
CHAPTER IV D

Colusa National Wildlife Refuge Alternative Plans



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

COLUSA NATIONAL WILDLIFE REFUGE
CHAPTER IV D

Colusa National Wildlife Refuge is located in Colusa County, California, and is one of the largest and most diverse wetlands in the State. The refuge was established in 1944 and covers 4042 acres and is managed by the State of California. The refuge is a critical habitat for many species of birds, mammals, and reptiles, and is also an important source of water for irrigation. The refuge is divided into several management units, including the Central Valley, the Delta, and the Sacramento-San Joaquin River Delta. The refuge is also an important source of water for irrigation, and is a critical habitat for many species of birds, mammals, and reptiles.

A. WATER RESOURCES

The Colusa National Wildlife Refuge is located in the Central Valley of California, and is one of the largest and most diverse wetlands in the State. The refuge was established in 1944 and covers 4042 acres and is managed by the State of California. The refuge is a critical habitat for many species of birds, mammals, and reptiles, and is also an important source of water for irrigation. The refuge is divided into several management units, including the Central Valley, the Delta, and the Sacramento-San Joaquin River Delta. The refuge is also an important source of water for irrigation, and is a critical habitat for many species of birds, mammals, and reptiles.

Water

The Colusa National Wildlife Refuge is located in the Central Valley of California, and is one of the largest and most diverse wetlands in the State. The refuge was established in 1944 and covers 4042 acres and is managed by the State of California. The refuge is a critical habitat for many species of birds, mammals, and reptiles, and is also an important source of water for irrigation. The refuge is divided into several management units, including the Central Valley, the Delta, and the Sacramento-San Joaquin River Delta. The refuge is also an important source of water for irrigation, and is a critical habitat for many species of birds, mammals, and reptiles.

The Colusa National Wildlife Refuge is located in the Central Valley of California, and is one of the largest and most diverse wetlands in the State. The refuge was established in 1944 and covers 4042 acres and is managed by the State of California. The refuge is a critical habitat for many species of birds, mammals, and reptiles, and is also an important source of water for irrigation. The refuge is divided into several management units, including the Central Valley, the Delta, and the Sacramento-San Joaquin River Delta. The refuge is also an important source of water for irrigation, and is a critical habitat for many species of birds, mammals, and reptiles.

Diversions from the Tehama-Colusa Canal flow into the Williams Outlet. The Williams Outlet has a capacity of 130 cfs and is used to divert water to the GCID Main Canal via Fresh Water Creek to serve Colusa NWR (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 the Service, GCID conveys a maximum of 25,000 acre-feet to the Colusa NWR. The historical water supplies to Colusa NWR are summarized in Table IV D-1.

Based upon existing data, water quality of the water delivered by GCID appears to be suitable for irrigation under most conditions. Agricultural return flows are generally of poorer quality especially for flows that are reused several times.

Additional water may be obtained from GCID facilities, 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 and may not be available during the irrigation season. In addition, the water may not be of suitable quality.

Without the water from the Tehama-Colusa Canal, water must be provided to the GCID Main Canal from other sources during the winter. Water may be provided from the Black Butte Reservoir to the GCID Main Canal, as discussed under the preferred plan for Water Supply Level 2 for the Sacramento NWR. Additional water could be provided to the southern portion of the refuge from the 2047 Drain during the winter. Groundwater also could be used during the winter. Approximately 6,850 acre-feet of water is needed during the winter, however the safe-yield of the groundwater aquifer under this refuge is only 4,850 acre-feet per year.

Another refuge water supply problem is related to the lack of conveyance facilities for fresh water to the northeastern portion of the refuge. Tracts 7, 8, and 11 could utilize water from the 2047 Drain if a lift station were constructed. Tracts 9 and 4 require an internal conveyance system.

