RTD-109

Delta Division

Central Valley Project

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The Delta Division--Central Valley Project

The Delta Division of the Central Valley Project (CVP) acts as the hub around which the CVP revolves. The Delta Division contains the facilities that transfer water from the Sacramento River, to bolster irrigation supplies to thirsty lands formerly dependent on water from the San Joaquin River. In time, the Delta Division became the hub for controversy revolving around the Central Valley Project.

Project Location

The Sacramento-San Joaquin Delta is a roughly, triangle shaped patch of land just northeast of Oakland and San Francisco. The Delta is about fifty miles long north to south with a maximum width of approximately twenty-five miles. Over one-half of the once marsh-filled basin lies at or below sea level. In a 1928 report, engineer Thomas H. Means said the Delta's Carquinez Straits represented the approximate dividing line between salt and fresh waters. Means based his conclusion on the salt water tolerant plants around San Pablo Bay and the fresh water plants bordering Suisun Bay.[1]

Water from the northern Central Valley travels down the Sacramento River to combine with the San Joaquin River in the Delta. The Delta Division of the Central Valley Project removes the water and serves lands to the south in seven California counties; Alameda, Contra Costa, Fresno, Merced, Sacramento, and Stanislaus. The Delta Cross Channel is the only Delta facility in Sacramento County. Most Delta facilities lie in Contra Costa County including; Contra Costa Canal, Clayton Canal, Ygnacio Canal, Martinez Dam and Reservoir, and Contra Loma Dam and Reservoir. The Tracy Pumping Plant and the beginning of the Delta-Mendota Canal are in Alameda County. The Delta-Mendota Canal travels through Stanislaus, San

1. A. W. Kidder, R. E. Glover, and F. E. Swain, "Compilation of Technical Data On The Delta Cross Channel, Central Valley Project, California: Report on technical studies relating to the transfer of water from the Sacramento River to the San Joaquin River for export to the Delta-Mendota Canal and for salinity repulsion in the lower Delta--Central Valley Project, California, March 12, 1951," *Project Reports*, Record Group 115, September 1951, box 180, 1; W. Turrentine Jackson and Alan M. Paterson, *The Sacramento-San Joaquin Delta: The Evolution and Implementation of Water Policy, An Historical Perspective* (Davis: California Water Resources Center, University of California, June 1977), 1. Hereafter Record Group 115 cited as RG 115.

Joaquin, and Merced Counties, ending at the Mendota Pool in Fresno County.[2]

Historic Setting

When Native Americans inhabited the area, before intrusion by Europeans, the Sacramento-San Joaquin Delta was a marshland cut by a network of channels linked to the Sacramento and San Joaquin Rivers. Wildlife, in the form of game, birds, and fish, flourished in the Delta. Mostly, Patwins and Eastern Miwoks inhabited the Delta. When the Spanish arrived in the area, setting up missions and military posts, they began proselytizing the two Native American groups.[3]

Spanish explorers entered the Delta region in the late eighteenth century. Their explorations soon enlightened them about the persistent threat of salt water intrusion faced by the Delta. Father Juan Crespi and Pedro Fages first explored the Delta area in 1774. They encountered fresh water in Suisun Bay down near Carquinez Straits on March 29, 1774. The next year, when Juan Manuel de Ayala sailed the *San Carlos* into Suisun Bay, he found salt water penetrating halfway up the bay. An expedition led by a Commander Ringgold entered the Delta in the summer of 1841. Camping four miles upstream from the mouth of the San Joaquin River, near the site of Antioch, he described the water there as "still brackish."[4] After the United States' annexation of California in the Treaty of Guadalupe-Hidalgo of 1848, after the Mexican-American War, farmers first diverted irrigation water from the Merced River in 1852. Subsequent diversions from the San Joaquin River noticeably reduced stream flow by 1870. Many immigrants' conformity to the agricultural ideal led them to try to reclaim any land they could for farming. Settlers built dikes along the channels closing off land tracts, pumped out the water, and started farming the land. Increasing expansion of agriculture in California eliminated

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2. Bureau of Reclamation, *Central Valley Project: South Half, California*, Mid-Pacific Region, Map No. 214-208-4175, January 1994; Bureau of Reclamation, *Central Valley Project: Delta Division, California*, Mid-Pacific Region, Map No. 214-208-4177, January 1985.
3. Kidder, Glover, and Swain, "Compilation of Technical Data On The Delta Cross Channel," 1; Water Education Foundation, *Layperson's Guide to the Delta* (Sacramento: Water Education Foundation, 1993, 5; Patti J. Johnson, "Patwin," in *Handbook of North American Indians*, ed. William C. Sturtevant (Washington: Smithsonian Institution, 1978), vol. 8, *California*, ed. Robert F. Heizer, 351; Richard Levy, "Eastern Miwok," in *Handbook of North American Indians*, ed. William C. Sturtevant (Washington: Smithsonian Institution, 1978), vol. 8, *California*, ed. Robert F. Heizer, 399.
4. Jackson and Paterson, *The Sacramento-San Joaquin Delta*, 1.

natural conditions in the Delta by 1920.[5]

Upstream mining operations had serious effect on the Delta region. Hydraulic mining washed more than 800 million cubic yards of mining debris through the Delta. The increased sediment raised stream beds and narrowed channels, elevating water levels in the Delta. Higher levees and reclaimed land reduced the size of the flood plain. These factors along with diversions from the Sacramento and San Joaquin Rivers allowed salt water to push farther upstream during high tides. Ever increasing development upstream from the Delta further aggravated the problem.[6]

The Sacramento-San Joaquin Delta's continual salinity intrusion from San Francisco Bay, through Suisun Bay, especially caused problems for the towns of Antioch and Pittsburg, which depended on the nearby water for agriculture and industrial uses. Periods of high salinity made the water useless for these purposes. Unless water flowed past Antioch at a minimum rate of 3,300 cubic feet per second against the high tide, salt water entered Suisun Bay and the Delta, lowering the water quality. Between 1919 and 1924, salt water in Suisun Bay fostered the growth of teredo, a woodboring, salt water worm, whose increased population destroyed $25 million of the bay's wharves and pilings. In 1924, the water reached its lowest recorded stream flow, and the salt water content at Pittsburg reached 65 percent. In 1926, the high salinity forced Pittsburg and Antioch to stop using water from Suisun Bay for crops and industry, which both communities had used as a water source since the middle of the nineteenth century.[7]

The proliferation of the teredo, along with a series of unfortunate circumstances, led to tragedy. One of the wood piers at the town of Avon in Suisun Bay belonged to the Associated Oil Company. Affected by the teredo, the pier collapsed on the night of October 28, 1924, while the oil tanker *Alden Anderson* unloaded its cargo. The falling pier short circuited the wires of the electric lamp. The short circuit ignited a gasoline supply stored in a shed on the wharf, and the

