Lower Colorado River
Multi-Species Conservation Program

Mohave Valley Conservation Area
Restoration Development and Monitoring Plan

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

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- 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

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- Arizona Game and Fish Department
- Arizona Power Authority
- Central Arizona Water Conservation District
- Cibola Valley Irrigation and Drainage District
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- 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

**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

**Other Interested Parties Participant Group**
- QuadState Local Governments Authority
- Desert Wildlife Unlimited
Lower Colorado River
Multi-Species Conservation Program

Mohave Valley Conservation Area
Restoration Development and Monitoring Plan

Prepared by:
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Beth Sabin, Wildlife Group
Jeff Lantow, Fisheries Group
Becky Blasius, AMP Group
### ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
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<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<td>CDFW</td>
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<td>CSLC</td>
<td>California State Lands Commission</td>
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<td>LCR</td>
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<td>LCR MSCP</td>
<td>Lower Colorado River Multi-Species Conservation Program</td>
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<tr>
<td>LRFD</td>
<td>Load and Resistance Factor Design</td>
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<td>MVCA</td>
<td>Mohave Valley Conservation Area</td>
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<tr>
<td>pH</td>
<td>potential of hydrogen – a figure expressing the acidity or alkalinity of a solution</td>
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<td>PIT</td>
<td>passive integrated transponder</td>
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<td>Reclamation</td>
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### Symbols

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<tr>
<th>Symbol</th>
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</tr>
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<tr>
<td>µm</td>
<td>micrometer (equivalent to $10^{-6}$ m)</td>
</tr>
<tr>
<td>%</td>
<td>percent</td>
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<tr>
<td>±</td>
<td>plus or minus</td>
</tr>
</tbody>
</table>
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>Purpose</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Location and Description</td>
<td>2</td>
</tr>
<tr>
<td>1.3</td>
<td>Land Ownership</td>
<td>4</td>
</tr>
<tr>
<td>1.4</td>
<td>Water</td>
<td>4</td>
</tr>
<tr>
<td>1.5</td>
<td>Lease Agreement</td>
<td>7</td>
</tr>
<tr>
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<td>7</td>
</tr>
<tr>
<td>2.1</td>
<td>Conceptual Design</td>
<td>8</td>
</tr>
<tr>
<td>2.2</td>
<td>Channel Design</td>
<td>8</td>
</tr>
<tr>
<td>2.3</td>
<td>Roadway Crossings</td>
<td>9</td>
</tr>
<tr>
<td>2.4</td>
<td>Water Control Structures</td>
<td>9</td>
</tr>
<tr>
<td>2.5</td>
<td>Backwater Access</td>
<td>11</td>
</tr>
<tr>
<td>2.6</td>
<td>Planting Design</td>
<td>11</td>
</tr>
<tr>
<td>2.7</td>
<td>Planting Material/Planting Techniques</td>
<td>12</td>
</tr>
<tr>
<td>2.7.1</td>
<td>Marsh Plants</td>
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</tr>
<tr>
<td>2.7.2</td>
<td>Riparian Plants</td>
<td>15</td>
</tr>
<tr>
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<td>15</td>
</tr>
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<td>Site Maintenance</td>
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<tr>
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<td>Herbicide/Fertilizer/Pesticide Application</td>
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</tr>
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</tr>
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<td>Water Quality</td>
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<td>5.2</td>
<td>Final Report</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Literature Cited</td>
<td>23</td>
</tr>
</tbody>
</table>
Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Summary of the Park Moabi and Beal Slough backwaters</td>
</tr>
<tr>
<td>2</td>
<td>Land cover acreage for the MVCA</td>
</tr>
<tr>
<td>3</td>
<td>Native plant species to be planted within the MVCA</td>
</tr>
<tr>
<td>4</td>
<td>Sampling parameters</td>
</tr>
</tbody>
</table>

Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The MVCA</td>
</tr>
<tr>
<td>2</td>
<td>Extended map of the project area showing neighboring backwaters and other site features</td>
</tr>
<tr>
<td>3</td>
<td>MVCA site plan overview</td>
</tr>
<tr>
<td>4</td>
<td>Planting scheme for backwater</td>
</tr>
<tr>
<td>5</td>
<td>Land cover type resulting from the 60% Mohave Valley backwater design</td>
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</table>
1.0 INTRODUCTION

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a multi-stakeholder Federal and non-Federal partnership responding 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.