2. Water Conveyance Facilities

Portions of the refuge are located to the north of Abel Road. Approximately 60 percent of the refuge 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. Low water levels in the 2047 Drain frequently prevent the pumps from providing adequate flows to the refuge. The Davis Weir is located on the 2047 Drain downstream of the Colusa NWR,

IVD-2

TABLE IV D-1
WATER DELIVERIES
COLUSA NWR
(acre-feet)

Year	Colusa Basin Drain	Well 1	J Drain	Total GCID Canal ^(a)	Total
1977	(b)	0	(b)	2,142	2,142
1978	10,976	1,040	1,040	996	14,052
1979	5,643	5,136	5,136	1,515	17,430
1980	14,375	(c)	(c)	1,710	16,085
1981 (c)	10,335	(c)	(c)	4,352	14,687
1982 (c)	13,987	(c)	(c)	2,210	16,197
1983 (c)	8,058	(c)	(c)	1,791	9,849
1984 (c)	7,253	(c)	(c)	3,119	10,372
1985 (c)	6,048	(c)	(c)	3,322	9,370
1986 (c)	4,845	(c)	(c)	5,452	10,297

Notes:

(a) Glenn-Colusa Irrigation District

(b) Data missing at time of study

(c) Data does not include Winter Pumping.

Source: USBR, 1986a

as shown in Figure IV D-1. The Davis Weir is operated by GCID and is used to create a backwater pool in the 2047 Drain to allow operation of the refuge pumps that transfer water to those areas north of Abel Road. The weir boards are removed from the Davis Weir in October as the rice fields are drained. Removal of the weir boards prevents adequate operation of the refuge pumps.

The GCID H-1 Canal conveys water to pumps on the centralwest side of the refuge. The pumps lift water from the H-1 Canal to the refuge land. Water for portions of the refuge located to the south of Abel Road is provided by the Reclamation District 2047 "J" Drain, 2047 Drain, and GCID Laterals 64-1, 64-C, and 64-2A.

The refuge conveyance system is adequate. However, the refuge is subjected to periodic flooding. Due to the flood events, additional maintenance work is needed to repair levees and ditches. As discussed above, the water supply in the northern and southern portions of the refuge served by the 2047 Drain is not available in the winter following the removal of the weir boards at the GCID Davis Weir.

In the past, water could not flow by gravity from the GCID canals to the refuge. However, as land near the northwestern portion of the refuge changes ownership, easements for conveyance facilities may be obtained.

3. Groundwater

Colusa NWR is located in flood plain deposits of the Sacramento River flood basin underlain by the Tehama Formation. Wells drilled to depths of more than 400 feet may enter the Tehama Formation aquifer and may produce 1,000 to 4,000 gpm. The quality appears to be suitable for irrigation and waterfowl needs, based upon existing data. The safe yield of the aquifer under Colusa NWR has been estimated by the Reclamation to be 4,850 acre-feet. The refuge has one existing well, with a production capacity of 3,300 gpm.

B. FORMULATION & EVALUATION OF ALTERNATIVE PLANS

Colusa NWR has relied upon available water supplies to meet the water demands. To provide for full development of the refuge, the annual water requirement is estimated to be 25,000 acre-feet. However, for the purposes of assessing the impacts of water delivery alternatives, four levels of water supply have been identified, as presented in Table IV D-2. Each of the water supply levels provide a different rate and volume of water, and are summarized as follows:

- Level 1 - Existing firm water supply
- Level 2 - Current average annual water deliveries

