

The Baker Project

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The Baker Project

In the West, along the Powder River, Mother Nature can be both kind and cruel. Abundant winter snows lead to spring runoffs that hold the promise of growth and prosperity. But often, the summer months are long, hot, and dry, leaving the land barren and almost lifeless. Nature's kindness is in providing such an abundant supply of water. Her cruelty is in providing that supply when it is not needed and taking it away when it is. This problem is not unique to the valley of the Powder River in eastern Oregon. It is a problem that faces farmers in hundreds of valleys throughout the West. To the farmers of the Powder River Valley, the solution to the problem was the same as for farmers in many other valleys: capture the excess water of the spring and hold it for use during the dry months of the summer and fall.

Project Location

The Baker Project is located in east-central Oregon in the counties of Baker and Union. The project consists of two divisions; the Upper and Lower. The Upper Division furnishes supplemental water to 18,500 acres of land along both sides of the Powder River just north of Baker, Oregon. The Lower Division provides a supplemental water supply to about 7,300 acres of land along the Powder River about 10 miles northeast of Baker.¹

Historic Setting

The first non-Native settlement in the Baker area occurred in the early 1860s following the discovery of gold on Griffith's Gulch, about three miles from the town of Baker. Other discoveries in the area fueled settlement. The town of Baker was established in 1863 where the Oregon Trail entered the Powder River valley. Although mining brought the first settlers to the region, stock raising and farming soon became prominent activities. Irrigation along the Powder

1. Department of the Interior, Water and Power Resources Service, Project Data, (Denver: U.S. Government Printing Office, 1981), 19.

River began in the 1870s and consisted of simple diversions from and rivers and streams.

Construction of a railroad through the valley in 1884 further stimulated development and growth of the livestock and timber industries.

The Powder River valley suffered from a problem that was not uncommon in the West: river flows during the spring and early summer provided more than enough water to irrigate crop and pasture land, but by mid-summer, the flows had diminished to almost nothing, leaving the fields and pastures without a stable water supply during the warmest months of the year. Without a way to store excess spring flows, farmers and ranchers in the area lived in a constant state of uncertainty wondering if they would have sufficient water to bring their crops to maturity.²

Project Authorization

Investigation and development of the area within the Lower Division began around 1910 and was carried out by the Powder Valley Irrigation Company under provisions of the Carey Act. Development consisted of diversion works and a canal system to provide water to about 7,300 acres. Following the initial development, further investigations were suspended. The flows of the Powder River proved to be too erratic to support sustained crop production, and in 1921, area water users turned to the Reclamation Service for assistance. Surveys and investigations began in late 1921, and in March 1931, construction of Thief Valley Dam was determined to be feasible by the Secretary of the Interior. Construction of the dam and reservoir were authorized by the President on March 18, 1931. On May 18, 1931, the Bureau of Reclamation and the Lower Powder River Irrigation District signed a repayment contract to cover the cost of construction of Thief Valley Dam, clearing the way for construction to begin.³

2. Project Data 19; United States Department of Interior, Bureau of Reclamation, Repayment of Reclamation Projects, (Washington: U.S. Government Printing Office, 1972), 7.

3. Project Data, 20; Repayment of Reclamation Projects, 7.

Authorization of the Upper Division came after more than thirty years of study. Throughout the period of study, local support for the development was high, although some early water rights holders elected not to join the district, believing the project would not benefit them. The final plan, a revision of an earlier plan that contemplated a valley-wide development, was approved by Congress on September 27, 1962.⁴

Construction History

Lower Division⁵

Plans and specifications for Thief Valley Dam were drawn up in the Office of the Chief Engineer in Denver. Reclamation received twelve bids for construction which were opened on July 27, 1931. The contract was awarded to the second lowest bidder, the W. H. Puckett Company of Boise, Idaho, on September 3, 1931, after it was determined that the low bidder, the Idaho Contracting Company did not have the experience or financial ability to complete the contract. The winning bid was \$71,850. Notice to proceed was issued on September 22, setting the date for completion at July 19, 1932, in time to store water for the 1932 irrigation season.⁶

The contractor's crew arrived at the site in early September to begin construction of the contractor's camp. The camp was located about 100 yards upstream from the dam and consisted of a mess hall, three bunkhouses, several tents, and a storehouse. In addition, a timber framing shed and blacksmiths shop were constructed near the site of excavations, and the Government field office was constructed near the camp.

