, the New Magma Irrigation and Drainage District (NMIDD) and the Tohono O'odham Nation entered into an agreement to provide for the delivery of the Tohono O'odham Nation's CAP water for water storage at a groundwater savings facility. The Tohono O'odham Nation desires to deliver up to 25,000 acre-feet per year of their CAP water to NMIDD in consideration for all long-term storage credits created in lieu of pumping groundwater. On March 14, 2016, an Assignment and Transfer from the Chandler Heights Citrus Irrigation District (CHCID) to CAWCD was executed, which assigned 315 acre-feet of CHCID's Arizona fourth-priority Colorado River water entitlement to CAWCD. CHCID's annual entitlement was terminated, and CAWCD's annual entitlement was increased by 315 acre-feet: from 7,996 to 8,311 acre-feet. On November 3, 2016, the Avra Water Co-Op, Inc., assigned and transferred its annual CAP municipal and industrial (M&I) water entitlement of 808 acre-feet to the town of Marana. The Avra Water Co-Op, Inc.'s annual CAP M&I water entitlement was terminated, and the town of Marana's annual CAP M&I water entitlement was increased from 1,528 to 2,336 acre-feet.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
Changes in Delivery Related to Water Transfers (page 2-32; Table 2-21, page 2-32)	• Delivery of water pursuant to contracts that recognize temporary or permanent transfers of water entitlements	• Approval of new contracts or contract changes to recognize temporary or permanent transfers of water entitlements	• Review of contracts and consultation on new or amended contracts that recognize transfers of water entitlements	The following conservation and transfers were made pursuant to the Colorado River Water Delivery Agreement. They represent changes in delivery amounts and points of diversion required to implement the Quantification Settlement Agreement. **1988 IID/MWD Conservation** – 105,000 acre-feet • Transfer to MWD – 90,374 acre-feet • Transfer to CVWD – 14,626 acre-feet **IID Transferred to SDCWA** – 130,796 acre-feet **IID Extraordinary Conservation Transferred to MWD** – 56,232 acre-feet **IID All-American Canal Lining Conservation** – 67,700 are-feet • IID Transfer – 56,200 acre-feet • IID Transfer to MWD – 11,500 acre-feet **IID Intra-Priority Transfer** – 41,000 acre-feet **Coachella Canal Lining Project Conservation** – 30,850 acre-feet • CVWD transferred to SDCWA – 22,078 acre-feet • CVWD transferred to MWD – 4,500 acre-feet • CVWD Salton Sea environmental mitigation – 4,272 acre-feet **CVWD Pilot System Conservation Program** – 21 acre-feet **Reclamation Yuma Desalting Plant** – 152 acre-feet
Changes in Delivery Related to Off-Stream Storage (page 2-32; Table 2-22, page 2-33)	• Delivery of water under executed off-stream storage agreements pursuant to 43 CFR Part 414	• Execution of Storage and Interstate Release Agreements pursuant to 43 CFR Part 414	• Delivery of water under executed off-stream storage agreements pursuant to 43 CFR Part 414	No off-stream storage of water took place in 2016.
Changes in Amount of Delivery (page 2-33; Table 2-23, page 2-34)	• Delivery of water pursuant to executed contracts or amendments to recognize changes in amounts of delivery or changes in points of diversion	• Execution of contract amendments or amendments to recognize changes in amounts of delivery or changes in points of diversion	• Review of contracts and consultation on new or amended contracts	No changes.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
Changes in Type of Water Use (page 2-34; Table 2-24, page 2-34)	• Delivery of water pursuant to executed contracts or contract amendments that recognize changed water use types	• Execution of contracts or contract amendments that recognize changed water use types	• Review of contracts and consultation with Reclamation on new or amended contracts	No changes.
Inclusions and Exclusions to Service Areas (page 2-34; Table 2-25, page 2-35)	• Delivery of water pursuant to executed contract amendments or new contracts that include or exclude lands in service areas	• Execution of contract amendments or new contracts that include or exclude lands in service areas	• Review of contracts and consultation on new or amended contracts	On January 7, 2016, Reclamation approved an exclusion of approximately 2.25 acres of land from the Central Irrigation and Drainage District service area.
Contract Terminations (page 2-35; Table 2-26, page 2-36)	• None	• Termination of water contract due to abandonment • Execution of contract amendments when entitlement holder has relinquished water	• Consultation on the disposition of any water allocated for use, but not consumptively used within, a State	No water contracts were terminated.
2.3 WESTERN AREA POWER ADMINISTRATION	—	—	—	See section 2.2.1.5 accomplishments in this table.
2.4 NATIONAL PARK SERVICE	—	—	• Water entitlement holder	See section 2.2.1.8 accomplishments in this table.
2.5 BUREAU OF INDIAN AFFAIRS				
2.5.2.2 Ongoing Water Conservation Practices (page 2-77)	—	• Conduct conservation measures for efficient water use	—	Existing practices were continued.
2.5.2.6 Flow-Related Actions (page 2-82)	—	—	• Water entitlement holder	See section 2.2.1.8 accomplishments in this table.
2.5.3.2 Future Water Conservation Practices (page 2-77)	—	• Institute new conservation measures for efficient water use	—	No implementation in 2016.

Federal Covered Actions *Biological Assessment* Chapter 2	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions[1]	2016 Accomplishments[2, 3]
2.5.3.5 Headgate Rock Dam Operation and Maintenance (page 2-88)	—	• Water releases and generate hydropower with these water releases	—	Existing practices were continued.
2.6 U.S. FISH AND WILDLIFE SERVICE	—	—	• Water entitlement holder	See section 2.2.1.8 accomplishments in this table.
2.7 BUREAU OF LAND MANAGEMENT	—	—	• Water entitlement holder	See section 2.2.1.8 accomplishments in this table.

[1] See the *Lower Colorado River Multi-Species Conservation Program Final Habitat Conservation Plan*, *Volume II*, "Section 2.1.1, Relationship of Non-Federal Covered Activities to Federal Nondiscretionary Actions." This can be accessed at http://www.lcrmscp.gov/publications/hcp_volii_dec04.pdf

[2] Reporting for the non-Federal flow-related covered activities (attachment B, table B-3) is included in the Federal flow-related covered actions and accomplishments.

[3] Flow-related Federal covered actions and flow-related non-Federal covered activities are reported for calendar year 2016.

B-2: Federal Non-Flow-Related Covered Actions and Incidental Take Summary, Fiscal Year 2016

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.2 BUREAU OF RECLAMATION										
2.2.3 Ongoing Non-Flow-Related (Facilities and Channel Activities) (page 2-36; Table 2-27, page 2-37)	• Operate, maintain, and control river in Arizona, California, and Nevada • Construct, maintain, and improve drainage works for water projects • Maintain floodway to accommodate floodflows for 100-year event or 40,000 cubic feet per second, whichever is greater • Measure diversions and return flows to and from the main stem of the Colorado River	—	• Administration of contracts for water district operation and maintenance of federally owned facilities							See line items in this table.
2.2.3.1 Channel Maintenance (page 2-38)	—	—	—							
Wash Fans (page 2-40; Table 2-30, page 2-42)	—	• Wash fan removal	—	4	Parker	151.1	Cattails Mesquite	1 1	1, 3, and 4	Quien Sabe Wash fan removal.
Protected Bankline Maintenance and Care of Unprotected Banklines (page 2-43)	—	• Protected bankline location and maintenance	—							No implementation in fiscal year (FY) 2016.

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
Levee Maintenance (page 2-44)	—	• Levee location and maintenance	—	7	Yuma	22.1	None	0	1, 3, and 4	Levee retaining wall repair.
Desilting Basins (page 2-46; Table 2-32, page 2-46)	—	• Sediment dredging upstream of principal canal diversions and disposal sites • Maintenance of settling basins to remove sediment and maintain flows; four principal basins	—							No implementation in FY16.
Jetties and Training Structures (page 2-47; Tables 2-33 – 2-34, page 2-48)	—	• Jetty and training structure location and maintenance	—							No implementation in FY16.
Stockpiles (page 2-49; Table 2-37, page 2-49)	—	• Location of three future stockpiles	—							No implementation in FY16.
Riprap Placement and Haul Roads (page 2-50)	—	• Haul roads and riprap storage location and maintenance	—	7	Limitrophe	0 to 24	None	0	1, 3, and 6	Limitrophe: 59.2 miles (mi)
				6	Yuma	24 to 50	None	0	1, 3, and 6	Yuma: 158.1 mi
				6	Laguna	24 to 50	None	0	1, 3, and 6	Laguna: 3 mi
				6	Gila River Area	24 to 50	None	0	1, 3, and 6	Gila River Area: 19.4 mi
				4	Cibola	87 to 193	None	0	1, 3, and 6	Cibola: 67.6 mi
				4	Palo Verde	87 to 193	None	0	1, 3, and 6	Palo Verde: 0.0 mi
				3	Mohave Valley	193 to 276	None	0	1, 3, and 6	Mohave Valley: 38.1 mi

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.2.3.2 Major Federal Facilities and Miscellaneous Operation, Maintenance, and Replacement (page 2-50; Table 2-36, after page 2-50)	—	• Maintenance of Yuma area drainage wells and conveyance facilities, including maintenance and access roads • Maintenance of open channel drains and outfall channels • Maintenance and replacement of gauging stations, survey line markers, and boat ramps • Senator Wash penstock repairs	—	7 7 7 7 7 6	242 Well Field South Gila Well Field Yuma Valley Well Field DPOC #1 MOD (7E) Senator Wash	3 32 15 34 30 51	None None None None None None	0 0 0 0 0 0	1, 3, and 6 1, 3, and 6 1, 3, and 6 1, 3, and 6 1, 3, and 6 1, 3, and 6	Maintenance work on 242-18. Maintenance work on SG-12 and SG-714. Maintenance work on YM-2, YM-11, YV-7, YV 17 ¼, YV-23 and YV-25. Concrete work at Pump Channel 1. Project completed in FY16. MOD – Replace headwalls at Fortuna Siphon Project and replaced 1,500 feet concrete downstream from DPOC 1. Project completed FY16. Replace coupling on Senator Wash penstock pipe.
Maintenance Activities at the Southerly International Boundary (page 2-52)	—									No implementation in FY16.
2.2.3.3 Backwater Maintenance (page 2-53; Table 2-37, page 2-54)	—	• Backwater maintenance	—							No implementation in FY16.
Mohave Division (page 2-55; Table 2-38, page 2-56)	—	• Backwater maintenance	—							No implementation in FY16.
Parker Division (page 2-57; Table 2-39, page 2-57)	—	• Backwater maintenance	—							No implementation in FY16.

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
Palo Verde Division (page 2-58; Table 2-40, page 2-58)	—	• Backwater maintenance	—							No implementation in FY16.
Cibola Division (page 2-58; Table 2-41, page 2-59)	—	• Backwater maintenance	—							No implementation in FY16.
Imperial Division (page 2-59; Table 2-42, page 2-59)	—	• Backwater maintenance	—							No implementation in FY16.
Laguna Division (page 2-60; Table 2-43, page 2-60)	—	• Backwater maintenance	—							No implementation in FY16.
Yuma Division (page 2-60; Table 2-44, page 2-61)	—	• Backwater maintenance	—							No implementation in FY16.
Limitrophe Division Mitigation Obligations (page 2-61; Table 2-45, page 2-62)	—	—	—							No implementation in FY16.
2.2.3.4 Limitrophe Division Maintenance (page 2-62)	—	—	—							No implementation in FY16.
2.2.4 Future Non-Flow-Related Actions (page 2-63)	—	—	—							
2.2.4.1 Topock Marsh (page 2-63)	—	—	—							No implementation in FY16.
2.2.4.2 Laguna Reservoir (page 2-63)	—	—	—	6	Laguna Dam	49.0	Cattails	7	1, 3, and 6	Laguna Reservoir Restoration Project. Ongoing dredging activities above Laguna Dam. The 7 acres is the total amount of cattail vegetation impacted to date.

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.2.4.3 Bankline Maintenance – Unprotected Banklines (page 2-65; Table 2-46, page 2-66)	—	—	—							No implementation in FY16.
2.2.4.4 Proposed Jetties (page 2-67; Table 2-48, page 2-67)	—	—	—							No implementation in FY16.
2.3 WESTERN AREA POWER ADMINISTRATION										No implementation in FY16.
2.4 NATIONAL PARK SERVICE										
2.4.2 Riparian Habitat Restoration (page 2-70)		• Riparian habitat restoration on Lake Mead and Lake Mohave			Lake Mead Lake Mohave		Sarah mustard Tamarisk Sahara mustard Fountain grass Tamarisk California fan palm Puncturevine Date palm Oleander Mexican paloverde	8 acres 4.55 acres 3 acres 1 acre 0.46 acre 0.31 acre 0.1 acre Small infestations		Habitat restoration through removal of exotic plants (gross infested acres).

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.4.3 Fishery Management (page 2-71)		• Habitat modifications on Lake Mead and Lake Mohave, including development and enhance-ment of grow-out ponds, construction of docks, and creation of angler enhancement structures			Lake Mohave			0.03 acre		Creation of fish habitat at Bass, Carp, Princess, Shoshone, and Solicitor Coves in partnership with the Nevada Division of Wildlife.
2.4.4 Boating Access (page 2-72)		• Maintenance and enhance-ment of boating access on Lake Mead and Lake Mohave			**Lake Mead** Echo Bay Callville Bay Hemenway Harbor Temple Bar South Cove			178 square yards (yd^2) 327 yd^2 871 yd^2 111 yd^2 149 yd^2		Extension of existing launch ramps.

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.5 BUREAU OF INDIAN AFFAIRS										
2.5.2.1 Ongoing Irrigation System Operation and Maintenance (page 2-74)		• Irrigation system operation and maintenance for existing irrigation projects		3	Fort Mohave	—	None	0	1 and 3	Continued existing practices.
				3	Chemehuevi	—	None	0	1 and 3	Continued existing practices.
				4	Colorado River Indian Tribe	—	None	0	1 and 3	Continued existing practices.
				6	Fort Yuma	—	None	0	1 and 3	Continued existing practices.
				7	Cocopah	—	None	0	1 and 3	Continued existing practices.
2.5.2.2 Ongoing Water Conservation Practices (page 2-77)		• Operation and maintenance of existing equipment								Continued existing practices.
2.5.2.4 Ongoing Wildland Fire Management (page 2-88)		•Implementation of fuel management projects								No implementation in FY16.
2.5.2.5 Ongoing Woodland and Shoreline Maintenance (page 2-82)		• Maintenance on Chemehuevi Woodlands Project								Continued existing practices.
2.5.3.1 Future Canal Lining (page 2-84)		• Repair, reline, and line irrigation canals								No implementation in FY16.
2.5.3.2 Future Water Conservation Practices (page 2-85)		• Installation, operation, and maintenance of new equipment								No implementation in FY16.

Federal Covered Actions *Biological Assessment* Chapter 2	Covered Actions Summary			Covered Actions Implemented						Notes
	Nondiscretionary Actions	Discretionary Actions	Nondiscretionary Actions Related to Non-Federal Actions	Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.5.3.3 Future Farmland Development (page 2-85)		• Develop additional agricultural acreage, including construction of irrigation systems								No Implementation in FY16.
2.5.3.6 Future Wildland Fire Management (page 2-88)		• Implementation of new fuel management projects								No implementation in FY16.
2.6 U.S. FISH AND WILDLIFE SERVICE										No non-flow-related actions are covered under the LCR MSCP.
2.7 BUREAU OF LAND MANAGEMENT										No non-flow-related actions are covered under the LCR MSCP.