The LCR MSCP is a long-term (50 year) plan consisting of conservation measures that provide protection along the LCR from Lake Mead to the Southerly International Boundary with Mexico for 26 species currently threatened or endangered and 5 species on the verge of becoming threatened or endangered. The LCR MSCP anticipates development and/or protection of a minimum of 8,132 acres of habitat consisting of a mosaic of Fremont cottonwood-Goodding’s willow (*Populus fremontii-Salix gooddingii*) (hereafter cottonwood-willow), honey mesquite (*Prosopis glandulosa*), marsh, and backwater components. The program uses adaptive management principles to research and monitor species and habitats as well as to enhance management actions and science applications over the life of the program.

Under the guidance of the LCR MSCP’s Habitat Conservation Plan, the program is tasked with creating 85 acres of connected backwater habitat between Davis and Parker Dams (LCR MSCP 2004). Habitat Conservation Plan Conservation Measure FLSU1 states, “Create 85 acres of flannelmouth sucker (*Catostomus latipinnis*) habitat. Of the 360 acres of LCR MSCP-created backwaters, at least 85 acres will be created in Reach 3 with water depth, vegetation, and substrate characteristics that provide the elements of flannelmouth sucker habitat.”

Much of the bank line within Reach 3 of the Colorado River is developed or runs through Topock Gorge, which is composed of steep, rocky terrain that is unsuitable for LCR MSCP development based on site access restraints and landownership restrictions. However, within the Moabi Regional Park (Park Moabi) south of Needles, California, an approximately 149-acre parcel of land residing within the historical flood plain of the LCR possesses the landscape characteristics to allow for the development of a connected backwater. (See Appendix G in Otis Bay, Inc., and Tetra Tech, Inc. [2015] for historical imagery.)

1.1 Purpose

The purpose of this project is to create a connected backwater for native fishes and restore native riparian and upland habitat for the benefit of LCR MSCP covered species. Target species include the flannelmouth sucker and the
razorback sucker (*Xyrauchen texanus*). This project will create a mosaic of marsh and riparian habitat through management of the four land cover types: cottonwood-willow, honey mesquite, marsh, and backwater.

Following the guidelines of the LCR MSCP Habitat Conservation Plan, the backwater must be connected to the Colorado River so that it is accessible to native fishes from the main stem. The Mohave Valley Conservation Area (MVCA) backwater will have an upstream connection to the river and discharge downstream into Park Moabi. Partners in the design of the MVCA consist of representatives from the following organizations:

- California State Lands Commission
- California Department of Fish and Wildlife
- San Bernardino County
- Bureau of Reclamation (Reclamation)
- Lower Colorado River Multi-Species Conservation Program

The project area will be 149 acres, which includes the main parcel bound by gravel roads as well as lands used to connect the backwater to the main stem of the Colorado River and the Park Moabi channel (figure 1).

### 1.2 Location and Description

Park Moabi operates on 1,027 acres and has two landowners: the California State Lands Commission (CSLC) and Reclamation. The proposed MVCA land is located along the LCR, approximately 13 miles south of Needles, California, between River Miles 236 and 237 (figure 1) and is owned by the CSLC. According to the lease between San Bernardino County and the CSLC, which came into effect on July 2, 1965, the property of interest commences at the center of Section 6, Township 7 N, and Range 24 E, S.B.M. The LCR MSCP is partnering with the CSLC and San Bernardino County, the lessee, to develop a backwater through the parcel northwest of the existing Park Moabi channel (figure 1).

The existing Park Moabi channel was dredged starting in 1961 to create a deep water area for boat launching and to improve the sport fishery. Subsequently, the park has expanded to provide other recreational activities and is called the Moabi Regional Park. Currently, the park provides a seven-lane launch ramp, and while sport fishing does occur, the LCR MSCP monitors razorback suckers within the Park Moabi channel.

The concessionaire under contract with San Bernardino County has significantly developed the services available within the Moabi Regional Park. Services developed by the concessionaire/sublessee include an upgraded seven-lane launch
ramp, a marina, recreational vehicle and tent camping, waterfront cabins, a convenience store, and the Pirate’s Cove Restaurant & Bar. The MVCA is upstream of the Park Moabi channel and services but parallels the riverside campsites on the east side of the levee road.