5. Jackson and Paterson, *The Sacramento-San Joaquin Delta*, 2, 5; Kidder, Glover, and Swain, "Compilation of Technical Data On The Delta Cross Channel, Central Valley Project, California," 1.
6. Water Education Foundation, *Layperson's Guide to the Delta*, 5; Jim Cook, "Sacramento-San Joaquin Delta: A Man-Made Environment," *Reclamation Era*, August 1972, 21.
7. Charles E. Coate, "Water, Power, and Politics in the Central Valley Project, 1933-1967," (Ph.D. diss., University of California, Berkeley, 1969), 6; Bureau of Reclamation, *Annual Project History, Central Valley Project, to December 31, 1936*, RG 115, 19.

blaze quickly spread across the dock to the ship, engulfing it in flames. The *Alden Anderson* drifted to the center of Suisun Bay, carrying six crew members to their deaths.[8]

An idea for a dam to block salt water gained momentum in the 1920s. Delta residents rejected the idea because they believed it would raise water levels in Suisun Bay. On July 2, 1920, Antioch filed a lawsuit against upstream irrigators to stop the diversion of excess water which slowed the stream flow. Sacramento Valley water users pushed for a salt water barrier in hopes of ending the litigation against them by the Delta interests. W.A. Beard, head of the Sacramento Valley Water Development Association worked especially hard to promote construction of the barrier.[9]

Captain C. S. Jarvis of the Army Corps of Engineers (COE) proposed a salt water barrier with a moveable crest and multiple locks between Suisun Bay and the junction of the Sacramento and San Joaquin Rivers. The Corps wanted to create a reservoir, raising the water five to ten feet, but the prospect worried area residents. The Sacramento Valley irrigators won their court battle, but continued pressing for a salt water barrier. Possibly because of their loss in court, some Delta residents became more responsive to the barrier proposal.[10]

In a report about the salt water barrier, Reclamation engineer Walker R. Young predicted it would prove an expensive proposition and hinder navigation. Young estimated the water level of Suisun Bay could not be safely raised high enough for operation of a barrier with the existing (1926) Delta levees. The Bay Barrier Association formed in January 1929, to lobby the California legislature in support of the salt water barrier. The joint legislative committee looking into the matter rejected the salt barrier proposal in April 1929, in spite of the money and lobbying effort put forth by the Association.[11]

The Association reorganized and changed its name to the Salt Water Barrier Association (SWBA) on November 27, 1929. A 1930 promotional campaign by the SWBA, included bumper stickers and tire covers promoting the salt water barrier. A Martinez movie theater

8. Jackson and Paterson, *The Sacramento-San Joaquin Delta*, 10.
9. *Ibid*., 2, 7.
10. *Ibid*., 8, 9.
11. *Ibid*., 11, 16.

showing the Gary Cooper film "The Virginian," exhibited the proclamation, "Boost the Salt Water Barrier for a Better Martinez."[12]

Both the city of Stockton and the Corps of Engineers opposed a salt water barrier in the 1930s, because of its threat to navigation on the San Joaquin and Sacramento Rivers. Stockton's reluctance stemmed from its recent payment of one-half of the six million dollars needed to deepen the channels of the San Joaquin River and establish a deep water port. In 1924, Major U.S. Grant III, COE's Second District Engineer, argued water storage should be the first priority, and the barrier could prove more expensive than the benefits would justify. Walker Young's report estimated the cost of the salt water barrier ranged from $39 to $97 million. The barrier went down in defeat for numerous reasons, including the belief that the proposed Kennett (Shasta) Dam would sufficiently help curb the salinity problem.[13]

The California State Water Plan called for construction of a 420 foot high dam at Kennett, on the Sacramento River, to maintain a regular flow of water to Antioch and keep the salt water intrusion out of the Delta. In the 1930s, California state officials realized the state could not afford to implement the State Water Plan. California turned to Reclamation for assistance in constructing the planned facilities, and salinity control in the Delta became one of the major goals of the Central Valley Project through the Water Exchange Contract. The Water Exchange Contract was water supply agreement with San Joaquin Valley irrigators to exchange northern water for natural flows of the San Joaquin River diverted at Friant Dam, and set maximum allowable chloride levels for the water. The contract came about to satisfy lower San Joaquin farmers that they would not lose irrigation water due to construction of Friant.[14]

Project Authorization

President Franklin D. Roosevelt authorized the Central Valley Project on December 2, 1935. Originally the Project contained three Divisions; Friant, Kennett (Shasta), and Contra Costa (Delta). The Rivers and Harbors Act of 1937, re-authorized the CVP's initial divisions.

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12. *Ibid*., 19, 20.
13. *Ibid*., 11, 21, 22, 24, 25.
14. Coate, "Water, Power, and Politics," 9; Jackson and Paterson, *The Sacramento-San Joaquin Delta*, 42.

The act prioritized improvement of navigation, regulation, and flood control of the Sacramento and San Joaquin Rivers, with irrigation and domestic uses secondary. The act's third priority, power generation, did not apply to the Contra Costa Division. On July 1, 1937, Reclamation changed the name of the Contra Costa Division to the Delta Division. The Division included the Contra Costa Canal and the San Joaquin Pumping System.[15]

Construction History

Division Operation

The Delta Division is complex in its operation, and all its features do not operate in conjunction with each other. The Contra Costa Canal transports water to Contra Costa County. The Delta Cross Channel moves water from the Sacramento River through an excavated channel and natural channels to the Tracy Pumping Plant, which pumps the water into the Delta-Mendota Canal. The Delta-Mendota Canal delivers water to the west side of the San Joaquin Valley, ending at the Mendota Pool, thirty miles west of Fresno.[16]

Contra Costa Canal

15. Reclamation, *Project History, Central Valley Project, to 1936*, 21; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1937*, RG 115, 42; "Memorandum 'A'," Colorado River Project--Central Valley (California)--Land Acquisition, papers of Harry W. Bashore, box 4, American Heritage Center, University of Wyoming, Laramie, Wyoming, 4; Department of the Interior, Bureau of Reclamation, *Federal Reclamation and Related Laws Annotated*, (Washington: Government Printing Office, 1972), vol. 1, *Through 1942*, 583-4.
16. Water and Power Resources, *Project Data*, 179, 181.

Table I. Construction Contractors on the Contra Costa Canal.

