DRAFT FINAL ENVIRONMENTAL ASSESSMENT

FOR

RENOVATION OF CIBOLA HIGH LEVEE POND TO REMOVE

NON-NATIVE FISHES AND REPATRIATE NATIVE SPECIES

Cibola National Wildlife Refuge

Department of the Interior
U.S. Fish and Wildlife Service

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EXECUTIVE SUMMARY

The purpose of the proposed action is to restore and enhance the native fish community in the Lower Colorado River by eradicating non-native fish from Cibola High Levee Pond, Imperial County, California, and La Paz County, Arizona (Figure 1), and restocking the backwater with native fish, such as the endangered razorback sucker (*Xyrauchen texanus*) and bonytail chub (*Gila elegans*). Providing habitat for threatened and endangered species would aid in recovery of these species. Conservation and recovery actions that improve the status of species and reduce threats to the species is covered under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (ESA). Currently, our ability to effectively conserve and manage native fish in the Lower Colorado River is limited due to the presence of non-native fish. Yet isolated backwaters such as High Levee Pond provide important habitat for endangered fishes and provide an opportunity to rear these species in a protected environment. This action would be undertaken cooperatively by the Fish and Wildlife Conservation Offices, Cibola National Wildlife Refuge of the U.S. Fish and Wildlife Service (Service), and in coordination with other partners. This EA is considered to be a supplement and tiered to the "Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Environmental Assessment 1994-2014."

The preferred alternative would include the use of a chemical piscicide to remove non-native fish. The chemical renovation would occur during 2008-2014 as needed. Following use of the piscicide, native species, such as razorback sucker and bonytail, would be restocked into the backwater. With this initial renovation, it is anticipated restocking efforts would be completed by winter 2008 and a long-term monitoring program would be initiated to evaluate success of the preferred alternative and for management of the re-established native fishery.

Under the National Wildlife Refuge Administration Act, the Service is responsible for "administration of a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Further, the Act states that "The National Wildlife System serves a pivotal role in the conservation of migratory birds, anadromous and interjurisdictional fish, marine mammals, endangered and threatened species, and the habitats on which these species depend" (NWRAA 1998).

The Arizona Game and Fish Department (AGFD) have supported the Service for conservation work previously conducted at Cibola High Levee Pond, and remains an active partner in the proposed action. The California Department of Fish and Game has been involved in management actions in the past; however is not a participant in the proposed action. Conservation through re-establishment of native fishes in Arizona is consistent with the AGFD's "Wildlife 2006" (AGFD 2001) Nongame and Endangered Wildlife subprogram

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narrative and “Comprehensive Wildlife Conservation Strategy’s” (AGFD 2006) Wildlife Action Plan. Goals of the narrative and Plan include restoration of native biological diversity and recovery of imperiled species. The State of Arizona’s Heritage and State Wildlife Grants Programs are consistent with recovering imperiled native wildlife and increasing common species occurrence. Furthermore, through a June 2002 Memorandum of Agreement, the Service and AGFD have mutually agreed to participate in actions to improve the status of wildlife species-at-risk, such as the bonytail chub and other native fish.

The decision is whether the Service will, 1) eradicate non-native aquatic species from Cibola High Levee Pond using chemical piscicide and restock the area with native fish; or 2) take no action on removing non-natives from the area. The Service will make a decision on action to be taken after a 30-day public review of this draft environmental assessment, and after consideration of public comments received during the comment period. If the alternative selected would cause significant adverse impacts on the human or natural environment, an Environmental Impact Statement would be prepared prior to implementing the alternative. If no significant adverse impacts are anticipated, we will prepare a Finding of No Significant Impact and a final environmental assessment. These documents will be posted on our website http://www.fws.gov/southwest/es/arizona/) and mailed to those who provide comments on this draft or who request copies.

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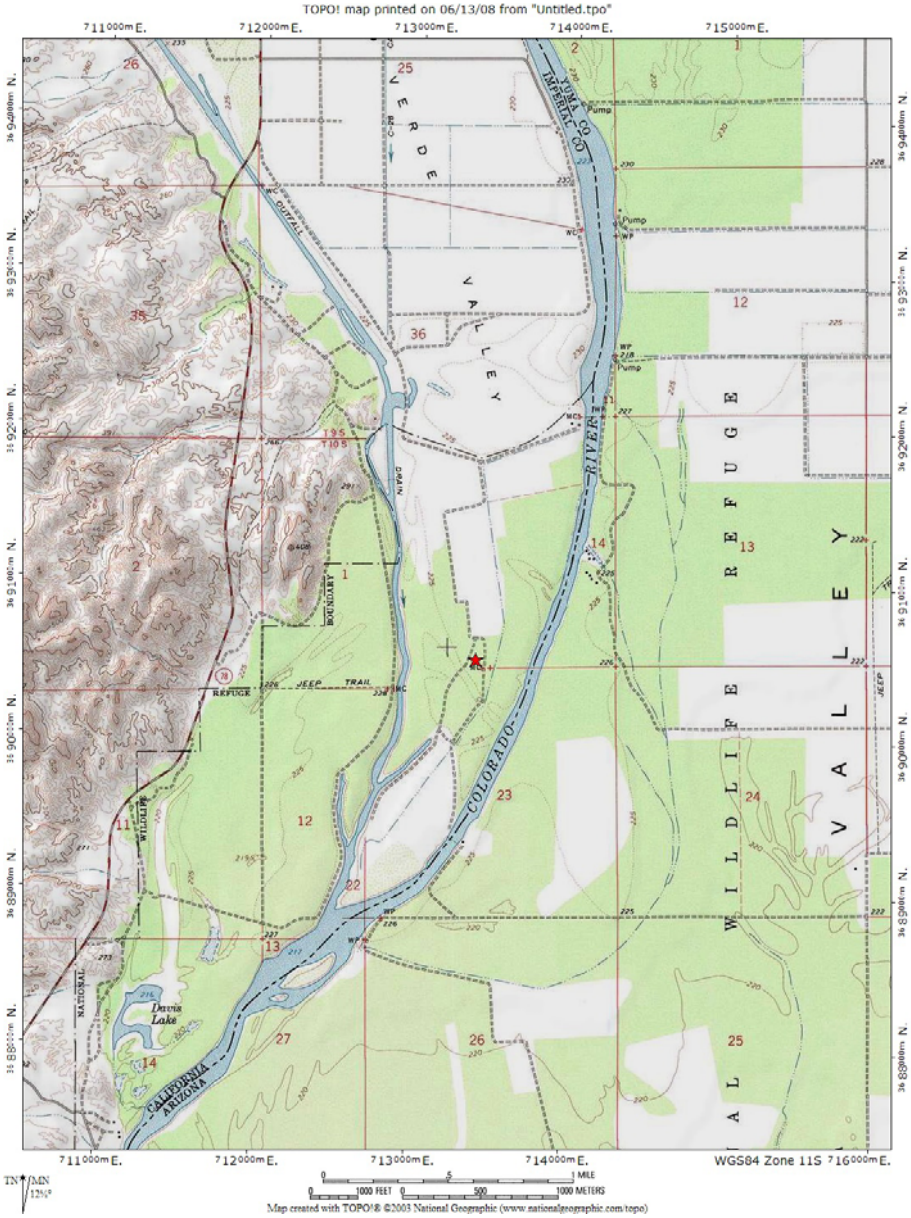

Figure 1. Location of Cibola High Levee Pond, in the Lower Colorado River. Red star indicates project area.

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CHAPTER 1: PURPOSE AND NEED

1.1 Introduction

The Service has prepared this Environmental Assessment (EA) to analyze potential effects to physical, biological, and cultural resources that may result from native fish renovation efforts in High Levee Pond on the Cibola National Wildlife Refuge.

This document is organized into six chapters:

- Chapter 1: *Purpose and Need*: Presents information on the history of the proposed action, purpose of and need for the proposed action, and the lead agencies' proposal for achieving that purpose and need. This section also details how the lead agency informed the public of the proposal and how the public responded.

- Chapter 2: *Comparison of Alternatives, including Preferred Alternative*: Provides a detailed description of the lead agency preferred alternative, alternative methods for satisfying the stated purpose and need, and significant issues raised by the public, preferred alternative proponents, and other agencies.

- Chapter 3: *Affected Environment:* Describes the project environment.

- Chapter 4: *Environmental Consequences*: Describes the environmental consequences of implementing the preferred alternative and other alternatives. This section also includes a summary table of the environmental consequences associated with each alternative.

- Chapter 5: *Agencies and persons consulted*: Lists preparers and agencies consulted during development of the EA.

- Chapter 6: *Literature Cited*: Lists documents used in the preparation of this EA.

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1.2 Purpose for the Proposed Action

The purpose of the proposed action is to restore and enhance the native fish community in Cibola High Levee Pond. A renovated Cibola High Levee Pond would provide a sanctuary for these fish due to reduced non-native predator loads and a source of native fish for recovery and conservation actions in downstream areas. This EA is considered to be a supplement and tiered to the "Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Environmental Assessment 1994-2014".