The site is a mixture of sand dunes formed from disposed dredge spoil during the construction of Park Moabi with saltcedar (Tamarix spp.) and arrowweed (Pluchea sericea) interspersed. A dense thicket of saltcedar runs through the
Mohave Valley Conservation Area  
Restoration Development and Monitoring Plan

proposed channel footprint. Exploratory excavation indicated more compact soil and coarser substrate are found on the far western side of the parcel that is bound by a gravel road.

Two culverts that drain storm water off the steep slopes further to the west run under the gravel road directly into the site (figure 2). Additionally, an estimated 6,000 cubic yards of rock ranging in size from 6 inches to 3 feet is stockpiled within the proposed channel footprint. The rock stockpile will be utilized during the construction process for erosion control and placement in the backwater substrate. Just outside the western boundary of the project area there is a buried gas pipeline. Project activities will not disturb the pipeline, as it is out of the project boundary; nevertheless, equipment operators will be made aware of the pipeline’s location prior to construction.

Less than 1.5 miles upstream of the proposed inlet, also on the California side of the Colorado River, is another backwater known as Beal Slough (figure 2). Dredged in 1979, Beal Slough supports a population of razorback suckers. Table 1 summarizes the history and physical attributes of the two neighboring backwaters.

### 1.3 Land Ownership

The MVCA is located on portions of the property owned by the State of California, which is currently leased to San Bernardino County. Reclamation will lease the area where the backwater channel is to be constructed from the CSLC. Under the previous Restoration Development and Monitoring Plan approved by the California Department of Fish and Wildlife (CDFW), the CDFW was to enter into the lease with the CSLC. This change was discussed and recommended by the California parties and included representatives from the CDFW. Following the signing of the lease, Reclamation, as implementing agency of the LCR MSCP, was to enter into an agreement for restoration activities consistent with the LCR MSCP with the CDFW. Under the California Endangered Species Act Permit, habitat established in the State of California shall be protected in perpetuity. However, as stated in a letter dated September 2, 2016, from Reclamation to the CDFW, the Land Use Agreement is no longer necessary, but Reclamation is willing to sign a document to address any of the CDFW’s concerns on perpetuity.

### 1.4 Water

As documented in the 2012 Conceptual Design Report, the water for this project is supplied through the LCR MSCP Water Accounting Agreement passed by
Figure 2.—Extended map of the project area showing neighboring backwaters and other site features.
## Table 1.—Summary of the Park Moabi and Beal Slough backwaters

<table>
<thead>
<tr>
<th>Years constructed</th>
<th>Purpose of construction</th>
<th>Channel width (feet)</th>
<th>Channel length</th>
<th>Maximum depth (feet)</th>
<th>Open water acreage</th>
<th>Connection to river</th>
<th>Additional information</th>
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<tbody>
<tr>
<td><strong>Park Moabi channel</strong></td>
<td>Started in 1961*</td>
<td>Deep-water area created for fisheries and to improve boat launching.ǂ</td>
<td>50–500</td>
<td>1.5 miles (7,920 feet)</td>
<td>16^</td>
<td>40 acres</td>
<td>A culvert inlet structure moves water into the upper channel; however, a sediment plug has formed, which limits the flow within the upper 7 acres. The lower 33 acres receives water through the open channel outlet.</td>
</tr>
<tr>
<td><strong>Beal Slough</strong></td>
<td>1979–1980*</td>
<td>Entry 1: For fish and wildlife agencies.ǂ</td>
<td>150–550</td>
<td>0.8 mile (4,224 feet)</td>
<td>17^</td>
<td>25 acres</td>
<td>A porous dike and metal pipe culvert (18–24 inches) at inlet. Porous dike at outlet.</td>
</tr>
</tbody>
</table>

* Historical imagery.  
^ Bathymetry surveys of Beal Slough and Park Moabi were conducted in April 2013. The results from those surveys are provided in Appendix B of Otis Bay, Inc., and Tetra Tech, Inc. (2015).
Congress as part of the Omnibus Public Land Management Act of 2009 (Public Law No. 111-11, Title IX, Subtitle E, 123 Statute 991, 1327-29). The water accounting agreement permits Reclamation to create and manage conservation areas, which do not contain any water entitlement from the Secretary of the Interior, by using Colorado River water to meet the performance requirements of the LCR MSCP (LCR MSCP 2010). Under the Water Accounting Agreement, Reclamation shall not consider any resulting increase in evaporation or percolation of LCR water, for any backwater or marsh at an LCR MSCP conservation area where no entitlement exists, to be a diversion or consumptive use.

