

---

## **CHAPTER IV D**

### *Colusa National Wildlife Refuge Alternative Plans*



---

*U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
MID-PACIFIC REGION*

## CHAPTER IV D

### COLUSA NATIONAL WILDLIFE REFUGE

Colusa National Wildlife Refuge (Refuge) was established in 1944 under the Lea Act, which authorized and appropriated funds for the purchase of land for migratory waterfowl refuges in the Sacramento Valley. Additional land was acquired in 1949 and 1952 with Migratory Bird Hunting Stamp Act funds. The Refuge covers 4042 acres and is located about one-half mile southwest of Colusa in Colusa County. The Refuge is bordered on the north by State Highway 20 and on the south by Ware Road. The Refuge provides wintering and resting areas for ducks and geese, and reduces waterfowl damage to crops on neighboring farms. The Refuge is part of a group of refuges located in the Colusa Basin, as discussed in Chapter IV B.

The Refuge consists of permanent ponds, seasonal marshes, millet and moist soil fields, and upland areas. A portion of the crops remain in the field to serve as food for waterfowl. The wetlands support sources of waterfowl food such as swamp timothy and invertebrate populations. The upland areas of the Refuge provide habitat for geese, upland birds, and other wildlife species. The amount of land used for fields, ponds, and upland uses varies each year depending upon the amount of water available.

#### A. WATER RESOURCES

The Refuge has no firm water supply and receives surplus runoff flows from the Reclamation District 2047 Drain, and surplus Central Valley Project (CVP) water through Glenn-Colusa Irrigation District (GCID) facilities.

##### 1. Surface Waters

The Refuge obtains most of its water from the Reclamation District 2047 Drain. As discussed in Chapter IV C, most of the water in the 2047 Drain during the irrigation season is from agricultural return flows which are of poorer quality than CVP water, but acceptable for refuge use. The 2047 Drain also transports storm water runoff. The Refuge has one appropriative right for diversion from the 2047 Drain under License 4197. However, due to prior appropriations, water is generally not available for the Refuge during July and August from the 2047 Drain. The Refuge also receives agricultural return flows from fields outside of the Refuge through the "J" Drain.

The Refuge receives surplus CVP water from the Sacramento River via the Tehama-Colusa Canal (TCC). Water from the TCC flows into the Williams Outlet which conveys water to the GCID Main Canal. Water flows from the GCID Main Canal through Fresh Water Creek to the Refuge (USBR, 1986a).

As discussed in Chapter IV B, GCID conveys CVP water or provides GCID water through exchange agreements with the CVP to the Colusa Basin refuges. A portion of the water supplied by GCID is from agricultural return flows. Under Contract 14-06-200-8181A and Contract 14-06-0001-78021 with Reclamation, GCID conveys a maximum of 25,000 acre-feet to the Refuge. The quality of the water delivered by GCID appears to be suitable for refuge irrigation under most conditions.

Additional water may be obtained from GCID Powell Slough or the 2047 Drain. Use of wastewater effluent from the Colusa wastewater treatment plant has been suggested for use as a supplemental water supply. However, the total amount of available water is less than 1,000 acre-feet per year and may not be available during the irrigation season due to previous contracts.

For the purpose of this analysis, it was assumed that winter water would be provided to the TCC from the Sacramento River through the Red Bluff Diversion Dam or surplus water would be available in the winter from Black Butte Reservoir, as discussed in Chapter IV B. Winter water also could be provided from the 2047 Drain.

## 2. Water Conveyance Facilities

Approximately 60 percent of the Refuge is located north of Abel Road and receives water from the 2047 Drain. Three pumps provide water for a portion of this area, which is known as the O'Hair Tract. Another pump provides water to a portion of the Refuge known as the Lynn Tract. The Davis Weir is located on the 2047 Drain downstream of the Refuge, as shown in Figure IV D-1. The Davis Weir is operated by GCID and creates a backwater pool in the 2047 Drain that allows operation of the refuge pumps. Low water levels in the 2047 Drain frequently prevent the pumps from providing adequate flows to the Refuge. The weir structure is removed from the Davis Weir in October as the rice fields are drained. Removal of the weir makes the operation of the Refuge pumps difficult even with normal winter flows.

