Weber Basin Project

Christopher J. McCune
Bureau of Reclamation
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Table of Contents

The Weber Basin Project

In 1969, the Bureau of Reclamation completed the Weber Basin Project in Utah; an endeavor that had been over twenty-five years in the making, constructed in response to the growing populations of cities such as Ogden, Bountiful, and Layton. Consisting of six primary dams and reservoirs, three diversion dams, two aqueducts, one tunnel, four canal systems, and two powerplants, the project also incorporated previous work done by Reclamation for the Weber River, Provo River, and Ogden River Projects. The result is a comprehensive municipal and agricultural program under the jurisdiction of the Weber River Water Users Association, which benefits residents within the Weber River Basin. As the population of the Basin (further mention of the Basin is in reference to the Weber River Basin) continues to grow, the importance of the Weber Basin Project and the necessity for water conservation, hydroelectric power, and flood control will become increasingly significant.

Project Location

The Weber Basin Project is a group of water storage and delivery structures located within the drainage basin between the Weber and Ogden Rivers, just to the north and west of Salt Lake City, Utah. The largest city within the project lands is Ogden, with a population of 66,507 as of 1998.[1] However, the project also serves cities and farmers in areas throughout Weber, Summit, Morgan, and Davis Counties. The most prominent features of the project are its dams and reservoirs – Arthur V. Watkins Dam and Willard Reservoir; Pineview Dam and Reservoir; Causey Dam and Reservoir; East Canyon Dam and Reservoir; Lost Creek Dam and Reservoir; and Wanship Dam and Rockport Lake. Although Pineview Dam and Reservoir are officially part of the Ogden River Project, the enlargement of Pineview Dam was performed

1. U.S. Bureau of the Census, Subcounty Population Estimates, June 30, 1999.

under the auspices of the Weber Basin Project. Except for East Canyon Dam, which is a concrete thin arch design, the dams are all zoned earthfill structures. The Stoddard and Slaterville Diversion Dams are concrete gate structures located along the Weber River, while the Ogden Valley Diversion Dam is a gated spillway on the Ogden River upstream from Pineview Dam. The water carnage facilities, which include the Gateway Tunnel, all aqueducts and canals, and several pumping plants, total 66.55 miles and have a total carrying capacity of 4,181.5 cubic feet per second. These facilities are located throughout the project lands. Lastly, the Gateway Powerplant is located ten miles southeast of Ogden, with a nameplate capacity of 4,275 kW, while the Wanship Powerplant is located at the foot of Wanship Dam and has a capacity of 1,425 kW.[2] As of 1992, the project encompassed 90,501 acres of irrigable lands, serving a population of 505,226 of whom 99% are considered non-farm populace.[3]

Historic Setting

Although the Weber River Basin is known primarily for the settlement of the region by followers of the Church of Jesus Christ of Latter-day Saints (more commonly known as the Mormons), the history of the region stretches back for centuries. Geologically, the Basin was once a part of ancient body of water known as Lake Bonneville. Scientists disagree on when Bonneville achieved its high-water mark (anywhere from 15,000-65,000 years ago), but it is known that at one point, this gigantic lake covered a maximum surface area of 20,000 miles, about the size of Lake Michigan. The lake encompassed most of northwestern Utah, and also stretched into Idaho and Nevada. Bonneville's drainage basin, at 53,325 square miles, was the

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2. U.S. Department of the Interior, Water and Power Resources Service. *Project Data*, (Denver: Government Printing Office, 1981)1311-4.
3. U.S. Department of the Interior, Bureau of Reclamation. "Weber Basin Project: Project Data," *DataWeb*, Internet, www.dataweb.usbr. gov/html/ucwbsprjdata.htm, accessed June 4, 2001.

size of New York or Pennsylvania.[4] Prolonged centuries of drought 4,000 years ago severely receded Bonneville's shoreline. Today, all that is left of this enormous body of water is the Great Salt Lake, a large body of water in its own right; the rivers of the Weber Basin flow into this lake, rather than serve as tributaries of larger waterways such as the nearby Colorado River.

The Basin was first inhabited by hunter-gatherer bands of the Ute, Paiute, and Shoshone tribes, who sometimes fished by the shores of Utah Lake, just south of the Great Salt Lake. In 1776, the first European contact arrived by way of the mouth of Spanish Fork Canyon. These new arrivals were Spanish Franciscan monks from Santa Fe, who glimpsed the Salt Lake Valley but did not enter, and stayed in the area only for a brief time before returning to New Mexico. In the 1820's, fur trappers searching for beaver roamed near Salt Lake's shores. These explorers included a captain of the Hudson's Bay Company by the name of Peter Skene Ogden, as well as mountain men Jedediah Smith and Jim Bridger. John C. Frèmont led expeditions to the Great Salt Lake in 1843 and 1845. In 1846, Miles Goodyear built Fort Buenaventura at the confluence of the Ogden and Weber Rivers, which served as his home until his holdings were purchased by the Mormons in 1848.[5]

The arrival of the Mormons to the Salt Lake Basin in 1847 precipitated the formation of the first large-scale Anglo settlements in the region. In an effort to strengthen the presence of the church in the West, their leader Brigham Young sent out colonists to found various settlements throughout Utah, as well as in the nearby regions of present-day Idaho, Colorado, Nevada, Arizona, and California. In a manner consistent with the faith's emphasis on communal subsistence, these settlements were rarely very far from one another, "true villages chosen with a

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4. Samuel G. Houghton. *A Trace of Desert Waters: The Great Basin Story*, 2nd ed., (Reno: University of Nevada Press, 1994) 223.
5. David L. Bigler. *The Forgotten Kingdom: The Mormon Theocracy in the American West*, (Spokane: The Arthur H. Clark Company, 1998) 30-4.

view to Indian defense," and the presence of water and arable land to encourage the agriculturally-based economy that the Mormons wished to establish.[6]

When water was scarce, the Mormons were forced to improvise, almost from the very beginning of their arrival in the Salt Lake Valley. The aridity of the Weber River Basin is one of its key geographic features, receiving an average annual precipitation of 18 inches a year.[7] The lack of steady and abundant rainfall in these areas prompted the Mormons to develop systems of diversion canals, ditches, and dams throughout their settlements, as well as regulations regarding their use. When Ogden was officially incorporated as a city on February 6, 1851, one of the responsibilities outlined for the city council was to provide water; when interpreted liberally, this law also gave the councils control over irrigation streams within city limits in addition to municipal supplies. In 1852, Utah Territory established water rights through prior appropriation rather than riparian rights, giving first claimants a right to the water needed for crops. Future claimants could also acquire rights from the same stream, but the water needs of the first claimant are met in times of shortage before these subsequent claims are addressed. Unlike Colorado and California, where prior appropriation was instituted primarily for mining claims, water rights in Utah were directed towards agricultural developments. Because of the communal philosophy of the Mormon settlers, water allocations were established by church leaders in the community to provide "the greatest benefit to the greatest number." In the 1860's the territorial legislature established the framework for water districts, allowing "landowners 'in a county or part there of' power to organize as a controlling group." The landowners in the district, run by a board of trustees, were entitled to a share of the district's waters if they contributed a

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6. Howard R. Lamar. *The Far Southwest 1846-1912: A Territorial History*, revised ed., (Albuquerque: University of New Mexico Press, 2000) 278-9.
7. U.S. Department of the Interior, *Project Data*, 1312.

proportionate tithe of money and/or labor to fund construction and maintenance of water projects.[8]

Although these water laws contributed to the development of Ogden through the church hierarchy's regulation of resources, it is the area's location that contributed the most to its growth as an agricultural and municipal center. Despite its relative lack of precipitation, the Basin is well-watered thanks to the tributaries of the Weber and Ogden Rivers that flow down the Wasatch Mountains. The availability of several nearby streams helped Ogden to grow almost as instantaneously as Salt Lake City. In the 1870's, Ogden's place along the transcontinental railroad helped transform its economy from agricultural to industrial and further expand its population. In 1880, the Ogden Water Company was formed, with the city of Ogden buying over half the available shares in the company to provide a stable financial base. However, despite the assistance of a $100,000 bond in 1888 to develop sewers and extend the water system, in 1890 financial difficulties forced Ogden to sell the water properties to the Bear Lake and River Water Company, a private water organization. In 1914, four years after buying back its water delivery infrastructure from the company, the city developed artesian wells in the Ogden River Valley.[9]

Water use development throughout the Basin progressed in a manner similar to the region's main population and economic center in Ogden. Towns were usually established by Mormon pioneers, with municipal improvements and infrastructure under the auspices of local bishoprics or priest's quorums (similar to a Catholic diocese). As Utah became more industrialized, and as the railroads brought more Gentiles (non-Mormons) into the territory, the

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8. Richard W. Sadler and Richard D. Roberts. *The Weber River Basin: Grassroots Democracy and Water Development*,(Logan: Utah State University Press, 1994) 18-22.
9. Sadler & Roberts, 31-3.

responsibilities of municipal development came to be delegated through secular rather than ecclesiastical means. Towns such as Slaterville, Uintah, Bountiful, Coalville, and Harrisville, all underwent this change from theocratic to secular democratic control, and in the process developed a complex yet disparate system of water delivery under the control of local water districts.[10] After the passage of the Reclamation Act in 1902, these cities began to turn to the Federal Government for assistance in the development of their water delivery infrastructures.