4. Denver, National Archives and Records Administration, Rocky Mountain Region, Record Group 115, Records of the Bureau of Reclamation, "Project History - Baker Project - Oregon: Upper Division, 1968," 1; Project Data, 20.

5. As originally envisioned, the Baker Project consisted as a single division. It was not until the authorization of Mason Dam and other Upper Division facilities in 1962 that the project was divided into divisions. At that time, the original project, consisting of Thief Valley Dam and associated facilities and lands, became known as the Lower Division.

6. Denver, Colorado, National Archives and Records Administration, Rocky Mountain Region, Records of the Bureau of Reclamation, Record Group 115, Box 31, Engineering and Research Center, Project Reports, 1910-1955. "Final Report on Design and Construction of Thief Valley Dam and Reservoir, Baker Project, Oregon," 57-58.

Clearing of the dam site began on September 12, followed five days later by excavations for the foundation. Excavations ranged in depth to about ten feet. It was unnecessary to divert the river around the excavations as the contractor arranged with water users upstream to divert and waste as much of the river as possible in order to reduce flows at the construction site. By diverting the river upstream, unwatering the construction site was handled by a single pump. When increased flows developed in November, a series of low dams were constructed upstream from the excavations to hold back the flows. Excavations for the abutments, cutoff trench, and buttress footing were well under way by mid-October. As excavations continued for the abutments, it became clear that the quality of the rock was not what had been indicated by early core drilling, and a significant amount of additional excavation was required. The problem also forced some changes in the design of the dam, increasing the quantity of concrete and steel required.⁷

Concrete operations began in mid-October. One problem was lack of high quality sand and gravel deposits within a reasonable distance of the construction site. This forced the contractor to use less desirable deposits located nearby, which required strict control over aggregate processing in order to assure acceptable results. Because of the type of dam chosen for the site, a concrete slab and buttress dam, two classes of concrete were required. The first class had to have a minimum strength of 2,000 pounds per square inch for use in the abutments, cutoffs, and buttresses. The second class had to have a minimum strength of 3,000 pounds per square inch for use in the face slabs, reinforced sections, and the thinner sections of the dam.

Concrete was delivered to chutes by cars running on a trestle that paralleled the downstream face of the dam. The concrete forms were made of wood faced with sheet metal and

7. Ibid., 58-60; Clifford A. Betts, "Construction of Thief Valley Dam," The Reclamation Era, December, 1932, 194-195.

proved to be the most costly aspect of the concreting operation. Additional carpenters were hired, but due to the lack of experienced local laborers, form work delayed the concreting schedule somewhat. Forms were moved and placed using a cableway installed just upstream from the axis of the dam. The weather also caused problems during concrete placing operations. Because the contract stipulated that the dam be completed in time to store water for the following irrigation season, it was necessary to place most of the concrete during the coldest part of the winter. Because of the cold weather (the temperature from November through January averaged less than 32°), the water and aggregates were heated prior to mixing and newly poured sections were covered with canvas and kept warm by stoves or fires during the curing process.