B-3: LCR MSCP Non-Federal Covered Activities and Incidental Take Summary, Fiscal Year 2016

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.2 ARIZONA								
2.2.1 Ongoing Flow-Related Covered Activities[1] (page 2-4)	• Diversion of up to 2.8 maf of Arizona's full annual entitlement, plus surplus, plus Arizona's share of any unused apportionment, plus the volume of return flow, as applicable • Generation and transmission of hydroelectric power • Power contracting							Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1).
2.2.2 Future Flow-Related Covered Activities[1] (page 2-6)	Future Arizona water contract holder activities may include: • Diversions, discharges, and return flows through existing facilities • Changes to points of diversion • New points of diversion • Interstate water banking • Water marketing • Water transfers • Any other actions as made possible from any future agreements and/or measures taken by the Arizona Department of Water Resources or contract holder(s) Future Arizona hydroelectric power contract holder activities may include: • Execution, administration, and operation of extended, renewed, new, or additional contracts for hydroelectric power from hydroelectric facilities at Hoover Dam, Davis Dam, Parker Dam, Headgate Rock Dam, Siphon Drop Power Plant, and Pilot Knob Power Plant							Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1).

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.2.3 Ongoing Non-Flow-Related Covered Activities (page 2-7)	Operation, maintenance, and replacement of: • The facilities and equipment through which water is diverted and conveyed • The facilities through which return flows are returned to the river • Drainage wells in the Yuma area • The facilities and equipment through which electric power is generated and transmitted • The appurtenant works that support these facilities, including access and service roads, electric power and communication transmission lines, and substations, docks, boat ramps, and bankline protection	6	Yuma Valley	—	—	—	1 and 3	195 miles of canal maintenance and 60 miles of open drain maintenance.
2.2.3.1 Arizona Game and Fish Department Programs and Activities								
Vegetation and Habitat Management Programs (page 2-8)	• Aquatic, wetland, and riparian habitat maintenance and restoration activities							No implementation in FY16.

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
Fish Surveys (page 2-8)	• Surveys for non-native fish species							**Kingman Region:** Lake Mead: 2 nights gillnets, 4 nights electrofishing Lake Mohave: 2 nights gillnets, 2 nights electrofishing Topock Marsh: 2 nights gillnets **Yuma Region:** Lake Havasu: 3 nights electrofishing **Parker Strip:** 2 nights electrofishing **Palo Verde Division:** 1 night electrofishing **Imperial Division:** 2 nights electrofishing **Mittry Lake:** 2 nights electrofishing
Fish Stocking(page 2-9)	• Stocking of trout							No fish stocking activity.
Maintenance of Aids to Navigation and Boating Access (page 2-9)	• Place and maintain aids to navigation							Maintained 132 buoys, 1 boat dock, and 1 boat ramp.
Law Enforcement Patrol Activities (page 2-9)	• Administer law enforcement and boating safety program using watercraft patrols							An estimated 4,165 hours of watercraft law enforcement. Includes all Arizona Game and Fish Department Regions III and IV watercraft law enforcement patrols.

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.3 CALIFORNIA								
2.3.1 Ongoing Flow-Related Covered Activities[1] (page 2-11)	• Diversion of up to 4.4 maf of California's full annual entitlement (consistent with the Quantification Settlement Agreement), plus California's share of any unused apportionment and designated surpluses, plus volume of return flows, as applicable • Generation and transmission of hydroelectric power • Power contracting							Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1).
2.3.2 Future Flow-Related Covered Activities[1] (page 2-13)	Future California water contract holder activities may include: • Diversions, discharges, and return flows through existing facilities • Changes to points of diversion • New points of diversion • Interstate water banking • Water marketing • Water transfers • Any other actions as made possible from any future agreements and/or measures taken by the Colorado River Board of California or contract holder(s) Future California hydroelectric power contract holder activities may include: • Execution, administration, and operation of extended, renewed, new, or additional contracts for hydroelectric power from hydroelectric facilities at Hoover Dam, Davis Dam, Parker Dam, Headgate Rock Dam, Siphon Drop Power Plant, and Pilot Knob Power Plant							Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1).

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.3.3 Ongoing Non-Flow-Related Activities	Operation, maintenance, and replacement of: • The facilities and equipment through which water is diverted and conveyed • The facilities through which return flows are returned to the river • The facilities and equipment through which electric power is generated and transmitted • The appurtenant works that support these facilities, including access and service roads, electric power and communication transmission lines, and substations, docks, boat ramps, and bankline protection	4 6	Palo Verde Irrigation District Bard Water District	—	—	—	1 and 3 1 and 3	17.93 acres 6.1 acres Only emergency work during marsh bird breeding season March 15 – July 31.
2.4 NEVADA								
2.4.1 Ongoing Flow-Related Covered Activities[1] (page 2-15)	• Diversion of up to 0.3 maf of Nevada's full annual entitlement, plus surplus flows, plus Nevada's share of any unused apportionment, plus volume of return flows, as applicable • Generation and transmission of hydroelectric power • Power contracting							Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1).

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.4.2 Future Flow-Related Covered Activities (page 2-17)	Future Nevada water contract holder activities may include: • Diversions, discharges, and return flows through existing facilities • Changes to points of diversion • New points of diversion • Interstate water banking • Water marketing • Water transfers • Any other actions as made possible from any future agreements and/or measures taken by the Colorado River Commission of Nevada or contract holder(s) Future Nevada hydroelectric power contract holder activities may include: • Execution, administration, and operation of extended, renewed, new, or additional contracts for hydroelectric power from hydroelectric facilities at Hoover Dam, Davis Dam, Parker Dam, and Headgate Rock Dam							Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1).

Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2	Covered Activities Summary	Covered Activities Implemented						Notes
		Reach	Location	River Miles	Habitat Type Impacted	Number of Acres Impacted	Complied with Avoidance and Minimization Measures	
2.4.3 Ongoing Non-Flow-Related Activities (page 2-18)	Operation, maintenance, and replacement of: • The facilities and equipment through which water is diverted and conveyed • The facilities through which return flows are returned to the river • The facilities and equipment through which electric power is generated and transmitted • The appurtenant works that support these facilities, including access and service roads, electric power and communication transmission lines, and substations, docks, boat ramps, and bankline protection							No implementation in FY16.
2.4.3.1 Nevada Department of Wildlife Programs and Activities (page 2-18)	Implementation of select federally funded: • Aquatic, wetland, and riparian habitat maintenance and restoration activities	—	—	—	—	—	—	A total of 11 habitat modules were placed on approximately 0.1 acre at Princess, Prospect, Shoshone, and Solicitor Coves on Lake Mohave. Cooperative project with the National Park Service and the Arizona Game and Fish Department.
	• Aquatic, wetland, and riparian revegetation enhancement activities	—	—	—	—	—	—	No implementation in FY16.
	• Place and maintain aids to navigation and boating access	3	Clark County, downstream from Davis Dam	257.5 – 275.0	None	0	1 and 3	Performed routine maintenance and inspection of aids to navigation.
	• Administer law enforcement and boating safety program using watercraft patrols	1 and 2	—	Lake Mead – 275.0	None	0	1 and 3	Conducted routine law enforce-ment patrols on Lake Mead, Lake Mohave, main stem of the lower Colorado River below Davis Dam, and limited patrol activities in Laughlin Lagoon.

[1] See the *Lower Colorado River Multi-Species Conservation Program Final Habitat Conservation Plan*, *Volume II*, "Section 2.1.1, Relationship of Non-Federal Covered Activities to Federal Nondiscretionary Actions." This can be accessed at http://www.lcrmscp.gov/publications/hcp_volii_dec04.pdf

Attachment C – Recommendations from Resource Agencies

United States Department of the Interior
Fish and Wildlife Service
Arizona Ecological Services Office
9828 N. 31st Avenue Ste C3
Phoenix, AZ 85051
Telephone: (602) 242-0210 Fax: (602) 242-2513

AESO/SE
22410-2004-F-0161

July 12, 2016

Memorandum

To: Program Manager, Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation (Attention: John Swett)

From: Field Supervisor

Subject: Acceptance of Lower Colorado River Multi-Species Conservation Program: *Consistency Review for Final Implementation Report, Fiscal Year 2017 Work plan and Budget, Fiscal Year 2015 Accomplishment Report*

This responds to your memorandum dated June 28, 2015, requesting review by the Fish and Wildlife Service (Service) of the combined document containing the Fiscal Year 2015 Accomplishment Report and the Fiscal Year 2017 Work Plan and Budget for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). This combined document encompasses the reporting requirements of the LCR MSCP section 10(a)(1)(A) permit dated April 4, 2005, (TE-086834-0) and the biological and conference opinion dated March 4, 2005, and requirements of the Funding and Management Agreement sections 7.4.2. and 7.4.3.

The Fiscal Year 2017 Accomplishment Report details the activities undertaken by the Bureau of Reclamation (Reclamation) to implement the LCR MSCP in accordance with the section 10 permit and biological opinion. The report also lists the Federal actions and non-Federal activities included in the LCR MSCP as covered actions that were implemented during Fiscal Year 2015 covered by the LCR MSCP (October 1, 2014-September 31, 2015), including the reporting of incidental take that occurred during this period. The LCR MSCP Steering Committee voted to approve the report and submission to the Service on June 22, 2016.

We have reviewed the information provided and conclude that the document meets the requirements for the annual report for the LCR MSCP under the section 10(a)(1)(A) permit and the reporting requirements of the terms and conditions of the biological and conference opinion. All covered actions and activities and implementation of the Conservation Plan are suitably described and documented.

The Fiscal Year 2017 Work Plan and Budget contains the work tasks and estimated costs for LCR MSCP implementation during Fiscal Year 2017 beginning on October 1, 2016. We have

reviewed the Work Plan and determined that its implementation is directly applicable to meet the conservation requirements and is consistent with the LCR MSCP section 10(a)(1)(A) permit and biological opinion.

We appreciate the positive working relationship between the Service and Reclamation on the implementation of the LCR MSCP. The opportunity to review and contribute to the development of the Accomplishment Report and Work Plan is greatly appreciated. Thank you for your significant efforts to conserve listed and special-status species through the LCR MSCP.

If there are any questions or concerns about this response, please contact Jessica Gwinn, Mike Martinez, or me at (602) 242-0210.

Steven L. Spangle

cc (electronic):

Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES, Marty Tuegel)

W:\Jessica Gwinn\LCR MSCP 15-16 WorkplanBudget concurrence 07122016.docx: jkey

United States Department of the Interior
Fish and Wildlife Service
Arizona Ecological Services Office
9828 N. 31st Avenue, C3
Phoenix, Arizona 85051-2517
Telephone: (602) 242-0210 Fax: (602) 242-2513

In reply refer to:

AESO/SE
22410-2004-F-0161

February 1, 2017

OFFICIAL FILE COPY RECEIVED		
REPLY DATE		
DATE	INITIALS	CODE
2/10/17		LC-8001
		LC-8260
CLASSIFICATION		
PROJECT		
CONTROL NO.		
FOLDER ID		

Memorandum

To: Program Manager, Lower Colorado River Multi-Species Conservation Plan, Bureau of Reclamation, Boulder City, Nevada (LC-8315)

From: Field Supervisor

Subject: Approval of Minor Modification to the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Habitat Conservation Plan

This memorandum responds to your December 8, 2016, request for the U.S. Fish and Wildlife Service (Service) to approve a minor modification to the Bureau of Reclamation's (Reclamation) Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Habitat Conservation Plan. On April 27, 2016, the LCR MSCP Steering Committee approved minor modification to be implemented to the Funding and Management Agreement and the By-Laws in accordance with Section 4.1 of the Implementation Agreement. The purpose of these minor modifications is to allow Native American Tribes (Tribes) to be included as Permittees in the Native American Participant Group, rather than as Permittees participating under the respective State participant groups.

Program Decision Document 16-001 summarizes the minor modification. Under the authority of the Hoover Power Allocation Act of 2011 (HPAA), Public Law 112-72, Tribes can become Hoover Dam power contractors under Electrical Service Contracts with Western Area Power Administration (Schedule D contractors). All new Schedule D contractors, including Tribes, are required by HPAA, sect. 2(d), to pay a share to the LCR MSCP (as defined in section 9401 of the Omnibus Public Land Management Act of 2009 (Public Law 111-11; 123 Stat. 1327). Additionally, Tribes are given the option to receive a certificate of inclusion under the LCR MSCP, which solidifies their Section 10 coverage under the program. This minor modification to the LCR MSCP allows consistency with Section 7.3.2 E of the Funding and Management Agreement, and Section 2.2 E of the By-Laws, which outlines that members of the Native American Participant Group are tribes who own lands on or adjacent to, or who divert water from the Lower Colorado River, and will now include those tribes that are Permittees to undertake or implement Covered Activities within the states of Arizona, California, and Nevada. Sections that will be modified are as follows: Funding and Management Agreement Sections 7.3.2 B; 7.3.2 C; 7.3.2.D; and By-Laws Sections 2.2 B; 2.2 C; 2.2 D; 2.2 E. The Service approves these minor modifications to the Funding and Management Agreement and By-Laws of the LCR MSCP Habitat Conservation Plan.

The LCR MSCP has accomplished significant conservation benefits in the over ten years since it was signed in 2005. We look forward to our continuing involvement with this important program.

If there are other questions, or we may assist in any way, please contact Jessica Gwinn, or me at 602-242-0210.