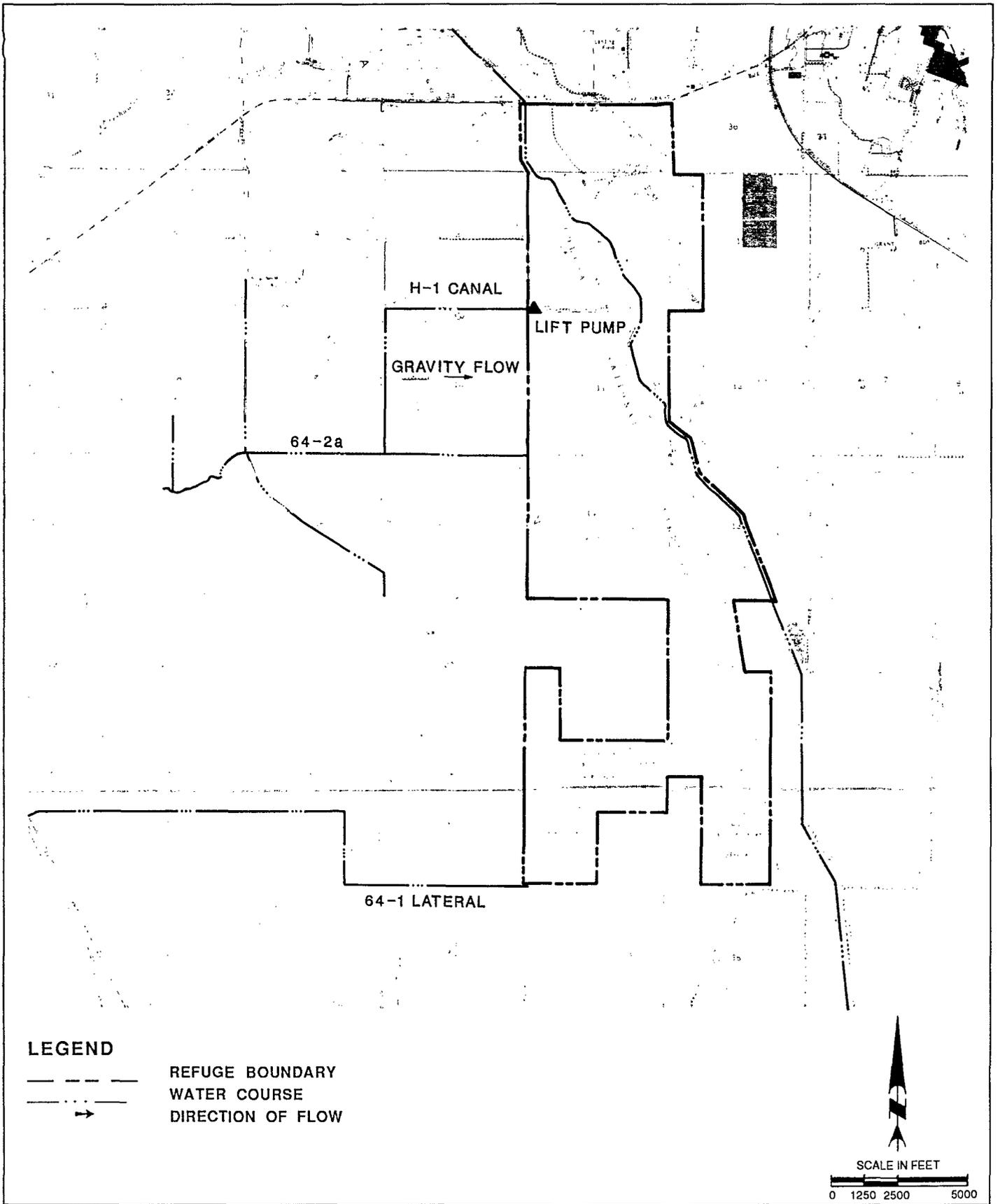


FIGURE IV D-1
COLUSA NATIONAL WILDLIFE REFUGE
 EXISTING WATER SUPPLY FACILITIES



TABLE IV D-2
DEPENDABLE WATER SUPPLY NEEDS
ALTERNATIVE SUPPLY LEVELS FOR THE COLUSA NWR

Month	Supply Level 1		Supply Level 2		Supply Level 3		Supply Level 4	
	ac-ft	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft	cfs
January	0	0.0	1,200	19.5	1,200	19.5	1,200	19.5
February	0	0.0	800	14.4	800	14.4	800	14.4
March	0	0.0	350	5.7	350	5.7	350	5.7
April	0	0.0	770	12.9	770	12.9	770	12.9
May	0	0.0	1,440	23.4	1,440	23.4	1,440	23.4
June	0	0.0	2,500	42.0	2,500	42.0	2,500	42.0
July	0	0.0	2,880	46.8	2,880	46.8	2,880	46.8
August	0	0.0	2,880	46.8	2,880	46.8	2,880	46.8
September	0	0.0	3,840	64.5	3,840	64.5	3,840	64.5
October	0	0.0	3,840	62.5	3,840	62.5	3,840	62.5
November	0	0.0	2,400	40.3	2,400	40.3	2,400	40.3
December	0	0.0	2,100	39.0	2,100	34.2	2,100	34.2
Total	0	0.0	25,000	418.0	25,000	413.1	25,000	413.1
Maximum	0	0.0	3,840	64.5	3,840	64.5	3,840	64.5

Notes:

