
**Environmental Assessment (with Draft FONSI)
and 404 (b)(1) Alternatives Analysis**

Caspian Tern Nesting Island Construction Project

**Tule Lake and Lower Klamath National Wildlife Refuges
Klamath Basin National Wildlife Refuge Complex Projects**

Siskiyou and Modoc County, California



April 2009



**U.S. Army Corps of Engineers,
Portland and San Francisco Districts**

TABLE OF CONTENTS

1.0 Proposed Project.....1

 1.1 Background Information and Project Description.....1

 1.2 Project Location.....2

 1.3 Purpose and Need for Proposed Action.....4

 1.4 Project Authority.....4

2.0 Scope of Analysis.....5

3.0 Proposed Action.....5

 3.1 Habitat Construction: Sump 1B in Tule Lake NWR.....6

 3.1.1 Island Design.....6

 3.1.2 Timing of Construction.....8

 3.1.3 Construction Methods.....8

 3.1.4 Access.....8

 3.1.5 Borrow Sites.....9

 3.1.6 Staging Area.....13

 3.1.7 Summary of Fill Requirements and Footprint.....13

 3.2 Habitat Construction: Orems 1 Management Unit in Lower Klamath NWR.....13

 3.2.1 Island Design.....13

 3.2.2 Timing of Construction.....14

 3.2.3 Construction Methods.....14

 3.2.4 Access.....15

 3.2.5 Borrow Sites.....15

 3.2.6 Staging Area.....15

 3.2.7 Summary of Fill Requirements and Footprint.....15

 3.3 Habitat Construction: Sheepy Lake in Lower Klamath NWR16

 3.3.1 Island Design.....16

 3.3.2 Timing of Construction.....17

 3.3.3 Construction Methods.....17

 3.3.4 Access.....17

 3.3.5 Borrow Sites.....18

 3.3.6 Staging Area.....18

 3.3.7 Summary of Fill Requirements and Footprint.....18

 3.4 Predator Management.....18

 3.5 Post-Construction Monitoring.....19

 3.6 Maintenance Methods.....20

 3.6.1 Sump 1B.....20

 3.6.2 Orems 1.....21

 3.6.3 Sheepy Lake.....21

4.0 Alternatives.....21

 4.1 No Action Alternative.....21

 4.2 Alternative Nesting Habitat Enhancement Sites.....21

 4.3 Alternative Island Designs.....22

 4.4 Alternative Access Routes.....24

 4.4.1 Northwest side of Sheepy Lake, at Stateline Road.....25

4.4.2	Northwest side of Sheepy Lake, south of the highway.....	25
4.4.3	West side of Sheepy Lake.....	26
4.4.4	Access Alternative Not Being Considered.	26
5.0	Impact Assessment.....	26
6.0	Summary of Indirect and Cumulative Effects.....	44
6.1	Indirect Effects.....	44
6.1.1	Caspian Terns.....	44
6.1.2	Fishes.....	44
6.1.3	Endangered and Threatened Species.	44
6.1.4	Other Birds.	45
6.1.5	Socioeconomic Effects.....	45
6.2	Cumulative Effects.....	45
7.0	Environmental Compliance.....	46
8.0	Agencies Consulted and Public Notifications.....	49
9.0	Mitigation Measures.....	49
10.0	Determination and Statement of Findings	50
11.0	Literature Cited.....	51
	Draft Finding of No Significant Impact (FONSI).....	53

APPENDICES

Appendix A: Agency and Public Participation.....	54
Appendix B: Species List.....	55
Appendix C: Table: Alternatives Not Being Considered.....	56
Appendix D: Klamath Basin Map.....	58

LIST OF FIGURES

1.1	Map of Tule Lake NWR and Lower Klamath NWR within the vicinity of Klamath Basin NWRs, Oregon and California.....	3
3.1	Map of proposed project site within Sump 1B at Tule Lake NWR.	7
3.2	Location of proposed project site, borrow sites, and access for construction of Sump 1B island.....	9
3.3	Aerial photo of Borrow Site B.....	10
3.4	Aerial photo of Borrow Site C with potential access road from staging area.....	11
3.5	Aerial photo of Borrow Site D.....	12
3.6	Aerial photo of Orems 1 wetland management unit with location of proposed island and temporary road.	14
3.7	Proposed island location at Sheepy Lake.....	16
3.8	Photo diagram of floating island constructed at Dutchy Lake.....	17
3.9	Aerial photo of Sheepy Lake with proposed island launch site, access road, and private land.....	26

LIST OF TABLES

1.1	Caspian Tern Habitat Completed and Proposed Construction Schedule.....	5
3.1.	Sump 1B Fill and Footprint Requirements.....	13
3.2	Orems 1 Fill and Footprint Requirements.....	15
3.3	Sheepy Lake Fill and Footprint Requirements.....	18
4.1	Comparison of Fill Volumes and Footprints for Three Proposed Island Designs.	24
5.1	Acres of Fill in Waters of the US and Wetlands.....	36
7.0	Environmental Compliance.....	46

ACRONYMS

APHIS-WS.....Animal Plant Health Inspection Service, Wildlife Service
BA.....Biological Assessment
BO.....Biological Opinion
CA.....California
CWA.....Clean Water Act
CRE.....Columbia River Estuary
cy.....cubic yards
DO.....dissolved oxygen
EA.....Environmental Assessment
ESA.....Endangered Species Act
EIS.....Environmental Impact Statement
FEIS.....Final Environmental Impact Statement
FONSI.....Finding of No Significant Impact
ft.....feet
NEPA.....National Environmental Policy Act
NGVD..... National Geodetic Vertical Datum
NMFS.....NOAA’s National Marine Fisheries Service
NWR.....National Wildlife Refuge
OR.....Oregon
PRBO.....Point Reyes Bird Observatory
ROD.....Record of Decision
USACE.....United States Army Corps of Engineers
USDA.....United States Department of Agriculture
USFWS.....United States Fish and Wildlife Service
UV.....ultra violet

1.0 PROPOSED PROJECT

1.1 Background Information and Project Description

This Environmental Assessment (EA) addresses the construction of one island within Sump 1B at Tule Lake National Wildlife Refuge (Tule Lake NWR) and two islands within wetland management units Orem's 1 and Sheepy Lake at Lower Klamath National Wildlife Refuge (Lower Klamath NWR) to provide nesting habitat for Caspian Terns (*Hydroprogne caspia*, formerly *Sterna caspia*). The primary purpose of the proposed action is to develop alternative nesting habitat for Caspian terns, in conjunction with social facilitation measures, which is intended to reduce the number of these birds nesting in the Columbia River Estuary (CRE), thereby reducing their predation on juvenile salmonids. Caspian terns consumed an estimated 6.7 million juvenile salmonids from the CRE during 2008; the average annual consumption in the CRE for 2001-2008 was 5.1 million juveniles (Bird Research Northwest 2008).

In addition to creating replacement nesting habitat for Caspian terns from the Columbia River Estuary, the project would restore a population of island nesting waterbirds that were largely extirpated during reclamation of the lakes and marshes of the Klamath Basin in the early 20th Century to both refuges. Historically, both refuges and in particular Lower Klamath NWR supported large populations of island nesting waterbirds. These refuges were established via Executive Order for the primary purpose of protecting fall and spring migrant waterfowl and colonial¹ nesting waterbirds. A narrative from Weddell et al. (1998) illustrates some of the historic waterbird populations present in the early 1900s, including "colonies on tule islands in Lower Klamath Lake that contained at least 500 pairs of nesting ring-billed (*Larus delawarensis*) and California gulls (*L. californicus*), as well as nesting cormorants, pelicans, gulls, and terns. In addition ... a colony containing an estimated 500 Caspian tern (*Sterna caspia*) nests on Lower Klamath Lake."

Currently only one very small (<0.10 acre) island exists on both Tule Lake and Lower Klamath NWRs which support relatively small sporadic nesting populations of pelicans and cormorants. Caspian terns no longer nest on either refuge.

Historic and recent bird surveys reveal that Caspian terns have been observed at the refuges. A historic account of Caspian tern nesting colonies can be found in section 1.3 "Background on Project Collaboration with USFWS" below. Waterbird surveys conducted by Point Reyes Bird Observatory (PRBO) from April through August in 2003 and 2004 resulted in the observations of Caspian terns at both Tule Lake and Lower Klamath NWRs. The high count during this period was 25 terns at Lower Klamath NWR and 253 terns at Tule Lake NWR. Based on these recent tern observations, success of restoring nesting colonies to the refuges is anticipated (Shufford et. al 2006).

The proposed action represents implementation of the environmentally preferred management alternatives as identified in the USACE November 22, 2006 Record of

¹ Colonial nesting birds share the characteristic of typically nesting in colonies.

Decision (ROD) (USACE 2006) that adopted the 2005 *Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary*, Final Environmental Impact Statement (FEIS) (USFWS 2005), and is hereby incorporated by reference. The FEIS (USFWS 2005) and ROD (USACE 2006) are available on the USACE Portland District internet website (https://www.nwp.usace.army.mil/pm/e/en_plan_avian.asp) and are available from Allison Bremner (415-503-6861) upon request. Based on the evaluation and comparison of alternatives and associated consequences as provided in the FEIS, Alternative C: Redistribution of East Sand Island Tern Colony was initially identified by USFWS as the environmentally preferred alternative. However, USFWS identified a modified version of Alternative C based on review of the National Oceanic Atmospheric Administration's Fisheries Service (NMFS) Biological Opinion (BO) (NMFS 2006) and concerns regarding the potential magnitude of tern predation on other listed salmonids in some of the proposed locations described in Alternative C; USACE concurred with the selection of a modified version of Alternative C.

Key components of the modified Alternative C include:

- Create new or enhance existing tern nesting habitat in Oregon and California to ensure a suitable network of sites is available for nesting terns on a regional scale. A total of 7 acres of habitat will be managed for nesting terns.
- The current 6-acre tern nesting site on East Sand Island will gradually be reduced as tern nesting habitat is created or enhanced at alternative regional locations to 1.5 to 2 acres; this will accommodate up to approximately 3,000 pairs of terns. Habitat enhancement and reduction of habitat on East Sand Island would be phased in at a 2:1 ratio.
- The reduction in habitat at East Sand Island is not contingent upon Caspian terns occupying the managed habitat developed at the alternative locations.

To attain further habitat reduction, adaptive management would be undertaken such that tern nesting habitat acreage on East Sand Island could be reduced to 1 to 1.5 acres (as described in Alternative C) if alternative site(s) are identified in the future (USACE 2006). The criteria for alternative site selection are described in Appendix G of the FEIS (USFWS 2005). If a new site that has not already been analyzed in the FEIS is identified, a site specific NEPA document would be prepared for that site. This EA meets that requirement.

This document is in compliance with the National Environmental Policy Act (NEPA) (40 CFR part 1500-1508, November 29, 1978) as amended on May 27, 1986 (40 CFR part 1502) and Section 404 (b)(1) Guidelines of Section 404 of the Clean Water Act of 1977 (40 CFR part 230).

1.2 Project Location

Tule Lake and Lower Klamath NWRs are managed within the United States Fish and Wildlife Service (USFWS) Klamath Basin National Wildlife Refuges Complex (Figure 1.1), which is approximately 140 miles inland from the west coast of California and Oregon.

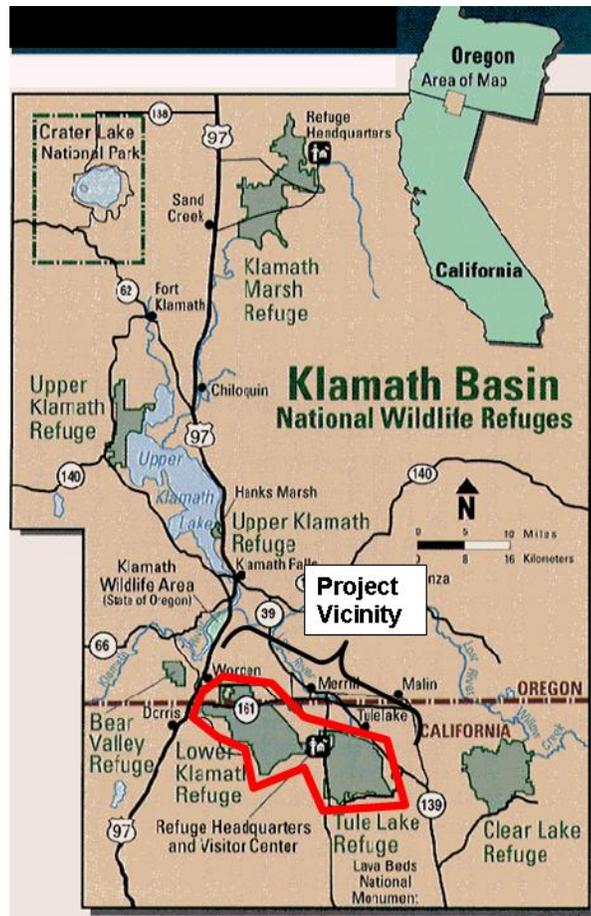


Figure 1.1 Map of Tule Lake NWR and Lower Klamath NWR within the vicinity of Klamath Basin NWRs, Oregon and California.

Tule Lake NWR is located within Siskiyou and Modoc counties, California, near the Oregon state border. Tule Lake NWR is located near the small town Tulelake; the nearest city, Klamath Falls, Oregon, is located 25 miles north of the refuge. Tule Lake NWR covers 39,116 acres of mostly open water and croplands; 19,000 acres of this land is farmed for crops, which is a major food source for wintering and migratory waterfowl. Tule Lake NWR (Sump 1A and Sump 1B) receives water via a canal from the Upper Klamath Lake. The canal is then diverted to Lost River, which flows into Sump 1A, directly northwest of Sump 1B. Water is gravity-fed into Sump 1B from Sump 1A but is controlled by a tide gate. Water is pumped from the sumps via a tunnel that goes through a ridge to the west and into wetland units within Lower Klamath NWR.

Lower Klamath NWR is in northeastern California (Siskiyou County) and southern Oregon (Klamath County), a few miles west of Tule Lake NWR. The 50,092-acre refuge is a varied mix of intensively managed shallow marshes, open water, grassy uplands, and

croplands that provide feeding, resting, nesting, and brood-rearing habitat for waterfowl and other water birds. As previously stated, Lower Klamath NWR receives water via a tunnel from sumps within Tule Lake NWR. Most of the water that is received feeds the wetland units. Any leftover water would flow into the Klamath Straits drain, which leads to the Klamath River. Sheepy Lake of Lower Klamath NWR may also receive water as part of the distribution throughout the refuge but also is fed by tributaries Sheepy Creek and Cottonwood Creek.

Please see Appendix D for a map of the Klamath Basin hydrography.

1.3 Purpose and Need for Proposed Action

The need for the proposed action is to reduce the predation-related loss of juvenile salmonids in the CRE attributable to Caspian terns (USACE 2006). Extensive background information on the formation of the colonies and the resulting detrimental effect on the juvenile salmonid populations can be found in the FEIS (USFWS 2005).

The purpose of the proposed action is to implement a component of the environmentally preferred management alternative, modified Alternative C, as identified in the USACE November 22, 2006 ROD (USACE 2006). The key component of modified Alternative C (USACE 2006) is the requirement for habitat enhancement and reduction of habitat on East Sand Island to be phased at a 2:1 ratio. The proposed actions presented in this assessment would enhance up to four acres of tern nesting habitat; therefore, up to two acres of habitat can be reduced at East Sand Island upon completion of the enhancement sites by spring 2010.

1.4 Project Authority

The proposed action is authorized under Section 906(b)(1) of the Water Resources Development Act of 1986. This action, in concert with comparable actions at other western region locations (see Table 1.1), is intended to reduce the Caspian tern population in the CRE, thereby reducing the number of juvenile salmonids consumed annually by Caspian terns.

Table 1.1 Caspian Tern Habitat Completed and Proposed Construction Schedule	
Calendar Year	Caspian tern habitat site
2008 (Constructed Islands)	Crump Lake, OR
	Fern Ridge, OR
	Summer Lake, OR - East Link Island
2009 (Proposed Construction Locations)	Summer Lake, OR – Dutchy Lake Island
	Summer Lake, OR – Gold Dike Island
	Tule Lake NWR, CA- Sump 1B
	Lower Klamath NWR, CA-Orems 1 Unit
	Hayward Regional Shoreline
2010 (Proposed Construction Locations)	Lower Klamath NWR, CA - Sheepy Lake Unit
	Don Edwards NWR, CA-Salt Ponds N3 & N5
	Brooks Island, CA (TBD)

The proposed actions are consistent with management objectives for the two NWRs, such as protecting native habitats and wildlife representative of the natural biological diversity of the Klamath Basin.

2.0 SCOPE OF ANALYSIS

The scope of analysis under NEPA will consider direct, indirect, and cumulative environmental factors occurring within the project footprint, and indirect effects that may occur later in time and/or further removed from the project footprint. Actions within the scope of analysis include the construction methods used to build the nesting islands, the use of staging areas at the project site, the installation and removal of roads used to access the islands, excavation of borrow materials, transportation of material from the source sites to the project site, future maintenance of the islands, and monitoring of the colonies. The geographical scope of analysis includes all areas within the project footprint (i.e. Tule Lake NWR and Lower Klamath NWR). The CRE, specifically East Sand Island and open water containing resident and migratory fish communities within the CRE, is included in the geographical scope of analysis for indirect effects of the proposed actions.

