

Bitter Root Project

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Bitter Root Project

Private interests built the Bitter Root Project irrigation system in the early 1900s. Standards used during the project's initial construction were not high, and the irrigation works experienced problems from the beginning of operations. Since 1930, Reclamation has invested substantial amounts of money for rehabilitating and upgrading the project's facilities. Reclamation's assistance helped stabilize the economy in the Bitter Root Valley which depends heavily on irrigated agriculture, and the irrigation works of the Bitter Root Project provide water for 16,665 acres of bench lands within the Bitter Root Valley surrounding the town of Stevensville, Montana.¹

Project Location

The Bitter Root Project is located in the Bitter Root Valley in western Montana, and makes up most of Ravalli County, which is located just west of the Continental Divide. The county lies between the Bitter Root Mountains in the west, which form the Idaho State line, and the Sapphire Mountains in the east. The eight mile wide valley runs north and south for approximately 100 miles.² Project lands are irrigated by water from the Bitterroot River and its tributaries. The project lands are mostly bench lands that are at such a slope that it is difficult to irrigate them.³

The climate of the project area is characterized by low precipitation and mild temperatures for the latitude at which its located. The summers are long and moderate and the

1. Department of the Interior, Bureau of Reclamation, "Project Histories: Bitter Root Project," 1965-1966, 4 (hereafter referred to as "Project History" followed by the year and page); United States Department of the Interior, Bureau of Reclamation, *Bitterroot Valley Project, Montana, Project Planning Report 0. 1-5.33-O.S.*, a supplement to the *Columbia River Basin Report*, (Region 1, Boise, Idaho, May 1949), 1.

2. "Project History," 1931-1962, 2, 162.

3. "Project History," 1967-1968, 8.

winters are short and fairly mild. These mild temperatures are due, in large part, to the Bitter Root Mountain Range acting as a natural climate barrier. The project area's annual rainfall amounts to twelve to thirteen inches with a total annual snowfall of approximately six inches. Temperatures can range from -36 degrees to 104 degrees with a mean temperature of 45 degrees. The area's frost free growing season normally runs from 115 to 129 days. The chief crops grown are pasture, alfalfa, barley, wheat, oats, apples, beans, potatoes, seed peas, sugar beets, and corn.⁴

Historic Setting

Indians long inhabited the region of the Bitter Root Valley, extensively using the plant which is now Montana's state flower, and for which the valley is named, as an article of food. Meriwether Lewis and William Clark encountered the region's Indians, who they named Flatheads, when their exploration brought them into the Bitter Root Valley in 1805.⁵

After Lewis and Clark's expedition hunters and trappers began increasingly passing through the region, and in 1835 a group of Canadian voyagers from the Hudson Bay Fur Company entered the valley in the hopes of establishing trade with the Indians and extending the fur company's power. These trappers and traders exposed the Flatheads to the Christian religion. In 1839 a delegation of Flathead Indians, headed by a Frenchman named Ignace LaMousse, went to St. Louis, Missouri with the intention of bringing a priest back to their homelands. Thus, in 1840 the group headed toward Montana with Father Pierre Jean DeSmet, who had agreed to go with them. However, upon reaching the Gallatin Valley in Montana, Father DeSmet decided that for his mission to be successful he would need help, therefore he went back to St. Louis for

4. "Project History," 1931-1962, 31-2.

5. *Ibid.*, 2.

assistance. He arrived in the region of the Bitter Root Valley in 1841 with Father Pointa, Father Mengarine, carts, wagons, seeds, horses, mules, oxen, and some small tools. That fall the Flatheads assisted the priests in establishing the first white settlement in the region, helping to build the St. Marry's Mission, which included houses, shops and a chapel. Construction of this Mission also established the town of Stevensville.⁶

The spring of 1842 saw the priests' first attempts at farming in the region. They planted crops of oats, wheat, and potatoes. That same year the Hudson Bay Company brought the first cows to the region from their post at Fort Coleville, Oregon. Soon after, the region's population grew as other settlers entered the valley. Saw and grist mills were built nearby the Mission. The burs for the grist mills were transported from Belgium around Cape Horn to the Columbia River, and then brought by river boat and then wagon to the Bitter Root Valley. With these burs came Father Ravalli, after whom, years later in 1893, Ravalli County was named.⁷