Steven L. Spangle

cc: Chief, Nongame Branch, Arizona Game and Fish Department, Phoenix, AZ
Marty Tuegel, Environmental Review Supervisor, Ecological Services, Fish and Wildlife Services, Albuquerque, NM

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Attachment D – Financial Statement

D-1: Required Contributions

	FY06	FY07	FY08	FY09	FY10	Subtotal
Reclamation						
Cash	6,072,381.00	6,291,054.00	6,655,509.00	6,784,470.00	7,255,458.00	33,058,872.00
Reclamation Total	**6,072,381.00**	**6,291,054.00**	**6,655,509.00**	**6,784,470.00**	**7,255,458.00**	**33,058,872.00**
Arizona						
Cash	471,863.10	488,855.40	517,175.90	866,420.50	926,568.70	3,270,883.60
Habitat Maintenance Fund	135,375.00	140,250.00	148,375.00	151,250.00	161,750.00	737,000.00
Arizona Total	**607,238.10**	**629,105.40**	**665,550.90**	**1,017,670.50**	**1,088,318.70**	**4,007,883.60**
Nevada						
Cash	1,838,148.82	1,904,342.55	2,014,665.43	1,884,091.00	1,578,887.40	9,220,135.20
Habitat Maintenance Fund	135,375.00	140,250.00	148,375.00	151,250.00	161,750.00	737,000.00
In-Kind Credit	0	0	0	0	436,000.00	436,000.00
Nevada Total	**1,973,523.82**	**2,044,592.55**	**2,163,040.43**	**2,035,341.00**	**2,176,637.40**	**10,393,135.20**
California						
Cash	**3,220,869.08**	**3,336,856.05**	**3,530,167.67**	**3,266,131.22**	**3,492,870.91**	**16,846,894.93**
Metropolitan Water District of Southern California	1,887,361.54	1,955,327.46	2,068,604.00	1,939,074.72	2,073,688.19	9,924,055.91
Imperial Irrigation District	500,971.43	519,011.96	549,079.48	559,718.78	598,575.29	2,727,356.94
Coachella Valley Water District	273,257.15	283,097.43	299,497.92	305,301.15	326,495.61	1,487,649.26
Los Angeles Department of Water and Power	154,845.72	160,421.88	169,715.48	173,003.99	185,014.18	843,001.25
San Diego County Water Authority	145,737.14	150,985.30	159,732.19	0	0	456,454.63
Palo Verde Irrigation District	122,067.53	126,463.31	133,789.60	136,382.00	145,849.84	664,552.28
Southern California Public Power Authority	63,760.00	66,056.07	69,882.84	71,236.94	76,182.31	347,118.16
Southern California Edison Company	54,651.43	56,619.49	59,899.60	61,060.23	65,299.11	297,529.86
Bard	6,072.38	6,291.05	6,655.52	6,784.47	7,255.46	33,058.88
Colorado River Board of California	6,072.38	6,291.05	6,655.52	6,784.47	7,255.46	33,058.88
Needles	6,072.38	6,291.05	6,655.52	6,784.47	7,255.46	33,058.88
Funding Credit						
San Diego County Water Authority	**0**	**0**	**0**	**162,827.28**	**174,130.99**	**336,958.27**
Metropolitan Water District of Southern California	**0**	**0**	**0**	**0**	**0**	**0**
Habitat Maintenance Fund	**270,750.00**	**280,500.00**	**296,750.00**	**302,500.00**	**323,500.00**	**1,474,000.00**
California Total	**3,491,619.10**	**3,617,356.05**	**3,826,917.67**	**3,731,458.50**	**3,990,501.90**	**18,657,853.20**
TOTAL	**12,144,762.00**	**12,582,108.00**	**13,311,018.00**	**13,568,940.00**	**14,510,916.00**	**66,117,744.00**

	FY11	FY12	FY13	FY14	Underfunding	FY15
Reclamation						
Cash	16,400.070.00	16,661,700.00	17,226,270.00	17,570,520.00	0	18,699,660.00
Funding Credit					3,800,520.00	
Reclamation Total	**16,400.070.00**	**16,661,700.00**	**17,226,270.00**	**17,570,520.00**	**3,800,520.00**	**18,699,660.00**
Arizona						
Cash	1,120,135.50	1,138,005.00	926,991.00	818,554.00	0	1,502,461.88
Funding Credit					(20,219.36)	20,384.48
Habitat Maintenance Fund	1,339,875.00	1,361,250.00	1,407,375.00	1,732,170.00	338,020.32	1,201,002.18
Remedial Measures Fund	0	0	249,574.50	84,854.00	252,277.04	81,100.46
Arizona Total	**2,460,010.50**	**2,499,255.00**	**2,583,940.50**	**2,635,578.00**	**570,078.00**	**2,804,949.00**
Nevada						
Cash	3,144,146.00	3,637,260.00	3,510,931.50	3,454,132.00	0	4,307,245.77
Funding Credit					(40,438.72)	40,768.95
Habitat Maintenance Fund	1,339,875.00	1,361,250.00	1,407,375.00	1,732,170.00	338,020.32	1,201,002.18
Remedial Measures Fund	0	0	249,574.50	84,854.00	842,574.40	60,881.10
In-Kind Credit	436,000.00	0	0	0	0	0
Nevada Total	**4,920,021.00**	**4,998,510.00**	**5,167,881.00**	**5,271,156.00**	**1,140,156.00**	**5,609,898.00**
						California
Cash	**5,333,036.34**	**5,418,114.16**	**5,102,554.16**	**5,608,045.52**	**0**	**7,231,377.16**
Metropolitan Water District of Southern California	2,320,583.58	2,357,603.81	1,938,340.56	2,380,598.24	(698,099.89)	3,796,523.39
Imperial Irrigation District	1,353,005.78	1,374,590.25	1,421,167.27	1,449,567.90	313,542.90	1,542,721.95
Coachella Valley Water District	738,003.15	749,776.50	775,182.15	790,673.40	171,023.40	841,484.70
Los Angeles Department of Water and Power	418,201.78	424,873.35	439,269.89	448,048.26	96,913.26	476,841.33
San Diego County Water Authority	0	0	0	0	0	0
Palo Verde Irrigation District	134,240.47	136,382.00	141,003.21	143,821.02	31,108.63	153,063.44
Southern California Public Power Authority	172,200.74	174,947.85	180,875.84	184,490.46	39,905.46	196,346.43
Southern California Edison Company	147,600.63	149,955.30	155,036.43	158,134.68	34,204.68	168,296.94
Bard	16,400.07	16,661.70	17,226.27	17,570.52	3,800.52	18,699.66
Colorado River Board of California	16,400.07	16,661.70	17,226.27	17,570.52	3,800.52	18,699.66
Needles	16,400.07	16,661.70	17,226.27	17,570.52	3,800.52	18,699.66
Funding Credit						
San Diego County Water Authority	**393,601.68**	**399,880.80**	**413,430.48**	**421,692.48**	**91,212.48**	**448,791.84**
Metropolitan Water District of Southern California	**613,650.48**	**623,440.04**	**644,564.86**	**0**	**105,624.14**	**0**
Habitat Maintenance Fund	**2,679,750.00**	**2,722,500.00**	**2,814,750.00**	**3,464,340.00**	**654,015.00**	**2,424,030.00**
Remedial Measures Fund	**0**	**0**	**499,149.00**	**169,708.00**	**1,239,434.38**	**180,614.00**
California Total	**9,020,038.50**	**9,163,935.00**	**9,474,448.50**	**9,663,786.00**	**2,090,286.00**	**10,284,813.00**
TOTAL	**32,800,140.00**	**33,323,400.00**	**34,452,540.00**	**35,141,040.00**	**7,601.040.00**	**37,399,320.00**

	Subtotal FY11 – FY15	FY16	Total FY06 – FY16
Reclamation			
Cash	86,558,220.00	15,370,734.00	134,987,826.00
Funding Credit	3,800,520.00	0	3,800,520.00
Reclamation Total	**90,358,740.00**	**15,370,734.00**	**138,788,346.00**
Arizona			
Cash	5,506,147.38	4,296,894.80	13,073,925.78
Funding Credit	165.12	0	165.12
Habitat Maintenance Fund	7,379,692.50	0	8,116,692.50
Remedial Measures Fund	667,806.00	276,013.00	943,819.00
Arizona Total	**13,553,811.00**	**4,572,907.80**	**22,134,602.40**
Nevada			
Cash	18,053,715.27	3,201,558.35	30,475,408.82
Funding Credit	330.23	0	330.23
Habitat Maintenance Fund	7,379,692.50	0	8,116,692.50
Remedial Measures Fund	1,237,884.00	276,013.00	1,513,897.00
In-Kind Credit	436,000.00	0	872,000.00
Nevada Total	**27,107,622.00**	**3,477,571.35**	**40,978,328.55**
California			
Cash	**28,693,127.34**	**6,399,331.23**	**51,939,353.50**
Metropolitan Water District of Southern California	12,095,549.69	3,545,435.31	25,565,040.91
Imperial Irrigation District	7,454,596.05	1,268,085.56	11,450,038.55
Coachella Valley Water District	4,066,143.30	691,683.03	6,245,475.59
Los Angeles Department of Water and Power	2,304,147.87	391,953.72	3,539,102.84
San Diego County Water Authority	0	0	456,454.63
Palo Verde Irrigation District	739,618.77	156,332.10	1,560,503.15
Southern California Public Power Authority	948,766.78	161,392.71	1,457,277.65
Southern California Edison Company	813,228.66	138,336.61	1,249,095.13
Bard	90,358.74	15,370.73	138,788.35
Colorado River Board of California	90,358.74	15,370.73	138,788.35
Needles	90,358.74	15,370.73	138,788.35
Funding Credit			
San Diego County Water Authority	2,168,609.76	368,897.62	2,537,507.38
Metropolitan Water District of Southern California	1,987,279.52	0	1,987,279.52
Habitat Maintenance Fund	**14,759,385.00**	**0**	**16,233,385.00**
Remedial Measures Fund	**2,088,905.38**	**552,026.00**	**2,640,931.38**
California Total	**49,697,307.00**	**7,320,254.85**	**75,675,415.05**
TOTAL	**180,717,480.00**	**30,741,468.00**	**277,576,692.00**

D-2: Funding Credits

D-2a: San Diego County Water Authority

Credits Earned

FY	Credits Earned	Composite i	2003 Dollars	Total 2003 Dollars
2005	145,737.14	1.019	143,019.76	143,019.76
2006	500,000	1.083	461,680.51	604,700.27
2007	250,000	1.122	222,816.39	827,516.66
2008	3,298,069.94	1.187	2,778,491.95	3,606,008.61

Credits Used – Revised Inflation Rate

FY	Total 2003 Credits Available	2003 Credits Used	Composite i	Current Year Credits
2009	3,606,008.61	134,568.00	1.210	162,827.28
2010	3,471,440.61	134,568.00	1.294	174,130.99
2011	3,336,872.61	330,480.00	1.258*	415,743.84
2012	3,006,392.61	330,480.00	1.278*	422,353.44
2013	2,675,912.61	330,480.00	1.321*	436,564.08
2014	2,345,432.61	330,480.00	1.347*	445,156.56
2015	2,014,952.61	330,480.00	1.358	448,791.84
2016	1,684,472.61	265,968.00	1.387	368,897.62
2017	1,418,504.61	265,968.00	1.393	370,493.42
2018	1,152,536.61			

* Revised inflation rate.

D-2b: The Metropolitan Water District of Southern California

Credits Earned

FY	Credits Earned	Composite i	2003 Dollars	Total 2003 Dollars
2008	1,834,768.57	1.187	1,545,719.10	1,545,719.10

Credits Used – Revised Inflation Rate

FY	Total 2003 Credits Available	2003 Credits Used	Composite i	Current Year Credits
2011	1,545,719.10	515,239.70	1.258*	648,171.54
2012	1,030,479.40	515,239.70	1.278*	658,476.34
2013	515,239.70	515,239.70	1.321*	680,631.64
2014	0			

* Revised inflation rate.

D-2c: Nevada

Credits Earned

FY	Credits Earned	Composite i	2003 Dollars	Total 2003 Dollars
2014	40,438.72	1.347	30,021.32	30,021.32

Credits Used

FY	Total 2003 Credits Available	2003 Credits Used	Composite i	Current Year Credits
2015	30,021.32	30,021.32	1.358	40,768.95
2016	0			

D-2d: Arizona

Credits Earned

FY	Credits Earned	Composite i	2003 Dollars	Total 2003 Dollars
2014	20,219.36	1.347	15,010.66	15,010.66

Credits Used

FY	Total 2003 Credits Available	2003 Credits Used	Composite i	Current Year Credits
2015	15,010.66	15,010.66	1.358	20,384.48
2016	0			

Credits/Debits – Revised Inflation Rate

FY	Credits/Debits Earned	Composite i	2003 Dollars	Total 2003 Dollars
2004	1,559,739.07	1.000	1,559,739.07	1,559,739.07
2005	4,112,477.11	1.019	4,035,796.97	5,595,536.04
2006	(2,871,624.04)	1.083	(2,651,545.74)	2,943,990.30
2007	2,314,455.02	1.122	2,062,794.14	5,006,784.44
2008	(495,025.15)	1.187	(417,038.88)	4,589,745.56
2009	1,833,416.80	1.210	1,515,220.50	6,104,966.06
2010	7,099,834.74	1.294	5,486,734.73	11,591,700.73
2011	796,149.37	1.258*	632,869.13	12,224,569.86
2012	(3,105,120.42)	1.278*	(2,429,671.69)	9,794,898.17
2013	(2,174,507.51)	1.321*	(1,646,107.12)	8,148,791.05
Underfunding 2014	(3,800,520.00)	1.347*	(2,821,469.93)	5,327,321.12
2014	(1,054,326.44)	1.347*	(782,721.93)	4,544,599.19
2015	1,502,469.24	1.358	1,106,383.83	5,650,983.02
2016	(666,351.00)	1.387	(480,426.10)	5,170,556.92

*Revised inflation rate.

D-3: Funding Accounts

D-3a: Habitat Maintenance Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2006	$500,000	$500,000		$500,000	1.083	$541,500		$541,500.00	$541,500.00	$552,705.68
2007	$500,000	$500,000		$500,000	1.122	$561,000		$561,000.00	$1,102,500.00	$1,154,574.04
2008	$500,000	$500,000		$500,000	1.187	$593,500		$593,500.00	$1,696,000.00	$1,812,275.61
2009	$500,000	$500,000		$500,000	1.210	$605,000		$605,000.00	$2,301,000.00	$2,467,094.21
2010	$500,000	$500,000		$500,000	1.294	$647,000		$647,000.00	$2,948,000.00	$3,154,714.70
2011	$4,500,000	$4,500,000		$4,500,000	1.191*	$5,359,500		$5,359,500.00	$8,307,500.00	$8,579,502.74
2012	$4,500,000	$4,500,000		$4,500,000	1.210*	$5,445,000		$5,445,000.00	$13,752,500.00	$14,164,435.13
2013	$4,500,000	$4,500,000		$4,500,000	1.251*	$5,629,500		$5,629,500.00	$19,382,000.00	$19,884,284.86
2014	$4,500,000	$4,500,000	$930,000	$5,430,000	1.276*	$5,742,000	$1,186,680.00	$6,928,680.00	$26,310,680.00	
2014 Underfunding Makeup						$654,015		$654,015.00	$26,964,695.00	
2014 Underfunding Overpay							$22,025.64	$22,025.64	$26,986,720.64	$27,619,568.11
2015 Underfunding Makeup							$654,015.00	$654,015.00	$27,640,735.64	
2015	$4,500,000	$3,570,000		$3,570,000	1.358	$4,848,060	($22,025.64)	$4,826,034.36	$32,446,770.00	$33,051,595.90
2016										$33,464,227.50
Total	**$25,000,000**	**$24,070,000**	**$930,000**	**$25,000,000**						
Program Total	**$25,000,000**			**$25,000,000**						

* Revised inflation rate.

Arizona Habitat Maintenance Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2006	$125,000	$125,000		$125,000	1.083	$135,375.00		$135,375.00	$135,375.00	$138,251
2007	$125,000	$125,000		$125,000	1.122	$140,250.00		$140,250.00	$275,625.00	$287,860
2008	$125,000	$125,000		$125,000	1.187	$148,375.00		$148,375.00	$424,000.00	$444,052.83
2009	$125,000	$125,000		$125,000	1.210	$151,250.00		$151,250.00	$575,250.00	$596,037.45
2010	$125,000	$125,000		$125,000	1.294	$161,750.00		$161,750.00	$737,000.00	$757,787.45
2011	$1,125,000	$1,125,000		$1,125,000	1.191*	$1,339,875.00		$1,339,875.00	$2,076,875.00	$2,097,622.45
2012	$1,125,000	$1,125,000		$1,125,000	1.210*	$1,361,250.00		$1,361,250.00	$3,438,125.00	$3,458,912.45
2013	$1,125,000	$1,125,000		$1,125,000	1.251*	$1,407,375.00		$1,407,375.00	$4,845,500.00	$4,866,287.45
2014	$1,125,000	$1,125,000	$232,500	$1,357,500	1.276*	$1,435,500.00	$296,670	$1,732,170.00	$6,577,670.00	
2014 Underfunding Makeup						$327,007.50		$327,007.50	$6,904,677.50	
2014 Underfunding Overpay							$11,012.82	$11,012.82	$6,915,690.32	$6,936,580.16
2015	$1,125,000	$892,500		$892,500	1.358	$1,212,015.00	($11,012.82)	$1,201,002.18	$8,116,692.50	$8,137,521.39
2016										$8,146,823.02
Total	**$6,250,000**	**$6,017,500**	**$232,500**	**$6,250,000**						
Program Total	**$6,250,000**			**$6,250,000**						

* Original inflation rate.

