

Solano Project

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The Solano Project

The Solano Project is a water project in the Sacramento River Valley in Northern California. Independent of other water projects in the state of California, Solano was built by the Bureau of Reclamation during the 1950s and early 1960s. Although it is technically not a part of the Central Valley Project, Solano remains a part of the total plan to develop the entire Central Valley Basin. Its spirit is very much the same as that of the CVP - to conserve to the maximum possible degree the waters of the Central Valley. Also, many of its technical features fit with those of other Central Valley Project works. Solano serves, primarily, Solano County, California. It distributes water to irrigable farmland in Solano County, as well as to the principle municipalities of the county. The Solano Project includes as its primary features: Monticello Dam and its accompanying reservoir, Lake Berryessa; Putah Diversion Dam, and its accompanying reservoir, Lake Solano; and the Putah South Canal.

Project Location

The Solano Project is located primarily in Solano County, California, which abuts the northeast extremity of San Francisco Bay. The reservoir that lays behind Monticello Dam, Lake Berryessa, is almost entirely in Napa County, directly northwest. Monticello Dam is on Putah Creek, the only stream on the project; it is a seasonal creek that runs dry in the summer months. The service area of the water project is entirely within Solano County.

The Solano Project area is within the Sacramento River Valley. The area of the Sacramento River Valley can be divided into three distinct physiographic regions, from east to west. The first of these regions is along the Sacramento River, and is made up of dense tree, vine, and brush vegetation interspersed with large tule marshes. The second region is made up of flat, open grassland plains containing occasional oak groves. The last, and most westerly

section, consists of the lower hills of the eastern Coast Range mountain slope, which rises all the way up to an elevation of 1,400 ft.¹

The Solano Project captures Putah Creek, which flows out of the eastern Coast Range. The area has a generally mild two-season climate that is typical of the Central Valley region. A warm, dry season extends from May until October, and a cool, wet season takes up the rest of the year. During the warm months, the daytime temperatures often get quite high, but the nights are generally cool. The winter temperatures rarely dip below freezing in the valley, but get slightly colder higher up in the coast range. Most of the precipitation comes in the form of rain, and it generally arrives in the winter months. Ninety percent of the rain comes in the months of December, January, and February. Snowfall is rare in the valley, and even in the mountains it is limited enough that it has no significant affect upon the hydrologic characteristics of streamflow.²

The main feature of the Solano Project is Monticello Dam, located on Putah Creek at the point where the stream crosses the Napa County/Solano County border. Behind it is Lake Berryessa, which has a storage capacity of 1,602,000 acre-feet. Six miles downstream from Monticello Dam on Putah Creek is the Putah Diversion Dam. From this point, the Putah South Canal breaks off from the creek and flows east for three miles, where it turns south, and carries water from the creek thirty miles to the terminal reservoir. Most of the irrigable lands lie below the canal, and are served by gravity.

Historic Setting

Prehistoric Setting

1. Sturtevant, William C., ed. *Handbook of North American Indians*. Vol. 8, *California*, Robert F. Heizer, ed. Washington, D.C., Smithsonian Institution, 1978, 350.

2. United States Department of Interior, Bureau of Reclamation, *Monticello Dam: Technical Record of Design and Construction*, (Denver, U.S. Government Printing Office, 1959) 1.

The first systematic cultural resources studies of the Putah Creek area were conducted during construction of Monticello Dam. Prior to, and also during, the construction of the dam and Lake Berryessa, fifty-three archaeological sites were recorded for the area. Of these fifty-three sites, forty-eight were inundated by the reservoir. Subsequent to construction of the lake, an additional twenty-nine archaeological sites have been recorded, most of which are partially or fully covered by the lake during periods of high water. The sites consist of isolated artifacts, artifact scatters, artifact concentrations, campsites, and large village sites. All of the large village sites were located along major drainages; most were on Putah Creek. Because of their low elevation, all of the large villages are now underwater.³

At least two periods of occupation are represented in archaeological remains in the Solano County area. The earlier period of occupation dates from 5,000 - 2,000 years ago (late Archaic - early Pacific period). The material culture represented at sites dating to this period is generally characterized by large milling tools, choppers, and scrapers. The later period of occupation dates from 2,000 years ago to protohistoric times (middle - late Pacific period). The material culture of this later period is characterized by clam shell disc beads, obsidian arrowheads, mortars and pestles, and glass trade beads in the later sites.

The people inhabiting the area at the time of European contact are known as the Patwin. The term "Patwin" was the term that the indigenous inhabitants of the area used to describe themselves; the term merely means "people." In no way does the word "Patwin" designate a political entity. The language of the Patwin people belongs to the Wintuan group of the Penutian language family, which also includes a number of other Northern California indigenous groups. Patwin territory consisted of the western portion of the Sacramento River Valley, including the

3. United States Department of Interior, Bureau of Reclamation, *Lake Berryessa Reservoir Area Management Plan Environmental Impact Statement*, (Washington D.C., U.S. Government Printing Office, 1989) 40.