One of the first major water projects in the Basin was a concrete dam and reservoir constructed on East Canyon Creek, about 18 miles east of Ogden. The Davis and Weber Canal Company, a collection of private interests, first built this structure in 1896, to alleviate the strain on the Weber River during dry summers and periods of drought. The reservoir proved to be a boon for several surrounding communities, including Layton, Clinton, and Roy, increasing agricultural production primarily in Davis County. Because of increased demand, in 1916 the reservoir was expanded from its original capacity of 3,850 acre-feet to 29,000 acre-feet, and a new concrete dam replaced the old earthen structure. The success of the dam on East Canyon led to its inclusion in the Weber Basin Project after the project's authorization.[11]

The development of water use in the Basin was also aided by new laws pertaining to water use on both national and state levels. Perhaps the three most significant included the Reclamation, or Newlands, Act of 1902, which provided for financial assistance from the government to construct major water projects. A 1903 state law required a water use permit from the state engineer and limited the amount of time the water could be used; another state law in 1919 authorized a study of water claims in Utah and "reaffirmed the role of irrigation districts and continued the broad participation of the citizenry." The latter law was particularly

10. Sadler & Roberts, 33-47.
11. Sadler & Roberts, 62-6, 191; U.S. Department. of the Interior, *Project Data*, 1311.

influential, as it led to a 1937 court decree specifically designating which water claims in the Basin would be recognized, and a water conservancy law in 1941 that taxed the property of all citizens in the district to pay for the district's water projects. This would allow for the later development of large-scale water projects by holding citizens who benefitted from the water projects accountable for a project's funding. The Reclamation Act, the 1903 state water use law, and 1919 state water claims law provided the foundation for the construction of the Weber River(1927-1931) and Ogden River Project(1933-1941) by the Bureau of Reclamation, and the eventual construction of the more comprehensive Weber Basin Project.[12]

Project Authorization

The Weber Basin Project was in the planning stages as early as 1903, when Reclamation engineers first surveyed the Weber River Basin. In 1904 and 1905, Reclamation conducted further surveys of the Weber River and installed gaging stations, gathering data for use in possible future plans for the development of projects along the river. In 1907, surveys were conducted by Frank C. Kelsey and Willard Young for Weber and Davis counties; some of their recommendations of dam sites and the location of what would eventually become the Gateway Canal were included in the construction plans for the Weber Basin Project. In 1922, William M. Green conducted further surveys along the Weber River for Reclamation.[13]

The eventual construction of the Weber River and Ogden River Projects, based on these surveys, produced a total of 118,175 acre-feet of reservoir storage space. However, it was felt that a more comprehensive plan was needed, in light of these surveys, to capture as much water from the streams as possible before they flowed into the Great Salt Lake. Reclamation engineers

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12. Sadler & Roberts, 104-13.
13. United States Department of the Interior, Bureau of Reclamation, *The Weber River Project (Echo Dam)*, by Christopher J. McCune, project history, Bureau of Reclamation History Program (Denver: Bureau of Reclamation, 2000), 5-6.

H. E. Wilbert, Norman T. Olsen, and I. F. Richards conducted further studies of the Weber Basin from 1938-1942, but serious consideration was not given to such a project until after World War II, when the Basin's population began to grow again and soldiers began arriving home from Europe and Japan. In 1946, a study of the Basin's water resources was begun in June. Between June 1946 to 1948, an inventory was gathered of all irrigated and irrigable lands in the Weber River Basin, from the Great Salt Lake to the tributaries and headwaters of both the Weber and Ogden Rivers. The study also provided an overview of all water rights, available water resources not in use, reservoir operations, and potential reservoir sites. In the meantime, local politicians who were supportive of the project heavily promoted its necessity to the citizens whom would be affected the most by its construction.[14]

Efforts at legislation to authorize and fund the project began February 9, 1948, when Congressman William Dawson introduced a bill to the House of Representatives that would provide for the construction of project facilities in the Basin. As a prior condition for any construction, the proposed legislation would also establish a water conservancy district, to be responsible for repayment of construction costs to the United States. Although Dawson was defeated in the November election by Reva Beck Bosone (who also gave her support to the project), his bill provided the basis for future legislation. In January 1949, Representative Walter Granger and Senator Arthur Watkins introduced bills to their respective houses of Congress calling for funding for Weber Basin, contingent upon approval of Reclamation's plan for the project. The act called for a comprehensive reclamation project that would provide water for irrigation, municipal, and industrial uses, flood control, and hydroelectric power. The act

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14. Sadler & Roberts, 139, 144-53; Denver, Colorado, National Archives and Records Administration: Rocky Mountain Region. Records of the Bureau of Reclamation, Record Group 115, "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 6.

also called for a sixty-year repayment plan for the estimated $69.5 million cost of the project.

In the meantime, the first draft of Reclamation's report on the project was completed in February 1949. Pressure from county groups, Utah Congresspersons, and Regional Director E. O. Larson compelled the bureau to finish the final report in July rather than the end of the year as planned. Despite opposition from the Utah Fish and Game Commission, the U.S. Forest Service, and the Department of Agriculture (who were involved because part of the project lands would be in the Wasatch-Cache National Forest), President Truman signed the bill authorizing the Weber Basin Project on August 29, 1949.[15]

Truman did not sign the project into law without reservations, however. In a statement accompanying his signature, Truman declared that "(the bill) was enacted without following the normal procedures for obtaining full information and adequate review concerning irrigation projects before authorization." Truman specified that, among other things, the repayment schedule had been increased to sixty years, in contradiction of the forty-year schedule that had been in place since 1939. The bill also included non-reimbursable allocations for recreation, an amenity not anticipated in drafting the 1902 Act and thus calling into question the agricultural purposes the project was to serve. In addition, the Department of Agriculture had not had the chance to properly review the project report. Truman went on to say that, "I consider it essential that the (Reclamation) program be not jeopardized by premature authorization of projects in advance of resolution of questionable features. To do so may lead to unsound action which will endanger the success of our whole reclamation program."[16]

Construction History

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15. Sadler & Roberts, 153-66; United States Department of the Interior, *Federal Reclamation and Related Laws Annotated, Volume II, 1943-1958* (Washington: United States Government Printing Offices, 1972), 965-7; "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 2-4.
16. "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, Appendix, 3-5.

Introduction

To expedite appropriations for the project, the need for a water conservancy district to contract with Reclamation for repayment arose. This was accomplished on June 26, 1950, when the Weber Basin Water Conservancy District (WBWCD) was authorized by the 2nd District Court of Utah. In March of 1951, Ward C. Holbrook and Ezra J. Fjeldsted of WBWCD went to Washington, D.C., to try and secure an appropriation of $1.5 million to begin construction. A Senate Appropriations subcommittee included a $1 million amount, but it was eliminated in July by the full committee. Meanwhile, representatives of WBWCD and Reclamation met in October, when it was decided that the final repayment contract would be delayed until final approval of the Definite Plan Report for the project was received from President Truman.[17]

Truman slowed the beginning of the construction process when he issued a "no new starts" policy, except for defense or emergency, for public works projects in 1952. This led to the Bureau of the Budget approving only $250,000 in January of 1952 for construction of the project, as opposed to the $4 million Reclamation requested. A later request for $1.35-2.1 million was rejected in March, because of conflicting reports between Reclamation and the Department of Agriculture concerning the ability of the water users to repay the construction costs. Finally, Senator Carl Hayden of Arizona, who was on the Senate Appropriations Subcommittee, provided $1.35 million for Weber Basin among funding for nine other reclamation projects. This was approved by the Senate on June 25, 1952, and signed by Truman on July 9. After the Definite Plan Report was approved by Reclamation Commissioner Michael Straus and Interior Secretary Oscar L. Chapman in August, Truman authorized approval of the

17. "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 4, 7.

report on September 29.[18]

While negotiations were underway for funding of the Weber Basin Project, WBWCD and Reclamation developed a unique repayment plan, similar to what had caused Truman so much concern after the project was authorized. The contract was to be paid back over a sixty year period rather than the usual forty years. At $57,694,000, the repayment obligation was the largest that Reclamation had ever entered, and included recreational facilities for the first time in Reclamation's contracting history among the proposed benefits. WBWCD, rather than Reclamation, was to acquire all rights of way, easements, and purchase contracts for the construction of facilities. These facilities included the diversions dams, powerplants, drains, and wells. While WBWCD would have control over all water use, with supervision over water allotments and distribution, and be responsible for operation and maintenance of the project, the United States would retain responsibility for flood control, recreation, and fish and wildlife. The contract would be repaid by the water users of WBWCD, at a cost of $2.00-$3.50 an acre-foot for industrial and municipal users.[19]

In December of 1952, a special election was held among the water users in WBWCD asking for approval of the contract, as well as approval of $6.5 million worth of bonds to finance structures such as filtration plants and regulatory reservoirs that would facilitate the delivery of project water. Despite heavy opposition from voters in Summit and Morgan Counties, many of whom were farmers who felt they were losing "good agricultural land for a reservoir that would not directly benefit them," both measures overwhelmingly passed. The final tally approving construction of the project was 4,184 to 852, while the vote for the bonds came out 3,979 to 909. Not surprisingly, it was voters in the more populous Weber and Davis counties, who would