In 1850 Major John Owens bought St. Mary's Mission and all its improvements for \$250. Owens then built a substantial fort of sun dried bricks within which he ran a trading post which supplied Indians and settlers. This fort also supplied the nucleus around which the region's population continued to grow. Settlers not only went to the fort to get supplies, but also to seek protection from attacks by the Blackfoot Indians. As the population grew, so did the region's need for agricultural development. As time passed trappers and hunters became traders who lived by trading with the immigrant trains heading to Oregon.⁸ A few more years passed, and the valley's agricultural demands continued to increase with the establishment of nearby mining communities which sprang up shortly after the discovery of silver and gold in western Montana

6. *Ibid.*

7. *Ibid.*

8. *Ibid.*

in the 1860s. Additionally, construction camps for the workers building the Northern Pacific Railway also provided a market for food grown in the Bitter Root Valley. It was during this era of growth that small works in the valley irrigated the area's staple crops, which were the same crops established years before by the priests at St. Mary's Mission. Father DeSmet had predicted that the valley would someday be heavily settled, and that irrigation would not be a problem because of the regions numerous rivulets and streams.⁹

Marcus Daly, an extremely wealthy copper king, arrived in the Bitter Root Valley in 1887. He acquired an extensive estate, built a considerable mansion, and founded the town of Hamilton, which he named after one of his foremen. His arrival marked the expansion of irrigation activities in the valley. He enlarged and expanded the already existing Hedge Irrigation Ditch, and bought the Republican Irrigation Ditch. He also built a canal from the Bitterroot River to lands near Hamilton, reclaiming thousands of acres of benchland on the west side of the valley. He developed plans to extend the irrigation system to the east side of the valley as well, however, his death on November 12, 1900, halted these plans.¹⁰

The same year as Daly's death another man became involved with irrigation in the valley. Samuel Dinsmore succeeded in establishing an irrigation company known as the Dinsmore Irrigation Company, for which he provided aid with his own money for options and surveys. He hired H. S. Lord to survey the area on which he planned to build the Dinsmore Canal. This canal was to be taken out of the Bitterroot River's west fork, on the west bank fourteen miles above Darby, Montana. His plan was to run the canal twenty-two miles along the west side of the Bitterroot River. Here the plans called for the construction of a 4,800 foot pipeline to meet a

9. *Ibid.*, 2, 3.

10. *Ibid.*, 3.

point just north of Harland Creek. In later years this point proved to be directly opposite the Lake Como Reservoir site, however, Dinsmore's plans did not include a storage reservoir at that time.¹¹

After six years of planning and surveys, Dinsmore's finances ran low. He traveled to Chicago attempting to attract eastern capital. In 1906 he interested several wealthy men in his irrigation project. These men invested their own money in the irrigation project which revitalized the work on the canal system. The company's capital increased to \$3,000,000, and Dinsmore changed the name to the Bitterroot District Irrigation Company. W. I. Moody, one of Dinsmore's investors, conceived the idea of storing water in Lake Como, thus it was 1906 before that feature was added to the project's development plan.¹²

However, throughout 1907 and 1908 the project's construction continually plagued the company with problems. In 1908 a receivers sale took place. The Assets Realty Company, which were bondholders, bid in the property for \$50,000 plus attached liabilities for \$512,000. The bondholders then needed to secure the cooperation of the valley's citizens in order to gain control of the property. To this end the Bitter Root Valley Irrigation Company was organized, and work on the project's main canal continued. Under this company, by 1909, 56 miles of canal had been built, the dam to help store water in Lake Como saw significant construction, and the company sold 15,000 acres of land in anticipation of the project's completion. By 1910 the canal was 80 miles long, and all the benchlands between Missoula and Stevensville, Montana had been reclaimed.

11. *Ibid.*

12. *Ibid.*

Lake Como Reservoir was formed by placing a dam across the outlet of the natural lake. The dam consisted of a 2,500 foot long earthen embankment. Its maximum height was 65 feet above the original creek bed and 50 feet above the original lake level. At the dam's north end they placed a 75 foot wide, eleven foot deep, reinforced steel concrete spillway. The spillway's original capacity totaled 2,400 cubic feet per second with an emergency capacity of 8,400 cfs. Upon the completion of the dam the company had invested a total of more than \$6,000,000 in this irrigation project.¹³