1.3 Need for the Proposed Action

Renovation would benefit native fishes in the Lower Colorado River by eliminating non-native predators and allowing native fishes in Cibola High Levee Pond the ability to grow to larger, less predator-vulnerable size. Historically, Cibola High Levee Pond provided habitat for razorback suckers and bonytail chub. After renovation in 1993, the pond was stocked with these species and a recruiting population was established. The pond was compromised in 2003 when largemouth bass (*Micropterus salmoides*), a non-native fish known to prey on the native fish, were found in the pond. As a consequence, recruitment by native fishes has not been observed since 2004, indicating that restoration of razorback sucker and bonytail populations in the pond require the removal of all largemouth bass from the pond. The proposed action addresses the potential renovation of Cibola High Levee Pond only and does not address non-native fish populations in the mainstem Lower Colorado River.

Under the National Wildlife Refuge Administration Act, the Service is responsible for "administration of a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Further, the Act states that "The National Wildlife System serves a pivotal role in the conservation of migratory birds, anadromous and interjurisdictional fish, marine mammals, endangered and threatened species, and the habitats on which these species depend" (NWRAA 1998).

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Conservation through re-establishment of native fishes in Arizona is consistent with the AGFD's Wildlife 2006 Nongame and Endangered Wildlife subprogram narrative. Goals include restoration of native biological diversity and recovery of imperiled species. Furthermore, through a June 2002 Memorandum of Agreement, the Service and AGFD have mutually agreed to participate in actions to improve the status of wildlife species-at-risk, such as bonytail chub and other native fish. AGFD's management goals for the Lower Colorado River (which encompasses Cibola High Levee Pond), include protection of current and potential values for threatened, endangered, and sensitive (TES) stream and riparian habitats, fish, waterfowl, big game, small game, and non-game species with primary emphasis on TES species and their habitats.

1.4 Decision to be made

The Service must decide whether or not the environmental (or biological) consequences of any of the alternatives would be significant, and determine if either a Finding of No Significant Impact or an environmental impact statement (EIS) should be prepared. If the preferred alternative is chosen, the Service in cooperation with other partners would renovate Cibola High Levee Pond. Since the proposed action would be a joint action by the Arizona Fish and Wildlife Conservation Office (AZFWCO) and Cibola National Wildlife Refuge, the decision memo would be signed by Stewart Jacks, Project Leader AZFWCO

and Mike Oldham, Refuge Manager (CNWR).

Monitoring for this project (outside this EA) would occur in cooperation with the Bureau of Reclamation and the AGFD, under the "Native Fish Sanctuary Concept" (Appendix A).

1.5 Scoping Process

The decision will occur after a 30-day public review of this draft environmental assessment and after consideration of all public comments received during the comment period. If the alternative selected would cause significant adverse impacts on the human or natural environment an EIS would be prepared prior to implementing the alternative. If no significant adverse impacts are anticipated, the Service will prepare a Finding of No Significant Impact and a final environmental assessment. These documents will be posted on our website (http://www.fws.gov/southwest/es/arizona/) and mailed to those who provided comments on this draft or who request copies.

1.6 Consultation and Coordination

This document was prepared in cooperation with biologists at Cibola National Wildlife Refuge and other fishery biologists including state, federal and academic partners. Information on this project was presented at the Colorado River Area Biologists meeting in Laughlin, NV in 2008 as well as the Desert Fishes Council meeting in Ventura, California, in 2007.

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1.7 Issues and Concerns

The Service has proposed to renovate High Levee Pond on CNWR using piscicide. The pond is bisected by the Arizona/California state line, which presents some complexity with regard to necessary permits required to complete the renovation. The State of California has stated that a National Pollution Discharge Permit (NPDES) is required prior to project implementation. The State of Arizona has exempted fish management activities from water quality permitting under the Department of Environmental Quality, Title 18 Chapter 11 Section R 18-11-116.

We have determined that a NPDES permit is not required from the California Regional Water Quality Control Board to use piscicides for renovation on CNWR due to case law including Ropanos 2006 and Fairhurst v Hagener. The State of California believes a NPDES permit is required under the Clean Water Act due to concern about the solubility of rotenone and chemical transference off site and into other watersheds. This concern was addressed in Finlayson et al. (2000) which stated: "The ability of rotenone to move through soil is low to slight. Rotenone moves only 2 cm in most types of soils. An exception would be in sandy soils where the movement is about 8 cm. Rotenone is strongly bound to the organic matter in soil so it is unlikely that rotenone would enter groundwater." As the

substrate of Cibola High Levee Pond is organic, movement would be minimal and pose no threat to fish in adjacent waters. In addition, per April Fletcher, Invasive Species Coordination with NWRS, indicated that the absorption coefficient for rotenone was very high; therefore, eliminating the possibility of rotenone migrating away from High Levee Pond. In addition:

- The KOC (A measure of a material's tendency to adsorb to soil particles) of rotenone is around 10,000, reducing its potential for movement through an organic substrate to the river essentially to zero
- The half-life of rotenone is between 1 and 3 days with essentially all toxicity gone in 5 to 6 days
- There is no surface connection between the Colorado River and the pond where rotenone will be used

Therefore, this issue (NPDES permit) is considered to be outside the scope of the document and will not be further analyzed.

High Levee Pond was developed by the Arizona Fish and Wildlife Conservation Office and CNWR as a native fish facility in 1993 and used until 2005. High Levee Pond was the only managed site in the Colorado River basin where the endangered razorback sucker and bonytail maintained self-sustaining populations, contributing to the conservation and recovery of these species. Largemouth bass were illegally introduced into the pond in 2003 and resulted in a complete elimination of the native fish population. Renovation using piscicides (rotenone or antimycin) is required to restart this system and continue restoration activities presented in the Lower Basin Management Plan for Big River Fishes and the Native Fish Sanctuary Program.

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CHAPTER 2: DESCRIPTION OF ALTERNATIVES

2.1 No Action Alternative

Under a No Action alternative, neither renovation nor repatriation of native fish in Cibola High Levee Pond would occur. The enclosed, lotic nature of Cibola High Levee Pond provides prime habitat for spawning and recruitment of non-native aquatic species such as common carp (*Cyprinus carpio*) and catfish (*Ictalurus* spp.). Therefore, if renovation does not occur, non-natives will continue to thrive, and management of native fishes and other native aquatic species will be impractical at Cibola High Levee Pond. There would be no cost for implementing the No Action Alternative.

2.2 Alternative A, Preferred Alternative (Chemical Renovation and Restocking of Native Fish)

Use of Chemical Piscicide to Renovate Cibola High Levee Pond: The purpose of the proposed action is to restore and enhance the native fish community in Cibola High Levee Pond by removal of all non-native fish (e.g. largemouth bass). A fish toxicant effective in killing most species and life stages of gill-breathing fishes will be used to remove non-native fishes from Cibola High Levee Pond. Sodium or potassium permanganate will be used as detoxifying agent at the downstream end of the treatment zone. Following the eradication of non-native fishes from Cibola High Levee Pond, restocking efforts will restore the native fish community that was historically found in the area, primarily razorback sucker and bonytail. Both the bonytail and razorback sucker are listed as endangered under the Endangered Species Act (Act).

The EPA-registered piscicide (antimycin or rotenone) would be applied under the supervision of a certified applicator and in accordance with a treatment plan approved by the Service. If the treatment chemical is rotenone, the formulation used would be either Nusyn-Noxfish or CFT Legumine. Both formulations have rotenone as the primary active ingredient, but the older formulation of Nusyn-Noxfish has several hydrocarbon-based diluents and surfactants in low concentrations that impart a diesel-like odor that could permit fish avoidance. The recent formulation of CFT Legumine replaces most of those chemicals with fewer and better-performing diluents, thus decreasing and altering its smell, and potentially reducing its ability to be detected by fishes. Both formulations would be applied using backpack sprayers along shorelines and small boats with electric motors to cover deeper sections of Cibola High Levee Pond.

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If antimycin is used, Cibola High Levee Pond would be treated with a combination of aqueous antimycin A (Fintrol-Concentrate) and possibly sand coated antimycin A (Fintrol-15). Fintrol-Concentrate is comprised of the active ingredient antimycin A and inert ingredients soy lipids, acetone (diluents), biethyl phthalate (a surfactant), and nonoxyl-9 (a detergent). Fintrol-concentrate would be applied either by backpack sprayer or mixed in buckets with water and dispersed by hand. Fintrol-15 is comprised of antimycin A coated over a grain of sand that is then coated with other inert materials that dissolve slowly when in water. This allows antimycin to be released over a depth of 15 feet when applied at the surface. Fintrol-15 is applied by hand or with a hand-held seed or fertilizer spreader.

Prior to treatment, Cibola High Levee Pond volume would be calculated using direct measurements. Appropriate calculations would then be made to determine the amounts of piscicide necessary to treat Cibola High Levee Pond and examined by a certified pesticide applicator.

Renovation activities would be coordinated by the Service and other partners, complying with applicable state and Federal rules and regulations. Sodium or potassium permanganate would be used to detoxify the fish toxicant, to ensure that downstream water quality and public safety concerns are met. A detoxification drip station would be established downstream of the Cibola High Levee Pond outflow (where Prettywater begins) to apply either aqueous potassium permanganate ($KMnO_4$) or sodium permanganate

($NaMnO_4$) into the area during the course of each piscicide treatment to ensure detoxification. Although the piscicide will not move out of the Pond via subsurface flows, an additional detoxification station would also be established within the Colorado River. For each station, a cage with sentinel fish would be placed approximately 100 yards downstream of the detoxification area to ensure that the detoxification is occurring as intended.