18. "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 4, 7-9; Sadler & Roberts, 209-12.
19. Sadler & Roberts, 213-4.

receive the greatest benefits, that helped produce such a lopsided victory for supporters of the project. As a result, the repayment contract was signed on December 12, 1952. The preconstruction process began that same day by Utah Construction Company, who had been awarded the contract on December 10, with the construction of an access road to the west portal of the Gateway Tunnel.[20]

The Weber Basin Project was completed in several phases, due to the complexity of the project and sheer number of structures that needed to be built. As a result, the project required 17 years to finish. The basic plan of the first phase, the largest of the construction process, began with the production of the Gateway Canal and Tunnel, the Weber Aqueduct, and the first section of the Davis Aqueduct. The goal was to provide for delivery of water by the 1956 irrigation season. The first phase would also include the final sections of the Davis Aqueduct, both aqueducts' respective pumping plants, enlargement of Pineview Dam and Reservoir, construction of the Stoddard and Slaterville Diversion Dams, Wanship Dam and Reservoir, and the placement of drains at Hooper, Syracuse, and in South Davis County.[21] Phase Two planned for construction of the Gateway and Wanship Powerplants, the Willard and Layton Canals, and the Willard, Lost Creek, and Causey Reservoirs.[22] The third and final phase was the enlargement of East Canyon Dam and Reservoir, as well as minor supplementary projects such as equalizing reservoirs, drains, and laterals.[23]

Phase 1

Prior to the official start of construction on January 9, 1953, preconstruction efforts were underway in the Basin to prepare sites for full-fledged activity. Strip topography was performed

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20. Sadler & Roberts, 214-8; "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 11-3.
21. Sadler & Roberts, 169-81; "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 13.
22. Sadler & Roberts, 182.
23. Sadler & Roberts, 185, 191-4.

at the sites for the Davis and Weber Aqueducts, as well as the Gateway Canal, with lines staked and cross-sectioned. Between May of 1948 and 1950, 297 piezometer wells were installed along the East Shore area; in 1952, 150 more were installed in the same area as well as in the Bountiful region. The contractor J. S. Lee and Sons built Observation Well No. 1, near the mouth of Weber Canyon, between November 6 and December 20, 1952. In addition, because of protests by residents in Summit County, alternate sites for Wanship Dam were studied, including a 15,000 acre site at Lost Creek. The studies confirmed that the Wanship site would be the best location, but future work there would be hampered throughout the construction process by landowners who did not support the dam.[24]

Utah Construction Company, who was awarded the contract for construction of the Gateway Tunnel on December 10, 1952, continued preconstruction removal of common material from the west portal until January 9, 1953. The west portal of the tunnel was located about five miles southeast of Ogden at the west portal, and planned at 3.3 miles long by nine feet, four inches in diameter. On January 9, 1953, the first rock was blasted from the west portal in a ceremony marking the official beginning of the project's construction. Crews worked three shifts a day, six days a week, to line the entire tunnel with reinforced concrete. Due to the composition of the tunnel rock, which ranged in composition from hard Gneiss to chlorite, talc, feldspar, and mud, workers used almost twice as much concrete (31,855 cubic yards) to line the tunnel as originally estimated. The geological composition also necessitated reinforcement with roof bolts and steel supports throughout seventy-eight percent of the tunnel. The last fifty feet, which was largely soft clay, received most of the reinforcement. A strike in June delayed the construction process somewhat, but work crews were still able to bore through the tunnel by

24. Sadler & Roberts, 169-70; "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 16.

March 25, 1954, and all work was completed on December 31.[25]

The completion of the Gateway Tunnel allowed the construction of the remaining Phase 1 facilities to proceed. The Gateway Canal was begun September 27, 1954 by the Morrison-Knudsen Company, and work continued through most of 1955. (This was for the western portion; the eastern three thousand feet were subcontracted to the Horner Construction Company in 1955) At one point, work crews had to contend with landslides adjacent to the canal excavations, as well as floods in December of 1955. In August of 1955, the work order for the canal was changed so that the entire length of the canal would be lined with concrete rather than a partial lining, which was found to be less economical; crews completed lining the canal by the following October. Workers also placed eight protective stair structures near siphons in the canal, which served as a means for livestock or humans to escape before being sucked into the siphons. In spite of delays caused by the landslides and floods, the entire canal was finished on August 13, 1956.[26]

The Stoddard Diversion Dam, three miles west of Morgan, was designed as a concrete gate dam. After being awarded the construction contract on July 22, 1955, the Horner Construction Company built the structure from August of 1955 to July of 1956. Good weather at the site throughout much of the winter allowed work crews to proceed rapidly, diverting the Weber River around the site, placing concrete on the dam site, and installing groundwater pumps and trashracks. On April 23, 1956, the river was rerouted through the dam in time for the spring run-off. Crews devoted the remainder of construction to installation of the dam's supplementary features, including a fish deflector, Parshall flume, and irrigation crossings. The final structure

25. Sadler & Roberts, 170-1; "Annual Project History, Weber Basin Project, Utah," Volume 2, 1953, 12-6; "Annual Project History, Weber Basin Project, Utah," Volume 3, 1954, 10.
26. Sadler & Roberts, 174-5; "Annual Project History, Weber Basin Project, Utah," Volume 3, 1954,16; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 20; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1956, 3, 12.

contained four twenty-five foot radial gates along a total dam length of 110 feet, with a diversion capacity of 700 cubic feet a second.[27]

The contract for the first three sections of the Davis Aqueduct, was awarded to the United Concrete Pipe Corporation, who began work on the structure August 11, 1954. This structure was to run south from the Gateway Tunnel through Davis County for twenty-two miles, past Farmington and Bountiful, delivering water to farmers and municipalities along the way. Workers trenched the waterway and laid sand in the trench as bedding for the concrete pipe, which ranged from forty-two to eighty-two inches in diameter. The process of laying the pipe was delayed somewhat because of difficulties in making acceptable joints and reinforcement cages for the pipes, as well as adverse groundwater conditions in some areas along the route. All work on the first three sections, including testing, was completed by May 27, 1957, while construction began on the final section by contractor, W. W. Clyde and Company that same year.

In April of 1956, the Nelson Brothers Construction Company began work on the East Bountiful and South Davis pumping plants, located where the aqueduct connected with the Woods Cross and West Farmington trunklines. These facilities would serve water to lands at higher elevations, using hydroelectric power generated at the project . Laying of forty-eight inch concrete pipe in the aqueduct was completed on January 1957, and the first water was delivered on July 18. In the meantime, the remainder of pipe was laid, tested, and repaired by July 20, 1957, and the pumping plants were completed seven days later. The trunklines were constructed from September 1957 to October 17, 1958, while the Farmington Bay wasteway, a feature of the aqueduct meant to carry overflow from the aqueduct to Farmington Bay near the Great Salt Lake, was also completed about this time. Davis Aqueduct has an initial carrying capacity of

27. Sadler & Roberts, 173-4; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 20; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1956, 12.

355 cubic feet per second.[28]

Wheelwright Construction Company began work on the Weber Aqueduct during March of 1955. Good weather throughout the year allowed for rapid placement of forty-two and forty-eight inch concrete pipe, beginning March 31. By June of 1956, all pipe had been laid, and the rest of the year was devoted to completing the remainder of the aqueduct and its supplemental facilities, including an equalizing and wasteway reservoir on the Uintah Bench. When finished, the aqueduct ran north for 4.2 miles from the west portal of the Gateway Tunnel, and possessed a carrying capacity of eighty cubic feet per second.[29]

Construction on the two most controversial and arguably complex features of the project, the Wanship Dam, Powerplant, and Reservoir (also known as Rockport Lake) and the enlargement of Pineview Reservoir, took place throughout most of the first phase of construction. Wanship Dam was particularly troublesome, not only because of the opposition of local rural citizens to the presence of the dam, (because the reservoir would inundate usable farmland) but also the extensive relocation work that needed to be done on Highway 32.

