

# MARSH FIRE

## BURNED AREA REHABILITATION PLAN

**U.S. FISH AND WILDLIFE SERVICE  
HAVASU NATIONAL WILDLIFE REFUGE  
August 2005; Revised September 2006**



Resprouting Non-Native Invasive Tamarisk Trees in Burned Area

**FIRE DATE:** June 22, 2005

**AGENCY/UNIT:** U.S. Fish and Wildlife Service  
Havasu National Wildlife Refuge  
PO Box 3009, Needles CA. 92363  
Phone: 760-326-3853

**LOCATION/SIZE:** Mojave County, Arizona  
206 acres  
Lat. and Long.; 34° 45' 44.30" x 114° 30' 46"

**PREPARED BY:** U.S. Department of Interior  
U.S. Fish and Wildlife Service  
Havasu National Wildlife Refuge and  
Regional Office BAER Team

Prepared and Submitted By:

Date: September 25, 2006

Jack Allen, Refuge Biologist, Havasu National Wildlife Refuge

**BURNED AREA REHABILITATION PLAN REVIEW AND APPROVAL**

**I. Project Leader approval that the Burned Area Rehabilitation Plan meets approved land management plan management objectives.**

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John Earle, *Refuge Manager*

Date

**II. Regional Fire Management Coordinator concurrence that the plan fits the technical definition for use of Rehabilitation finding.**

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Dave Lentz, *Regional Fire Management Coordinator, Region 2*

Date

**III. Rehabilitation Funding Approval (check one box below):**

Approved

Approved with Revision (see attached)

Disapproved

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Dr. Benjamin N. Tuggle, *Regional Director, Region 2*

Date

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## EXECUTIVE SUMMARY

### Introduction

This plan has been prepared in accordance with USFWS policy. This plan provides burned area rehabilitation recommendations for all lands burned within the Marsh Fire perimeter which lie within the Havasu National Wildlife Refuge (NWR) administered by the U.S. Fish and Wildlife Service (USFWS). The primary objectives of the Marsh Fire Burned Area Rehabilitation Plan are:

- Prevent regrowth and re-establishment of undesirable exotic plant species, primarily salt cedar, through integrated management using herbicide and mechanical treatments.
- Rehabilitate areas burned under moderate to high fire severity with native forbs, grasses, willows, mesquites and other native species as specified in the Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Refuge Habitat Management Plan.

This plan will be managed and implemented by John Earle (Refuge Manager), Ty Benally (Assistant Refuge Manager), and Jack Allen (Refuge Biologist).

The 206-acre Marsh Fire encompasses an island dominated by salt cedar, screwbean mesquite (*Prosopis pubescens*), arrow-weed (*Tessaria sericea*), and spike rush (*Eleocharis caribaea*), along with other native grasses and forbs. Cottonwood (*Populus fremontii*) and willow (*Salix goodingii*) are also found in some wetter parts of the burn. The fire burned with mixed severity mostly under moderate (with some high and low) severity. Many of the species listed above are in the early stages of resprouting or emerging from seed including the salt cedar. Aggressive herbicide treatment of salt cedar resprouts will be a major step in the successful rehabilitation to native vegetation and reduction of wildland fire risk. Additionally, limited seeding and plantings of native species in areas with poor potential for natural regeneration may be necessary.

### Fire Background

The lightning caused Marsh Fire was reported around 5:00 pm on Sunday, June 22, 2005, at Havasu NWR in the southwest portion of Topock Marsh, Mojave County, Arizona. The incident was managed by Deon Steile as the Incident Commander, with suppression forces from the Mojave Valley Interagency Fire Station. The fire exhibited moderate fire behavior including limited spotting, and torching with winds up to 15 mph. The fire was contained to an island on refuge lands using fire engine personnel transported by boat. The fire was contained on June 24 at 1900 and declared controlled on June 29, 2005 at 1200.

### Fire Damages and Threats to Human Safety and Natural and Cultural Resources

The current burned area poses no threat to human safety or cultural resources in the area. The area lies within the Havasu NWR and is an important wildlife and recreational area east of the Colorado River between the river and the open water portion of Topock Marsh. The nearby marsh and adjacent riparian forests are habitat for the Endangered Yuma clapper rail and southwestern willow flycatcher. The adjacent river and marsh is popular for boating, skiing, hunting, fishing, and is used by tourists and local residents. The majority of the burned area encompasses an entire island (Map 1) where non-native invasive salt cedar, native screwbean mesquite and native surface vegetation cover including native grasses, forbs, sedges, and cattails were consumed. Although salt cedar has begun to resprout in many locations, the native vegetation is also resprouting and seedlings are germinating. If left unmanaged, the salt cedar likely will spread across and cover the majority of this island--even in places where it did not exist prior to the fire. This will result in salt cedar being

the predominant species cover type on this island, habitat with less biological diversity, degradation and loss of native and Threatened and Endangered species habitat, and increased hazardous fuels and wildland fire threats. The rehabilitation of native riparian and wetland habitats will help restore wildlife habitat and natural resource values, while providing alternative habitat for the Endangered rails and the flycatchers.

**Management Requirements**

Aggressive control of salt cedar is recommended throughout the burned area using manual labor to apply herbicide to resprouts, seedlings, and cut stumps (See Appendix II – Long-Term Integrated Vegetation Management Plan). This area will need to be treated three times over the next year to adequately cover missed plants, new resprouts, and new seedlings. A portion of the burned area will be revegetated using local plant resources (native seeds and plant materials for pole planting) where the fire burned under moderate to high severity or where local environmental conditions permit. Additionally, monitoring the effectiveness of the treatments upon salt cedar mortality and native revegetation response will be conducted over the life of the project. If no management of salt cedar occurs, the area will likely be invaded by salt cedar within five years creating a severe fire hazard and degraded wildlife habitat and resource values.

**Rehabilitation**

The following statements in approved management plans justify the proposed burned area rehabilitation treatments funded with Burned Area Rehabilitation funds.

Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Environmental Assessment, page 55, lists revegetation, including salt cedar removal, as a goal and objective of Havasu NWR (approved 9/94, J. Rogers).

Restore riparian areas invaded by salt cedar to historic southwestern willow flycatcher habitat, (Lower Colorado River Refuge Complex Comprehensive Conservation Plan, page 31, C. Smith, 10/97).

Guidance for rehabilitation of wildfire areas is provided by the USFWS Fire Management Handbook (Release: 7/17/00) and 095 FW3 (2/00).

The burned area presents an opportunity to prevent the invasive exotic salt cedar from further dominating this area by restoring it with native plant species. This will enhance the wildlife habitat at this site through the establishment of native species, habitat with greater biological diversity and resource values. Additionally the use of native species will provide habitat and fuels that are less susceptible to wildland fires.