3.0 PROPOSED ACTION

To accomplish the stated purpose and need, USACE proposes to construct nesting habitat (islands) for Caspian terns at Tule Lake and Lower Klamath NWRs and, in combination with social attraction measures (i.e. decoys and tern call broadcasting) attract nesting Caspian terns to the new island sites. Construction of these islands also represents restoration of a Klamath Basin ecosystem habitat feature (islands) utilized by colonial

nesting water birds that were historically present in the basin and are severely lacking under current conditions. The proposed action involves construction of three islands: a two-acre rock fill island in Sump 1B, Tule Lake NWR; a one-acre rock fill island in Orems 1 Unit; and a one-acre floating island in Sheepy Lake Unit at Lower Klamath NWR.

The proposed actions at Tule Lake and Lower Klamath NWRs represent partial completion of implementation actions for the preferred alternative as identified in the FEIS and modified in the subsequent RODs by the USFWS and USACE. Alternatives consideration was completed during the development of the FEIS (USFWS 2005). The USFWS and USACE RODs allowed for the implementation of Adaptive Management measures should alternative sites be identified after issuance of the agencies RODs provided that such sites complied with NEPA and necessary permits were obtained. Tule Lake and Lower Klamath NWR sites represent alternative sites identified after issuance of the RODs that meet the criteria for Caspian tern habitat development or restoration.

3.1 Habitat Construction: Sump 1B in Tule Lake NWR

3.1.1 Island Design. The proposed Caspian tern island would be located in the southwest corner of Sump 1B, approximately 1500 feet from the southern shoreline, and 5000 feet from the western shoreline (Figure 3.1) (41° 50' 38" N 121° 28' 36" W). Sump 1B is approximately 3,300 acres. The normal water level operating range for Sump 1B is between elevation 4034 feet and 4035.5 feet National Geodetic Vertical Datum 29 (NGVD29; all elevations in this EA are in NGVD29). The proposed island location in Sump 1B has an average substrate elevation of approximately 4032.5 feet. The southeast section of this location is shallower than surrounding areas (~ two feet deep at a water level of 4,035.5 feet) because it overlaps with the site of a historic island. The island would be constructed when Sump 1B is seasonally dewatered. This is a normal management action that the USFWS performs periodically (approx. every three years) to enhance emergent plant development and promote the growth of annual seed-producing plants that, when reflooded in fall, provide extensive habitat for fall migrant waterfowl.

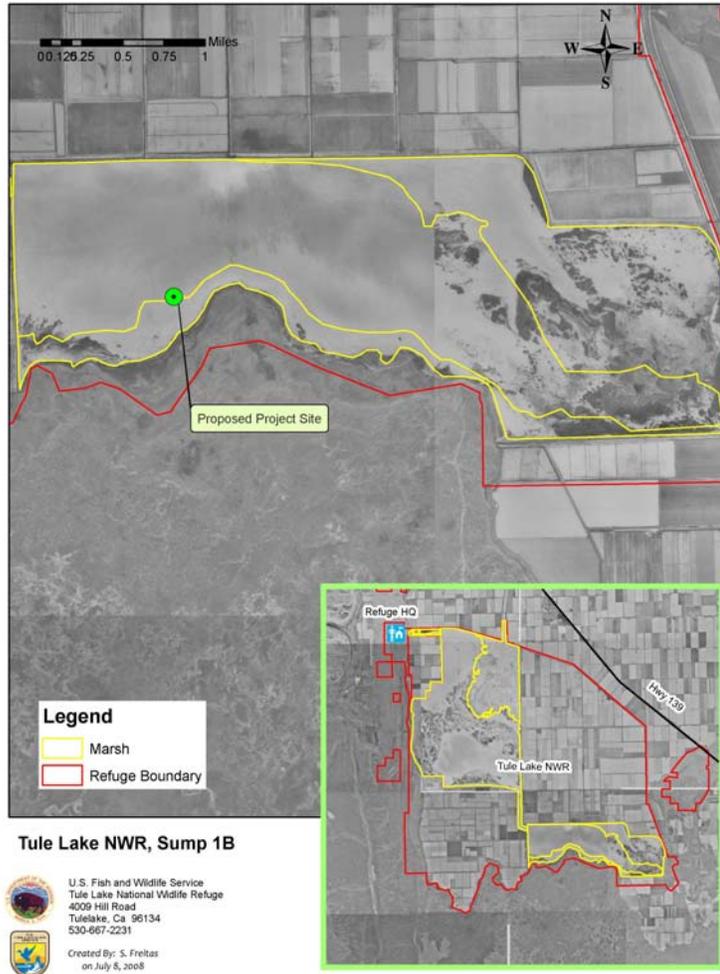


Figure 3.1 Map of proposed project site within Sump 1B at Tule Lake NWR.

The proposed two-acre island would be ellipsoid-shaped with nesting surface dimensions of approximately 250 feet by 445 feet (2.01 acres) at the crest excluding revetment; the base dimension is approximately 471 feet by 276 feet (2.3 acres), including the rip rap that would be placed around the perimeter of the island. The proposed island would be constructed to elevation 4039 feet or approximately 6.5 feet above the approximate substrate elevation at the island location. This surface height would keep the island surface 3.5 feet above normal full pool elevation (4035.5 feet). The 3.5 feet of freeboard would protect against an estimated maximum wave height of 2.5 feet, preventing over wash of the bird colony. In addition to the dimensions of the ellipsoid-shaped island, a submerged bench, 300 feet-long, 30 feet-wide at the crest and two feet-high, would be constructed to encompass the southeast end of the island. The purpose of this bench is to provide a suitable substrate for tule (*Schoenoplectus acutus*) establishment. Approximately 490 cubic yards (cy) of lake sediment would be utilized to aid establishment of tules either through natural propagation or plantings of seeds and tubers. Tules would serve as screening vegetation for birds colonizing the location and are intended to lessen the potential for human disturbance.

Core material (island fill) would utilize approximately 18,000 cy of quarry waste borrowed from a nearby borrow pit located on Tule Lake NWR, or would be derived from local commercial sources. Sources of quarry material available on-site are described below. A Caspian tern nesting substrate consisting of a one-foot layer (~3,300 cy) of small-diameter gravel and sand would be placed over the two-acre surface of the island. Nesting substrate material would be obtained from a local commercial source.

Geotextile filter fabric would encapsulate the quarry waste used to form the island core. The geotextile fabric would prevent subsidence of the quarry waste into the underlying native substrate, prevent erosion of the core material through the rip rap and prevent the nesting substrate from sifting downward into the core material. Side slopes are designed to be one foot vertical to two feet horizontal. A two-foot layer of rip rap would be placed on the windward (northwest) side to afford additional protection from wind-generated waves. Elsewhere along the island shoreline, a one-foot layer of rip rap would be placed to protect the island slopes. Approximately 5,300 cy of rip rap would be used for shoreline protection. Rip rap material would be obtained from Borrow Sites D, E, and potentially A.

The island would be oriented (bow on) to the prevailing wind for protection from wind-induced waves. This would aid observation of nesting birds by monitors who will occupy a blind on the island.

3.1.2 Timing of Construction. Island construction is proposed to begin in July 2009 and end by September 2009. Sump 1B drawdown is expected to begin in May 2009; the sump should be void of water by late June and completely dry by mid to late July. Water may be released back into the lake immediately following construction.

3.1.3 Construction Methods. Rock fill, rip rap and surface substrate suitable for Caspian tern and other colonial bird nesting use would be hauled to and placed on the Sump 1B island site by conventional and/or off-road dump trucks. A dozer would be used to push the island core material into the designed, survey marked, island shape and to compact the material. Geotextile fabric would underlie the island footprint to minimize settlement and pumping of soil; this fabric would also underlie the rip rap protecting the island shoreline to minimize wave erosion of core material. Rip rap would be placed around the island perimeter using a trackhoe. The island surface material would be placed atop the core material.

3.1.4 Access. Materials and equipment for island construction would be trucked across the dry lakebed on a temporary, graveled, access road. The access road would be constructed from the kiosk area for a distance of approximately 1800 feet northwest to the island location. The kiosk would remain in its current location. The access road would be approximately 20 feet-wide at the crest of the road and would consist of a layer of geogrid or geotextile fabric on the ground surface with a minimum of 12 inches (1600 cy) of rock and/or quarry waste placed on top; an additional layer of geogrid and rock/quarry waste (1600 cy) would be placed atop the initial layer. Rock/quarry waste may be obtained from the adjacent refuge quarry borrow area and/or a local commercial

source. A 24-inch culvert and road fill would be placed in the existing trench for a construction crossing; fill dimensions are 40 feet-long by 30 feet-wide by 4 feet-high and would require approximately 190 cy of fill material. The fill material would be obtained from Borrow Site C. Post-construction, the temporary access road would be removed and rock/quarry waste placed in the nearby, existing borrow pit (Site C).

3.1.5 Borrow Sites. Borrow material source locations (sites A, B, C, D, and E) within the vicinity of Sump 1B are described below; see figure 3.2 below for the location of each site. The following proposed borrow sites are being considered because they are all previously-disturbed quarry and borrow sites that meet the requirements for materials needed for construction of the island and associated access road. The total amount of material needed for construction of Sump 1B Island is 27,395 cy, excluding the material to be excavated from the lake bottom for tule vegetation management and the nesting substrate material which will be purchased from a local commercial quarry.



Figure 3.2 Location of proposed project site, Borrow Sites A-E, and access (yellow dotted line) for construction of Sump 1B island.

Site A

The area identified as Site A is a large mound at the southwest edge of Tule Lake. Areas adjacent to Site A is rich with pumice, has trace amounts of obsidian, and was recently burned by a wildfire. Approximately 1200cy of rip rap material may be available at this site.

An area lying at the base of a short rock rim may be a viable option for rip rap borrow material, but necessitates further available material volume calculations. Portions of the area were previously disturbed; rip rap rock would be procured from scattered piles from within the disturbed areas.

Rip rap material at Borrow Site A is primarily located on the surface in discrete piles. An excavator, probably with a thumb attachment, would be used to remove rock and place in dump trucks to be hauled to the island construction site. Access for dump trucks is immediately off the county road or an agricultural access road; site soil conditions in summer would support truck traffic, thus temporary access roads would not be constructed.

Site B

The borrow area identified as Site B is a mound of material that was dredged to create a channel adjacent to and connecting to the shoreline of Sump 1B (Figure 3.3). The mound has a footprint of 0.72 acres, an average basal width of 48.6 feet, a height of 15 feet, side slopes that are 1:1, and has approximately 12,050 cy of available borrow material. The mound is primarily fine loam sand with gravel and is dominated by pepperweed and other bunch grasses. Rabbitbrush grows on the sides of the mound.



Figure 3.3. Aerial photo of Borrow Site B. The yellow line outlines the mound of borrow material.

An observation kiosk is presently situated toward the east end of the mound; a bridge and pedestrian path from the adjacent parking lot access the mound and kiosk. Those portions of the mound west of the access trail/bridge and kiosk would be borrowed for use as island core material. The observation kiosk, bridge and pedestrian trail would remain in their current location.

Construction actions at this location include borrow of material that forms the crescent-shaped mound where the kiosk has been placed and use of the existing parking lot for a

construction staging area. The kiosk and pedestrian access path and bridge would not be impacted. Borrow of this material would most likely be accomplished by an excavator loading material into dump trucks. The temporary access road would extend from the kiosk parking lot across the kiosk trench northwest to the island location. The portion of the temporary road lake-ward of the trench would be removed post-construction. The trench crossing would be retained.

Site C

Borrow Site C is located immediately east of the observation kiosk/Borrow Site B near the southern shoreline of Tule Lake Sump 1B (Figure 3.4). This site is at a low elevation and is within the historical inundation zone of the lake. An existing road extends from the county road to the borrow pit, thus no access road construction is required. This borrow site has been previously excavated, thus alleviating cultural resource concerns. Material excavated from the existing pit would only be removed from previously disturbed areas within the pit to preclude impacts to cultural and environmental resources.

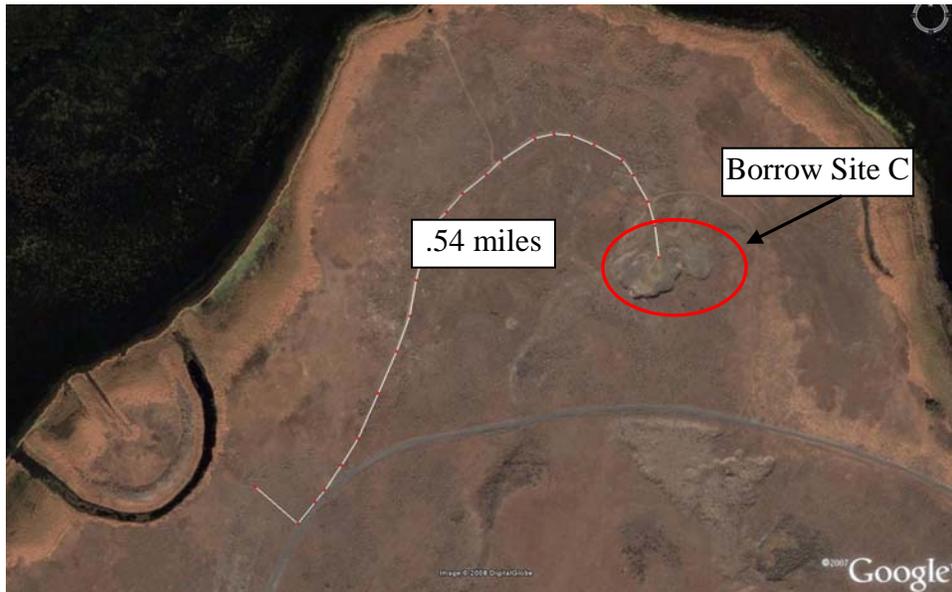


Figure 3.4 Aerial photo of Borrow Site C with potential access road from staging area.

Material would be removed by excavating deeper from within the pit and would not extend beyond the perimeter of the existing quarry. Excavation would be accomplished by an excavator and cats; borrow material would be loaded onto dump trucks for transport to the proposed island.

Due to the low elevation of Borrow Site C, the site is currently not visible from the nearby county road and observation points at Lava Beds National Monument which tourists frequent. Further excavation within the pit would not change the current condition.

Borrow Site C would provide an adequate volume of material for the island and temporary road construction. Material at this site is characterized as gravelly silty sand containing approximately 2-3" granule fill and 20-30% fine material. It would also serve as a disposal site for material used to construct the temporary access road, essentially returning material to the point of origin.

Site D

Borrow Site D is located east of Borrow Site C on the southern shoreline of Tule Lake Sump 1B. Figure 3.5 outlines a mound of rock suitable for use as rip rap that may be removed and used for armoring the island. The mound has an area of approximately 0.38 acres (16,553 sq ft), averages eight feet in height, and contains approximately 4,900 cy of rip rap rock.



Figure 3.5. Aerial photo of Borrow Site D. The yellow line illustrates the distance (0.15 miles) of a road that could be constructed to access the borrow site. The red line outlines the footprint of the rip rap mound.

Borrow Site D would be accessed by constructing a 0.15 mile temporary road from the south shoreline road to the western terminus of the mound. Although there is an existing road to the site, the existing road is not used anymore and would require some development (e.g. leveling, addition of gravel). The existing road is at a higher elevation and laden with obsidian and other archaeology sites, thus precluding the site from further use. The route delineated in Figure 3.4 is located in an area with a lower elevation that was previously lake bed.

A dozer would be used to level the ground for the temporary 20 foot-wide access road. Geotextile fabric would be laid down over the surface, and approximately 600 cy of gravel would be spread over the fabric surface. There is a depressional area that is the apparent original source of the rip rap mound. Approximately 90 cy of additional fill would be needed to temporarily fill the channel for access. Material used for the temporary access road and culvert would be removed post-construction.

Borrow of rip rap rock would be accomplished by an excavator. Rip rap would be hauled from the site in dump trucks to the island location.

Site E

Borrow Site E, located east of Borrow Site D, is adjacent to the boundary of Lava Beds National Monument and the gravel road that runs along the shoreline of Sump 1B. Rip rap rock was apparently placed in a low, linear mound at this location in the past. There is adequate room at this site for equipment needed to excavate materials. An excavator would be used to pick the rip rap rock and place in dump trucks for transport to the island location. There are no cultural resource concerns associated with this location.

3.1.6 Staging Area. The gravel lot available for recreational parking and access to the observation kiosk located south of the mound will be closed to the public and used as the main staging area. This site would preclude impacts to previously undisturbed project lands thus avoiding potential impacts to adjacent cultural resource sites. Gravel to be used for the island surface will be stockpiled at this location. Access to the temporary construction access road would be available from the northwestern side of the staging area.

3.1.7 Summary of Fill Requirements and Footprint. Table 3.1 below summarizes the fill requirements (cy) and footprint (acres and/or linear feet) of in-water work for island construction at Sump 1B. Maintenance requirements are negligible; see maintenance methods for an explanation of revetment and anti-erosion efforts.

