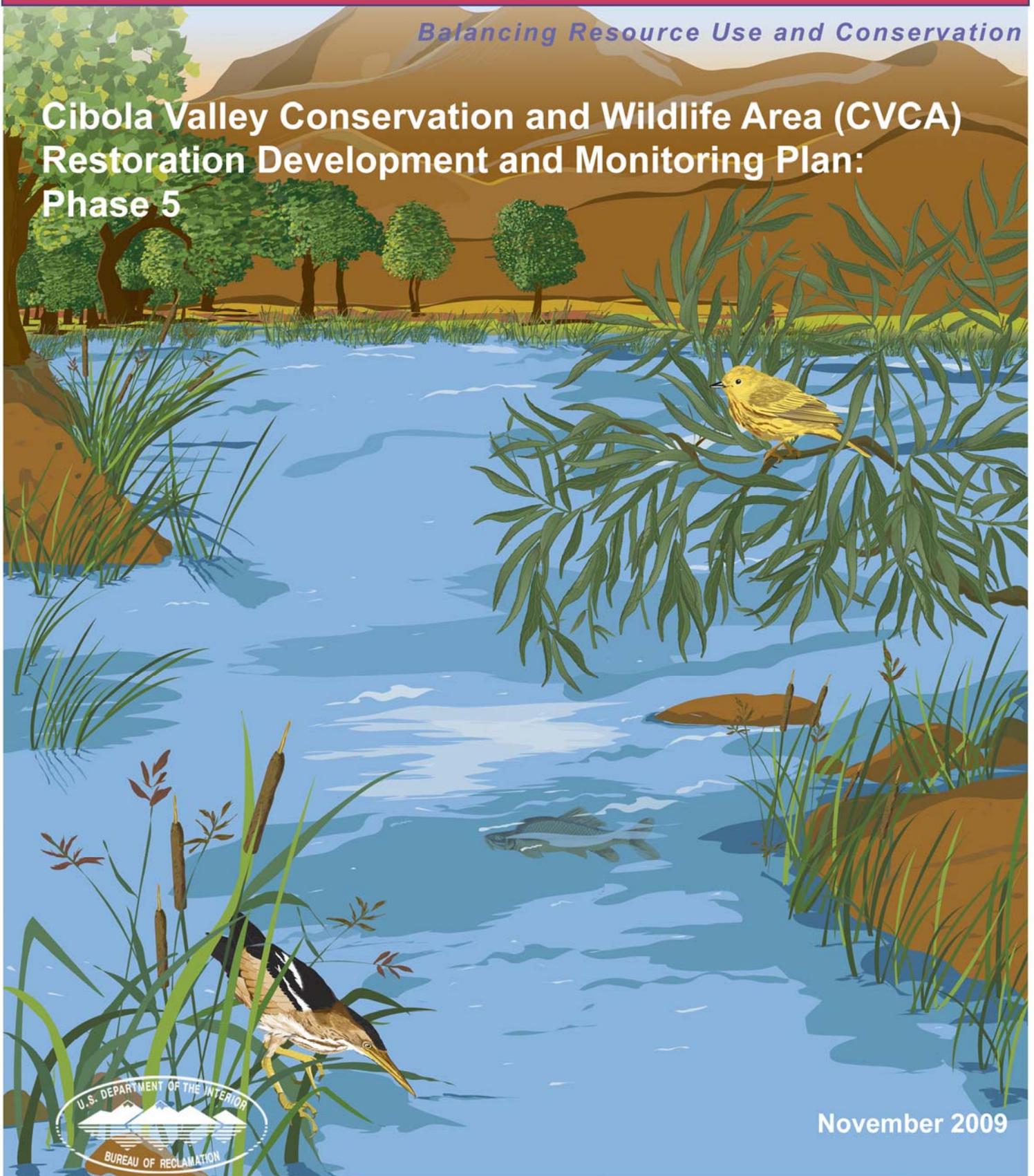




Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Cibola Valley Conservation and Wildlife Area (CVCA) Restoration Development and Monitoring Plan: Phase 5



November 2009

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 County Government Coalition
Desert Wildlife Unlimited

California Participant Group

California Department of Fish and Game
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
Cocopah Indian Tribe

Conservation Participant Group

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



Lower Colorado River Multi-Species Conservation Program

Cibola Valley Conservation and Wildlife Area (CVCA) Restoration Development and Monitoring Plan: Phase 5