The GCID H-1 Canal conveys water to a pump on the central-west side of the Refuge. The pumps lift water from the H-1 Canal to the Refuge's main canal. Water for portions of the Refuge located to the south of Abel Road is provided by the Reclamation District 2047 "J" Drain and GCID Laterals 64-1, 64-C, and 64-2A.

Tracts 7, 8, and 11 in the northeastern portion of the Refuge could receive water from the 2047 Drain if a lift station were constructed.

The existing conveyance system on the developed portions of the Refuge is adequate. Periodically, the Refuge is subjected to flooding. Following flood events, additional maintenance work is needed to repair levees and ditches. Tracts 9 and 4 require an internal conveyance system.

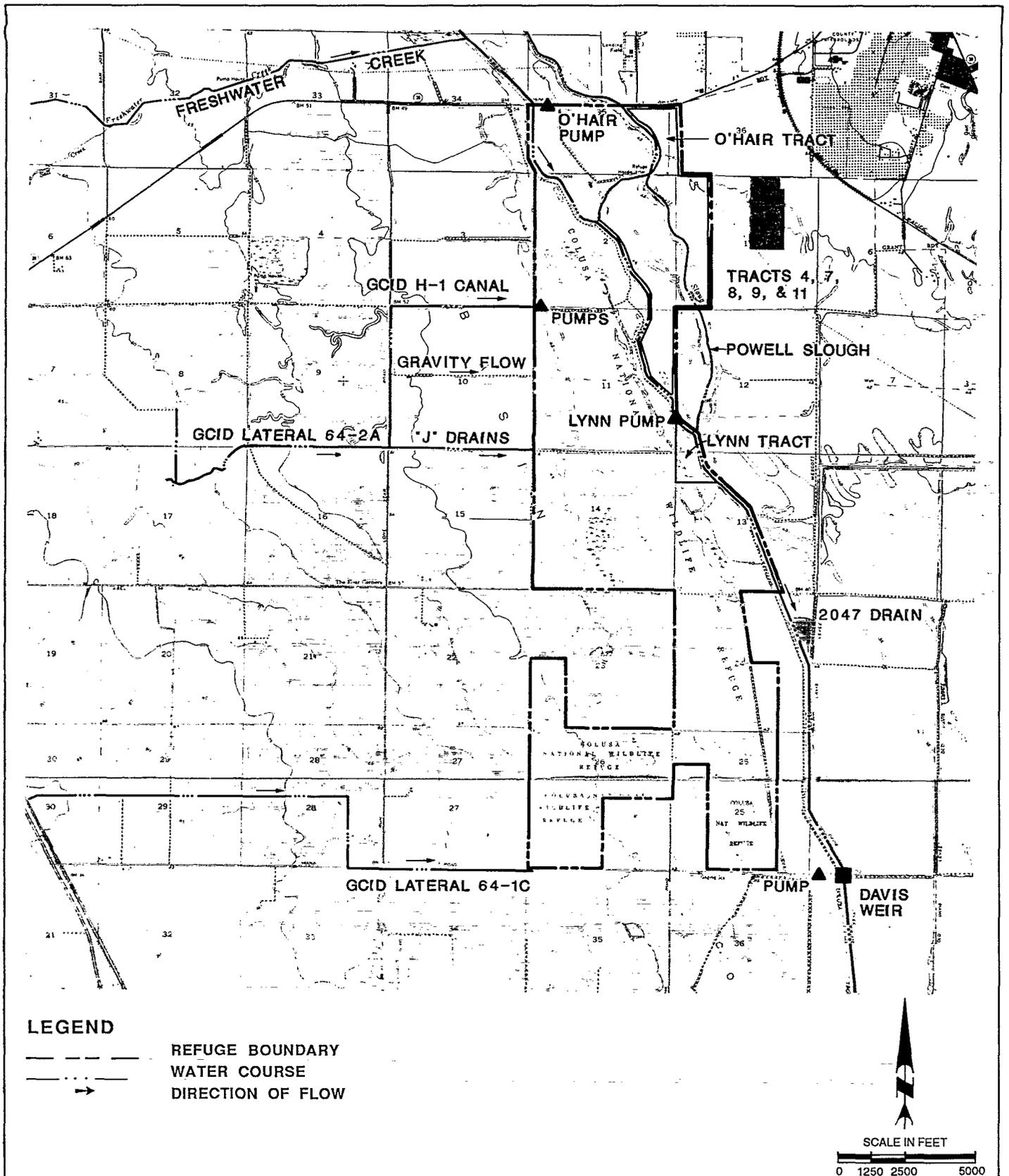
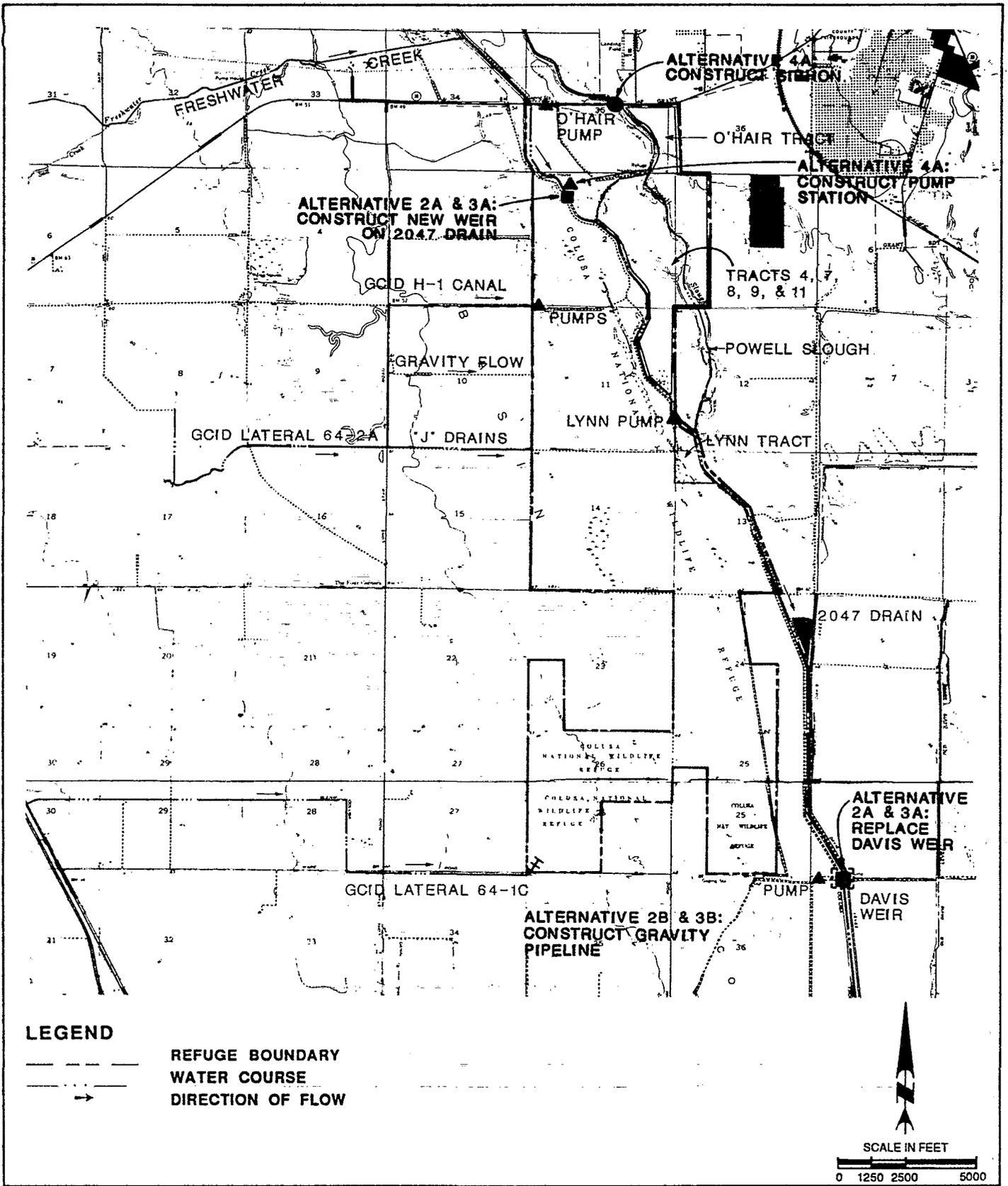