Table 3.1 Sump 1B Fill and Footprint Requirements					
Island Fill Material (cy)	Nesting Substrate (cy)	Revetment (cy)	Temporary Access Roads (cy)	Other (cy)	Footprint
18,000	3,300	5,300	3,200 (road to island site) 180 (culvert to Borrow Site B) 625 (road to Borrow Site D) 90 (culvert to Borrow Site D)	490 (dredged, for tule bench)	2.3 acres 1800 linear feet, 20 ft wide (temporary access road)
Total Fill: 30,695 cy					

3.2 Habitat Construction: Orems 1 Management Unit in Lower Klamath NWR

3.2.1 Island Design. The proposed Caspian tern island would be located near the center of wetland management unit Orems 1 (Figure 3.6), approximately 2,000 feet east of the western edge and 2,300 feet south of the northern edge of the unit (41°57'43" N, 121 38'03" W). The proposed island location has an average substrate elevation of approximately 4,081 feet. Orems 1 management unit is 617 acres. The location of the

proposed island is within the historic lakebed. Cultural resources are not anticipated to occur at this location due to historic coverage by lake waters. The proposed one-acre island (Fig. 3.6a) would be ellipsoid-shaped with dimensions of 150 feet by 370 feet at the crest, excluding revetment; the base dimension is approximately 388 feet by 168 feet (1.2 acres). The proposed island would be constructed to a height of 4 feet initially, though some settling at the base may occur post-construction. These dimensions should keep the island surface two feet above normal pool elevation. Side slopes are designed to be one foot vertical to two feet horizontal. A one-foot layer of revetment (2,000 cy) would be placed to protect island slopes. A USFWS quarry near Orem's 1 contains a limited amount of material that is preserved for the immediate needs for USFWS road maintenance; therefore, rip rap for slope protection and small-diameter gravels for nesting substrate would be purchased by USACE and trucked in from a local private quarry.

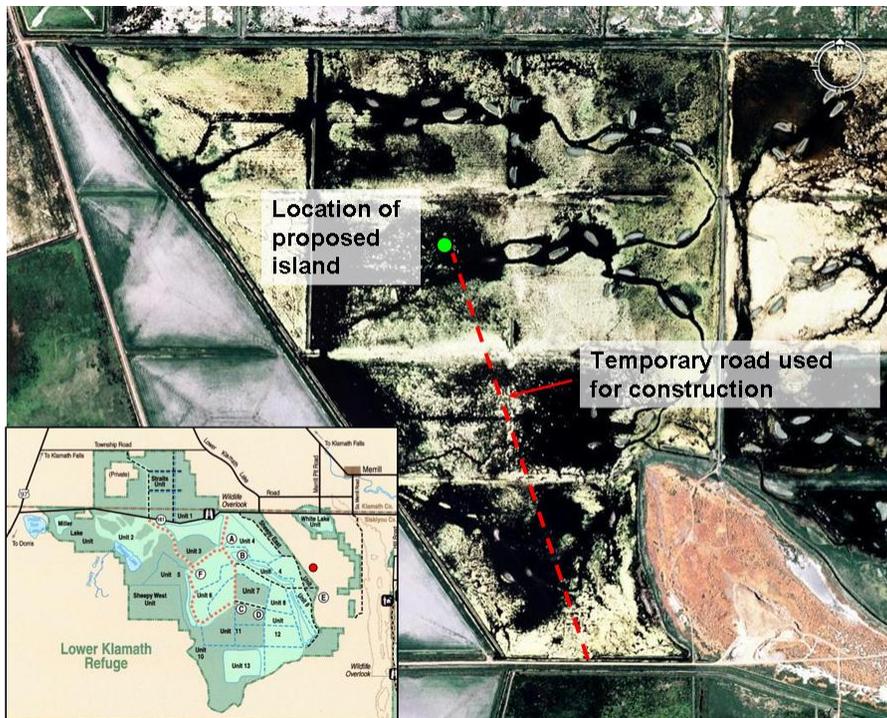


Figure 3.6. Aerial photo of Orem's 1 wetland management unit with location of proposed island and temporary road.

3.2.2 Timing of Construction. Island construction is proposed to occur in September and early October 2009. Annually, the management unit is typically filled in the spring; fill level is dependent upon water availability. Post-fill, the unit gradually dries up due to evaporation; the unit is expected to be dry by July or August 2009.

3.2.3 Construction Methods. Lake bed sediments would be excavated from approximately 3 acres around the proposed island location to a depth of approximately one foot. This borrow material would provide approximately 5300 cy of material to be used as island fill. A Caspian tern nesting substrate consisting of a one-foot layer (approximately 1650 cy) of small gravel and coarse sand or comparable material would

be placed over the one-acre surface of island fill. Geotextile filter fabric would be used to encapsulate the island fill to minimize settlement and pumping, prevent erosion of fill material, and preclude the nesting substrate from sifting downward into the base material.

3.2.4 Borrow Sites. The material used to build the nesting island will be derived from the lake bed; therefore, there will be no borrow sites for the proposed action at Orems 1.

3.2.5 Access. Construction during late summer is anticipated to negate the need to place rock and/or geotextile fabric for the temporary access road. Temporary fill will be required at the southern end of the temporary access road to cross an existing drainage ditch. This temporary fill, approximately 50 feet-long by 40 feet-wide by 10 feet-deep, will require approximately 740 cy of rock. It would be removed post-construction with the rock deposited in the USFWS’ nearby quarry. Though it is not anticipated, there is an option to build a temporary access road if necessary. The access road would be approximately 20 feet-wide at the crest of the road and would consist of a layer of geogrid or geotextile fabric on the ground surface with a minimum of 12 inches (approx. 1,700 cy) of rock and/or quarry waste placed on top; an additional layer of geogrid and rock/quarry waste (approx. 1,700 cy) would be placed atop the initial layer. Rock/quarry waste may be obtained from the adjacent refuge quarry borrow area and/or a local commercial source.

3.2.6 Staging Area. The principal staging area for the proposed action would be located at the adjacent USFWS quarry (see lower right corner of Figure 3.6). Some equipment, such as dozers and an excavator, would remain on the island site during the construction process. Surface rock for the bird nesting island would be stockpiled at the quarry location prior to island construction. There are no cultural resource concerns at the quarry location as project-related actions would be confined to previously disturbed, excavated areas.

3.2.7 Summary of Fill Requirements and Footprint. Table 3.2 below summarizes the fill (cy) requirements and footprint (acres and/or linear feet) of in-water work for island construction at Orems 1. Maintenance requirements are negligible; see maintenance methods for an explanation of anti-erosion and revetment efforts.

Island Fill Material (cy)	Nesting Substrate (cy)	Revetment (cy)	Temporary Access Road (cy)	Footprint
5,300 (dredged)	1,650	2,000	740 (drainage ditch fill) 3,400 (optional)	1.2 acres (fill) 3 acres (dredging) 3,700 linear feet, 20 feet wide (temporary access road)
Total Fill: 9690 cy*				
*Total fill amount does not include the optional access road volume.				

3.3 Habitat Construction: Sheepy Lake in Lower Klamath NWR

3.3.1 Island Design. The proposed Caspian tern island would be located near the center of the southern lobe of Sheepy Lake within Lower Klamath NWR (Figure 3.7; 41° 58' 78" N, 121° 47' 27" W). Sheepy Lake has an average surface elevation of approximately 4079 feet. Sheepy Lake is approximately 430 acres in size. The proposed island would float on the lake's surface rather than be a conventional rock fill. The floating islands are made of plastic primarily derived from recycled material. Layers of the matrix are bonded together with foam, which also provides buoyancy. The plastic material is stabilized with latex that has been baked onto it. The latex is dark, which enhances for ultra violet (UV) protection. In addition, the design is for islands to be completely covered with nesting substrate to prevent actual UV exposure.



Figure 3.7. Proposed island location at Sheepy Lake.

The proposed floating island would be approximately one-half acre to one acre in extent, depending on available funding. Island height would be approximately two feet; maximum dimensions would be approximately 150 feet by 370 feet. The island will be covered by a four to seven-inch layer of small gravel/coarse sand in order to provide suitable nesting habitat for Caspian terns. The island would have a lip around the edge of the perimeter to prevent nesting substrate from sliding off the island; flagstone revetment will be placed along this lip. Drainage through the plastic material is provided by perforations and approximately two feet of freeboard. The maximum acreage of the

floating island on Sheepy Lake would remain one acre. See Figure 3.8 for a picture of a similar floating island during mid-construction on Dutchy Lake, Oregon.

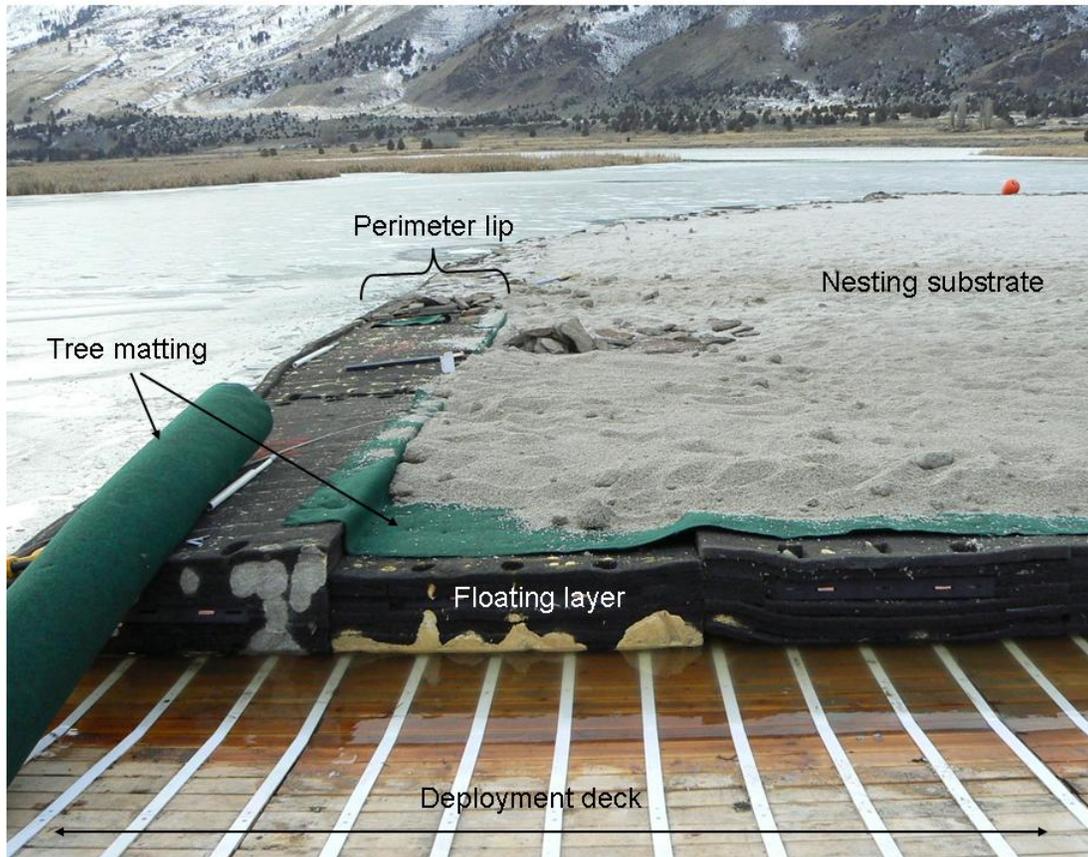


Figure 3.8. Photo diagram of floating island constructed at Dutchy Lake.

3.3.2 Timing of Construction. Island construction is proposed to occur in November 2009 for approximately 30 days.

3.3.3 Construction Methods. Pre-constructed island modules would be truck-transported to Sheepy Lake, fastened together on a pre-fabricated launch platform temporarily established on the lake shoreline, and then floated, using outboard motor boats for propulsion, to the selected island location and anchored in place using concrete anchors and chains/cables. Some minor excavation and leveling of a perimeter dike may be required at the launch location; the site would be restored to pre-project conditions post-construction. A layer of tree matting would be placed atop the floating island prior to placement of the nesting substrate. Approximately 550 to 1,650 cy of small diameter gravels/coarse sand would be placed to an approximate depth of four to seven inches on the floating island for nesting substrate. The nesting substrate material would be obtained from a local private quarry. A layer of flagstone revetment (5.5-11 cy) will be placed on the island perimeter lip.

3.3.4 Access. Access to Sheepy Lake would be obtained via a private road from the west side of Sheepy Lake. An alternative route may be used if necessary. The

alternatives considered for access to the proposed island site on Sheepy Lake and staging areas are found in the Alternatives section 4.4.

3.3.5 Borrow Sites. Nesting substrate material would not be borrowed from sites within the vicinity of the project site. Material would be obtained from a local, private quarry.

3.3.6 Staging Area. Island modules will be staged on Lower Klamath NWR lands or private lands adjacent to the west side of Sheepy Lake if permission is secured. A launch platform approximately 16-20 feet wide by the length of the island, with a slight downward angle to Sheepy Lake, may be temporarily installed to facilitate fastening the modules together and launching them into the lake. Surface substrate for the floating island would be trucked to the launch site and distributed on the surface of the modules just prior to launch. Equipment used at the launch site would be staged nearby.

3.3.7 Summary of Fill Requirements and Footprint. Table 3.3 below summarizes the fill (cy) requirements and footprint of in-water work (acres and/or linear feet) for island construction at Sheepy Lake. Maintenance requirements are negligible; see maintenance methods for an explanation of revetment efforts.

Table 3.3 Sheepy Lake Fill and Footprint Requirements				
Island Fill Material (cy)	Nesting Substrate (cy)	Flagstone Revetment (cy)	Access Road (cy)	Footprint
1615-3230 (floating fill)	475-950	5.5-11	100 cy (temporary fill in ditch) 1000 cy (temporary fill in road) 300 cy (road repair)	½ acre -1 acre, 2200 linear feet temporary road access, 3800 linear feet road repair
Total Maximum Fill: 5591 cy				

3.4 Predator Management

Predator management is discussed in the FEIS (USFWS 2005) as a management action that will help achieve the project objective. Also, one potential site condition (as evaluated in the feasibility assessment for the FEIS) is that potential predators (mammalian or avian) must be absent or controllable (USFWS 2005). A depredation permit will be acquired for control of avian predators, if determined necessary, for implementation at each island. The necessity of gull control will be determined through monitoring of Caspian terns occupying each site and their interaction with gull species also expected to utilize these islands for nesting purposes. Observations at Crump Lake, Oregon in 2008 demonstrated that California gulls (*Larus californicus*) and to a lesser extent, ring-billed gulls, can inflict substantial losses on egg clutches and nests of

Caspian terns. Predation on Caspian tern egg clutches at Crump Lake was determined to be the work of just a few individual gulls that had learned techniques to distract or drive off Caspian tern adults and steal their eggs. Removal of these few individuals, just 10 gulls at Crump Lake from a population in excess of 3,200 gulls in 2008, was sufficient to preclude further depredation of tern nests and allow for successful nesting by terns. Gulls successfully nested at Crump Lake in 2008 with approximately 850 pairs of ring-billed and 500 pairs of California gulls nesting there in conjunction with the 428 pairs of Caspian terns.

Predator control measures may be used in the first few years after the island nesting habitat has been constructed if monitoring determines that individual gulls are depredating Caspian tern nests. Removal of problem individual gulls was also demonstrated to be effective in 1999 and 2000 at East Sand Island in the CRE at aiding the establishment of a Caspian tern colony there. Gull control was discontinued at East Sand Island after 2000 as it was no longer determined to be necessary. A similar short term gull control effort may be all that is necessary at Tule Lake and Lower Klamath NWR islands to ensure establishment of a Caspian tern colony.

3.5 Post-Construction Monitoring

All three islands will be monitored by the Department of Fisheries and Wildlife at Oregon State University. Monitoring objectives include: (1) Determine breeding population of all bird species with an emphasis on Caspian terns; (2) Determine nest and fledgling success; (3) Determine diet composition of Caspian terns. Note: Diet composition of gulls, cormorants and/or American white pelicans would be difficult to determine without lethal collection of these species. Caspian terns bring their prey items to the nesting colony in their beak. Trained monitors thus are able to distinguish prey captured by Caspian terns. Gulls, cormorants and pelicans swallow their prey and transport to the colony location in their gut, subsequently regurgitating their captured prey for young to consume. Thus the limiting of diet collection data to just Caspian terns; (4) Determine if adverse interactions are occurring between gulls and Caspian terns which are adverse to tern colony establishment and that may require resolution through removal of problem individuals.

Monitoring would be conducted two to four times per week during the breeding season (April through August) from a small observation blind located on or immediately adjacent to each island. Blinds would be accessed during daylight hours but the approach would be screened from view by nesting birds to minimize disturbance. The monitoring techniques for island access and colony observation have been employed in the CRE, at Crescent Island in McNary Pool, Columbia River, at Brooks Island in San Francisco Bay and at Crump Island in the Warner Valley of Oregon. Thus, they are proven methods with minimal impact to nesting colonial birds.