Berryessa Valley, where the reservoir is now. A number of different ethnographic groupings seem to have lived in the Sacramento River Valley, but the Patwin had a strong hold on the Putah Creek region. Before European contact, the population of Patwin people, including their Wintu and Nomlaki neighbors (who also inhabited the Sacramento River Valley), seems to have been roughly 12,500.

Historic Setting

Upon contact with Euroamericans in the eighteenth century, the area of the Solano Project was inhabited by Patwin people. The earliest historical record of the region comes from Spanish Mission registers of baptisms, marriages, and deaths of Indian neophytes. By 1800, Indians were being forcibly taken from Patwin settlements to Mission Dolores in San Francisco, and Mission San Jose. At the missions, the Patwin provided both a labor force and military protection for the Spanish from other indigenous groups. Many other Indian groups of the San Francisco Bay area did not receive the proselytizing of the Spanish Missionaries as peacefully as the Patwin; or, rather, many groups resisted capture and indoctrination by the Spanish. At a rather rapid rate, many of the Patwin were baptized by the missions. During the 1830s and 1840s, Patwin land was rapidly devoured by both Spanish and American settlers. One researcher noted in 1877 that by the 1830s, much of the native culture of the Patwin people had surely been destroyed.

By 1840, American settlers William and John Wolfskill had established themselves along the banks of Putah Creek by constructing homesteads. In 1842, more settlers moved into the valley. The Vaca and Pena families each settled on Putah creek. Settlers competing for land and resources with the Patwin people resulted from both the missions, and explorers and fur-trappers that began coming to the region in the 1830s. Explorers like Jedediah Smith in 1830, John Work

in 1832-1833, and Lieutenant George Derby in 1849, all migrated to the Solano County area to check out the availability of trappable furs in the area, and to scout the most desirable places for a military installation.⁴

Missionization, military forays, raids by whites over supposed livestock theft, and to round up ranch workers, all decreased the native population during the middle of the nineteenth century. A malaria outbreak in 1833, coupled with a smallpox outbreak in 1837, took a heavy toll upon the Patwin. By the 1850s and 1860s, with increased immigration of whites into the area, most of the surviving Patwin either assimilated as laborers on white ranches, or were placed upon small reservations by the U.S. Government. By the time of the Solano Project's construction, in the 1950s, it is estimated that only between three and seven people of more than 1/4 Patwin ancestry lived in the area.⁵ After more than one hundred years of pressure by Europeans, the Patwin had either died off, or assimilated into Anglo culture.

The first major land grant in the Patwin territory came in 1843. Rancho Las Putas, located on Putah Creek and covering most of Berryessa Valley, was granted by the Mexican government to José and Sixto Berryessa. The rancho contained 35,515.82 acres, and was one of relatively few Mexican land grants confirmed by the United States after it acquired California in 1848. In 1850, when California became a state, Solano County was founded as one of California's original twenty-seven counties. It was named for Chief Solano, a Patwin leader who had worked as a diplomat during conflicts between the Mexican regional government and other Native American groups. By 1866, Rancho Las Putas had been passed to other hands, and was being subdivided into various smaller properties. In that same year, the town of Monticello was

4. Sturtevant, William C., ed. *Handbook of North American Indians*. Vol. 8, *California*, Robert F. Heizer, ed. Washington, D.C., Smithsonian Institution, 1978, 351.

5. Sturtevant, William C., ed. *Handbook of North American Indians*. Vol. 8, *California*, Robert F. Heizer, ed. Washington, D.C., Smithsonian Institution, 1978, 353.

established, and within two years it had two hotels and a general store. By this point, the Berryessa Valley was entirely dominated by new American settlers; the last of the Berryessa brothers was dead by 1874.⁶

Adding to the increased migration of Euroamericans into the Solano County area was the area's important military installations. In August of 1851, the Benicia Arsenal was established in Benicia, a city that would become one of Solano County's largest. Captain Charles Stone, with twenty-one U.S. Army enlisted men, established the arsenal as a storage depot for ordinance on the West Coast. Between 1853 and 1863, the Arsenal expanded, using Congress' allotment of \$550, 000 for the build-up of the arsenal. Fifteen stone and frame buildings were built on the site. By the time of the Civil War, it became the U.S. Army's primary ammunition depot on the West Coast. It remained a major ammunition storage station throughout both World War I and World War II.

Not very long after establishment of Benicia Arsenal, another military installation in Solano County was established. The Mare Island Naval Yard, in the San Pablo Bay, became the first United States Naval Yard on the West Coast. In 1854, the base was established by Naval Commodore David G. Farragut, and soon thereafter, Mare Island began producing ships for the U.S. Navy. Through the second world war, Mare Island was the largest naval yard on the West Coast, and was the principle supply base for the Pacific fleet. Even in the prewar years of the late 1930s, Mare Island was employing 6,000 workers in its shipyards, making it one of the largest employers in Solano County.⁷ The Mare Island Naval Yard was operated by the United States Government for almost 150 years; it was decommissioned in 1996.