First operation began upon completion of the construction. From the very beginning the project's developers knew that the key to their success was an ample water supply. This they found in Lake Como which is fed by Rock Creek, which in turn is fed by the large snow packs from the high mountain country. They believed control of the waters of Lake Como would assure their irrigation project of success. The company planned to release 700 cfs of water from Lake Como Reservoir into Rock Creek and divert it at Rock Creek Diversion Dam (a rock-filled wooden structure constructed across the creek) into the Main Canal one mile below the reservoir. The canal passed through steep mountain slopes, over the 4,000 foot wide Sleeping Child Canyon, to continue on and pass over creeks, gulleys, ravines, deep gulches, and pass through rocky cliffs. This rough terrain required several wooden flumes and siphons to move the water through the canal to its destination. However, even at the start of its operations, the irrigation system experienced breaks in the canal and extensive seepage. Initially, total water loss from leakage, seepage, and evaporation was upwards of twenty-five percent. Despite this high rate of

13. *Ibid.*, 7, 13.

water loss, however, the water that did reach the benchlands rapidly increased the agricultural development in the Bitter Root Valley.¹⁴

Thousands of acres of newly irrigable land were purchased by newcomers. These newly settled lands became the subdivisions of East Side Addition, Hamilton Heights, Home Acres, Mountain View Orchards, Summer Dale, Thousand Acres, and University Heights. Each of these divisions saw the construction of golf courses and large inns. Additionally, many of these divisions planted acres of McIntosh Apple orchards. Intense advertising to attract even more people to these lands occurred, boasting that land selling from \$200 to \$300 per acre could earn net returns of \$5000 for each ten acre plot. The Bitter Root Valley Irrigation Company even offered a development plan for undeveloped lands. This plan consisted of a buyer paying \$300 per acre for land and having the company caring for an orchard on that land for five years, after which the company represented the land as being self supporting. At that point the buyer could either settle on the land or have the company continue to care for the orchard for an agreed upon price. After this development the land was considered to be worth \$500 per acre.¹⁵

However, even the sale of project land to growing numbers of settlers could not keep the Bitter Root Valley Irrigation Company out of financial trouble. On January 3, 1916, the company filed for bankruptcy. Although the actual legal litigation in the bankruptcy case took several years, the demand for farm products brought on by World War I made continual operation of the irrigation project necessary. As a result, from 1916 to 1920 the landowners, under court jurisdiction, operated the project. When litigation proceedings finally came to an end, the original investors lost close to \$4,500,000, and the project was sold to other private

14. *Ibid.*

15. *Ibid.*, 11.

interests.¹⁶ These new private interests organized the Ravalli Water Company, and petitioned the court for the creation of an irrigation district. The company's original petition, dated January 7, 1920, included the signatures of 594 land owners representing 17,389 acres of land. In the end, however, this company too was unable to meet the project's financial obligations. It was then that the farmers themselves took over the project.¹⁷

In December of 1920 the Bitter Root Irrigation District formed as a municipal corporation under Montana law. When the district organized it consisted of 25,067 acres, of which 18,240 acres were irrigable lands. However, this was deemed too much land, and the district was reduced to 16,665 acres. A \$600,000 bond issue was sold during the years 1923-1924 under state irrigation law. The district used proceeds of the bond issue to make payment for the canal system and reconstruction of the project works. The reconstruction work on the system involved adding concrete, installing steel pipes, and replacing about half of the project's wooden flumes with earth fills. Additionally, they repaired all remaining flumes. At all pipelines they placed reinforced concrete intakes, and constructed a modern spillway at Como Dam. They also constructed concrete wasteways and siphons at the East Side Crossing and placed new concrete and steel turnouts for the Main Canal. Finally, they overhauled the original lateral system which consisted of just over 77 miles of unlined laterals.¹⁸

Despite this rehabilitation work, the irrigation system caused the district continual problems. The remaining wooden flumes washed out on a regular basis, and the cost of repairs could not be offset with levies against irrigators because farm prices were in decline. As a result the district could not repay the principle on the their \$600,000 debt. Within four years they

16. *Ibid.*, 12.