FIGURE IV D-1

COLUSA NATIONAL WILDLIFE REFUGE  
**EXISTING WATER SUPPLY FACILITIES**





pumphouse. The 3-foot high, 60-foot long weir structure would create a 4-foot deep pool in the 2047 Drain to improve pumping capabilities following removal of the weir boards at Davis Weir.

This alternative also would include replacement of the Davis Weir to provide adequate water for the southern portions of the Refuge. The new radial weir structure would be 8 feet high and 60 feet long and would create a pool in the 2047 Drain.

**Alternative 2B - Convey CVP Water Through Zumwalt Farms and Glenn-Colusa Irrigation District Canals.** CVP water would be transported from the TCC to the GCID Main Canal through existing canals operated by GCID and Zumwalt Water District. A 300-foot, 30-inch diameter pipeline, control gate, road crossing, connecting ditch, and siphon would be constructed to transport water by gravity from GCID 64-1C Lateral to the Refuge.

**Alternative 2C - Implement a Conjunctive Use Plan.** Twelve wells would be constructed on the Refuge to deliver the maximum month water demand. The exact locations of the wells on the Refuge would be determined in a future study. The wells would be developed as part of a conjunctive use program. During dry years, water demands would be supplied by wells, as discussed in Chapter III. During wet years, the wells would probably not be needed if CVP water is provided. This alternative also would require implementation of Alternative 2A or 2B.

### 3. Delivery Alternatives for Level 3 (25,000 acre-feet)

Water Supply Level 3 is equal to Level 2. Therefore, the facilities alternatives discussed under Level 2 also would be considered for Level 3.

**Alternative 3A - Construct New Weir on the 2047 Drain and Replace Davis Weir.** This alternative is identical to Alternative 2A.

**Alternative 3B - Convey CVP Water Through Zumwalt Farms and Glenn-Colusa Irrigation District Canals.** This alternative is identical to Alternative 2B.

**Alternative 3C - Implement a Conjunctive Use Plan.** This alternative is identical to Alternative 2C. This alternative also would require implementation of Alternative 3A or 3B.

### 4. Delivery Alternatives for Level 4 (25,000 acre-feet)

Water Supply Level 4 is equal to Level 2. However, the water would be distributed differently throughout the Refuge in order to develop Tracts 4, 7, 8, 9, and 11. Alternative 4A would provide the facilities to serve these tracts. Alternative 4B would provide wells for a conjunctive use program.

Alternative 4A - Construct Facilities to Serve Tracts 4, 7, 8, 9, and 11. This alternative would require two separate facilities to be constructed. A new 25 cfs pump station would be constructed on the 2047 Drain at the Refuge bridge to serve Tracts 7, 8, and 11. A 15 cfs siphon would be constructed under Powell Slough to allow water to flow from the western portions of the Refuge into Tracts 4 and 9. This alternative would require implementation of Alternatives 3A or 3B.

Alternative 4B - Implement a Conjunctive Use Plan. This alternative is identical to Alternative 3C. Implementation of this alternative also would require implementation of Alternative 3A or 3B, as well as Alternative 4A.

#### 5. Summary of Alternatives.

The beneficial and adverse effects of each alternative were compared with respect to the criteria listed in Chapter II.

There are no alternatives for Level 1 because the Refuge has no firm water supplies at this time.