6. United States Department of Interior, Bureau of Reclamation, *Lake Berryessa Reservoir Area Management Plan Environmental Impact Statement*, (Washington D.C., U.S. Government Printing Office, 1989) 40.

7. Thoreson, L. L., "Mare Island: Where the Pacific Fleet is Maintained," *California - Magazine of the Pacific*, June, 1939.

Historically, Solano County's other large industry is agriculture. The cattle ranching that occupied the time of the early ranchos was impacted in the 1860s by a series of heavy floods, followed by years of severe drought. The economy that started out based upon cattle raising began to switch over to one based on farming. At the end of the nineteenth century, grain became Solano County's primary crop. Both irrigation and dry land farming were popular in the area, and as nearby San Francisco grew into a major metropolis, Solano County's specialty crop industry prospered. However, with increased irrigation and urban development, water supply dwindled.⁸

Project Authorization

In 1940, the Solano Board of Supervisors organized the Solano County Water Council. The purpose of the water council was to study the areas of greatest water need and promote general water development in Solano County. Eight years later, in 1948, the Solano Irrigation District was founded, to obtain irrigation water from the newly proposed Solano Water Project. Later that year, on November 11, Secretary of the Interior Julius A. Krug authorized the Solano Project. The Bureau of the Budget gave its own clearance to the project on January 26, 1949, and two days later the project report was submitted to the Speaker of the House, thereby completing the authorization procedures as prescribed by the Reclamation Project Act of 1939. That year, the 81st Congress, First Session, appropriated \$100,000 in fiscal year 1950 for a re-study of the economics of the project. The Second Session of the 81st Congress appropriated another \$321,000 for fiscal year 1951 for the advanced planning of the project prior to construction.⁹

Initially, there was some debate at Reclamation as to whether or not the Solano Project

8. United States Department of the Interior, Bureau of Reclamation, *Solano Project California*, (Washington D.C., U.S. Government Printing Office, 1959) 10-1.

9. "Annual Project History, Solano Project," Volume I, 1952, 1-2.

should be included as a part of the Central Valley Project. From the beginning of the Solano Project, it was included in the Bureau of Reclamation's comprehensive plan to develop the Central Valley's water resources. However, many believed that the project to be constructed along Putah Creek should be financed, and operated, independently from the Central Valley Project. To this end, a public hearing was held in November of 1952, in Sacramento, by a committee headed by Senator William Knowland to determine whether or not the Solano Project be included with the CVP. Early in 1953, it was finally decided that Solano should be undertaken as a separate project.

The initial goals of the approved project were to meet "urgent" demands for water at the nearby national defense establishments (both Mare Island Naval Yard and Benicia Arsenal, as well as Travis Air Force Base), and at nearby industrial sites and municipalities. Also, the Solano Project was to provide irrigation water for farmland in Solano County. The water from the project, it was estimated, would allow 55,930 acres of new farmland to come into production, as well as provide supplemental water to 18,870 acres of current farmland. Other benefits of the project included flood control for the lower stretches of Putah Creek and recreation on the proposed Lake Berryessa.¹⁰

To facilitate this water development and allocation, The Solano County Flood Control and Water Conservation District was authorized by the state, and activated by the Solano County Board of Supervisors on November 28, 1951. This would be the agency responsible for the distribution of water from the Solano Project to the organizations and citizens of Solano County. The method by which the water would be allocated to these various organizations was approved in March of 1953. On March 2, the Solano County Flood Control and Water Conservation

10. "Annual Project History, Solano Project," Volume I, 1952, 1-2.

District unanimously approved, by resolution, the contract providing water service to Solano County, and the operation of certain aspects of the Solano Project by the County. In June of 1953, the Secretary of Interior this contract. Once the Solano County Flood Control and Water Conservation District obtained water from the Bureau of Reclamation, it would sell water to its member units. In effect, Reclamation stored the creek, and diverted it to a canal that took the water to the water users; the district diverted the water in the canal to the users.¹¹

The total estimated cost, at the time of construction, was \$51,611,000. This was to be paid back by water sales in approximately fifty years. The water rate was fifteen dollars per acre-foot for water delivered to municipalities and areas that amounted to less than two acres. The rate for irrigation water varied; it was \$1.55 per acre-foot for the first two years, \$2.05 per acre-foot for the next three years, and \$2.65 per acre-foot for the remainder of the pay out period.¹²

Construction History

In July of 1952, Congress appropriated \$3,000,000 for use on the Solano Project in Fiscal Year 1953. However, Congress stipulated that construction could not begin until after the final decision about whether or not to make Solano a part of the CVP. Later that same month, the first construction field office for the project was established in Winters, California. The field office was followed a month later by placement of house trailers for Reclamation employees in Winters. The last major step of the year was the transfer of the materials lab from Los Banos to Winters in October of 1952.¹³

With the decision, early in 1953, to construct the Solano Project as a separate entity from the Central Valley Project, initial construction preparation could take place. First, much land

11. "Annual Project History, Solano Project," Volume II, 1953, 5-6.