The MVCA will create approximately 50 acres of connected backwater habitat by diverting water off the main stem of the LCR, just south of River Mile 237, and will return the water from the main stem 2 miles downstream. Under the auspices of the Water Accounting Agreement, Reclamation shall not consider any resulting increase in evaporation or percolation of LCR water to be a diversion or consumptive use.

1.5 Lease Agreement

The fully executed lease agreement between Reclamation and the CSLC provides the terms of use for the MVCA property within the Park Moabi Regional Park boundary. The lease provides Reclamation the authority to develop the MVCA within the designated project area.

2.0 RESTORATION AND DEVELOPMENT PLAN

As partial fulfillment of the LCR MSCP’s backwater acreage goals within Reach 3, approximately 50 acres of connected backwater habitat will be for native fishes of the LCR: the flannelmouth sucker, razorback sucker, and bonytail (Gila elegans). The backwater habitat will consist of open water and marsh land cover types. The goal of this project is to maximize backwater acreage and incorporate marsh, cottonwood-willow, and mesquite land cover types where appropriate.

The design lays out the excavation and grading for a backwater channel that extends from the Colorado River to the existing Park Moabi channel and two water-crossing structures over the excavated backwater channel. Land-based clearing will be done to remove existing vegetation and allow for contouring, infrastructure construction, and planting of native species. Currently, the majority of the MVCA is dominated by saltcedar, arrowweed, and wetland scrub/shrub. No open water or marsh currently exists. Approximately 50 acres of the MVCA
will be cleared of existing vegetation using land-based mechanical and hydraulic equipment. Removed material will be used to build access roads and a boat ramp, and excess material will be placed adjacent to the backwater within the 149-acre boundary. Once clearing is completed, excavation and contouring will be done, followed by infrastructure construction.

The water control structures include adjustable sills and are designed to provide hydraulic control for flows in and out of the backwater channel during moderate to high flows in the Colorado River. These water control structures will also limit the amount of Colorado River bed sediment entering the backwater channel.

The design will provide spatially variable topography with an appropriate distribution of depths and velocities for a variety of aquatic habitats in order to reduce long-term maintenance requirements.

### 2.1 Conceptual Design

This project comprises a new backwater channel that extends from an inlet at the Colorado River to an exit at the existing Park Moabi channel. The channel is contoured and graded to include deeper pools and shallower areas to provide fish habitat and to promote the establishment of healthy vegetation. The inlet and outlet roadway structures provide water control at the upstream and downstream ends of the new channel.

### 2.2 Channel Design

The 60% backwater channel design is based on the grading that was included in the 30% draft design, with modifications to reduce the number of disconnected islands. HEC-RAS modeling developed for the 60% design was documented in the Hydrologic and Hydraulic Technical Memorandum (see Appendix A in Otis Bay, Inc., and Tetra Tech, Inc. [2015]). The results show that mean velocities through the main section of the channel will remain below 0.5 foot per second under high flow conditions, with velocities through the concrete-arch culvert openings peaking at approximately 4 feet per second. The modeling shows that the backwater channel will decrease the water surface elevation in the Colorado River by less than 0.1 foot and will slightly increase the velocities near the outlet of the project site on the Park Moabi channel. Both changes are considered to be insignificant. Overall, the 60% design meets the design criteria for the backwater channel.
2.3 Roadway Crossings

The design includes structural roadway crossings over where the backwater channel intersects existing roadways. The selected structure for each crossing is a concrete-arch culvert equivalent to a CONTECH prefabricated B-series arch structure with a concrete base slab foundation. The north, upstream bridge at the Colorado River inlet is 36 feet wide by 8 feet high. The south, downstream bridge, at the discharge to the Park Moabi channel, is 36 feet wide by 8 feet high. The selected dimensions were based on an iterative analyses of the flow capacity using the HEC-RAS model for the 60% channel design.