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

November 2009

This page intentionally blank

Table of Contents

Acronyms and Abbreviations	6
Background	7
1.0 Purpose	7
2.0 Planting Design	9
Planting Techniques	10
Grading	11
Irrigation	11
3.0 Monitoring	12
Monitoring Design	12
Predevelopment Monitoring	13
Implementation Monitoring	14
Habitat/Species Monitoring	15
Vegetation Classification	18
Monitoring Analysis and Evaluation	18
Reference Conditions	18
Thresholds	18
Trigger Points	18
Data Collection and Analysis	19
4.0 Adaptive Management	19
Literature Cited	20

Figures

Figure 1. Proposed Phasing Map	8
Figure 2. Phase 5 Habitat Creation Planting Design	9
Figure 3. Furrows Prepared for Planting	10
Figure 4. Typical Furrow Irrigation	11

Tables

Table 1. Number of Proposed Plants	10
Table 2. Reference Variables for Phase 4	18

Acronyms and Abbreviations

AGFD	Arizona Game and Fish Department
BACI	Before-After-Control-Impact
CVIDD	Cibola Valley Irrigation and Drainage District
CVCA	Cibola Valley Conservation Area
CVCA	Cibola Valley Conservation and Wildlife Area
CW	Cottonwood-willow land cover type, as defined in the LCR MSCP HCP
HCP	Habitat Conservation Plan
LCR	Lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
Reclamation	Bureau of Reclamation
SWFL	Southwestern Willow Flycatcher
YBCU	Yellow-billed Cuckoo

Background

In 2002, the Bureau of Reclamation (Reclamation) secured 1,309 acres of land within the Cibola Valley Irrigation and Drainage District (CVIDD) in southwestern Arizona and established the Cibola Valley Conservation Area (CVCA). In September 2007, the property was conveyed to the Arizona Game and Fish Department (AGFD) through an agreement among AGFD, Reclamation, the Mohave County Water Authority (MCWA), and The Conservation Fund. Under the agreement, AGFD retains title to the property and leases the land and water rights to Reclamation until April 5, 2055 as part of the Lower Colorado River Multi-Species Conservation Program.

In September, 2008 a Memorandum of Understanding (MOU) was signed between Reclamation and AGFD that assures availability of land and water resources for the 50-year term of the LCR MSCP. This MOU changed the name to the Cibola Valley Conservation and Wildlife Area (CVCA).

The proposed development plan for the property is shown in Figure 1. Additional site information can be found on the LCR MSCP Web site (www.lcrmscp.gov) in a report entitled *Cibola Valley Conservation Area Restoration Development Plan: Overview*.

In April 2006, Reclamation planted 91 acres in Phase 1 consisting of a native plant nursery and cottonwood-willow land cover type (CW). The nursery was established initially as an on-site native plant nursery for future plant stock collection and may be managed for habitat after other nurseries have been developed for the LCR MSCP. Phase 3, consisting of 103 acres, was planted in March 2007, in accordance with the *CVCA Restoration Development Plan: Phase 3*. Phase 2, originally scheduled for early spring of FY 2007 was delayed for 1 year. It was planted in March 2008, in accordance with the *CVCA Restoration Development Plan: Phase 2*. Phase 4, consisting of 58 acres of honey mesquite and atriplex land-cover type was planted in March 2009.

1.0 Purpose

The purpose is to create 71 acres of honey mesquite land cover type for the sooty-wing skipper, elf owl, Arizona Bell's vireo, and other neotropical migrants covered in the LCR MSCP HCP. Honey mesquite will be planted in conjunction with already created cottonwood-willow adjacent to the Colorado River. This habitat area is designed to mimic the historical landscape patterns of plant communities along the LCR and to create an integrated mosaic of habitats.

Implementation of Phase 5 will begin in March 2010 and will expand upon the methodologies used in previous phases. The current field preparation process for Phase 5 includes fallowing the acreage for half a year prior to planting. During this time period, the field may be irrigated during the growing season in order to allow volunteer morning glory or cotton seed to germinate. Following germination, the fields would be disked. This process would be repeated several times prior to 2010 planting. Winter wheat will be planted in Phase 6 in January, 2010, at the request of AGFD. This wheat will double as a cover crop to keep the site weed free and as a wildlife forage crop.