Two, 4 $\frac{3}{4}$ -foot by 6 -foot slide gates were installed between buttresses 5 and 6, and 6 and 7, during February, and the river was diverted through the gates for the first time on February 27. A sudden increase in temperatures in late February forced crews to construct an emergency coffer dam to protect concrete placing operations for the face slab between buttresses 4 and 5 were the river had been diverted during placement of the gates. On April 2, ten days before the last of more than 6,200 cubic yards (cy) of concrete was placed, the slide gates were partially closed, and for the first time, water began backing up behind the dam. Concrete operations were completed on April 12, at which time the contractor began moving out equipment and dismantling the construction camp. Clean-up of the construction site and removal of all equipment and camp buildings was completed by the end of April, and on May 1, the gates were closed completely. The level of the reservoir reached the crest of the spillway and began spilling over on May 13. Operation and maintenance of the dam and reservoir was turned over to the Lower Powder River Irrigation District on May 26, 1932, almost two months ahead of the

scheduled completion date.⁸

Thief Valley Dam is a concrete slab and buttress dam 390 feet long and 73 feet high containing 6,300 cy of concrete. The spillway is an uncontrolled overflow section located in the center of the dam with a capacity of 35,000 cubic feet per second (cfs). The outlet works consists of two openings through the face of the dam, each controlled by a 4 ¾ -foot by 6 -foot slide gate. The capacity of the outlet works is 2,440 cfs. Thief Valley Reservoir has a maximum capacity of 17,600 acre feet (af) and a surface area of 740 acres. Water stored in Thief Valley Reservoir is released for diversion downstream into existing distribution canals and laterals.⁹

Upper Division

Construction of facilities of the Upper Division came about after more than thirty years of study. Initial investigations of the Upper Division areas by the Bureau of Reclamation were the result of a contract signed in 1933 between Reclamation and the State of Oregon. The contract called for Reclamation to investigate ways to augment the irrigation supplies in the Baker and Brogan Projects.¹⁰ The initial report was submitted in 1934, and indicated that development of the entire area surrounding the city of Baker was possible, but that the costs would be high. The report also outlined alternative plans that involved irrigation of smaller areas at reduced costs. It was a variation of one of the alternative plans that was finally adopted.¹¹

Preconstruction activities on the Upper Division began in 1963 and included land classification and appraisal, completion of a Definite Plan report, negotiations with several state

8. "Final Report on Design and Construction of Thief Valley Dam and Reservoir, 68-71, 72-73; "Construction of Thief Valley Dam," 194-196.

9. Project Data , 22.

10. The Brogan Project later became the Bully Creek Unit of the Vale Project.

11. Denver, Colorado, National Archives and Records Administration, Rocky Mountain Region. Records of the Bureau of Reclamation. Record Group 115, Box 29, Engineering and Research Center, Project Reports, 1910-1955, "Baker Project Investigations," by E. B. Debler and L. J. Foster, October 1934; 1-2; Project Data, 20.

agencies regarding relocation of roads in the reservoir area, and negotiation of a repayment contract with the Baker Valley Irrigation District. The repayment contract was approved by a vote of the water users on April 2, 1965. The agreement was executed on April 5, and validated on June 3.¹²

The contract for the construction of Mason Dam was awarded to Osberg Construction Company of Seattle on December 9, 1965. The contractor received notice to proceed on December 15 and was given 900 days to complete the work, making the completion date June 2, 1968.

Mason Dam was designed as a zoned earth and rockfill embankment dam consisting of several zones of different materials. The central core of the embankment, zone 1, consists of impervious materials that are spread in layers and compacted by rollers. Zone 2 consists of sand, gravel and cobbles which is placed both up and downstream of zone 1 and provides protection and stability for the central core. Zone 3 is made up of larger stones and is placed along the up and downstream toes of the embankment to provide additional stability for the entire structure. The upstream face of the dam is protected by a three foot layer of riprap to protect the embankment from damage due to wave action.

The contractor began moving equipment on to the site in early January and commenced construction activities on January 13, 1966. The first work consisted of clearing the construction site and building access roads. That was followed by excavations for the foundation area and diversion tunnel. Limited placement of zone 3 embankment material began in May, and the diversion tunnel was holed through on June 18. Concrete operations began in June with placements in the outlet works intake structure and upstream diversion conduit. Excavation in the diversion tunnel was completed and concrete lining of the tunnel begun in mid-July.

12. "Project History - Baker Project - Oregon, 1963-1965," 1964, 64; 1965, 121.