The concrete-arch culverts are designed with a cast-in-place concrete floor due to the limited bearing capacities of the existing soils. CONTECH prefabricated structures are designed to meet American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges – Section 16.8 and Load and Resistance Factor Design (LRFD) Bridge Design Specifications – Section 12.14, and they are manufactured in accordance with American Society for Testing and Materials (ASTM) C1504. With a suitable foundation design and adequate bearing capacities, the CONTECH O-series arch can be designed to safely carry HS20 or highway loads.

2.4 Water Control Structures

Water control structures are required at the concrete-arch culverts to regulate the fluctuation of water passing through the backwater channel during moderate to high flows in the Colorado River (figure 3). The 60% HEC-RAS analysis confirmed that the optimal sill elevation is 453.5 feet, which was recommended in the 2012 conceptual design report.

The 60% design includes a stoplog system that will provide an adjustable crest elevation to regulate the water surface in the backwater channel. The stoplog system was selected on the basis of an alternatives analysis that was included in the 30% draft design. A copy of this evaluation in letter format is included in Appendix D of Otis Bay, Inc., and Tetra Tech, Inc. (2015). Stoplogs can either be custom fabricated or specified as one of the available prefabricated options available through a manufacturer. Further structural design of the water control structure will be developed for the 90% submittal.
Figure 3.—MVCA site plan overview.
The intent of the design is to provide a sill elevation with flexibility so that the inflow and outflow from the new backwater channel can be adjusted for adaptive management. Therefore, the adjustable sill elevation is designed to vary between 452.5 and 454.5 feet. This elevation brackets the elevation (453.5) in the 2012 conceptual design by ± 1 foot.

### 2.5 Backwater Access

The 60% draft design includes a boat ramp facility that is intended to be used by the LCR MSCP for maintenance and monitoring. The new boat ramp will be accessed from the existing road along the west side of the project and will be obscured by fill areas to be inconspicuous to the public. The new boat ramp is 30 feet wide with a slope of 15% and is intended for lightweight and non-motorized boat launching. The ramp includes 2-foot-diameter boulder breakwaters and gravel fill placed within a Presto Geoweb system. The low-impact design will blend well with the surrounding features.

### 2.6 Planting Design

The planting design incorporates native LCR marsh, riparian, and upland species into a mosaic of created land cover types (see figure 4). The species will be stratified according to water demand and depth outlined in table 2. Tall, emergent marsh species will be planted along the bank lines in deeper water, while shorter emergent marsh species will be planted further up slope to prevent inundation (see figure 5). In areas where shallow water transitions to saturated soils and upland areas, species adapted to varying water depths, seasonal drought, and higher salinities will be planted. Tables 2 and 3 present the acreages of land cover types and the species proposed for planting in each zone.

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<th>Land cover type</th>
<th>Elevation (feet)</th>
<th>Acreage</th>
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<td>Backwater</td>
<td>451–458</td>
<td>26.4</td>
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<tr>
<td>Marsh</td>
<td>452–456.5</td>
<td>23.8</td>
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<tr>
<td><strong>Combined total area of backwater and marsh</strong></td>
<td><strong>50.2</strong></td>
<td></td>
</tr>
<tr>
<td>Cottonwood-willow</td>
<td>456.5–464</td>
<td>15.1</td>
</tr>
<tr>
<td>Upland (honey mesquite and arrowweed)</td>
<td>464–472</td>
<td>28.0</td>
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Table 3.—Native plant species to be planted within the MVCA

<table>
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<th>Plants</th>
<th>Acres</th>
<th>Plants per acre</th>
<th>Total number of plants</th>
<th>Plant order</th>
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<td><em>Schoenoplectus californicus</em></td>
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<td>4,356</td>
<td>52,272</td>
<td>53,000</td>
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<td>4,356</td>
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<td><strong>Riparian</strong></td>
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<td><em>Distichlis spicata</em></td>
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<td>13,560</td>
<td>94,920</td>
<td>100,000</td>
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<td>2,178</td>
<td>6,534</td>
<td>7,000</td>
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<td><em>Salix gooddingii</em></td>
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<td>2,178</td>
<td>6,534</td>
<td>7,000</td>
</tr>
<tr>
<td><em>Populus fremontii</em></td>
<td>2</td>
<td>2,178</td>
<td>4,356</td>
<td>4,500</td>
</tr>
<tr>
<td><strong>Upland</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Prosopis glandulosa</em></td>
<td>28</td>
<td>195</td>
<td>5,460</td>
<td>5,500</td>
</tr>
</tbody>
</table>