12. "Annual Project History, Solano Project," Volume V, 1956, 3-4.

13. "Annual Project History, Solano Project," Volume I, 1952, 3-4.

had to be acquired from private sources for the reservoir and dams. A Bureau of Reclamation report from the time attests, “considerable attention was given to the developing of good public relations in the project area.” To further this goal, land for the project was not taken immediately from private citizens, although it was acquired. Those who had to give up land for the project were allowed to continue to use (farm, reside on, etc.) the land until it was finally made inaccessible by flooding. They were, however, paid eighty percent of the purchase fee up front, before the land was abdicated. The last twenty percent would be paid upon the flooding of the area. This system attests to Reclamation’s attention to the needs of Berryessa Valley landowners.

Reclamation began initial staking of the works to be built. First, Reclamation staked the axes of the Putah Diversion Dam site. Monticello Dam site also had its axis staked, along with the axis of the spillway and the diversion tunnel. A grid, on ten-foot coordinates, for a cross section of the dam also was established. Other surveying work was done on the relocation of State Highway 128, and on a temporary construction detour.

Before any new structures could be built, an aggregate quarry site had to be located, from which to collect the necessary materials for concrete and asphalt. Throughout 1953, fifteen possible aggregate deposits or quarry sites were investigated by Reclamation. The Denver Laboratory tested materials from favorable deposits, and three sources of asphalt for the new road were investigated.

On July 30, 1953, opening bids for Monticello Dam construction were taken at City Hall in Winters, California. On August 7, the joint contract for construction of Monticello Dam and the first stretch of the State Highway 128 relocation was awarded to Peter Kiewit Sons Company and Parish Brothers. The two companies would be responsible for building the main dam on the

Solano project, and the moving of the first section of highway. On August 24, Reclamation gave notice to the contractors that they could proceed with construction of the dam and highway. Finally, on September 24, a groundbreaking ceremony was held for Monticello Dam. It was attended by Governor Earl Warren, among other prominent local, state, and federal officials. Warren, along with California State Senator Luther Gibson, drove the first bulldozer to break ground at the damsite. Excavation of the damsite continued throughout the year. With all the work done that year, however, the only concrete that was actually placed in 1953, was on the new permanent highway bridge across Putah Creek.¹⁴

Construction on the permanent State Highway 128 bridge continued into 1954, and was finished and opened for use on November 9. Work on the right abutment of Monticello Dam began the previous fall, and kept up through 1954. Work on the left abutment of the dam began in August of 1954. Construction on the spillway shaft and diversion tunnel on Monticello Dam was started in March, and finished in November. Construction went fairly smoothly, with Putah Creek flooding in January, March, and April, and causing washouts of temporary causeways and flooding construction areas. However, work was mostly steady. The first section of the highway relocation finished in November, and the second section was started a few months prior to this, on July 26.

Nineteen-fifty-four also brought the first survey work on the Putah South Canal, the thirty-three mile canal that would eventually bring water to its required locations in Solano County. In August, field tests were conducted to determine whether the canal would be concrete-lined or earth-lined. The results led Reclamation to decide to line the canal with concrete. The as-yet unnamed Monticello reservoir (Lake Berryessa would not be so titled until

14. "Annual Project History, Solano Project," Volume II, 1953, 6-7.

1956) was also surveyed, with heavy emphasis on rights of way data, new highway location, and a detailed survey of the old Monticello Cemetery which was within the reservoir boundary.

Also new to the Solano Project in 1954 were safety regulations and precautions. The principle contractor on the job instituted monthly safety meetings among workers. In August, they hired a general safety engineer, and also began providing an ambulance and a First Aid room. The contractors also established crew-level safety meetings, and in September, established a joint safety committee composed of representatives of the contractor and Reclamation. Parallel to the contractor's efforts, Reclamation hired a full-time safety engineer.