**PART A - FIRE LOCATION AND BACKGROUND INFORMATION**

<b>Fire Name</b>	<b>Marsh</b>
<b>Fire Number</b>	<b>BVX4</b>
<b>Agency Unit</b>	<b>Havasu National Wildlife Refuge</b>
<b>Region</b>	<b>Southwest</b>
<b>State</b>	<b>Arizona</b>
<b>County(s)</b>	<b>Mojave</b>
<b>Ignition Date/Cause</b>	<b>June 22, 2005 / Lightning Caused</b>

<b>Zone</b>	<b>LCR Interagency</b>
<b>Date Controlled</b>	<b>June 29, 2005 @ 1200</b>
<b>Total Acres</b>	<b>206</b>
<b>Date Contained</b>	<b>June 24, 2005 @ 1900</b>

**PART B - NATURE OF PLAN**

**I. Type of Plan (check one box below)**

- Emergency Stabilization**
- Rehabilitation**
- Both Emergency Stabilization and Rehabilitation**

**II. Type of Action (check one box below)**

- Initial Submission**
- Updating or Revising the Initial Submission**
- Supplying Information of Accomplishment to Date on Work**
- Different Phase of Project**
- Final Accomplishment Report (To Comply with the Closure of the 9262 Account)**

**PART C - REHABILITATION PLAN OBJECTIVES**

- Prevent regrowth and re-establishment of undesirable exotic plant species, primarily salt cedar, through integrated management using herbicide and mechanical treatments.
- Rehabilitate areas burned under moderate to high fire severity with native forbs, grasses, willows, mesquites and other native species as specified in the Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Refuge Habitat Management Plan.

**PART D – BURNED AREA REHABILITATION TEAM MEMBERS**

<b>Position</b>	<b>Team Member (Agency)</b>
<b>Team Leader*</b>	<b>John Earle, Refuge Manager (USFWS)</b>
<b>NEPA Compliance and Planning</b>	<b>John Earle, Jack Allen (USFWS)</b>
<b>Hydrologist</b>	<b>Andrew Hautzinger (USFWS)</b>
<b>Fire Ecologist/Planner</b>	<b>Mark Kaib (USFWS)</b>
<b>Wildlife Biologist</b>	<b>Jack Allen (USFWS)</b>
<b>Contracting</b>	<b>Mary Garcia</b>
<b>Threatened and Endangered Species Compliance</b>	<b>Leslie Fitzpatrick, Ecological Services Biologist (USFWS)</b>

**PART E - SUMMARY OF ACTIVITIES AND COSTS**

The summary of activities, treatments, and estimated costs below are proposed for funding from Burned Area Rehabilitation, agency operation, and other funding sources, per year, for FY 2007 and FY 2008.

**REHABILITATION ACTIVITIES COST SUMMARY TABLE – HAVASU MARSH FIRE**

Spec #	Title	Unit	Unit Cost	No. Units	No. Times	Work Agent	Cost
1	Herbicide Treatment of Non-native Plants	Acre	\$125.00 (FY07)	150 (FY07)	2	C	\$18,750 (FY07)
		Acre	\$100.00	150 (FY08)			\$15,000 (FY08)
2	Native Seed and Revegetation Stock Acquisition and Planting (Cottonwood and willow poles, mesquite seeds)	Acre	\$100.00	150	2	FA	\$19,500 (FY07) \$10,500 (FY08)
3	Monitoring Treatment Effectiveness	Acre	\$100.00	150	2	C	\$15,000 (FY07) \$15,000 (FY08)
4	Rehabilitation Planning and Technical Support	150 Acres	\$5,000.00	1	2	FA	\$5,000 (FY07) \$5,000 (FY08)
<b>TOTAL COST FY07</b>							<b>\$53,750</b>
<b>TOTAL COST FY08</b>							<b>\$50,000</b>

**PART F - INDIVIDUAL TREATMENT SPECIFICATIONS**

SPECIFICATION TITLE:	Herbicide Treatments	AGENCY:	Contractor
PART E: Treatment Specification # 1	Herbicide treatment of non-native plants	FISCAL YEAR(S) (list each year):	FY 07, FY08

**I. WORK TO BE DONE (describe or attach exact specifications of work to be done)**

<p><b>Number and Describe Each Task:</b></p> <p><b>A. General Description:</b> Apply the herbicides Habitat and Tahoe 4 using a backpack pump sprayer in areas where non-native species have been detected. Apply Tahoe 4 herbicide away from water at recommended concentrations for oil-basal or cut-stump treatments. See Appendix II – Long-Term Integrated Vegetation Management Plan for more detailed herbicide treatment specifications.</p> <p><b>B. Location/Suitable Sites:</b> Up to 150-acre at Marsh Fire on Havasu National Wildlife Refuge.</p> <p><b>C. Design/Construction Specifications:</b> Apply herbicide in adherence with the label guidance to saltcedar resprouts when 3-4 feet tall and cut stumps.</p> <p><b>D. Purpose of Treatment Specifications:</b> To cause mortality to a large percentage of the salt cedar in this burned area/island.</p>
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**II. LABOR, MATERIALS AND OTHER COSTS:**

<b>PERSONNEL SERVICES:</b>	<b>COST/ITEM</b>
TOTAL PERSONNEL SERVICE COST	\$33,750
<b>EQUIPMENT PURCHASE, LEASE AND/OR RENT</b>	<b>COST/ITEM</b>
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	0
<b>MATERIALS AND SUPPLIES</b>	<b>COST/ITEM</b>
TOTAL MATERIALS AND SUPPLY COST	0
<b>TRAVEL COST</b>	<b>COST/ITEM</b>
TOTAL TRAVEL COST	0
<b>CONTRACT COST</b>	<b>COST/ITEM</b>
<b>TOTAL</b>	<b>\$33,750</b>

**SPECIFICATION COST SUMMARY**

FISCAL YEAR	UNIT	UNIT COST	# OF UNIT	COST	FUNDING SOURCE	METHOD
FY 07	Job	\$18,750	1	\$18,750	R	Contract
FY 08	Job	\$15,000	1	\$15,000	R	Contract

**FUNDING SOURCE**

F - Suppression Operations      P - Agency Personnel Services  
R - Burned Area Rehabilitation    C - Contract (long-term)  
OP/O - Agency Operations/Other

**METHODS**

EWP - Emergency Watershed Protection  
EFC - Emergency Fire Contract (short-term)  
FC - Incident Management Crew Assignment

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	C,P
5. No cost estimate required -- cost charged to Fire Suppression Account.	

P = Personnel Services    E = Equipment    M = Materials/Supplies    T = Travel    C = Contract    F = Suppression

**PART F - INDIVIDUAL TREATMENT SPECIFICATIONS Cont.**

<b>SPECIFICATION TITLE:</b>	Native Seed and Revegetation Stock Acquisition and Planting	<b>AGENCY:</b>	Contractor/Agency
<b>PART E: :Treatment Specification # 2</b>	Revegetate burned areas with native seed and native pole planting	<b>FISCAL YEAR(S) (list each year):</b>	FY 07,08

**I. WORK TO BE DONE (describe or attach exact specifications of work to be done)**

<b>Number and Describe Each Task:</b>
<b>A. General Description:</b> Collection of Native Seed and Revegetation Stock. Mesquite seeds and pods to be broadcast in burned areas. Cottonwood and willow poles to be placed in holes augered to the water table.
<b>B. Location/Suitable Sites:</b> Havasu NWR, Marsh Fire burned area. Up to 150 acres.
<b>C. Design/Construction Specifications:</b> Contractor to collect mesquite seeds and pods from along the Colorado River floodplain within 100 miles of the Havasu National Wildlife Refuge. Cottonwood and willow poles to be collected on the Havasu National Wildlife Refuge and to be used for pole planting.
<b>D. Purpose of Treatment Specifications:</b> Reestablish native vegetation.