Nevada Habitat Maintenance Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2006	$125,000	$125,000		$125,000	1.083	$135,375.00		$135,375.00	$135,375.00	$137,378.85
2007	$125,000	$125,000		$125,000	1.122	$140,250.00		$140,250.00	$275,625.00	$286,813.26
2008	$125,000	$125,000		$125,000	1.187	$148,375.00		$148,375.00	$424,000.00	$453,778.83
2009	$125,000	$125,000		$125,000	1.210	$151,250.00		$151,250.00	$575,250.00	$619,413.59
2010	$125,000	$125,000		$125,000	1.294	$161,750.00		$161,750.00	$737,000.00	$789,731.22
2011	$1,125,000	$1,125,000		$1,125,000	1.191*	$1,339,875.00		$1,339,875.00	$2,076,875.00	$2,133,479.56
2012	$1,125,000	$1,125,000		$1,125,000	1.210*	$1,361,250.00		$1,361,250.00	$3,438,125.00	$3,500,534.71
2013	$1,125,000	$1,125,000		$1,125,000	1.251*	$1,407,375.00		$1,407,375.00	$4,845,500.00	$4,920,897.14
2014	$1,125,000	$1,125,000	$232,500	$1,357,500	1.276*	$1,435,500.00	$296,670.00	$1,732,170.00	$6,577,670.00	
2014 Underfunding Makeup						$327,007.50		$327,007.50	$6,904,677.50	
2014 Underfunding Overpay							$11,012.82	$11,012.82	$6,915,690.32	$7,005,875.48
2015	$1,125,000	$892,500		$892,500	1.358	$1,212,015.00	($11,012.82)	$1,201,002.18	$8,116,692.50	$8,236,569.18
2016										$8,274,230.08
Total	**$6,250,000**	**$6,017,500**	**$232,500**	**$6,250,000**						
Program Total	**$6,250,000**			**$6,250,000**						

* Original inflation rate.

California Habitat Maintenance Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2006	$250,000	$250,000		$250,000	1.083	$270,750.00		$270,750.00	$270,750.00	$277,075.83
2007	$250,000	$250,000		$250,000	1.122	$280,500.00		$280,500.00	$551,250.00	$579,900.78
2008	$250,000	$250,000		$250,000	1.187	$296,750.00		$296,750.00	$848,000.00	$914,443.95
2009	$250,000	$250,000		$250,000	1.210	$302,500.00		$302,500.00	$1,150,500.00	$1,251,643.17
2010	$250,000	$250,000		$250,000	1.294	$323,500.00		$323,500.00	$1,474,000.00	$1,607,196.03
2011	$2,250,000	$2,250,000		$2,250,000	1.191*	$2,679,750.00		$2,679,750.00	$4,153,750.00	$4,348,400.73
2012	$2,250,000	$2,250,000		$2,250,000	1.210*	$2,722,500.00		$2,722,500.00	$6,876,250.00	$7,204,987.97
2013	$2,250,000	$2,250,000		$2,250,000	1.251*	$2,814,750.00		$2,814,750.00	$9,691,000.00	$10,097,100.27
2014	$2,250,000	$2,250,000	$465,000	$2,715,000	1.276*	$2,871,000.00	$593,340.00	$3,464,340.00	$13,155,340.00	$13,677,112.47
2015 Underfunding Makeup							$654,015.00	$654,015.00	$13,809,355.00	
2015	$2,250,000	$1,785,000		$1,785,000	1.358	$2,424,030.00		$2,424,030.00	$16,233,385.00	$16,677,505.33
2016										$17,043,174.40
Total	**$12,500,000**	**$12,035,000**	**$465,000**	**$12,500,000**						
Program Total	**$12,500,000**			**$12,500,000**						

* Original inflation index.

D-3b: Remedial Measures Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2011	$266,000									
2012	$266,000									
2013	$266,000	$798,000	$0	$798,000	1.251*	$998,298.00	$0	$998,298.00	$998,298.00	$1,001,102.71
2014	$266,000	$266,000	$0	$266,000	1.276*	$339,416.00	$0	$339,416.00	$1,337,714.00	
2014 Underfunding Makeup						$37,373.00		$37,373.00	$1,375,087.00	
2014 Underfunding Makeup Additional			$756,381.59	$756,381.59	1.347		$1,018,846.00	$1,018,846.00	$2,393,933.00	
2014 Underfunding Overpay							$38,632.44	$38,632.44	$2,432,565.44	$2,441,713.88
2015 Underfunding Makeup						$37,373.00		$37,373.00	$2,469,938.44	
2015 Underfunding Makeup Additional			$892,398.95	$892,398.95	1.347		$1,202,061.38	$1,202,061.38	$3,671,999.82	
2015	$266,000	$266,000		$266,000	1.358	$361,228.00	($38,632.44)	$322,595.56	$3,994,595.38	$4,019,296.52
2016	$796,000	$796,000	$0	$796,000	1.387	$1,104,052.00	$0	$1,104,052.00	$5,098,647.38	$5,154,340.85
2017	$796,000	$796,000	$0	$796,000	1.393	$1,108,828.00	$0	$1,108,828.00		
2018	$796,000	$796,000	$0	$796,000	1.410	$1,122,360.00	$0	$1,122,360.00		
Total	$3,718,000	$3,718,000	$1,648,780.54	$5,366,780.54						
Program Total	**$13,270,000**			**$13,270,000.00**						

* Original inflation index.

Arizona Remedial Measures Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2011	$66,500									
2012	$66,500									
2013	$66,500	$199,500.00	$0	$199,500.00	1.251*	$249,574.50	$0	$249,574.50	$249,574.50	$249,574.50
2014	$66,500	$66,500.00	$0	$66,500.00	1.276*	$84,854.00	$0	$84,854.00	$334,428.50	
2014 Underfunding Makeup						$18,686.50		$18,686.50	$353,115.00	
2014 Underfunding Makeup Additional			$166,580.55	$166,580.55	1.347		$224,384.00	$224,384.00	$577,495.00	
2014 Underfunding Overpay							$9,206.54	$9,206.54	$586,705.54	$586,705.54
2015	$66,500	$66,500.00		$66,500.00	1.358	$90,307.00	($9,206.54)	$81,100.46	$667,806.00	$667,806.00
2016	$199,000	$199,000	$0		1.387	$276,013.00	$0	$276,013.00	943,819.00	$944,722.67
2017	$199,000	$199,000	$0		1.393	$277,207.00	$0	$277,207.00		
2018	$199,000	$199,000	$0		1.410	$280,590.00	$0	$280,590.00		
Total	**$929,500**	**$929,500**	**$166,580.55**	**$1,096,080.55**						
Program Total	**$3,317,500**			**$3,317,500.00**						

* Original inflation index.

Nevada Remedial Measures Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2011	$66,500									
2012	$66,500									
2013	$66,500	$199,500.00	$0	$199,500.00	1.251*	$249,574.50	$0	$249,574.50	$249,574.50	$249,601.70
2014	$66,500	$66,500.00	$0	$66,500.00	1.276*	$84,854.00	$0	$84,854.00	$334,428.50	
2014 Underfunding Makeup						$18,686.50		$18,686.50	$353,115.00	
2014 Underfunding Makeup Additional			$589,801.04	$589,801.04	1.347		$794,462.00	$794,462.00	$1,147,577.00	
2014 Underfunding Overpay							$29,425.90	$29,425.90	$1,177,002.90	$1,177,637.60
2015	$66,500	$66,500.00		$66,500.00	1.358	$90,307.00	($29,425.90)	$60,881.10	$1,237,884.00	$1,242,877.63
2016	$199,000	$199,000	$0	$199,000	1.387	$276,013.00	$0	$276,013.00	$1,513,897.00	$1,524,135.35
2017	$199,000	$199,000	$0	$199,000	1.393	$277,207.00	$0	$277,207.00		
2018	$199,000	$199,000	$0	$199,000	1.410	$280,590.00	$0	$280,590.00		
Total	**$929,500**	**$929,500**	**$589,801.04**	**$1,519,301.04**						
Program Total	**$3,317,500**			**$3,317,500.00**						

* Original inflation index.

California Remedial Measures Fund

FY	HCP Table 7-1 2003 Dollars	Required 2003 Dollars	Additional 2003 Dollars	Total 2003 Dollars	i	Required Current Year Dollars	Additional Current Year Dollars	Total Current Year Dollars	Cumulative Current Year Dollars	Cumulative With Interest Current Year Dollars
2011	$133,000									
2012	$133,000									
2013	$133,000	$399,000	$0	$399,000	1.251*	$499,149.00	$0	$499,149.00	$499,149.00	$501,926.51
2014	$133,000	$133,000	$0	$133,000.00	1.276*	$169,708.00	$0	$169,708.00	$668,857.00	$677,370.74
2015 Underfunding Makeup						$37,373.00		$37,373.00	$706,230.00	
2015 Underfunding Makeup Additional			$892,398.95	$892,398.95	1.347		$1,202,061.38	$1,202,061.38	$1,908,291.38	
2015	$133,000	$133,000		$133,500.00	1.358	$180,614.00		$180,614.00	$2,088,905.38	$2,108,612.89
2016	$398,000	$398,000	$0	$398,000	1.387	$552,026.00	$0	$552,026.00	$2,640,931.38	$2,685,482.83
2017	$398,000	$398,000	$0	$398,000	1.393	$554,414.00	$0	$554,414.00		
2018	$398,000	$398,000	$0	$398,000	1.410	$561,180.00	$0	$561,180.00		
Total	**$1,859,000**	**$1,859,000**	**$892,398.95**	**$2,751,398.95**						
Program Total	**$6,635,000**			**$6,635,000.00**						

* Original inflation index.

D-3c: Land and Water Fund

FY	Current Year Contributions	Current Year Withdrawals	Cumulative Contributions
2011	$8,900,000	$0	$8,900,000
2012	$4,600,000	$0	$13,500,000
2013	$0	$0	$13,500,000
2014	$0	$0	$13,500,000
2015	$6,100,000	$0	$19,600,000
2016	$4,100,000	$8,300,000	$15,400,000

D-4: Cumulative Program Accomplishment

Work Task	2004 Obligations	2004 Expenditures	2005 Obligations	2005 Expenditures	Subtotal Expenditures
A1	$0.00	$0.00	$421,740.74	$403,953.57	$403,953.57
G2	$0.00	$0.00	$0.00	$0.00	$0.00
Total A	**$0.00**	**$0.00**	**$421,740.74**	**$403,953.57**	**$403,953.57**
B1	$55,223.00	$55,223.00	$115,645.72	$115,645.72	$170,868.72
B2	$0.00	$0.00	$155,810.60	$145,568.04	$145,568.04
B3	$200,000.00	$0.00	$0.00	$14,527.30	$14,527.30
B4	$0.00	$0.00	$100,000.00	$9,857.95	$9,857.95
B5	$0.00	$0.00	$108.50	$40,720.81	$40,720.81
B6	$0.00	$0.00	$25,878.76	$25,878.76	$25,878.76
B7	$0.00	$0.00	$186,003.61	$186,003.61	$186,003.61
B8	$54,762.00	$54,762.00	$70,030.00	$70,030.00	$124,792.00
B9	$0.00	$0.00	$3,073.11	$3,073.11	$3,073.11
B10	$0.00	$0.00	$0.00	$0.00	$0.00
B11	$0.00	$0.00	$0.00	$0.00	$0.00
Total B	**$309,985.00**	**$109,985.00**	**$656,550.30**	**$611,305.30**	**$721,290.30**
C1	$0.00	$0.00	$45,276.00	$45,276.00	$45,276.00
C2	$0.00	$0.00	$0.00	$0.00	$0.00
C3	$0.00	$0.00	$0.00	$0.00	$0.00
C4	$0.00	$0.00	$0.00	$0.00	$0.00
C5	$0.00	$0.00	$0.00	$0.00	$0.00
C6	$0.00	$0.00	$0.00	$0.00	$0.00
C7	$0.00	$0.00	$0.00	$0.00	$0.00
C8	$0.00	$0.00	$177,053.00	$136,060.00	$136,060.00
C9	$0.00	$0.00	$43,816.00	$43,816.00	$43,816.00
C10	$0.00	$0.00	$0.00	$0.00	$0.00
C11	$0.00	$0.00	$0.00	$0.00	$0.00
C12	$0.00	$0.00	$0.00	$0.00	$0.00
C13	$0.00	$0.00	$99,996.80	$99,996.80	$99,996.80

Work Task	2004 Obligations	2004 Expenditures	2005 Obligations	2005 Expenditures	Subtotal Expenditures
C14	$0.00	$0.00	$0.00	$0.00	$0.00
C15	$0.00	$0.00	$22,255.00	$22,255.00	$22,255.00
C16	$0.00	$0.00	$0.00	$0.00	$0.00
C17	$0.00	$0.00	$45,000.00	$9,750.00	$9,750.00
C18	$0.00	$0.00	$41,981.82	$41,981.82	$41,981.82
C19	$0.00	$0.00	$0.00	$0.00	$0.00
C20	$64,011.00	$0.00	$53,779.96	$53,779.96	$53,779.96
C21	$0.00	$0.00	$95,534.00	$70,000.00	$70,000.00
C22	$0.00	$0.00	$48,096.00	$0.00	$0.00
C23	$0.00	$0.00	$0.00	$0.00	$0.00
C24	$0.00	$0.00	$0.00	$0.00	$0.00
C25	$0.00	$0.00	$0.00	$0.00	$0.00
C26	$0.00	$0.00	$0.00	$0.00	$0.00
C27	$0.00	$0.00	$0.00	$0.00	$0.00
C28	$0.00	$0.00	$0.00	$0.00	$0.00
C29	$0.00	$0.00	$0.00	$0.00	$0.00
C30	$0.00	$0.00	$0.00	$0.00	$0.00
C31	$0.00	$0.00	$0.00	$0.00	$0.00
C32	$0.00	$0.00	$0.00	$0.00	$0.00
C33	$0.00	$0.00	$0.00	$0.00	$0.00
C34	$0.00	$0.00	$0.00	$0.00	$0.00
C35	$0.00	$0.00	$0.00	$0.00	$0.00
C36	$0.00	$0.00	$0.00	$0.00	$0.00
C37	$0.00	$0.00	$0.00	$0.00	$0.00
C38	$0.00	$0.00	$0.00	$0.00	$0.00
C39	$0.00	$0.00	$0.00	$0.00	$0.00
C40	$0.00	$0.00	$0.00	$0.00	$0.00
C41	$0.00	$0.00	$0.00	$0.00	$0.00
C42	$0.00	$0.00	$0.00	$0.00	$0.00
C43	$0.00	$0.00	$0.00	$0.00	$0.00