Contra Costa Canal Contractors

Contractor	Contract Awarded	Canal Stations
Haas, Doughty & Jones and Marshall & Stacy	March 19, 1937 December 2, 1938	2+00-208+50 638+00-1066+00
Pearson, Minnis, Moody, Werner & Webb	June 30, 1938	209+65-638+00
Heafy-Moore Co. and Frederickson & Watson Construction Co.	October 14, 1939	1066+00-1542+72 2349+83-2359+82
Trewhitt-Sheilds & Fisher	October 18, 1940 (Canceled)	1542+72-1993+11 1993+11-2321+25
Parish Brothers	March 18, 1946 March 1947	2321+25 to end 1993+11-2321+25

Reclamation awarded many contracts for the Contra Costa Canal over a period of about ten years (see Table. I).[17] The delay resulted from the United States' entry into World War II. Reclamation awarded the first construction contract for the Contra Costa Division to Haas, Doughty & Jones and Marshall & Stacy (Haas-Marshall), for the first section of the Contra Costa Canal, on March 19, 1937. The contractors received the notice to proceed on October 13, 1937, and started work on October 19. The contract inaugurated work on the Central Valley Project. By the end of the year, the contractors completed the Marsh Creek Siphon and started on the Fox Slough Siphon. A strike in 1938, caused the contractors to hire members of a different labor union as the dispute went unresolved. Haas-Marshall completed the contract August 5, 1938. During the year Reclamation revised its cost estimate of the canal from $3.2 million in 1937, to $4,212,800. The revised estimate went over the four million dollar ceiling the Contra Costa County Water District wanted to maintain, Reclamation officials believed, correctly, the District

17. "Notes For Contractors," *The Reclamation Era*, May 1937, 118; "Notes For Contractors," *The Reclamation Era*, August 1938, 151; "Notes For Contractors," *The Reclamation Era*, January 1939, 19; "Notes For Contractors," *The Reclamation Era*, November 1939, 19; "Notes For Contractors," *The Reclamation Era*, December 1941; 328; "Notes to Contractors," *The Reclamation Era*, June 1946, 139; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1947: Part 2, Section 3*, RG 115, A-70.

Directors would accept the increase.[18]

Reclamation awarded the contracts for Contra Costa Canal construction to Pearson, Minnis, Moody, Werner and Webb (Pearson) on June 30, 1938, Haas-Marshall on December 2, 1938. Haas-Marshall started construction on their contract near the end of the year, receiving the notice to proceed on January 6, 1939. Both Haas-Marshall and Pearson finished their contracts in 1939. Heafey-Moore Company and Frederickson & Watson Construction Company (Heafey-Moore & Frederickson) received a contract on October 14, 1939. The companies nearly finished the contract before the end of 1940, completing the final work on February 15, 1941. Heafey-Moore & Frederickson's section of the Contra Costa Canal included a concrete lined section.[19]

Reclamation awarded George B. Henly Construction Company the $130,397 contract for construction of Contra Costa Pumping Plants One through Four on March 5, 1939. Pomona Pump Company supplied the pump units for $79,392. Henly received the notice to proceed on March 25, 1939, but had already started work March 14. The contractor placed twenty-four inches of reinforced concrete for the base slabs of the plants. Each plant had six pumping units, with nine foot six inch wide intake bays formed by eighteen inch thick concrete walls. Henly completed all contract work on the four pumping plants March 7, 1940.[20]

Lee J. Immel received the contract for the Contra Costa Canal headworks, Dutch Slough Dam bridge, a bridge at Station 1+98, and a bridge at Rock Slough. Originally the contract specified August 16, 1940, as Immel's completion date, but additional work brought an extension

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18. "Notes For Contractors," *The Reclamation Era*, May 1937, 118; Reclamation, *Project History, Central Valley Project, 1937*, 40, 42; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1938*, RG 115, 67, 86; R. F. Walter, Chief Engineer, to Walker R. Young, Supervising Engineer, 30 December 1938, *Bureau of Reclamation Project Correspondence File, 1930-1945: Central Valley*, RG 115, file 301.5: Correspondence Regarding Canals and Laterals, Thru December 1940, box 170, 1-3; Department of the Interior, "Memorandum for the Press," *Bureau of Reclamation Project Correspondence File, 1930-1945: Central Valley*, RG 115, file 301.5: Correspondence Regarding Canals and Laterals, Through December 1940, box 170, 23 March 1937, 2.

19. Reclamation, *Project History, Central Valley Project, 1938*, 79; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1939*, RG 115, 134, 146, 147; "Notes For Contractors," *The Reclamation Era*, August 1938, 151; "Notes For Contractors," *The Reclamation Era*, January 1939, 19; Reclamation, *Project History, Central Valley Project, 1940*, 161; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1941: Part 4*, RG 115, 14; "Notes For Contractors," *The Reclamation Era*, November 1939, 19; Bureau of Reclamation, "Contra Costa Canal--concrete lined section--sequence of construction procedure under Specifications No. 865--Station 1066+00 to 1542+72--Delta Division," *Project Reports*, RG 115, November 20, 1940, box 180, 1.

20. Reclamation, *Project History, Central Valley Project, 1939*, 134, 145; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1940*, RG 115, 161; O. G. Boden and Max R. Johnson, "Contra Costa Canal Pumping Plants," *The Reclamation Era*, June 1941, 182, 184; "Notes For Contractors," *The Reclamation Era*, May 1938, 83; "Notes For Contractors," *The Reclamation Era*, August 1938, 151.

to September 15. The added work included placing gravel and corrugated pipe, and surfacing the operating road. Immel completed all of the work on time. Ground saturation did displace earth and concrete in one section of the canal, but F. Stamm and Son restored the damaged section during 1940.[21]

Reclamation started test pumping at Pumping Plant One during the summer of 1940, in preparation for using operational portions of the Contra Costa Canal in the fall. Walker Young threw the switch to start one of the pump units on July 8, 1940, on the same day elsewhere on the Central Valley Project, work crews placed the first bucket of concrete on Shasta Dam. Reclamation turned the first water into the sea level section of the canal on August 9, 1940. The hardness of Pittsburg's well water supply increased from 150 parts per million (ppm) in 1929, to about 800 ppm in 1940. The decreasing water quality convinced Pittsburg residents to contract with Reclamation for water deliveries from the canal. Pittsburg built a water treatment plant in 1939, to accommodate expected delivery. The plant had four pressure filtration units, with a capacity of 2.6 million gallons a day. Pittsburg received its first water delivery from Contra Costa Canal on August 18, 1940. On that date the Contra Costa Canal stretched twenty miles, reaching four miles past the city.[22]

Anticipating an extension of the Contra Costa Canal to reach the city of Martinez, city officials advertised the sale of $286,000 in bonds to finance a water treatment plant in 1941. Unsure if Reclamation would construct the extension, Cappy Ricks, Martinez's Mayor wrote to Reclamation Commissioner John C. Page. Ricks complained that Martinez could not afford construction of both the treatment plant and the canal extension if Reclamation did not build the extension. Ricks said two city council members opposed the bonds, with a third in the balance. The Mayor also feared further financial encroachment by the California Water Service Company, which, he claimed, already took 300 outside customers from Martinez. Regarding the canal extension, Ricks said, "We cannot proceed against corporate greed and dumb citizens

21. Reclamation, *Project History, Central Valley Project, 1940*, 161, 162.
22. "Central Valley Milestones," *The Reclamation Era*, October 1940, 285; Garfield Stubblefield, "Contra Costa Canal in Operation," *The Reclamation Era*, December 1940, 329, 330; Reclamation, *Project History, Central Valley Project, 1940*, 182.

unless we get some encouraging word from you."[23] Construction of the Contra Costa Canal already lagged six months behind schedule because of a landslide four miles east of Martinez.[24]