In June of 1954, Reclamation began preliminary work on identification of graves in the old Monticello Cemetery. The old cemetery, located in Berryessa Valley, would be flooded by the new reservoir. Relocation of the cemetery required identification of graves, and locating the heirs of the deceased in order to obtain necessary permission. This continued throughout 1954. Reclamation also established contracts with the Board of Directors of the Cemetery Association in an effort to select a site for the relocated cemetery. By the end of the year, a new site had yet to be selected. However, the identification of graves was essentially done, as was heir location.¹⁵

At the beginning of 1955, work was underway on the lining of the diversion tunnel and excavation of Monticello Dam. In February, the diversion tunnel was completed, and ready for the creek to rush through it. On March 17, Putah Creek was diverted through the tunnel by the use of an upstream cofferdam. With the water now out of the way, construction on the actual dam could begin. On May 11, foundation grouting on the dam began, and by July, the concrete mixing plant nearby was complete. On August 9, 1955, the contractor placed the first concrete in Monticello Dam. October and November saw the dam's outlet pipes placed. By the end of

15. "Annual Project History, Solano Project," Volume III, 1954, 3-4.

the year, a total of 123,200 cubic yards of concrete had been placed in the structure - approximately thirty-eight percent of the total. In four of thirteen blocks, concrete had been placed to a height ninety-five feet, and to a height of sixty-five feet in the lowest blocks. Total amount paid to the contractor for work completed, at this point, was \$5,118,645.

Work on the second ten-mile section of State Highway 128 relocation was completed and accepted by the State of California on October 31, 1955. Just prior to this, in early September, the third section of the highway relocation was begun. The construction crews made good progress throughout the fall until heavy rains in December caused major damage to a number of partially constructed culverts. The culverts had to be rebuilt, which slowed work. On October 17, a contract for the job of clearing the lower portion of Berryessa Valley in preparation for the reservoir was awarded, and work on this task commenced. The upper portions of the Berryessa Valley had to be cleared of trees and other debris, so that the debris could not cause damage to boats or the dam itself.¹⁶

The first five months of 1956 produced almost no progress on dam construction because of heavy rains. The flooding that ensued caused damage to the contractor's trestles and form yards. On May 15, after sitting idle since the end of December, the contractors - Peter Kiewit Sons Company and Parish Brothers - began placing concrete again. They worked on a three-shift basis until the middle of December, constantly having three shifts working at once in order to make up for lost time. At this point, the dam was nearing completion and the high walls of the dam became so thin that they only had room for a single crew. By the end of December of 1956, a total of 318,000 cubic yards of concrete had been placed, or 92.5 percent of the total. Just under a year and a half had elapsed since the first placement of concrete in the dam. In four

16. "Annual Project History, Solano Project," Volume IV, 1955, 2-3.

of the nineteen blocks, the construction crews had reached an elevation of 454 feet, out of a total height of 456 feet.

The third section of State Highway 128 was completed on August 30 1956. The heavy rains of the winter months of 1956 took their toll on the road, causing the extension of completion date. On October 3, the contractor completed the clearing of the reservoir area, after being shutdown throughout January, February, and March because of heavy rains. The Monticello Cemetery relocation project was begun on July 9, and was finished on October 29. All told, 308 remains had been exhumed and re-interred.

On January 31, 1956, Reclamation awarded a contract for the first section of the Putah South Canal. By December, 96.3 percent of it had been completed. Lastly, on August 24, 1956, Reclamation awarded a contract for construction of Putah Diversion Dam. Work on it began on September 5.

On April 27, 1956, the 84th United States Congress, 2nd session, approved bill S-2775, which named the reservoir behind Monticello Dam. Until then, the reservoir had been referred to as “Monticello Reservoir.” From then on, however, it would be known as Lake Berryessa. The lake has an average annual inflow of 375,000 acre-feet, and a total storage capacity of 1,602,300 acre-feet.¹⁷

The contractor completed most construction on the Solano Project in 1957. Monticello Dam was officially completed on November 7, 1957. It is a constant-center arch concrete dam with a structural height of 304 feet, and a crest length of 1,023 feet. Exactly 325,890 cubic yards of concrete were placed in its construction. Putah Diversion Dam was completed in October of 1957. It is located six miles downstream from Monticello Dam on Putah Creek. The dam is a

17. “Annual Project History, Solano Project,” Volume V, 1956, 5-6.

gated concrete weir structure with an earthfill embankment wing. Its height is twenty-nine feet, and its crest length is 910 feet. The dam creates Lake Solano, which is roughly one-and-one-half miles long, and has a maximum capacity of 750 acre-feet. Putah South Canal, section one, was completed in February 1957, four months ahead of schedule. The next section of the canal was complete, with the exception of cleanup work, at the year's end. The third section of the canal was thirty percent complete by the end of December, 1957. The fencing around Lake Berryessa was eighty-eight percent complete by the end of 1957. Also, in 1957, the California State Park Commission approved establishment of a state park on the west side of Lake Berryessa.¹⁸

On January 2, 1958, Reclamation awarded the contract for the construction of the final four-and-one-half mile stretch of Putah South Canal. Darkenwald Construction and Vinson Construction Company combined in a joint effort for the contract, which was worth \$1,537,474. By the end of the year, the canal had been excavated and concrete lining operations were complete. Only slight minor adjustments remained to be made. Also, at the end of 1958, the entire Lake Berryessa Recreation Area, established the year before, was leased to Napa County for management of recreation and other land uses.