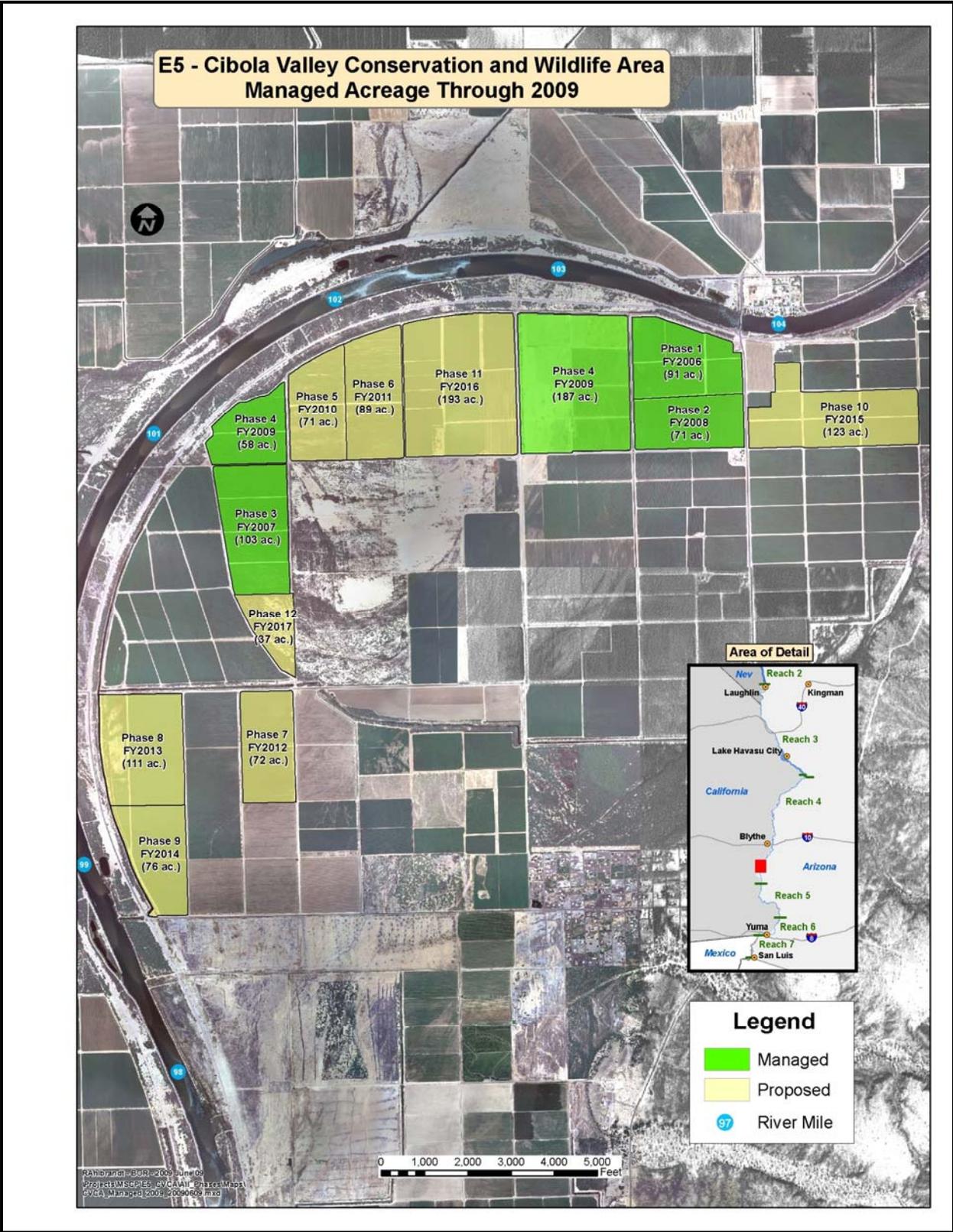


Figure 1: Proposed Phasing Map

2.0 Planting Design

Phase 5 converts 71 acres of active agricultural fields to honey mesquite land cover that, in coordination with earlier and later planting phases, is designed to create a native vegetation mosaic. This phase consists of eight fields or checks, arranged in size from 8 to 10 acres (Figure 2) with mesquite and atriplex planted in east-west rows.