As would prove the case throughout the construction process, the most contentious hurdle that Reclamation and the WBWCD had to overcome was often land acquisition, especially on site for the Wanship Dam and Reservoir, eleven miles northeast of Park City. The location of Wanship Dam in Summit County proved to be a continual source of conflict between county residents and WBWCD. When studies of potential dam sites were conducted for the Project in the late 1940s, county residents supported placing a dam at the proposed Perdue site on the Weber River, five miles above the town of Oakley. However, studies showed that Perdue

28. Sadler & Roberts, 175-6; "Annual Project History, Weber Basin Project, Utah," Volume 3, 1954, 4-5, 11; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 16; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1956, 21; "Annual Project History, Weber Basin Project, Utah," Volume 6, 1957, 15.
29. Sadler & Roberts, 176; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 31; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1956, 21.

would not be a feasible long-term site for a major water storage structure. A dam at Perdue would have to be built 200 feet high to hold 60,000 acre-feet of water, whereas Wanship could hold the same amount at 140 feet, reducing construction costs. Furthermore, the presence of extensive fault lines near the Perdue site pushed issues of future safety to the forefront of the site's eventual rejection.[30]

The decision to build the dam at Wanship sparked protests by landowners in the area, and WBWCD sometimes had to resort to land condemnation proceedings to acquire the needed rights of way when they encountered resistance. While condemnation proceedings were not the norm, preconstruction surveys were hampered by landowners in the Wanship area who refused to allow Reclamation employees access to the site, causing some delay to the construction process Fortunately, most land tracts were attained through purchase and/or donation of easements and land, or by crossing and relocation agreements.[31]

Utah Construction Company began work on the dam itself in late July, 1954, with excavations for the outlet works tunnel and stilling basin, while the Clyde Construction Company worked on the highway relocation from 1954 until late September of 1955. By May 5, 1955, water was being diverted through the dam's outlet works, and by the end of the year, grouting on the abutments and construction of the spillway had been completed, save for the stilling basin and intake structure, which were finished in December of 1956. Construction of the dam embankment was slowed, however, by the presence of large rocks in the Zone 1 borrow area, which had to be removed by hand. In addition, the Zone 2 material was so wet that it mired the compacting equipment, requiring drainage of the borrow area. Although oversize rock in the borrow areas continued to be an annoyance throughout the embankment process, placement of

30. Sadler & Roberts, 206-7.
31. Sadler & Roberts, 172; "Annual Project History, Weber Basin Project, Utah," Volume 2, 1953, 16, 19.

materials was finished by November of 1956.[32]

Clearing of the reservoir area, begun by H & M Construction Company of Denver, Colorado, in late 1955, was completed May 19, 1956. Crews finished the outlet works during the winter season of 1957, and all work on the dam, save the powerplant, was finished by March 25. Wanship Dam became the first major operational dam of the Weber Basin Project on May 9, 1957, when Reclamation Commissioner William Dexheimer closed the gates during a dedication ceremony to begin reservoir storage in Rockport Lake. The final dimensions of this zoned earthfill structure were 156 feet high by 2,015 feet along the crest, with a seventy-five foot long uncontrolled concrete spillway at the right abutment, capable of carrying 10,800 cubic feet per second. The reservoir has a capacity of 62,120 acre-feet, and a surface area of 1,007 acres.[33]

The enlargement of Pineview Dam and Reservoir, approximately 10 miles east of Ogden, proved to be an extremely contentious issue for several years. Not only had the enlargement been opposed by many of the residents in the area, but a new water-use contract between WBWCD and the Ogden River Water Users Association (ORWUA) was under constant negotiation. Furthermore, the reservoir enlargement was located over a system of artesian wells that the city of Ogden partially drew their water from, so a new water use contract between ORWUA and WBWCD was required for modification of the wells.

Although Reclamation had informed both parties that the Bureau would decide on equity for joint ownership of the dam enlargement, frustration with the proceedings led the ORWUA to issue a request on December 21, 1954, to Reclamation to add the Pineview Dam enlargement to

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32. Sadler & Roberts, 172-3; "Annual Project History, Weber Basin Project, Utah," Volume 3, 1954, 11. Embankment materials are classified as follows: Zone 1 – impervious clays and silty clays; Zone 2 – semipervious gravel, silt, and clay; and Zone 3 – large rocks, also known as rip-rap. Materials are placed from Zone 1 at the core, outward to Zone 3.

33. Sadler & Roberts, 172-3; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 20; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1956, 6,12; "Annual Project History, Weber Basin Project, Utah," Volume 6, 1957, 6.

the Ogden River Project rather than the Weber Basin Project, including the necessary funding for the enlargement. Considering the position ORWUA was in as a participant and beneficiary of the Weber Basin Project, the request was outrageously brash, but also demonstrated the lack of optimism of the ORWUA that an acceptable arrangement could be reached. The Association's request was rejected by Commissioner Dexheimer on March 22, 1955, and subsequent appeals were rejected by Senators Arthur Watkins and Wallace Bennett, the Federal District Court and Circuit Court of Appeals. It would not be until September 8, 1957 that contracts for the operation of Pineview Dam and the artesian well modifications were finally signed.[34]

In spite of the extended contract negotiations, construction proceeded on Pineview Dam and modifications of the contemporary water infrastructure. The Utah Construction Company began work in July of 1955, modifying the spillway, relocating the Eden Highway to the right abutment, and installing a multiplate culvert at Wheeler Creek. Some material from the right abutment was found to be usable in the embankment of the dam. Work on the structure suffered a serious setback on November 23, when winter storms completely inundated a dragline and five pumps at the site. The equipment was recovered in the spring after the reservoir was drained to prepare for flood control storage.

The relocation of the Huntsville Highway began in the spring of 1956. Although bad weather and traffic congestion at the site plagued crews throughout the year, modification of the artesian wells was completed by December 22, 1956, embankment was placed to within eight feet of the final planned crest, and the spillway and outlet works were close to completion. By the end of 1957, in addition to the completion of the spillway and outlet works, workers had also repaired the stilling basin and finished the highway relocation. The reservoir area was cleared in

34. Sadler & Roberts, 178-9; "Annual Project History, Weber Basin Project, Utah," Volume 3, 1954, 8; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1957, 4.

1958, and construction of recreation facilities took place from April 29 to December 11 the same year. The construction of recreation facilities became particularly necessary because of the difficulties the Forest Service, which was in charge of recreation activities at the reservoir, experienced in regulating the increased amount of boating activity by visitors. To cope with the enlarged area of the reservoir for recreation, six sites received facilities in 1959, including forest camps, picnic areas, and boating docks. When completed, the enlarged Pineview Dam stood 137 feet high by 600 feet along the crest, with a concrete-lined spillway at the right abutment controlled by its two radial gates, and increased the capacity of the reservoir from 44,200 acre feet to 110,000 acre feet.[35]

The construction of the Slaterville Diversion Dam and Layton Pump intake channel, located a mile west of Ogden, helped transition the project from the first phase to the second by virtue of its planned function. This reinforced concrete structure, consisting of six gates, would be part of an operation to divert water from the Weber River through the Hooper, Slaterville, Willard, and Layton Canals. Water from the Willard Canal would be diverted north to the Willard Reservoir and south to the diversion dam, while the Layton Canal would carry water south and west through Davis County, irrigating land west of Clearfield, Layton, and Kaysville. The contract for construction was awarded to Mountain States Construction Company on June 15, 1956, and work on the dam began shortly after that summer of 1956. Work efforts proceeded nicely until bad weather and a rupture in the channel lining for the Layton Pump facility, due to excessive groundwater, caused delays. The contractor, also improvised the structure by placing a cement bound pile curtain at the upstream cutoff wall rather than a traditional steel sheet piling.

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35. Sadler & Roberts, 179; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 31; "Annual Project History, Weber Basin Project, Utah," Volume 5, 1956, 30; "Annual Project History, Weber Basin Project, Utah," Volume 6, 1957, 2-3, 24; "Annual Project History, Weber Basin Project, Utah," Volume 7, 1958, 4-5, 22; "Annual Project History, Weber Basin Project, Utah," Volume 8, 1959, 3.

The concrete gate diversion dam was eight feet by 162 feet, and held six twenty-five-foot long radial gates. The completion of this dam in the fall of 1957, allowed construction to commence on the Willard Canal and Reservoir.[36]

The final portion of the first phase of construction was the placement of drains in the western area of the project for the purposes of groundwater studies, as well as draining high water from the area for agricultural reclamation, a significant goal considering that the farmland was considered too worn out to be productive again. It was felt that draining the water from the lands would allow them to once again be productive. A total of 118 wells were drilled after 1953, during the first phase of construction, including drains at Hooper, Syracuse, and south Davis County between 1954 and 1957.[37]

Phase 2

The second phase of construction furthered work on dam and reservoir development, with three new facilities built at the Willard, Lost Creek, and Causey sites. Powerplants at the Gateway Tunnel and Wanship Dam were also built during this time. After dedication of Wanship Dam in May of 1957, crews moved forward with work on the powerplant and recreation facilities. The Davis and Butler Construction Company began work on the 1,500 kilowatt Wanship Powerplant at the foot of the dam on April 15, 1957. Generators were installed in February of 1958, while an 1,800 foot transmission line to connect with Utah Power and Light was constructed in June. By August 3, 1958, the powerplant had been tested and cleared for operation, and commercial operations began August 5. Recreationists first arrived at Wanship during the 1957 summer season. Despite having only a gravel road for access, 260 boats registered for use at the reservoir sixty days after the dedication ceremony. By the end of

36. Sadler & Roberts, 179-80; "Annual Project History, Weber Basin Project, Utah," Volume 6, 1957, 19.
37. Sadler & Roberts, 180.