- Alternative 1 Existing firm water supply
- Alternative 2 Current average annual water deliveries
- Alternative 3 Full use of existing development
- Alternative 4 Optimum management

Sources: USBR, 1986a; USFWS, 1986c, 1986d, and 1986e

Level 3 - Water supply needed for full use of existing development

Level 4 - Water delivery needed for optimum management

Multi-objective project evaluation procedures, in accordance with concepts outlined by the Water Resources Council, is one of the tools used in evaluating and comparing alternatives. The Water Contracting EIS's will evaluate the national, regional, and site specific environmental impacts of providing water to the refuges under the different water supply levels and to other potential users. Based on the results of the Water Contracting EIS's, water supply levels will be identified for each refuge. Following completion of the Water Contracting EIS's, the plans to meet the identified water level will be compared under the National Economic Development Account, Environmental Quality Account, and Social Account. A summary comparison of the alternatives to provide additional water to the refuge for water supply levels 1, 2, 3, and 4 is presented in Table IV D-3.

Delivery alternatives have been considered to convey the identified levels of water supply described above. The alternatives presented for Levels 2, 3, and 4 were developed based upon the assumption that water would be available during the winter from Black Butte Reservoir, as described under the alternative plan for the Sacramento NWR (Alternative A). That plan would require construction of a removable flood gate and use of the existing pumps to transfer water from Stony Creek into the GCID Main Canal. All of the alternatives include the request to continue to obtain CVP water through GCID facilities on a long-term basis.

1. Delivery Alternative for Level 1 (No Action Alternative)

Because the Colusa NWR does not have a firm water supply, no facilities are required.

2. Delivery Alternative for Level 2

This level of water delivery represents the current average water deliveries needed to maintain existing management levels. If the alternative plan for implementation of Level 2 at the Sacramento NWR (Alternative A) is implemented, water could be delivered into the GCID Main Canal during the winter. The alternatives developed for Level 2 at the Colusa NWR were developed to improve water deliveries, especially during the low winter flow periods.

Alternative A - Construct New Weir on the 2047 Drain. Under this alternative, a low weir could be constructed on the 2047 Drain to provide adequate water levels for pumping into the northern and southern portions of the refuge. The weir could be constructed immediately downstream of the existing southern pumphouse. The

TABLE IV D-3
SUMMARY COMPARISON OF WATER DELIVERY ALTERNATIVES
COLUSA NWR

	Supply Levels 2, 3, & 4				Supply Level 4
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Availability of Water Supply	Yes	Yes	Maybe	Yes	Yes
Ability to Convey Water	Yes	Yes	Yes	Yes	Yes
Need New Water	Yes	Yes	No	Yes	No
Need New Conveyance Agreements	No	No	No	Yes	No
Type of Water Supply	Agricultural Return Water	Agricultural Return Water	Groundwater	Fresh Water	Agricultural Return Water
Operational Flexibility	Partial	Partial	Yes	Partial	Yes
Wildlife Habitat	Improve	Improve	Improve	Improve	Increased Pond Area
Public Use	No Change	No Change	No Change	No Change	Increased
Total Annual Costs (\$) ^(a)	1,520	83,240	86,030	64,470	11,250

Notes: Alternative A: Construct New Weir on the 2047 Drain
Alternative B: Improve Davis Weir
Alternative C: Conjunctive Use
Alternative D: Convey Water through Zumwalt Farms and Glenn-Colusa Irrigation District Canals
Alternative E: Construct Facilities to Serve Tracts 4, 7, 8, 9, and 11

(a) Total Annual Costs includes annualized construction cost, annual operation and maintenance cost, annual power and wheelage cost.

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.

Alternative B - Improve Davis Weir. Modifications to the Davis Weir could be constructed to provide adequate water levels for pumping water into the southern portions of the refuge. The modified weir structure would be 4-feet high and 60-feet long and would create a 4-foot deep pool in the 2047 Drain.

Alternative C - Conjunctive Use. A well field could be developed inside of the refuge boundaries to supply the total refuge need during the winter months. Two wells designed to produce 2,500 gpm each could be used to provide a total of 4,850 acre-feet per year. This amount would be equal to the safe-yield of the aquifer under the refuge. The water would be discharged directly to the refuge conveyance ditches.