Reclamation awarded a $319,862 contract to Trewhitt-Shields and Fisher (Trewhitt-Shields) October 18, 1940. The company received the notice to proceed February 2, 1941, and started earthwork, canal lining, and structures on March 21, 1941, nearly completing the contract by the end of the year. Trewhitt-Shields completed the contract May 17, 1942, less than a week before operations on Contra Costa Canal halted because of World War II. Trewhitt-Shields received the contract for the next section of canal, and subcontracted it to J.M.S. Company. The subcontractor consisted of former members of the Haas-Marshall joint venture. Work started on May 2, 1942, but Reclamation's failure to supply construction material prevented any significant progress before the War Production Board (WPB) stopped work.[25]

To allow continued operations, on February 26, 1942, Reclamation applied for a preference rating for Contra Costa Canal under the War Food Program. The War Production Board refused the rating because the excessive quantity of critical materials was deemed greater than any benefits from the canal. Work on the Contra Costa Canal halted on May 23, 1942. On August 8, 1943, Reclamation Commissioner Harry Bashore again submitted an application to the WPB to resume construction, obtain priority assistance, and an allotment for controlled materials to complete the Contra Costa Canal system. Once more the WPB rejected the application.[26]

Reclamation officials raised the possibility of resuming construction of the Contra Costa Canal several times during the war years, but never received authorization. Reclamation hired armed guards to protect the canal in 1942. Reclamation also armed operating personnel who patrolled the canal's reaches. The protection program ended in 1944, but Reclamation persuaded

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23. Cappy Ricks, Mayor of Martinez, California, to John C. Page, Bureau of Reclamation Commissioner, 15 December 1941, *Bureau of Reclamation Project Correspondence File 1930-1945*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals January 1941 to January 1942," box 170, 1.
24. *Ibid*.
25. Reclamation, *Project History, Central Valley Project, 1941: Pt. 4*, 14; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1942: Pt. 4*, RG 115, 11, 18; "Notes For Contractors," *The Reclamation Era*, December 1941, 328.
26. Harry Bashore, Bureau of Reclamation Commissioner, to George P. Miller, Congressman from California, 19 May 1945, *Bureau of Reclamation Project Correspondence File 1930-1945: Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals, October 1944 Thru," box 169; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1942: Pt. 4*, RG 115, 8.

several of the guards to remain on as maintenance personnel. When work continued after World War II, the remaining work on the Contra Costa Canal consisted of ten miles of canal, two re-lift canals, and pumping plants at an estimated cost of $1.5 million.[27]

Reclamation awarded Parish Brothers the contract for construction of Mountain View (later renamed Martinez) Dam for $568,974 on March 18, 1946. Parish Brothers started work on the dam on May 8, 1946, anticipating the notice to proceed, which the contractor received May 28. The Parish Brothers' contract included the last section of Contra Costa Canal. The contractor finished embankment placement on the dam November 12, 1946, and completed the outlet control tower during the year. Parish Bothers completed Martinez Dam in May 1947. The contractor finished that section of the Contra Costa Canal on September 29, 1947.[28]

In March 1947, Parish Brothers received the contract originally awarded to Trewhitt-Shields for Contra Costa Canal, but re-advertised by Reclamation after World War II. Parish Brothers began work on the contract in April 1947. The contract included construction of Ygnacio and Clayton Canals. Exhaustion of funds for the Contra Costa Canal in November 1947, restricted construction on the contract. The same lack of funds also slowed work on the Ygnacio and Clayton Canals.[29]

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27. Walker R. Young, Acting Chief Engineer, to Harry Bashore, Bureau of Reclamation Commissioner, 13 December 1943, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: December 1943," box 169; Charles E. Carey, Region 2 Director, to Harry Bashore, Bureau of Reclamation Commissioner, 13 December 1943, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: December 1943," box 169; William E. Warne, Assistant Commissioner of Bureau of Reclamation, to Sinclair O. Harper, Chief Engineer, 6 December 1943, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: December 1943," box 169; William E. Warne, Assistant Commissioner of Bureau of Reclamation, to Sinclair O. Harper, Chief Engineer, 30 November 1943, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: September 1943 to November 1943," box 170; Walker R. Young, Acting Chief Engineer, to Harry Bashore, Bureau of Reclamation Commissioner, 29 November 1943, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: September 1943 to November 1943," box 170; George Blowers, Assistant Chief, Bureau of Government Requirements to Sinclair O. Harper, Chief Engineer, 22 April 1942, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: February 1942 to August 1943," box 170; Reclamation, *Project History, Central Valley Project, 1942: Pt. 4*, 8; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1944: Sec. 3*, RG 115, 6; Charles E. Carey, Region 2 Director, to Sam Kagel, Director of the War Manpower Commission, 5 May 1945, *Bureau of Reclamation Project Correspondence File: 1930-1945, Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals: October 1944 Thru," box 169.

28. Bureau of Reclamation, *Annual Project History, Central Valley Project, 1946: Pt. 2 Sec. 3*, RG 115, 5, 13; "Notes to Contractors," *The Reclamation Era*, June 1946, 139; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1947: Pt. 2 Sec. 3*, RG 115, A-26, A-50.

29. Reclamation, *Project History, Central Valley Project, 1947: Pt. 2 Sec. 3*, A-70, A-63, I-1.

Parish Brothers lined Clayton Canal with concrete, but lined 4.06 miles of Ygnacio Canal with a two inch layer of asphaltic concrete. The lining consisted of asphalt, sand, and some mica. The contractor backed the lining with aluminum foil, and used Standard Plastic Cement on all joints. Parish Brothers used soil sterilants on the canal to prevent weed growth. The contractor used a combination of organic and inorganic soil sterilants. The inorganic sterilant consisted of .608 pounds of borax to one-half pound of Borix Acid per gallon of water. Parish Brothers applied approximately .8 gallons of the mixture per one square yard of the canal. The inorganic sterilants consisted of two types of fuel oil, Dinitro-Ortho-Cresol, and pentachlorophend. Parish Brothers completed construction on Contra Costa, Ygnacio and Clayton Canals by November 8, 1948.[30]

Reclamation awarded Walsh and Puccetti the contract for the Clayton and Ygnacio Pumping Plants on June 21, 1946. The contractor completed most of the work in August 1947, except the fence, surfacing yards, and outlet transition at Clayton. Walsh and Puccetti completed finishing work on the Ygnacio Pumping Plant on September 9, 1947, and Clayton on September 12.[31]

Contra Costa Canal travels for 47.7 miles from the Delta to Martinez Dam and Reservoir with a capacity of 350 cubic feet per second. The canal has a bottom width of twenty-four feet. Martinez is a modified homogeneous offstream dam 1,200 feet long at the crest, and sixty-two feet wide. The dam has a top width of twenty feet and a maximum base width of 317 feet, with a total volume of 195,000 cubic yards. Martinez Reservoir has a capacity of 268 acre-feet. The Clayton Canal has a length of 4.8 miles and a bottom width of four feet. The Ygnacio Canal travels 5.2 miles with a bottom width of five feet.[32]

Delta-Mendota Canal

Because the Madera and Friant-Kern Canal systems of the Friant Division diverted most