**II. LABOR, MATERIALS AND OTHER COSTS:**

<b>PERSONNEL SERVICES:</b>	<b>COST/ITEM</b>
<b>TOTAL PERSONNEL SERVICE COST</b>	<b>\$24,300</b>
<b>EQUIPMENT PURCHASE, LEASE AND/OR RENT</b>	<b>COST/ITEM</b>
Two motorized, hand-held augers for drilling holes for pole planting, about \$600 each	\$1200
<b>TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST</b>	<b>\$1,200</b>
<b>MATERIALS AND SUPPLIES</b>	<b>COST/ITEM</b>
Screwbean mesquite seeds and pods (mulched): 20lb/ac for 150 acres @ \$30.00/acre (contractor provides)	\$4,500
<b>TOTAL MATERIALS AND SUPPLY COST</b>	<b>\$4,500</b>
<b>TRAVEL COST</b>	<b>COST/ITEM</b>
<b>TOTAL TRAVEL COST</b>	<b>0</b>
<b>CONTRACT COST</b>	<b>COST/ITEM</b>
<b>TOTAL</b>	<b>\$30,000</b>

**SPECIFICATION COST SUMMARY**

FISCAL YEAR	UNIT	UNIT COST	# OF UNIT	COST	FUNDING SOURCE	METHOD
FY07	Job	\$15,600	1	\$19,500	R	C,P,FC
FY08	job	\$14,400	1	\$10,500	R	P,FC

**FUNDING SOURCE**

F - Suppression Operations  
R - Burned Area Rehabilitation  
EWP - Emergency Watershed Protection  
OP/O - Agency Operations/Other

**METHODS**

P - Agency Personnel Services  
C - Contract (long-term)  
EFC - Emergency Fire Contract (short-term)  
FC - Incident Management Crew Assignment

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	C
2. Documented cost figures from similar project work obtained from local agency sources.	

3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P, E, M/S
5. No cost estimate required -- cost charged to Fire Suppression Account.	

P = Personnel Services    E = Equipment    M = Materials/Supplies    T = Travel    C = Contract    F = Suppression

**PART F - INDIVIDUAL TREATMENT SPECIFICATIONS Cont.**

<b>SPECIFICATION TITLE:</b>	<b>Monitoring Treatment Effectiveness</b>	<b>AGENCY:</b>	<b>Contractor</b>
<b>PART E: Treatment Specification # 3</b>		<b>FISCAL YEAR(S) (list each year):</b>	<b>FY07, FY08</b>

**I. WORK TO BE DONE (describe or attach exact specifications of work to be done)**

<p><b>Number and Describe Each Task:</b></p> <p><b>A. General Description:</b> Run transects to collect mortality data and relate to treatment effectiveness. Analyze data collected.</p> <p><b>B. Location/Suitable Sites:</b> 206 acres burned in Marsh Fire, Havasu National Wildlife Refuge .</p> <p><b>C. Design/Construction Specifications – See Appendix II – Long-Term Integrated Vegetation Plan.</b> Analyze data to determine treatment effectiveness and make recommendation for further herbicide treatment.</p> <p><b>D. Purpose of Treatment Specifications:</b> Assess recovery of native plants and determine effectiveness of herbicide treatments</p>
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**II. LABOR, MATERIALS AND OTHER COSTS:**

<b>PERSONNEL SERVICES:</b>	<b>COST/ITEM</b>
<b>TOTAL PERSONNEL SERVICE COST</b>	<b>\$30,000</b>
<b>EQUIPMENT PURCHASE, LEASE AND/OR RENT</b>	<b>COST/ITEM</b>
<b>TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST</b>	<b>0</b>
<b>MATERIALS AND SUPPLIES</b>	<b>COST/ITEM</b>
<b>TOTAL MATERIALS AND SUPPLY COST</b>	<b>0</b>
<b>TRAVEL COST</b>	<b>COST/ITEM</b>
<b>TOTAL TRAVEL COST</b>	<b>0</b>
<b>CONTRACT COST</b>	<b>COST/ITEM</b>
<b>TOTAL</b>	<b>\$30,000</b>

**SPECIFICATION COST SUMMARY**

FISCAL YEAR	UNIT	UNIT COST	# OF UNIT	COST	FUNDING SOURCE	METHOD
FY07	Job	\$15,000	1	\$15,000	R	C
FY08	Job	\$15,000	1	\$15,000	R	C

FUNDING SOURCE

METHODS

F - Suppression Operations  
R - Burned Area Rehabilitation  
EWP - Emergency Watershed Protection  
OP/O - Agency Operations/Other

P - Agency Personnel Services  
C - Contract (long-term)  
EFC - Emergency Fire Contract (short-term)  
FC - Incident Management Crew Assignment

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required -- cost charged to Fire Suppression Account.	

P = Personnel Services    E = Equipment    M = Materials/Supplies    T = Travel    C = Contract    F = Suppression

**PART F - INDIVIDUAL TREATMENT SPECIFICATIONS Cont.**

<b>SPECIFICATION TITLE:</b>	<b>Rehabilitation Planning and Technical Support</b>	<b>AGENCY:</b>	<b>Agency</b>
<b>PART E: Treatment Specification # 4</b>		<b>FISCAL YEAR(S) (list each year):</b>	<b>FY07, FY08</b>

**I. WORK TO BE DONE (describe or attach exact specifications of work to be done)**

<p><b>Number and Describe Each Task:</b></p> <p>A. Assess Marsh Fire burned area, and revise and implement BAR plan.</p> <p>B. Consult with Refuge employees, pesticide experts, and contractors.</p> <p>C. Write Scopes of Work and assist in preparation of purchase requests.</p> <p>D. Conduct site visits with potential contractors.</p>
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**II. LABOR, MATERIALS AND OTHER COSTS:**

<b>PERSONNEL SERVICES:</b>	<b>COST/ITEM</b>
<b>TOTAL PERSONNEL SERVICE COST</b>	<b>\$ 10,000</b>
<b>EQUIPMENT PURCHASE, LEASE AND/OR RENT</b>	<b>COST/ITEM</b>
<b>TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST</b>	<b>0</b>
<b>MATERIALS AND SUPPLIES</b>	<b>COST/ITEM</b>
<b>TOTAL MATERIALS AND SUPPLY COST</b>	<b>0</b>
<b>TRAVEL COST</b>	<b>COST/ITEM</b>
<b>TOTAL TRAVEL COST</b>	<b>0</b>
<b>CONTRACT COST</b>	<b>COST/ITEM</b>
<b>TOTAL</b>	<b>\$10,000</b>

**SPECIFICATION COST SUMMARY**

FISCAL YEAR	UNIT	UNIT COST	# OF UNIT	COST	FUNDING SOURCE	METHOD
FY07	Job	\$ 5,000	1	\$ 5,000	R	P
FY08	Job	\$ 5,000	1	\$ 5,000	R	P

**FUNDING SOURCE**

F - Suppression Operations  
R - Burned Area Rehabilitation  
EWP - Emergency Watershed Protection  
OP/O - Agency Operations/Other

**METHODS**

P - Agency Personnel Services  
C - Contract (long-term)  
EFC - Emergency Fire Contract (short-term)  
FC - Incident Management Crew Assignment

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	P
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required -- cost charged to Fire Suppression Account.	