Rotenone: In addition to applicability as a piscicide, rotenone is registered as an insecticide for use on dogs, cattle, sheep, ornamental plants, trees, and turf. Rotenone is also used for foliar preharvest application to vegetables, berries, tree fruit, nuts, forage crops, and sugar cane. Rotenone, a naturally occurring compound extracted from the roots of certain species of the bean family, has been used for centuries to capture fish (Finlayson et al. 2000). When introduced at a proper dosage into water, rotenone interrupts cellular respiration in gill-breathing animals by blocking the transfer of electrons in mitochondria. Scientists believe that fish are more sensitive to rotenone because it is rapidly absorbed into the bloodstream from water flowing across the gill membrane. Both fish and aquatic insects are highly susceptible to rotenone (Skaar 2001), although aquatic insect populations usually rebuild to pre-treatment levels quite rapidly (Lennon 1971, Schnick 1974). Gill-breathing amphibians (i.e., frog and toad tadpoles and larval salamanders) are also adversely affected.

Rotenone is very unstable in the environment (half-life measured in days) and completely breaks down within one to four weeks depending on pH, alkalinity, temperature, dilution, and exposure to sunlight (Schnick 1974). Rapid neutralization (oxidation) occurs when rotenone is mixed with potassium permanganate (see Permanganate section below). Inert ingredients in the liquid formulation of rotenone as Nusyn-Noxfish consist of petroleum hydrocarbons as solvents and emulsifiers (primarily naphthaline, methylnaphthalenes, trichloroethylene, and xylenes), whereas those ingredients have been essentially replaced with n-methyl-2-pyrrolidone and diethylene glycol ethyl ether in the CFT Legumine formulation. There are no Federal or Arizona water quality standards for rotenone. When applied to surface waters according to label instructions for fish control, rotenone is not a pollutant as defined under the Clean Water Act.

Antimycin A: Antimycin A is an organic compound that was isolated from the bacterium *Streptomyces girseus* at University of Wisconsin in 1945 (Leben and Keitt 1948, Dunshee et al. 1949). Antimycin ($C_{28}H_{40}N_2O_9$; Rinne and Turner 1991)), which inhibits growth of some fungi but does not affect most bacteria, was later found to be toxic to fish and patented as a piscicide in 1964. The formulation proposed for use in this project was Fintrol-Concentrate (Aquabiotics Corp., Bainbridge Island, Washington). Fintrol is registered with the Environmental Protection Agency under registration number 39096-2, and it is recognized by the Arizona Department of Environmental Quality as acceptable under the conditions of the Arizona Water Quality Standards for Surface Waters. It consists of 10% antimycin, a surfactant, and acetone.

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The degradation compounds of antimycin have very low toxicity for both fish and mammals (Herr et al. 1967). Detoxification of antimycin is accelerated by pH greater than 7.0 and exposure to sunlight (Lee et al. 1971, Marking and Dawson 1972). When exposed to sunlight or open shade, antimycin degrades completely in 1.0 hour and 1.5 hours, respectively (Lee et al. 1971). The above-neutral pH (> 7.0) of Cibola High Levee Pond (Carpenter 2007) and exposure to sunlight would result in relatively rapid and total degradation of antimycin. For this reason, antimycin A application stations need to be established at 100-150 m intervals to maintain desired toxicity levels.

Antimycin acts at a cellular level to interrupt respiration (Schnick 1974:11) by inhibiting electron transport between cytochrome *b* and cytochrome *c* in Complex III of the cellular respiratory chain (Potter and Reif 1952, Rieske et al. 1967a, b). Antimycin does not repel fish (i.e. they are unable to detect it), and thus they do not attempt to avoid treated areas. Its action is rapid and irreversible (Aquabiotics Corp 1970). It is deactivated quickly and easily with approximately 1 mg/L potassium permanganate ($KMnO_4$) at the downstream end of the treatment area (Stefferud et al. 1991).

Temporary signs would be placed at public access points along Cibola High Levee Pond prior to and during renovation activities that would explain the preferred alternative and list public precautions. Permanent signs would be placed near visited areas to inform the public about the value of native fish populations and the penalties associated with live transfer of non-native fishes under Arizona Revised Statutes.

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Permanganate: Although antimycin and rotenone rapidly degrade naturally, permanganate is the recommended neutralizer to ensure that fishes in Pretty Water or in the Lower Colorado River below the levees are not affected by the piscicide treatment. Potassium permanganate (or sodium permanganate) is a strong oxidizer that breaks down into potassium (or sodium), manganese, and water very rapidly. These substances are common in nature and have no deleterious effects at concentrations normally used with neutralizing applications (Finlayson et al. 2000). Potassium permanganate reduces the half-life of antimycin from approximately 5 hours to 7 to 11 minutes in a laboratory setting (BSFW 1974). Neutralization is slowed by low temperatures and accelerated at high temperatures. Potassium permanganate itself can be toxic to some fish under certain hard water conditions at high concentrations (generally >4 parts per million) and long exposure periods (several hours; Marking and Bills 1975).

Fish Salvage: AGFD has the authority to manage fish and wildlife resources of the State and would approve and oversee activities associated with fish salvage and renovation. Fish salvage operations would commence two to three days prior to rotenone or antimycin treatment of Cibola High Levee Pond. Using a combination of electrofishing and nets, desirable sportfish such as flathead catfish, large/smallmouth bass and channel catfishes would be captured and restocked into cleared waters of the state at the discretion of the AGFD, California Game and Fish and Cibola National Wildlife Refuge. Since there is a

possibility of also capturing native fishes, any native species would be released downstream of the Cibola High Levee Pond outflow into the Lower Colorado River.

Repatriation: This preferred alternative includes repatriation of native fishes such as bonytail and razorback sucker. Fish would be hauled to Cibola High Levee Pond by vehicle on established roads. The intent of the proposed action is for native fishes to be able to reproduce successfully in a low predator environment.

Monitoring and Re-treatment: Following the initial chemical treatment, Cibola High Levee Pond would be intensively sampled by the Service to determine if project objectives were met. If pisicivorous, non-native fish remain in Cibola High Levee Pond post-renovation, re-treatment would be necessary. The preferred alternative could include up to three piscicide treatments, within a three month period, if necessary, to remove non-native fishes until 2014. In addition, the preferred alternative would include the option of conducting up to 5 complete re-treatments of Cibola High Levee Pond within the ten year period covered by this document. We expect that additional treatment may be necessary due to non-natives invading Cibola High Levee Pond through illegal introductions. However, the need for additional chemical treatments would be assessed based upon the extent of the reinvasion. We expect to work cooperatively with Cibola NWR in implementation of the Native Fish Sanctuary Management Plan for Cibola High Levee Pond to determine when and if additional application of fish toxicant is necessary.

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Following successful treatment, monitoring Cibola High Levee Pond would be conducted through a collaborative, cooperative effort that is identified in a Native Fish Sanctuary Management Plan (Sanctuary Plan, Appendix A). The Sanctuary Plan is a working document intended to identify and describe management goals, resources and methods required to effectively manage native fishes at Cibola High Levee Pond. The Sanctuary Plan also identifies research opportunities. Through the active management of these native species in small sanctuary habitats, scientists and resource managers can gain the knowledge and experience that would be important for the species recovery on a larger scale.

The proposed action is related to other native fish improvement efforts on-going along the Lower Colorado River. The Service has been working with partners on Three Finger Lake on the Cibola NWR as part of a multi-year project to establish a repository for large (≥ 30 cm TL) razorback suckers for establishing future “populations” in other native fish habitats. Additionally, the Lower Colorado River Multi-Species Conservation Program (MSCP), a coordinated, long term multi-agency effort to conserve and recover endangered species and critical habitat on the lower Colorado River, has been involved in the creation of isolated backwaters for native fish. The proposed action is also consistent with on-going recovery actions for razorback sucker and bonytail chub, as identified in the Razorback Sucker and Bonytail Chub Recovery Plan (USFWS 1998), the Razorback Sucker and

Bonytail Chub Recovery Goals: amendment and supplement to the Razorback Sucker Recovery Plan (USFWS 2002).

Costs for the preferred alternative would include personnel time, monitoring, and equipment. Dependent on the type of fish toxicant applied, the costs for chemicals may be reduced due to existing stock among contributing partners.

2.3 Mitigation Measures for Preferred Alternative

Mitigation measures are prescribed to avoid, reduce or compensate for potential adverse effects of an action. The following measures would be implemented for the preferred alternative:

- Public information and education materials describing project effects and benefits would be prepared and distributed to local residents and through the media.
- Crews working on Cibola High Levee Pond during salvage, renovation and monitoring activities would practice "leave no trace" camping techniques.
- Strict adherence to the piscicide label would be required for transportation, storage, mixing and personal protective equipment.
- Daily use records would be kept to document the use of the piscicide, as required.
- Dead fish removed whether by mechanical or chemical means would be collected and buried on site.

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2.4 Alternatives Considered but Not Analyzed

During the early planning phases, several alternative actions for meeting the purpose and need were considered but eliminated from further analysis as described below. These alternatives included consideration of different treatment methods.