3.6 Maintenance Methods

3.6.1 Sump 1B. The principal maintenance requirement for Sump 1B Island would be annual vegetation removal and prevention. Vegetation management can be attained via pulling, hoeing and/or application of an appropriate herbicide to remove and/or kill vegetation on the site. The timeframe for vegetation management would be just prior to the arrival of colonial birds expected to nest on the island. For Caspian terns, annual vegetation management would occur in March – early April. Earlier treatment may be required if an earlier nesting colonial bird species also occupies the island.

Access to the island would be by airboat or shallow draft small boat. The USFWS – Tule Lake NWR, who would conduct vegetation management on the island, possess airboats equipped with spray equipment that can access the Sump 1B Island. These boats can transport personnel, all terrain vehicles (ATV), equipment and any necessary supplies to the island. Should herbicide application be utilized, backpack and/or ATV mounted sprayers could be utilized to apply herbicide.

Large-scale maintenance would entail repair of rip rap; the addition of island core material and nesting substrate material is not anticipated. The perimeter revetment should prevent wave erosion, particularly since Sump 1B is a very shallow body of water, and thus wave size is limited it is not an area affected by currents. Rip rap would be recovered from the water body and placed on the windward side as additional protection. There will be no side-sloughing into channels because the bottom substrate of the impoundments at the proposed island site is, for all intents and purposes, level. The nesting substrate (small-diameter crushed rock) will not erode in the wind due to its large size and interlocking angular surfaces. In the event of heavy rainfall, the level surface of the islands coupled with the size of the surface rock would preclude erosion from surface runoff. Rain should percolate through the surface rock and base material rather than run over the surface as it would on a sloped ground surface.

Should large-scale maintenance be required, the methods employed would be comparable to island construction. Access to the island would have to occur when the impoundment is drawn down. An access road, using geofabric, geogrid and one or two lifts of rock would have to be established. The access road rock would be obtained from the material used during initial construction that would have been placed in the nearby quarry pit or utilize additional borrow material from that pit. Repair material, whether island core fill or rip rap, could come from the refuge source locations identified for island construction (Borrow Sites A-E) and/or a commercial source. Eroded areas would be repaired as necessary plus that amount necessary to prevent future reoccurrence. Upon completion of repair efforts, the access road would be removed and the road material would be placed in the refuge quarry.

USFWS will have the option to maintain the bench that would be constructed on the fill island. After completion of construction of the bench USFWS will retain all maintenance responsibilities.

3.6.2 Orems 1. Vegetation management requirements, methods, and access for Orems 1 Island would be comparable to that described for Tule Lake Sump 1B Island.

Similarly, we do not expect any large scale repair/replacement requirements associated with the island core, rip rap, or surface material. Should large scale repair operations be required, the site would be accessed probably in late summer/fall after the impoundment has naturally dried down. Repair material, whether island core fill or rip rap, would be recovered from the water body or from the refuge source locations identified for island construction at Sump 1B and/or a commercial source. Eroded areas would be repaired as necessary. Upon completion of repair efforts, the access materials, such as fill needed for a ditch-crossing, would be removed and the road material would be placed in the refuge quarry.

3.6.3 Sheepy Lake. Operation and maintenance actions for the floating island at Sheepy Lake would primarily entail vegetation management and replacement of modules. Vegetation management requirements, methods, and access for Sheepy Lake Island would be comparable to that described for Tule Lake Sump 1B Island Orem 1 islands. The floating island would be constructed of hundreds of modules bolted together to form a one-acre island. Replacement of modules would be accomplished by unbolting damaged modules and replacing them with new modules, including fabric cover and nesting substrate. Replacement modules and other necessary materials would be floated to the island site with the aid of a small motorboat. Access would be from adjacent refuge land that is proposed for use during construction.

4.0 ALTERNATIVES

4.1 No Action Alternative

The No Action Alternative assumes that nesting habitat is not created within Tule Lake and Lower Klamath NWRs. Thus, no effects to the physical environment are expected. Nesting habitat for Caspian terns does not currently exist on Tule Lake and Lower Klamath NWRs, so terns are not expected to nest in this area under this alternative.

If Caspian tern nesting habitat was not constructed at the proposed sites (Sump 1B, Orem 1, and Sheepy Lake), nesting habitat would be constructed at alternative sites identified in the FEIS (USFWS 2005) and BO (NMFS 2006).

4.2 Alternative Nesting Habitat Enhancement Sites

An alternatives analysis for potential Caspian tern nesting sites was conducted for the *Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary FEIS* (USFWS 2005). A total of 77 individual historic, current, and potential nesting sites in the Pacific Coast region were evaluated to determine their management potential for Caspian terns. During the feasibility assessment, a site was determined to have management potential for Caspian terns if the following conditions were met: (1) Suitable nesting habitat is present or habitat enhancement requirements are minimal; (2) Site is available or could be managed for nesting terns every year; (3) Site can support a substantial number of breeding terns; (4) Prey is available in most or all years; (5) Potential predators are absent or controllable; (6) Levels of natural or human

disturbance are absent, minimal, or controllable. Appendix G of the FEIS (USFWS 2005), which contains the entire analysis, is available at: https://www.nwp.usace.army.mil/pm/e/reports/environmental/misc/terns/Caspian_Tern_Final_EIS%20Appendices.pdf. Alternative nesting sites were analyzed for eligibility in the FEIS, Appendix G (USFWS 2005). A table listing the site names and reasons for elimination from consideration can be found in Appendix D.

Two of the seven sites identified by the feasibility assessment (USFWS 2005), Dungeness NWR, and Brooks Island in San Francisco Bay, are not being considered further (Dungeness NWR) or is delayed (Brooks Island) for further investigation. The other five sites identified in the analysis have been constructed or are being planned for construction (see Table 3.1).

The proposed island locations at Tule Lake and Lower Klamath NWRs are not among the seven preferred sites identified in the analysis. According to the alternatives analysis in the FEIS (USFWS 2005), Tule Lake and Lower Klamath NWR were eliminated from consideration during the EIS process because of “loss of site” and the “historic nesting colony last nested in 1962 and 1976”, respectively. “Loss of site” refers to the historic sites, islands within lakes that were drained for agricultural purposes, which was concurrent with the initial major loss of the island nesting habitat for colonial bird species. The inclusion of the Tule Lake and Lower Klamath NWR sites as alternative nesting habitat development locations was provided for in the USACE ROD for the proposed action under the concept of adaptive management for site selection. The concept of adaptive management, as described in the ROD, implies that if alternative sites could be identified and meets the criteria, and the appropriate NEPA documentation and permitting was completed, the alternative nesting habitat could be constructed (USACE 2006). Upon further discussions with USFWS NWR it was determined the proposed Tule Lake and Lower Klamath NWR sites meet the seven criteria listed above and are available for such use.

4.3 Alternative Island Designs

Three different methods were considered for constructing islands for the purpose of Caspian tern nesting habitat. The first type of island design is using fill material from an off-site source to construct a mound which is then armored with rip rap. The second type of island design has a similar outcome as the fill island, but the material is excavated from the lake bed directly around the proposed island site, and then piled into a mound. The excavated island can be armored with rip rap as well. The third type of island is a manufactured island designed to float on the water’s surface. Revetment is not needed since the manufactured modules of the floating island would not erode over time or due to heavy winds. All three island designs are capable of holding a layer of coarse gravel for tern nesting substrate.

Constructing an island with fill and constructing an island by excavating the fill from the lake bed will result in similar project footprints; excavating material from around the perimeter of the proposed island location to construct an island would result in a slightly

larger impacted area. Both island designs necessitate access to the proposed island location. This is most easily attained by draining the water body prior to constructing the road and if needed, constructing a temporary road. A floating island project footprint is temporary in nature, would not impact bottom substrate, and would be deployed by pulling the island from the staging area on the shore to the proposed location via motor boat.

There are several factors to consider when choosing a design for an island, such as water depth, access, impacts to wetlands, water quality impacts, and availability of fill material. Both Sump 1B and Orems 1 are shallow water management units that are drained every few years for vegetation management. The limited maximum depth and the fact that the units are drained indicate that a floating island (which typically has a draft of at least two feet) would not particularly be a good design. Though it would not be detrimental for a floating island to touch the bottom of the water basin, deploying the floating island would be difficult and some of the benefits of using a floating island, such as a lack of bottom substrate disturbance, would be lost. Sheepy Lake in Lower Klamath NWR cannot be drained and is relatively deep compared to other water bodies in the Klamath Basin NWR Complex. These characteristics made Sheepy Lake a viable option for a floating island.

If a water body can be drained (preferably as part of a routine operation), and if there are accessible and affordable sources of material to construct a temporary road and island, then building an island with fill material is the preferred method. Due to the availability of materials from Borrow Sites A-E at Sump 1B, and because the sump was being drained for vegetation management purposes, a fill island is the best alternative for Sump 1B. Fill material is not available on-site or near Orems 1, and therefore would need to be obtained from a privately-owned quarry. Purchasing and delivering thousands of cubic yards of fill material is costly; therefore, excavating the lake bed to construct an island is the most practicable alternative for the Orems 1 site.

See Table 4.1 for a comparison of volumes of fill (cy) required and the project foot print for each site-specific island design. Please note that it is difficult to compare the fill amounts of the three different island designs because the fill island (Sump 1B) is designed to have twice the area as the other two, and access road fill volumes vary depending on the location of the island within the basin and the stability of the substrate.

Table 4.1 Comparison of Fill Volumes and Footprints for Three Proposed Island Designs						
Island Site	Island Fill Material (cy)	Nesting Substrate (cy)	Revetment (cy)	Temporary Access Road (cy)	Total (cy)	Footprint
Sump 1B* (fill island)	18,000	3,300	5,300	3,200 cy (road to island site) 180 cy (culvert to Borrow Site B) 625 cy (road to Borrow Site D) 90 cy (culvert to Borrow Site D)	30,695	2.3 acres 1800 linear feet, 20 feet wide (access road) (includes side slopes)
Orems1 (excavated island)	5,300 (dredged)	1,650	2,000	740 (temporary fill in culvert) 3400 (optional)	9690	1.2 acres (fill) (includes side slopes) 3 acres (dredging) 3,700 linear feet, 20 feet wide (access road)
Sheepy Lake	1615-3230 (floating fill)	475-950	5.5-11 (flagstone)	100 cy (temporary fill in ditch) 1000 cy (temporary fill in road) 300 cy (road repair)	5591 (maximum, most of which is temporary or floating fill)	½ acre -1 acre, 2200 linear feet temporary road access, 3800 linear feet road repair
*Note: Sump 1B island would be two-acres; Orems1 and Sheepy Lake islands would be one-acre.						

4.4 Alternative Access Routes

Access routes to the proposed island sites at Sump 1B (Figure 3.2) and Orems 1 (Figure 3.6) were identified based on availability of non-private lands, ease of ingress, proximity to the proposed island location, and the goal of reducing potential impacts to environmental and cultural resources.

The proposed floating island for Sheepy Lake can be deployed from the shore of the lake at several different spots. Factors taken into consideration when choosing the preferred alternative include environmental impacts, access to private lands, and practicability. The preferred alternative is described in the “Access” section 3.3.5 within the Proposed Action section of this document. The following alternatives were considered for Sheepy Lake access.

4.4.1 Northwest side of Sheepy Lake, at Stateline Road. The potential staging area at the northwest corner of Sheepy Lake is problematic for parking or turning trucks around in its current state. The dike roads to the north of Stateline Road and which flank the water control structure appear to be of insufficient width for truck parking, unloading, and stockpiling materials or staging equipment. Further, the potential staging area is across the highway from the launch point into Sheepy Lake, which would necessitate transporting the floating island modules across the highway to the launch point. This would entail numerous crossings and traffic flaggers, thus being potentially dangerous, and slowing down local traffic and increase the installation period. This access route is not the preferred alternative access route.

4.4.2 Northwest side of Sheepy Lake, south of the highway. A plot of land that is approximately 0.43 acres in extent is located on the northwest corner of Sheepy Lake immediately adjacent to Stateline Road (Figure 3.9). This area is also directly adjacent to the launching access point for Sheepy Lake. However, the majority of this area is a wetland that would necessitate a temporary fill to provide equipment parking and offloading capability. The fill would be removed following construction and stockpiled at the refuge maintenance facility approximately 6.6 miles east of the staging area or at the gravel pit near Orems 1 management unit. Provided rock is used for fill, the material could be subsequently used on the refuge’s roadways as needed for future use (picture available of route if needed).

The volume of rock required to fill the wetland is approximately 5,000 cubic yards. The temporary fill area would extend west from the launch to the dike road that runs south and from the highway shoulder to the edge of the waterway. Even with temporary fill to west of the launch point, it is questionable if the area would provide sufficient room for stockpiling the gravel that will be placed on the nesting island. The floating island modules and rock could be stored at the refuge maintenance facility. Rock could be added to the island modules at the facility and then placed onto a truck or flatbed trailer using a trackhoe for transport to the launch point. Another trackhoe would be stationed at the launch in order to remove the modules from the truck and place the modules in the water. A few trucks/flatbed trailers would be cycled through this process to ensure efficient production.

Each floating island module would be launched individually given the narrow width of the channel at the boat launch. The modules would be maneuvered to a nearby location in Sheepy Lake for assembly. Due to the necessity of filling wetlands for this alternative, it is not the proposed alternative access route.

4.4.3 West side of Sheepy Lake. Access to the western shoreline of Sheepy Lake is available via a private dirt road between a county road and refuge land along the shoreline (Figure 3.9). Potential access and use of the quarter-mile road has been discussed with the landowners. Lower Klamath NWR managers are currently working with the private landowners to secure access to the potential floating island staging and launching area. Gravel (2-inch surface along 3800 linear feet, maximum 300 cy) would be placed on a segment of the NWR road to support an increase in traffic and load. Additional gravel would be placed temporarily on the undeveloped road (2200 linear feet, maximum 1000 cy) and in a ditch (100 cy) that connects the NWR road and the proposed launch site. This material will be removed after construction is complete. Due to the minimal environmental impacts associated with this alternative, access to the deployment site via the west side of Sheepy Lake is the preferred and proposed access route.

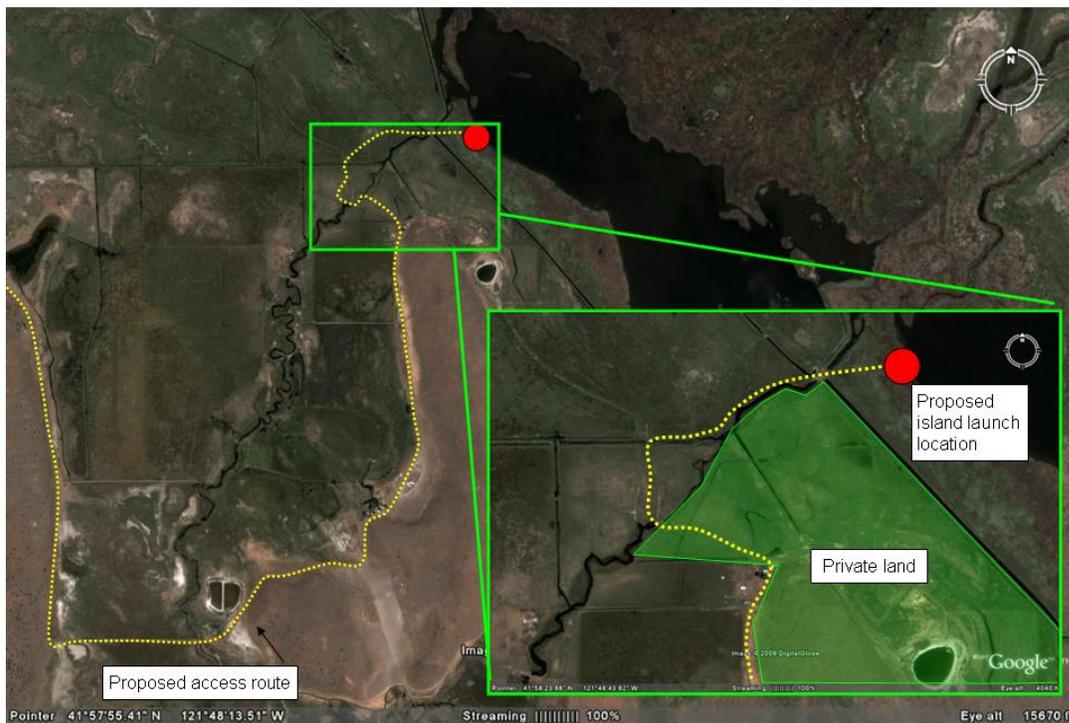


Figure 3.9. Aerial photo of Sheepy Lake with proposed island launch site, access road, and private land.

4.4.4 Access Alternative Not Being Considered. A launch point in the northeastern corner of Sheepy Lake is not being considered for staging and assembly of the floating island. The location is quite distant from the ultimate location of the floating island and would necessitate travel through very narrow channels in the tule marsh that are often blocked by vegetation. This route is not suitable for transport of the floating island.

5.0 IMPACT ASSESSMENT

Potential impacts of the proposed alternative are assessed in relation to the No-Action Alternative and include considerations of the construction methods used to create

Caspian tern islands, the use of staging areas at the project site, the installation and removal of roads used to access the islands, the excavation of material at borrow sites and any transportation of material from the source sites to the project site.