30. Bureau of Reclamation, "Report Of Asphaltic Lining–Ygnacio Canal," *Project Reports*, RG 115, Region 2, Lower San Joaquin District, Antioch CA, September 1948, box 195, 1, 5, 7; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1948: Pt. 2*, RG 115, 52, 68.
31. "Notes to Contractors," *The Reclamation Era*, August 1946, 186; Reclamation, *Project History, Central Valley Project, 1947: Pt. 2 Sec. 3*, A-44, A-50.
32. Water and Power Resources, *Project Data*, 181-2.

of the San Joaquin River's flow out of the river channel, Reclamation built the Delta-Mendota Canal to replace the water diverted at Friant Dam, with a supply from the north. The plan called for the Tracy Pumping Plant to divert water from the Sacramento River into the Delta-Mendota Canal. The canal would transport to water to the Mendota Pool, created by a concrete dam constructed in 1919, for storage. The Mendota Pool is located at the junction of the San Joaquin River and the north fork of the Kings River.[33]

The length of the Delta-Mendota Canal required several contracts to complete construction of the earthwork, concrete lining, and structures (see Table. II). Reclamation awarded the first contract for Stations 185+00-231+00 and 243+00-774+00 to Morrison-Knudsen Company, Inc., and M. H. Hasler Construction Company (Morrison-Knudsen & Hasler) on October 25, 1946. The contractors acknowledged the notice to proceed on December 30, 1946. Morrison-Knudsen & Hasler obtained a forty day extension and finished the contract on April 18, 1949.[34]

Reclamation awarded the contract for Delta-Mendota Canal Station 686+00-1365+00 and the Westley wasteway to Hubert H. Everist Sr. June 14, 1946. Everist started work in August 1946, before receiving the notice to proceed on September 5, 1946. Workers went on strike against the structure subcontractor, Fred J. Maurer and Son, on November 12, 1946. The strike did not end until December 30, 1946. Everist finished the work on November 8, 1948, five days before the completion deadline. Most work on the canal went more smoothly.[35]

Reclamation awarded Western Contracting Corporation the contract for a holding reservoir dike, in addition to the earth work on the Delta-Mendota Canal (see Table. II). Johnson Western

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33. Bureau of Reclamation "Final Construction Report on Columbia and Mowry Delivery Systems and Pumping Plants, Specifications No. DC-3551," *Project Reports*, RG 115, May 25, 1953, box 181, 1; Water Education Foundation, *Layperson's Guide to the Central Valley Project* (Sacramento: Water Education Foundation, 1994), 9.
34. Bureau of Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal: Constructed 1946-1952, Central Valley Project--California*, Denver Colorado, June 1959, 103.
35. Reclamation, *Project History, Central Valley Project, 1946, Pt. 2 Sec. 3*, 13, 17, 21; Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal*, 103, 104.

Constructors received the contract for the Columbia Pumping Plant, Mowry Pumping Plant, and their delivery systems. Reclamation awarded Stolte, Inc., the contract for earthwork, pipelines, and structures (including pumping plants, laterals, and sublaterals) for the Plain View Water District.[36]

The Delta-Mendota Canal contractors excavated the canal with motor-driven or tractor-

Table II. Construction Contractors on the Delta-Mendota Canal. Source: *Technical Record of Design and Construction, Delta-Mendota Canal*, 103-5.

Delta-Mendota Canal Contractors

Contractor	Contract Awarded	Canal Stations
Morrison-Knudsen Company, Inc. & M. H. Hasler Construction Company	October 25, 1946	L-185+00-L-231+00
	June 30, 1948	L-243+00-L-774+00 L-774+00-L-908+85
	August 30, 1949	L-908+85-L-1240+00 L-1240+00-686+00 3024+80-3538+00
	Nov. 10, 1949	3538+00-4108+50 4108+50-4535+00
Hubert H. Everist Sr.	June 14, 1946	686+00-1365+00 Westley wasteway
	January 3, 1949	1366+50-2149+80
Western Contracting Corporation	June 22, 1949 June 29, 1950	2149+80-3024+80 San Luis wasteway
United Concrete Pipe Corporation & Vinnell Company, Inc.	Jan. 18, 1950	4535+00-5155+00 5155+00-5485+00 Firebaugh wasteway
	May 16, 195	Newman wasteway 78+40-432+70
A. Teichert & Sons, Inc.	May 16, 1950	Newman wasteway 1+79-78+40

towed scrapers, draglines, and bulldozers. Morrison-Knudsen & Hasler operated the canal construction's largest dragline on a three shift basis for twenty-one hours a day, six days a week. They trimmed the high spots with a bulldozer and a grader. Part of the United Concrete Pipe

36. Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal*, 106.

Corporation and Vinnell Company, Inc., contract on the lower reach of the canal remained unlined. United Concrete Pipe & Vinnell set aside 5 percent of the excavated material for later use in the unlined canal invert.[37]

Around Station 5000, high ground water and sand forced de-watering of the area into a pilot ditch and sump. United Concrete Pipe & Vinnell pumped the water into adjacent drains to allow further excavation. Some areas had unsuitable foundation material classified as "adobe" soil, which the contractors removed before plowing, sprinkling, and compacted the material by rolling. The control structures at Station 5476+35, and nearby, lay below the canal subgrade and required de-watering for construction. United Concrete Pipe & Vinnell installed sump pumps for de-watering the sites.[38]

Morrison-Knudsen & Hasler built the Mountain House Road Siphon, placing the last concrete in the structure on March 14, 1949. The siphon had an inside diameter of twenty-four feet three inches with a shell thickness of two feet. Mountain House Road Siphon extended for 1,200 feet. Initial leakage from the siphon amounted to 50,000 gallons in twenty-four hours. Morrison-Knudsen & Hasler backfilled the structure, reducing the leakage to 31,000 gallons in twenty-four hours. Lead wool caulking further reduced the leaks.[39]

Rainfall during November 18-19, 1950, caused high water in Los Banos and San Luis Creeks. Water from both creeks broke into the Delta-Mendota Canal, causing considerable damage to the canal and siphons. Water from Los Banos Creek flowed both north and south through the canal. The northward flow emptied out of the San Luis wasteway turnout. San Luis Creek broke into a lined section of the canal, downstream from San Luis Creek Siphon, and rushed out of a wasteway. Water flowing through the San Luis Creek Siphon filled part of the canal with water and debris.[40]

The rushing water washed away concrete forms and nearly filled the San Luis Creek Siphon with debris and gravel. The water flow demolished two partly completed construction

37. *Ibid*., 109, 111.
38. *Ibid*., 112, 114.
39. *Ibid*., 129.
40. *Ibid*., 142.

forms, forcing removal and replacement of the forms and reinforcement steel. The rampaging water damaged some twenty-four inch welded steel pipe, reinforcing steel, and partially placed wood side panels on one of Morrison-Knudsen & Hasler's sections. The floods stopped work by Morrison-Knudsen & Hasler and United Concrete Pipe & Vinnell, until the contractors could de-water the canal and repair the damage. About two weeks later, during the weekend of December 3, 1950, heavy rains caused water from Garzas Creek to undermine an overchute pier and float some of the Delta-Mendota Canal's concrete lining. United Pipe & Vinnell underwent a series of strikes from May 1 to May 14, 1951. Because of the delays, Reclamation allowed United Concrete Pipe & Vinnell an extension of sixty days on one schedule and 116 days on another.[41]