17. *Ibid.*

18. *Ibid.*, 12, 13, 15.

could no longer make interest payments. At this point the Bitter Root Irrigation District turned to the Federal Government for help. Through legislation sponsored on August 24, 1931, by Senators B. K. Wheeler and Thomas Walsh of Montana, the Secretary of the Interior was directed to use monies to aid the district. Congress appropriated \$750,000 of Reclamation funds for the purpose of rehabilitating the district's irrigation system and retiring the district's private debt.¹⁹

Project Authorization

Rehabilitation of the Bitter Root Project was initially authorized on July 3, 1930 (Public Law No. 506, 46 Stat. 852). This act appropriated \$750,000 for rehabilitation of the Bitter Root Project and the liquidation of the Bitter Root Irrigation District's private indebtedness. However, further problems plagued the district and additional extensive rehabilitation of the project was authorized under the Rehabilitation and Betterment Act of October 7, 1949 (63 Stat. 724). Severe flood damage to the project in 1974 was repaired through an additional appropriation of funds authorized under the Emergency Fund Act of June 26, 1948 (62 State. 1052).²⁰

Construction History

The main features of the Bitter Root Project include Como Dam, Lake Como Reservoir, Rock Creek Diversion Dam, and a distribution system consisting of the Main Canal, the Lost Horse Creek Feeder Canal, and approximately 132 miles of laterals.²¹ Currently, water flows through the system beginning in Rock Creek, a tributary of the Bitterroot River. On Rock Creek, water is stored in Lake Como Reservoir, which has a capacity of 38,495 acre-feet. This storage

19. *Ibid.*, 16, 19.

20. *Ibid.*, 38; Water and Power Resources Service, *Project Data*, (Denver: GPO, 1981), 39.

21. *Ibid.*, 37.

water is then released back into Rock Creek and diverted by the Rock Creek Diversion Dam, located one mile downstream from Lake Como, and about fourteen miles south of Hamilton, Montana, into the 72 mile long Main Canal, located one mile below the reservoir. The Main Canal has a capacity of 330 cfs, and also receives water one mile below the Rock Creek Diversion Dam from the Lost Horse Creek Feeder Canal which diverts water seven miles from Lost Horse Creek into the Main Canal. The Main Canal then distributes the water into 132 miles of laterals.²²

The initial rehabilitation program began in 1932. The Bitter Root Irrigation District received \$250,000 for rehabilitation of the project works after their bonded indebtedness was paid off by Reclamation. The main thrust of the 1930s rehabilitation was replacement of siphons and remaining flumes on the Main Canal. This first work was contracted to R. M. Baunton for replacement of Flume 57 and associated earthwork, while C. J. Brown received the contract for earthwork for Flume 9 in 1932. In 1933 Brown also received a contract to replace Flumes 3, 14 - 17, and 23, and to haul fill for Flumes 22 and 24.²³ The Government again contracted with Brown in 1934, this time to conduct blasting and drilling operations and to replace Flumes 32, 34, and 36. At the same time Howard N. Bates received the contract for hauling fill, concrete placement, earthwork and backfilling operations for Flumes 32, 34, and 36. The contractors carried on this work through 1934 and completed it at the end of 1935.²⁴ In 1936 J. L. McLaughlin and Howard Bates were granted a contract to replace three wood siphons, at Birch

22. *Ibid.*; Performance Parameters Team, *Focused Summary of Performance Parameters for Como Dam, Bitter Root Project, Montana*. (Denver: United States Department of the Interior, Bureau of Reclamation, February 3, 1995), 2; "Project History," 1967-1968, 8; "Project History," 1931-1962, 81; "Project History," 1965-1966, 4; "Project History," 1963-1964, 20.

23. "Project History," 1931-1962, 39, 40.

24. *Ibid.*, 41.

Creek, Spooner Creek, and Willoughby Creek, with steel siphons supported by concrete. The contract called for the siphons to be 70 inches wide and 2,500 feet long. The contractors completed all work that same year.²⁵

All other rehabilitation work done in the 1930s was performed by district forces using Reclamation funds. In 1936 the district built a siphon at Ambrose Creek and began constructing a siphon at Grey Horse Creek, which they completed in 1938. Additionally, during 1936 district forces constructed the Lost Horse Feeder Canal to contribute to the project's water supply.²⁶

Rehabilitation work on the Bitter Root Project continued for several years, with the main thrust of the program occurring between 1948 and 1967.²⁷ One of the biggest aspects of the rehabilitation program was the constant repair work on the Main Canal. Many of the problems with the Main Canal were a direct result of the canal's location. The canal was built through rocky terrain on miles of steep hills and crossing abrupt draws. Much of the earth through which the canal was originally constructed was very porous, especially in the draw areas, causing excessive leakage. Instability in the canal banks also led to slippage of banks and canal leakage.²⁸ Consequently, over the years the canal experienced several breaks. In 1937 several water users were paid damages by the district as a result of breaks along the Main Canal, in the Lost Horse Creek Feeder Canal, and overflow from Como Dam's spillway. The repairs to the feeder canal alone cost the district \$25,000.²⁹

Beginning in the early 1940s, the Bitter Root Irrigation District took steps to help prevent seepage from the Main Canal. First the district lined the canal with clay and aquaseal. However,

25. *Ibid.*, 45.