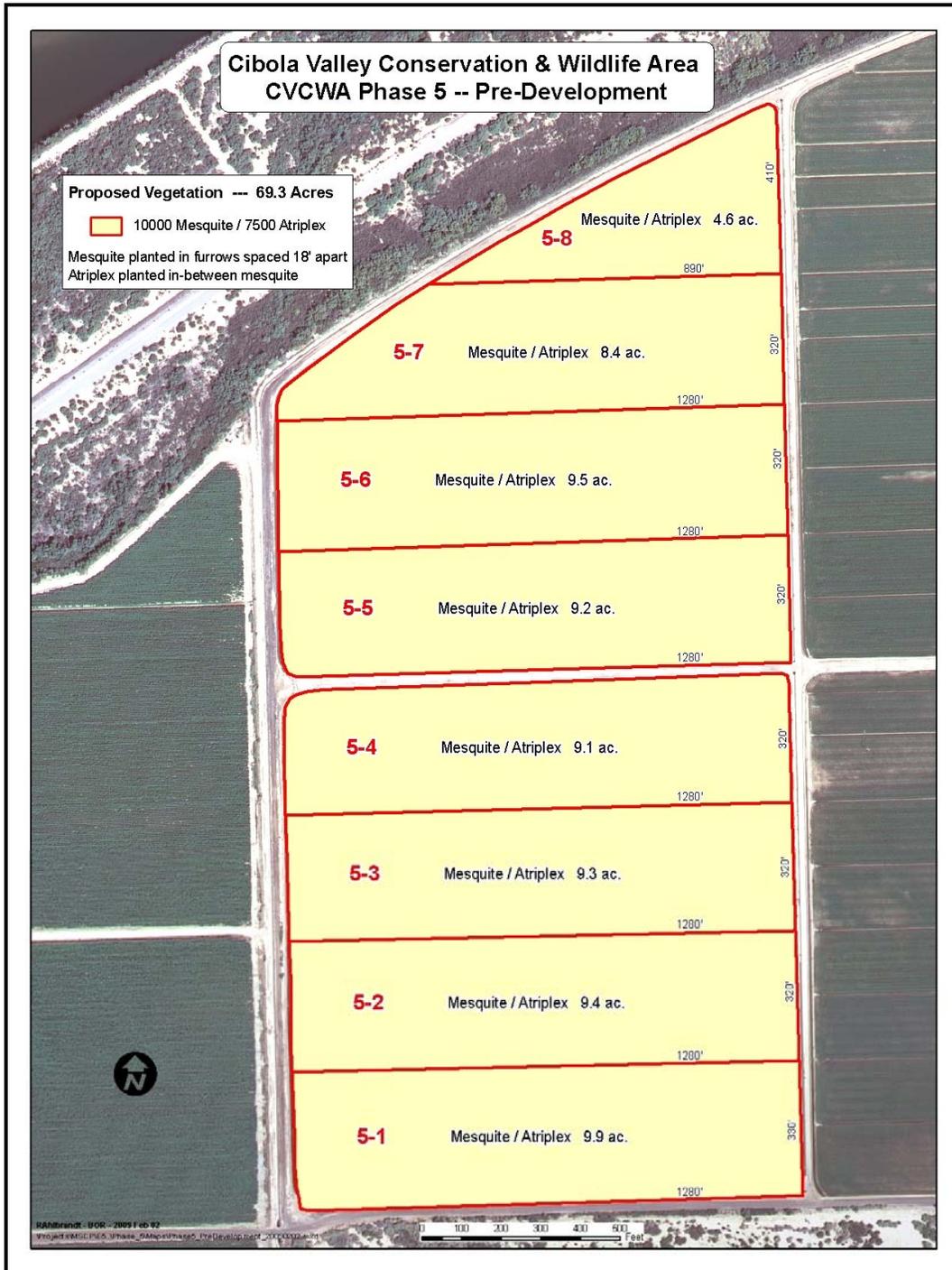


Figure 2: Phase 5 Habitat Creation Planting Design

Table 1 below, lists the number of plants proposed for this phase.

Table 1. Number of Proposed Plants

Scientific Name	Common Name	Number of Plants
<i>Atriplex lentiformis</i>	Quailbush	7,500
<i>Prosopis glandulosa torreyana</i>	Honey mesquite	10,000
Total		17,500

Planting Techniques

Phase 5 native plants will be planted in furrows with a plant in-line spacing of 15 feet and a furrow row spacing of 18 feet wide. Invasive plants will be controlled by mechanically disking between the furrows and with the application of preemergents during their first year of growth. Disking will keep the open areas weed free until the trees. Once the fields are prepared, 1-gallon potted mesquite plants will be hand planted in the trough of the furrow. *Atriplex* will also be hand planted just inside the furrows typically near the top, between the mesquite plantings (Figure 3).



Figure 3: Furrows Prepared for Planting

Grading

The fields will be laser-leveled prior to planting to ensure complete and even irrigation coverage and flow.