1958, additional facilities had been installed, including a boat dock along the lake and some picnic areas at the toe of the dam.[38]

Excavation for the 4,275 kilowatt Gateway Powerplant began in July of 1957. Work continued on the structure, including a caretaker's residence, until its completion on November 16, 1958. The construction process for this project was severely hampered by bad weather and excessive groundwater in the area, as well as an iron workers' strike that took place from June 23 to July 8, 1958 (the strike also affected work at the Davis and Weber Aqueducts). The powerplant went online December 1, 1958.[39]

Construction of the dam sites designated for the second phase began with Willard Dam and Reservoir, which took seven years and three construction phases to complete. The site for Willard Dam, a zoned earthfill structure, was located adjacent to the Great Salt Lake, nine miles northwest of the Slaterville Diversion Dam. In the summer of 1957, workers from the Parson Construction Company began work on a low dike on the west and north sides of the dam site, and drains on the south and east. The drains and dike protected the site from inflowing streams and the Great Salt Lake, respectively. Construction during 1958 was devoted entirely to placement of two million cubic yards of embankment by the Hasler and Smith Construction Company, which was awarded the contract in early 1958, and completed their designated work in July 1959. For the second stage of construction, George M. Brewster & Son, Inc., was awarded a contract June 5, 1959. The company continued placing embankment upon the dam, enlarged and extended the drains, and installed five piezometer gauging stations. Work on the embankment progressed steadily, and almost exclusively save for toe drain installation in 1962,

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38. Sadler & Roberts, 173; "Annual Project History, Weber Basin Project, Utah," Volume 6, 1957, 11-2; "Annual Project History, Weber Basin Project, Utah," Volume 7, 1958, 10-1.
39. Sadler & Roberts, 182; "Annual Project History, Weber Basin Project, Utah," Volume 6, 1957, 2, 12; "Annual Project History, Weber Basin Project, Utah," Volume 7, 1958, 5, 12.

for the next three years. In the meantime, the Gibbons & Reed Construction Company began concrete work on the inlet and outlet structures, beginning July of 1961. Two pumping plants were completed between 1961 and 1963, nearly two years before the Willard Canal for which they were constructed.

W. W. Clyde Construction took over the final phase of construction during the summer of 1962. The contract included placement of bedding and riprap on the dam surface, excavation for the inlet and outlet works, installation of settlement measurement devices, and development of marina facilities for recreation. Final work was completed on the dam and reservoir by the fall of 1964. The largest of the Weber Basin Project features, Willard Dam is fifteen miles long and thirty-six feet high, contains approximately seventeen million cubic yards of material, and a siphon spillway with a capacity of 2,000 cubic feet per second. Although the reservoir is capable of holding 215,000 acre-feet, the total allowable capacity is actually 185,000 acre-feet. In 1969, Willard Dam was renamed Arthur V. Watkins Dam in honor of the Utah Senator who helped make the Weber Basin Project a reality.[40]

The Willard Canal was built contiguously with Watkins Dam from 1961 to 1964. Work on the 10.7 mile long earth-lined canal began in August of 1961, with crews working to drain water from the canal bed due to a high water table. The excessive amount of moisture on the site also led to caving and sloughing of the banks in places along the canal, requiring second and sometimes even third excavations. Work continued through early 1964, when crews finished lining the canal, placing riprap, and installing gravel protection at the completed turnouts. Water began running through the canal in June of 1964, at a capacity of 1,050 cubic feet per second. While this was being completed, the Wheelwright Construction Company began work on the

40. Sadler & Roberts, 183-5.

Layton Canal, nine miles south of the Stoddard Diversion Dam, after being awarded the contract on January 15, 1963. Excavation for the canal took place primarily from March 1962 to the summer of 1964. Other work included the placement of 24 to 72-inch concrete siphons, along with bridges, turnouts, and diversion boxes. Compacting of the canal and placing of riprap took place in late 1964, and was completed June 14, 1965. The Layton Canal is nine miles long, with a capacity of 180 cubic feet per second.[41]

The site of Causey Dam and Reservoir on the South Fork of the Ogden River had actually been relocated from earlier plans to place it four miles downstream, after further studies regarding geology and cost showed the current Causey site to be more feasible. The contract was awarded to the R. A. Heintz Construction Company on June 15, 1962, with plans to finish during 1965. Just prior to the start of construction on the earthfill structure, a road was carved out of the mountainside and extended to Camp Keisel, a camp for Boy Scouts located by the reservoir. The rock and earth moved for construction of this road was eventually used on the dam itself, after construction on the project began during the summer of 1962, along with clearing of the reservoir area, excavation of the outlet facilities, and diversion of South Fork. During excavation for the outlet works, crews reinforced the diversion tunnel with rock bolts and wire mesh, with steel rib supports at the inlet tunnel. Caverns were encountered where the spillway was to be located, adjacent to the Camp Keisel road, so crews filled these areas with concrete mixtures via grout pipes. Much of the grouting and concrete work for the outlet works was placed throughout the summer of 1963, and concrete work on the diversion tunnel was completed in October, allowing workers to step up production on the dam.

Work slowed considerably in 1964, due to heavy runoffs during the spring season and

41. Sadler & Roberts, 185-6.

thunderstorms from June 17 to the 23. These delays set back the project to the point that, by the time of scheduled completion, only about 70% of the work had actually been accomplished. Fortunately, most of the dam material was placed during the summer of 1965, while riprap would be placed throughout the fall; the spillway would be finished during this time as well. Work was completed on supplemental jobs such as electrical installations and gate controls during the summer of 1966, with final work on the dam being done in August. When completed, Causey Dam stood 218 feet high and 845 feet along the crest, with an approach channel spillway and an outlet works capable of carrying 8,900 cubic feet per second. Causey Reservoir has a capacity of 7,870 acre-feet.[42]

The second phase of construction concluded with the building of Lost Creek Dam and Reservoir, twelve miles northwest of Devil's Slide in Lost Creek Canyon. Work on the earthfill structure began July of 1963, with the relocation of the county road, clearing and stripping of the canyon bottom, and excavation of the cutoff trench, and inlet and outlet tunnels. The latter were located in the same type of geologic formation as the Causey diversion tunnel, so workers placed steel supports, roof bolts, and wire fabric to support it. Work on the embankment began in the fall, as well as drilling and grouting operations. Work was delayed by bad weather in the winter, forcing crews to place three thirty-six inch culverts at the site to divert the stream from the dam structure and prevent further damage by heavy spring runoffs in 1964. These culverts were plugged in May, while construction began on the outlet works, spillway, and stilling basin that spring and summer. Work during the fall of 1964 consisted primarily of placement and compaction of zone 1 and 2 materials, and grouting of both dam abutments. The walls of the stilling basin were also completed during this time. However, another winter of heavy

42. Sadler & Roberts, 187-8.

precipitation slowed operations to such an extent that significant progress on the embankment and spillway was not able to continue until the summer of 1965.[43]

These delays forced the contractor, Steenburg Construction Company, to abandon the contract in September of 1965 after the company determined it was losing too much money by staying on the site. Prior to leaving the site on September 20, the contractor placed concrete forms for the spillway, and project officials terminated the contract due to default on September 28. Work on the spillway and a diversion dike to prevent damage to the dam was completed in the fall by other contractors. The dam would not be completed until January of 1967, after LeGrand Johnson Construction received the contract on May 15, 1966. Lost Creek Dam stands 248 feet high, with a crest length of 1,078 feet and an approach channel spillway on the left abutment. Lost Creek Reservoir has a capacity of 51,200 acre-feet.[44]

Phase 3

The final phase of project construction focused on the enlargement of the East Canyon Dam and Reservoir, as well as completion of various laterals, equalizing reservoirs, roads, and repairs to completed structures. East Canyon Dam, expanded in 1916 to hold 13,800 acre feet, was constructed as a 260-ft. high double arch curvature concrete structure, with an uncontrolled overflow spillway at the left abutment, and a reservoir capable of holding 54,000 acre-feet. Work on this edifice presented a unique challenge because of the proximity of the old dam – in some places, the old dam was within ten feet of the excavation area, and in order to avoid rattling it to the ground, the subcontractor could only use a limited amount of explosives during the excavation process. Aided by accelerometers, the contractor developed a six-step pre-splitting process for blasting material from the keyway. While workers built a roadway to the damsite

43. Sadler & Roberts, 188-90.
44. Sadler & Roberts, 190.

during the summer, progress on the new dam proved laborious due to the difficulties of excavation, putting the contractor ten weeks behind schedule and necessitating an extension of the contract. The old rockfill dam was breached in October and November, but held back 10,000 acre-feet of water for the 1965 irrigation season. Excavation of the keyway continued through the winter of 1964-65, as did the beginning of grouting operations and the first placement of concrete blocks in the new dam.

By the end of June, the new structure was equal in height to the old dam; rapid work and good weather allowed workers to place concrete in all blocks of the dam by the end of September. Meanwhile, work on the spillway and thrust block began in August. In an attempt to minimize erosion and prevent rock from falling under the spillway, a shale seam wall was placed at the left side of the canyon just downstream of the dam. Through the fall, workers completed concrete placement in the curbs and parapet walls, and cleared the reservoir for water storage, which began December 21, 1965. The last bucket of concrete was poured during a special ceremony held January 14, 1966, after which the dam began full-time operations.[45]

Supplementary projects made up the bulk of construction activities culminating in the project's official completion in 1969. In addition to equalizing reservoirs at Woods Cross and Farmington, laterals and maintenance, Reclamation also supervised construction of delivery facilities for various creeks into the system of aqueducts, as well as facilities for the Weber Basin Job Corps Conservation Center in 1965-66. Final completion of the Project was early 1969, although work on smaller projects such as recreation facilities continued through the summer. Jurisdiction was turned over to the Weber Basin Water Conservancy District in April, and a

45. Sadler & Roberts, 190-3.

dedication ceremony was held at Pineview Dam on August 16, 1969.[46]

Project Facilities and Function

The Weber Basin Project is a multi-facility project providing urban and rural residents of Morgan, Summit, Weber, and Davis Counties with water over a project land area of approximately 2,500 square miles, or 3% of Utah. Streamflow is regulated on the Weber River and Ogden River systems by four newly constructed reservoirs and two enlarged existing reservoirs, in addition to three diversion dams, four canals, and two aqueducts. Hydroelectric power to operate the facilities is provided by two powerplants at the Gateway Canal and Wanship Reservoir (Rockport Lake).