This impact assessment will not include effects related to the dewatering of Sump 1B. Dewatering Sump 1B is a normal activity that the USFWS performs every few years for vegetation management associated with wildlife habitat. The proposed island construction was planned to coincide with the dewatering management action to allow for easier access to the construction site.

Potential Impacts

Water

(X) Quality - temperature, salinity patterns and other parameters:

Sump 1B Island: Summer water quality in the sumps is similar to other water bodies within the Upper Klamath Basin and is considered hypereutrophic (Hicks et al. 1998). Water quality problems include low dissolved oxygen (DO) and high hydrogen ion concentrations (pH) and unionized ammonia. Water quality in the Tule Lake sumps is directly affected by hypereutrophic conditions in Upper Klamath Lake (Hicks et al. 1998). Water quality in Sump 1B has improved over the past decade due to the implementation of the Sump 1B Wetland Enhancement Project, a plan to establish desired emergent vegetation within Sump 1B. The lowest DO measurement during the 2005 study year was recorded on 17 August (3.12 mg/l) and the highest reading on 20 July (10.76 mg/l). Temperature readings of Sump 1B in 2005 ranged from 15.24 °C on 13 September to 25.35 °C on 20 July. The proposed actions, construction of a temporary access road and an island within Sump 1B, would result in minimal disturbance to ambient water quality parameters because the proposed construction site would be drawn down and fairly dry at the time of construction. A geotextile fabric would be placed over the temporary access road corridor and the island footprint prior to placement of rock to prevent the displacement of sediments due to truck traffic and erosion. Minor disturbance to the Sump 1B lakebed surface would be expected when the temporary access road is removed. The use of geotextile fabric and rip rap for shore protection at Sump 1B Island would minimize the potential for erosion of island fill material. Once water levels are returned to normal capacity in late summer/early fall, added sediments may slightly decrease dissolved oxygen, but is considered a minor, temporary and insignificant amount. Methods for large-scale maintenance, such as the replacement of rip rap, would be similar to those proposed for construction, thus resulting in comparable minor and temporary impacts to water quality; the need for large-scale maintenance is expected to be rare. The exposed materials at the island location after construction would consist of native rock derived from local quarry sites. Material from the borrow sites (see section 3.1.5 “Sump1B Borrow Sites” for a description of materials) do not pose a concern for contamination as they are native material obtained from a previously opened pit in an area not subject to agricultural or industrial use. Thus construction is not expected to impact water quality, temperature, salinity or other parameters.

Orems 1 Island: The topography of this wetland management unit was previously disturbed through management actions to develop micro-topographic features (swales, ¹hummocks, channels) from the flat surface that exemplified the site when it was subject to agricultural use. The proposed action to construct a one-acre island would utilize these sediments to form the core of the one-acre island. The core of the island would be enclosed by a geotextile fabric to minimize the potential for water-induced erosion of the core material post-construction. Rip rap would be placed around the perimeter of the island to preclude erosion of the island, too. The rip rap would be obtained from a local quarry source.

Construction of the Orems 1 Island would occur in the dry season. The unit is anticipated to be drying in mid to late summer, with construction slated for late summer and early fall while the unit remains dry. Based upon observation of USFWS construction efforts in an adjacent unit in fall 2008, we anticipate that trucks would be able to haul rocks across the surface of the unit without the need to build a temporary access road. If a temporary access road needs to be constructed to handle truck traffic, the minor and temporary impacts would be comparable to those described for Sump 1B.

The exposed materials at the island location after construction would consist of native soil from the borrow area adjacent to the island and rip rap derived from local quarry sites. Material from the borrow sites do not pose a concern for contamination as they are native to the site and represent no more exposure than occurs under current operational conditions. Thus construction is not expected to impact water quality, temperature, salinity or other parameters.

Methods for large-scale maintenance, such as the replacement of rip rap, would be similar to those proposed for construction with the exception of excavation. Material, such as rip rap, would be transported to the island after the water body dries out, thus resulting in minor impacts to water quality; the need for large-scale maintenance is expected to be rare.

Sheepy Lake Floating Island: Floating islands constructed of recycled inert plastic material were designed to improve water quality within the body of water by mimicking wetland functions. Wetlands offer surface area and circulation: surface area for the growth of microbes, which are responsible for removing nutrients and other pollutants from water; circulation for getting the water in contact with these microbes (FII 2009). The use of a floating island will provide beneficial impacts to the water quality in Sheepy Lake.

The construction of a rock-based island at Sheepy Lake would have resulted in greater environmental harm than the proposed action. A temporary access road would have to have been constructed across an open water body to the island location. Construction placement of the rock materials to form the island plus removal of the temporary access road would have a greater impact on water quality than the proposed floating island.

¹ Hummock is a general geological term referring to a small knoll or mound above ground.

The additional impact would be due to turbidity occurring during road construction and removal, increased human activity in a portion of the lake being utilized by fish and wildlife resources, and more disturbances to wildlife compared to a floating island assembled at a discrete location and then floated into position.

Small-scale maintenance of a floating island would not necessitate moving the island and constructing a temporary launch platform. New modules would be attached from a boat adjacent to the island. Large-scale maintenance would entail similar methods to the construction, thus experiencing similar impacts to water quality. Large-scale maintenance is not expected to be needed.

(X) Turbidity, suspended particulates:

Sump 1B Island: Construction of the fill island at Sump 1B would be done when the water is drawn down (as part of the normal operation for vegetation management), so there would be no turbidity concerns during construction. Post-construction, when Sump 1B is refilled, the likelihood of turbidity is also minimal as the sump would fill gradually over essentially a level surface thus precluding current erosion or erosion due to cutting when water fills depressions. The use of geotextile fabric and rip rap for shore protection at Sump 1B Island would minimize the potential for erosion of island fill material, thus negating turbidity and suspended particulates concerns at the island location. Maintenance activities would be conducted under dry conditions during the normal refuge vegetation management drawdown period and thus would not have impacts on turbidity.

Orems 1 Island: Turbidity concerns are very comparable to those stated for Sump 1B Island. Borrow of lakebed material would form a shallow depression, approximately one foot in depth around the constructed island. Erosion of soil, leading to turbidity and suspended particulates, as water flows into this shallow depression is expected to be minimal and confined to the local area. The previously constructed micro-topography in Orems 1 Unit does not indicate that erosion from water flowing into channels or depressions is an issue. Some erosion on the perimeter of constructed hummocks was observed in the field. The use of geotextile fabric and rip rap for shore protection at Orems 1 Island would minimize the potential for erosion of island fill material, thus negating turbidity and suspended particulates concerns at the island location. Maintenance activities would be conducted under dry conditions and thus would not have impacts on turbidity.

Sheepy Lake Floating Island: Soil disturbance from the floating island construction would be confined to the immediate area of the launch platform and is expected to be minimal as the prefabricated wood platform would protect soils from disturbance. Soil removed from the launch location would be replaced and the site re-seeded to preclude future erosion or sediment run-off. Impacts of large-scale maintenance would entail similar methods to the construction, thus experiencing similar impacts on turbidity.

(X) Substrate:

Sump 1B Island: Direct impacts to the substrate in the proposed Sump 1B island location, which is characterized as silty with some gravel, would occur from construction activities. The principle impact would result from construction of the islands by covering substrate at the island location with rock and borrow material. The Sump 1B island construction impact would be approximately 2.3 acres in extent at the base. The impact of the access roads would extend 1,800 linear feet within Sump 1B and would only be temporary in nature. The Sump 1B temporary access road would be removed upon completion of the island. Compaction associated with the temporary access road is anticipated but would be limited to the footprint and should lessen over time with subsequent inundation.

Orems 1 Island: The bed of this wetland management unit was previously disturbed through management actions to develop micro-topography (swales, ¹hummocks, channels) from the flat surface that exemplified the site when it was subject to agricultural use. Direct impacts at Orems 1 would be comparable to the island construction at Sump 1B. Orems 1 island construction would impact approximately 1.2 acres at the base plus three acres total around the island location that would be used for borrow; Orems 1 has a total area of 617 acres. The impact of the access roads would extend 3,700 linear feet within Orems 1. For Orems 1, construction access would be limited to a corridor over native soil; impacts from trucks would cause soil compaction, which would be addressed through tillage and should be temporary in nature. Other than the minor construction impacts identified, no significant impacts to soils are expected.

Sheepy Lake Floating Island: The substrate will not be impacted by the floating island in Sheepy Lake, as the island will float on the water surface. The placement of the floating island anchor will displace substrate sediments when placed upon installation of the island.

(X) Currents, circulation or drainage patterns:

Sump 1B Island: Tule Lake wetland sumps 1A and 1B receive their water from return flow irrigation. Water levels within the sumps have been stabilized to prevent flooding of adjacent lands; therefore, waters have minimal flow and circulation in Sump 1B. Sump 1B is hydrologically connected to Sump 1A through a narrow, gated canal and is managed as either a year-round water body or less often a seasonal wetland through regulation of the flow in the canal separating the two sumps (USGS 2006). Impacts to the tidal prism, which is associated with drainage, are expected to be minimal due to the very small ratio of island size (two acres) to water body size (3,300 acres). The construction of a two-acre island within Sump 1B will have minor impacts on currents or circulation.

Orems 1 Island: Lower Klamath NWR is intensively managed for wetlands and agriculture. The inflow is provided through water control structures that connect the unit

¹ Hummock is a general geological term referring to a small knoll or mound above ground.

to irrigation canals. Currents and circulation are negligible parameters in this managed wetland. Similar to Sump 1B, the impacts to the tidal prism, which is associated with drainage, would be minimal due to the very small ratio of island size (one acre) to water body size (617 acres). The construction of a one-acre island within Orems 1 would have minimal impacts on currents or circulation.

Sheepy Lake Floating Island: The construction and operation of a one-acre floating island within this impoundment would have no effect on currents, circulation and/or drainage.

() **Mixing zone (in light of the depth of water at the disposal site; current velocity, direction and variability at the disposal site; degree of turbulence; water column stratification; discharge vessel speed and direction; rate of discharge; dredged material characteristics; number of discharges per unit of time; and any other relevant factors affecting rates and patterns of mixing):** N/A

(X) **Flood control functions:**

Sump 1B Island: The construction of a two-acre island within Sump 1B (3,300 acres) is expected to have a negligible effect on the water storage capacity. An estimated 8 acre-feet of storage would be lost due to construction of the island, which is a minimal impact to flood control functions. More importantly, Sump 1B is not managed as a flood control unit; water is released into and out of the unit for wildlife habitat management.

Orems 1 Island: The Orems 1 management unit is operated as a seasonally flooded wetland, and not as a flood control unit. The construction of a one-acre island within the management unit would have no bearing on flood control storage.

Sheepy Lake Floating Island: The floating island would have no impact to flood control storage because the island sits on the water surface and displaces a negligible volume of water.

(X) **Storm, wave and erosion buffers:**

Sump 1B Island: The two-acre island would be armored by rip rap with an extra foot of thickness on the windward shore to preclude erosion of the island from storm-produced waves. In addition to the storm and wave-erosion buffering characteristics of Sump 1B, such as its gradual incline of substrate and densely vegetated shoreline, the proposed island may provide minimal buffering to the adjacent shoreline in addition, thus minimizing erosion of the water body's shoreline.

Orems 1 Island: Orems 1 does not have significant fetch capabilities due to its geographical location, therefore storms and waves do not pose a threat to eroding or changing the topography of the unit. The proposed one-acre island, located within the center of the management unit, would act as minor storm, wave or erosion buffers if, in

the slight chance, storms, waves or erosion were of concern. For this same reason, the proposed armored island would be sufficiently protected against erosion.

Sheepy Lake Floating Island: The offshore floating island would not act as significant storm, wave or erosion buffers. The island, which would float on the water surface, would be anchored at one corner and will move around with storms and waves, thus not acting as a buffer. The island will be constructed to withstand anticipated storms and waves.

(X) Erosion and accretion patterns:

Sump 1B: Sump 1B is an impoundment, thus erosion and accretion patterns, typically associated with rivers and streams, are not present. Diked areas are protected by rip rap and/or established vegetation to minimize erosion. The construction of an island would have an insignificant impact on current erosion and accretion patterns.

Orems 1 Island: Due to the similar conditions to Sump 1B, please see the erosion and accretion patterns analysis for Sump 1B above. The construction of an island would have an insignificant impact on erosion and accretion

Sheepy Lake Floating Island: The construction of a floating island would not affect erosion and accretion.

- () **Aquifer recharge:** N/A
- () **Base flow:** N/A
- () **Water supplies, conservation:** N/A

(X) Aquatic Habitat:

Tule Lake NWR Sump 1B: Aquatic habitat within Sump 1B consists of approximately 3,100 acres of open water mixed with dense stands of sago pondweed (*Potamogeton pectinatus*) and lesser amounts of coontail (*Ceratophyllum demersum*) and 400 acres of emergent wetland vegetation (e.g. hardstem bulrush, *Scirpus acutus*) dispersed throughout the pond but predominantly in the eastern portion of the lake. The average depth of Sump 1B is approximately 1.5 to 2 ft. Historically, the aerial extent of Tule Lake wetlands fluctuated greatly from year to year depending on regional precipitation. These fluctuations would have resulted in the formation of islands; the number, size and location of islands would have been dependent upon the annual water level attained. Currently, Sump 1B has relatively stable water levels, even bottom surface gradient and lacks islands which may be used for colonial bird nesting habitat. Native bluebunch wheat grass (*Pseudoroegneria spicata*) and non-native slender and intermediate wheat grasses (*Agropyron spp.*) occur at the wetland/upland interface interspersed around the perimeter. The Sump 1B Island location is located within fairly-barren areas in the sump, which lack submergent and emergent vegetation.

The proposed action would alter portions of Sump 1B's current geomorphology through creation of a permanent two-acre island. In consideration of the island size, and the current and future uses of Sump 1B, this change is considered to be minor and beneficial because of the diversity of habitat it provides. Minimal impacts on emergent wetland vegetation are associated with the temporary access road in Sump 1B. A minimal and temporary impact to the native bluebunch wheat grass and the non-native slender and intermediate wheat grasses may occur from road construction actions at the wetland/upland interface. This impact would occur from grading, leveling and subsequent removal of the temporary access road. Impacted vegetation will grow back after construction once the water level is restored to its normal operating level.

Orems 1 Island: Orems 1 is 617 acres that is flooded from early winter through late summer every year as a managed seasonal marsh. The aquatic habitat consists of approximately 495 acres of open water and/or mudflat, depending on water elevation, and approximately 122 acres of emergent vegetation consisting of primarily alkali bulrush (*Scirpus maritimus*) with small amounts of hardstem bulrush. The current geomorphology of the unit reflects recent management actions to alter the micro-topography of the unit to diversify water depths and vegetative conditions to upgrade habitat conditions for waterfowl, shorebirds and other wildlife species.

The proposed action, construction of a one-acre island, would further diversify wildlife use in the unit through provision of suitable nesting habitat for colonial nesting birds. The proposed action would alter the geomorphology on approximately one acre in the 617-acre wetland management unit. There are minor and temporary vegetation impacts associated with the temporary access road and construction of the island in Orems 1 Unit. The proposed island would be located in a mudflat area void of vegetation. Any existing vegetation located where the temporary access road would be constructed is seasonal and would be dried (as part of normal wetland operation) at the time of construction activities. Vegetation will grow back upon normal water release in the lake.

Sheepy Lake Floating Island: Sheepy Lake is a permanent lake characterized by a submergent plant community that is dominated by sago pondweed with lesser amounts of baby pondweed (*P. pusillus*) and coontail (*Ceratophyllum demersum*). This community is found in open water zones where water depths range from 6 inches to 3 feet. The shoreline is sparsely vegetated with native and nonnative grasses, similar to Sump 1B.

The proposed one-acre floating island would not alter the geomorphology of Sheepy Lake since the island would be floating on the water surface. The island's anchor would sit on the bottom of the lakebed, but would not permanently alter the topography. The placement of a one-acre floating island in Sheepy Lake would have no impact on aquatic vegetation because the island will be moored in an area void of submergent vegetation.

(X) Organisms:

Fish

Sump 1B Island: Trap net sampling conducted in the summer and late fall of 2007 (Hodge and Buettner 2008), in Sump 1A captured 3,453 Sacramento perch, 1,499 tui chubs, 831 blue chubs, 130 brown bullhead, 16 goldfish, 15 fathead minnows, 4 yellow perch, and 2 Lost River suckers (540 trap hours). Fish captured from Sump 1B included 5,717 tui chubs, 1,197 Sacramento perch, 126 blue chubs, 5 goldfish, 3 yellow perch, and 2 brown bullheads (440 trap hours). A total of 13,000 fish for both sumps combined were captured of which two were Lost River suckers (0.015%). Caspian terns, American white pelicans, gulls and other fish eating birds are already present on Tule Lake or are within commuting range of other locales that they frequent. The presence of a relatively-large nesting island would potentially increase the number of these fish-eating birds on the refuge; however, the large numbers and density of other forage fish species greatly reduces the probability that significant numbers of suckers (federally-listed as endangered) will be consumed. Furthermore, suckers are bottom-oriented fish; therefore, predation by surface feeding bird species such as Caspian terns and ring-billed and California gulls should be negligible. Caspian tern diet would be a component of the proposed monitoring program following construction.