Alternatives 2A and 2B and Alternatives 3A and 3B would provide winter water when the Davis Weir is opened. These alternatives would require a dependable supply of surface water during the summer and long-term conveyance agreements with GCID and Reclamation District 2047. Alternatives 2B and 3B also would require long-term conveyance agreements with Zumwalt Water District.

Alternatives 2C and 3C and Alternative 4B would provide wells to be used during dry years when CVP water may not be available. These alternatives would cause overdraft conditions because the water needs would exceed the safe yield under the Refuge. Alternative 2C would require implementation of surface water alternatives, Alternatives 2A or 2B. Alternative 3C would require implementation of Alternatives 3A or 3B.

Alternative 4A would require implementation of Alternatives 3A or 3B. Alternative 4B would require implementation of Alternatives 3A or 3B, as well as 4A.

#### C. COSTS AND ECONOMIC ANALYSIS

Costs for the alternative plans for Levels 2, 3, and 4 are presented in Table IV D-2. The construction costs include factors to cover engineering, contingencies, and overhead. Annual operation and maintenance (O&M) costs include only the local cost of delivering water. The annual O&M costs do not include costs to purchase CVP water. During the advanced planning phase, these costs will be refined further.

Construction of facilities under all of the alternatives would result in additional money being spent in the economy of Colusa

TABLE IV D-2  
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES  
COLUSA NWR

Items	Alternatives				
	2A & 3A	2B & 3B	2C & 3C	4A	4B
Additional Water (ac-ft)	25,000	25,000	25,000	25,000	25,000
<b>Construction Costs</b>					
Wells	\$ --	\$ --	\$ 897,000 <sup>(c)</sup>	\$ --	\$ 897,000 <sup>(c)</sup>
Diversion Structures	260,000 <sup>(a)</sup>	10,350	--	--	--
Pipelines/Canals	--	9,650 <sup>(b)</sup>	--	3,600 <sup>(e)</sup>	--
Pump Stations	--	--	--	84,000 <sup>(f)</sup>	--
Subtotal	\$260,000	\$ 20,000	\$ 897,000	\$ 87,600	\$ 897,000
Other Costs	--	--	260,000 <sup>(d)</sup>	260,000 <sup>(d)</sup>	347,600 <sup>(g)</sup>
Total (h)	\$260,000	\$ 20,000	\$1,157,000	\$347,600	\$1,244,600
<b>Annualized Construction Costs (8.87%, 30 yrs)</b>	\$ 25,000	\$ 1,920	\$ 111,300	33,440	119,730
<b>Additional Annual Costs</b>					
Operation & Maintenance <sup>(i)</sup>	\$ 1,500	\$ 50	\$ 30,500	\$ 1,250	\$ 30,500
Power	500 <sup>(j)</sup>	--	166,250 <sup>(k,l)</sup>	2,100 <sup>(m)</sup>	166,250 <sup>(k,l)</sup>
Local Conveyance Cost <sup>(n)</sup>	37,500	37,500	--	--	--
Subtotal	\$ 39,500	\$ 37,550	\$ 196,750	\$ 3,350	\$ 196,750
Other Costs	--	--	19,750 <sup>(d,l)</sup>	39,500 <sup>(d)</sup>	21,425 <sup>(g,l)</sup>
Total (h)	\$ 39,500	\$ 37,550	\$ 216,500	\$ 42,850	\$ 218,175
<b>Total Annual Cost</b>	\$ 64,500	\$ 39,470	\$ 327,800	\$ 76,290	\$ 337,905
<b>Cost/Additional Acre-Foot</b>	\$ 2.60	\$ 1.60	\$ 13.10	\$ 3.10	\$ 13.50

**TABLE IV D-2**  
**SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES**  
**COLUSA NWR**  
**(Continued)**

---

Notes: Alternatives 2A and 3A - Construct New Weir on the 2047 Drain and Replace Davis Weir.  
Alternatives 2B and 3B - Convey CVP Water through Zumwalt Farms and Glenn-Colusa Irrigation District Canals.  
Alternatives 2C and 3C - Implement a Conjunctive Use Plan.  
Alternative 4A - Construct Facilities to Serve Tracts 4, 7, 8, 9 and 11.  
Alternative 4B - Implement a Conjunctive Use Plan.