Alternative D - Convey CVP Water Through Zumwalt Farms and Glenn-Colusa Irrigation District Canals. CVP water would be transported from the GCID Main Canal through existing canals operated by GCID and Zumwalt Water District under this alternative. Under this alternative, a pipeline, control gate, road crossing, connecting ditch, and siphon, would be constructed, as shown in Figure IV D-2. A 300-foot, 30-inch diameter pipeline would be constructed to transport water by gravity from GCID 64-1 Lateral to the refuge. During preparation of this study, Zumwalt Farms indicated that they did not want to participate in the project.

3. Delivery Alternatives for Level 3.

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

4. Delivery Alternatives for Level 4.

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, 9, and 11. Alternative E would provide the facilities to serve these tracts.

Alternative E - Construct Facilities to Serve Tracts 4, 7, 9, and 11. A new 4,500 gpm pump station could 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 to the western portions of the refuge into Tracts 4 and 9.

5. Summary of Alternatives.

There are no alternatives for Level 1. Alternatives A, B, and C were developed for Levels 2, 3, and 4. Alternatives A and B were primarily developed to provide water to the refuge during the

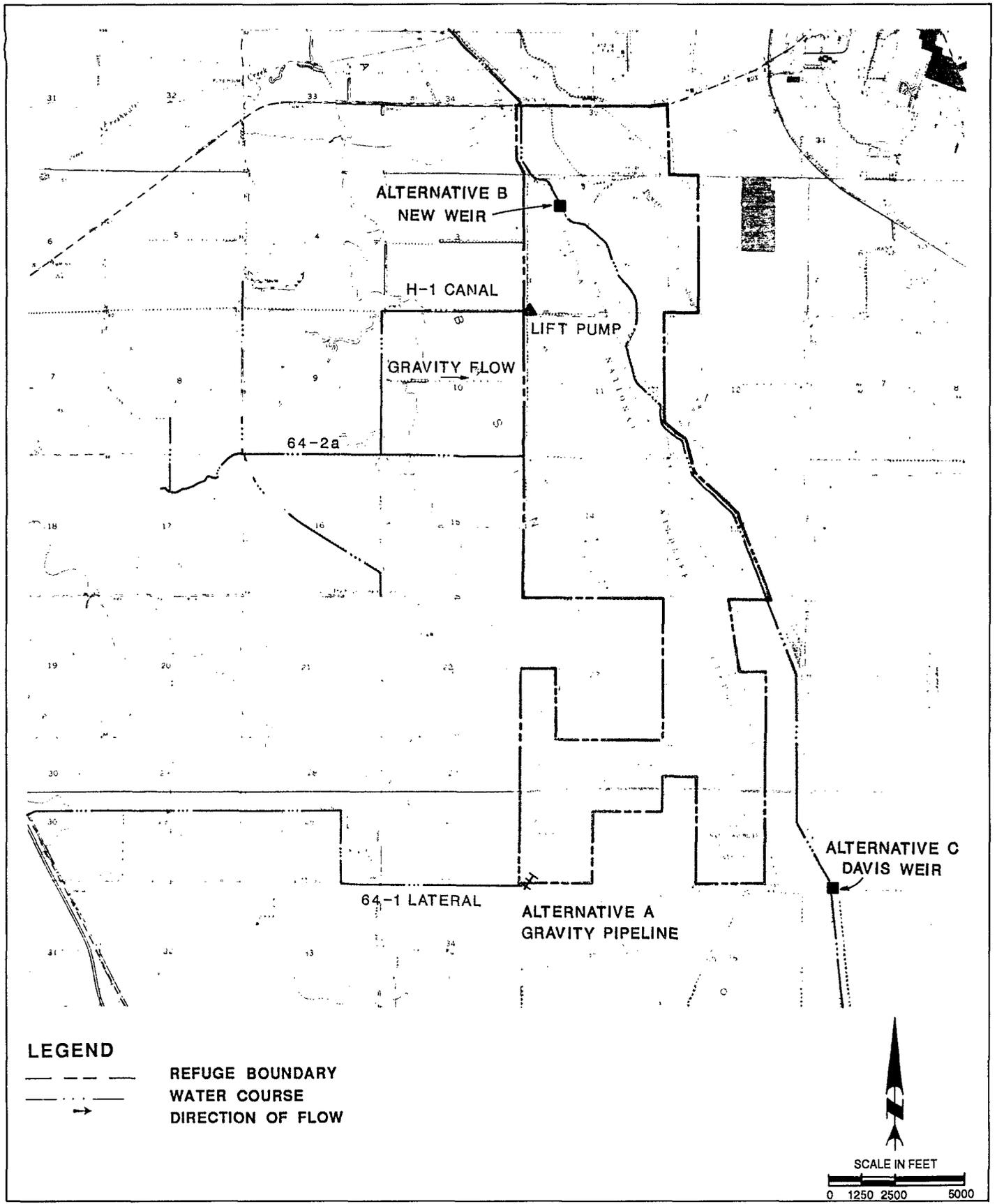


FIGURE IV D-2

COLUSA NATIONAL WILDLIFE REFUGE

**PROPOSED WATER SUPPLY FACILITIES
ALTERNATIVES A, B, & C**



winter when the Davis Weir is opened. Alternative C was developed to provide groundwater to the refuge during the winter or drought periods. Because the CVP water is not provided as a firm supply and sufficient groundwater is not available to meet the refuge needs, all of the alternatives require long-term contracts to receive CVP water. Alternatives A and B would require long-term conveyance agreements with Reclamation District 2047 and GCID to transport water to the Colusa NWR.

During the evaluation of these alternatives, the Zumwalt Farms indicated that the District did not want to consider participation in the conveyance of CVP water to the refuge at this time. Therefore, Alternative D was eliminated from consideration.

Alternative A would improve pumping capabilities to the northern portion of the refuge. Alternative B would improve pumping capabilities to the southern portion of the refuge. Both of these improvements are important, therefore, the alternative plan would include Alternatives A, B, and E. Alternative C could provide water to the refuge during the winter months or during a drought. However, the operations cost to pump 4,850 acre-feet of water would be significant.