### 2.7 Planting Material/Planting Techniques

Plant material for this project would be delivered via a contractor. Planting techniques that will be used onsite include:

- Automated mass transplanting
- Planting poles, potted plants, or slips with a conventional tree planter or by hand
- Perimeter planting of poles, potted plants, or slips

#### 2.7.1 Marsh Plants

California bulrush (*Schoenoplectus californicus*) will be planted 3 feet inline spacing with rows 40 inches apart for a total of 4,356 per acre, planted first in the deeper water areas. Chairmaker’s bulrush (*Schoenoplectus americanus*) (formerly known as *Scirpus americanus*) will be planted 3 feet inline spacing with rows 40 inches apart for a total of 4,356 per acre (see table 3).
Figure 4.—Planting scheme for backwater.
Figure 5.—Land cover type resulting from the 60% Mohave Valley backwater design.
2.7.2 **Riparian Plants**
Saltgrass (*Distichlis spicata*) will be planted 1 foot inline spacing with rows 24 inches apart for a total of 13,560 per acre. Coyote willow (*Salix exigua*), Goodding’s willow, and Fremont cottonwood will be planted 6 feet inline spacing with rows 40 inches apart for a total of 2,178 per acre. One-gallon mesquite trees will be hand planted 15 feet on center for a total of 195 per acre at the highest elevation.

### 3.0 MANAGEMENT OVERVIEW

#### 3.1 Land Manager

Reclamation will be responsible for ensuring long-term operation and maintenance of the MVCA throughout the term of the LCR MSCP. The details of operation and maintenance of the MVCA will be agreed upon between Reclamation and the CDFW to include species monitoring, law enforcement, public use, wildfire management, research, and monitoring. After development, long-term management of each conservation area will be documented in a site-specific management plan.

#### 3.2 Law Enforcement

The CDFW is responsible for law enforcement at the MVCA. Reclamation will work with the Bureau of Land Management to provide additional assistance and to ensure project activities do not conflict with the LCR MSCP Habitat Conservation Plan.

#### 3.3 Public Use

The CDFW has the authority to regulate fish, wildlife, and recreation uses pursuant to CDFW statutes, regulations, and policies. In cooperation with Reclamation, the CDFW will coordinate its public use and related activities so they are consistent with, and do not adversely affect, restoration activities at the MVCA.

#### 3.4 Wildfire Management

As guided by commitments in the LCR MSCP Habitat Conservation Plan, wildfire management practices on the MVCA would reduce the risk of loss.
of related habitat to wildfire by providing resources to suppress wildfires (e.g., contributing to and integrating with local, State, and Federal agency fire management plans) and to implement land management and habitat creation measures to support the re-establishment of native vegetation that is lost to wildfire.

A specific fire management plan will be drafted as described in the LCR MSCP Law and Fire Strategy.

### 3.5 Site Maintenance

Reclamation will be responsible for maintaining the levee road adjacent to the MVCA backwater and the access roads that are used to define the footprint of the MVCA. Future backwater maintenance activities may involve dredging the backwater in order to maintain a channel depth of at least 10 feet of open water habitat. The dredging and placement of the dredge material would occur within the previously disturbed project footprint. Equipment (e.g., backhoes, excavators, dump trucks, etc.) may be used for land-based maintenance activities such as cattail (Typha sp.) removal and vegetation clearing.

### 3.6 Herbicide/Fertilizer/Pesticide Application

To ensure the total eradication of non-native plant species (e.g., saltcedar) before planting and to maintain healthy stands of native vegetation species, the application of herbicides, fertilizers, or pesticides may be required. All herbicide, fertilizer, or pesticide application would be applied or supervised by a current Certified Pesticide Applicator for the chemical being applied and in compliance with the rules, regulations, and laws set by the State of California, San Bernardino County.

All records and associated chemical application documents will be stored by the land manager and will include:

- Training records of all employees handling herbicides and pesticides
- Safety Data Sheets for all herbicides, fertilizers, and pesticides
- Location map of herbicide and pesticide storage site
- Use of California approved herbicides, fertilizers, and pesticides
- Record of herbicide, pesticide, or fertilizer use
4.0 MONITORING

4.1 Fisheries Monitoring

Monitoring at the MVCA is designed such that general use of the backwater by LCR MSCP covered fish species can be documented. Methods used will be diverse enough to detect multiple life stages over several seasons, with an emphasis during seasons of highest abundance. In addition to fish surveys, general habitat assessments will include zooplankton and phytoplankton monitoring as well as water quality monitoring and analysis.