P = Personnel Services    E = Equipment    M = Materials/Supplies    T = Travel    C = Contract    F = Suppression

**PART G - POST-REHABILITATION**

The following are post-rehabilitation, implementation, operation, maintenance, monitoring, and evaluation actions potentially beyond three years to ensure the effectiveness of initial investments. Cost for monitoring and revegetation beyond three years will be incurred by refuge.

**Restoration**

1. Restore former vegetation to site with appropriate species as specified in the Lower Colorado River National Wildlife Refuges Comprehensive Management Plan. Plant willow, cottonwood, mesquite, grass, and forb seedlings, poles, and/or seeds to restore desired vegetation, and wildlife habitat.
2. Continue invasive species control treatments and monitoring.
3. Long-term monitoring: monitor native and riparian vegetation recovery.

## **APPENDIX I - ENVIRONMENTAL COMPLIANCE**

### **Federal, State, and Private Lands Environmental Compliance Responsibilities**

All projects proposed in the Marsh Fire Burned Area Rehabilitation Plan that are prescribed, funded, or implemented by Federal agencies on Federal, State, or private lands are subject to compliance with the National Environmental Policy Act (NEPA) in accordance with the guidelines provided by the Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508); Fish and Wildlife Service Fire Management Handbook (Release 7/17/00) and 095 FW3,3.9B,C. This appendix documents the Team considerations of NEPA compliance requirements for prescribed rehabilitation and monitoring actions described in this plan for all jurisdictions affected by the Marsh burned area emergency.

### **Related Plans and Cumulative Impact Analysis**

The Lower Colorado River National Wildlife Refuges Comprehensive Management Plan, approved 9/19/94, was reviewed and it was determined that actions proposed in the Marsh Fire Plan within the boundary of the Marsh Fire are consistent with the management objectives established in the Comprehensive Management Plan. The Comprehensive Management Plan NEPA compliance process specifically addresses:

- Part X: Synthesis, Goals and Objectives, Issue 8: Revegetation  
“In cooperation with the Bureau of Reclamation (BR), revegetate substantial amounts of habitat with native mixes of vegetation leading to biological diversity.”

### **Cumulative Impact Analysis**

Cumulative effects are the environmental impacts resulting from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions, both Federal and non-Federal. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. The emergency protection and rehabilitation treatments for areas affected by the Marsh Fire, as proposed in the Marsh Fire Plan, do not result in an intensity of impact (i.e. major ground disturbance, etc.) that would cumulatively constitute a significant impact on the quality of the environment. The treatments are consistent with the above jurisdictional management plans and associated environmental compliance documents and categorical exclusions listed below.

### **Applicable and Relevant Categorical Exclusions**

The individual actions proposed in this plan for rehabilitation of the Marsh Fire are Categorically Excluded from further environmental analysis as provided for in the DM 516, DM 6, Appendix 1, 1.4 B. (3) iii, (5), (6), and (11).

### **Statement of Compliance for the Marsh Fire Burned Area Rehabilitation Plan.**

This section documents consideration given to the requirements of specific environmental laws in the development of the Marsh Fire Plan. Specific consultations initiated or completed during development and implementation of this plan are also documented. The following executive orders and legislative acts have been reviewed as they apply to the Marsh Fire Plan:

- National Historic Preservation Act (NHPA).

- Executive Order 11988. Floodplain Management.
- Executive Order 11990. Protection of Wetlands.
- Executive Order 12372. Intergovernmental Review.
- Executive Order 12892. Federal Actions to Address Environmental Justice in Minority and Low-income Populations.
- Endangered Species Act.
- Secretarial Order 3127. Federal Contaminated
- Clean Water Act.
- Clean Air Act.

## **CONSULTATIONS**

- BOR

**Excluded and an Environmental Assessment (EA) is required.**

(Yes) (No)

- (X) Adversely affect Public Health and Safety
- (X) Adversely affect historic or cultural resources, wilderness, wild and scenic rivers aquifers, prime farmlands, wetlands, floodplains, ecologically critical areas, or Natural Landmarks.
- (X) Have highly controversial environmental effects.
- (X) Have highly uncertain environmental effects or involve unique or unknown environmental risks.
- (X) Establish a precedent resulting in significant environmental effects.
- (X) Relates to other actions with individually insignificant but cumulatively significant environmental effects.
- (X) Adversely effects properties listed or eligible for listing in the National Register of Historic Places
- (X) Adversely affect a species listed or proposed to be listed as Threatened or Endangered.
- (X) Threaten to violate any laws or requirements imposed for the "protection of the environment" such as Executive Order 1 1 988 (Floodplain Management) or Executive Order 1 1 990 (Protection of Wetlands).

**National Historic Preservation Act:**

Ground disturbance will occur on sites below elevation 461 msl.

**A NHPA Clearance Form:**

- Is required because the project may have affected a site that is eligible or on the national register. The clearance form is attached. SHPO has been consulted under Section 106 (see Cultural Resource Assessment, Appendix I).
- Is not required because the Plan has no potential to affect cultural resources (initial of cultural resource specialist).

**Other Requirements:**

(Yes) (No)

- (X) Does the Plan have potential to affect any Native American uses? If so, consultation with affiliated tribes is needed.
- ( ) Are any toxic chemicals, including pesticides or treated wood, proposed for use? If so, local agency integrated pest management specialists must be consulted. (Note: Herbicides are proposed.)

I have reviewed the proposals in the Marsh Fire Burned Area Rehabilitation Plan in accordance with the criteria above and have determined that the proposed actions would not involve any significant environmental effect. Therefore it is categorically excluded from further environmental (NEPA) review and documentation. Team technical specialists will complete necessary coordination and consultation to insure compliance with the National Historic Preservation Act, Endangered Species Act, Clean Water Act and other Federal, state and local environment review requirements.

---

**Refuge Manager, Havasu National Wildlife Refuge**

**Date**

**APPENDIX II**

**LONG-TERM INTEGRATED VEGETATION  
MANAGEMENT PLAN**

**MARSH FIRE  
BURNED AREA REHABILITATION**

**Havasu National Wildlife Refuge  
Arizona  
2006**

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# LONG-TERM INTEGRATED VEGETATION MANAGEMENT PLAN

## MARSH FIRE BURNED AREA REHABILITATION

Havasu National Wildlife Refuge, Arizona

2006

### Introduction

Havasu National Wildlife Refuge (the Refuge) is located along the Colorado River near Needles, California. Created in 1941, it was established primarily to provide suitable habitat for wintering migratory birds.