On the Weber River, streamflow is regulated through Wanship Dam, then through Echo Reservoir of the Weber River Project before being sent to the Stoddard Diversion Dam near the town of Morgan. This water supply is joined by flow from East Canyon Creek and Lost Creek, via reservoir systems of the same name. At Stoddard, water is sent at an initial flow of 700 cubic feet per second through the Gateway Canal. Eight and a half miles from the inlet at the canal head, water required for prior downstream rights, as well as surplus flows, are turned into the Gateway powerplant penstock, then returned to the Weber River. The rest is conveyed through the 3.3 mile long Gateway Tunnel, then diverted north through the Weber Aqueduct and south through the Davis Aqueduct. The Weber Aqueduct delivers water along a 4.2 mile stretch to irrigation lands on Uintah Bench, and municipal and industrial users in Ogden and its surrounding communities via a treatment plant. Davis Aqueduct runs south twenty-two miles along the Wasatch Mountains to North Salt Lake City, providing irrigation, municipal, and industrial water for farmers and communities in Davis County. Surplus water is sent to the

46. Sadler & Roberts, 194-5, 225; "Annual Project History, Weber Basin Project, Utah," Volume 18, 1969, 1-2, 141.

Slaterville Diversion Dam.

On the Ogden River system, water is sent from Causey Reservoir to the Ogden Valley Diversion Dam and Canal to irrigate lands in Huntsville and Eden. What is not used by these communities is sent down the river to the enlarged Pineview Reservoir for irrigation in the Ogden River Project. Water is then sent to the Slaterville Diversion Dam, which captures water from both the Ogden and Weber River systems and sends it to the Willard and Layton Canals. Water through the Willard Canal is sent eight miles north to Willard Reservoir by the Great Salt Lake, where it is held by the fifteen-mile long Arthur Watkins Dam. If water supplies from upstream are meager, water is pumped from Willard Bay, then sent by reverse flow to Slaterville or released at canal turnouts depending upon need. Layton Canal is the primary feature of a system of three canals, two of which are supplementary, and extends south for nine miles through Weber and Davis Counties. The project is also enhanced by nine emergency wells and thirty four and a half miles of drains.[47]

Post-Construction History

After construction on the Weber Basin Project was completed in 1969, the project's jurisdiction came under control of WBWCD. Since that time, the increased population growth along the Wasatch Front has directed the project in ways that have shown the project to be a necessity in many ways, especially for providing water and recreational space to these new residents. At the same time, the development of the Basin in recent years is demonstrative of the certain social and economic trends in Utah and the American West as a whole. Although the project's facilities are capable of irrigating more than 90,000 acres of farmland, as the Wasatch Front urbanizes, water will increasingly be delivered for municipal rather than agricultural

47. *Project Data*, 1305-8, "Annual Project History, Weber Basin Project, Utah," Volume 21, 1972, Appendix, 32.

purposes. In spite of the savings that this will bring in terms of water use, the cycles of drought and flood that are so prevalent throughout the Rocky Mountain West demonstrate the dependancy that residents now have upon these types of water projects. These cycles also serve to remind the Basin's citizens of the limits imposed by nature, despite decades of effort to bring the region's water resources under control.

Operation and Maintenance

Operation and maintenance of the Weber Basin Project is administered by the Weber Basin Water Conservancy District. During the construction period through the few years following its completion in 1969, very little occurred on most of the project sites save for routine maintenance. Usually, the worst damage to structures in the project have been the result of acts of vandalism, such as people rolling stones into the waterways. However, the Gateway sections of the project proved to be a perpetual maintenance problem, from the project's first phase of construction until the late 1970's. This was primarily due to the presence of moss in the Weber River, which accumulated upstream (possibly in Echo Reservoir near Coalville) and taken into the canal by water diverted from the Stoddard Diversion Dam. The resulting build-up of moss clogged the canal inlet. By 1963 the accumulation of moss, in addition to sand and silt from nearby road construction, was so bad that it affected operations at the Gateway Powerplant. The WBWCD installed line strainers to catch the material, but in the summer when algae growth was highest the strainers had to be cleaned every few hours. So thick was the algae, in fact, that a well had to be dug next to the powerplant to provide cooling water for the powerplant equipment, rather than use the water that ran through the canal.

By 1965, the silt and moss were not only affecting operations at Gateway, but also causing additional wear and tear to the pumps and pressure regulators in Davis and Weber

Aqueducts. Furthermore, the shifting of wet earth along parts of the canal caused the concrete lining to crack in several places, leading to repairs in 1967 and 1972, and the installation of six seventy-foot drainage wells. In 1977, a sand and silt extractor works was installed along the canal, but this still proved inadequate to solve the problem. High quantities of sand in the forebay forced WBWCD to deactivate the canal for two or more weeks at a time to clean out the facilities, and even then, these efforts only delayed the debris from entering the facilities downstream. In 1981, a dredging machine called a "Mudcat" was installed in the Gateway Canal forebay, after being observed in action at a Casper, Wyoming, powerplant. The installation of the Mudcat apparently solved the decades-long headache, as no further mention of problems in the Gateway Canal due to sand or moss is provided in Reclamation's project histories of Weber Basin.[48]

The powerplants have been occasional, but significant, recipients of maintenance efforts since the project's completion. The repairs on the Gateway Canal, resulted in the digging of wells near the powerplant to provide cooling water that was relatively free of sand and silt for the equipment. In 1973, the Gateway plant developed a short in one of the transformers during the summer, while a turbine at Wanship lost a wear ring. Both resulted in major repairs for these facilities. Beginning in the late fall of 1983, the Wanship power plant underwent a major upgrade, allowing it to produce ten to thirteen million kilowatt hours a year. In 1985, the Gateway power plant underwent a similar overhaul, and produced a net supply of over eighteen

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48. "Annual Project History, Weber Basin Project, Utah," Volume 7, 1958, 28; "Annual Project History, Weber Basin Project, Utah," Volume 8, 1959, 17; "Annual Project History, Weber Basin Project, Utah," Volume 12, 1963, 6-7; "Annual Project History, Weber Basin Project, Utah," Volume 14, 1965, 8-9; "Annual Project History, Weber Basin Project, Utah," Volume 16, 1967, Appendix, 24-30; "Annual Project History, Weber Basin Project, Utah," Volume 21, 1972, 13; "Annual Project History, Weber Basin Project, Utah," Volume 22, 1973, 45; "Annual Project History, Weber Basin Project, Utah," Volume 26, 1977, 64; "Annual Project History, Weber Basin Project, Utah," Volume 30, 1981, 119.

million kilowatt hours in 1986.[49]

However, the biggest potential for disaster lies in the location of some dams, which were built on or near old fault lines in the Basin, making them vulnerable to earthquakes. The most threatened of these structures is Lost Creek Dam, although East Canyon, Causey, and Pineview are also in proximity of faults which pose varying degrees of menace to the structures. An earthquake with a magnitude of 2.9 on the Richter scale occurred August 29, 1983, near Croyden, Utah, threatening but not damaging Lost Creek and Pineview Dams. Events like this demonstrate the need for constant vigilance of the dam structures, but also the difficulty to adequately prepare should a stronger earthquake occur.[50]

Recreation

Recreation at the project's reservoirs proved to be extremely popular as soon as they were constructed. By 1963, Rockport Lake logged 168,327 visitor days, three times more than in 1962, while Pineview Reservoir counted 372,000 visitors. These numbers fluctuated throughout the coming years, but visitorship remained strong, especially at East Canyon and Willard Reservoirs. By 1983, these two reservoirs were receiving 284,088 and 287,094 visitors, respectively, while Rockport Lake, Causey Reservoir, and Lost Canyon Reservoir counted 293,893 visitors combined. Administration for Causey and Pineview Reservoirs is provided by the Forest Service of the United States Department of Agriculture, while the Utah Division of Parks and Recreation is responsible for Rockport Lake, Willard Bay, East Canyon Reservoir, and Lost Creek Reservoir. Activities at these reservoirs range from fishing, (including ice fishing in

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49. "Annual Project History, Weber Basin Project, Utah," Volume 22, 1973, 45; "Annual Project History, Weber Basin Project, Utah," Volume 33, 1984, 39; "Annual Project History, Weber Basin Project, Utah," Volume 34, 1985, 6; "Annual Project History, Weber Basin Project, Utah," Volume 35, 1986, 181.

50. "Annual Project History, Weber Basin Project, Utah," Volume 32, 1983, 58; United States Department of the Interior, Bureau of Reclamation, SEED Reports, "Causey Dam," "East Canyon Dam," "Lost Creek Dam," "Pineview Dam," Division of Dam Safety, Denver Office.

the winter) boating, camping, and swimming.