Work Task	2004 Obligations	2004 Expenditures	2005 Obligations	2005 Expenditures	Subtotal Expenditures
C44	$0.00	$0.00	$0.00	$0.00	$0.00
C45	$0.00	$0.00	$0.00	$0.00	$0.00
C46	$0.00	$0.00	$0.00	$0.00	$0.00
C47	$0.00	$0.00	$0.00	$0.00	$0.00
C48	$0.00	$0.00	$0.00	$0.00	$0.00
C49	$0.00	$0.00	$0.00	$0.00	$0.00
C50	$0.00	$0.00	$0.00	$0.00	$0.00
Total C	**$64,011.00**	**$0.00**	**$672,788.58**	**$522,915.58**	**$522,915.58**
D1	$0.00	$0.00	$29,367.09	$29,367.09	$29,367.09
D2	$0.00	$0.00	$750,000.00	$370,174.62	$370,174.62
D3	$0.00	$0.00	$0.00	$0.00	$0.00
D4	$0.00	$0.00	$60,520.00	$60,520.00	$60,520.00
D5	$0.00	$0.00	$247,118.33	$247,118.33	$247,118.33
D6	$0.00	$0.00	$0.00	$0.00	$0.00
D7	$0.00	$0.00	$0.00	$0.00	$0.00
D8	$0.00	$0.00	$134,246.08	$134,246.08	$134,246.08
D9	$55,000.00	$0.00	$0.00	$0.00	$0.00
D10	$0.00	$0.00	$0.00	$0.00	$0.00
D11	$400,000.00	$168,133.36	$341,866.45	$100,963.76	$269,097.12
D12	$0.00	$0.00	$0.00	$0.00	$0.00
Total D	**$455,000.00**	**$168,133.36**	**$1,563,117.95**	**$942,389.88**	**$1,110,523.24**
E1	$1,077,729.33	$835,629.33	$348,991.39	$388,028.39	$1,223,657.72
E2	$0.00	$0.00	$147,333.85	$147,333.85	$147,333.85
E3	$1,037,791.00	$400,290.00	$31,268.45	$83,721.77	$484,011.77
E4	$0.00	$0.00	$17,278.54	$17,278.54	$17,278.54
E5	$0.00	$0.00	$80,058.95	$100,548.43	$100,548.43
E6	$110,004.00	$0.00	$109,927.52	$79,586.39	$79,586.39
E7	$0.00	$0.00	$370,437.68	$312,199.68	$312,199.68
E8	$0.00	$0.00	$1,035.50	$1,035.50	$1,035.50
E9	$0.00	$0.00	$53,320.19	$53,320.19	$53,320.19

Work Task	2004 Obligations	2004 Expenditures	2005 Obligations	2005 Expenditures	Subtotal Expenditures
E10	$0.00	$0.00	$0.00	$0.00	$0.00
E11	$0.00	$0.00	$0.00	$0.00	$0.00
E12	$6,673.38	$6,673.38	$70,893.38	$25,754.05	$32,427.43
E13	$0.00	$0.00	$48,482.00	$25,912.33	$25,912.33
E14	$0.00	$0.00	$84,309.07	$84,309.07	$84,309.07
E15	$0.00	$0.00	$0.00	$0.00	$0.00
E16	$0.00	$0.00	$134,814.86	$5,392.59	$5,392.59
E17	$0.00	$0.00	$0.00	$0.00	$0.00
E18	$0.00	$0.00	$0.00	$0.00	$0.00
E19	$0.00	$0.00	$0.00	$0.00	$0.00
E20	$95,000.00	$35,000.00	$0.00	$0.00	$35,000.00
E21	$0.00	$0.00	$19,729.97	$19,739.97	$19,739.97
E22	$5,088.00	$4,028.00	$0.00	$0.00	$4,028.00
E23	$0.00	$0.00	$0.00	$0.00	$0.00
E24	$0.00	$0.00	$0.00	$0.00	$0.00
E25	$0.00	$0.00	$0.00	$0.00	$0.00
E25 In-Kind	$0.00	$0.00	$0.00	$0.00	$0.00
E26	$0.00	$0.00	$0.00	$0.00	$0.00
E27	$0.00	$0.00	$0.00	$0.00	$0.00
E28	$0.00	$0.00	$0.00	$0.00	$0.00
E29	$0.00	$0.00	$0.00	$0.00	$0.00
E30	$0.00	$0.00	$0.00	$0.00	$0.00
E31	$0.00	$0.00	$0.00	$0.00	$0.00
Total E	**$2,332,285.71**	**$1,281,620.71**	**$1,517,881.35**	**$1,344,160.75**	**$2,625,781.46**

Work Task	2004 Obligations	2004 Expenditures	2005 Obligations	2005 Expenditures	Subtotal Expenditures
F1	$0.00	$0.00	$199,492.67	$199,492.67	$199,492.67
F2	$0.00	$0.00	$65,235.81	$65,235.81	$65,235.81
F3	$0.00	$0.00	$23,023.55	$23,023.55	$23,023.55
F4	$0.00	$0.00	$0.00	$0.00	$0.00
F5	$0.00	$0.00	$0.00	$0.00	$0.00
F6	$0.00	$0.00	$0.00	$0.00	$0.00
F7	$0.00	$0.00	$0.00	$0.00	$0.00
Total F	**$0.00**	**$0.00**	**$287,752.03**	**$287,752.03**	**$287,752.03**
G1	$235,000.00	$0.00	$0.00	$0.00	$0.00
G3	$0.00	$0.00	$0.00	$0.00	$0.00
G4	$0.00	$0.00	$0.00	$0.00	$0.00
Total G	**$235,000.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
H1	$0.00	$0.00	$0.00	$0.00	$0.00
H2	$0.00	$0.00	$0.00	$0.00	$0.00
Total H	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
I1	$0.00	$0.00	$0.00	$0.00	$0.00
G5	$0.00	$0.00	$0.00	$0.00	$0.00
Total I	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
GRAND Totals	**$3,396,281.71**	**$1,559,739.07**	**$5,119,830.95**	**$4,112,477.11**	**$5,672,216.18**

Work Task	2006 Obligations	2006 Expenditures	2007 Obligations	2007 Expenditures	2008 Obligations	2008 Expenditures	2009 Obligations	2009 Expenditures	2010 Obligations	2010 Expenditures	Subtotal Expenditures
A1	$1,120,653.36	$1,138,440.53	$1,052,867.52	$1,037,492.71	$965,660.35	$965,660.35	$1,052,853.25	$1,052,853.25	$1,296,959.74	$1,255,046.41	$5,449,493.25
G2	$57,262.87	$57,262.87	$73,272.35	$73,272.35	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$130,535.22
Total A	**$1,177,916.23**	**$1,195,703.40**	**$1,126,139.87**	**$1,110,765.06**	**$965,660.35**	**$965,660.35**	**$1,052,853.25**	**$1,052,853.25**	**$1,296,959.74**	**$1,255,046.41**	**$5,580,028.47**
B1	$222,390.86	$216,316.31	$227,440.83	$246,686.92	$149,085.82	$144,764.64	$206,001.63	$223,658.88	$234,965.09	$234,965.09	$1,066,391.84
B2	$206,485.90	$206,485.90	$233,348.47	$149,191.21	$334,013.77	$330,768.94	$503,628.30	$417,210.83	$352,255.56	$555,904.57	$1,659,561.45
B3	$13,190.17	$13,190.17	$41,588.73	$41,588.73	$102,288.46	$77,288.46	$169,669.00	$179,239.39	$95,522.93	$106,304.52	$417,611.27
B4	$127,627.57	$54,248.17	$117,698.86	$174,269.47	$140,519.61	$86,110.71	$229,364.46	$212,292.78	$269,833.73	$318,418.43	$845,339.56
B5	$176,017.60	$121,570.05	$301,359.83	$95,138.87	$303,301.12	$186,455.13	$259,449.57	$231,055.42	$351,957.84	$481,429.95	$1,115,649.42
B6	$101,713.03	$36,713.03	$20,654.33	$50,255.33	$48,190.46	$10,897.25	$31,769.89	$59,462.10	$41,521.10	$77,031.09	$234,358.80
B7	$205,640.44	$167,528.16	$136,000.40	$171,075.40	$173,950.09	$173,950.09	$185,238.41	$185,238.41	$165,056.32	$165,056.32	$862,848.38
B8	$50,869.73	$50,869.73	$46,711.07	$46,711.07	$66,890.83	$66,890.83	$73,421.00	$26,111.00	$78,710.75	$126,020.75	$316,603.38
B9	$570.14	$570.14	-$36.00	-$36.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$534.14
B10	$57,122.00	$0.00	$260,000.00	$147,305.11	$74,191.86	$126,084.93	$89,956.67	$122,880.49	$70,053.15	$140,878.20	$537,148.73
B11	$39,704.30	$39,704.30	$67,010.31	$2,010.31	$16,879.79	$28,895.98	$119,439.72	$47,327.37	$53,930.37	$132,727.00	$250,664.96
Total B	**$1,201,331.74**	**$907,195.96**	**$1,451,776.83**	**$1,124,196.42**	**$1,409,311.81**	**$1,232,106.96**	**$1,867,938.65**	**$1,704,476.67**	**$1,713,806.84**	**$2,338,735.92**	**$7,306,711.93**
C1	$73,525.15	$72,382.15	$0.00	$29,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$101,382.15
C2	$10,000.00	$0.00	$10,000.00	$0.00	$10,000.00	$20,000.00	$10,000.00	$20,000.00	$10,000.00	$10,000.00	$50,000.00
C3	$161,445.47	$161,445.47	$34,848.11	$34,848.11	$4,637.56	$4,637.56	$11,547.48	$11,547.48	$13,285.36	$13,285.36	$225,763.98
C4	$14,128.53	$4,128.53	$11,780.56	$1,780.56	$12,667.29	$22,667.29	$15,557.23	$25,557.23	$11,532.14	$10,648.80	$64,782.41
C5	$8,583.92	$8,583.92	$47,425.58	$47,425.58	$82,971.14	$82,971.14	$83,428.78	$83,428.78	$97,189.14	$97,189.14	$319,598.56
C6	$76,875.35	$76,875.35	$26,676.33	$26,676.33	-$2,110.00	-$2,110.00	$0.00	$0.00	$0.00	$0.00	$101,441.68
C7	$189,789.41	$68,121.58	$80,818.40	$102,387.02	$88,573.21	$148,829.53	$129,403.53	$110,818.42	$58,380.22	$116,808.22	$546,964.77
C8	$187,973.54	$108,932.54	$180,751.80	$157,708.80	$190,297.91	$142,918.10	$23,606.34	$39,115.60	-$4,417.26	-$4,417.26	$444,257.78
C9	$30,253.86	$5,828.86	$38,785.76	$63,210.76	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$69,039.62
C10	$63,519.00	$47,365.78	$106,382.73	$116,382.73	$159,000.24	$156,041.84	$132,905.58	$51,983.16	$127,882.41	$204,288.36	$576,061.87
C11	$95,301.06	$44,091.06	$142,660.83	$147,083.82	$128,801.82	$121,895.64	$135,376.13	$98,043.33	$160,883.55	$137,378.89	$548,492.74
C12	$173,576.33	$122,584.33	$184,685.94	$155,160.86	$174,728.02	$155,237.02	$184,842.91	$209,012.49	$216,432.73	$171,572.67	$813,567.37
C13	$265,621.17	$160,471.22	$302,066.02	$325,075.86	$147,816.23	$170,683.76	$149,876.40	$209,148.98	$341,670.90	$266,310.38	$1,131,690.20
C14	$38,229.17	$8,229.17	$67.52	$67.52	$0.00	$0.00	$65,136.31	$13,360.30	$67,997.50	$63,679.95	$85,336.94

Work Task	2006 Obligations	2006 Expenditures	2007 Obligations	2007 Expenditures	2008 Obligations	2008 Expenditures	2009 Obligations	2009 Expenditures	2010 Obligations	2010 Expenditures	Subtotal Expenditures
C15	$98,025.48	$98,025.48	$92,892.96	$92,892.96	$81,892.97	$81,892.97	$80,882.78	$80,882.78	$96,551.48	$96,551.48	$450,245.67
C16	$0.00	$0.00	$55,332.60	$18,882.60	$0.00	$36,450.00	$0.00	$0.00	$0.00	$0.00	$55,332.60
C17	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C18	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C23	$0.00	$0.00	$138,945.21	$138,945.21	$148,207.26	$143,751.26	$70,985.95	$74,129.95	$0.00	$0.00	$356,826.42
C24	$0.00	$0.00	$0.00	$0.00	$86,935.13	$86,935.13	$377,198.25	$281,820.73	$165,079.12	$250,183.33	$618,939.19
C25	$0.00	$0.00	$0.00	$0.00	$210,841.42	$129,741.75	$228,412.27	$216,650.06	$213,756.65	$245,692.99	$592,084.80
C26	$0.00	$0.00	$0.00	$0.00	$621.85	$621.85	$74,709.00	-$291.00	$82,395.92	$49,780.55	$50,111.40
C27	$0.00	$0.00	$0.00	$0.00	$93,190.68	$39,734.64	$110,074.68	$147,061.35	$57,914.14	$71,248.65	$258,044.64
C28	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$130,739.27	$68,885.22	$26,392.77	$52,670.45	$121,555.67
C29	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$80,464.99	$80,464.99	$126,061.29	$26,061.29	$106,526.28
C30	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$94,554.39	$59,880.30	$77,335.50	$93,241.41	$153,121.71
C31	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$103,693.22	$66,655.68	$100,903.63	$73,863.03	$140,518.71
C32	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$87,893.04	$87,893.04	$85,228.77	$85,228.77	$173,121.81
C33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$205,229.84	$5,229.84	$70,817.31	$75,956.21	$81,186.05
C34	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$42,196.13	$42,196.13	$69,518.18	$69,518.18	$111,714.31
C35	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$33,949.46	$10,688.46	$10,688.46
C36	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$21,836.95	$93,004.96	$93,004.96
C37	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$266,477.27	$113,822.56	$113,822.56
C38	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6,250.70	$6,250.70	$6,250.70
C39	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$251,804.17	$170,403.17	$170,403.17
C40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$71,936.76	$2,106.76	$2,106.76
C41	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,885.67	$5,885.67	$5,885.67
C42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$49,236.73	$49,236.73	$49,236.73
C43	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Work Task	2006 Obligations	2006 Expenditures	2007 Obligations	2007 Expenditures	2008 Obligations	2008 Expenditures	2009 Obligations	2009 Expenditures	2010 Obligations	2010 Expenditures	Subtotal Expenditures
C44	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C49	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total C	**$1,486,847.44**	**$987,065.44**	**$1,454,120.35**	**$1,457,528.72**	**$1,619,072.73**	**$1,542,899.48**	**$2,628,714.50**	**$2,083,474.84**	**$2,980,169.16**	**$2,728,139.86**	**$8,799,108.34**
D1	$44,997.82	$44,997.82	$18,766.77	$18,766.77	$20,146.27	$20,146.27	$27,400.01	$27,400.01	$18,997.38	$18,997.38	$130,308.25
D2	$848,505.45	$708,099.72	$915,330.65	$711,050.40	$621,896.84	$907,303.29	$1,274,835.64	$556,069.59	$152,316.08	$719,637.66	$3,602,160.66
D3	$74,346.50	$25,199.42	$72,362.72	$78,829.48	$81,286.79	$69,400.31	$222,500.41	$140,793.91	$104,750.84	$113,389.00	$427,612.12
D4	$66,045.80	$3,058.80	$71,104.98	$111,368.21	$75,233.41	$61,170.52	$780.62	$24,973.85	$0.00	$0.00	$200,571.38
D5	$245,205.41	$245,205.41	$238,487.89	$238,487.89	$254,903.38	$254,903.38	$282,279.28	$282,279.28	$224,813.84	$224,813.84	$1,245,689.80
D6	$158,961.43	$58,961.43	$177,773.39	$192,511.07	$124,050.07	$166,931.67	$300,988.48	$148,813.20	$226,354.82	$194,266.82	$761,484.19
D7	$454,775.02	$166,600.05	$450,164.71	$463,095.44	$526,687.60	$710,350.15	$526,939.86	$447,287.78	$548,459.47	$521,922.72	$2,309,256.14
D8	$310,623.73	$302,623.73	$332,620.94	$340,620.94	$339,719.60	$339,719.60	$469,412.71	$469,412.71	$676,835.76	$636,835.76	$2,089,212.74
D9	$99,886.92	$33,254.92	$89,831.54	$79,684.54	$101,177.29	$40,618.43	$139,417.88	$153,474.97	$162,881.50	$169,968.27	$477,001.13
D10	$18,977.01	$18,977.01	$27,483.85	$12,118.85	$5,369.81	$20,734.81	$0.00	$0.00	$0.00	$0.00	$51,830.67
D11	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
D12	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12,886.12	$7,730.12	$7,730.12
Total D	**$2,322,325.09**	**$1,606,978.31**	**$2,393,927.44**	**$2,246,533.59**	**$2,150,471.06**	**$2,591,278.43**	**$3,244,554.89**	**$2,250,505.30**	**$2,128,295.81**	**$2,607,561.57**	**$11,302,857.20**
E1	$273,378.20	$240,612.20	$230,237.45	$181,081.26	$120,026.35	$115,480.80	$195,931.36	$197,716.08	$204,821.21	$213,790.05	$948,680.39
E2	$270,978.22	$238,212.22	$0.00	$0.00	$26,446.69	$95,003.21	$86,242.83	$68,373.83	$91,981.79	$106,416.04	$508,005.30
E3	$53,581.02	$53,581.02	$94,430.60	$94,430.60	$65,565.30	$65,565.30	$97,370.14	$96,480.04	$17,434.18	$15,805.84	$325,862.80
E4	$590,485.99	$275,398.70	$782,488.02	$706,458.13	$828,982.19	$662,454.83	$1,349,593.46	$952,890.91	$1,553,565.67	$1,355,331.31	$3,952,533.88
E5	$1,292,930.68	$843,994.77	$3,322,086.06	$997,606.83	$3,611,928.60	$3,207,890.57	$789,905.06	$3,373,478.92	$770,765.54	$559,001.12	$8,981,972.21
E6	$23,437.93	$23,437.93	$16,036.43	$16,036.43	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$39,474.36
E7	$12,309.09	$12,309.09	$5,515.55	$5,515.55	$4,410.55	$597.23	$0.00	$0.00	$0.00	$0.00	$18,421.87
E8	$488,610.09	$185,255.91	$71,382.17	$317,523.58	$163,444.58	$169,788.34	$132,389.11	$104,938.56	$0.00	$59,498.19	$837,004.58