- *Treatment of Cibola High Levee Pond using detonation cord (Primacord)*: Detonation cord has been used in some cases instead of piscicides due to its cost effectiveness under certain conditions, elimination of chemical residues associated with emulsifiers, carriers and detoxicants and the absence of piscicide escapement from the target area (Bass and Hilt 1979, Metzger and Shafland 1986, Platts 1974). More recent evaluation (Bayley and Austen 1988) concluded that in shallow impoundments use of detonation cord was inferior to rotenone (chemical piscicide) with respect to efficiency of fish removal, cost, personnel, and convenience. In addition, the potential effects to aquatic habitat are unknown. Due to the lack of

information on how explosives may impact the complex system of inflows that create Cibola High Levee Pond, this alternative was eliminated from further analysis.

- *Mechanical Removal*: To date, nearly $4.4 million has been spent in the upper Colorado River basin (USFWS 1988-2003) to mechanically remove >1.5 million fish from open systems (Mueller 2005). Most of these fish were small cyprinids and removal costs ranged from $2 to $86 per fish. Increasing pressure from angler groups, land owners, and state resource agencies has restricted or limited removal of some recreational species; this has increased logistics and program costs (Swanson 2001). Recreational species salvaged from removal programs cost 2.5 to 10 times more than hatchery produced fish (Brooks et al. 2000) and are sometimes placed where they can re-invade treatment areas.

  Benefits to native fish populations from mechanical removal efforts are still uncertain. In a review of the Upper Colorado River basin effort, seven of the nine independent investigators concluded that were no tangible benefits to the native community. The one positive response was based solely on the presence of natives (Modde 1997). Six studies reported no significant change while three reported a decline in large non-native predators (McAda 1997; Brooks et. al. 2000; Modde and Fuller 2002). Northern pike (*Exox lucius*) were substantially reduced because these fish originated as escapees from an upstream reservoir (McAda 1997).

  Channel catfish (*Ictalurus punctatus*) reproduce in the Colorado River and present a different dilemma. Biologists have successfully reduced the abundance of large channel catfish in the San Juan River (Davis 2003) through mechanical removal. However, because channel catfish actively reproduce in the San Juan River and mechanical removal tends to target larger life history stages, juveniles have become more plentiful, suggesting that distribution has shifted toward smaller fish. In the San Juan, razorback suckers are being lost when they are only a few days old; this implies they are being lost to small or intermediate, not large, predators (Begon et al. 1996). As such, a shift toward more numerous smaller predators as a result of mechanical removal could actually worsen predation pressure for early life stages of native species. While mechanical removal by itself would not achieve the project goals, mechanical removal could be used as a tool in the ongoing management of Cibola High Levee Pond.

- *Use of pumping to reduce water volume or to "dry" Cibola High Levee Pond*: Cibola High Levee Pond is thought to be at "steady state," where inflow through the levee on the Lower Colorado River side is balanced by flow under the levee near Pretty Water. Therefore any pumping would need to overcome the inflow to make progress at significantly reducing the water level in Cibola High Levee Pond. In addition, there is 10 feet (3 meters) of elevation head that a pump would need to overcome to disperse the water downstream. A pumping capacity of 54,000 gallons/hour would be required to stay ahead of the 2 cfs of inflow.

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2.5 Comparison of Alternatives

Table 1. Summary of actions under each alternative.

No Action	Alternative A (Preferred Alternative)
• No action would be taken	• Fish toxicant used to remove non-native fish • Removal effectiveness monitoring • Potential re-treatment • Stocking with native fishes • Native fish monitoring

CHAPTER 3: AFFECTED ENVIRONMENT

This chapter presents relevant resource components of the existing project environment. Below is a discussion of physical and biological factors including location, water resources, vegetation, soils, terrestrial wildlife and human health, fish and aquatic wildlife, threatened and endangered species, recreation and visual aesthetics, and cultural resources.

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3.1 Location

Cibola High Levee Pond (CHLP) is located on Cibola National Wildlife Refuge approximately 2 miles south of Palo Verde, California (Figure 1). The habitat is part of the old river channel that was isolated in the late 1980's during the channelization of the Colorado River by the Bureau of Reclamation (USBR). The California and Arizona state line runs through the middle of the pond, following the course of the old river channel.

Figure 2. Location of Cibola High Levee Pond, in the Lower Colorado River. Red star indicates project area.

3.2 Water Resources

Cibola High Levee Pond is approximately 5 surface acres and is formed by 2 parallel levees that border its eastern and western banks. The exact water volume is contingent on river level since both levees are re-enforced with riprap stabilization materials that facilitate some water movement between the River and the Pond. The eastern levee is covered with gravel to the shoreline while the riprap on the western levee is exposed, consisting of large boulders extending into the pond. The southeastern shore is also riprapped but has been covered in salt cedar and mesquite. The northwestern shore is vegetated by cattail, salt cedar, and mesquite. Riprapped areas represent ~40% of the shoreline and provides substantial cover as does seasonal, submerged vegetation (e.g., water milfoil and spiny naiad).

Water quality parameters are summarized in Table 3 and are assumed to be representative of pond conditions. However, the USGS National Water-Quality Assessment Program conducted a water quality assessment within the Central Highlands Province of Arizona (which contains Cibola High Levee Pond) and found that water quality in most streams is generally reflective of natural conditions (Anning 2004). However, in some stream reaches within the province, bed-sediment and tissue samples had detectable concentrations of organochlorine pesticides, including a chemical breakdown product of the insecticide DDT (Anning 2004).

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Table 3. Summary of water quality parameters from Cibola High Levee Pond, Lower Colorado River (Carpenter 2007) from 2005-2007.

Date	Time	Depth, m	Water Temp Deg C	SpCond µS/cm	Dissolved Oxygen mg/L	DO %	pH	Salinity
26-Oct-05	17:00	Surface	24.27	1112	8.39		7.98	0.58
		0.5	23.50	1110	7.50		7.95	0.58
		1.0	22.70	1108	7.04		7.95	0.58
		1.5	22.22	1108	6.83		7.95	0.58
		2.0	21.94	1105	6.48		7.99	0.58
		2.5	21.80	1110	6.19		7.94	0.58
13-Jul-06	11:24	Surface	32.18	1244	8.22	133.3	8.64	0.62
		0.5	32.21	1248	7.75	127.4	8.65	0.62
		1.0	31.88	1250	7.45	122.5	8.61	0.63
		1.5	31.00	1242	7.80	30.1	7.41	0.62
		2.0	27.93	1210	0.47	7.2	7.26	0.61
		2.5	25.70	1201	0.55	7.7	7.50	0.60
		3.0	24.05	1202	0.28	3.8	6.80	0.60
		3.4	23.35	1197	0.22	3.4	6.80	0.59

14-Nov-06	12:15	0.5	16.3	1700	7.8		9.6
		1.0	16.3	1740	8.3		9.6
		1.5	16.2	1700	7.9		9.6
		2.0	15.9	1750	8.3		9.6
		2.5	15.7	1700	8.2		9.5
		2.9	15.6	1700			9.5
6-Aug-07	10:40	Surface	29.17	1543	7.05		8.01
		0.5	29.12	1545	6.56		8.07
		1	28.90	1540	6.51		8.10
		1.2	28.80	1542	6.46		8.12
31-Oct-07	1100	Surface	19.52	1680	8.45	95.5	9.10
		0.5	19.56	1680	8.41	95.6	9.11
		1.0	19.42	1680	8.34	94.6	9.12
		1.5	19.30	1680	8.01	91.3	9.10
		2.0	19.19	1680	7.50	85.4	9.06
		2.5	19.14	1670	7.30	82.2	8.99
		3.0	19.13	1680	7.04	79.8	8.96
		3.3	19.13	1670	6.90	78.1	8.96

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3.3 Vegetation

The area includes associated riparian habitats, floodplains, backwaters, and adjacent uplands. The diverse topography is dissected and ranges in elevation from 200 to 250 feet. The width of the river channel and floodplain varies from less than 0.1 to greater than 0.5 miles. Prominent cliffs rise 100 to 300 feet above the River.

3.4 Soils

Soils in the project area consist of sandy loam intermixed with some heavier clays that extend past the riparian area into the uplands. Soils near the riparian area are generally compacted due to road development and levee maintenance.

3.5 Terrestrial Wildlife and Human Occurrence

Terrestrial Wildlife: Comprehensive avian, mammalian, and herpetofaunal surveys have not been conducted on the CNWR in the immediate vicinity of Cibola High Levee Pond; however, riparian vegetation communities typically support diverse and abundant native faunal populations, particularly in the arid Southwest.

Based upon a limited amount of small mammal trapping, surveys, or anecdotal observations, biologists on the CNWR have created a list of species that occur or potentially occur on the Lower Colorado River National Wildlife Refuges. Common big

game species include mule deer *(Odocoileus hemionus*) and collared peccaries (*Tayassu tajacu*). Pronghorn (*Antilocapra americana*) occur in low numbers, using the uplands that adjoin the Lower Colorado River. Mountain lion (*Felis concolor*) occupy the riparian corridor and rugged side drainages.

Common predators and furbearers that inhabit the area include striped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), and bobcat (*Felis rufus*).

Northern river otter (*Lontra canadensis*), desert cottontail (*Sylvilagus floridanus*), rock squirrel (*Spermophilus variegates*), raccoon (*Procyon lotor*), cliff chipmunk (*Eutamias dorsalis*), white throated woodrat (*Neotoma albigula*), Steven's woodrat (*Neotoma stephensi*), deer mouse (*Peromyscus maniculatus*), and brush mouse (*Peromyscus boylii*) have also been observed in the area.