Western Contracting Corp.'s completion of the San Luis wasteway and holding reservoir dike on April 9, 1952, finished construction of the Delta-Mendota Canal. The final contract cost of the canal totaled $40,981,980.63. Reclamation estimates of the final total cost of the canal reached $48,644,027.32.[42]

The Delta-Mendota Canal originates at the intake headworks on the bank of Old River, a natural channel in the Delta. Tracy Pumping Plant raises water from the intake channel some 197 feet to the headworks where the canal carries the water south. The first ninety-five miles of the Delta-Mendota Canal have a concrete lining. The remaining distance is unlined. The canal stretches a distance of 115.7 miles. Delta-Mendota Canal has a bottom width of 100 feet and a capacity of 4,600 cubic feet per second.[43]

Tracy Pumping Plant

On June 23, 1947, Reclamation Commissioner Michael Straus personally awarded contracts totaling $5,888,000 for the Tracy Pumping Plant and appurtenant facilities to SUHB Companies, a joint venture of Stolte, Inc., United Concrete Pipe, Ralph A. Bell, and Duncan-

41. Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal*, 144; Bureau of Reclamation, "Final Construction Report On Earthwork And Structures Station 4535+00 To Station 5485+50, Specifications No. 2857, Delta-Mendota Canal And Firebaugh Wasteway," *Project Reports*, RG 115, Region 2, Delta District, Solano Construction Field Division, Tracy California, March 25, 1953, box 181, 2, 7, 8.
42. Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal*, 10, 11, 106.
43. Bureau of Reclamation, "Report: Firebaugh Drainage Investigation," *Project Reports*, RG 115, Region 2, Division of Operation and Maintenance, January 1953, box 195, 13; Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 131; Water Education Foundation, *Layperson's Guide to the Central Valley Project*, 9; Water and Power Resources Service, *Project Data*, 182.

Harrelson Company. The contract was the first awarded by a Commissioner in excess of $500,000. Schedule one included the Tracy Pumping Plant structure, the Delta-Mendota Intake Channel, the railroad and highway culvert, and the higher head discharge pipes. The second schedule specified the lower head discharge pipes and the outlet structure. SUHB Companies also received the contract for finishing work and installation of major equipment.[44]

SUHB excavated the Tracy Pumping Plant, used untreated forty-two to fifty-one foot Douglas fir pilings, and used pumpcrete machines to transport concrete from the mixer to the placement area. The contractors placed a total of 29,410 cubic yards of concrete and 2,695 tons of reinforcement steel. Worthington Pump and Machinery Corporation of Harrison, New Jersey, supplied the six eighty-four inch pumps for Tracy Pumping Plant, and Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin, supplied the pump drive motors. SUHB installed the pumps and related machinery.[45]

SUHB completed Tracy Pumping Plant and the Intake Channel work on December 30, 1949, at an estimated cost of $16,236,513. Tracy Pumping Plant delivers water to the Delta-Mendota Canal. The pumping plant has six pumping units and a total capacity of 4,602 cubic feet per second.[46]

Delta Cross Channel

On January 12, 1945, Reclamation announced the final location for the Delta Cross Channel. The channel transports water from the Sacramento River to the Tracy Pumping Plant The route followed the plan chosen by California's State Engineer Edward Hyatt, and the state legislature approved the channel location. Reclamation believed the Delta Cross Channel and the training works in the San Joaquin River necessary to prevent the highly polluted low water flows of the San Joaquin from getting into the Tracy Pumping Plant. The intrusion could raise

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44. Bureau of Reclamation, *Technical Record of Design and Construction, Tracy Pumping Plant and Intake Canal and Discharge Lines: Constructed 1947-1951, Central Valley Project--California*, Denver, May 1959, 93, 97; "Commissioner Authorized To Award Top Value Contracts," *The Reclamation Era*, August 1947, 187.
45. Reclamation, *Technical Record of Design and Construction, Tracy Pumping Plant*, 97, 98, 102, 117; Bureau of Reclamation, "Final Construction Report On Delta-Mendota Intake Canal And Tracy Pumping Plant And Discharge Lines, Specifications No. 1810, Central Valley Project, California," *Project Reports*, RG 115, Region 2, Delta District, Tracy California, March 27, 1952, box 195, 10, 16.
46. Reclamation, *Technical Record of Design and Construction, Tracy Pumping Plant*, 93, 97, 139; Water and Power Resources, *Project Data*, 182.

salinity in the adjoining waters above the standards set in the Water Exchange Contract for low water flow.[47]

Reclamation awarded the contract for earthwork on the Delta Cross Channel to the George Pollock Company on May 8, 1950. Other contract awards for the channel included Consolidated Western Steel Corporation's for supplying the sixty by thirty foot radial gates on May 5, 1950, and Bethlehem Pacific Coast Steel Corporation for the radial gate hoists for the channel flood gate structure on May 15.[48]

The Delta Cross Channel travels 1.2 miles between the Sacramento and the Mokelumne River Systems. The channel has a bottom width of 210 feet and a capacity of 3,500 cubic feet per second. Delta Cross Channel draws fresh water from the Sacramento to the Mokelumne, to combat salt water intrusion in the Delta and dilute local pollution. The water travels through natural channels to the Intake Channel at the Tracy Pumping Plant. Reclamation closed the control gates of the Delta Cross Channel during high water to prevent flood stages in the San Joaquin section of the Delta. After the flood danger passes, Reclamation opens the gates to allow Sacramento River water through to the Tracy Pumping Plant.[49]

Contra Loma Dam

Reclamation awarded the contract for construction of Contra Loma Dam to Parish Brothers, Inc., on March 17, 1966, for $1,781,626. Parish Brothers received the notice to proceed April 2, 1966. The dedication ceremony for the dam was held on November 3, 1967. Parish Brothers completed Contra Loma Dam November 24, 1967. Final cost of the dam reached $1,960,000.[50]

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47. "Delta Channel Route Is Chosen By Water Bureau," *Fresno Bee*, 12 January 1945, in *Bureau of Reclamation Project Correspondence File 1930-1945: Central Valley*, RG 115, file 301.5: "October 1944 Thru," box 169; "Memorandum for the Press," 8 January 1945, *Bureau of Reclamation Project Correspondence File 1930-1945: Central Valley*, RG 115, file 301.5: "October 1944 Thru," box 169; E. B. Debler, Hydraulic Engineer, to Charles E. Carey, Region 2 Director, 9 September 1944, *Bureau of Reclamation Correspondence File 1930-1945: Central Valley*, RG 115, file 301.5: "Correspondence Regarding Canals and Laterals, January 1944 to September 1944," box 169.
48. "Notes For Contractors," *The Reclamation Era*, July 1950, inside back cover.
49. Bureau of Reclamation, "Central Valley Project Operating Plan," *Project Reports*, RG 115, Region 2, October 1952, box 159, 14, 46; Cook, "Sacramento-San Joaquin Delta," 22; Water Education Foundation, *Layperson's Guide to the Central Valley Project*, 9; Water and Power Resources, *Project Data*, 182.
50. Bureau of Reclamation, *Annual Project History, The Central Valley Project, 1966*, RG 115, Contract Summary Report Appendix; Bureau of Reclamation, *1967 Annual Report: Central Valley Project*, in *Annual Project History, Central Valley Project, 1967*, RG 115, 3, 9.