By the end of July, construction had fallen about two weeks behind schedule, primarily due to delays in excavation for the spillway stilling basin and placement of concrete in the outlet works and spillway structure. At that time, the primary contractor initiated a plan to speed-up construction and bring the work back on schedule by the end of the year. In mid-November, movement was observed in the slope above the cut for the road along the left abutment, requiring the removal and additional material and the reshaping of the slope. Although the work took several weeks to complete, it did not cause any further delays. Major excavation and tunnel lining operations were completed in December with concrete placement in the spillway, outlet works, and stilling basin progressing steadily. Grouting operations, which began in August, were also progressing at a steady rate. By the end of December 1966, the contractor had made up for delays and was actually slightly ahead of schedule.¹³

The contractor's grouting and concreting operations continued throughout the first part of 1967. In early January, the contractor moved the grouting equipment into the diversion tunnel and began pressure grouting the tunnel lining. Grouting in the tunnel was completed in mid-March, at which time, the contractor resumed drilling and grouting the foundation. The river was diverted through the tunnel on March 31. In April, having again fallen behind schedule, the contractor started a third shift to expedite drilling and grouting operations. Placement of zone 1 material began on May 8, but was halted on May 9 when high river flows flooded the haul roads, preventing transport of embankment materials from the borrow pit.

Placement of zone 1 material resumed on June 5, and placement of all zones proceeded at a rapid pace. Drilling and grouting operations finished on July 21. The embankment was completed on October 14, with the last of the riprap placed on the upstream face 10 days later.

13. "Project History - Baker Project - Oregon, Upper Division, 1965-1966," 81-126; Memorandum, Glen D. Cheney, to Chief, Inspections Branch [Bureau of Reclamation], subject: Examination Report of Mason Dam for SEED (Safety Evaluation of Existing Dams) Program - July 29-30, 1980, dated June 9, 1982. Bureau of Reclamation, Office of Dam Safety.

On October 30, the diversion tunnel was closed, and storage of water in Phillips Lake began. The permanent closure plug for the diversion tunnel was placed on November 4. Installation of the control gates and associated machinery was completed by the end of November, and the second stage concrete in the gate chamber was placed in early December. By the end of 1967, the dam and associated works was essentially complete. The first releases of irrigation water took place on April 2, 1968, and on May 1, two months ahead of schedule, all work under the contract for construction of Mason Dam was completed and accepted by the Bureau of Reclamation.¹⁴

Mason Dam is a zone earth and rockfill embankment dam, 173 feet high and 895 feet long. The maximum width of the dam from upstream toe to downstream toe is 875 feet. The embankment contains 894,794 cy of material. The outlet works consists of a tunnel through the left abutment controlled by two high pressure gates. The capacity of the outlet works is 875 cfs. The spillway is a concrete lined chute on the left abutment with an uncontrolled concrete crest. The maximum capacity of the spillway is 1,210 cfs. The spillway and outlet works share a common stilling basin. Phillips Lake has a maximum capacity of 95,500 af and a surface area of 2,235 acres. As with the Lower Division, water stored in Phillips Lake is released into the Powder River for diversion downstream into existing distribution canals and laterals.¹⁵

Construction of the Lilley Pumping and Lilley Relift Pumping Plants and associated canals and pipelines was carried out concurrently with that of Mason Dam. The contract for construction of the two pumping plants and appurtenant works was awarded November 10, 1966, to Galey Construction Company of Boise, which submitted the low bid of \$483,162. The scheduled date for completion was set at March 25, 1968. The contractor met with Reclamation

14. "Project History - Baker Project - Oregon, Upper Division, 1967," 70-108; Memorandum: "Examination Report of Mason Dam for SEED Program - July 29-30, 1980," 6-7.