The estimated total cost of the Solano Project was \$37,397,000, a substantial decrease from the projected cost a few years earlier. The decrease was due to removal of the distribution and drainage systems from the project, as these features were now to be constructed by the irrigation district.¹⁹

The water that flows through Putah Creek is captured by Monticello Dam to form Lake Berryessa. The water that Reclamation releases from the dam flows six miles downstream in the creek bed to Putah Diversion Dam, which again pools the water of Putah Creek, creating Lake

18. "Annual Project History, Solano Project," Volume VI, 1957, 1.

19. "Annual Project History, Solano Project," Volume VII, 1958, 2-3.

Solano. There, water diverted into Putah South Canal, is carried east for three miles, and then south for another thirty miles. Along the way, much of it is diverted, via canals and pipelines, to the farm communities of Solano County. The Putah South Canal ends at the Terminal Reservoir, which saves the unused water to be utilized by area municipalities and industry.

Post-Construction History

All Solano Project construction was finished at the end of 1958, with the exception of Putah South Canal, which was 99.4 percent complete. Monticello Dam and its appurtenant works, Lake Berryessa, and Putah Diversion Dam were all transferred to operative status on July 1, 1959. It was, and is, operated by the Bureau of Reclamation. Putah South Canal was transferred to the Solano County Flood Control and Water Conservation District on May 1, 1959. The district then transferred operation of the canal to the Solano Irrigation District. On December 21, 1959, Reclamation closed the Solano Project office in Winters and established a construction field branch to finish construction activities.²⁰

All work on Putah South Canal was completed and accepted in February of 1960. Although the main canal was operative, considerable work was done on the Green Valley conduit, a high-pressure concrete pipeline that extends 8,400 feet from the Putah South Canal into Green Valley. Several subconduits lead from this main conduit, carrying water across the valley to farmland. Of the 68, 020 irrigable acres of the project, 38,800 acres are served by unlined gravity canals, 21,430 acres are served by gravity pipelines, and 7,790 acres are served by concrete pipe lift systems, with a total of fifty seven pumps.²¹

Lake Berryessa filled on April 18, 1963. However, in 1964, leakage developed along both the Putah South Canal and the Terminal Reservoir, where the canal eventually ends.

20. "Annual Project History, Solano Project," Volume VIII, 1959, 3.

21. "Annual Project History, Solano Project," Volume IX, 1960, 1.

Although the canal was operated by the Solano Irrigation District, the Bureau of Reclamation agreed to take care of the leaks. However, no work was done that year to repair the problem.²²

Repair work on the Solano Project began in 1965. Much of the seepage problem on the Putah South Canal was fixed. The rest of the canal seepage problem was repaired in 1966. On November 28, 1966, Reclamation awarded a contract for the repair of the Terminal Reservoir seepage problem. The contract went to R. C. Collet, Inc., of Woodland, California. It provided for the installation of an interceptor drain system and a sump structure at the reservoir. Work, however, was not started until the following year.²³

In January of 1967, R. C. Collet initiated repair work on the Terminal Reservoir, and it was complete by March of 1967. Also in that year, the Solano Irrigation District extended a forty-two-inch pipeline to serve the city of Benicia. After construction, the pipeline had seepage problems, and Reclamation began a study to determine the cause of the problem. Later that year, construction finished on a turnout and appurtenant works to provide water to the California Medical Facility at Vacaville. A turnout and pump facility was also under construction to provide water to the University of California at Davis, and was completed the following year.²⁴

In 1972, Reclamation initiated a \$2,000,000 rehabilitation and betterment campaign on the Solano Project, through a contract with the Solano Irrigation District. Funds were transferred from Reclamation to the irrigation district, which would then perform the necessary work through contract or by its own forces. During 1972, this project repaired and replaced leaking pipelines and canal lining for distribution system of the drainage system. This included the installation of groundwater wells and pumps, and extension of concrete lined drains.²⁵

22. "Annual Project History, Solano Project," Volume XIII, 1964, 1.

23. "Annual Project History, Solano Project," Volume XV, 1966, 2.

24. "Annual Project History, Solano Project," Volume XVI, 1967, 1.

25. "Annual Project History, Solano Project," Volume XX, 1972, 2.