Contra Loma Dam is an offstream storage facility for the Contra Costa Canal. The dam consists of the dam and two dikes. Contra Loma Dam is a zoned earthfill structure 107 feet high with a crest length of 1,050 feet. The top width of the dam is thirty feet and the maximum base width is 630. Contra Loma Dam has a total volume of 641,000 cubic yards. Contra Loma Reservoir has a capacity of 2,100 acre-feet. The emergency spillway on the right is an uncontrolled ogee crest with a concrete chute and stilling basin. The spillway has a capacity of 600 cubic feet per second. The dam and reservoir sit at the southern end of the city of Antioch. The pumping plant pumps water from the Contra Costa Canal into the reservoir for storage, and releases the water by gravity.[51]

Post Construction History

The powerful pumping plants in the Delta Division had a major, and often detrimental effect, on stream flow in the Delta and the San Joaquin River Basin. During periods of low water flow and high quantities of exports, the Delta pumps actually reversed the flow of the San Joaquin River, taking it back upstream. Through the Delta's transport system, water normally traveling to the west, toward San Pablo Bay, instead moves back toward the east and south. The "reverse flows" disorient migratory fish, often luring them to the pumps, and draw salty ocean water into the San Joaquin River and other waterways.[52]

In 1944, Reclamation officials realized the salinity problem in the Delta was more pronounced than they previously thought. Charles E. Carey, the Region Two Director in 1944, believed Shasta Dam could not entirely control the salinity problem, precluding use of the Delta as a reservoir as planned at one time. Carey announced some possible alternatives to alleviate the salinity problem: build a closed conduit through or around the Delta to carry Sacramento River water directly to the other side without letting it mix with Delta water; change the Water Exchange Contract to make the water quality requirement less extreme (Carey believed this

51. Water and Power Resources, *Project Data*, 181; Bureau of Reclamation, *SEED (Safety Evaluation of Existing Dams) Report on Contra Loma Dam, Central Valley Project, California, Mid-Pacific Region*, Department of the Interior, Bureau of Reclamation, Division of Dam and Structural Safety, Assistant Commissioner--Engineering and Research, Denver, December 1982, Management Summary, 9, Evaluation Report, 2.
52. Water Education Foundation, *Layperson's Guide to the Delta*, 18.

unlikely, but others claimed it was possible); control the Sacramento River tributaries to control salinity and assure water quality; build Folsom Dam.[53] The proposed closed conduit foreshadowed later plans for the Peripheral Canal.

In the course of Delta Division development, though not built, the Peripheral Canal became one of the most controversial elements of Division planning. Reclamation proposed the Peripheral Canal to the Interagency Delta Committee (IDC) in early 1963, as an alternative water transfer system. By early 1965, the proposed canal had almost universal acceptance in the Delta region. California wanted Reclamation to design and construct the Peripheral Canal, then the state would assume control of the feature. Reclamation did not want state control of the canal, but did not have the authority to build it. California's Department of Water Resources (DWR), on the other hand, did have the authority to construct the canal.[54]

The IDC pointed out that much of the Peripheral Canal route would parallel Interstate 5, and material excavated from the canal could be used as highway fill. In January 1968, the California Departments of Water Resources and Public Works executed an agreement under which Public Works advanced $2 million to purchase rights of way in San Joaquin County for the canal. DWR agreed to repay the money when canal construction began, or no later than January 1, 1976.[55]

Changing attitudes in the United States, toward the environment and a myriad of other issues, soon infected perceptions of the Peripheral Canal. Contra Costa County opposed the canal because residents viewed it as another way to transport fresh water, out of their locale, to southern California. About the same time, questions arose about the environmental impact of the Peripheral Canal on fish populations in the Delta and the Central Valley. Environmentalists believed the canal's outlets would draw fish to them. They also believed the nitrogen rich water from agricultural drainage could foster algae growth, stagnating waters and suffocating the fish.[56]

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53. Millard Browne, "Key Delta Unit Worst Headache For Valley Project Engineers," *The Sacramento Union*, 15 March 1944, in *Bureau of Reclamation Project Correspondence File 1930-1945: Central Valley*, RG 115, file .023: "Clippings: January Thru June 1944," box 99.
54. Jackson and Paterson, *Sacramento-San Joaquin Delta*, 93, 121, 147.
55. *Ibid*., 148.
56. *Ibid*., 149, 151.

In a December 4, 1969, speech to the Irrigation Districts Association, William Gianelli, Director of DWR, responded to the environmental arguments, contending, "Californians must not 'fall into the quagmire trap of Chicken Little emotionalists."[57] The draft environmental impact report of 1974 received such a negative response, DWR decided to take some extra time to prepare an acceptable final report. Early in 1975, with construction of the Peripheral Canal scheduled to commence that summer, Director of DWR John Teerink announced a one year delay.[58]

The Department of Water Resources "proposed an amalgam of joint state-federal programs and facilities," including the forty-two mile Peripheral Canal, in 1977.[59] DWR contended the canal would circumvent the Delta channels and carry water more efficiently from the Sacramento River to the pumping plants of the CVP and the State Water Project. The canal could release fresh water into the Delta at certain points along its reaches to support irrigation, to benefit fish and wildlife, and to combat salt water intrusion. Supporters, including the Metropolitan Water District of southern California and various agribusinesses, argued the canal would help end the reverse flows caused by the south Delta pumps. Opponents continued arguing against the environmental impact of the canal, and further exports to southern California. A referendum on the entire project went before California voters as Proposition 9 in 1982. Proposition 9 failed because of cost (an estimated $3.1 billion) and environmental concerns. Other alternatives surfaced after the defeat of Proposition 9, but none went forward.[60]

Environmental problems came to the forefront in the Central Valley Project, and the Delta Division is only partially to blame for these problems. All divisions of the Central Valley Project and the features of the State Water Project supply water to the Central Valley, and they all contribute to the problems. One high profile problem which grew out of the CVP was the declining population of Chinook salmon in the Sacramento River. Most attention focused on the

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57. *Ibid*., 153.
58. Ibid., 168.
59. Water Education Foundation, *Layperson's Guide to the Delta*, 18.
60. Water Education Foundation, *Layperson's Guide to the Delta*, 18; Leonard Pitt, *California Controversies: Major Issues in the History of the State*, 2d ed. (Arlington Heights, Illinois: Harlan Davidson, Inc., 1987), 300.

winter-run Chinook salmon, listed as threatened species by the Federal government and endangered species by California. The estimated population of the winter-run Chinook in 1969, reached 117,000. In 1991, only 191 adults returned to the Sacramento River to spawn.[61]