Irrigation

Irrigation gates are located at on the eastern boundary of Phase 5. A crop consultant may be utilized to recommend schedules for water and fertilizer applications. During the growing season, the consultant may sample and analyze plant tissue for nitrogen levels and other nutrients as necessary. Figure 4 depicts how the water will be applied in the furrows. The water savings utilizing this system of furrows is expected to save approximately two-thirds of the water normally applied utilizing flood irrigation of the whole field.



Figure 4: Typical Furrow Irrigation

3.0 Monitoring

Conservation area monitoring plans are based on elements described in the LCR MSCP HCP (LCR MSCP 2004) and Final Science Strategy (LCR MSCP 2007). Monitoring of CVCA will be structured into four main categories:

- Predevelopment.
- Implementation Monitoring.
- Habitat/Species Monitoring.
- Vegetation Classification.

Pre-development monitoring is designed to establish baseline data for evaluating post development activities, and to identify whether a covered species currently inhabits CVCA. Implementation monitoring will analyze whether the site was created as designed. Habitat/species monitoring will analyze whether the site meets the established life requirements necessary to provide habitat for the targeted covered species. Vegetation classification will classify the vegetation within the stand according to the Anderson and Ohmart (1976, 1984) classification system.

Reference conditions will be used as to benchmark the ultimate goals for the conservation area. The Phase 5 reference conditions will be based on the mesquite habitat goals listed in the LCR MSCP HCP.

The primary goal of Phase 5 is to produce mesquite habitat for sooty-wing skipper, elf owl, vermilion flycatcher, Arizona Bell's vireo, and other neotropical migrants covered in the LCR MSCP HCP. According to Table 5-3 of the LCR MSCP HCP, the minimum requirements for these species are Honey mesquite type III with no minimum patch size.

Monitoring Design

Monitoring design is based on quasi-experimental design using the “Before-After-Control-Impact” (BACI) approach (Stewart-Oaten and Osenberg 1992, Bernstein and Zalenski 1983, Green 1979). The BACI approach prescribes the collection of data prior to an activity and comparison to data collected after the activity (Smith 2002). The quasi-experimental design will use pre-restoration phases as controls, along with a long-term control area. The designs will utilize randomization, where possible. Subsamples of each phase will be taken at the same or similar randomized points both pre- and post-restoration. Control areas and each implemented phase will be monitored during same or similar time periods. To the greatest extent practicable, pre-restoration monitoring will be conducted for a minimum of 1 year prior to the implementation of each phase.

Population and habitat resources are determined based on the appropriate Avoidance and Minimization Measures, Monitoring and Research Measures, and General and Species-Specific Conservation Measures. Monitoring will be conducted both pre- and post-restoration but select resources will only be monitored post-restoration if no potential exists prior to development for the existing agricultural fields to support populations of targeted covered species (e.g., SWFL has never been found to occupy cotton fields). In most cases, resources monitoring will focus on

guilds of species for efficiency. The pre- and post-restoration resources that will be monitored are summarized below in each appropriate monitoring category. Specific protocols that have been developed for each resource may be found in the document entitled *Draft 2006 Monitoring Protocols for the LCR MSCP*.

Predevelopment Monitoring

Pre-development surveys and monitoring will identify the baseline and controls for post-restoration monitoring. The data will be compared to data from a long-term control site at CVCA (a specific area set aside for approximately 7-10 years prior to development), post-restoration data for each specific phase, and data from other restoration sites implemented as part of the LCR MSCP.

- **Abiotic Monitoring**

- **Soils**

Soil samples will be taken in each field to determine baseline soil moisture, pH, salinity, textural classification, depth to groundwater, and nutrients (including nitrates, ortho-phosphate, and ammonia). Approximately 5 to 10 samples will be taken on Phase 5 evenly distributed throughout the fields. Soil samples will be collected after existing crops have been harvested and the field has been disked and prior to planting native vegetation.

- **Biotic Monitoring**

- **Vegetation Monitoring**

A qualitative overall description of type of vegetation in each agricultural field will be described before planting. Photo points may be established.

- **Avian Monitoring:**

- **Avian**

Marshbirds will not be monitored, as marsh habitat is not present.

Pre-development monitoring for neo-tropical avian species has been conducted sufficiently on agricultural fields and in 1-year-old planted fields at CVCA; no more surveys of these land cover types will be conducted.

Cavity nesting birds will not be monitored, as the required structure of riparian habitat is not present.

Species-specific SWFL pre-development surveys will not be conducted, as the required structure of riparian habitat is not present.

Species-specific yellow-billed cuckoo (YBCU) pre-development surveys will not be conducted, as the required structure of riparian habitat is not present.