Work Task	2006 Obligations	2006 Expenditures	2007 Obligations	2007 Expenditures	2008 Obligations	2008 Expenditures	2009 Obligations	2009 Expenditures	2010 Obligations	2010 Expenditures	Subtotal Expenditures
E9	$117,538.92	$77,538.92	$85,084.59	$115,256.59	$182,393.19	$184,705.20	$2,285,834.49	$1,776,712.34	$2,129,989.54	$2,072,293.39	$4,226,506.44
E10	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E11	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E12	$32,151.02	$32,151.02	$11,633.08	$11,633.08	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$43,784.10
E13	$82,438.05	$82,438.05	$18,876.44	$18,876.44	$110.00	$110.00	$0.00	$0.00	$0.00	$0.00	$101,424.49
E14	$2,114,868.58	$1,630,141.53	$3,188,676.30	$3,664,056.46	$965,430.09	$970,775.11	$540,515.32	$442,013.60	$655,197.95	$464,914.90	$7,171,901.60
E15	$265,497.38	$220,949.66	$421,634.95	$383,320.87	$433,665.01	$338,520.03	$161,470.80	$201,103.14	$4,331.69	$121,330.87	$1,265,224.57
E16	$158,330.58	$200,443.47	$103,685.80	$103,685.80	$234,994.34	$234,994.34	$203,840.83	$203,145.39	$294,547.68	$251,048.46	$993,317.46
E17	$1,287.40	$1,287.40	$4,757.28	$4,757.28	$10,480.66	$10,480.66	$7,711.94	$7,711.94	$1,013,487.38	$13,487.38	$37,724.66
E18	$0.00	$0.00	$2,376.11	$2,376.11	$25,218.68	$25,218.68	$205,056.92	$190,497.11	$197,050.80	$154,637.24	$372,729.14
E19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E21	$0.00	$0.00	$0.00	$0.00	-$802.38	-$802.38	$83,869.06	$83,869.06	$26,129.72	$26,129.72	$109,196.40
E22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E23	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E24	$0.00	$0.00	$55,957.46	$51,332.46	$1,075,422.08	$389,885.00	$689,711.29	$988,219.33	$523,414.75	$590,792.33	$2,020,229.12
E25	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$137,722.25	$117,119.60	$63,672.19	$84,274.84	$201,394.44
E25 In-Kind	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$436,000.00	$436,000.00	$436,000.00
E26	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$147.62	$147.62	$0.00	$0.00	$147.62
E27	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12,635.95	$12,635.95	$688,738.54	$283,233.36	$295,869.31
E28	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$257,890.16	$156,905.74	$156,905.74
E29	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$173,512.57	$173,512.57	$173,512.57
E30	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E31	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total E	**$5,777,823.15**	**$4,117,751.89**	**$8,414,858.29**	**$6,673,947.47**	**$7,747,715.93**	**$6,470,666.92**	**$6,979,948.43**	**$8,817,053.42**	**$9,102,531.36**	**$7,138,403.35**	**$33,217,823.05**
F1	$138,265.04	$138,265.04	$286,184.13	$255,369.52	$305,647.09	$221,016.81	$360,842.17	$344,424.98	$394,781.36	$379,228.21	$1,338,304.56
F2	$28,524.45	$28,524.45	$143,492.76	$143,492.76	$157,021.22	$78,686.22	$143,556.56	$182,724.56	$114,944.30	$125,520.30	$558,948.29
F3	$10,384.22	$10,384.22	$30,038.11	$30,038.11	$33,109.48	$33,109.48	$55,782.13	$55,782.13	$48,782.43	$48,782.43	$178,096.37
F4	$0.00	$0.00	$69,897.69	$69,897.69	$93,145.13	$93,145.13	$92,697.58	$92,697.58	$115,018.90	$115,018.90	$370,759.30

Work Task	2006 Obligations	2006 Expenditures	2007 Obligations	2007 Expenditures	2008 Obligations	2008 Expenditures	2009 Obligations	2009 Expenditures	2010 Obligations	2010 Expenditures	Subtotal Expenditures
F5	$0.00	$0.00	$41,573.87	$41,573.87	$137,912.88	$129,939.88	$175,494.19	$167,068.67	$156,279.56	$169,647.12	$508,229.54
F6	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$17,076.49	$17,076.49	$41,207.42	$41,207.42	$58,283.91
F7	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total F	**$177,173.71**	**$177,173.71**	**$571,186.56**	**$540,371.95**	**$726,835.80**	**$555,897.52**	**$845,449.12**	**$859,774.41**	**$871,013.97**	**$879,404.38**	**$3,012,621.97**
G1	$97,959.45	$97,959.45	$144,443.78	$94,607.72	$145,357.59	$174,902.91	$337,661.19	$318,351.29	$484,297.71	$438,276.83	$1,124,098.20
G3	$283,189.83	$206,117.04	$342,265.08	$230,401.38	$414,505.30	$273,816.05	$388,826.06	$441,109.20	$241,728.79	$326,952.38	$1,478,396.05
G4	$82,039.77	$80,869.98	$60,549.49	$61,719.28	$8,485.07	$8,485.07	$33,419.32	$33,419.32	$33,414.42	$33,414.42	$217,908.07
Total G	**$463,189.05**	**$384,946.47**	**$547,258.35**	**$386,728.38**	**$568,347.96**	**$457,204.03**	**$759,906.57**	**$792,879.81**	**$759,440.92**	**$798,643.63**	**$2,820,402.32**
H1	$541,500.00	$541,500.00	$561,000.00	$561,000.00	$593,500.00	$593,500.00	$605,000.00	$605,000.00	$647,000.00	$647,000.00	$2,948,000.00
H2	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total H	**$541,500.00**	**$541,500.00**	**$561,000.00**	**$561,000.00**	**$593,500.00**	**$593,500.00**	**$605,000.00**	**$605,000.00**	**$647,000.00**	**$647,000.00**	**$2,948,000.00**
I1	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16,429.75	$16,429.75	$18,946.39	$18,946.39	$35,376.14
G5	$8,789.12	$8,789.12	$35,511.43	$35,511.43	$16,759.13	$16,759.13	$0.00	$0.00	$0.00	$0.00	$61,059.68
Total I	**$8,789.12**	**$8,789.12**	**$35,511.43**	**$35,511.43**	**$16,759.13**	**$16,759.13**	**$16,429.75**	**$16,429.75**	**$18,946.39**	**$18,946.39**	**$96,435.82**
GRAND Totals	**$13,156,895.53**	**$9,927,104.30**	**$16,555,779.12**	**$14,136,583.02**	**$15,797,674.77**	**$14,425,972.82**	**$18,000,795.16**	**$18,182,447.45**	**$19,518,164.19**	**$18,411,881.51**	**$75,083,989.10**

Work Task	2011 Obligations	2011 Expenditures	2012 Obligations	2012 Expenditures	2013 Obligations	2013 Expenditures	2014 Obligations	2014 Expenditures	2015 Obligations	2015 Expenditures	Expenditures Grand Total
A1	$1,138,509.80	$1,164,324.46	$917,627.80	$917,627.80	$975,426.99	$969,759.51	$985,556.40	$985,457.99	$1,140,477.22	$1,104,389.01	$10,995,005.59
G2	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$130,535.22
Total A	$1,138,509.80	$1,164,324.46	$917,627.80	$917,627.80	$975,426.99	$969,759.51	$985,556.40	$985,457.99	$1,140,477.22	$1,104,389.01	$11,125,540.81
B1	$206,468.97	$196,380.27	$203,360.50	$186,340.73	$195,004.95	$152,635.70	$193,518.74	$179,737.54	$183,182.91	$206,307.57	$2,158,662.37
B2	$230,585.84	$215,918.30	$298,730.97	$180,923.42	$615,852.78	$343,915.36	$305,132.56	$308,238.89	$312,306.38	$642,201.69	$3,496,327.15
B3	$136,901.52	$141,549.52	$145,868.05	$109,027.59	$197,235.85	$186,396.43	$183,710.01	$166,462.04	$174,637.87	$208,839.94	$1,244,414.09
B4	$150,310.56	$111,787.33	$148,422.27	$166,656.48	$247,640.41	$259,507.68	$606,288.45	$596,353.32	$224,440.99	$153,262.76	$2,142,765.08
B5	$270,542.88	$516,841.63	$306,855.83	$287,412.97	$308,173.52	$218,444.47	$300,297.40	$231,069.94	$686,937.96	$329,397.65	$2,739,536.89
B6	$17,692.75	$23,230.91	$66,798.28	$30,281.95	$96,823.96	$119,515.93	$135,579.70	$146,246.94	$238,485.46	$71,584.82	$651,098.11
B7	$246,148.11	$242,893.11	$173,805.16	$170,634.16	$190,829.84	$168,099.87	$223,986.77	$248,091.51	$181,782.56	$171,800.23	$2,050,370.87
B8	$83,094.77	$63,127.77	$65,514.81	$85,481.81	$96,819.84	$96,819.84	$102,290.33	$80,913.05	$115,059.95	$111,067.21	$878,805.06
B9	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$3,607.25
B10	$3,498.01	$17,672.96	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$554,821.69
B11	$25,979.31	$72,240.61	$36,397.60	-$8,660.52	$49,516.55	$83,448.61	$50,000.00	$2,596.71	$0.00	$28,664.08	$428,954.45
Total B	$1,371,222.72	$1,601,642.41	$1,445,753.47	$1,208,098.59	$1,997,897.70	$1,628,783.89	$2,100,803.96	$1,959,709.94	$2,116,834.08	$1,923,125.95	$16,349,363.01
C1	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$146,658.15
C2	$11,293.33	$1,293.33	$10,731.82	$731.82	$11,341.43	$31,329.22	$21,811.11	$21,823.32	$10,673.49	$10,673.49	$115,851.18
C3	$10,270.70	$10,270.70	$13,408.44	$13,408.44	$19,456.71	$19,456.71	$9,297.76	$9,297.76	$466.27	$466.27	$278,663.86
C4	$11,705.91	$8,879.67	$10,162.78	$10,901.46	$10,506.74	$13,477.64	$10,846.42	$1,259.62	$10,843.67	$15,532.04	$114,832.84
C5	$95,482.79	$95,482.79	$86,835.87	$86,835.87	$48,599.65	$48,599.65	$3,360.57	$3,360.57	$0.00	$0.00	$553,877.44
C6	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$101,441.68
C7	-$2,315.00	-$2,315.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$544,649.77
C8	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$580,317.78
C9	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$112,855.62
C10	$132,922.93	$117,400.67	$126,121.64	$72,417.95	$120,874.14	$125,353.43	$133,266.56	$109,426.09	$0.00	$64,062.25	$1,064,722.26
C11	$57,589.11	$165,093.69	$140,147.91	$73,984.67	$152,127.61	$111,169.59	$153,129.68	$111,670.90	$97.67	$116,877.11	$1,127,288.70

Work Task	2011 Obligations	2011 Expenditures	2012 Obligations	2012 Expenditures	2013 Obligations	2013 Expenditures	2014 Obligations	2014 Expenditures	2015 Obligations	2015 Expenditures	Expenditures Grand Total
C12	$196,158.23	$230,969.52	$54.45	-$8,270.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,036,266.87
C13	$80,324.83	$155,096.91	$134,764.80	$135,353.24	$135,193.23	$135,193.23	$135,247.93	$8,671.93	$135,241.40	$29,606.10	$1,695,608.41
C14	$71,883.70	$117,164.58	$71,167.73	$12,243.41	$1,468.04	$71,205.04	$1,949.93	$1,949.93	$87.21	$87.21	$287,987.11
C15	$23,239.78	$23,239.78	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$495,740.45
C16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$55,332.60
C17	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9,750.00
C18	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$41,981.82
C19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$53,779.96
C21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70,000.00
C22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C23	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$356,826.42
C24	$183,056.69	$24,155.95	$243,998.17	$207,976.82	$187,914.63	$322,007.97	$414,350.46	$194,369.60	$161,927.64	$339,933.36	$1,707,382.89
C25	$252,351.95	$243,390.68	$246,544.45	$229,804.62	$226,898.52	$230,291.57	$179,807.87	$169,446.24	$184,143.25	$179,423.65	$1,644,441.56
C26	$4,795.46	$112,410.83	$1,165.90	-$33,711.16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$128,811.07
C27	$42,984.20	$42,984.20	$56,612.17	$36,612.17	$20,514.72	$8,968.15	$39,890.93	$44,403.27	$39,005.31	$47,692.75	$438,705.18
C28	-$4,261.38	$31,314.99	$483.66	$212.08	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$153,082.74
C29	$0.00	$100,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$206,526.28
C30	$91,603.18	$84,466.75	$65,684.91	$68,876.25	$10,656.35	$33,249.11	$305.47	$305.47	$0.00	$0.00	$340,019.29
C31	$111,372.84	$175,450.98	$124,776.15	$63,276.86	$131,290.14	$151,860.69	$134,780.01	$45,850.27	$141,928.74	$73,073.82	$650,031.33
C32	$92,560.49	$92,560.49	$115,711.54	$115,711.54	$108,597.79	$108,597.79	$104,611.98	$104,611.98	$96,353.36	$96,353.36	$690,956.97
C33	$50,844.82	$245,705.92	$97,020.68	$78,504.28	$103,611.38	$80,964.08	$4,096.37	$26,374.45	$4.17	$18,889.79	$531,624.57
C34	$12,304.81	$12,304.81	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$124,019.12
C35	$146,076.28	$11,161.28	$289,115.34	$188,039.98	$25,598.83	$253,834.76	$28,887.66	$59,903.09	-$2,710.51	-$2,710.51	$520,917.06
C36	$50,440.81	$138,207.29	$13,383.19	$20,656.70	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$251,868.95
C37	$53,704.86	$150,988.99	$26,351.59	$26,351.59	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$291,163.14