For the fifteen years of operation leading up to 1973, the recreation resources and uses of Lake Berryessa on the Solano Project had been managed by the local county government. Some of the recreation services had been of appropriate quality, however, most had not. Because of the complexities of the problem, the Bureau of Reclamation Mid-Pacific region established a field headquarters at Lake Berryessa and assigned a natural resource specialist to relate and cooperate more directly with county officials, as well as recreation users.²⁶

The following year, in 1974, Congress authorized Reclamation to develop, operate, and maintain recreation facilities at Lake Berryessa, under Public Law 93-493. The bill was signed by President Gerald Ford on October 27, 1974.²⁷

The Bureau of Reclamation took over the operation of Lake Berryessa on July 1, 1975. At this point, Reclamation adopted the National Park Service Public Use Plan of 1959 to use as a guide for development of the recreation area, with appropriate provisions being made.²⁸

During 1980, visitor use days at the Lake Berryessa recreation area numbered approximately 1,124,767. Reclamation carried out, in many cases through the volunteer help of Boy Scout troops and other youth organizations, general campground maintenance, and sign, sewer, parking lot, and culvert maintenance and installation. Also, in 1980, Congress passed Public Law 96-375 which gave Reclamation the right to negotiate with present concessionaires for a new agreement regarding their services. The law also gave concessionaires ownership of all improvements that they make to the recreation site. Finally, a Safety Evaluation of Existing Dams (SEED) examination was conducted on Monticello Dam on January 31.²⁹ The overall dam safety evaluation was classified as FAIR, in the 1986 SEED report. The reason for the FAIR

26. "Annual Project History, Solano Project," Volume XXI, 1973, 1.

27. "Annual Project History, Solano Project," Volume XXII, 1974, 1.

28. "Annual Project History, Solano Project," Volume XXIII, 1975, 1.

29. "Annual Project History, Solano Project," Volume XXVIII, 1980, 2.

rating was the sizable population living just downstream in the flood plain of Monticello Dam. In the event of a dam failure (which was not considered to be likely), the potential for loss of life would be particularly great at the Solano Project.³⁰

In 1981, the U.S. government executed a supplemental agreement with Napa County Flood Control District and Water Conservation District to allow Napa County to use increased amounts of water provided by its 1964 contract . The counties of Napa and Solano also settled a lawsuit pending between the two regarding usage of Solano Project water. Napa agreed to use the amount of water provided in its 1964 contract before taking any of the Solano Project's supplemental water. Also, Napa County agreed to withdraw a license request with the Federal Energy Regulatory Commission to develop power at Monticello Dam. On the project maintenance front, Monticello Dam had force vibration tests performed by ANCO Engineers, Inc. to determine the dam's reaction to a seismic event.

The Solano Irrigation District received, in 1981, a license from the Federal Energy Regulatory Commission for construction of a hydropower plant at Monticello Dam. The construction contract for the power plant was awarded to Syblon-Reid, of Folsom, California. Construction was scheduled for 1983.³¹

Monticello Dam Powerplant was constructed in 1983 at the base of Monticello Dam. It is owned, operated, and maintained by the Solano Irrigation District. The powerplant has three generators and a capacity of 11,500 Kilowatts.

In 1995, a Field Exploration Program removed fifty-feet of ten-inch diameter concrete core from block twelve of Monticello Dam. The core was shipped to the Technical Service Center for testing. Because of a scatter of results on the first test, in 1998, another 112 feet of

30. United States Department of the Interior, Bureau of Reclamation, Division of Dam Safety, *SEED Report on Monticello Dam*, (Denver, U.S. Government Printing Office, 1986), 1.

31. "Annual Project History, Solano Project," Volume XXIX, 1981, 1-2.

ten-inch-diameter core was drilled from block five of the dam, and sent off for testing.

In March of 1996, a probable maximum flood study was conducted to test the probabilities of dam failure. In May of 1999, a scoping level risk analysis was conducted to re-evaluate the 1996 test. The results concluded that the main contributor to risk is the large population that lives just downstream in the flood plain of the dam. However, the dam was considered to be in excellent condition and the annualized loss of life risk was deemed to be quite low.³²

In February of 1999, Reclamation reached an agreement with the Napa County Flood Control and Water Conservation District that entitles them to 1,500 acre-feet of water per year for the next twenty-five years.³³

Settlement of the Project

In 1992, the Solano Project provided water to 925 farms in Solano County. As of that year, the total irrigable acreage in Solano County was 71,445. The majority of these are served by unlined gravity canals, with a lesser number of acres being served by gravity pipelines, and a small amount of acres being served by concrete pipe lift systems. Solano water does not provide full irrigation service for any land; the entirety of its irrigable acreage receives supplemental water from other sources. In 1992, of the 71,445 irrigable acres in Solano County, 70,307 were farmland that would be supplemented by other water sources. The remaining 1,138 acres of irrigable land were commercial, industrial, or residential in nature.

The actual number of irrigated acres has been consistently less than the possible irrigable acres. In 1968, the total number of irrigated acres was 45,693. This number has fluctuated a

32. United States Department of Interior, Bureau of Reclamation, *Report of Findings: Monticello Dam Issue Evaluation, Solano Project, California*, (Washington, U.S. Government Printing Office, 2000), 3-7.