C. COSTS AND ECONOMIC ANALYSIS

Costs for the alternative plans for Levels 2, 3, and 4 are presented in Table IV D-4. The construction costs include factors to cover engineering, contingencies, and overhead. During the advanced planning phase, these costs will be refined further. Annual O&M costs include only the actual cost of delivering water. These costs do not include the costs avoided by the other agencies. The GCID charges the Service \$1.50 per acre-foot for wheeling water to the refuges. Under the Contract No. 14-06-200-8181A, the GCID receives one acre-foot of wheeling through the Tehama-Colusa Canal for each acre-foot delivered to the refuge, thus avoiding the contract wheeling charge of \$1.50 per acre-foot which is then absorbed by Reclamation.

Construction of weirs, siphons, and pump stations would result in additional money being spent in the economy of Colusa County during the construction. The construction could be completed within one summer season by construction workers who reside within the area. Currently, the annual public use at Colusa NWR is about 7,200 visits per year. If the water is not provided, the attendance levels will decrease significantly.

D. WILDLIFE RESOURCES

The annual waterfowl use on the Colusa NWR is approximately 16,780,000 use-days based upon census data from 1980 and 1981. Approximately 90 and 5 percent of the waterfowl use are by ducks and geese, respectively, including many species which nest on the refuge. Wildlife and fishery resources associated with the refuge are presented in Table IV D-5. The only listed

TABLE IV D-4
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
COLUSA NWR

Items	Water Delivery				
	Levels 2, 3, & 4 Alternatives				Level 4 Alternative
	A	B	C	D	E
Total Construction Costs	\$ 15,000	\$200,000	\$149,500	\$ 20,000	\$ 87,600
Power Costs (\$/acre-feet)	0.00	0.02	13.70	0.00	0.75
Water Wheeling Costs (\$/Ac-Ft)	0.00	2.50	0.00	2.50	0.00
Annualized Construction Costs (8.875%, 30 Years)	1,440	19,240	14,380	1,920	8,430
Annual Operations & Maintenance Costs	80	1,000	5,200	50	1,245
Annual Power Costs	0	500	66,450	0	1,575
Annual Water Wheelage Costs	<u>0</u>	<u>62,500</u>	<u>0</u>	<u>62,500</u>	<u>0</u>
Total Annual Costs	\$ 1,520	\$ 83,240	\$ 86,030	\$ 64,470	\$ 11,250

Alternative A - Construct New Weir on the 2047 Drain

Alternative B - Improve Davis Weir

Alternative C - Conjunctive Use

Alternative D - Convey CVP water through Zumwalt Farms and Glenn-Colusa Irrigation District canals.