The Lower Colorado River is a significant perennial waterway in Arizona, supporting rare or priority management riparian breeding bird species, and serving as an important stopover and/or wintering grounds for a host of migratory birds. The riparian community along the Lower Colorado River provides breeding habitat for a number of neo-tropical migratory birds including species of concern such yellow-billed cuckoos (*Coccyzus americanus*), Lucy's warblers (*Vermivora luciae*), Bell's vireos (*Vireo bellii*), and summer tanager (*Pyranga rubra*). Wintering and fall migrants detected in the area include bald eagles (*Haliaeetus leucocephalus*), ferruginous hawks (*Buteo regalis*), red-tailed hawks (*Buteo jamaicensis*), sage thrashers (*Oreoscoptes montanus*), and Brewer's sparrows (*Spizella breweri*).

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Human Occurrence: While access to Cibola High Levee pond is limited due to it's location on the wildlife refuge, anglers, hunters and recreationists can easily access the pond through existing roads and trails. During renovation activities, this area will be signed and personnel will be onsite at all times to ensure the public stays clear of the immediate treatment area.

Vehicular access to Cibola High Levee Pond is obtained through the National Wildlife Refuge. Permission from the Refuge Manager would be required to access Cibola High Levee Pond prior to project implementation.

3.5 Fish and Aquatic Wildlife

Cibola High Levee Pond was started as a native fish grow out pond in 1993 with the introduction of federally endangered razorback sucker and bonytail. Recruitment was documented in both species by 2000 (Mueller 2003). As a result, researchers and managers began emulating conditions at Cibola High Levee Pond at other habitats. Investigations continued on the razorbacks and bonytails until 2003 when largemouth bass

(*Micropterus salmoides*) were documented in Cibola High Levee Pond.

Downstream from the project area, recent surveys have found similar fish species in the mainstem Lower Colorado River. Nonnative species such as carp, green sunfish (*Lepomis cyanellus*) and largemouth bass are prolific in areas below Cibola High Levee Pond.

Non-native fish dominate significant portions of Arizona's streams. If natives exist, they do so without noticeable recruitment (Minckley 1991). Following a long history of habitat loss and degradation (Minckley 1991, Rosen and Schwalbe 1995, Pacey and Marsh 1998, Marsh and Pacey 2005), the spread and establishment of non-indigenous aquatic organisms, especially fish, are increasingly viewed as one of the most serious long-term threats to the status and recovery of native aquatic vertebrates. Direct impacts of non-native fishes to native forms include predation, competition, hybridization, and parasite and pathogen transmission. Predation on early life stages (i.e., eggs, larvae, juveniles) is considered the primary avenue by which non-native fishes depress and often eliminate what are considered "predator naïve" native species (Minckley 1991). Evidence suggests that to survive and persist, even in physically degraded habitats, native species need habitats free of and protected from established populations of non-native species.

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3.6 Threatened and Endangered Species

Table 4 presents the federally listed, proposed, and candidate species that occur in the project area. Listed species are afforded protection under ESA. Candidate species are those of which the Service has sufficient information to propose them as endangered or threatened, but for which listing is precluded due to other higher priority listings. Proposed species have been formally proposed to be listed.

Table 4. Federally-listed and candidate species in LaPaz County (May 2006).

Common Name	Scientific Name	Status
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered
Bonytail chub	*Gila Elegans*	Endangered with critical habitat
Razorback sucker	*Xyrauchen texanus*	Endangered with critical habitat
Yellow-billed Cuckoo	*Coccyzu americanus*	Candidate
Southwestern Willow flycatcher	*Empidonax extimus traillii*	Endangered with critical habitat

California brown pelican (*Pelecanus occidentalis californicus*) would not be affected by the project due to lack of suitable habitat and/or because the current range for the species is outside the project area.

Yuma clapper Rail: The Yuma clapper rail is a 14 inch long marsh bird with long legs and a short tail. Its bill is long, slender, and curved downward slightly. Anteriorly, coloration is a mottled brown on a gray background. Its flanks and underside are dark gray with narrow vertical white stripes that produce a barred effect. This species inhabits freshwater or brackish stream-sides associated with dense riparian and marsh vegetation under 1,372 m (4,500ft) elevation. This species requires a wet substrate, such as a mudflat, sandbar, or slough bottom that supports cattail and bulrush stands of moderate to high density adjacent to shorelines.

Historical range is uncertain. The Yuma clapper rail may have occurred in the marshes of the Lower Colorado River and its tributaries in Mexico and the United States. No records in U.S. before 1902 (Yuma County); type specimen taken near Laguna Dam in 1921. In its current range, the Yuma clapper rail occurs along the Colorado River in Yuma, La Paz, and Mohave counties, Arizona, from Lake Mead to Mexico; on the Gila and Salt rivers upstream to the area of the Verde confluence (Maricopa and Pinal counties, Arizona); at Picacho Reservoir (Pinal County, Arizona); and on the Tonto Creek arm of Roosevelt Lake (Gila County). This rail may be expanding into other suitable marsh habitats in western and central Arizona.

The amount of cattail in Cibola High Levee pond is limited to a thin strip along the west side. Recent surveys have not found clapper rails in Cibola High Levee pond (Dominic Barrett, CNWR Biologist, pers comm.). Any disturbance to individual rails moving through the area will be insignificant and discountable. The proposed project will temporarily remove cattails for better chemical application but regrowth is expected to be within several weeks. The temporarily loss of this limited area of cattail in Cibola High Levee pond is not significant for the clapper rails in this portion of the River. There exists ample cattail habitat within a few hundred yards of the project site (Pretty Water) if a rail is displaced from the project site during renovation activities.

A Recovery Plan was completed in February 1983 and is available online at: http://www.fws.gov/southwest/es/arizona/Documents/RecoveryPlans/YumaClapperRail.pdf. Yuma clapper rail survey protocol is available online at http://www.fws.gov/southwest/es/arizona/. The Yuma clapper rail is also listed as a Wildlife Species of Special Concern by the State of Arizona.

Bonytail: The bonytail was listed as endangered on March 11, 1967 (USDI 1967). The bonytail was once common throughout the Colorado River system, including the Gila River basin, but natural populations are now found only in scattered areas of the upper Colorado River system in Utah, Colorado, and Arizona (USDI 1990). In the lower Basin of the Colorado River, bonytail are found in Lakes Havasu and Mohave, in isolated backwaters along the historical Colorado River channel, and are also being stocked into the mainstem below Parker Dam.

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Razorback sucker: The razorback sucker was listed as endangered on October 23, 1991 (USDI 1991b). Critical habitat was designated on March 21, 1994 (USDI 1994) and includes portions of the Colorado, Verde, Gila, and Salt Rivers in the Lower Colorado River Basin. This species was once common throughout the Colorado River basin, but now exists sporadically throughout 750 miles of river in the Upper Colorado River basin. In the Lower Colorado River Basin, razorback suckers are found from the lower Grand Canyon down to Imperial Dam, with both natural populations (Lake Mead and Lake Mohave) and reintroduced populations present. Razorback suckers have been stocked in numerous locations in the Gila, Salt, and Verde River basins in an attempt to recover the species. Stocking in the Lower Colorado River continues from Lake Mohave down to Imperial Dam. Critical habitat includes the river and 100-year floodplain at Cibola High Levee Pond.

Yellow-billed Cuckoo: On July 25, 2001, the Service published a notice in the Federal Register (USDI 2001) that the petition to list the western yellow-billed cuckoo was warranted, but was precluded by higher listing actions. The yellow-billed cuckoo remains a candidate species. The yellow-billed cuckoo is a late migrant associated with large tracts of undisturbed riparian deciduous forest where willow, cottonwood, sycamore, or alder is present. Yellow-billed cuckoos require fairly large tracts (minimum of 25 acres) of habitat for nesting at least 300 feet wide (Latta et al. 1999). However, recent research (personal communication, Murrelet Halterman, January 29, 2003) indicates that yellow-billed cuckoos can successfully reproduce in smaller habitat patches consisting of narrow stringers of trees. Preliminary information on the San Pedro River indicates cuckoos use patches between 10 and 50 acres in size. In all sites, cottonwood/willow patches were surrounded by mesquite and hackberry. Cuckoos on the Bill Williams River appear to use larger patches. Yellow-billed cuckoos in higher elevations may be found in mesquite and tamarisk. The yellow-billed cuckoo feeds almost entirely on large insects, and if food-stressed, may also feed on berries and fruit.

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Yellow-billed cuckoos were detected in the Lower Colorado River by SWCA (2003). There is no yellow-billed cuckoo breeding habitat immediately surrounding Cibola High Levee Pond (above the berm). In addition, little breeding habitat is available downstream of the project area.

3.7 Recreation and Visual Aesthetics

Scenic condition: The project area is defined by a series of inter-connected backwaters that were the historic channel prior to the Cibola dry-cut being constructed in the 1960's. While native vegetation proliferates near the adjacent perennial backwaters, visual quality is disrupted by continued use by high recreational use by boaters in the winter months.