The construction of several dams upstream of the wildlife area during the early to mid 1900's significantly changed the historical flow patterns of the river. Where once the river topped the banks into the flood plain each spring, leaving behind thousands of acres of wetland and riparian habitat, it has since been tamed by dams constructed for a variety of purposes including flood control, diversion for agriculture, hydroelectric power, and recreation. The result of that taming has been changes not only in the natural flood cycles of the river, but also consequently in vegetation and related wildlife values. One of those primary changes has been the influx and rapid spread of invasive salt cedar into the former flood plain of the River. Areas where once cottonwood, mesquite, and willow predominated are now occupied by extensive infestations of salt cedar. Concomitant with the influx of that invasive species has been a significant increase in fires since salt cedar readily ignites, and then often burns so hot as to destroy much of the remaining native woody vegetation.

On Sunday, June 22, 2005, lightning ignited a fire on an island approximately one mile West of Topock, Mojave County, in the Topock Marsh Unit of Havasu National Wildlife Refuge. It was finally contained by fire suppression forces from the Mojave Valley Interagency Fire Station on June 29, 2005. The wildfire burned a total of two hundred and six (206) acres under mostly moderate severity, although there were some spots of low and high severity damage to vegetation.

Prior to the fire the native vegetation included honey mesquite (*Prosopis glandulosa*), screwbean mesquite (*Prosopis pubescens*), seep willow (*Baccharis salicifolia*), arrow-weed (*Pluchea sericea*), spike rush (*Eleocharis carbibaea*), saltgrass (*Distichlis spicata*), common cattail (*Typha latifolia*), and other scattered herb and grass species.

The island also had been invaded by saltcedar (*Tamarisk spp.*), which is a major exotic species problem on the lower Colorado River. Saltcedar trees around the exterior of the island were fairly large (exceeding 15 feet), and these trees were mostly undamaged by the fire. In the interior portions of the island, the aerial portions of most all of the saltcedar shrubs (most being less than eight (8) feet tall) were burned, but almost all of these plants had sprouted by May 2006. Also, some of the saltcedar seedlings apparently had developed from seed dispersal from July 2005 to May 2006. Since the large, undamaged saltcedars on the island were capable of producing up to a half-million seeds each year from April through October, much of the island was subject to seed dispersal. Furthermore, it must be realized that seeds from surrounding saltcedar infestations on the Refuge have and will continue to be dispersed on the island from wind, water, and birds. Over

time, it is highly likely that saltcedar will eventually become the dominate plant species on the island just as has occurred in surround sites on the Lower Colorado River system. Following a fire that burn most of the vegetation, saltcedar has a competitive advantage over native plants and usually becomes the climax vegetation type. Fortunately, this situation has not yet developed on the island.

During a site visit on May 19, 2006, it was noted that the native plant species were still present in sufficient numbers to effectively revegetate the island. In fact, the most abundant species were arrow-weed, common cattail, and seep willow. Other native species were present and recovering from the fire

This recently burned area presents an opportunity to prevent the invasive exotic salt cedar from further dominating the area by controlling it before it becomes large and well established, and by restoring the island with native plant species. Restoration of the island to native species such as screwbean mesquite and quailbrush will enhance the wildlife habitat at the site by preserving and increasing biological diversity and resource values. Restoration will provide flowers in the spring for native invertebrates; which in turn will provide food for nesting resident birds as well as neotropical migrant birds that are known to use the Colorado River corridor as part of their migration route. A good coverage of native plants will discourage reinfestation by salt cedar. Also, by controlling salt cedar and restoring the site to native species, the island will be less susceptible to wildfire.

## Management Objectives

The following have been identified as management objectives for Havasu NWR and the Marsh Fire vegetation restoration project

- **Remove saltcedar and restore native vegetation.** The Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Environmental Assessment, page 55, lists revegetation, including saltcedar removal, as a goal and objective of the Havasu NWR (Approved in September 1994).
- **Restore riparian sites invaded by saltcedar to historic southwestern willow flycatcher (*Empidonax trailli extimus*) habitat** (U.S. Fish and Wildlife Service, 2002, southwestern Willow Flycatcher Recovery Plan, Region 2, Albuquerque, NM), and other neotropical bird species (Lower Colorado River Refuge Complex Comprehensive Conservation Plan, page 31 (Approved in October 1997)
- **Rehabilitate wildlife areas damaged by fire.** Guidance for rehabilitation of wildlife areas is provided in the USFWS Fire Management Handbook (Released on July 17, 2000) and 095 FW3 (February 2000).
- **Prevent re-growth and re-establishment of undesirable exotic plant species.** (Executive Order? [USFWS Exotic plant strategy reference](#))
- **Establish the island as a demonstration area for Long-term Integrated Vegetation Management of saltcedar and restoration of native plant communities.**

## Strategy

Integrated Vegetation Management involves choosing a variety of vegetation management options for invasive plants, addressing prevention, containment, and control, that have proven to be effective and economical, and environmentally acceptable. It must be recognized that where reinvasion is likely, management of undesirable plants will require not only control of the initial infestation but also sustained control actions, including follow-up treatments. However, follow-up maintenance treatments should require less effort each year that they are conducted.

For long-term restoration, implementing a well-planned strategic IVM program following two or three years of salt cedar control, will require only infrequent maintenance treatments. Maintaining or re-establishing desirable vegetation on sites where control actions have been implemented is essential for effective IVM.

For the Marsh Burn site, the strategy will be to selectively remove saltcedar plants on the island to reduce the infestation to an insignificant level without adversely impacting non-target vegetation. The goal of the first year's treatment will be to control at least eighty (80) percent of the saltcedar trees and shrubs on the island. The large saltcedar trees around the perimeter of the island will be cut with a chainsaw and an herbicide (imazapyr) immediately applied to the cut surface. The smaller saltcedar shrubs on the island will be treated with an oil basal treatment using triclopyr. The objective of these two techniques is to achieve root-kill of treated plants without adversely impacting adjacent desirable species.

Removal of the saltcedar infestation will allow native plants to recover and occupy the island without the high cost of artificial revegetation. Most species will recover naturally, but some seeding may augment recovery of species like salt grass. Healthy native vegetation will discourage saltcedar seedling development in the future.

It will not be possible to achieve total, permanent removal of the saltcedar due to ongoing, long-term potential for reinfestation from populations in the surrounding area and upriver. Follow-up control will be needed a second year to reduce the infestation to a low level. The major effort and cost will occur during the first treatment, and follow-up work should require considerably less effort. After treating for two (2) or possibly three (3) years, annual maintenance will require treatment of only a few saltcedar plants that develop from seed dispersal from off-site. Periodic surveillance and control of invading saltcedars, perhaps every third year, will be necessary to maintain the native plant community.

## Integrated Vegetation Management (IVM) Standards

To ensure long-term successful control of salt cedar on the Marsh Fire site, the Service has established the following IVM standards, based on data indicating that they are obtainable and measurable.

- **Control Effectiveness.** Treatments must show a strong potential for success, i.e., eighty (80) percent or higher control of saltcedar.