Alternative E - Construct Facilities to Serve Tracts 4, 7, 8, 9 and 11.

TABLE IV D-5

WILDLIFE RESOURCES

COLUSA NWR

Ducks

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

Geese and Swans

Snow Goose	White-fronted Goose	Cackling Goose
Ross Goose	Canada Goose	Lesser Canada
		Whistling Swan

Coots

American Coot^(a)

Shore and Wading Birds

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

TABLE IV D-5
WILDLIFE RESOURCES

COLUSA NWR
(Continued)

Upland Game

Ringed-neck Pheasant ^(a)	Rock Dove	Mourning Dove ^(a)
-------------------------------------	-----------	------------------------------

Raptorial Birds

Turkey Vulture	White-tailed Kite ^(a)	Marsh Hawk
Sharp-shinned Hawk ^(a)	Cooper's Hawk ^(a)	Red-tailed Hawk ^(a)
Rough-legged Hawk	American Kestrel ^(a)	Barn Owl ^(a)
Great Horned Owl ^(a)	Red Shouldered Hawk ^(a)	Golden Eagle
Bald Eagle		Peregrine Falcon

Fish

Steel head Catfish	Salmon Black Crappie	Largemouth Bass
-----------------------	-------------------------	-----------------

Furbearers

Opposum	Gray Fox	Coyote
Raccoon	Beaver	Mink
Skunk	Muskrat	

Others

California Quail ^(a)	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.

threatened and endangered species associated with Colusa NWR are the Aleutian Canada goose, Branta canadensis leucopareia; bald eagle, Haliaeetus leucocephalus; peregrine falcon, Falco peregrines, and the Valley elderberry longhorn beetle, Desmoceris californicus dimorphus. Candidate species associated with the Delevan NWR include the white-faced ibis, Plegadis chichi; tricolored blackbird, Agelaius tricolor; and California hibiscus, Hibiscus californicus, as listed in Table IV D-6.

The alternative plans would provide a more reliable water supply to improve habitat in the refuge and develop an additional 360 acres for ponds, seasonal marsh, and watergrass areas. The improved habitat would increase the number of waterfowl use days and recreational levels, as indicated in Table IV D-7.

Implementation of the alternative plans would not adversely effect the listed and candidate threatened and endangered species of birds and will improve habitat that could be used by the white-faced ibis and Aleutian Canada goose. 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 Plan could result in the loss of habitat if interim water supplies are not available in the future. The results of the preliminary environmental analysis for the alternative plans are presented in the Environmental Appendix. Additional environmental analyses will be completed as part of the Water Contracting EIS's.

E. SOCIAL ANALYSIS

The social consequences of constructing and operating the weirs, siphons, and pump stations would be positive due to the potential increase in wildlife use and subsequently public use. The local social environment is discussed in the Social Appendix.

F. POWER ANALYSIS

Pacific Gas & Electric Company (PG&E) serves the Colusa NWR 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 power to the refuge is 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 the Power Analysis section of Chapter IV B.

G. PERMITS

Construction of the weirs, siphons, and pump stations 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 effected by the new ditches and siphons. Construction of the facilities also would require approvals and permits/easements from the

TABLE IV D-7

WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS

COLUSA NWR

Item	Water Delivery Levels			
	Level 1	Level 2	Level 3	Level 4
Habitat Acres				
Permanent Pond	0	495	455	455
Seasonal Marsh	0	2,280	2,280	2,280
Watergrass	0	535	535	535
Rice	0	86	86	86
Bird Use Days				
Ducks	0	15,200,000	15,200,000	16,000,000
Geese	0	1,000,000	1,000,000	1,000,000
Waterbirds	0	580,000	580,000	600,000
Endangered Species	0	30	30	30
Public Use Days				
Consumptive	0	4,100	4,100	4,100
Non-Consumptive	0	3,100	3,100	3,100
Annual Recreational Benefits	0	\$ 155,950	\$ 155,950	\$ 155,950

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.

IVD-8

C - 0 6 7 7 3 6

C-067736