Recreation: While recreation demand is high in some parts of the Lower Colorado River due to the presence of public access and perennial water, Cibola High Levee Pond receives little recreational use. The adjacent backwaters, Prettywater, Hippy Hole, and

Cibola Lake receive varied amounts of fishing and swimming during winter months. During the summer, activities subside substantially due to the heat.

There are opportunities for sportfishing along the Lower Colorado River. Angler use days (AUD) are attributed to warm water sportfishing, for non-native. Neither California Game and Fish Department or AGFD have conducted an assessment of AUD on Cibola High Levee Pond specifically. However, the Department estimates that angler use in the High Levee Pond area is minimal due to limited access.

3.8 Cultural Resources

The latest listing of the National Register for Historic Places was consulted; no sites listed or formally determined eligible for inclusion on the Registers are known within the project area.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Effects of the no action and action alternative are summarized in Table 6. The no action alternative would likely continue current conditions under which non-native fish community dominance increases resulting in continued negative impacts to native fish. The following elements have been analyzed and will not be affected: Air Quality, Areas of Critical Environmental Concern, Farm Lands, Native American Religious Concerns, Wastes (hazardous or solid), Wild and Scenic Rivers, and Wilderness.

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4.1 Water Resources

No Action Alternative

No environmental consequences to water resources, including water quality and quantity, would occur under this alternative.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

Chemical renovation (piscicide application) would impact the length of Cibola High Levee Pond (approximately 5 surface acres). The effects from the use of fish toxicant at recommended concentrations would be restricted to fish and aquatic macroinvertebrates and would be short-term.

Rotenone: Rotenone is a large, heavy molecule that is not soluble, and tends to attach to organic matter (e.g. algae, sediment). Sunlight and the natural physical and chemical characteristics of Cibola High Levee Pond would quickly break down the rotenone into inert byproducts. Any rotenone applied to Cibola High Levee Pond that went sub-surface would

be inundated with organic material and removed from the system. Byproducts of neutralized rotenone are not harmful to fish or other organisms (Finlayson et al. 2000).

Antimycin: Antimycin A is an organic compound that was isolated from the bacterium *Streptomyces girseus* at University of Wisconsin in 1945 (Leben and Keitt 1948, Dunshee, et al. 1949). The formulation proposed for use in this project is Fintrol-Concentrate produced by Aquabiotics Corp. of Bainbridge Island, Washington. Fintrol is registered with the Environmental Protection Agency under registration number 39096-2, and is recognized by the Arizona Department of Environmental Quality as acceptable under the conditions of the Arizona Water Quality Standards for Surface Waters. It consists of 10% antimycin, a surfactant, and acetone.

Permanganate: Permanganate detoxification stations placed below Cibola High Levee Pond and adjacent to the levee on the Lower Colorado River side to ensure no chemical piscicide goes downstream. Permanganate is quickly broken down as it reacts to organic material and either rotenone or antimycin. Breakdown components of sodium permanganate (sodium, manganese, and water) are common in nature and have no deleterious environmental effects at concentrations used for neutralization of rotenone and antimycin (Finlayson et al. 2000). Therefore, water chemistry within Cibola High Levee Pond would return to pretreatment conditions within a few hours and no measurable effect on water quality would be anticipated downstream of the project area during piscicide application.

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4.2 Vegetation

No Action Alternative

No environmental consequences to aquatic or riparian vegetation would occur under this alternative.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

Chemical Renovation:. There would be a minor impact to vegetation along the edge of Cibola High Levee Pond from personnel working along Cibola High Levee Pond during project implementation. Some removal of cattails would be necessary to ensure proper chemical dispersal along shorelines. Cattail regrowth is rapid and no long term consequences are expected to occur.

Repatriation of Native Fish: Aquatic or riparian vegetation would not be harmed by the addition of native fish to Cibola High Levee Pond.

4.3 Soils

No Action Alternative

No environmental consequences to soil resources would occur under this alternative.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

No environmental consequences to soil resources would occur under this alternative.

4.4 Terrestrial Wildlife and Human Occurrence

No Action Alternative

No environmental consequences to terrestrial wildlife would occur under this alternative.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

Chemical Renovation: The potential effects to terrestrial wildlife from fish toxicants, rotenone and antimycin, and permanganate neutralizing agent are described below.

Rotenone: Humans and wildlife could be exposed to concentrations of rotenone in surface waters of the project area for a minimal time period due to the presence of high organic material in Cibola High Levee Pond. Rotenone when applied in a piscicide formulation is non-toxic to humans and non-aquatic vertebrates.

The active ingredient of Nusyn-Noxfish and CFT legumine is rotenone (5%). The Pesticide Action Network (PAN) Pesticides Database (http://www.pesticideinfo.org) lists information regarding the pesticide identification, toxicity, ecotoxicity, registered uses in the United States, product registration history, company and agent information, and links to literature regarding its use and toxicity. Rotenone is a certified organic botanical compound that has been used as an insecticide on crops and livestock for many years. The EPA has stated that “rotenone use in fish control does not present a risk of unreasonable adverse effect to humans or the environment.” Rotenone is not listed as a PAN Bad Actor Chemical (chemicals that are either highly acutely toxic, cholinesterase inhibitors, known/probably carcinogens, known ground water pollutant, or known reproductive or developmental toxicant). Rotenone has acute aquatic toxicity and the PAN Pesticide Database lists the pure active ingredient as having “moderate” acute toxicity.

Antimycin: The degradation compounds of antimycin have very low toxicity for both fish and mammals (Herr et al. 1967). Detoxification of antimycin is accelerated by pH greater than 7.0 and exposure to sunlight (Lee et al. 1971, Marking and Dawson 1972). When exposed to sunlight or open shade, antimycin degrades completely in 1.0 hour and 1.5

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hours, respectively (Lee et al. 1971). The above-neutral pH of Cibola High Levee Pond and exposure to sunlight would result in relatively rapid and total degradation of antimycin. The effects of consuming fish killed by chemical renovation are poorly studied, but there have never been any reports of negative effects to humans or wildlife from eating fish killed by rotenone. Both rotenone and antimycin degrade rapidly under natural stream conditions, and when exposed to sodium or potassium permanganate, the remaining byproducts after neutralization are not harmful to humans or other organisms. During active treatment, human consumption of stream water or fish killed by piscicide would be prohibited and signs would be posted in the area noting this prohibition. Although the EPA (1981) has stated that there is no need to restrict livestock consumption of treated waters, if livestock are present in the treatment area we will work with adjacent landowners to move livestock to other areas during the treatment.

Permanganate: Although antimycin and rotenone rapidly degrade naturally, permanganate is the recommended neutralizer to ensure that fishes in Cibola High Levee Pond below the levees are not affected by the piscicide treatment. Potassium permanganate (or sodium permanganate) is a strong oxidizer that breaks down into potassium (or sodium), manganese, and water very rapidly. These substances are common in nature and have no deleterious effects at concentrations normally used with neutralizing applications (Finlayson et al. 2000).

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4.5 Fish and Aquatic Wildlife

No Action Alternative

In the absence of action to protect and reestablish the native fish community, the trend of increasing non-native populations and decline of native populations would continue, and Cibola High Levee Pond would remain a nonnative fish dominated water. Maintaining the non-native fish assemblage may also adversely affect native amphibians and reptiles associated with Cibola High Levee Pond and the Lower Colorado River.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

Chemical Renovation: Piscicide treatment would impact 5 acres of Cibola High Levee Pond. Detoxification at the levees would prevent the rotenone and antimycin from affecting any areas downstream. Chemical renovation would eliminate all fishes within the treated area. Any native fishes, such as the bonytail and suckers detected in 2005 and 2006, would be salvaged and placed downstream prior to treatment. Although we do not expect that salvage operations would recover all native fish, this action would minimize loss of these fish.

Effects of piscicides on aquatic invertebrates are variable. Any effects on aquatic insect populations are usually short-term, as kills are incomplete and recolonization is rapid

(Whelan 2002). The ability to recolonize is dependent upon up- and downstream sources, and with the Lower Colorado River and other backwaters adjacent to the project area, we would expect recolonization to occur relatively quickly. Potassium permanganate itself can be toxic to some fish under certain hard water conditions at high concentrations (generally >4 parts per million) and long exposure periods (several hours) (Marking and Bills 1975).

Neither rotenone nor antimycin would remove crayfish populations. Although it is desirable to eliminate crayfish from Cibola High Levee Pond to reduce predation on repatriated native fishes, their continued presence of crayfish is not expected to jeopardize the goals and objectives of the project. Crayfish have not been shown to interfere with native fishes to the point where fishes cannot successfully complete their life cycles and sustain populations. However, investigations are ongoing to develop methods to eliminate crayfish.

Re-establishment of native fishes: The re-establishment of native fishes to Cibola High Levee Pond would have beneficial environmental consequences. Stocking native fishes such as razorback sucker and bonytail would aid in restoring the native fish community in the Lower Colorado River and aid in the recovery process for the imperiled warm water native fish fauna of the Lower Colorado River Basin. This action, in conjunction with other projects, could eventually lead to downlisting and delisting of some fishes from the ESA.