4.1.1 Fish Monitoring

Monitoring will include six trips per year to conduct presence/absence surveys for multiple year classes of native fishes. Five spring surveys (January – May) will be conducted to coincide with spawning activities and larval emergence of razorback and flannelmouth suckers (Mueller 2003) as well as the presumed spawning period for bonytail (Wagner 1955). A single fall survey (November) will be conducted to assess species use outside the spawning season. All trips will consist of 2 nights of surveys. The spring trips will include trammel netting, remote sensing, and larval collections; the fall survey will include trammel netting and remote sensing. Catch per unit effort will be determined for each survey method and compared for annual and seasonal variation.

Six trammel nets of two different sizes (three at 75 feet x 0.5 inch and three at 150 feet x 1.5 inches) will be deployed during each night of the survey event. The nets are typically set perpendicular to shore with one end attached to shore or anchored near shore and then stretched toward the center of the pond and marked with a small buoy. The nets will fish throughout the night and then retrieved the following morning. All fish will be collected from the net and held in fresh water. All fishes will be identified, measured for total length, weighed, and released at the capture location. In addition, native fishes will be scanned for passive integrated transponders (PIT) and wire tags and subsequently injected with a PIT tag if none is found.

Larval collections will be conducted in 15-minute intervals at a minimum of three locations per night. Two 12-volt “crappie” lights will be connected to a battery, placed over each side of the boat, and submerged in 4–10 inches of water. Two “netters” equipped with long-handled aquarium nets will be stationed to observe the area around the lights. Larval fishes that swim into the lighted area will be dip netted out of the water and placed into a holding bucket. Larvae will be identified and enumerated as they are placed into the holding bucket and released at the point of capture once sampling is completed (Albrecht et al. 2010). A subset of larval samples may be retained for genetic analyses or species identification. During construction, a series of antennae will be installed into the slab of the inlet.
and outlet structures. These antennae will run the entire length of the foundation and will be used to track the movement of tagged fishes into and out of the backwater. Data collected from the antennae will be downloaded during each scheduled fish monitoring trip and will supplement the manual monitoring data.

### 4.1.2 Zooplankton/Phytoplankton Monitoring

Zooplankton and phytoplankton will be monitored quarterly from two fixed locations, the deepest area near the inflow and outflow. Zooplankton will be collected using a vertical tow with a 64-micrometer (µm) plankton net. The depth of the tow will be recorded and used to calculate sample volume; multiple tows are taken to achieve the desired filtered volume (250 liters). All plankton will be rinsed into an amber sample bottle and preserved with 0.3 milliliter of Lugol’s iodine solution per 100-milliliter of sample. Samples will be analyzed for biomass and relative abundance and then compared to other regional backwaters.

### 4.1.3 Water Quality

Water quality will be monitored by conducting vertical profiles at least six times per year. All surveys will be separated by a minimum of 1 month and will encompass at least three seasons (spring, summer, and fall). Surveys will occur during the six fish monitoring events (five spring trips and one in fall) as well as one summer trip. A profile will be taken before 9:00 a.m. from the two fixed stations near the inflow and outflow. Profiles will be recorded in 0.5-meter increments using a YSI professional plus multi-parameter probe or similar instrument. Nominal parameters measured will include temperature, conductivity, dissolved oxygen, and pH; Secchi depth will also be recorded when the pond bottom is not visible.

### 4.1.4 Water Chemistry

Water chemistry samples will be collected once annually between July and September and will be analyzed for general chemistry. This analysis will include:

- Physical properties, conductivity, pH, total dissolved solids, and total suspended solids
- Major and minor ions
- Metals (including selenium)
- Nutrients, nitrate, nitrite, total nitrogen, orthophosphate, and total phosphate
- Total nutrients
Three 1-liter samples will be collected from each of the water quality stations. Collection for all parameters will occur just below the water surface (approximately 0.2 meter depth). All sample bottles will be rinsed with the water at the sampling station prior to collecting the sample. Each sample will be immediately placed on ice after collection. The three samples from each station will be mixed as a single composite sample prior to being decanted into the appropriate sample bottles. The samples will then be preserved using the appropriate methods for each water quality parameter (described below) and placed on ice for shipping or delivery to the Lower Colorado Region Water and Soil Laboratory.