- Small mammal presence/absence transects were conducted between January and March 2008 in areas adjacent to sites to determine potential dispersal areas. Traps were placed in linear transects approximately 500 feet in length, with one trap placed every 33 feet along each transect. Transects were located to most efficiently trap the selected area, with the actual distance apart determined by the size of the area being surveyed. Trapping is being conducted for a minimum of 500 trap nights. A trap night is defined as setting one trap over one night.
- Preliminary presence/absence bat surveys will not be conducted within this phase due to the sampling of similar sites within CVCA. Anabat bat detectors are being used in other areas as controls for existing agriculture fields and will be used to correlate bat activity with phases that have been planted with covered species habitat.

Implementation Monitoring

Implementation monitoring will be conducted to assess whether land cover type creation and management actions have been implemented as designed on each phase. This type of monitoring quantifies changes immediately after treatments and evaluates whether actions were implemented as prescribed (Block et al. 2001). The results of this monitoring may:

- Determine if the appropriate number of acres of created land cover types has been achieved as designed.
- Determine if the mechanized planting technique is effective and plants have been planted according to design specifications.
- Determine the survival rate, composition, and distribution of trees planted.

Post-restoration data will be compared and contrasted to predevelopment data where appropriate, data from the long-term control area, the existing habitat data for targeted covered species, and data from other restoration sites implemented as part of the LCR MSCP.

- Abiotic Monitoring
 - Soil Salinity and nutrients

Salinity and nutrient levels in each irrigated field will be determined by obtaining soil samples at approximately 10 samples per 40 acres.

For Phase 5, this equates to approximately 10-12 samples evenly distributed throughout the fields. Soil sampling will be conducted annually, until a steady state has been achieved, and salinity has not increased. Then soil sampling will be conducted every 2 to 5 years, unless data indicates a return to annual sampling.

- Water use

Water deliveries will be recorded by the entity conducting the deliveries.

- Biotic Monitoring

- Vegetation

Four to 6 weeks after planting, a subset of all trees planted will be counted and a general assessment of condition (live, stressed, or dead) will be recorded to determine initial survivorship. This data will be used to guide initial management activities such as water use and re-planting.

At the end of the first growing season (October 2009), each land cover type will be monitored to determine vegetation survival. Initial survivorship monitoring will be conducted for 1 year to consider survival during establishment and determine whether mortality within the first growing season is due to implementation-related factors (e.g., planting shock, seed viability, water availability, soil conditions and characteristics, competition with exotics). During the first two growing seasons, nested plots will be established. The number of nested plots will be determined based on several factors including patch size, restoration technique, vegetation species, and variation within each stand. Within each nested plot, every tree will be counted and recorded by species.

Habitat/Species Monitoring

Habitat/Species monitoring will be conducted to determine whether Phase 5 achieved the reference conditions, as discussed in the reference conditions section of this report, and to determine any covered species use of that habitat (Block et al. 2001).

The results of this monitoring may determine whether vegetation has become targeted covered species habitat, as determined by the reference conditions; determine whether created habitat supports multiple layers, seral stages, and age cohorts of trees; and determine whether the habitat is being utilized by targeted covered species.

- Habitat Monitoring

Vegetation Monitoring – After the third growing season, habitat condition will be monitored using a standardized protocol based on a nested sample plot design. Fixed radius plots that were established for the implementation monitoring will be measured to track growth and survival over time. The

sample interval will depend on stand maturation. Vegetation monitored will include but will not be limited to: overstory trees, sapling, shrub, understory, herbaceous layer, vertical foliage density, and crown closure. This monitoring will be conducted annually in years 3 through 6 after planting, and will then be conducted every other year between years 6 through 10. After year 10, each site will be sampled every 5 years to monitor successional change through year 50. In the case of a catastrophic disturbance to the site (e.g., fire, flood) post-disturbance monitoring will mimic the post-restoration monitoring regime.

- Covered Species Monitoring

- Marshbirds

Monitoring will not be conducted because no marshbird habitat is being created at CVCA.

- Neotropical Birds

A standardized area search survey methodology will be utilized. Surveys will be conducted annually during the breeding season (May-July) beginning the second May after planting Phase 5.

If covered species are observed, species-specific surveys, nest searches, and mist-netting/banding may be conducted.

- Cavity Nesting Birds

Elf owl presence/absence surveys will be conducted after 4 to 6 years, depending on when the land cover type, structure, and density indicates that the habitat contains the characteristics known to be preferred by the species. Any installed nest boxes will be monitored during the breeding season. If elf owls are detected during the breeding season, nest searches and mist-netting/banding may be conducted.