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4.6 Threatened and Endangered Species

No Action Alternative

Repatriation of listed and sensitive fishes would not occur. No improvement to the recovery status of listed species would occur.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

Bonytail and razorback sucker: The preferred alternative may impact bonytail and razorback sucker since there is a possibility of large razorbacks or bonytails that remain in Cibola High Levee Pond. The following actions will be undertaken to minimize mortality. Two nights of netting will be completed prior to the renovation. The purpose of this is to collect valuable sportfish but also any remaining razorbacks or bonytails. Native fishes will be transported to the river, PIT tagged and released. Once chemical application begins, if any razorbacks or bonytails are seen coming to the surface, they will be immediately collected and put into a freshwater, oxygenated bath to help offset the impacts of the chemical. This procedure works best with rotenone and depends on dosage levels and how long fish were exposed to the toxicant. Every attempt will be made to collect native fishes exposed to the chemical and revive them in fresh water.

Effects to critical habitat for razorback sucker would be limited to temporary degradation of

water quality in the pond due to the application of piscicides. As described above, the persistence of these chemicals will be short, and no long-term adverse effects would occur.

The preferred alternative would result in a net positive effect on bonytail and razorback sucker. Following removal of non-native fish from Cibola High Levee Pond, the preferred action would stock these species in Cibola High Levee Pond which would provide a source population for recovery and conservation actions in the mainstem Colorado River. In addition, Cibola High Levee Pond currently serves as a source of non-native fish that enter other aquatic habitat downstream. By removing non-native fishes, the proposed alternative would aid in decreasing the population of predatory and competitive non-native fish in the lower Colorado River. The removal of non-native fish may aid successful reproduction and survival of downstream native fish populations. However, due to habitat degradation and the presence of non-native fish below Cibola High Levee Pond, the beneficial effect would dissipate downstream.

Yellow-billed cuckoo: There is no suitable habitat for yellow-billed cuckoo in the project area, so we do not expect any impacts to this species or their habitat from this alternative.

Southwestern Willow Flycatcher: There is no suitable habitat for southwestern willow flycatcher in the project area, so we do not expect any impacts to this species or their habitat from this alternative.

Yuma Clapper Rail: The habitat available in Cibola High Levee pond is limited and likely is of low value to the clapper rail. It is unlikely that clapper rails breed here and recent survey evidence failed to encounter any clapper rails in Cibola High Levee pond. Prior to cattail removal, a survey will be conducted to ensure that there are no clapper rails in the immediate area.

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4.7 Recreation and Visual Aesthetics

No Action Alternative

No environmental consequences to recreation would occur under this alternative. There would be no effect to scenic condition. We would also not expect any change in fishing pressure in the area. Cibola High Levee Pond receives little angler visitation.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

Angler use in the Cibola High Levee pond area is minimal due to limited access and management goals that are focused on native fish recovery as opposed to sportfishing opportunities (personal communication, Bill Seese, Refuge Manager).

There would be a temporary visual impact from the presence of dead fish following

piscicide application. However, fish would be removed quickly and the visual impact would be minimal.

4.8 Cultural Resources

No Action Alternative

No environmental consequences to cultural resources would occur under this alternative.

Alternative A, Preferred Alternative (Chemical Renovation and Repatriation of Native Fish)

No environmental consequences to cultural resources would occur under this alternative.

4.9 Cumulative Impacts

The Council on Environmental Quality defines cumulative impacts as the incremental impact of multiple and future actions with individually minor, but collectively significant, effects. Cumulative impacts can be concisely defined as the total effects of the multiple land uses and development, including their interrelationships, on the environment.

Most of the current land uses were described in the "Affected Environment" herein. In the Cibola High Levee Pond area, these include dispersed recreation and ongoing refuge operations. However, both of these activities are limited within the project area. An additional action that is difficult to quantify is continued ground water pumping in the watershed around Cibola High Levee Pond. The population of Imperial and La Paz counties is growing at a very high rate, and as such, development is also increasing in the areas surrounding the National Wildlife Refuge. That may result in more people accessing the river corridor for recreational impacts. Changes in water delivery as included in the Lower Colorado River Multi-Species Conservation Plan may, over the next 50-years, result in a drop in water levels in Cibola High Levee Pond as water currently diverted at the lowest end of the river is diverted further up in the system. This effect should not have significant adverse impacts to the pond.

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4.10 Comparison of Alternatives

Table 5. Summary of impacts to environmental resources by alternative.

Resource Issue	No Action	Alternative A, Preferred Alternative-Chemical Renovation and Restocking of Native Fish
Water Resources	No effect	Short-term impact to Cibola High Levee Pond from application of chemical piscicide and permanganate neutralizing agent.
Vegetation	No effect	No effect
Soils	No effect	No effect
Terrestrial wildlife	No effect	Temporary, minor disturbance to small mammals and herpetofauna due to biologists presence in the area
Human Health	No effect	No effect, piscicides are not toxic to humans
Fish and Aquatic Wildlife	Non-native fish community dominance increases and continuing negative impacts to native fish, frogs.	Elimination of non-native fish community from approximately 5 acres of Cibola High Levee Pond; short-term reduction in macroinvertebrates; and, prevents continued source of non-native fish in the Lower Colorado River
Threatened and Endangered Species	No effect	Beneficial effects to razorback and bonytail critical habitat and native fish habitat in Cibola High Levee Pond. Benefit to native species that would be reintroduced into Cibola High Levee Pond, including the endangered razorback sucker and bonytail chub.
Recreation and Visual Aesthetics	Non-native fish would continue to negatively impact native species recovery efforts.	Shift in angling opportunities from non-native to native species in Cibola High Levee Pond. Potential negative impact to current sportfishing opportunities in Cibola High Levee Pond. Very brief short-term impact to visual quality due to temporary presence of dead fish following

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		application of fish toxicant.
Cultural resources	No effect	No effect

CHAPTER 5: AGENICES AND PERSONS CONSULTED

List of preparers:

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Other contributors:

The Draft Final EA was noticed in the Palo Verde Times and sent to local landowners, interested parties, local governments, and agencies for review and comment. The comment period was open for 30 days to receive public comment and input.

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APPENDIX A: **NATIVE FISH SANCTUARY MANAGEMENT PLAN**

Location: Cibola High Levee Pond, Cibola National Wildlife Refuge, Cibola, Arizona
Managing Agency: Fish and Wildlife Service

Project Principles: Mike Oldham, Refuge Manager,
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Goal: To provide habitat conditions that promote native fish recruitment at levels that sustains a natural community while providing management and research opportunities to promote advances in conservation and recovery.

Purpose of this document: This Management Plan is a working document intended to identify and describe management goals, resources and methods required to effectively manage native fishes at this site and research opportunities. Through the active management of these species in small sanctuary habitats, scientists and resource managers will gain the knowledge and experience that will be critical for the species to be recovered on a larger scale. This document describes those steps, resources and opportunities.

Last Modified: September 3, 2007

INTRODUCTION

In 1989, the Fish and Wildlife entered into a cooperative, multiagency program call the Native Fish Work Group. The group of state, federal agencies and academia pooled resources and expertise in a joint effort to save razorback suckers in Lake Mohave (Mueller 1995). The program evolved into a strategy of collecting wild born sucker larvae and growing them in isolated ponds until fish reached a sized deemed sufficient to avoid predation. They were then stocked into the reservoir to augment the dwindling population of old adults.

The approach was adopted for other portions of the river basin. In 1993, FWS converted Cibola High Levee Pond into a rearing facility for razorback suckers and bonytail. Nearly 58,400 small bonytail and 14,000 razorback sucker were stocked between 1993 and 1996. Fish growth was monitored and as fish reached 30 cm in length they were removed, PIT tagged and stocked elsewhere.

In December 1998, biologists discovered that both species had successfully produced young. Fish stocking and removal were both suspended in order to study this phenomena. USGS and FWS biologist studied this community and found that both species were successfully recruiting young at levels necessary to support the community. The community consists of roughly 6,000 bonytail (>15 cm) and 1,100 razorback suckers. In 2002 the pond's carrying capacity was measured at 4,350 fish/ha with a biomass of 635 kg/ha.

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In 2004, largemouth bass were discovered. Attempts to remove these fish failed and they were able to spawn in 2005, resulting in the production of thousands of young bass. By the end of 2005, largemouth bass numerically dominated the fish community. Sampling in that fall indicated the absence of native young and that largemouth bass represented more than 80% of the fish community.

As a result, steps are being taken for the salvage, chemical renovation and restocking of the pond with native fishes. The pond's fish community was unique in that it represented the only sustainable natural recruitment of these species in the world. W.L. Thorson's (et al. 2003) Conservation Plan For Native Fishes was based on this phenomena as are key components of C.O. Thorson's Lower River Management Plan. As outlined in the BioScience paper, these communities are temporary and require long-term management. This management plan outlines the goals, resources and steps necessary for the maintenance of Cibola High Levee Pond.

MANAGEMENT PLAN ISSUES

Habitat Quality:

The conditions at Cibola High Levee Pond are unique in terms of habitat and water quality. The pond represents a historical portion of the river channel which contains a wide variety of substrate types. Groundwater hydraulics is unique in terms of water circulation and flow gradient. Both the river and flood levee are permeable, allowing river/ground water to flow between the river and Pretty Water. This combination maintains optimal water quality, especially temperature and dissolved oxygen which are critical parameters for desert aquatic habitats.