- (a) New 3-foot high, 60-foot wide weir; and a new 8-foot high, 60-foot wide radial weir.
- (b) 300-feet, 30-inch diameter pipeline; one siphon, and one turnout.
- (c) 12 wells, 750 feet deep, 110-foot lift.
- (d) Alternative 2C assumes implementation of Alternative 2A, Alternative 3C assumes implementation of Alternative 3A, and Alternative 4A assumes implementation of Alternative 3A.
- (e) 80-feet, 24-inch diameter siphon.
- (f) 15 cfs, 8-foot lift pump station.
- (g) Alternative 4B assumes implementation of Alternative 3A and 4A.
- (h) Costs have not been included in this analysis for funding facilities described in Chapter IVB to provide winter water supply.
- (i) Basis for O&M costs are discussed in Appendix F.
- (j) Power cost for moving radial gate is \$500/year.
- (k) Unit Pumping Cost = \$13.30/af.
- (l) Values were multiplied by 0.5 because facilities are assumed to be used only 5 out of 10 years.
- (m) Unit Pumping Cost = \$1.00/af.
- (n) Unit Conveyance Cost = \$1.50/af.

County during construction. The construction could be completed within one summer season by construction workers who reside within the area.

Currently, the annual public use (Level 2) at the Refuge is about 7,200 visits per year. If additional water is provided the public use days are not anticipated to increase.

#### D. WILDLIFE RESOURCES

The annual bird use on the Refuge is approximately 28,106,000 use-days based upon census data from 1987. Approximately 90 and 5 percent of the bird use are by ducks and geese, respectively. Wildlife and fishery resources associated with the Refuge are presented in Table IV D-3. The listed threatened and endangered species associated with the Refuge are the Aleutian Canada goose, Branta canadensis leucopareia; bald eagle, Haliaeetus leucocephalus; peregrine falcon, Falco peregrines anatum; and the Valley elderberry longhorn beetle, Desmocerus californicus dimorphus. Candidate threatened and endangered species associated with the Refuge include the white-faced ibis, Plegadis chichi; tricolored blackbird, Agelaius tricolor; and California hibiscus, Hibiscus californicus, as listed in Table IV D-4.

The alternative plans would provide a more reliable water supply to maintain habitat in the Refuge and develop additional ponds, seasonal marsh, and watergrass areas. The number of bird-use days and recreational-use days would increase if a more reliable water supply is provided, as indicated in Table IV D-5.

Implementation of the alternative plans probably would not adversely affect the listed and candidate threatened and endangered species. Detailed field investigations will be completed during the advanced planning phase of the project. Implementation of the plan would result in overall beneficial environmental effects. The No Action Alternative would result in the loss of habitat. Additional regional environmental analyses will be completed as part of the Water Contracting EIS's.

#### E. SOCIAL ANALYSIS

The social consequences of constructing and operating the facilities under all of the alternatives would be positive due to the continued public use.

#### F. POWER ANALYSIS

The Pacific Gas & Electric Company serves the Refuge under the PA-1 rate schedule for agricultural users. A facility must be an authorized function of the CVP to receive project-use power. The authority to deliver CVP project-use power to the Refuge is

## TABLE IV D-3

## FISH AND WILDLIFE RESOURCES

## COLUSA NWR

## Ducks

Hooded Merganser	Blue Winged Teal <sup>(a)</sup>	Ring Necked Duck
Mallard <sup>(a)</sup>	Northern Shoveler <sup>(a)</sup>	Common Goldeneye
Gadwall <sup>(a)</sup>	Pintail <sup>(a)</sup>	Greater Scaup
European Wigeon	Wood Duck <sup>(a)</sup>	Lesser Scaup
American Wigeon	Redhead <sup>(a)</sup>	Buffle Head
Green winged Teal <sup>(a)</sup>	Canvasback	Common Merganser <sup>(a)</sup>
Cinnamon Teal <sup>(a)</sup>	Ruddy Duck <sup>(a)</sup>	