Gilded flickers and Gila woodpeckers will be surveyed as part of the system-wide neotropical bird monitoring effort. Once suitable nesting habitat (snags with cavities) develops on the site, more directed presence/absence surveys may be conducted for gilded flicker or Gila woodpeckers. If gilded flickers or Gila woodpeckers are detected during breeding season, nest searches and mist-netting/banding may be conducted.

- Southwestern Willow Flycatcher

Although Phase 5 does not contain nesting habitat for southwestern willow flycatchers, nearby and adjacent areas have been planted (Phases 1, 2 and 3) or will be planted with cottonwood and willow. Phase 5 may provide foraging habitat for flycatchers that may nest in nearby cottonwood and willow and for migrating flycatchers. Cottonwood and willow habitat in CVCA will be surveyed for flycatchers according to standardized presence-absence surveys (Korokiewicz and McLeod 2009, Sogge et al. 1997) after three growing seasons (2011). Birds nesting adjacent to or

utilizing Phase 5 during migration may be detected incidentally during standardized willow flycatcher surveys or during the system-wide neotropical bird monitoring effort.

- Yellow-billed Cuckoo

Although Phase 5 does not contain ideal nesting habitat for cuckoos, nearby and adjacent areas have been planted (Phases 1, 2 and 3) or will be planted with cottonwood and willow. Phase 5 may provide foraging habitat for cuckoos that may nest in nearby cottonwood and willow and for migrating cuckoos. Cottonwood and willow habitat in CVCA will be surveyed for cuckoos according to standardized presence-absence surveys (Haltermann et al. 2009) after three growing seasons (2011). Birds nesting adjacent to or utilizing Phase 5 during migration may be detected incidentally during standardized cuckoo surveys or during the system-wide neotropical bird monitoring effort.

- Small Mammals

Because known populations of *Sigmodon arizonae* exist near this site, small mammal presence/absence surveys may be conducted using a standardized protocol between September-November and February-May if adequate ground cover exists. Trapping would be conducted overnight, and traps will be placed in parallel, linear transects approximately 250 meters in length with a trap placed every 10 meters. Transects would be approximately 10 meters apart, with the actual number of traps and transects being determined by the size of the available habitat, but not to exceed 200 traps per night. If presence of *S. arizonae* is confirmed, individuals will be marked with a PIT tag and ear clipped for genetic evaluation to determine the source population.

- Bats

Presence/absence surveys may be conducted utilizing active/passive Anabat bat detectors at least 2 days per season (spring, summer, winter, and fall) annually if additional replicates for the study design are needed at CVCA.

- MacNeill's Sootywing

Surveys for MacNeill's sootywing are being conducted in all restoration sites that contain its host plant, quail brush (*Atriplex lentiformis*), and are \geq 1 year old. A transect will be walked along all of one road bordering the plot, or within the plot. Sootywings on quail brush or nectar-producing plants (e.g. heliotrope) will be counted. Heights of quail brush, air temperature, relative humidity, and wind speed will be recorded. Surveys will be conducted every 2-3 weeks from April through September.

Vegetation Classification

The HCP (LCR MSCP 2004) outlines the specific habitat acreage to be restored and utilizes the Anderson and Ohmart (1976, 1984) classification system as the performance standard. Reclamation will determine vegetation classification annually until target goals have been met. To map the vegetation at CVCA, Reclamation will use aerial imagery of the site to map each phase according to the Anderson and Ohmart (1976, 1984) system (See Phase 1 report).

Monitoring Analysis and Evaluation

Once the implementation and effectiveness monitoring data are analyzed, the results will be evaluated with two sets of management guidance criteria: thresholds and trigger points. These criteria will be used to evaluate all phases of implementation.

Reference Conditions

Phase 5 reference conditions will be based on needs of the targeted covered species. These variables may change depending on future analysis of system-wide studies that are currently being conducted. Reference variables for Phase 5 are presented in Table 2 and may change as future data refine these ranges.

Table 2. Reference Variables for Phase 5

Canopy Height (M) based on Honey Mesquite III Land cover type	Average greater than 4.0 m
Vertical Foliage Distribution	Greatest between 1 and 3 m above ground based on Ohmart and Anderson Honey Mesquite III land cover type. This may change as additional analysis is completed.

Thresholds

Thresholds signal that conditions are appropriate and to continue current management practices. The thresholds currently established are:

- Vegetation conditions have been achieved for reference conditions.
- Phase 5 is being utilized by one or more covered species during migration.
- Site is being utilized by one or more covered species during breeding.