Studies link several factors to the decline of the Chinook population including predation by two species introduced into the Delta, Striped bass and Colorado River squawfish, lack of water flow in the rivers because of upstream dams, and disorientation and destruction by the Delta Division pumping plants. The Striped bass population also experienced large declines. Another species facing declines and possible extinction is the three inch long Delta smelt. A fish found only in the Sacramento-San Joaquin Delta, the smelt faces destruction by the same forces as the Chinook salmon. The California Fish and Game Commission rejected the smelt for a state listing as a threatened or endangered species, but in March 1993, the Fish and Wildlife Service listed the smelt as a threatened species under the Federal Endangered Species Act.[62]

Settlement of the Project

Because settlers moved into the Central Valley long before Reclamation started construction of the CVP, the Project had little effect on settlement of agricultural land in the area. The CVP's improvement of the area's industrial water supply showed the greatest effect on the Delta region, allowing industry to grow and employ greater numbers of workers, especially during World War II. Contra Costa County grew from a population of 31,674 in 1910, to 100,450 in 1940. The county's population exploded to 298,984 by 1950. Merced County had a population of 46,988 in 1940, and Stanislaus had 74,866 inhabitants, which grew to an estimated 81,000 by 1942.[63]

As with the rest of California, the counties in the Delta Division reached population numbers rarely found in the counties of other western states. By 1990, Alameda County had a

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61. Water Education Foundation, *Layperson's Guide to the Delta*, 11.
62. Water Education Foundation, *Layperson's Guide to the Delta*, 11; Water Education Foundation, *Layperson's Guide to the Central Valley Project*, 17; Betty Brickson, "The Endangered Species Act and California Water: Where Projects and Species Meet," *Western Water*, November/December 1990, 9; Jim Dyar, "Dam Gates Give Salmon Real Problem," *Redding Record Searchlight*, 14 July 1994, in Bureau of Reclamation News Clips.
63. Bureau of Reclamation, "Report on The Feasibility and Estimated Cost Of The Southwest Contra Costa County Water District System," *Project Reports*, RG 115, November 1953, box 159, 15; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1942: Pt. 1*, RG 115, 51.

population of 1,279,182, and Sacramento was the second largest county with 1,041,219. Contra Costa County reached a population of 803,732, and Fresno had 667,490. Stanislaus County came in next to last with 370,522 inhabitants, and Merced County had 178,403. Delta Division facilities served 3,914 farms in 1992, with a population of 10,686.[64]

Uses of Project Water

The facilities of the Delta Division provide irrigation water for many acres of farm land in the Central Valley. Most of the land lies outside the Delta. The Contra Costa and Delta-Mendota Canals served over 300,000 people in 1966. Only about 18,000 people in the Delta received irrigation water from the Central Valley Project in 1977. Over 190,000 received water for municipal and other uses during the same year.[65]

One priority of Delta residents is assuring a supply of fresh water for a variety of uses. Salinity control contributed to some discord between Reclamation and Delta water users. Reclamation encountered problems in negotiating repayment contracts with the water users because irrigation expenses for other Central Valley water users became salinity control costs for Delta water users. Reclamation did reach a repayment agreement with the Sacramento River and Delta Water Association and the Delta Water Users Association in November 1965.[66]

World War II created more problems for agriculture on the Delta than just halting construction of Delta Division facilities. The removal of Japanese and Japanese-Americans from the west coast and the Central Valley caused a shortage of farm workers at harvest time, but the importation of farm workers from Mexico alleviated the problem.[67]

The Delta Division supports a large agricultural industry even with the problems it faces with salinity intrusion. Farmers in the Division grow a large number of crops on many acres of

64. Department of Commerce, Bureau of the Census, *Twenty-First Census of the United States, 1990: Population and Housing*, Bureau of the Census, 1990; Bureau of Reclamation, *Crop Production Report--1992: Mid-Pacific Region*, Bureau of Reclamation, 1992, 217.
65. Water and Power Resources, *Project Data*, 181; Bureau of Reclamation, *Annual Project History, Central Valley Project, 1966*, RG 115, Appendix: Crop Production and Water Reports.
66. Jackson and Paterson, *Sacramento-San Joaquin Delta*, 121.
67. Reclamation, *Project History, Central Valley Project, 1942: Pt 1*, 52.

land (see Table. III). Much of the acreage lies south of the geographic Delta.[68]

Conclusion

Reclamation developed the Delta Division in an area ripe for controversy, before and after construction of the Central Valley Project. Special interest groups compete to use the Delta and its water for their own special interests. Some groups argued for land use zoning areas strictly for municipal purposes, recreational development, fish and wildlife enhancement, or maintaining the Delta in its "natural" state. Conflicts between some of these groups still continue. Returning the Delta to its natural state seems the least likely, and indeed the most farfetched, idea. The Delta's true natural state began disappearing over a century ago as river diversions, hydraulic mining, industrial development, agricultural development, and the building of state and Federal water projects transformed the region.[69]

The Delta Division could be considered a microcosm of the struggle between man and nature. Californians struggled, from the beginning of settlement in the area, to make the Delta hospitable. Nature continues fighting back with floods, droughts, salt water intrusion, and California's most famous catastrophe, earthquakes. The struggle continues, but the outcome remains in doubt.

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68. Reclamation, *Central Valley Project: South Half, California*, Map No. 214-208-4175; Reclamation, *Central Valley Project: Delta Division, California*, Map No. 214-208-4177.
69. Cook, "Sacramento-San Joaquin Delta: A Man-Made Environment," 22.

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Table III. Crops Grown on the Delta Division--CVP in 1992. Source: Bureau of Reclamation, *Crop Production Report--1992: Mid-Pacific Region*, Bureau of Reclamation, 1992, 218-20.

Crops on the Delta Division--CVP in 1992

Cereals			
Barley	853	Corn	185
Oats	1,450	Rice	270
Wheat	2,844		
Forage Crops			
Alfalfa Hay	14,160	Irrigated Pasture	1,586
Other Hay	1,104	Silage or Ensilage	1,408
Misc. Field Crops			
Beans, dry & edible	15,015	Sugar Beets	4,717
Cotton, lint (upland)	37,487	Other Misc. Field Crops	1,666
Cotton, lint (Am. Pima)	405		
Vegetables			
Asparagus	403	Onions, dry	66
Beans (processing)	3,117	Peas, green (processing)	1,293
Beans (fresh market)	202	Peas, green (fresh market)	80
Broccoli	1,188	Peppers	1,144
Cauliflower	1,150	Tomatoes (canning)	12,581
Corn, sweet (fresh market)	154	Tomatoes (fresh market)	1,388
Greens	23	Other Vegetables	99
Seeds			
Alfalfa	9,304	Other Seed	8
Onion	50		
Fruits			
Apples	302	Peaches	89
Apricots	8,928	Melons (cantaloupe)	6,223
Cherries	644	Honey Ball, Honey Dew	1,443
Oranges & Tangerines	249	Watermelon	428
Dates	249	Prunes & Plums	319
Grapes, table	204	Other fruits	11
Grapes, other	891		
Nuts			
Almonds	12,036	Other Nuts	20
Walnuts	7,453		
Other			
Family Gardens & Orchards	87	Total Cropland and Pasture	152,277

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