15. "Project Data," 22.

officials in early December and submitted a construction schedule and purchase orders for necessary equipment. Field work was scheduled to begin in April 1967.¹⁶

In January, the contractor was forced to locate an alternative supplier for the pumping units in order to meet the required specifications. Actual construction activities began in early March, a month ahead of schedule. Initial activities consisted of excavation for the discharge pipeline of the relift plant. Concrete work began in April, as did excavation for the pumping plant. Work at both plants continued through the summer, with work on the relift plant structure completed in September. In early November, work on the structure of the pumping plant was completed, and activities at both plants were suspended pending delivery of the pumping units.¹⁷

Work resumed in March 1968, and installation of the pumping equipment was essentially complete by May. Equipment testing and adjustments were made during May, and the pumps placed into service soon after. All work under the contract was completed and accepted in early August.¹⁸

The Lilley Pumping Plant contains four units: one, 125-horsepower (hp) unit with a capacity of 7.3 cfs, one, 250-hp unit with a capacity of 15.6 cfs, and two 350-hp units, each with a capacity of 22.3 cfs. The plant has a total pumping capacity of just over 67 cfs and pumps against a head of 101 feet. The Lilley Pumping Plant lifts water from the Powder River and discharges it into the Lilley Canal which serves approximately 3,450 acres. From the end of the Lilley Canal, a short pipeline conveys water to the Lilley Relift Pumping Plant. The Lilley Relift Pumping Plant has three units: one 30 hp unit with a capacity of 4.9 cfs, one 60 hp unit with a capacity of 9.8 cfs, and one 125 hp unit with a capacity of 19.6 cfs. The units pump against a head of 35 feet and have a total capacity of slightly more than 34 cfs. The Lilley Relift Plant

16. "Project History, 1956 - 1966," 1965-1966, 115, 125-126.

17. "Project History, Upper Division 1966 - 1967," 1967, 70-108.

18. "Project History, Upper Division, 1968," 7; "Project History, Upper Division, 1969-71," 1969, 3.

serve approximately 670 acres.¹⁹

Post Construction History

The operation of Thief Valley Dam and facilities of the Lower Division were taken over by the Lower Powder River Irrigation District on June 1, 1932. Since that time, the District has operated the project with few problems. Other than some difficulty in retaining a reliable dam tender in the years following completion of the dam, the project has proven efficient and economical. Frequent inspections by officials of the Bureau of Reclamation and the irrigation district showed the dam to be holding up well and without any unexpected problems. In 1966, inspection of the dam revealed significant wear of the concrete in the stilling basin downstream from the outlet gates. Repairs to the damage were carried out following the 1968 irrigation season.²⁰

Operation and maintenance of Upper Division facilities was transferred to the Baker Valley Irrigation District on August 23, 1968. In early 1977, a hole appeared on the right abutment of Mason Dam about twenty feet downstream from the toe of the dam. Investigations revealed that the hole resulted from the collapse of a previously unknown mine shaft. Similar shafts had been identified and filled during construction. Investigations of the shaft showed no seepage of water or threat to the structure of the dam. The shaft was filled with soil and is continually monitored for any further problems.²¹

One problem that has continually plagued Mason Dam is erosion of the floor of the outlet works stilling basin. First detected during an inspection in October 1975, the damage was repaired in February 1976. Subsequent inspections revealed a continuation of the erosion in spite of efforts to halt the damage. Inspections in 1983 and 1986 showed significant

19. "Project Data," 22.

20. "Project History, Lower Division, 1966-1968," 1966, 9; 1967, 69-70.

21. Memorandum: "Examination Report of Mason Dam for SEED Program - July 29-30, 1980," 7, 12.

deterioration of the stilling basin floor which included exposed reinforcement bar. An inspection in 1988 revealed greater deterioration and exposure of additional reinforcement bar. The problem has been traced to sand and gravel that is backwashed into the stilling basin. This material, when churned up by releases from the outlet works, acts as an abrasive, eroding the concrete of the stilling basin. The problem poses no threat to the safety of the dam and is being monitored closely while a permanent solution is sought.²²