Orems 1 Island: Orems 1 Management Unit is filled with water and is then allowed to dry through evaporation on an annual basis. Thus the unit does not support a permanent population of fish. Fish are present in nearby irrigation canals, Sheepy Lake, the Klamath River, and Sumps 1A and 1B on the nearby Tule Lake NWR. Fish species composition in the area is comparable to that reported for Tule Lake NWR Sump 1A and 1B (above). Lower Klamath NWR currently supports a population of fish-eating birds that is also comparable to Tule Lake NWR. Avian impacts to fish present in the general area should be comparable to that described for Tule Lake NWR Sump 1B Island.

Sheepy Lake Floating Island: Sheepy Lake is a permanent body of water. Fish species composition is anticipated to be generally comparable to that observed for Tule Lake Sumps 1A and 1B. Species composition of fish eating birds and their potential impact to fish are considered comparable to that described for Sump 1B Island.

Wildlife

Sump 1B: The open water habitat that characterizes the proposed island location is utilized by many species of waterfowl and waterbirds, such as American white pelican (*Pelecanus erythrorhynchos*), Snow (*Chen caerulescens*), Ross' (*Chen rossii*), white-fronted (*Anser albifrons*), and Canada geese (*Branta Canadensis*), pintail (*Anas acuta*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), canvasback (*Aythya valisineria*), Western (*Aechmophorus occidentalis*) & eared (*Podiceps nigricollis*) grebes, and black tern (*Chlidonias niger*) amongst others. Adjacent expanses of tule marsh support tri-colored blackbirds (*Agelaius tricolor*), white-faced ibis (*Plegadis chihi*), herons (Ardeidae family) and egrets (*Egretta spp.*) for nesting and foraging activities. Raptors such as peregrine falcons (*Falco peregrinus*), bald eagles (*Haliaeetus leucocephalus*), northern harriers (*Circus cyaneus*), and red-tailed hawks (*Buteo jamaicensis*) are common in the area due to the abundance of prey species and carrion.

The proposed island would be constructed after the refuge completes a drawdown of Sump 1B as part of their normal refuge management prescription. As drawdown lowers the water level and then exposes the site, fish eating birds would become more prevalent as prey species are concentrated in shallow water and would be easily attainable. Once drawdown has been completed, Sump 1B would support little wildlife due to the absence of vegetation, water, and prey species. Consequently, by coordinating island construction with the refuge's prescribed drawdown of Sump 1B, impacts to wildlife species would be the same as the no-action alternative. The drawdown is part of the normal operation of the lake. All construction activities would be conducted after the resident bird nesting, rearing and fledging period.

Orems 1 Island: Wildlife use of this management unit is primarily driven by the presence of water. The provision of water to the unit in late winter and early spring, plus the gradual loss of water through the latter part of spring into summer, makes this an attractive location for puddle ducks (i.e. mallards, pitails, etc.) and shorebirds (i.e. ibis, heron, etc.) that frequent productive, shallow water habitat for nesting, foraging and brood rearing activities. Once water has evaporated from the unit, wildlife use significantly lessens. Horned larks are present and probably most prevalent in the unit when dry. Consequently, by coordinating island construction with the refuge's prescribed management of allowing Orems 1 to dry every summer, impacts to wildlife species would be minimized.

Sheepy Lake Floating Island: As a permanent body of water, wildlife species composition at Sheepy Lake would be comparable to that observed at Tule Lake Sump 1B, although numbers of wildlife present would be expected to be less than observed for Sump 1B. Given that the floating island is assembled against the shoreline at a discrete, small area, and then floated into place, wildlife disturbance and impacts to wildlife habitat would be minimal.

(X) Special aquatic sites (wetlands, mudflats, coral reefs, pool and riffle areas, shallows, sanctuaries and refuges, other):

Sump 1B: The USACE has not conducted a wetlands jurisdictional determination; however, portions of this site may qualify as a special aquatic site. This analysis below is in consideration of these sites existing. Sump 1B may qualify as a special aquatic site because the site is currently managed as a freshwater lake and infrequently (approx. every 3 years) as a seasonal wetland. The proposed activity would entail filling approximately 2.3 acres of the 3,298 acres comprising Sump 1B, which is a jurisdictional water of the United States. The temporary access road would fill .05 acres of potential wetland habitat, but will be removed following construction. Construction of this nesting island would improve wildlife use in Sump 1B through provision of secure nesting habitat for colonial nesting birds that had been previously reduced and is lacking in the area.

Orems 1 Island: The USACE has not conducted a wetlands jurisdictional determination; however, portions of this site may qualify as a special aquatic site. This analysis below is in consideration of these sites existing. Orems 1, which dries annually, lacks wetland

vegetation and is considered jurisdictional waters of the United States for the same reasons listed above for Sump1B. The proposed action would restore an element of the natural habitat diversity to the Lower Klamath NWR wetlands that were previously altered by drainage and agricultural use and is therefore a significant beneficial impact. Impacts to waters of the United States include the excavation of 3 acres of lake bed; the material would then be mounded as fill covering 1.2 acres. Temporary fill would be placed in an adjacent drainage ditch to allow truck access to the site. This fill would be removed following construction.

Sheepy Lake Floating Island: The USACE has not conducted a wetlands jurisdictional determination; however, portions of this site may qualify as a special aquatic site. This analysis below is in consideration of these sites existing. The proposed action would also restore an element of the natural habitat diversity to the Lower Klamath NWR that was previously altered by drainage and agricultural use. The floating island concept would be comparable to the floating mats of tules that historically supported nesting colonial bird species in the Klamath Basin and therefore would be a significant beneficial impact. Aside from the island anchoring device, which would be temporary in nature, no fill would be placed in these waters since the island will be floating on the water surface.

Table 5.1. Acres of Fill in Waters of the US and Wetlands*			
Island Site	Type of Fill	Fill** in Non-Wetlands, Waters of the US (acres)	Fill** in Wetlands (acres)
Sump IB	Island fill	2.3	<.1
	Access road	(.8)	(<.1)
Orems 1	Island fill	1.2	<.25
	Access road (temporary fill)	(1.7)	--
Sheepy Lake	Island fill	--	--
	Access road (temporary fill)	--	--
Total		3.5 and (2.5)	<.35 and (<.1)
*USACE has not conducted a jurisdictional determination, thus the acreage is based on the vegetated area within the project footprint.			
**acreages in parenthesis indicate that the fill is temporary			

All activities and designs are conducted in consideration of minimizing the footprint of fill into Waters of the United States and other sensitive habitat in order to satisfy island design criteria and to meet the enhanced nesting habitat acreage requirement as indicated in the FEIS (USFWS 2005) and ROD (USACE 2006).

(X) Terrestrial Habitat:

Historically, the Klamath Basin was an 88,000 acre lake that contained many hills and ridges that functioned as islands. Since the reclamation of the land in the early 20th Century, the land has been flattened and managed for agriculture.

Sump 1B: Generally, the topography is gentle with surrounding lands containing sparsely timbered hills, uplifts, and cinder cones. A small portion of the Refuge lying along the west boundary includes the steep hillsides and rock outcrops of Sheepy Ridge. The terrestrial habitat surrounding the sump is characterized as previously-disturbed grasslands dominated by sagebrush (*Artemisia tridentata* spp.), rabbitbrush (*Chrysothamnus* spp.) and cheatgrass (*Bromus tectorum*).

Source material for construction of the Sump 1B island would primarily be obtained from existing on-refuge borrow pits and disposal rock piles. For the existing borrow pit, the footprint of the excavation will stay within previously disturbed/excavated areas; no new ground would be disturbed. Potential borrow sites have been coordinated with the USFWS (land-owner). Island nesting substrate would be obtained from a commercial quarry. Thus, no new borrow areas would be disturbed as a result of the proposed action on the refuge.

Localized impacts to small areas that may occur at the local quarry locations during borrow operations, including any temporary roads constructed to access these locations. A temporary construction access road will run from the kiosk parking lot across an upland area, then across the upland/wetland interface, and then enter the lakebed of Sump 1B. A temporary road would also be established across a vegetated flat at one area to access a rip rap source; approximately 0.4 acres of vegetation (spp. named above) would be impacted. These temporary roads would be removed post-construction and re-seeded. Access to other borrow sites would be on existing roads. Road maintenance and removal of rock from borrow locations would impact some vegetation (see listed spp. above) that has encroached onto roads and borrow areas.

Orems 1 Island: The geomorphology of the Orems 1 Management Unit was historically altered for agricultural purposes and more recently the surface of the unit was modified to provide a diverse micro-topography to increase habitat and wildlife species diversity in the managed, seasonal wetland. Upland vegetation, including pepperweed (*Lepidium latifolium* L.) and various invasive thistles such as Russian thistle (*Salsola kali*), may occur in the upland areas, which may be characterized as grasslands.

The bulk of the source material for the island would be derived from soil borrowed in a three-acre area immediately surrounding the island and the rip rap and nesting substrate for Orems 1 Island would be obtained from a commercial quarry; therefore, no upland on-site borrow areas would be utilized. The construction of a one-acre island, including the borrow area surrounding it, will contribute to the habitat diversity of the management unit and should increase wildlife species use through provision of nesting habitat.

A minor and temporary impact to upland vegetation, such as the species listed above, may occur from establishment of a road crossing at the drainage ditch on the unit perimeter. This impact would occur from placement of a culvert and associated fill for

the temporary access road. Fill would be removed post-construction and the vegetation community is expected to rapidly re-colonize the location due to the presence of water and adjacent dense vegetation. The temporary access road across the interior of the Orem's 1 Management Unit to the island location would also have a temporary impact to vegetation (see spp. listed above) within the unit. This road would be removed post-construction, if rocky, or else tilled to reduce compaction if no rock is added.

Sheepy Lake Floating Island: The upland terrestrial habitat surrounding Sheepy Lake is characterized as grasslands consisting of grasses and weeds (see vegetation described for Sump 1B). The only modification to geomorphology associated with this proposed island would occur at the island assembly site on the shoreline of Sheepy Lake. Potentially, an area of the perimeter dike would be temporarily lowered to facilitate assembly of island modules and their launch into the lake. The altered area would be returned to pre-construction configuration post-construction. Surface material (nesting substrate) for the island would be obtained from a commercial quarry.

Impacts to vegetation would occur from a temporary access road across private pastureland and USFWS uplands, plus some impacts to vegetation on the dike that abuts Sheepy Lake. These temporary road routes would be tilled and re-seeded to reestablish vegetative ground cover. Similarly, the dike area disturbed due to construction activities would be reseeded with vegetation. Large-scale maintenance, though not anticipated, would have impacts on terrestrial vegetation similar to those described for construction.

(X) Organisms:

Sump 1B: Construction and implementation of the nesting areas will benefit Caspian terns and other colonial nesting species such as American white pelicans (*Pelecanus erythrorhynchos*) that occur in the Tule Lake and Lower Klamath NWR area by providing suitable nesting habitat. Wildlife resources using the refuges are not anticipated to be significantly impacted by the construction action. The construction schedule occurs in the July-August timeframe prior to the arrival of migrant species, i.e. waterfowl, which extensively use the refuge. Some disturbance impacts to terrestrial wildlife, i.e. black-tailed jack rabbit (*Lepus californicus*), would be expected to occur from construction traffic on the existing access roads and the quarry operation. Recreational and agricultural traffic already occurs on these roads with minimal impact to wildlife. The proposed action is not anticipated to result in additional disturbance at a level of concern. Habitat impacts are minimal and would not be expected to adversely affect terrestrial wildlife to a significant extent.

Orem's 1 Island: The proposed action would have little impact to terrestrial organisms. Only a few species, such as horned larks (*Eremophila alpestris*), will occupy the drawn down management unit during island construction. The temporary road crossing of the drainage ditch would affect a few individual small mammals, i.e. deer mice (*Peromyscus maniculatus*) and voles (*Cricetidae* family) and song birds, i.e. vesper sparrow (*Pooecetes gramineus*), rock wren (*Salpinctes obsoletus*), at most. The use of existing roads, an

existing quarry site and a commercial quarry for rip rap and surface rock preclude impacts to most wildlife species. Some temporary disturbance impacts to terrestrial wildlife would be expected to occur from construction traffic on the existing access roads. Recreational and agricultural traffic already occurs on these roads with minimal impact to wildlife.

Sheepy Lake Floating Island: A minimal impact to small terrestrial mammals, i.e. deer mice and voles, would be expected from this proposed action. Wildlife disturbance is principally limited to the access corridor across private pasturelands, a narrow stretch of upland habitat on USFWS lands and at the island assembly area for the floating island. Some disturbance impacts to terrestrial wildlife would be expected to occur from construction traffic on the existing public roads. Recreational and agricultural traffic already occurs on these roads with minimal impact to wildlife. Large-scale maintenance, though not anticipated, would have minimal impacts on terrestrial vegetation similar to those described for construction.

(X) Endangered or Threatened Species:

Shortnose suckers (*Chasmistes brevirostris*) and Lost River suckers (*Deltistes luxatus*) are federally-listed endangered species and can be found within the Klamath Basin (i.e. Tule Lake Sump 1A, Klamath River, and Upper Klamath Lake). A potential impact of the proposed action to the listed suckers is the predation on the suckers from an enhanced population of fish-eating birds, such as Caspian terns and American white pelicans, which may utilize the islands. The USFWS NWR and USACE have made a preliminary determination that the proposed action may affect, and is likely to adversely affect Lost River suckers and shortnose suckers and is currently preparing a Biological Assessment. The USFWS NWR and USACE have initiated formal consultation under Section 7 of the Endangered Species Act (ESA) with the Endangered Species branch of the USFWS. All avoidance and minimization measures as well as terms and conditions in the USFWS-issued Biological Opinion will be incorporated into the project design.

(X) Air Quality: The Klamath Basin is in attainment for federal standards of PM₁₀ and is unclassified for all other federal criteria pollutant standards. This includes the entire project footprint, which spans both Siskiyou and Modoc Counties, which are each managed by the Siskiyou County Air Pollution Control District and Modoc County Air Pollution Control District, respectively. Projects in an attainment area or in an unclassified area are not subject to any conformity analysis. Per the Siskiyou and Modoc County Air Pollution Control District conservation recommendations, gravel roads would be watered down to prevent fine particles from entering the atmosphere.

(X) Geology and Soils: A discussion on direct impacts to soils within the management units can be found in the for aquatic substrate section above. The local quarry sites have already been opened and borrow operations will remain within the previously disturbed footprint. Other than the minor construction impacts identified, no significant impacts to soils are expected.

(X) **Mineral Resources:** The proposed action will have no effect on mineral resources within the proposed project footprint.

(X) **Noise:** The proposed actions will take place from approximately 7:00 am to 5:00 pm Monday through Saturday. The proposed island sites are remote and have no immediate local residences with the exception of one private property owner at Sheepy Lake. As access through private property will be required at Sheepy Lake, the landowner will be coordinated with regarding construction activities. Construction noise will be a temporarily impact to refuge visitors at Tule Lake, but only in the immediate vicinity of the construction and only during the daytime work hours; noise impacts associated with construction methods will be of short duration. Traffic-related noise occurs within the refuges from recreational visitor use and will increase minimally and temporarily due to truck and construction equipment noise during transportation of materials, excavation, and construction of the islands and access roads.

(X) **Recreation:** The proposed action will temporarily impact refuge visitors due to noise and traffic, but the result of the action will beneficially impact recreation by providing increased opportunities for wildlife observation. Boating and fisheries activities would not be occurring at or near the proposed island locations because Sump 1B and Orems 1 units would be drawn down. Fishing is not allowed on Sheepy Lake. Lava Beds National Monument borders Sump 1B to the south and attracts visitors; the proposed nesting island for Sump 1B would create a new wildlife viewing opportunity thus beneficially impacting recreation at Lava Beds National Monument. Hunting does occur within Sump 1B, but the proposed island location occurs within a portion of Sump 1B that is not open to hunting, therefore, there would be no impacts to hunting in this area.

(X) **Land use classification:** The proposed activities are consistent with Tule Lake and Lower Klamath NWR objectives, which include: (1) maintain habitat for endangered, threatened and sensitive species; (2) provide and enhance habitat for fall and spring migrant waterfowl; (3) protect native habitats and wildlife representative of the natural biological diversity of the Klamath Basin; (4) integrate the maintenance of productive wetland habitats and sustainable agriculture; (5) ensure that the refuge agricultural practices conform to the principles of integrated pest management; and (6) provide high quality wildlife-dependent visitor services (USFWS website <http://www.fws.gov/klamathbasinrefuges/tulelake/tulelake.html>.)

(X) **Transportation and traffic:** The Corps will implement measures to ensure safe movement of traffic during the construction period. The following measures or similar measures will be applied at the proposed construction sites.

Sump 1B: Closure or modified traffic patterns on some local roads may occur during construction; this may temporarily prevent or disrupt recreational (wildlife observers) traffic. The use of flaggers and reduced speed through the area would most-likely be implemented. The access road to and parking lot at the Visitor Kiosk will be closed during construction as the area will be used for equipment staging and project access.