The pond does have support lush growth of aquatic vegetation (*Potamogeton* sp.; *Naiad* sp.). During peak summer heat, fish congregate in the deepest portion of the pond where its suspected that substantial quantities of ground water enter. Evidence of this includes lower water conductivity and lush growth of aquatic vegetation at depths exceeding 3 meters. We suspect this growth is stimulated by incoming nutrients. During peak summer heat, fish take advantage of the cooler temperatures afforded by depth and from shade provided by floating mats of vegetation.

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Available Resources:

The purpose of this project is to determine if the native fish sanctuary approach is practical on a small and possibly larger scale. Currently, no one single agency has the expertise or the resources to implement such a program. However, by pooling various resources from several sources we feel such a test would be more economic and practical and results could be better controlled and measured. Even then, uncertainty pertaining to available resources, staff and funding makes it necessary to prioritize needs. This plan presents and prioritizes those management, monitoring and research needs. Available resources will be directed at the highest priority items. The priority order, addition or deletion of these lists will be an ongoing process as information is collected, processed and analyzed.

Environmental Compliance

The Arizona Fisheries Resources Office will work with refuge staff to meet appropriate compliance of federal and state environmental laws and regulations.

Management Options In Order of Priority (1 highest):

1. Natural Recruitment

    a. Establish, improve or maintain habitat conditions that support natural recruitment for both introduced native fishes at rates that sustain their population and produce surplus fish.
    b. Establish, improve or maintain habitat conditions that support natural recruitment for one introduced native fish at rates that sustain their population.
    c. Establish, improve or maintain habitat conditions that support limited natural recruitment for both introduced native fishes. Supplemental stocking is necessary to sustain one or both population.
2. Repository for adult razorback suckers
    a. Maintain a population of adult razorback suckers that were produced from wild-born larvae captured in Lake Mohave.
3. Grow-Out Facility
    a. Establish conditions that allow for grow-out of native fishes.
4. Abandon Project

Management Actions:

1. Physical Habitat Improvements
    a. Reduce the spread of cattails,
    b. Construct a floating island to provide structure and shade,
    c. Experiment with floating hummock designs.
2. Biological Actions
    a. Remove large surplus fish and stock in appropriate places.
    b. Stock natives to augment or replace losses due to natural causes (predators/habitat conditions).
    c. Maintain nonnative crayfish reduction efforts.
3. Interpretive Actions
    a. Develop a portable display for use at visitor centers,
    b. Develop a interpretative field talk.

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Management Triggering Actions

Cibola High Levee Pond will require management activities necessary to sustain the native fish community. This community is temporary, being subject to common or unique threats. These include invasion by nonnative fishes, storm events that result in fish kills, and existing habitats conditions that may not support spawning, natural recruitment or optimal productivity. In anticipation of these, the following 'triggering' conditions are specifically set in order to trigger appropriate management actions to mitigate or remedy the problem in a timely manner. All actions would require appropriate environmental compliance by FWS.

Problem	Management Action
>5% nonnative fish	Add to renovation list, initiate salvage
Poor recruitment	Initiate bullfrog, tadpole and crayfish control
Natural fish die-off	Restock w/multiple year classes
Poor body condition (stunting) (Need to set those standards, i.e., (K-0.8?)	Harvest and remove >20%

PROPOSED MONITORING

The conceptual plan for developing fish sanctuaries in the Colorado River (Thorson et al. 2003; BioScience 53:219-234) suggests that stabilizing native fish populations requires developing and/or creating habitats of sufficient physical, chemical, and biological quality. Thus the purpose of our monitoring plan is to evaluate these factors with regards to enhancing survival of all life stages of native fish. Our goal is to provide land managers with essential information for maintaining and improving the quality of High Levee as a fish sanctuary. The majority of this work has been accomplished during the past 5 years through the measurement of physical parameters. We propose a maintenance and refinement of that data set through routine monitoring and additional research.

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Physical Habitat Monitoring.

1): Instantaneous in-situ measurements will be taken using a Hydrolab to measure DO, temperature, pH, conductivity, and salinity measured at 0.5-m intervals at the deepest areas of the cove. We will continue to take these measurements on all semi-annual sampling trips.

2): Water quality sampling. We will collect initial samples for major ion analysis by BOR; chlorophyll, total suspended solids; and elemental and contaminant analysis (Hg, Se, As, ClO_4). Future sampling frequency will depend on initial levels of elements of concern.

3): 24-hr sampling of DO and water temperature. We expect DO to be lowest and temperatures highest in July and August. During this time we will use three MiniSondes (at bottom, middle, and upper sections of the water column along an installed post) to continually measure these variables over a 24-hr period.

4): Long-term temperature data. We will install a water temperature recorder (e.g., Hobos) to record hourly temperatures over a 1-yr period.

Zooplankton and Macroinvertebrates

1): Zooplankton. Three vertical tows will be taken in the deepest portion of the cove of the pond each trip. Biomass will be measured by filtering through a plastic graduated cylinder. All samples will be preserved for later analysis. Phytoplankton and chlorophyll will be sampled both trips.

2): Macroinvertebrates: Concurrent with zooplankton samples, we will collect aquatic insects caught in the larval light traps. In addition, we will collect macroinvertebrates using a variety of sample techniques at 6 locations at varying depths to determine average number of organisms/m^2. Our purpose is to measure the abundance of invertebrates, not to provide a detailed description of aquatic insect diversity.

Aquatic Vegetation

1): Estimate plant abundance and composition. During the fall survey, we will identify plant species present and estimate aerial vegetation coverage. When visibility is good, transects north-south and west-east across the cove will be snorkeled, as well as a transect around the entire perimeter. We will use these transects to create a map showing extent of coverage by each plant species. If water clarity is reasonable, we will take water surface and/or underwater photographs to serve as permanent records of plant abundance.

2): Evaluate the general health of the aquatic plants within the cove. On each sampling trip we will record water level of the cove and note if it is higher or lower than normal (i.e., are plants exposed or growing at deeper depths?). Once a year we will examine plants for general health; evidence of stress; or damage by animals or disease. We will note all invasive plants; and note whether installed salt cedar bundles have sprouted (notifying NPS as necessary).

3): Monitor trace element or contaminant bioaccumulation within the vegetation. We will determine levels of elements that may pose a threat to the health of the fish or ecosystem. We will collect three specimens of each existing plant species for analysis that may include, but is not limited to, selenium, mercury, arsenic, and perchlorate. Other elements or contaminants can be added to this list if there is a cause for concern, such as pesticides, pharmaceuticals, viruses, etc.

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Fish Populations

1): Are the stocked razorback and bonytail surviving or have they disappeared? Are they free of disease? Are non-natives present? We will collect population data via a snorkel survey in spring and electrofishing and/or trammel-netting in the fall. Each fish will be measured, weighed, and spawning condition evaluated. Crayfish and bullfrog presence and abundance will be estimated with minnow traps baited with canned food, set overnight.

2) If there are non-native fish, what is their relative abundance? Are the non-natives reproducing? This question can be answered from data collected above.

3): Are razorbacks and bonytail growing? This question can be answered by comparing data between samples by subsampling fish using PIT tags.

4): Are the razorback and bonytail spawning? We will set four larval light traps for 2-hr periods to determine presence of fish larvae. Larvae collected will be preserved to identify species.

5): Is there evidence of recruitment? We will look for young-of year fish during spring snorkeling surveys; and by setting minnow traps and ½ -inch trammel nets in the

fall.

6): Are razorback and bonytail using the available cover and substrate? We will snorkel and/or use underwater videography in the vicinity of the brush piles and installed substrates to determine use. To determine if the installed substrate is producing larvae, larval light traps will be set directly above in the spring.

Data Handling and Reporting

Jeanette Carpenter will maintain and keep all datasets. Annual reports will be written and provided to all interested persons and agencies. The monitoring program will be reviewed on an annual basis to determine if changes to the protocol need to be made. If a significant event occurs, such as an unusual climatological, hydrological, or biological event, we may need to revise our methods and consider additional or alternative monitoring techniques or sampling dates.

IDENTIFIED RESEARCH NEEDS:

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High Levee pond presents unique research opportunities that would advance the refinement of native fish sanctuaries. While out side the resources of this study, these research needs should be identified and promoted.

1. Examine the use of new PIT tag technology (134.2 kHZ) to monitor populations.
2. Identify the most efficient means of salvaging native fish. Can broadcast feeders and pop nets make salvage efforts more effective and less stressful on fish?
3. Measure the hydraulic exchange that is occurring and develop natural 'recharge' techniques to maintain water quality at other sites.
4. Examine rearing and growth parameters for bonytail.
5. Develop and test 'floating island' technology that would enhance aeration and provide solar shade.

PROPOSED SCHEDULE AND ACTIVITIES

Timing	Action	Crew#	Lead Agency Contact
September 2005	Salvage	10	FWS/USGS Thorson/Mueller
Spring 2006	Salvage	10	FWS/USGS Thorson/Mueller
Spring 2006	Renovation	10	FWS/USGS Thorson/Mueller
Summer 2006	Stocking	12	FWS Thorson
Fall 2006	Monitoring	3	USGS/FWS Carpenter/Thorson
Spring 2007	Monitoring	3	USGS/FWS Carpenter/Thorson
Fall 2007	Monitoring	3	USGS/FWS Carpenter/Thorson

Spring 2008	Monitoring	3	USGS/FWS	Carpenter/Thorson
Fall 2008	Monitoring	3	USGS/FWS	Carpenter/Thorson

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