- **Long-term Standard.** After **two (2) years of treatments within a 3-year period**, only one (1) to four (4) percent of the original number of saltcedar plants would remain, which would require minimal follow-up maintenance control on a periodic basis.
- **Efficiency:** Control methods will be selected that provide the maximum level of control at the least long-term economic and environmental cost.
- **Environmental Acceptability:** Vegetation management methods will be selected that will prevent or mitigate any adverse environmental effects. Prior to any on-the-ground vegetation management, an environmental analysis will be completed and approved. All pesticide applications will be implemented only after compliance with the National Environmental Policy Act and Section 7 Consultation, and after clearance through the service's Pesticide Use Proposal review process.
- **Mitigations and Best Management Practices (BMPs):** The standard is to ensure that vegetation control, especially the use of herbicides, would be done in a quality manner and in compliance with Service policy and Federal and State laws. Pesticide applicators will be certified by the State of Arizona (Structural Pest Control Commission) and must be sufficiently trained and experienced to ensure they understand established mitigations and BMPs.
- **Monitoring and Records:** The standard is to maintain adequate records to assess the effectiveness of treatments. Project records will include the following elements:
  - Date of application
  - Undesirable plant species
  - Control technique(s) used
  - Common name(s) of herbicide(s) used
  - Description of formulation(s) or tank mix (if used)
  - Application equipment used (helicopter, backpack, squirt-bottle)
  - Application technique used (foliar, basal, cut-stump, aerial application)
  - Quantity (ounces/pounds/percentage) of herbicide used
  - Weather conditions (highest temperature, average wind speed, precipitation, etc.)
  - Estimate of acres treated
  - Estimate of annual treatment success each year. This will be evaluated using the following methods:

- Small saltcedar shrubs. To measure annual treatment success, select an arbitrary compass azimuth and run a transect (10 feet wide) to determine whether the first fifty (50) shrubs have been killed or are still alive. For example, if forty-five (45) were killed, the percentage of kill would be ninety (90) percent. Triclopyr is slow acting; so, it will be necessary to allow eight (8) to nine (9) months for the herbicide to work before running the transect.
- Large diameter saltcedar. When cutting and treating large diameter saltcedars, cut stumps of twenty trees will be marked (flagged and spray painted) to determine the percentage kill. The percent control is determined by comparing the number of stumps that have sprouts with the number that have no sprouts. Since imazapyr is slow acting, measurement of treatment success will take about seventeen (17) months. So, if control work was done in November of 2006, follow-up measurements should be done no sooner than May, 2008.
- **Revegetation Monitoring:** A minimum of five (5) photo points will be established on the island in the fall of 2006 and photographed annually for at least five (5) years. The various points will be established to show different vegetative conditions, including: (1) a site with screwbean mesquite and possibly honey mesquite site and associated vegetation, (2) a site with seep willow and arrow-weed, (3) a site with spike rush and associated vegetation, (4) a site with salt grass and associated plant species, and (5) a marshy site with common cattail and associated plant species.

The GPS locations of the points will be recorded the center point marked with a metal fence post or similar marker. An azimuth for the direction of each photograph will be recorded at each point. Also, along the same azimuth as the direction of the photograph, the species and abundance of plants will be recorded in a rectangular strip-plot that is five (5) feet wide by twenty (20) feet long. For trees and shrubs, the number and estimated height of individual plants will be recorded annually. For grasses and other small plants, the area occupied will be measured annually.

At the end of five years, a final revegetation monitoring report will be prepared by Refuge personnel that will include the photographic record at each sample point, the plant species in the strip-plot at each point, and plant size or area occupied by the various species on each strip-plot.

- **Oversight:** The Refuge Manager will ensure that annual oversight and documentation of the IVM program is completed to determine if the management objective was met; treatments complied with standards, mitigations, and BMPs; and actions were in compliance with policies and law.

## **Methods of Control for Saltcedar:**

Refer to Parker et al., 2005, page 13, for estimated cost figures or the various methods used to control saltcedar

- **Methods that were considered but eliminated.**

- *Aerial application of herbicide.*

Dense stands of saltcedar over large acreages can be effectively controlled through the aerial application of imazapyr or a mixture of imazapyr and glyphosate. For optimal control, applications should be done from late August through mid October prior to foliar color change when plants are actively growing. These herbicides are slow acting and treated trees should not be removed for a period of three (3) years to achieve the desired root kill. It has been found that over ninety-seven (97) percent of trees must be killed in a treatment area to provide long-term control results, and revegetation is usually required to obtain sustainable, long-term results (Taylor and McDaniel 2004). If there are any nearby or upstream stands of saltcedar, it must be realized that they will often lead to rapid reinvasion of treatment sites, especially if natural regeneration does not occur or artificial plantings do not result in adequate ground cover to offer some competition to the development of saltcedar seedlings. Since the acreage of large-size saltcedars is small, aerial application would not be an economically effective technique to use. Furthermore, imazapyr and glyphosate are broad spectrum herbicides that will kill most plants, and expensive revegetation would be required where spraying was done. Therefore, this technique is not recommended.

- *Mechanical control.* Heavy equipment can be an effective method to remove dense stands of saltcedar, especially where few if any native plants are present. However, this method is non-selective and cannot be recommended for control of scattered saltcedar plants interspersed with desirable species.
- *Individual plant removal.* Hand grubbing of small saltcedar on the island would be too time-consuming and costly to be considered as a viable contain and control method. It is estimated the cost of hand grubbing would exceed several thousand dollar per acre, and the level of control would be unacceptable. Roots cannot be effectively killed by this technique, and sprouts would develop in the same season of control. Handgrubbing would also cause considerable soil surface disruption.

- **Methods Selected.**

The following methods provide the most effective, economical, and environmentally acceptable options to control the saltcedar infestation on the island:

- *Large Trees - Low-Volume, Cut Stump Method*

This method involves a combination of mechanical and herbicide treatments to achieve root-kill of saltcedar trees. Trees are first cut with a chainsaw just above the ground. All Service personnel using chainsaws should be trained and Service certified. Also, experienced chain saw operators are much more efficient.

Cut surfaces need to be horizontal to the ground to allow the herbicide to soak into the cut surface and not run off. Prior to applying the herbicide mixture, all sawdust needs to be removed for the cut surface.

Two different herbicides can be used. Garlon 3A, can be applied full strength as recommended on the Label, or it can be applied in a 50% concentration with water to reduce cost, which concentration usually yields acceptable results. Garlon 3A is a product with a triethylamine salt of triclopyr that mixes readily with water. Imazapyr (Arsenal; Habitat) can also be used. Due to its low toxicity to aquatic organisms, imazapyr is recommended for controlling trees along the edge of the island.

**Imazapyr:** This herbicide is non-selective and it provides pre-emergence and post-emergence control of a variety of grasses, broadleaf weeds, and woody plants. The half-life in soil ranges from 25-142 days, depending on soil type and environmental conditions (Vencill 2002). Foliar absorption usually is rapid (within 24 hours). It is an effective herbicide for a cut-stump application to achieve root kill, including application at full strength. The product name is *Arsenal*. *Habitat* is an aquatic formulation.