Orems 1 Island: Existing refuge roads are adequate to handle agricultural truck traffic. The addition of truck traffic associated with island construction would primarily occur during surface and rip rap rock stockpiling operations. Visitor use to this portion of the refuge is somewhat limited as the area is not a designated auto tour route. Traffic regulation, if it should occur, would probably be limited to the area where an interior refuge road and the temporary construction access road intersect. Signage would most likely be the traffic management measure at this location.

Sheepy Lake Island: Construction traffic for hauling materials and supplies to this location would primarily occur on existing public roads. Closure and/or modified traffic patterns would not be required to handle construction-related traffic. Large-scale maintenance, though not anticipated, would have impacts on terrestrial vegetation similar to those described for construction.

() **Navigation: N/A**

(X) **Prime and unique farmland:** The Orems1 island location is within a wetland management unit that has been converted back to wetlands from farmland. There would be no impacts to prime and unique farmland at any of the proposed sites.

(X) **Aesthetics/visual impact:**

Sump 1B: The proposed activities will result in additional bird observing opportunities for refuge visitors. Colonial nesting birds will be within viewing distance of the existing kiosk, thus there may be an increase in future visitor use, although it would likely be small given the tremendous resource base currently present on the refuge. The source of island fill for the proposed island in Sump 1B is a mound that exists on the water body's shoreline. The mound is considered visually unpleasing by the USFWS and Lava Beds National Monument, and its partial removal for island construction would therefore be an aesthetics beneficial impact. Other borrow sites were previously disturbed and the proposed action will not enlarge these sites or materially degrade them, thus there will be no net change in the landscape.

Orems 1 Island: This island is situated in the central portion of a 617-acre seasonal wetland management unit, approximately 4,300 feet from the most likely access road for wildlife observers. It is unlikely that colonial bird use of the site would attract additional visitors to the location given its location in a distant part of the refuge and distance from the road. No adverse impacts to aesthetics or the visual landscape would be expected. Other wetland management units in the Lower Klamath NWR support islands covered with vegetation that is consistent with the general setting. While Orems 1 Island will not be vegetated, it will blend into the mix of habitats in this seasonal wetland.

Sheepy Lake Island: The location of the floating island in Sheepy Lake is distant from any public roads and is also screened from view by tule marshes. The profile of the island is very low on the water. We anticipate minimal change to visual or aesthetic

values from the floating island. The aesthetic and visual characteristics of the island will be consistent with the general setting.

() **Public facilities, utilities and services: N/A**

() **Public health and safety: N/A**

() **Hazardous and toxic materials: N/A**

(X) **Energy consumption or generation:** The proposed actions have been designed so that the project consumes a minimal amount of energy. Fill material would be removed from quarry sites within the refuges and from the local area in order to reduce the amount of energy expended for transportation purposes.

(X) **Historic monuments, parks, national seashores, wild and scenic rivers, wilderness area, research sites, etc:** Details of the proposed activities have been coordinated with Lava Beds National Monument, which shares a border with Tule Lake NWR.

(X) **Archaeological site:** The project has been designed in consideration of avoiding impacts to sites currently listed and eligible to be listed on the National Register of Historic Places. Pre-construction field and record cultural resource surveys have been completed by the Heritage Stewardship Group, USDA Forest Service for the project footprint, including the proposed access roads, borrow sites, island locations, and staging areas. Their results and recommendations, based on the report "Tern Nesting Island Cultural Resources Study, Tule Lake, California" (USFS 2009) were provided to the California State Historic Preservation Office. The potential impact areas are not listed or are eligible for listing on the National Register of Historic Places. Such sites are adjacent to the proposed impacted sites; therefore, a cultural resource monitor will be on site during construction to further ensure compliance with applicable rules and regulations.

(X) **Socio-economic:** The proposed actions would not result in any foreseeable socio-economic significant negative impacts and possibly minimally beneficial impacts. The addition of the new habitat may attract more refuge visitors, thus bringing in more revenue into the community.

(X) **Environmental Justice:** The proposed action will not affect environmental justice. All work is being conducted within federal refuge lands.

(X) **Growth inducing impacts - community growth, regional growth:** The proposed actions may attract more wildlife observers., The project would be conducted concurrently with other habitat enhancement projects at the refuge that may also attract more wildlife observers, so the independent USACE-proposed actions would not have a significant impact on community and regional growth.

(X) **Conflict with land use plans, policies or controls:** The proposed actions support the refuge objectives for land use policy, such as providing and enhancing habitat for fall and spring migrant waterfowl. Enhancing habitat for colonial nesting waterbirds is a

primary purpose of both NWRs; this project will increase the capacity of the refuge to fulfill that purpose.

() **Other anticipated changes to non-jurisdictional areas that have been determined to be within the Corps' NEPA scope of analysis: N/A**

(X) **Irreversible changes, irretrievable commitment of resources:** The proposed islands may be removed if necessary, but commitment of resources would be irretrievable. Staging areas and access roads are temporary fixtures. The floating island may be removed as well.

(X) **Other Cumulative effects not related to the proposed action:**

1. Occurred on-site historically

Tule Lake NWR- Sump 1B: Tule Lake NWR, established in 1928, is surrounded by 17,000 acres of intensively farmed lands. The refuge and surrounding private agricultural lands occupy the historic lake bed of Tule Lake, a 95,000 acre lake and marsh area that was reclaimed in the early 1900's as part of the Klamath Reclamation Project.

Lower Klamath NWR- Orem's 1 and Sheepy Lake: Lower Klamath NWR represents the remnants of historic 80,000 acre Lower Klamath Lake. The area was established as our nation's first waterfowl refuge via Executive Order 924, dated August 8, 1908, and is managed to achieve the purposes of this Executive Order ("... as a preserve and breeding ground for native birds").

2. Likely to occur within the foreseeable future

Sump 1B: Current management of the refuge is directed by the Kuchel Act of 1964 which mandates the refuge be managed for the major purpose of waterfowl management but with optimal agricultural use that is consistent therewith. During winter, water within the sumps is comprised primarily of local runoff and during summer water is comprised primarily of irrigation return flows, originating from Upper Klamath Lake.

Lower Klamath NWR- Orem's 1 and Sheepy Lake: The Kuchel Act (Public Law 88-567), dated September 2, 1964 declared that lands within LKNWR were "dedicated to the major purpose of waterfowl management, but with full consideration to optimum agricultural use that is consistent therewith." These legislated purposes have been focused into a series of current and foreseeable future refuge goals (see "Land Use Classification" in the Impacts Assessment section above).

3. Contextual relationship between the proposed action and (1) and (2) above

The proposed actions at Sump 1B, Orem's 1 and Sheepy Lake are consistent with the management strategies as described in (2) above, such that the proposed islands would not affect how the water is directed for irrigation of agriculture and waterfowl management, plus, the proposed islands would complement the waterfowl management objectives by creating additional nesting habitat.

6.0 SUMMARY OF INDIRECT AND CUMMULATIVE EFFECTS

6.1 Indirect Effects

The Programmatic FEIS (USFWS 2005) in which this EA is tiered outlines guidance on the management of the current Caspian tern nesting habitat on East Sand Island in the CRE in relation to the current effort to create new Caspian tern habitat in other watersheds within the terns' historical range. Per the FEIS, habitat creation (at new sites) and reduction of habitat on East Sand Island would be phased in at a 2:1 ratio. Therefore, the proposed actions would create 3.5-4 acres of new Caspian tern nesting habitat, and 1.75-2 acres of nesting habitat would no longer be managed for Caspian tern nesting (i.e. allow islands to revegetate) on East Sand Island in the CRE. The reduction in habitat at East Sand Island is not contingent upon Caspian terns occupying the replacement nesting sites. Analyses of the effects of these actions, which are considered indirect effects of the proposed actions in this EA, are described in sections 6.1.1-6.1.5 below.

6.1.1 Caspian Terns. Based on the range of known nesting densities in the CRE, the tern colony on East Sand Island is expected to decrease to approximately 2,500 to 3,125 breeding pairs when nesting habitat is reduced to approximately 1 to 1.5 acres. Terns displaced from East Sand Island would most likely find replacement nesting sites throughout Southern Oregon and Northern California (see Table 1.1) per the Programmatic FEIS (USFWS 2005). Caspian terns were historically a species of ephemeral habitats and thus are very adept at locating alternative nesting sites. The reduction of tern nesting habitat at East Sand Island and development of alternative habitat elsewhere in the western region plays on the species mobility and adeptness in locating alternative nesting sites. Displaced terns may experience an initial decrease in productivity compared to that observed on East Sand Island because birds may be lost or may have trouble locating the nesting habitat. Caspian tern life history is well-suited to fluctuating levels of reproductive success. Ultimately, we expect the regional population trend to stabilize.

6.1.2 Fishes. The lack of vegetation management on East Sand Island would result in a decreased tern nesting colony, causing Caspian terns to seek new nesting habitat elsewhere. The reduction in numbers of terns breeding in the CRE would substantially reduce non-listed juvenile salmonid consumption levels by Caspian terns. Consumption of various marine fishes in the estuary (e.g., northern anchovy, sardines, herring, smelt) by Caspian terns would also substantially reduce with implementation of this project (i.e. with a smaller colony of Caspian terns in the CRE).

6.1.3 Endangered and Threatened Species. Based on the NMFS report (NMFS 2004; USFWS 2005), population growth rate increases for four steelhead ESUs could occur within one generation (4 to 5 years). A reduction in size of the tern colony is expected to occur by 2010. Thus, the initial benefits to ESA-listed salmonids could be seen as early as 2014.

The smaller nesting tern colony on East Sand Island will not affect roosting brown pelicans which primarily occur along the shorelines or on the beaches of the island.

6.1.4 Other Birds. Adverse effects to other bird species found on East Sand Island are not expected. Nesting gulls would benefit from the increase vegetated nesting area. Songbirds would benefit from the development of densely vegetated habitat.

6.1.5 Socioeconomic Effects. Consumption of juvenile salmonids by terns would decrease substantially under this alternative, potentially resulting in beneficial effects to commercial and recreational salmonid fisheries if reduction of tern predation aids salmon recovery in the Columbia River Basin.

6.2 Cumulative Effects

Lower Klamath and Tule Lake NWRs under Executive Orders 924 and 4975, respectively, have been managed “as a preserve and breeding ground for wild birds and animals” since 1908 and 1928, respectively. Management activities include: (1) management of water surface elevations and water control infrastructure to support over 40,000 acres of wetland habitats; (2) monitoring wildlife and fish populations; (3) habitat creation and enhancement projects; (4) and managing of a large agricultural program for the benefit of migratory birds.

In consideration of the above and due to the large scale of habitat and agricultural management activities that have occurred over several decades on the refuges, the proposed activities will have a beneficial impact on the physical and biological environment based on the scope of cumulative effects. By restoring the nearly extirpated avian population of island nesting waterbirds, the project will result in positive cumulative effects to the wetland ecosystems of the upper Klamath Basin.

7.0 ENVIRONMENTAL COMPLIANCE

Statute	Status of Compliance
National Environmental Policy Act (NEPA) of 1969 (42 USC 4341 <i>et seq</i>) Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR 1500-1508) dated July 1986	This EA has been prepared for continuing compliance with NEPA and is tiered from the Programmatic FEIS (USFWS 2005) and ROD (USACE 2006). All agency and public comments will be considered and evaluated. If appropriate, a FONSI will be signed with a conclusion of no significant impacts from this proposed action.
Clean Air Act (42 USC 7401 <i>et seq</i>)	In coordination with the Siskiyou Air Quality Control Board, it has been determined that the proposed action does not require a Clean Air Act conformity analysis based on the limited emissions associated with the activities. Conservation recommendations, such as dust abatement, will be utilized during the activity.
Clean Water Act of 1972 (33 USC 1251 <i>et seq</i>) Rivers and Harbors Act of 1899 (33 USC 403) Executive Order 11990, Protection of Wetlands, (42 FR 26961, 1977)	A Notice of Intent to Comply with the Terms of the General Water Quality Certification Order for Small Habitat Restoration Projects was filed with the North Coast California regional Water Quality Control Board. This document serves as compliance of the 404(b)(1) Guidelines. NA The proposed action would occur within 86,000 acres of managed wetlands. The proposed action, which has been designed to restore natural geomorphic characteristics to the wetlands, would impact approximately 3.5 acres. The ratio of impacted wetlands to the size of the total wetlands is minimal.
National Oceanic and Atmospheric Administration Federal Consistency Regulation (15 CFR 930) Coastal Zone Management Act of 1972, 16 USC 1451 <i>et seq</i> California Coastal Act of 1976	NA: Project does not occur within coastal zone jurisdiction. NA NA
Endangered Species Act of 1973 (16 USC 1531, as amended)	An inventory of listed and proposed endangered and threatened species and candidate species that may occur in the project area was requested from the U.S. Fish and Wildlife Service (USFWS). These inventories are provided in Appendix C. The USFWS NWR and USACE have made a preliminary

<p>Fish and Wildlife Coordination Act (16 USC 661-666c)</p> <p>Magnuson-Stevens Fishery Conservation and Management Act Fishery Conservation Amendments of 1996, (16 USC 1801 <i>et seq</i>) – Essential Fish Habitat (EFH)</p> <p>Migratory Bird Treaty Act (16 USC 703-711)</p> <p>Marine Mammal Protection Act (16 USC 1361 <i>et seq</i>)</p> <p>National Marine Sanctuaries Act (16 USC 1431 <i>et seq</i>)</p> <p>Marine Protection Research and Sanctuaries Act of 1972 (33 USC 1401 <i>et seq</i>) Or Ocean Dumping Ban Act of 1988 (Public Law 100-688; § 2030)</p>	<p>determination that the proposed action may affect, and is likely to adversely affect Lost River suckers and shortnose suckers and is currently preparing a Biological Assessment. The USFWS NWR and USACE have initiated formal consultation under Section 7 of the Endangered Species Act (ESA) with the Endangered Species branch of the USFWS. All avoidance and minimization measures as well as terms and conditions in the USFWS-issued Biological Opinion will be incorporated into the project design.</p> <p>The proposed action has been coordinated with the USFWS in compliance with this Act. The USFWS have been involved with project planning and will be in charge of future maintenance and monitoring activities.</p> <p>There are no fish species covered by Fisheries Management Plans within the project action area. The Upper Klamath River Hydrologic Unit, which contains EFH for Chinook and coho salmon, terminates at the Iron Gate Dam, which is downstream of the project area.</p> <p>This project will have a net benefit for migratory birds by creating up to four new acres of habitat for breeding and nesting.</p> <p>NA.</p> <p>NA</p> <p>NA</p>
<p>National Historic Preservation Act (16 USC 470 and 36 CFR 800): Protection of Historic Properties</p> <p>Executive Order 11593: Protection and Enhancement of the Cultural</p>	<p>Pre-construction field and record cultural resource surveys have been completed by the Heritage Stewardship Group, USDA Forest Service for the project footprint. Their results and recommendations, based on the report "Tern Nesting Island Cultural Resources Study, Tule Lake, California" (USFS 2009) were provided to the California State Historic Preservation Office. The potential impact areas are not listed or are eligible for listing on the National Register of Historic Places. Such sites are adjacent to the proposed impacted sites; therefore, a cultural resource monitor will be on site during construction to further ensure compliance with applicable rules and regulations</p> <p>See NHPA above</p>

<p>Environment</p>	
<p>Archaeological and Historic Preservation Act of 1974, (16 USC 469 <i>et seq</i>)</p>	<p>See NHPA above.</p>
<p>Abandoned Shipwreck Act of 1987, (43 USC 2101 <i>et seq</i>)</p>	<p>None occur on site.</p>
<p>Submerged Lands Act, (Public Law 82-3167; 43 USC 1301 <i>et seq</i>)</p>	<p>None occur on site.</p>

8.0 AGENCIES CONSULTED AND PUBLIC NOTIFICATION

The notification process includes mailing a project notice to agencies and other stakeholders regarding the availability of this EA; the EA will be posted on the USACE webpage for public access. A notification of the availability will be published in the regional newspaper, *Klamath Falls Herald and News*, as well. The following agencies are listed as placeholders; a summary of the comments will be entered after the comment period has ended. A complete list of notified agencies is located in Appendix A.

A. Federal agencies:

- 1) U.S. Fish and Wildlife Service
- 2) National Park Service, Lava Beds National Monument & Crater Lake National Park
- 3) National Marine Fisheries Service
- 4) United States Forest Service
- 5) EPA

B. State and local agencies:

- 6) State Historic Preservation Officer
- 7) North Coast Regional Water Quality Control Board Region
- 8) Siskiyou County Air Quality Control Board
- 9) Modoc County Air Quality Control Board
- 10) Oregon Department of Forestry
- 11) Oregon Department of Fisheries & Wildlife

9.0 MITIGATION MEASURES

Biological Measures. Islands are to be constructed in locations that are unoccupied by suckers (Lower Klamath NWR) or only minimally in the case of Sump 1B on Tule Lake NWR. An extensive Caspian tern monitoring program, including diet composition, will be conducted at the three proposed sites. For details of the monitoring program, please see “Post-Construction Monitoring” section 3.5 of this document. Take of listed species will be determined to the extent practicable in order to ensure that it does not exceed what is estimated in the Biological Assessment and Biological Opinion. All avoidance and/or minimization measures in the Biological Opinion will be incorporated into the project design.