26. *Ibid.*

27. "Project History," 1967-1967, 22.

28. "Project History," 1931-1962, 130.

29. *Ibid.*, 46.

this did not solve the district's problem and by 1946 the canal again began suffering from breaks.³⁰ Much work on the Main Canal was conducted by the district from 1948-1967. During that period the district continued to line the canal with clay and aquaseal, began enlarging and widening both sides of the canal, and continued their program of replacing flumes with fills to support the canal. All together, of the fourteen flumes which remained at the beginning of 1948, the district replaced eleven of them with earth canal sections, two with concrete structures, and one with a steel pipe siphon. However, problems still abounded. In 1953 the Main Canal broke, wreaking havoc downstream. This break occurred in high country and sent a heavy water flow downstream tearing up the land in its path as it went. As it passed, it left behind a trench 100 feet wide and 25 feet deep, causing thousands of dollars in damage. In addition to repairs on the Main Canal itself, the district also performed extensive repair and improvement work on several of the canal's siphons. At the time of these repairs some of the siphons were in such bad shape that the district feared failure of the structures.³¹

Rehabilitation on features other than the Main Canal also took place. Reclamation opened bids for reconstruction of the Rock Creek Diversion Dam in 1949. The Government awarded the contract to McCann Construction Company on June 29, 1949, and the contractor received notice to proceed September 6, 1949. The contract called for removal of the existing rock-filled timber crib structure, all required excavation and grading, and placing compacted backfill and cobble fill. It also required construction of a reinforced concrete intake structure containing screw-lift vertical steel gates, a reinforced concrete sluiceway with timber stop logs, and an 80 foot long rock-fill overflow dam with a creosoted piling core and reinforced concrete

30. *Ibid.*, 50, 55-56.

31. "Project History," 1967-1968, 13; "Project History," 1931-1962, 58, 80, 62, 28, 67, 68-70, 72, 14, 16, 71.

cap. The new dam was constructed 20 feet downstream from the original site, and was made of reinforced concrete, sheet piling, and cobble riprap. The new structure was built to a structural height of ten and one-half feet, a hydraulic height of five feet, and a crest length of 80 feet. Its diversion capacity totaled 330 cfs. The contractor completed all work under the contract on March 24, 1950, 50 days ahead of schedule.³²

The other structure rehabilitated during this time frame was the Como Dam.

Rehabilitation activities on Como Dam occurred in 1936, 1948, but the major rehabilitation work on the dam during this ear occurred in the mid-late 1950s, and the early 1960s.³³ Como Dam is located in Ravalli County, fifteen miles southwest of Hamilton and 60 miles south of Missoula, Montana. Lake Como was originally a natural body of water located on Rock Creek three and one-half miles above the creek's confluence with the Bitterroot River. The dam was built across the lake's outlet to form the Lake Como Reservoir. For years Reclamation and the Bitter Root Irrigation District discussed the possibility of raising the dam to provide more water storage.³⁴ In 1952 a Reclamation engineer visited the district to begin outlining the plans and figuring the cost of raising the dam six feet, enough to provide the district with 156 acre-feet of additional storage space.³⁵

Two years later, on June 17, 1954, Reclamation opened bids for enlarging and rehabilitating the dam. Union Construction Company received the contract on July 13, 1954, and acknowledged notice to proceed on August 11. The contractor began preliminary work on

32. *Ibid.*, 58, 78, 82, 13, 81, 59.

33. Performance Parameters Team, *Performance Parameters for Como Dam, Bitter Root Project, Montana, Technical Memorandum No. CQ-8313-12*. (Denver: United States Department of the Interior, Bureau of Reclamation, February 3, 1995), 1-2.

34. "Project History." 1931-1962, 89.

35. *Ibid.*, 61.