The recommended size and type of sample bottle is described in table 4 for each parameter. All sample containers shall be labeled correctly, including site name, date, sample parameter, preservation, and collector.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Preservation</th>
<th>Filtered</th>
<th>Volume (milliliters)</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>General chemistry</td>
<td>None</td>
<td>No</td>
<td>500</td>
<td>Refrigerate</td>
</tr>
<tr>
<td>Metals</td>
<td>Nitric acid (HNO₃) Two drops</td>
<td>Yes 0.45 µm</td>
<td>50</td>
<td>Refrigerate</td>
</tr>
<tr>
<td>Nitrate/nitrite</td>
<td>10% sulfuric acid (H₂SO₄) 0.4 milliliter</td>
<td>No</td>
<td>100</td>
<td>Refrigerate</td>
</tr>
<tr>
<td>Orthophosphate</td>
<td>None</td>
<td>Yes 0.45 µm</td>
<td>100</td>
<td>Frozen by 48 hours</td>
</tr>
<tr>
<td>Total nutrients</td>
<td>None</td>
<td>No</td>
<td>100</td>
<td>Frozen by 48 hours</td>
</tr>
</tbody>
</table>

### 4.2 Wildlife Monitoring

As stated above, the MVCA will be managed for covered fishes. Additional covered species may utilize the marsh, cottonwood-willow, and mesquite land cover types that will be planted. The site will be added to conservation area monitoring for marsh birds, neotropical birds, and small mammals once habitat develops. Monitoring will be conducted to document presence and may not be required annually.

- **Marsh Birds** – Monitoring will be conducted using the multi-species survey from the Standardized North American Marsh Bird Monitoring Protocol (Conway 2005) after all construction is complete and marsh vegetation develops (usually 1 year after planting). This protocol incorporates playing calls of marsh bird species at designated survey points to elicit responses in order to determine the presence of the target species.
Mohave Valley Conservation Area  
Restoration Development and Monitoring Plan

- **Neotropical Birds** – Double sampling, rapid intensive area search surveys will be conducted in April – June 2015 prior to construction to identify species currently using the site as detailed in Great Basin Bird Observatory (2012). The site will be surveyed again at least two growing seasons after planting when riparian woodland vegetation reaches sufficient height and density to provide nesting habitat.

- **Small Mammals** – Once potential Colorado River cotton rat (*Sigmodon arizonae plenus*) and desert pocket mouse (*Chaetodipus penicillatus sobrinus*) habitat develops, presence surveys will be conducted at least once during fall and/or spring. Trapping will be conducted overnight using Sherman live traps. Traps will be placed in linear transects within the transition zone.

If habitat for additional covered species develops, monitoring may be scheduled to document presence.

### 5.0 REPORTS

#### 5.1 Annual Report

An annual report summarizing the following will be prepared by Reclamation and made available each calendar year:

- A general description of the status of the project and the effects on covered species
- A table from the Mitigation Monitoring and Reporting Program indicating the current implementation status of each mitigation measure
- A description of all restoration activities and monitoring actions conducted over the past year
- A summary of monitoring and research activities over the past year
- Results and analyses of monitoring and research data
- An assessment of the effectiveness of each mitigation measure in minimizing and compensating for project impacts
- The total number of acres planted
• The total number of acreage that meets or exceeds the performance standards

• Any other applicable information

5.2 Final Report

A final report will be prepared by Reclamation and submitted no later than 180 days after the completion of all mitigation measures. The final report is anticipated in 2055 and will include the following information:

• A copy of the table in the Mitigation Monitoring and Reporting Program with notes showing when each mitigation measure was implemented

• All available information regarding project-related incidental take of covered species

• Information regarding other project impacts on the covered species in California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06

• An assessment of the effectiveness of the permit’s conditions of approval for minimizing and compensating for project impacts

• Recommendations on how mitigation measures might be changed to more effectively minimize and mitigate the impacts of future projects on the covered species

• Any other pertinent information
LITERATURE CITED