Trigger Points

Trigger points signal the need to alter current management activities to achieve the conservation area goals of the restoration site or change goals for site. The trigger points currently established are:

- Reference conditions for vegetation conditions have not been achieved.
- 50% or more of non-survival or low densities.

Data Collection and Analysis

All data collected will be entered into the long-term relational database that is in development for the LCR MSCP. Analysis will be both qualitative and quantitative, depending on the data collected.

A summary of vegetation and habitat characteristics will be produced post-restoration.

The area searches will record whether any of the targeted covered bird species were found utilizing the site. Data will be compiled and single factor ANOVA will be used for detection between survey dates. Species diversity, richness, and evenness will be determined using a natural logarithm version (Nur et al. 1999) of Shannon's Index (Krebs 1989).

The analyses methods for small mammals, bats, and MacNeill's sootywing skipper will focus on presence/absence of the species. All analyses will contain a list of species present and will compare species diversity and richness for both pre- and post-restoration.

4.0 Adaptive Management

Data will be evaluated annually to determine if thresholds and trigger points are reached. An annual monitoring report will be prepared with summary results of all monitoring studies conducted that year. A 5-year summary report will be prepared to analyze trends and to determine if results indicate that restoration activities meet or exceed thresholds.

Recommendations will be made in the annual report and in the 5-year summary report for future management actions and for changes in protocols or monitoring regimes. If results indicate that effects are deleterious to species or habitats, potential modifications will be identified and evaluated.

Literature Cited

- Anderson, B. W. and R. D. Ohmart. 1976. Vegetation type maps of the Lower Colorado River from Davis Dam to the Southerly International Boundary. Final Report. Bureau of Reclamation Lower Colorado Region, Boulder City, NV. [p27 & p32].
- Anderson, B. W. and R. D. Ohmart. 1984. Lower Colorado River riparian methods of quantifying vegetation communities to prepare type maps. Final Report. Bureau of Reclamation Lower Colorado Region, Boulder City, NV. [p80].
- Bernstein, B. B. and J. Zalenski. 1983. An optimum sampling design and power tests for environmental biologists. *Journal of Environmental Management* 30:129-133.
- Block, W. M., A. B. Franklin, J. P. Ward, Jr., J. L. Ganey, and G. C. White. 2001. Design and implementation of monitoring studies to evaluate the success of ecological restoration on wildlife. *Restoration Ecology* 9(3):293-303.
- Great Basin Bird Observatory. 2003. Nevada Bird Count: A habitat-based monitoring program for breeding birds of Nevada. Retrieved on 13 Feb. 2006.
http://www.gbbo.org/nbc_protocol.htm
- Green, R. H. 1979. *Sampling Design and Statistical Methods for Environmental Biologists*. John Wiley and Sons, New York.
- Halterman, M.D., E.T Rose, S.E. McNeil and D. Tracy. 2008. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries 2008 annual report. Prepared for the U.S. Bureau of Reclamation, LCR Multi-species Conservation Program, Boulder City, Nevada.
- Krebs, C. 1989. *Ecological methodology*. Harper and Row, New York.
- Lower Colorado River Multi-Species Conservation Program. 2004. Lower Colorado River Multi-Species Conservation Program, Volume II: Habitat Conservation Plan. Final. December 17. (J&S 00450.00) Sacramento, CA.
- Lower Colorado River Multi-Species Conservation Program. 2007. Final Science Strategy. Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV. 66 pp.
- McLeod, M.A., and T.J. Koronkiewicz. 2009. Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2008. Annual report submitted to U.S. Bureau of Reclamation, Boulder City, NV by SWCA Environmental Consultants, Flagstaff, AZ.
- Nur, N., S. L. Jones, and G. R. Guepel. 1999. *A statistical guide to data analysis of avian monitoring programs*. U.S. Department of the Interior, Fish and Wildlife Service. BTP-R6001-1999. Washington D.C.

- Smith, E. P. 2002. BACI design. Volume 1, pp. 141-148 in Encyclopedia of Environmetrics. Abdel H. El-Shaarawi and Walter W. Piegorsch, eds. John Wiley & Sons, Ltd. Chichester.
- Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbets. 1997. A southwestern willow flycatcher natural history summary and survey protocol. National Park Service Technical Report USGS/NAUCPRS/NRTR-97/12.
- Stewart-Oaten, A., J. R. Bence, and C. W. Osenberg. 1992. Assessing effects of unreplicated perturbations: No simple solutions. Ecology 73:1396-1404.