Erosion Control Measures- Sump 1B and Orems 1 Islands. Geotextile filter fabric would encapsulate the island fill used to form the island core. The geotextile fabric would prevent subsidence of the fill into the underlying native substrate, prevent erosion of the core material through the rip rap and prevent the nesting substrate from sifting downward into the core material. A two-foot layer of rip rap would be placed on the windward (northwest) side to afford additional protection from wind-generated waves. Elsewhere along the island shoreline, a one-foot layer of rip rap would be placed to protect the island slopes.

Geotextile fabric will also be placed on the access road to each island during construction to prevent pumping of sediments due to truck traffic.

Turbidity Measures. Construction of the Oremis 1 and Sump 1B islands will occur when the basins have been drained or dry up to avoid impacts of construction on turbidity levels in the water bodies.

Dust Control. Water trucks will water down all gravel roads used to transport materials to project sites in order to decrease the amount of fine matter particulates entering the air.

Vegetation Restoration Measures. A temporary road used to acquire borrow material for Sump 1B island would be established across a vegetated flat at one area to access a rip rap source; approximately 0.4 acres of vegetation would be impacted. These temporary roads would be removed post-construction and re-seeded.

The only impact to vegetation at Sheepy Lake would occur from a temporary access road across private pastureland and USFWS uplands, plus some impacts to vegetation on the dike that abuts Sheepy Lake. These temporary road routes would be tilled and re-seeded to reestablish vegetative ground cover. Similarly, the dike area disturbed due to construction activities would be reseeded with vegetation.

10.0 DETERMINATION AND STATEMENT OF FINDINGS

A Finding of no Significant Impact (FONSI) (33 CFR Part 325) is anticipated. The FONSI will be prepared after agency and stakeholder comments to this Environmental Assessment. A draft FONSI is attached.

11.0 LITERATURE CITED

- Anderson, S.K., D.D. Roby, D.E. Lyons, and K. Collis. 2007. Relationship of Caspian tern foraging ecology to nesting success in the Columbia River Estuary, Oregon, USA. *Estuarine, Coastal and Shelf Science* 73: 447-456.
- Collis, K., D.D. Roby, C. Couch, G. Dorsey, K. Fischer, D.E. Lyons, A.M. Myers, S.K. Nelson, J.Y. Adkins, A. Evans, and M. Hawbecker. 2006a. Piscivorous Waterbird Research on the Columbia River. FINAL 2004 Season Summary for Bonneville Power Administration and U.S. Army Corps of Engineers. <http://www.columbiabirdresearch.org/>
- Collis, K., D.D. Roby, D. E. Lyons, Y. Suzuki, J. Y. Adkins, L. Reinalda, C. Hand, N. Hostetter, A. Evans, and M. Hawbecker. 2006b. Research, Monitoring, and Evaluation of Avian Predation on Salmonid Smolts in the Lower and Mid-Columbia River. DRAFT 2006 Season Summary for Bonneville Power Administration and U.S. Army Corps of Engineers. <http://www.columbiabirdresearch.org/>
- Bird Research Northwest. 2008. Unpublished data provided to Portland District, U.S. Army Corps of Engineers. W9127N-08-2-0001, Cooperative Agreement for Avian Predation Research.
- Bird Research Northwest. 2009. Unpublished data provided to Portland District, U.S. Army Corps of Engineers. W9127N-08-2-0001, Cooperative Agreement for Avian Predation Research.
- Floating Island International (FII). 2009. www.floatingislandinternational.com.
- Gill, R.E. 1976. Notes on the foraging of nesting Caspian terns *Hydroprogne caspia* (Pallas). *California Fish and Game* 62, 155.
- Hicks, L.A., D.M. Mauser, J. Beckstrand, and D. Thomson. 1999. Ecology of shortnose and Lost River suckers in Tule Lake National Wildlife Refuge, California, Progress Report, April - November 1999.
- Lyons, D.E., D. Roby, and K. Collis. 2005. Foraging Ecology of Caspian terns in the Columbia River Estuary, USA. *Waterbirds* 28 (3): 280-291.
- NMFS. 2004. Caspian tern predation on juvenile salmonid out migrants in the Columbia River estuary. Northwest Fisheries Science Center, NMFS/NOAA, Seattle, WA, 31 pages.
- NMFS. 2006. Endangered Species Act – Section 7 Consultation Biological Opinion and Magnuson-Stevens Conservation and Management Act Essential Fish Habitat Consultation for the Caspian Tern Management to Reduce Predation of Juvenile

Salmonids in the Columbia River Estuary. National Marine Fisheries Service, Northwest Region, February 16, 2006.

Seto, N., J. Dillon, W.D. Shuford, and T. Zimmerman. 2003. A review of Caspian tern (*Sterna caspia*) nesting habitat: A feasibility assessment of management opportunities in the U.S. Fish and Wildlife Service Pacific Region. U.S. Department of Interior, Fish and Wildlife Service, Portland, OR.

Shufford, W.D., D.L. Thomson, D.M. Mauser, and J. Beckstrand. 2006. Abundance and Distribution of Nongame Waterbirds in the Klamath Basin of Oregon and California from Comprehensive Surveys in 2003 and 2004. August 2006. Final Report to: U.S. Fish and Wildlife Service Klamath Basin National Wildlife Refuge Complex.

USACE. 2006. Record of Decision (ROD). Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary. Northwestern Division, November 22, 2006.

USACE. 2007. Final Environmental Assessment Caspian Tern Nesting Island Construction Project Fern Ridge Lake Willamette Valley Projects Lane County, Oregon. Portland District, November 26, 2007.

United States Forest Service (USFS). 2009. Tern Nesting Island Cultural Resources Study, Tule Lake, California. Heritage Stewardship Group, USDA Forest Service (Enterprise Unit), Bend, Oregon.

United States Fish and Wildlife Service (USFWS). January 2005. Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary. Final Environmental Impact Statement. Portland, Oregon.

USFWS 2008. Don Edwards San Francisco Bay National Wildlife Refuge website. <http://www.fws.gov/desfbay/>

United States Geologic Survey (USGS). 2006. An Evaluation and Review of Water-Use Estimates and Flow Data for the Lower Klamath and Tule Lake National Wildlife Refuges, Oregon and California. U.S. Geologic Survey Scientific Investigations Report 2006–5036, prepared in cooperation with the US Bureau of Reclamation. <http://pubs.usgs.gov/sir/2006/5036/>

Weddell, B. J., K. L. Gray, and J. D. Foster. 1998. History and Ecology of Lower Klamath, Tule Lake, Upper Klamath, and Klamath Forest National Wildlife Refuges, Oregon and California, Report to U.S. Fish and Wildlife Service, Klamath Basin National Wildlife Refuge, Tulelake, Ca. 207 pp

PERSONAL COMMUNICATION

Dan Roby, USGS/Oregon State University: meeting at USWFS

DRAFT Finding Of No Significant Impact (FONSI)
Environmental Assessment
Caspian Tern Nesting Island Construction Project
Tule Lake And Lower Klamath National Wildlife Refuges
April 2009

I. Action. The action is construction of islands to provide nesting habitat for Caspian terns. In conjunction with social facilitation measures, this action is intended to reduce the number of Caspian terns nesting in the Columbia River Estuary, thereby reducing their predation on Endangered Species Act-listed juvenile salmonids. The project involves constructing: one two-acre island within a wetland management unit, Sump 1B, by importing local quarry material; one one-acre island that will utilize sediments excavated from the lakebed of a wetland management unit, Orem's 1; and deploying a prefabricated floating island into a managed lake, Sheepy Lake. This project is described in the Environmental Assessment for the Caspian Tern Nesting Island Construction Project, Tule Lake And Lower Klamath National Wildlife Refuges, Klamath Basin National Wildlife Refuge Complex, Siskiyou County, California And Klamath County, Oregon, which is incorporated herein (Attachment A).

II. Additional References. (1) *Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary* Final Environmental Impact Statement (USFWS et al. 2006); (2) *Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary* Record of Decision (ROD) (USACE 2006); (3) Endangered Species Act – Section 7 Consultation Biological Opinion and Magnuson-Stevens Conservation and Management Act Essential Fish Habitat Consultation for the *Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary* (NMFS 2006).

III. Factors Considered. Factors considered for this FONSI are impacts on air and water quality, fish and wildlife, endangered/threatened species, cultural resources, aquatic resources, and aesthetics. In addition, indirect and cumulative impacts were addressed in the attached Environmental Assessment for this action.

IV. Conclusion. Based on the information obtained in the preparation of the Environmental Assessment for this proposal, the habitat restoration measures identified in the document, and the associated permits, it is concluded the proposed action will not have a significant impact on the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required.

Date

Laurence T. Farrell
Lieutenant Colonel, U.S. Army
Commanding

APPENDIX A: AGENCY AND PUBLIC COMMENTS AND RESPONSES

1.0 MAILING LISTS

The following table contains a list of public agencies notified of the availability of this Environmental Assessment.

Agency	Date Notified
Crater Lake National Park	<p data-bbox="829 930 1377 1066">Mailing sent out on April 27, 2009. Phone calls were made on April 28, 2009. Notification in regional newspaper was published ~April 29/30, 2009.</p>
Klamath Basin Water Users	
ODFW	
UWFWS Eastside Federal Complex	
Modoc County	
Winemas National Forest	
Modoc NWR	
Siskiyou County	
Tulelake Irrigation District	
Siskiyou County Commission	
Tulelake Chamber of Commerce	
Klamath County Commission	
City of Klamath Falls	
US Fish and Wildlife, Region 8	
Lava Beds National Monument	
Oregon Natural Resource Council	
National Wildlife Refuge Association	
USDI - Office of Solicitor	
Klamath Forest Alliance	
USGS-Forest & Rangeland Ecosystems	
USFS - Fremont-Winema NF	
National Marine Fisheries Service	
EPA	
Siskiyou County Air Quality Control Board	
Modoc County Air Quality Control Board	
North Coast Regional Water Quality Control Board Region	

APPENDIX B: SPECIES LIST



United States Department of the Interior

FISH AND WILDLIFE SERVICE
 Klamath Falls Fish and Wildlife Office
 1936 California Ave
 Klamath Falls, Oregon 97601
 (541) 885-8481 FAX (541) 885-7837
kfalls@fws.gov

**LISTED, PROPOSED, AND CANDIDATE SPECIES THAT
 MAY OCCUR IN SISKIYOU COUNTY, CALIFORNIA**

Status: Endangered

Phylum	Common Name	Scientific Name	Critical Habitat
Fish	Lost River sucker	<i>Deltistes luxatus</i>	Proposed
Fish	Shortnose sucker	<i>Chasmistes brevirostris</i>	Proposed
Invertebrate	Shasta crayfish	<i>Pacifistacus fortis</i>	
Plant	Yreka phlox	<i>Phlox hirsute</i>	
Plant	Greene's tuctoria	<i>Tuctoria greenei</i>	Designated
Plant	Gentner's fritillary	<i>Fritillaria gentneri</i>	Designated

Status: Threatened

Phylum	Common Name	Scientific Name	Critical Habitat
Amphibian	California red-legged frog	<i>Rana aurora draytonii</i>	Designated
Bird	Northern spotted owl	<i>Strix occidentalis caurina</i>	Designated
Plant	Slender Orcutt grass	<i>Orcuttia tenuis</i>	Designated

Status: Candidate

Phylum	Common Name	Scientific Name
Mammal	Fisher	<i>Martes pennanti</i>
Amphibian	Oregon spotted frog	<i>Rana pretiosa</i>
Bird	Yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>
Invertebrate	Mardon skipper butterfly	<i>Polites mardon</i>

September 18, 2008

Source: http://www.fws.gov/klamathfallsfwo/es/species_list/Siskiyou%20County%20Species%20List.pdf

APPENDIX C: TABLE: ALTERNATIVES NOT BEING CONSIDERED

Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary Final EIS

TABLE G.4. Sites eliminated from consideration for Caspian Tern Management under Alternatives C and D. Sites are listed in geographical order from north to south.

SITE NAME	REASON FOR ELIMINATION FROM CONSIDERATION
WASHINGTON	
Commencement Bay	Loss of site due to environmental clean-up activities
Padilla Bay	WDFW does not support site development
Jetty Island	WDFW does not support site development
Grays Harbor (4 islands) ^a	WDFW does not support site development
Willapa Bay	Loss of site due to natural erosion
Banks Reservoir (3 islands)	Some nesting terns from this colony forage in the Columbia River, and thus, management of this site for Caspian terns does not support the reduction of tern predation on Columbia River salmon
Potholes Reservoir (2 islands)	Some nesting terns from this colony forage in the Columbia River, and thus, management of this site for Caspian terns does not support the reduction of tern predation on Columbia River salmon
Sprague Lake	Some nesting terns from this colony forage in the Columbia River, and thus, management of this site for Caspian terns does not support the reduction of tern predation on Columbia River salmon
Crescent Island	Location in the Columbia River, and thus, management of this site for Caspian terns does not support the reduction of tern predation on Columbia River salmon
Threemile Canyon Island	Location in the Columbia River, and thus, management of this site for Caspian terns does not support the reduction of tern predation on Columbia River salmon
Miller Rocks	Location in the Columbia River, and thus, management of this site for Caspian terns does not support the reduction of tern predation on Columbia River salmon
OREGON	
Rice Island	Location in the Columbia River, does not support reduction of tern predation on Columbia River salmon
Miller Sands Spit	Location in the Columbia River, does not support reduction of tern predation on Columbia River salmon
Coos Bay	ODFW does not support site development
Umpqua Estuary	ODFW does not support site development
CALIFORNIA	
Humboldt Bay NWR ^a	CDFG and Service California/Nevada Office does not support site development
Knight Island, San Francisco Bay ^a	Loss of nesting area to tidal restoration project by CDFG
Bair Island, San Francisco Bay	Loss of nesting area and restoration not feasible
Turk Island, San Francisco Bay	Loss of nesting area, restoration not feasible
Baumberg Tract, San Francisco Bay	Nesting habitat currently maximized, habitat enhancement not feasible
Alviso (Pond A7), San Francisco Bay ^a	Nesting habitat currently maximized and concerns associated contaminant issues
Moss Landing salt ponds, Monterey Bay	Loss of site
Salinas River NWR	Conflict with the western snowy plover
Elkhorn Slough Ecological Reserve ^a	Nesting habitat is not maximized, no habitat enhancement necessary
Pier 400, Terminal Island	Nesting habitat currently maximized, habitat enhancement not feasible
Clear Lake NWR	Nesting habitat is not lacking

Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary Final EIS

TABLE G.4. Sites eliminated from consideration for Caspian Tern Management under Alternatives C and D. Sites are listed in geographical order from north to south.

SITE NAME	REASON FOR ELIMINATION FROM CONSIDERATION
CALIFORNIA (continued)	
Lower Klamath NWR	Loss of site; extremely small historic nesting colony (15-27 pairs), last nested in 1976
Tule Lake NWR	Loss of site; small historic nesting colony (3-80 pairs), last nested in 1962
Mono Lake	Extremely small nesting colony (6 -8 nesting pairs)
Lemoore NAS sewer ponds	Extremely small nesting colony (0-20 nesting pairs)
Yolo Bypass Wildlife Area	CDFG does not support site development
City of Davis Wetlands	CDFG does not support site development
Westlake Farms South Evaporation Basin	Extremely small nesting colony (0 -3 nesting pairs)
Tulare lakebed	Extremely small nesting colony (0 -20 nesting pairs)
South Wilbur Flood Area	Extremely small nesting colony (0-70 nesting pairs)
Tulare Lake Drainage District	Extremely small nesting colony (0-1 nesting pairs)
Tulare Lake Drainage District	Extremely small nesting colony (0-40 nesting pairs)
Lake Elsinore	Extremely small nesting colony (0 -14 nesting pairs); high potential for human disturbance
Salton Sea	Uncertainty of long term water management and prey availability due to potential water transfer from Imperial Irrigation District to San Diego
IDAHO	
Mormon Reservoir	Availability of nesting habitat varies from year to year because of reservoir water levels; large distance from East Sand Island colony
Magic Reservoir	Availability of nesting habitat varies from year to year because of reservoir water levels; large distance from East Sand Island colony
Blackfoot Reservoir	Availability of nesting habitat varies from year to year because of reservoir water levels; large distance from East Sand Island colony
Minidoka NWR	Lack of nesting habitat; large distance from East Sand Island colony
Deer Flat NWR (Snake River Island)	Lack of nesting habitat; large distance from East Sand Island
Bear Lake NWR	Lack of nesting habitat; large distance from East Sand Island
NEVADA	
Carson Sink	Nesting habitat only available during high water/flood years
Anaho Island NWR	Lack of prey base
Stillwater Point Reservoir	Nesting habitat only available during high water/flood years

* Sites ranked "high" for potential Caspian tern management sites in Feasibility Study (Seto et al. 2003)

APPENDIX D: KLAMATH BASIN MAP