The moss accumulation that occurs in the Weber River, both naturally and due to the presence of the dams, has affected fishing activities in the past twenty years. The effect of the moss on the project's natural resources has been made plain in instances such as when a fish kill in Willard Bay occurred in 1982, along with the slow decline of trout fisheries at Pineview Reservoir. These events have been directly attributable to high levels of algae in the water, which used up most of the oxygen in the lakes. As of April of 2001, efforts had begun to develop recreational resources in two areas along the Weber River, between Ogden and Riverdale for kayakers and canoers, and along a twelve mile stretch between the mouth of Weber Canyon and the confluence with the Ogden River. The latter would serve as a non-motorized route for fishers, bikers, nature-watchers, and other recreationists.[51]

The increased usage of the reservoirs for recreation, while extremely beneficial and popular with the growing number of residents along the Wasatch, has also led in many instances to increased conflicts and problems that affect the operations of the recreational facilities and make visits to the reservoirs less enjoyable. In 1997, *The Salt Lake Tribune* reported that the impact of the 275,000 people who visit Willard Bay included increased amounts of trash along the roads and facilities, a large number of jet-skiers whom some visitors feel have shown little respect to the space of others, and "relic-hunters" who take home the bones of unearthed skeletons, many of which are thought to be remains of Shoshone Indians. Due to the increased incidence of alcohol and drug parties at East Canyon and Lost Creek State Parks, in October of 1985 the Morgan County sheriff and the parks superintendent requested that the state of Utah

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51. "Annual Project History, Weber Basin Project, Utah," Volume 31, 1982, 33-4; "Annual Project History, Weber Basin Project, Utah," Volume 35, 1986, 62; Mark Zoellner, "Weber River: Utah's New Playground?", *The Salt Lake Tribune*, April 3, 2001.

allow its park rangers to carry guns as a deterrent. In contrast to Pineview Reservoir, which had gained a reputation for being a "rough" area due to the revelers, East Canyon had been promoted as a family-friendly area, and the parties at the reservoir were damaging that carefully cultivated image.[52]

Development

Due to its complexity and the growing number of residents in the Weber Basin, development and enhancement of project facilities has been constant throughout the project's post-construction history. For several years after its completion in 1957, locals unhappy with the presence of Wanship Dam and Rockport Lake pressed WBWCD to develop a water storage facility up river. The growth in Summit County, particularly in Park City where water demands were rising, compelled WBWCD to finally comply with these requests in 1984 with the enlargement of the Smith and Morehouse Dam. The original structure, built with horse-drawn scrapers and capable of holding 1,040 acre-feet of water, leaked so badly that at the very least, serious repairs were needed. Although not officially a part of the Weber Basin Project, the modification was considered to be necessary for the Basin's future water needs in concert with the Project. Costs were funded jointly by the Utah Division of Water Resources and the Weber River Water Conservancy District. Construction on the dam took place from the fall of 1984 to spring of 1988, raising the dam's height to eighty-two feet and increasing the storage capacity to 8,350 acre-feet. Of this storage amount, 750 acre-feet was set aside for a nearby fish and wildlife conservation pool. Although originally projected to cost six million, cost overruns brought the final construction total to $11.7 million.[53] Other project additions included the

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52. "Annual Project History, Weber Basin Project, Utah," Volume 34, 1985, 40; Monte Whaley, "Recreationists Speak Up," *The Salt Lake Tribune*, April 16, 1997, D1.
53. Sadler & Roberts, 206-7; Weber Basin Water Conservancy District, "The Weber Basin Water Conservancy District Facilities," Internet, www.weberbasin.com/new/facilities.php3, accessed June 5, 2001.

extension of Layton Canal another 6.7 miles in 1984, ending at Gentile Street in West Layton. This addition allowed water to be delivered from Willard Reservoir to west Davis County.[54]

Extensive repair work has also been done to the Arthur V. Watkins Dam. Due to its proximity to the Great Salt Lake, as well as the lake's elevation rising to over 4,200 feet, by the mid-1980s the eroding action of waves along the dam's gravel coating required restoration in several areas. In some places, the dam (or dike, as it is more properly called) had settled by as much as six to eight feet, decreasing the capacity of the reservoir from a high of 210,000 acre-feet to 165,000 acre-feet. In 1985, WBWCD crafted a rehabilitation plan to raise the level of the dike along a six mile stretch ranging along the north, west, and south shores of Willard Reservoir. In December of that year, Reclamation allocated over three million dollars for these repairs. Construction began in 1988 and was finished in 1990, restoring the dike's crest to its original elevation of 4,235 feet.[55]

Towards the end of the 1990s, population growth along the Wasatch forced WBWCD to re-evaluate the water needs of the area and look into constructing additional facilities to meet demands. Because the Bear River is the last untapped stream in the Salt Lake Basin, plans have focused on how to develop this resource for future use. In 1991, a state task force determined that construction of a proposed Honeyville Dam near Elwood would be the cheapest means to store water from the river, costing $350 million to $500 million. In 1992, the Utah Legislature directed the state to investigate ways to bring water from the Bear River into storage at Willard Reservoir. In 1997, plans emerged that would allow the Salt Lake Conservancy District to construct a pipeline from the reservoir to the Jordan Valley Aqueduct, while allowing WBWCD

54. "Annual Project History, Weber Basin Project, Utah," Volume 34, 1985, 33.
55. "Annual Project History, Weber Basin Project, Utah," Volume 34, 1985, 31; "Annual Project History, Weber Basin Project, Utah," Volume 35, 1986, 33; United States Department of the Interior, Bureau of Reclamation, Performance Parameters Team, *Performance Parameters for A. V. Watkins Dam*,(Denver: Bureau of Reclamation, September 1998) 2.

to tap into the pipeline to meet demand in Weber and Davis Counties. This plan would be built at a cost of $220 million dollars, and is expected to begin construction in 2010.

These plans, especially the proposed Honeyville project, are extremely controversial. If built, the thirteen-mile long Honeyville Reservoir would inundate several thousand acres of grasslands, farms, and cultural resources. In response, in the year 2000, the Utah Division of Water Resources proposed a plan that would pipe water from the river downstream from the I-15 bridge near Elwood to Willard Reservoir, then carry water to a treatment plant near West Haven before distribution throughout Salt Lake, Davis, and Weber counties. Further illustrative of the tensions that occur when questions of water use and delivery are raised (as well as "Not in my backyard" sentiments), the city of Farmington has spoken out against a proposed reservoir that would be built near Rudd Creek as part of the 1997 plan, which would hold thirty million to 100 million gallons of water. It is likely that continuing population growth along the Wasatch Front (it is expected that, at current growth rates, water supplies for the Salt Lake Valley could be at their limit by 2015) will eventually force WBWCD, as well as other water associations, to confront means of stricter conservation and water use, should the construction of future delivery and/or storage systems be halted due to residential and cultural concerns.[56]

Drought and Flood

The history of the Weber Basin Project and Weber Basin region, like much of the arid west, is one of cycles of drought and flood. This is affected not just by the annual runoff amounts from the mountains, but also by runoff efficiency. If soils that the streams flow through

56. The Associated Press, "Historian Says Proposed Dam Would Harm Old Shoshone Site," *The Salt Lake Tribune*, September 2, 1994, B10; The Associated Press, "Bear River Diversion May Postpone Honeyville Dam Project," *The Salt Lake Tribune*, February 20, 1996, B2; Ryan Gailbraith, "Water: Finding Tomorrow's Gold Today," *The Salt Lake Tribune*, June 15, 1997, B1; The Associated Press, "Reservoir Site Picked in Farmington; City Not Happy Having Project in Backyard," *The Salt Lake Tribune*, June 22, 1997, B2; The Associated Press, "State of the State," *The Salt Lake Tribune*, July 31, 1999, D3; Kristen Moulton, "Build a Reservoir Where? We'll See," *The Salt Lake Tribune*, August 27, 2000, A8.

are largely dry, and/or the snow melts slowly, much of the moisture is absorbed into the ground and never makes it to the valleys below. During the early years of settlement by Mormon pioneers in Utah and into the 1930's, spring flooding was commonplace in West Bountiful, while spring runoffs from the Weber River frequently washed away crops and topsoil from farms located near river banks. A drought from 1931-1932 threatened to cripple the local agricultural economy, and was staved off primarily because of the water supply in the Weber River Project's Echo Reservoir. From the beginning of construction in 1952, wet weather frequently caused delays when heavy snows shut down production, or strong runoffs damaged structures and ruined equipment. This occurred in 1952, when precipitation was 150-170% above normal and total flow along the Weber River was as high as 198% above normal in some places. In 1955, heavy runoff from winter storms completely inundated equipment at Pineview Reservoir. Yet, in 1954, precipitation was sixty-seven percent of normal, forcing conservation measures during the summer and complete drainage of Echo Reservoir by October. In 1961, a particularly serious drought allowed irrigation contractors to receive only thirty percent of what they had contracted for, while the District increased their reliance on return flow, artesian wells, hydroelectric power water, and received 1,950 acre-feet from Echo Reservoir to meet water demands.[57]

In 1977, due to a drought in 1976 that affected several states in the United States including Utah, Congress passed the Emergency Drought Relief Act. Under the provisions of this act, WBWCD was able to secure a $4.3 million loan in April of 1977 to construct a reservoir next to the Layton Canal and a three mile long pipeline to the Davis and Weber Aqueducts. This would enable WBWCD to pump and exchange up to 50,000 acre feet a year with the Davis and

57. "Annual Project History, Weber Basin Project, Utah," Volume 1, 1952, 18; "Annual Project History, Weber Basin Project, Utah," Volume 3, 1954, 20; "Annual Project History, Weber Basin Project, Utah," Volume 4, 1955, 31-2; "Annual Project History, Weber Basin Project, Utah," Volume 10, 1961, 4.