Settlement of Project Lands

The area comprising the Baker Project was already extensively settled prior to construction of project facilities, therefore no new lands were withdrawn from entry for future settlement. Supplemental water supplied by construction of the features of the Baker Project helped assure that those already settled in the area would have a secure future. In 1970, two years after completion of the Upper Division, 158 farms units with a population of 424 people received project water. In 1980, the number of farms receiving project water had risen to 175 with a population of 440 people. In addition, 260 people not on farms received project water. In 1992, the population served by project water jumped to 1,792, mostly through an increase in non-farm users. In 1990, 169 farms with a population of 535 people received project water.²³

Project Benefits and Uses of Project Water

Facilities of the Baker Project provide supplemental water for irrigation of more than

22. Memorandum, Joseph Prizio, to Chief, Inspections Branch [Bureau of Reclamation], subject: Examination Report of Mason Dam for SEED (Safety Evaluation of Existing Dams) Program - Baker Project, Oregon - Pacific Northwest Region," dated January 31, 1986. Bureau of Reclamation, Office of Dam Safety, 9; Memorandum, Regional Engineer,[Pacific Northwest Region], to Regional Supervisor of Water, Power, and Lands, Attention: PN 430, subject: Transmittal of Report on Underwater Examination, Outlet Works Stilling Basin, October 7, 1988, Mason Dam, Baker Project, Oregon (Underwater Examination), dated: January 9, 1988, with attachments, Bureau of Reclamation, Office of Dam Safety.

23. Department of the Interior, Bureau of Reclamation, 1992 Summary Statistics, Water, Land, and Related Data, (Denver: U.S. Government Printing Office, 1995), 60, 63; Department of the Interior, Bureau of Reclamation, 1980 Annual Report, Appendix I: Crop and Related Data, Bureau of Reclamation, ([Denver]: U.S. Government Printing Office, 1981), 274, 277; Department of the Interior, Bureau of Reclamation, Federal Reclamation Projects, Water & Land Resource Accomplishments, 1970, Statistical Appendix, ([Denver]: U.S. Government Printing Office, 1971), 233, 235.

26,000 acres of project land. In the Upper Division, releases from Phillips Lake provide water to 18,500 acres, 4,120 acres by pumping from the Lilley Pumping and Lilley Relift Pumping Plants. In the Lower Division, releases from Thief Valley Reservoir provide water to 7,300 acres along the Powder River. In 1992, more than 24,700 acres of project lands received water from project facilities. The primary crops grown on project lands are forage and cereal crops such as alfalfa and barley. In addition, there is about 2,000 acres of irrigated pasture on the project. The total value of crops grown on project lands in 1992 was \$6,387,140.²⁴

Thief Valley Reservoir and Phillips Lake provide the residents of the area with numerous recreational opportunities. Boating, fishing, and camping are popular activities at project reservoirs. Recreational activities at Thief Valley Reservoir are administered by the Bureau of Reclamation and Union County. Phillips Lake is under the supervision of the U.S. Forest Service.²⁵

Phillips Lake provides residents of Baker Valley with a degree of flood control. Of the 95,500 af capacity of the lake, 17,000 af is dedicated to flood control with another 21,000 af dedicated as joint use capacity assigned to irrigation and flood control and utilized on a forecast basis.²⁶

Conclusion

The story of the Baker Project is one of success. Although very small compared to other projects constructed by the Bureau of Reclamation, the success of the project looms large in the lives of the citizens of the Powder River Valley. The story of the Baker Project is not unlike that of many reclamation projects in the west: small projects constructed to provide secure water supplies to a relatively small group of water users, who, without the assistance of the Bureau of

24. 1992 Summary Statistics, Water, Land, and Related Data, 147.

25. Ibid., 109, 115; Project Data, 21.

26. Project Data, 21.

Reclamation, could not have secured such a future for themselves.

About the Author

William Joe Simonds was born and raised in Colorado and has a clear understanding of the importance of water in the American West and its influence on the development of that region. He attended Colorado State University where he received a BA in History in 1992 and a Masters in Public History in 1995. He lives with his wife and two children in Fort Collins, Colorado.

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