- **Total Amount Needed.** It is estimated that no more than five (5) gallons of Arsenal will be needed to treat all of the large saltcedars that are present around the perimeter of the island.
- **Equipment.** A one quart spray bottle is the most efficient and safe equipment to use to treat a relatively of cut stems. Spray bottles with chemically resistant Viton seals are recommended. They can be obtained from Chemical Containers, Inc., for about \$4.00 per spray bottle
- **Mixing:** Imazapyr is applied to the cut surface in a 25% Habitat or Arsenal + 2% vegetable oil adjuvant + 73% water solution. If it is found that this mixture does not provide adequate results, the percent of Arsenal can be increased, up to a straight (100%) application of the product.

To make a quart (32 ounces) of a twenty-five percent solution of Arsenal, add one cup (8 ounces) of Arsenal and 2 teaspoons of vegetable oil (such as Improved JLB Plus), to 3 scant cups of water-- or fill to the 32 ounce mark.

- **Application:** Immediately following the cutting of trees, brush the sawdust off the stump and spray the entire perimeter of the sapwood (lighter colored wood that conducts water) of the cut surface. The herbicide solution will sink into water conducting tissues and will be moved to the growing points of the roots. On large stems that are 4 inches in diameter or larger, the darker colored heartwood is dead tissue and should not be sprayed. For small stems, the practical approach is to just spray the entire cut surface.
- ***Small trees and Shrubs - Low-volume oil basal herbicide application***

This method will provide effective control of small saltcedars about six feet tall or less and small trees that have stems with smooth bark and a stem diameter of about an inch at ground level (Parker and Williamson, 2003). A formulation of triclopyr that mixes with an all natural vegetable oil, such as Garlon 4 or Tahoe 4, is applied to the stems just above the ground level. The estimated cost for this approach is often less than \$100 per acre, including labor. The best time to do the treatment is late fall to early spring. Application should not be done if the stems are wet or there is a threat of rain within **6 hours**.

**Triclopyr:** This herbicide is selective and especially useful for control of

trees and shrubs. It acts by mimicking the activity of auxin, a natural growth hormone. The active ingredient is readily absorbed by foliage. Average half-life in soil is 30 days (Vencill 2002). Commercial formulations, *Garlon 3A* and *Garlon 4 (or similar products)* are used for vegetation management programs, and *Renovate 3* is a new aquatic formulation.

- **Total Amount Needed.** It is estimated that forty gallons (40) of Garlon 4 and one hundred and twenty (120) gallons of Improved JLB Oil Plus will be need to treat the saltcedar shrubs on the island for at least two (2) treatments (over two to three years) with contingency for up to three (3) treatments

- **Equipment.**

*Backpack sprayer.* A 4-gallon backpack sprayer is the best equipment to individually basal treat individual shrubs or trees in hard to reach sites. A backpack sprayer with a diaphragm pump is recommended. Sprayers with piston pumps are not recommended due to their tendency to leak. A Swissmex SP1 and a Solo Model 475 are commonly used units that are relatively inexpensive. Chemical Containers, Inc., can provide assembled backpack units, spray guns and nozzles, and safety equipment (1-800-346-7867 or [www.chemicalcontainers.com](http://www.chemicalcontainers.com)). A WCCI 210 Trigger Jet spray gun with a TP 1503 or TP 2503 flat fan spray tip will allow applicators to efficiently spray stem of shrubs or trees.

**The use of trade or firm names in this plan is provided for information and does not imply endorsement by the USFWS.**

(Although an ATV mounted sprayer with spray tank, 10-foot or longer hose, and spray gun can be used to treat saltcedar shrubs and trees, use of an ATV power sprayer would to impractical to use on the island, and damage to native plants would be unacceptable.)

- **Mixing:** A 25 percent mixture of the Garlon 4® or Tahoe 4® (triclopyr) in vegetable oil is recommended. Triclopyr is a systemic herbicide that readily moves through the stems of treated trees or shrubs, then throughout the plant to the sites of growth where the herbicidal activity occurs. It has little or no herbicidal activity in soil and the average half-life in soil is 30 days. Triclopyr is categorized as slightly toxic to humans and animals (primarily because it can cause serious damage if it comes directly into contact with eyes.) Improved JLB Oil Plus®, is the recommended oil, since it is an all-natural vegetable oil with limonene, a bark penetrant, added to increase efficacy. It is produced by Brewer International (1-800-228-1833 or [www.brewerint.com](http://www.brewerint.com))

**How to obtain a 25% mixture: Add 1 gallon (one part)  
Garlon 4 formulation to 3 gallons (three parts) Improved  
JBL Oil Plus.**

- **Application:** Spray the herbicide/oil mixture evenly but lightly around the stem from the base of the stem(s) up to 12 inches above the ground, making sure you spray complete

around the stem. For small shrubs (below 2 feet), it is only necessary to spray about 3- to 4 inches above the ground. It is important to cover the entire circumference of the stem(s), but not to cause runoff or puddling. The oil helps the spray mixture to wrap around the stem(s) as it flows downward with gravity. Linonene helps the herbicide to move through the bark.

Where there are many stems in a shrub, it usually is necessary to spray from 2 to 3 sides of the clump to ensure that all stems are sufficiently covered. Do not conduct treatments when the stems are wet from rain or snow. Water and oil do not mix, and the control results will not meet the objective (80% or higher control). It is not necessary to use a marker dye in the spray: Treated plants are easy to detect, even months following spraying.

## **Mitigations and Best Management Practices (BMPs)**

The application of herbicides is tightly controlled by state and federal agencies. The USFWS is required to follow all state and federal laws and regulations applicable to the application of herbicides, in addition to its own regulations and policies. The following mitigation measures will be followed when applying herbicides:

### **Mitigations**

- All herbicide label requirements will be followed.
- All Best Management practices will be followed.
- Herbicides will not be directly applied to water.
- Basal applications of triclopyr will not be done within ten (10) feet of the edge of water or when a significant rainfall or flooding event is expected or likely within 72 hours.
- Garlon 4 and Tahoe 4 are ester formulations of triclopyr that will volatilize. Therefore, they will not be applied in the summer when temperatures are expected to exceed 85°.
- Applicators will be required to wear long-sleeved shirts and long pants, boots plus socks, and other personal protective equipment as required on the label.
- All requirements in the following Safety and Spill Plan will be followed.
- Herbicides will be transported according to safety requirements.

### **Pre-spray BMPs**

- Comprehensive project files will be maintained.
- Herbicides are to be used when they provide the most effective control relative to cost and do not present unacceptable environmental or safety risk.

- Herbicides are selected based on their ability to provide the most effective control and least cost.
- Applicators, including contracted applicators, will be required to read and understand the Label and Material Data Safety Sheet for all herbicides being used.
- The lowest effective rate for herbicides is to be used. Application rates will not exceed those identified in this Plan or on the Label.
- Treatment sites will be checked to ensure they are not occupied by threatened, endangered, or sensitive species.