Weber Counties Canal Company, for storage in Weber Basin reservoirs upstream. Construction began on this small project in July and was completed January 31, 1978.[58]

This pattern continued into the 1990s and the current millennium. From 1987 through 1995, drought conditions existed to such a degree that in 1990, the storage capacity of reservoirs under the WBWCD's administration were at thirty percent of normal, and seventy-five percent in 1991. Faced with the annual possibility that reservoirs could run dry before all water needs were met, WBWCD undertook strict conservation programs and cloud-seeding (a process where silver iodide is dispersed into the atmosphere, causing condensation) to alleviate the shortages. Although the continuous growth throughout much of the region from the Wasatch Front to Heber City is a perpetual source of concern, ironically, the growth in Weber and Davis counties has helped decrease demand for water. This occurred in spite of a reluctance on the part of regional residents to install xeriscape landscaping on their lawns, which requires less water than traditional Kentucky bluegrass. Even though the demand for watering lawns is expected to triple by 2020 to 155,000 acre-feet a year, irrigation needs are projected to drop from 446,000 acre-feet to 328,000 acre-feet within that same time frame, with a projected surplus in municipal water in these two counties of 48,000 acre-feet. Record snowfall in 1997 prompted concerns about flooding along the Weber and Ogden Rivers, due to high runoff and inordinate amounts of silt and debris in the rivers that would displace much of the runoff onto the flood plains.[59]

From 1999-2001, the Weber Basin once again suffered through a cycle of drought. In

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58. "Annual Project History, Weber Basin Project, Utah," Volume 26, 1977, 93-7.

59. Robert Green, "Desperate Water District to Start Seeding Clouds," *The Salt Lake Tribune*, October 23, 1990, B3; Robert Green, "Despite Recent Rains, Counties Face Summer of Sunburnt Lawns, *The Salt Lake Tribune*, April 1, 1991, B1; Barbi Robison, "Waste Not, Want Not: Desert Dwellers Must Learn to Save Water Before It's Too Late," *The Salt Lake Tribune*, June 8, 1992, A6; The Associated Press, "Water Officials Limit Outdoor Watering," *The Salt Lake Tribune*, May 10, 1994, A12; Steve Green, "Shortages Everywhere So What's This Surplus?", *The Salt Lake Tribune*, September 30, 1996, D2; The Associated Press, "Flood Worries Rise About Weber River," *The Salt Lake Tribune*, March 6, 1997, C6.

spite of snowpack levels in the year 2000 that were eighty percent of the annual average, only twenty to thirty percent of this amount showed up as runoff because of dry soils. The State of the State address delivered on October 9, 2000, announced that WBWCD would participate in yet another cloud seeding program to increase precipitation and raise water levels in Lost Creek, Echo, East Canyon, and Rockport Reservoirs, as well as the privately developed Smith and Morehouse Reservoir. At the time the program was announced, these facilities' average capacity stood at thirty percent. By March 13, 2001, due to low snowpack, reservoirs across the state were at an average capacity of seventy-one percent, with Lost Creek and Pineview Reservoirs singled out for particular concern because snowpack along the Basin was only seventy-three percent of the yearly average.

The parched conditions posed a threat to water supplies for water users throughout the entire Salt Lake Basin, and created additional hazards in the form of drier landscapes that increased the threat of forest fires. In 2001, a low water table combined with a snowpack that was sixty percent below average resulted in low lake levels at the Bear River Migratory Bird Refuge, adjacent to Willard Reservoir. Furthermore, reservoirs in the region of the Basin known as the Wasatch Back receded a full month earlier than normal, including Rockport Lake and Echo Reservoir. These recent conditions compelled WBWCD as well as other water districts and associations to impose conservation measures, primarily through strict lawn-watering schedules that allow people to water their lawns only at certain hours and on certain days. The WBWCD has implemented this program successfully during most of the 1990's, saving as much as twenty percent of the secondary water supply.[60]

60. Associated Press, "State of the State," *The Salt Lake Tribune*, October 9, 2000, B3; Joe Bauman, "Spring Runoff Looks Grim for Northern Utah," *Deseret News*, March 13, 2001; Donna Kemp Spangler, "Utahns to Save Water, or Else," *Deseret News*, March 22, 2001; Joe Bauman, "Too Early to Cry Drought?" *Deseret News*, May 25, 2001; Brett Prettyman, "Bear River: Little Refuge for Waterfowl," *The Salt Lake Tribune*, June 26, 2001; Karl

(continued...)

Settlement of the Project

The Weber Basin Project was not meant to promote settlement of new lands within the Basin, but rather an effort to provide municipal and agricultural water supplies to the burgeoning residential and agricultural communities of the four-county area whom the project now serves. Although surveys had been conducted in the area since the early 20th century, serious planning for the project did not begin until after World War II, when the Basin's growing military and industrial economy brought new residents to settle in Ogden, and other towns along the Weber and Ogden Rivers. Compared to the more populous Salt Lake and Utah Counties, growth within the project area has not been quite as dramatic within Morgan, Summit, Weber, and Davis Counties in terms of raw numbers. However, percentage-wise, growth within the Basin has reflected the overall growth along the Wasatch Front within the past ten years.[61]

Uses of Project Water

The Weber Basin Project is capable of irrigating 90,501 acres in the Weber River Basin north of Salt Lake City, (32,819 of which are considered available for service) producing between $18 million and $22 million in crop values each year. The Gateway and Wanship power plants distribute hydroelectric power throughout the region. The upgrades of both facilities have enabled them to produce greater amounts of power– assisted by high streamflows, the 32 million kilowatts produced in 1986 set a new record in production. In 1992, the project delivered approximately 52,788 acre-feet of municipal water to a population of over 500 thousand residents, along with approximately 11,355 acre-feet for other non-agricultural

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60. (...continued)
Cates, "Drought Menaces Wasatch Back," *The Salt Lake Tribune*, June 30, 2001.
61. U.S. Bureau of the Census, Subcounty Population Estimates, June 30, 1999.

purposes.[62]

Collectively, the project's six reservoirs provide 5,071 acres of land for a variety of activities, including swimming, hiking, camping, hunting, and boating. Although conflicts have arisen in recent years due to an increase in jet-ski use among visitors, recreation continues to be highly popular among area residents, drawing 775,882 visitors in 1992. In cooperation with the Weber River Water Users Association, WBWCD dedicated 319,760 acre-feet to flood control in Echo, Rockport, Lost Creek, East Canyon, Causey, and Pineview Reservoirs. From 1950 to 1999, the project accumulated $19,532,000 in flood control benefits. Environmentally, the location of Willard Reservoir adjacent to the Bear River Migratory Bird Refuge along the Great Salt Lake allows it to act as an additional bay for 200 species of birds and forty species of mammals.[63]

Conclusion

The presence of the Weber Basin Project has shown during its existence to be a vital and necessary component of water development in the four-county area which it serves. In hindsight, the individuals who surveyed the Weber Basin in the early 20th century, such as Frank C. Kelsey, Willard Young, and William Green, produced a long-term vision for water development in the Basin that has served the region well. However, it is likely that the rapidly expanding population along the Wasatch Front, and in the Weber Basin in particular, will stretch the resources of the project to the limit in future years. This will likely lead to water delivery and storage facilities constructed primarily with private funds, evidenced by the enlargement of the Smith and Morehouse Dam and the discussions regarding the future of the proposed

62. U.S. Department of the Interior, Bureau of Reclamation, *1992 Summary Statistics* (Denver: Bureau of Reclamation, 1992), 11, 75, 257.

63. Sadler & Roberts, 110, 115; "Annual Project History, Weber Basin Project, Utah," Volume 28, 1979, 102; Weber Basin Water Conservancy District, "Benefits," Internet, www.weberbasin.com/new/facilities.php3, accessed June 5, 2001; Whaley, "Recreationists Speak Up," *The Salt Lake Tribune*, April 16, 1997, D1.

Honeyville Dam. However, the imposition of strict conservation measures by the Weber Basin Water Conservancy District and other water organizations could also relieve the drain on supplies for the time being. It is clear that any future projects in the region will rely heavily on the presence of the facilities of the Weber Basin Project and the water they provide for residents of the Weber Basin and beyond.

About the Author

Christopher J. McCune is a near-native of Colorado and life-long resident of the same. He is currently studying to complete his Master of Arts degree in Public History from Arizona State University, anticipated by December of 2001. In addition to having his nose perpetually stuck in a history book, Mr. McCune also enjoys watching the Denver Broncos football team and exploring the landscape of metropolitan Denver.

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Index