Work Task	2011 Obligations	2011 Expenditures	2012 Obligations	2012 Expenditures	2013 Obligations	2013 Expenditures	2014 Obligations	2014 Expenditures	2015 Obligations	2015 Expenditures	Expenditures Grand Total
C38	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6,250.70
C39	$174,690.00	$201,453.00	$252,447.59	$271,872.42	$279,418.33	$291,213.50	$212,290.69	$200,152.09	$305.36	$35,861.96	$1,170,956.14
C40	$125,751.99	$125,107.76	$180,401.56	$143,503.91	$221,864.02	$89,576.45	$180,030.92	$149,088.81	$186,066.42	$251,064.67	$760,448.36
C41	$31,150.14	$31,150.14	$31,584.07	$31,584.07	$57,946.18	$32,946.18	$59,605.33	$84,605.33	$330.22	$330.22	$186,501.61
C42	$103,142.42	$32,289.92	$118,748.43	$171,949.11	$180,759.55	$145,283.37	$6,542.58	$59,670.58	$1,768.46	$1,768.46	$460,198.17
C43	$1,099.56	$1,099.56	$15,413.97	$11,859.12	$27,536.19	$18,536.19	$57,873.82	$51,799.42	$24,984.19	$26,805.34	$110,099.63
C44	$33,542.26	$33,542.26	$94,204.34	$94,204.34	$98,327.59	$98,327.59	$16,059.47	$16,059.47	$0.00	$0.00	$242,133.66
C45	$175,342.41	$125,969.16	$193,102.42	$187,812.06	$203,401.27	$214,788.25	$145,520.50	$169,729.36	$0.00	$19,067.77	$717,366.60
C46	$103,992.63	$56,680.51	$117,603.73	$112,123.63	$72,730.42	$119,691.78	$2,210.78	$7,562.21	$0.00	$0.00	$296,058.13
C47	$1,147.88	$1,147.88	$237,437.06	$50,689.87	$242,379.43	$98,332.90	$236,065.29	$229,356.08	$505.49	$338,008.42	$717,535.15
C48	$50,572.34	$50,502.41	$50,590.60	$47,752.42	-$78.00	$2,830.11	$0.00	$0.00	$0.00	$0.00	$101,084.94
C49	$0.00	$0.00	$59,867.17	$59,867.17	$150,247.28	$108,750.98	$111,069.75	$55,525.84	$62.98	$25,091.79	$249,235.78
C50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C51	$0.00	$0.00	$26,532.93	$26,532.93	$16,027.17	$16,027.17	$0.00	$0.00	$0.00	$0.00	$42,560.10
C52	$0.00	$0.00	$22,422.40	$22,422.40	$149,568.98	$72,953.74	$290,368.44	$238,350.92	$107,103.99	$179,542.54	$513,269.60
C53	$0.00	$0.00	$105,869.79	$54,806.89	$112,559.64	$104,822.29	$117,501.56	$89,776.63	$117,133.38	$161,483.35	$410,889.16
C54	$0.00	$0.00	$0.00	$0.00	$9,110.44	$9,110.44	$0.00	$0.00	$0.00	$0.00	$9,110.44
C55	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
C56	$0.00	$0.00	$0.00	$0.00	$22,208.29	$22,208.29	$0.00	$0.00	$0.00	$0.00	$22,208.29
C57	$0.00	$0.00	$0.00	$0.00	$232,247.32	$164,854.07	$229,689.31	$147,537.58	$226,958.99	$229,487.28	$541,878.93
C58	$0.00	$0.00	$0.00	$0.00	$30,179.14	$30,179.14	$0.00	$0.00	$0.00	$0.00	$30,179.14
C59	$0.00	$0.00	$0.00	$0.00	$21,530.67	$21,530.67	$23,637.54	$23,637.54	$65,217.24	$65,217.24	$110,385.45
C60	$0.00	$0.00	$0.00	$0.00	$58,428.29	$58,428.29	$64,680.00	$13,524.27	$74,319.36	$48,114.99	$120,067.55
C61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$118,472.41	$15,602.82	$188,348.83	$194,290.53	$209,893.35
C62	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$192,514.27	$40,205.32	$175,622.04	$211,182.51	$251,387.83
C63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$102,751.51	$102,751.51	$102,751.51

Work Task	2011 Obligations	2011 Expenditures	2012 Obligations	2012 Expenditures	2013 Obligations	2013 Expenditures	2014 Obligations	2014 Expenditures	2015 Obligations	2015 Expenditures	Expenditures Grand Total
C64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$686,445.37	$502,874.59	$502,874.59
C65	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$20,738.26	$20,738.26	$20,738.26
Total C	$2,576,822.95	$3,046,622.40	$3,380,469.25	$2,686,898.91	$3,501,042.11	$3,465,950.03	$3,439,773.37	$2,504,908.76	$2,756,723.76	$3,403,642.12	$24,430,046.14
D1	$18,725.89	$18,725.89	$21,802.58	$21,802.58	$16,679.67	$16,679.67	$35,186.60	$35,186.60	$38,402.79	$38,402.79	$290,472.87
D2	$655,142.92	$850,868.92	$708,540.74	$654,118.74	$751,497.04	$607,541.04	$717,918.05	$780,849.57	$848,055.38	$756,195.15	$7,621,908.70
D3	$120,009.76	$96,376.11	$111,833.44	$123,606.98	-$355.45	$90,388.13	$536.95	$536.95	$0.00	$0.00	$738,520.29
D4	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$261,091.38
D5	$289,547.70	$289,547.70	$253,792.34	$253,792.34	$223,815.69	$223,815.69	$290,972.22	$290,972.22	$300,836.44	$300,836.44	$2,851,772.52
D6	$237,749.92	$295,090.92	$465,205.66	$282,206.66	$204,049.07	$271,954.57	$366,627.83	$447,814.76	$368,062.30	$258,214.80	$2,316,765.90
D7	$543,056.20	$600,256.19	$563,565.52	$569,156.61	$413,612.30	$477,418.69	$756,988.58	$677,804.89	$832,589.27	$694,743.66	$5,328,636.18
D8	$614,086.24	$592,711.03	$624,518.66	$617,542.15	$718,996.60	$680,269.86	$802,447.87	$707,882.53	$846,376.22	$901,689.69	$5,723,554.08
D9	$147,131.56	$217,528.56	$188,280.52	$141,512.52	$139,177.55	$120,617.55	$387,326.01	$266,830.50	$404,116.29	$446,743.21	$1,670,233.47
D10	$33,659.04	$33,659.04	$20,104.65	$20,104.65	$28,675.73	$28,675.73	$40,251.89	$40,251.89	$37,704.76	$37,704.76	$212,226.74
D11	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$269,097.12
D12	$117,017.13	$45,155.76	$238,443.61	$135,439.05	$27,021.18	$156,693.19	$29,627.44	$57,774.25	$16,710.85	$34,622.00	$437,414.37
D13	$0.00	$0.00	$0.00	$0.00	$31,431.21	$31,431.21	-$2,049.23	-$2,049.23	$0.00	$0.00	$29,381.98
Total D	$2,776,126.36	$3,039,920.12	$3,196,087.72	$2,819,282.28	$2,554,600.59	$2,705,485.33	$3,425,834.21	$3,303,854.93	$3,692,854.30	$3,469,152.50	$27,751,075.60
E1	$267,986.63	$222,156.86	$916,620.08	$890,963.41	$194,295.82	$288,427.90	$130,785.45	$140,850.75	$280,221.40	$272,738.49	$3,987,475.52
E2	$132,989.92	$140,484.47	-$424.29	-$424.29	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$795,399.33
E3	$0.00	$61,353.62	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$871,228.19
E4	$1,483,727.80	$1,502,175.84	$1,154,766.77	$1,688,339.54	$620,712.27	$950,586.82	$487,583.25	$413,261.53	$822,212.91	$796,715.11	$9,320,891.26
E5	$451,820.04	$734,522.58	$361,277.27	$265,712.51	$330,356.42	$334,268.82	$505,920.13	$362,619.34	$722,727.85	$572,069.89	$11,351,713.78
E6	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$119,060.75
E7	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$330,621.55
E8	$0.00	$22,143.98	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$860,184.06
E9	$738,284.20	$961,222.68	$414,640.69	$449,967.31	$533,086.04	$743,401.36	$229,824.73	$124,625.32	$204,369.70	$263,913.43	$6,822,956.73

Work Task	2011 Obligations	2011 Expenditures	2012 Obligations	2012 Expenditures	2013 Obligations	2013 Expenditures	2014 Obligations	2014 Expenditures	2015 Obligations	2015 Expenditures	Expenditures Grand Total
E10	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E11	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E12	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$76,211.53
E13	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$127,336.82
E14	$508,610.43	$683,705.92	$771,006.55	$456,991.14	$303,452.23	$211,790.86	$693,768.00	$603,003.55	$328,870.83	$457,512.18	$9,669,214.32
E15	$17,255.29	$17,255.29	$28,211.19	$28,211.19	$346,829.92	$346,829.92	$36,460.07	$36,460.07	$0.00	$0.00	$1,693,981.04
E16	$259,346.35	$186,157.60	$209,391.63	$261,624.65	$374,317.11	$340,717.17	$701,608.57	$664,262.56	$539,525.37	$502,846.80	$2,954,318.83
E17	$41,359.94	$730,765.63	$2,209,091.02	$332,533.05	$4,150.44	-$1,022.08	$29,544.13	$34,905.78	$1,450.25	$5,711.62	$1,140,618.66
E18	$205,944.26	$205,088.24	$326,234.76	$319,805.30	$320,149.03	$345,526.78	$268,053.92	$195,736.81	$226,303.00	$169,878.49	$1,608,764.76
E19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$35,000.00
E21	$34,019.70	$34,019.70	$44,803.79	$44,803.79	$21,118.37	$21,118.37	$45,033.35	$41,257.95	$78,302.48	$74,076.04	$344,212.22
E22	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4,028.00
E23	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E24	$639,675.70	$716,795.58	$862,441.09	$278,064.73	$486,307.81	$940,366.25	$209,836.42	$235,620.63	$655,451.78	$287,931.95	$4,479,008.26
E25	$10,293.25	$10,293.25	$16,826.97	$16,826.97	$33,525.59	$33,525.59	$30,349.86	$30,349.86	$24,878.09	$24,878.09	$317,268.20
E25 In-Kind	$436,000.00	$436,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$872,000.00
E26	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$147.62
E27	$3,060,556.46	$810,593.24	$6,562,631.03	$7,039,753.11	$9,741,932.20	$8,277,899.41	$6,081,471.60	$6,401,845.20	$1,759,859.79	$3,428,595.18	$26,254,555.45
E28	$258,521.17	$330,289.20	$75,792.42	$105,008.81	$407,557.78	$57,557.78	$492,318.96	$582,219.68	$467,563.97	$463,730.05	$1,695,711.26
E29	$59,667.12	$59,667.12	$16.19	$16.19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$233,195.88
E30	$88,884.93	$88,884.93	$166,849.05	$166,849.05	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$255,733.98
E31	$21,979.16	$16,115.11	$88,198.74	$40,690.67	$180,047.99	$166,150.09	$86,326.00	$121,088.85	$112,273.39	$96,396.54	$440,441.26
E32	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
E33	$0.00	$0.00	$0.00	$0.00	$68,671.93	$68,671.93	$344,159.32	$46,007.34	$970,299.11	$1,153,339.17	$1,268,018.44
E34	$0.00	$0.00	$0.00	$0.00	$31,841.15	$31,841.15	$49,616.14	$49,616.14	$51,701.73	$51,701.73	$133,159.02

Work Task	2011 Obligations	2011 Expenditures	2012 Obligations	2012 Expenditures	2013 Obligations	2013 Expenditures	2014 Obligations	2014 Expenditures	2015 Obligations	2015 Expenditures	Expenditures Grand Total
E35	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$460,588.99	$324,968.99	$324,968.99
Total E	$8,716,922.35	$7,969,690.84	$14,208,374.95	$12,385,737.13	$13,998,352.10	$13,157,658.12	$10,422,659.90	$10,083,731.36	$7,706,600.64	$8,947,003.75	$88,387,425.71
F1	$480,326.82	$497,781.32	$754,927.68	$534,777.49	$562,295.14	$570,240.00	$472,448.47	$556,007.87	$490,889.62	$582,775.42	$4,279,379.33
F2	$185,177.77	$158,354.77	$375,849.49	$144,306.35	$102,444.23	$251,596.81	$197,840.80	$219,866.33	$134,175.16	$249,662.70	$1,647,971.06
F3	$53,952.06	$53,952.06	$21,525.04	$21,525.04	$39,625.36	$39,625.36	$56,766.91	$56,766.91	$52,897.74	$52,897.74	$425,887.03
F4	$119,649.91	$118,393.86	$109,437.27	$108,730.08	$194,445.95	$115,358.44	$165,161.31	$135,657.71	$141,235.70	$204,901.37	$1,053,800.76
F5	$153,930.06	$153,930.06	$172,897.42	$172,897.42	$185,702.47	$169,462.47	$271,044.01	$282,119.71	$235,350.31	$235,255.38	$1,521,894.58
F6	$88,758.78	$88,758.78	$79,854.92	$79,854.92	$83,708.30	$83,708.30	$71,134.99	$71,134.99	$71,572.40	$65,976.52	$447,717.42
F7	$1,403.06	$1,403.06	$14,271.51	$14,271.51	$4,124.05	$4,124.05	$29,476.43	$29,476.43	$29,091.63	$29,091.63	$78,366.68
Total F	$1,083,198.46	$1,072,573.91	$1,528,763.33	$1,076,362.81	$1,172,345.50	$1,234,115.43	$1,263,872.92	$1,351,029.95	$1,155,212.56	$1,420,560.76	$9,455,016.86
G1	$678,848.47	$625,217.16	$728,250.63	$609,246.83	$735,993.97	$660,072.89	$878,992.90	$726,443.64	$572,953.39	$815,667.39	$4,560,746.11
G3	$54,339.42	$171,292.05	$282,786.62	$255,093.82	$276,217.73	$242,843.95	$260,667.43	$178,425.51	$133,374.64	$143,481.89	$2,469,533.27
G4	$137,434.07	$137,434.07	$127,754.31	$127,754.31	$260,581.13	$221,014.16	$275,414.62	$214,681.09	$212,457.02	$218,594.94	$1,137,386.64
Total G	$870,621.96	$933,943.28	$1,138,791.56	$992,094.96	$1,272,792.83	$1,123,931.00	$1,415,074.95	$1,119,550.24	$918,785.05	$1,177,744.22	$8,167,666.02
H1	$5,359,500.00	$5,359,500.00	$5,445,000.00	$5,445,000.00	$5,629,500.00	$5,629,500.00	$7,604,720.64	$7,604,720.64	$5,480,049.36	$5,480,049.36	$32,466,770.00
H2	$0.00	$0.00	$0.00	$0.00	$998,298.00	$998,298.00	$1,434,267.44	$1,434,267.44	$1,562,029.94	$1,562,029.94	$3,994,595.38
Total H	$5,359,500.00	$5,359,500.00	$5,445,000.00	$5,445,000.00	$6,627,798.00	$6,627,798.00	$9,038,988.08	$9,038,988.08	$7,042,079.30	$7,042,079.30	$36,461,365.38
I1	$76,251.83	$76,251.83	$96,516.90	$96,516.90	$97,824.27	$97,824.27	$104,431.22	$104,431.22	$98,604.57	$98,604.57	$509,004.93
G5	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$61,059.68
Total I	$76,251.83	$76,251.83	$96,516.90	$96,516.90	$97,824.27	$97,824.27	$104,431.22	$104,431.22	$98,604.57	$98,604.57	$570,064.61
GRAND Totals	**$23,969,176.43**	**$24,264,469.25**	**$31,357,384.98**	**$27,627,619.38**	**$32,198,080.09**	**$31,011,305.58**	**$32,196,995.01**	**$30,451,662.47**	**$26,628,171.48**	**$28,586,302.18**	**$222,697,564.14**