## Geese and Swans

Snow Goose	White-fronted Goose	Cackling Canada Goose
Ross' Goose	Canada Goose	Lesser Canada Goose
		Tundra Swan

## Coots

American Coot<sup>(a)</sup>

## Shore and Wading Birds

Western Grebe <sup>(a)</sup>	Virginia Rail <sup>(a)</sup>	Common Snipe
Eared Grebe	Sora <sup>(a)</sup>	Long-billed Dowitcher
Pied-billed Grebe <sup>(a)</sup>	Common Gallinule <sup>(a)</sup>	Least Sandpiper
Double-crested Cormorant	Ring-billed Gull	Dunlin
White Pelican	Caspian Tern <sup>(a)</sup>	Western Sandpiper
American Bittern <sup>(a)</sup>	Forester's Tern	Greater Yellowlegs
Least Bittern <sup>(a)</sup>	Black Tern <sup>(a)</sup>	Long-billed Curlew
Great Blue Heron <sup>(a)</sup>	Wilson's Phalarope	Killdeer <sup>(a)</sup>
Great (common) Egret <sup>(a)</sup>	American Avocet	Black-crowned Night Heron <sup>(a)</sup>
Snowy Egret <sup>(a)</sup>	Black-Necked Stilt	Greater Sandhill Crane
Green-backed Heron <sup>(a)</sup>		

## TABLE IV D-3

## FISH AND WILDLIFE RESOURCES

COLUSA NWR  
(Continued)

## Upland Game

Ringed-necked Pheasant<sup>(a)</sup>  
California Quail<sup>(a)</sup>

Rock Dove

Mourning Dove<sup>(a)</sup>

## Raptorial Birds

Turkey Vulture  
Sharp-shinned Hawk<sup>(a)</sup>  
Rough-legged Hawk  
Great Horned Owl<sup>(a)</sup>  
Bald Eagle

Black-shouldered Kite<sup>(a)</sup>  
Cooper's Hawk<sup>(a)</sup>  
American Kestrel<sup>(a)</sup>  
Red Shouldered Hawk<sup>(a)</sup>

Northern Harrier  
Red-tailed Hawk<sup>(a)</sup>  
Barn Owl<sup>(a)</sup>  
Golden Eagle  
Peregrine Falcon

## Fish

Steelhead Trout  
Catfish

Salmon  
Black Crappie

Largemouth Bass

## Furbearers

Opossum  
Raccoon  
Skunk

Gray Fox  
Beaver  
Muskrat

Coyote  
Mink

## Others

Black-tailed Deer

## Notes:

(a) Birds nesting on refuge

Source: USFWS computerized annual printout for NWR Birds, Department of Interior, USFWS (RF11650-2 9-79) (July 1973 to June 1974, NWRS Public Use Report (1)) and refuge records.

TABLE IV D-4

FEDERALLY LISTED, PROPOSED, & CANDIDATE THREATENED & ENDANGERED SPECIES

COLUSA NWR

Listed Species

Birds

Aleutian Canada goose, Branta canadensis leucopareia (E)  
Bald Eagle, Haliaeetus leucocephalus (E)  
Peregrine Falcon, Falco peregrines anatum (E)

Invertebrates

Valley elderberry longhorn beetle, Desmocerus californicus dimorphus  
(T)

Proposed Species

None

Candidate Species

Birds

White-faced ibis, Plegadis chihi (2)  
Tricolored blackbird, Agelaius tricolor (2)

Plants

California hibiscus, Hibiscus californicus (2)

Source: USFWS, June 4, 1987

- (E)—Endangered                      (T)—Threatened                      (CH)—Critical Habitat  
(1)—Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.  
(2)—Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

## TABLE IV D-3

## FISH AND WILDLIFE RESOURCES

COLUSA NWR  
(Continued)