### **Herbicide Spraying BMPs for this Plan**

- Individuals spraying herbicides will receive safety and application training prior to doing any treatment.
- Mixing of herbicides will not be done near water, recreation sites, or areas frequented by the public. For herbicides mixed before boat transport to the island, **all** Service requirements will be met for handling of pesticides, including containment.
- Spraying will not be done when the average wind speed exceeds 8 miles per hour or as indicated on the label, whichever is less.
- Applications will not be done when there is a threat of rain. Basal applications will not be done if a significant rain or river flooding event is likely within 72 hours.
- Daily herbicide treatment records will be kept.
- Applicators will use appropriate personal protective equipment (PPE).

### **Herbicide post-spray BMPs**

- Treatment areas will be checked to assess thoroughness and efficacy.
- Application records will be maintained in the project file.
- Managerial oversight will be done at least annually to ensure compliance with all requirements.

### **References Cited**

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## Appendix A

### Identification and Description of Plants

- **Saltcedar** (*Tamarisk* spp.). Saltcedar is an exotic plant that is in the tamarisk family (Tamaricaceae). It is a deep-rooted deciduous shrub or small tree that can reach up to twenty five (25) feet in height. It is highly invasive and forms dense stands that supplant native species, especially follow a wildfire. Individual trees can produce up to half a million seeds in a season, which can start in early April and extend through October. The stem of saplings is reddish-brown, and the leaves are small and scale-like, on highly branched slender stems. Root growth is predominantly downward with little branching until plants reach the water table, and root depth can exceed fifty (50) feet. Saltcedar trees readily form sprouts following cutting or burning of the above ground portions of the plant, and can grow up to six feet in height in one growing season.
- **Honey mesquite** (*Proposis glandulosa*). Honey mesquite is a deep-rooted, thorny shrub or small tree. It is a native plant that is in the pea or legume family (Fabaceae). The species is native to Arizona. Honey mesquite can develop into a tree twenty five (25) feet tall and thirty (30) feet wide, but it often remains a shrub, especially under the stressful conditions that are common in the deserts areas of the Southwest. This mesquite prefers to grow on relatively dry sites, but it can grow along the edges of riparian areas. The bright green fernlike leaves are four (4) inches long, with small individual leaflets. Among the foliage are thorns, which vary from a fourth ( $\frac{1}{4}$ ) to one (1) inch long. Honey mesquite can be deciduous during the winter. The sweet-smelling flowers are crowded together into fuzzy spikes. They bloom predominantly in April and May. The straw-colored leathery pods are about five (5) inches long and the seeds ripen in early July. Birds, small mammals, and cattle readily feed on the seeds. Since this species will readily sprout from roots, it can recover following having the aerial portions burned during a wildfire.
- **Screwbean mesquite** (*Proposis pubescens*). This plant is a small tree that can grow from ten (10) to fifteen (15) feet tall. It also is a native plant in the pea or legume family (Fabaceae). Screwbean mesquite generally grows in moist places along rivers and riparian sites. The creamy or yellow flowers are crowded together in long spikes, and they appear in May. Its distinctive pods make this mesquite easy to recognize. They are tightly coiled, like springs, and the coils are compressed together. Unlike most leguminous pods, which split to scatter their seeds, the pods of the various mesquite species in Arizona remain sealed. The pod must be eaten by mammals or birds to disperse the seed
- **Seep willow** (*Baccharis salicifolia*). Despite having long and narrow leaves, Seep willow is not a true willow; rather, it is a member of the sunflower family (Compositae). The long slender stems have characteristic stripes, which can be helpful in recognizing this species. This native shrub can grow up to six feet tall, and the plant is noted for forming graceful thickets along rivers, streambanks, and irrigation canals. Even intermittent streams provide suitable habitat as long as water is available beneath the surface. The plant will tolerate desert heat as long as its roots have access to water. Seep willow has inconspicuous flowers that occur from spring to fall. The flowers are highly attractive to bees, wasps, butterflies, and a variety of other insects.

- **Arrow-weed** (*Pluchea sericea*). Arrow weed has narrow, lance-shaped leaves and slender, flexible stems reminiscent of some slivery-leaved willow species. However, arrow weed is a native species that is a member of the sunflower family, (Compositae). Like true willows, arrow weed is a riparian plant. It is known for forming thickets in marshy areas, and the dense colonies are created as the underground, horizontal stems send up leafy shoots. Each colony is a clone, a single genetic individual. The colonial growth habit enables this plant to aggressively invade and occupy suitable habitat, such as following a fire or other disturbance. Arrow weed is among the first colonizers of barren sites. The pale, pinkish flowers, clustered in thimble-shaped heads, appear mostly in the spring. As the name suggests, native peoples used arrow weed in making weaponry. The straightness of the stems also made the plant useful in building houses, and their flexibility made them invaluable for basketry.
- **Quailbush** (*Atriplex lentiformis*). Quailbush is a native plant that is in the goosefoot family (Chenopodiaceae). This deciduous, many-branched shrub has a rounded form and can grow eight (8) feet tall and twelve (12) feet in diameter. The blue-gray leaves are variable in shape, from oblong to oval to triangular, and 1.5 inches long and one inch wide. The gray branches are often sharp-tipped. Quailbush will grow in many soil types, including poorly drained ones with high salt content. It typically grows on alkali flats and slopes below 3,000 feet in elevation. Clusters of greenish flowers appear along the branches from February through April, and are followed by tan, papery fruits. This shrub provides food and cover for a variety of desert wildlife.
- **Spike rush** (*Eleocharis geniculata*). This native plant is a member of the sedge family (Cyperaceae). The scientific name *Eleocharis caribaeais* considered by most contemporary authorities to be misapplied. The plants have stiff, firm, and sharp leaves that are tufted in appearance. Fruiting occurs from spring to winter. Spike rush occurs in salt marshes, brackish creeks, canal and ditch banks, mud flats, and lakeshores. The feeding activity of feral pigs may substantially reduce this plant on the island.
- **Salt grass** (*Distichlis spicata*). Salt grass is a native species that is a low, stiff perennial grass that can grow from four (4) to sixteen (16) inches high. It is in the grass family (Poaceae). It can reproduce by seed and creeping, underground rhizomes that root at the joints to produce new stems. Salt grass is one of a few species of grass that have male and female plants. It is found in the West and is common in alkaline soil and in flood plains and marshes in the desert. It is considered a desirable species in natural areas, but it can be a weed in irrigated lands.
- **Common cattail** (*Typha latifolia*). A member of the cattail family (Typhaceae), this plant is a native emergent perennial that can grow to about seven (7) feet tall. Plants have large creeping rhizomes, and they typically develop dense colonies in shallow water. The leaves are long, linear, broad, flat, parallel, and rather spongy. Mature inflorescences are velvety-brown, densely crowded, cylindrical heads. These eventually fall apart, releasing clouds of tiny tufted, air-borne fruits. Plants prevent erosion of shorelines, help remove excessive quantities of nutrients from water, and are a valuable source of food and shelter for wildlife. However, common cattail can be a problem in irrigation ditches, canals, and other controlled aquatic systems by impede water flow.

- **Native Wildflowers and other plants.** Several species of wildflowers, rushes, and other plants are present and appear healthy. These various native species are expected to recover without the need to artificially introduce them.