Work Task	2016 Obligations	2016 Expenditures	2017 Obligations	2017 Expenditures	2018 Obligations	2018 Expenditures	2019 Obligations	2019 Expenditures	2020 Obligations	2020 Expenditures	Expenditures Grand Total
A1	$1,188,765.48	$1,140,032.88									$12,135,038.47
G2	$0.00	$0.00									$130,535.22
Total A	**$1,188,765.48**	**$1,140,032.88**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$12,265,573.69**
B1	$216,932.74	$195,408.34									$2,354,070.71
B2	$309,156.64	$221,205.32									$3,717,532.47
B3	$269,149.88	$152,729.68									$1,397,143.77
B4	$253,146.40	$156,044.68									$2,298,809.76
B5	$731,953.63	$335,097.81									$3,074,634.70
B6	$241,051.09	$256,919.15									$908,017.26
B7	$149,862.21	$162,654.16									$2,213,025.03
B8	$140,133.31	$165,503.33									$1,044,308.39
B9	$0.00	$0.00									$3,607.25
B10	$0.00	$0.00									$554,821.69
B11	$62.19	$62.19									$429,016.64
B12	$70,499.86	$30,123.36									$16,379,486.37
Total B	**$2,381,947.95**	**$1,675,748.02**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$18,025,111.03**
C1	$0.00	$0.00									$146,658.15
C2	$11,311.51	$9,416.92									$125,268.10
C3	$0.00	$0.00									$278,663.86
C4	$0.00	$4,898.43									$119,731.27
C5	$0.00	$0.00									$553,877.44
C6	$0.00	$0.00									$101,441.68
C7	$0.00	$0.00									$544,649.77
C8	$0.00	$0.00									$580,317.78
C9	$0.00	$0.00									$112,855.62
C10	$0.00	$31,450.75									$1,096,173.01
C11	$0.00	$27,562.06									$1,154,850.76
C12	$0.00	$0.00									$1,036,266.87
C13	$184.39	$232,180.41									$1,927,788.82

Work Task	2016 Obligations	2016 Expenditures	2017 Obligations	2017 Expenditures	2018 Obligations	2018 Expenditures	2019 Obligations	2019 Expenditures	2020 Obligations	2020 Expenditures	Expenditures Grand Total
C14	$0.00	$0.00									$287,987.11
C15	$0.00	$0.00									$495,740.45
C16	$0.00	$0.00									$55,332.60
C17	$0.00	$0.00									$9,750.00
C18	$0.00	$0.00									$41,981.82
C19	$0.00	$0.00									$0.00
C20	$0.00	$0.00									$53,779.96
C21	$0.00	$0.00									$70,000.00
C22	$0.00	$0.00									$0.00
C23	$0.00	$0.00									$356,826.42
C24	$302,717.48	$328,007.72									$2,035,390.61
C25	$197,068.70	$156,562.06									$1,801,003.62
C26	$0.00	$0.00									$128,811.07
C27	$801.21	$13,260.91									$451,966.09
C28	$0.00	$0.00									$153,082.74
C29	$0.00	$0.00									$206,526.28
C30	$0.00	$0.00									$340,019.29
C31	$148,968.92	$109,157.90									$759,189.23
C32	$99,638.94	$99,638.94									$790,595.91
C33	$0.00	$0.00									$531,624.57
C34	$0.00	$0.00									$124,019.12
C35	$0.00	$0.00									$520,917.06
C36	$0.00	$0.00									$251,868.95
C37	$0.00	$0.00									$291,163.14
C38	$0.00	$0.00									$6,250.70
C39	$0.00	$0.00									$1,170,956.14
C40	$274,332.93	$168,168.67									$928,617.03
C41	$0.00	$0.00									$186,501.61
C42	$0.00	$0.00									$460,198.17

Work Task	2016 Obligations	2016 Expenditures	2017 Obligations	2017 Expenditures	2018 Obligations	2018 Expenditures	2019 Obligations	2019 Expenditures	2020 Obligations	2020 Expenditures	Expenditures Grand Total
C43	$39,374.35	$47,121.13									$157,220.76
C44	$0.00	$0.00									$242,133.66
C45	$0.00	$0.00									$717,366.60
C46	$0.00	$0.00									$296,058.13
C47	$0.00	$0.00									$717,535.15
C48	$0.00	$0.00									$101,084.94
C49	$0.00	$0.00									$249,235.78
C50	$0.00	$0.00									$0.00
C51	$0.00	$0.00									$42,560.10
C52	$151,012.21	$119,347.25									$632,616.85
C53	$112,896.35	$122,886.58									$533,775.74
C54	$0.00	$0.00									$9,110.44
C55	$0.00	$0.00									$0.00
C56	$0.00	$0.00									$22,208.29
C57	$3,227.48	$150,244.17									$692,123.10
C58	$0.00	$0.00									$30,179.14
C59	$167,129.76	$31,396.71									$141,782.16
C60	$11.05	$77,329.28									$197,396.83
C61	$175,395.05	$163,661.99									$373,555.34
C62	$147,788.13	$165,922.17									$417,310.00
C63	$90,290.50	$90,290.50									$193,042.01
C64	$656,351.17	$540,791.98									$1,043,666.57
C65	$99,329.26	$84,318.17									$105,056.43
C66	$83,717.80	$83,717.80									$83,717.80
Total C	**$2,761,547.19**	**$2,857,332.50**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$27,287,378.64**
D1	$36,470.97	$36,470.97									$326,943.84
D2	$748,047.05	$760,095.13									$8,382,003.83
D3	$0.00	$0.00									$738,520.29
D4	$0.00	$0.00									$261,091.38

Work Task	2016 Obligations	2016 Expenditures	2017 Obligations	2017 Expenditures	2018 Obligations	2018 Expenditures	2019 Obligations	2019 Expenditures	2020 Obligations	2020 Expenditures	Expenditures Grand Total
D5	$234,559.10	$234,559.10									$3,086,331.62
D6	$152,057.03	$297,303.10									$2,614,069.00
D7	$688,770.88	$860,371.04									$6,189,007.22
D8	$943,608.61	$775,008.88									$6,498,562.96
D9	$379,451.91	$470,531.02									$2,140,764.49
D10	$44,452.69	$44,452.69									$256,679.43
D11	$0.00	$0.00									$269,097.12
D12	$31,285.23	$31,006.41									$468,420.78
D13	$0.00	$0.00									$29,381.98
Total D	**$3,258,703.47**	**$3,509,798.34**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$31,260,873.94**
E1	$209,035.87	$208,513.89									$4,195,989.41
E2	$0.00	$0.00									$795,399.33
E3	$0.00	$0.00									$871,228.19
E4	$449,393.91	$424,660.32									$9,745,551.58
E5	$661,721.39	$627,510.72									$11,979,224.50
E6	$0.00	$0.00									$119,060.75
E7	$0.00	$0.00									$330,621.55
E8	$0.00	$0.00									$860,184.06
E9	$293,218.97	$354,396.15									$7,177,352.88
E10	$0.00	$0.00									$0.00
E11	$0.00	$0.00									$0.00
E12	$0.00	$0.00									$76,211.53
E13	$0.00	$0.00									$127,336.82
E14	$403,637.91	$339,732.72									$10,008,947.04
E15	$0.00	$0.00									$1,693,981.04
E16	$785,451.33	$771,277.61									$3,725,596.44
E17	$0.00	$104,457.79									$1,245,076.45
E18	$179,921.81	$96,635.50									$1,705,400.26
E19	$0.00	$0.00									$0.00

Work Task	2016 Obligations	2016 Expenditures	2017 Obligations	2017 Expenditures	2018 Obligations	2018 Expenditures	2019 Obligations	2019 Expenditures	2020 Obligations	2020 Expenditures	Expenditures Grand Total
E20	$0.00	$0.00									$35,000.00
E21	$10,548,669.63	$9,372,466.23									$9,716,678.45
E22	$0.00	$0.00									$4,028.00
E23	$0.00	$0.00									$0.00
E24	$843,168.99	$685,408.82									$5,164,417.08
E25	$12,101.05	$12,101.05									$329,369.25
E25 In-Kind	$0.00	$0.00									$872,000.00
E26	$0.00	$0.00									$147.62
E27	$846,914.71	$992,624.60									$27,247,180.05
E28	$318,447.52	$410,664.22									$2,106,375.48
E29	$0.00	$0.00									$233,195.88
E30	$0.00	$0.00									$255,733.98
E31	$42,096.23	$17,811.23									$458,252.49
E32	$0.00	$0.00									$0.00
E33	$322,214.66	$250,882.25									$1,518,900.69
E34	$123,672.64	$123,672.64									$256,831.66
E35	$158,178.28	$236,841.95									$561,810.94
Total E	**$16,197,844.90**	**$15,029,657.69**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$103,417,083.40**
F1	$471,224.34	$541,133.66									$4,820,512.99
F2	$273,682.73	$273,966.32									$1,921,937.38
F3	$63,377.64	$63,377.64									$489,264.67
F4	$36,810.41	$36,810.41									$1,090,611.17
F5	$241,313.96	$238,890.68									$1,760,785.26
F6	$49,043.49	$54,639.37									$502,356.79
F7	$23,225.44	$23,225.44									$101,592.12
Total F	**$1,158,678.01**	**$1,232,043.52**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$10,687,060.38**
G1	$919,025.71	$840,662.37									$5,401,408.48
G3	$190,240.44	$183,255.64									$2,652,788.91
G4	$420,190.00	$311,930.98									$1,449,317.62

Work Task	2016 Obligations	2016 Expenditures	2017 Obligations	2017 Expenditures	2018 Obligations	2018 Expenditures	2019 Obligations	2019 Expenditures	2020 Obligations	2020 Expenditures	Expenditures Grand Total
G6	$27,482.43	$3,359.07									$3,359.07
Total G	**$1,556,938.58**	**$1,339,208.06**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$9,506,874.08**
H1	$0.00	$0.00									$32,466,770.00
H2	$1,104,052.00	$1,104,052.00									$5,098,647.38
Total H	**$1,104,052.00**	**$1,104,052.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$37,565,417.38**
I1	$106,930.04	$96,930.04									$605,934.97
G5	$0.00	$0.00									$61,059.68
Total I	**$106,930.04**	**$96,930.04**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$666,994.65**
GRAND Totals	**$29,715,407.62**	**$27,984,803.05**									**$250,682,367.19**

Attachment E – Reports Published in Fiscal Year 2016

Except where otherwise noted for journal articles, these reports are available on the Lower Colorado River Multi-Species Conservation Program Web site at: http://www.lcrmscp.gov/steer_committee/technical_reports.html

Work Task	Report Title
C-2	Sticky Buckwheat/Threecorner Milkvetch Conservation, 2015 Annual Report
C-27	Habitat and Population Demographics of the Colorado River Cotton Rat Along the Lower Colorado River, 2009–2013 Final Report
C-35	Distribution and Roost Site Habitat Requirements of Western Yellow and Western Red Bats, November 2013
C-42	Lassenite Pozzolan Soil Amendment Study at the Beal Lake Conservation Area, 2013 Annual Report
C-43	Population Demographics and Habitat Use of the California Leaf-Nosed Bat, 2014 Annual Report
C-47	Genetic Monitoring and Biological Control of Recruitment in Bonytail Rearing Ponds, September 2015
C-52	Development of Appropriate Radio Telemetry Techniques for Glided Flickers in Western Arizona, 2013
C-62	Lowland Leopard Frog and Colorado river Toad Habitat and Ecology Study, 2014 Annual Report
C-64	Distribution and Post-Stocking Survival of Bonytail in Lake Havasu, 2013–2016
D-5	Monitoring Avian Productivity and Survivorship Breeding Season, 2013 Final Report
D-6	Lower Colorado River Riparian Bird Surveys, 2013 Annual Report
D-6	Lower Colorado River Riparian Bird Surveys, 2014 Annual Report
D-7	Yellow-Billed Cuckoo Presence/Absence Surveys, 2015 Annual Report
D-8	Razorback Sucker and Bonytail Stock Assessment, 2013–2014 Annual Report
D-8	Razorback Sucker and Bonytail Stock Assessment, 2015 Annual Report
D-10	Post-Development and System Monitoring of Rodent Populations, 2012–2014
D-12	Lowland Leopard Frog and Colorado River Toad Surveys, 2013 Annual Report

Work Task	Report Title
D-12	Lowland Leopard Frog and Colorado River Toad Surveys, 2014 Annual Report
E-5	Cibola Valley Conservation Area, 2013 Annual Report
F-1	Habitat Monitoring – Vegetation Survival and Growth, 2010 Annual Report
F-2	Avian Use of Restoration Sites, 2013 Annual Report
F-2	Avian Use of Restoration Sites, 2014 Annual Report
F-4	Post-Development Acoustic Bat Monitoring, 2012–2014 Results
G-4	Southwestern Willow Flycatcher Basic Conceptual Ecological Model for the Lower Colorado River, September 2016
G-4	Western Yellow-billed Cuckoo Basic Conceptual Ecological Model for the Lower Colorado River, March 2015
G-4	Sonoran Yellow Warbler Basic Conceptual Ecological Model for the Lower Colorado River, July 2015
G-4	California Black Rail Basic Conceptual Ecological Model for the Lower Colorado River, September 2015
G-4	Yuma Clapper Rail Basic Conceptual Ecological Model for the Lower Colorado River, August 2015
G-4	Western Red Bat Basic Conceptual Ecological Model for the Lower Colorado River, September 2016
G-4	Southwestern Willow Flycatcher Basic Conceptual Ecological Model for the Lower Colorado River, September 2015
G-4	Western Red Bat Basic Conceptual Ecological Model for the Lower Colorado River, September 2015
G-4	Western Yellow Bat Basic Conceptual Ecological Model for the Lower Colorado River, September 2015
G-4	Least Bittern Basic Conceptual Ecological Model for the Lower Colorado River, May 2015
G-4	Gilded Flicker Basic Conceptual Ecological Model for the Lower Colorado River, June 2015
G-4	Arizona Bell’s Vireo Basic Conceptual Ecological Model for the Lower Colorado River, December 2015

Work Task	Report Title
G-4	Gila Woodpecker Basic Conceptual Ecological Model for the Lower Colorado River, March 2016
G-4	Yuma Hispid Cotton Rat Basic Conceptual Ecological Model for the Lower Colorado River, April 2015
G-4	Colorado River Cotton Rat Basic Conceptual Ecological Model for the Lower Colorado River, April 2015
G-4	Vermilion Flycatcher Basic Conceptual Ecological Model for the Lower Colorado River, February 2016
G-4	Summer Tanager Basic Conceptual Ecological Model for the Lower Colorado River, October 2015
G-4	Elf Owl Basic Conceptual Ecological Model for the Lower Colorado River, October 2015
G-4	MacNeill's Sootywing Skipper Basic Conceptual Ecological Model for the Lower Colorado River, October 2015
G-4	Flannelmouth Sucker Basic Conceptual Ecological Model for the Lower Colorado River, June 2015