## Upland Game

Ringed-necked Pheasant<sup>(a)</sup>  
California Quail<sup>(a)</sup>

Rock Dove

Mourning Dove<sup>(a)</sup>

## Raptorial Birds

Turkey Vulture  
Sharp-shinned Hawk<sup>(a)</sup>  
Rough-legged Hawk  
Great Horned Owl<sup>(a)</sup>  
Bald Eagle

Black-shouldered Kite<sup>(a)</sup>  
Cooper's Hawk<sup>(a)</sup>  
American Kestrel<sup>(a)</sup>  
Red Shouldered Hawk<sup>(a)</sup>

Northern Harrier  
Red-tailed Hawk<sup>(a)</sup>  
Barn Owl<sup>(a)</sup>  
Golden Eagle  
Peregrine Falcon

## Fish

Steelhead Trout  
Cat fish

Salmon  
Black Crappie

Largemouth Bass

## Furbearers

Opossum  
Raccoon  
Skunk

Gray Fox  
Beaver  
Muskrat

Coyote  
Mink

## Others

Black-tailed Deer

## Notes:

(a) Birds nesting on refuge

Source: USFWS computerized annual printout for NWR Birds, Department of Interior, USFWS (RF11650-2 9-79) (July 1973 to June 1974, NWRS Public Use Report (1)) and refuge records.

**TABLE IV D-5**  
**WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS**  
**COLUSA NWR**

	No Action Alternative	Alternatives				
		2A & 3A	2B & 3B	2C & 3C	4A	4B
<b>Habitat Acres</b>						
Permanent Pond	--	455	455	455	495	495
Seasonal Marsh	--	2,280	2,280	2,280	2,280	2,280
Watergrass	--	535	535	535	535	535
Rice	--	86	86	86	86	86
<b>Bird Use Days</b>						
Ducks	--	23,316,000	23,316,000	23,316,000	26,300,000	26,300,000
Geese	--	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Waterbirds	--	1,790,000	1,790,000	1,790,000	1,790,000	1,790,000
Endangered Species	--	100	100	100	100	100
Total	--	28,106,100	28,106,100	28,106,100	31,090,100	31,090,100
<b>Public Use Days</b>						
Consumptive	--	4,100	4,100	4,100	4,100	4,100
Non-Consumptive	--	3,100	3,100	3,100	3,100	3,100
Total	--	7,200	7,200	7,200	7,200	7,200
<b>Total Annual Cost</b>	--	\$ 64,500	\$ 39,470	\$ 327,800	\$ 76,290	\$ 337,905
<b>Incremental Cost/Additional 1000 Bird Use Days</b>	N/A	\$ 2.30	\$ 1.40	\$ 11.70	\$ 2.50	\$ 12.00
<b>Incremental Cost/Additional Public Use Day</b>	N/A	\$ 9.00	\$ 5.50	\$ 45.50	\$ 10.60	\$ 46.90

Notes: Alternatives 2A and 3A: Construct New Weir on the 2047 Drain and Replace Davis Weir  
 Alternatives 2B and 3B: Convey Water through Zumwalt Farms and Glenn-Colusa Irrigation District Canals  
 Alternatives 2C and 3C: Implement a Conjunctive Use Plan  
 Alternative 4A: Construct Facilities to Serve Tracts 4, 7, 8, 9, and 11  
 Alternative 4B: Implement a Conjunctive Use Plan

currently being examined and will be detailed in the Refuge Water Supply Planning Report. A more detailed discussion of project-use power and wheeling agreements is provided in Chapter II.

#### G. PERMITS

Construction of the weirs, siphons, pump stations, and wells would require several permits. Colusa County would issue permits for facilities along stream banks and in natural drainage courses to ensure that the existing drainage would not be adversely affected. The County also would issue permits for construction of the wells. Construction of the facilities under Alternatives 2A, 3A, and Alternative 4A would require approvals and permits or easements from the Reclamation District 2047 and GCID. Construction of siphons under Powell Slough and construction of weirs and pump stations in 2047 Drain would require a Stream Alteration Permit from DFG and may require a Corps of Engineers permit for construction in wetlands.