33. United States Department of Interior, Bureau of Reclamation, Project Dataweb - Solano Project, <http://dataweb.usbr.gov/html/solano.html#plan> accessed 6/05/00.

great deal over the years. The number of irrigated acres climbed throughout the 1970s, reaching a peak of 62,673 acres in 1976. The late 1970s and early 1980s, however, showed a large drop in irrigated acreage, bottoming out in 1983 at 43,617 acres. For the most part, excepting the period between 1987 and 1989, the irrigated acreage in Solano county rose after this, reaching 59,378 acres in 1992.³⁴

Solano County farms produced \$61,023,665 in crop value in 1992. The main harvested crops include (in decreasing order of growing acreage): sugar beets, corn, tomatoes, wheat, castor beans, prunes, plums, pears, almonds, and a variety of others. During years of low water levels, the mix of crops grown often changes significantly to adjust to the amount of water available. During the drought year of 1977, for example, cereal grains (barley and wheat) replaced sugar beets as the number one crop for Solano County, as they require less water for cultivation.³⁵

Uses of Project Water

The Solano Project provides water for Solano County, California. Much of its water goes to farmland in the county. It was initially designed to irrigate approximately 96,000 acres of farmland. However, as of 1992, only 71,445 acres were irrigable under the Solano Project, and of that, only 59,378 were actually being irrigated. The project also provides water for municipal and industrial usage. The cities of Fairfield, Vacaville, Suisun, Dixon, Benicia, and Vallejo all receive their water from the Solano Project. Travis Air Force Base, Solano County's third military installation (along with Mare Island and Benicia Arsenal), gets its water from the Solano

34. United States Department of Interior, Bureau of Reclamation, Project Dataweb - Solano Project, <http://dataweb.usbr.gov/html/mpsolprjdata.html> accessed 6/05/00; United States Department of Interior, Water and Power Resources Service, *Project Data*, (Denver, U.S. Government Printing Office, 1981), 1173.

35. M. B. Sonnen Co., Inc., Prepared for Office of Water Research and Technology, Washington D.C., , *Incentives for Agricultural Water Conservation*, (Springfield, Virginia, National Technical Information Service, 1980), 64-6.

Project, as does the California Medical Facility and the University of California at Davis.

The Solano Project also produces power, although Reclamation was not involved with this section of the project. There is a small hydroelectric power plant at Monticello Dam. It was built by the Solano Irrigation District in 1983, and is currently owned and operated by the district. Its output is 11,500 kilowatts.

Recreation is a huge part of the Solano Project. Two major recreation areas are located on project lands, Lake Berryessa Recreation Area and Lake Solano Recreation Area. Lake Berryessa Recreation Area has been operated by the Bureau of Reclamation since 1975. Before that, it was administered by Napa County. It has seven developed concession resorts which offer boating, swimming, water skiing, fishing, camping, and picnicking. There are two prime day sites, Oak Shores and Smittle Creek, and a large boat ramp. The lake itself has a storage capacity of 1,600,000 acre-feet, and measures twenty-six mile long by three mile wide. Its total shoreline is 165 miles. Along the east side of the lake, there is a 2,000 acre wildlife area that is jointly managed by the Bureau of Reclamation and the California Department of Fish and Game.³⁶

Lake Solano has been administered by the Solano County Parks Department since 1971. It offers camping, boating, swimming, fishing, and picnicking as recreational options. The lake is one-and-one-half miles long, and has a storage capacity of 750 acre-feet. More than 200,000 visitors use Lake Solano's facilities annually. It is considered one of the best fly-fishing spots in the Sacramento River Valley. The county operates a campsite at the recreation area, which offers ninety sites, forty of which have electrical hook-ups.³⁷

36. Recreation.Gov, Lake Berryessa, <http://www.recreation.gov/detail.cfm?ID=17> accessed 6/05/00; United States Department of Interior, Water and Power Resources Service, *Project Data*, (Denver, U.S. Government Printing Office, 1981), 1172.

37. Recreation.Gov, Lake Solano, <http://www.recreation.gov/detail.cfm?ID=1987> accessed 6/05/00.

The Solano Project, and specifically Monticello Dam, provides flood control benefits for the downstream portion of Putah Creek. It is estimated that the facilities of the Solano Project prevented damages in the range of 5,015,000 dollars in the period 1957 to 1995.³⁸

Conclusion

The Solano Project provides water that irrigates almost 1000 farms in Northern California. It also allowed growth in cities in Solano County, an area that, much like most of the San Francisco Bay area, has grown rapidly over the last thirty years. Water initially designated for farmland and industrial uses, is increasingly going to municipal supply. Once a seasonal stream that ran dry in the summer, Putah Creek now provides water for the area on a year-round basis.

About the Author

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38. United States Department of Interior, Bureau of Reclamation, Project Dataweb - Solano Project, <http://dataweb.usbr.gov/html/solano.html#plan> accessed 6/05/00.

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