August 18, 1954, and started actual construction work one day later. Work progressed quickly, with all construction being completed November 16, 1954.³⁶ The rehabilitated dam possessed a structural height of 65 feet, a hydraulic height of 55 ft, a top width of 25 feet, a maximum base width of 400 feet, a crest length of 2,550 feet, and a crest elevation of 4249.3 feet. The spillway at the left abutment consisted of a concrete lined crest and channel with removable stoplog control. The outlet works was a concrete conduit through the dam's base and controlled by one, five and one-half foot wide gate valve for regular service, and one for emergency.³⁷

By the early 1960s the dam's original outlet caused the district trouble. Therefore, in 1962 rehabilitation work on Como Dam occurred once more. The district placed 2,650 pounds of reinforcement steel, and laid 55 cubic yards of new concrete in order to place the old outlet back into working order.³⁸

Upon completion of the Reclamation-constructed works (Como Dam and Rock Creek Diversion Dam), the structures were turned over to the Bitter Root Irrigation District for operation and maintenance. The district cared for and operated the other works simultaneously with the rehabilitation activities in which it and Reclamation were engaged. Reclamation considered all work authorized under the Rehabilitation and Betterment Program complete as of April 12, 1967.³⁹

Although the district's rehabilitation work began in 1931 with \$250,000 in available funds, this did not turn out to be sufficient to meet the bill for their rehabilitation needs. The original contract between the Government and the Bitter Root Irrigation District was signed

36. *Ibid.*, 87-8.

37. *Ibid.*, 63.

38. *Ibid.*, 72.

39. "Project History," 1967-1968, 23.

August 24, 1931. On March 17, 1936, the Government granted the district \$200,000 in additional funds. However, by 1938 the district began having difficulty meeting their repayment obligations. Thus, in 1939, Reclamation devised a repayment schedule which extended the district's payment schedule beyond the originally designated 40 years in order to reduce their annual payments. By 1944 the district seemed to be economically stable once more and became current on all rehabilitation payments owed. However, one year later the district again requested that the Government grant them economic relief. In 1948 the Bitter Root Irrigation District and Reclamation entered into an amendatory contract which again extended the district's payment period, revised their annual installments, and granted the district an additional \$10,000 in rehabilitation funds. Several years passed, but in 1955, the district, still plagued by problems with their irrigation works, again asked Reclamation for financial assistance. The Government approved the district's request and provided them with a new contract which loaned the district another \$20,000 for rehabilitation work. One year later the district was granted an supplemental contract which appropriated \$225,000 for additional rehabilitation work. These funds were designated to be repaid in 40 equal installments of \$5,625. However, the district's need for rehabilitation funds continued to expand. In 1960 the district wrote to Senator Lee Metcalf to ask for a Betterment loan to complete rehabilitation work. Reclamation granted their loan request, and on March 6, 1961, the district received an additional loan of \$425,367 to continue their work. However, once more the district needed help from Reclamation, and on July 27, 1962, the Government and the Bitter Root Irrigation District entered into another contract. This

new loan was not to exceed \$510,000, and the payments were scheduled to end in the year 2014. This loan in 1962, carried the district to completion of most of its rehabilitation efforts in 1967.⁴⁰

Post-Construction History

After completion of the rehabilitation program the Bitter Root Irrigation District kept up a continual maintenance and improvement program on the project works. The standard work in that program included continuing to reshape and line portions of the Main Canal where needed. It also included regular chemical treatments to control weeds in and around the project features, sandblasting and painting metal structures when needed, repairing concrete as necessary, removing trees and brush from canal banks and the edges of the reservoir, replacing riprap, repairing inlet and outlet structures on the siphons, and other general maintenance work.⁴¹

However the district also faced post construction problems. The effects of the errors made during the Main Canal's initial construction continued to frustrate the district's water users. Throughout the 1970s and 1980s the Main Canal was troubled with slides, and it and its siphons had several breaks. Slides caused by loose canal embankments and hillside debris continually clogged segments of the Main Canal, reducing the delivery capacity. Although district forces cut back the toe of the slides and flattened the surrounding hillsides as often as possible, slides still occurred. In fact, during irrigation seasons the threat of slides was so severe that the canal needed to be patrolled on a daily basis.⁴²

However, the biggest problems which occurred along the Main Canal were the breaks. In 1971, and again in 1972, the canal broke. Both failures were caused by rodent holes, and both

40. "Project History," 1931-1962, 38, 45, 47-48, 53-54, 57, 64, 66, 70-72.

41. "Project History," 1973-1974, 3; "Project History," 1931-1962, 122; "Project History," 1965-1966, 17, 74; "Project History," 1971-1972, (b); "Project History," 1977-1978, 16; "Project History," 1979-1980, 13; "Project History," 1983-1984, 4-12.

42. "Project History," 1975-1976, 3; "Project History," 1979-1980, 18.

breaks caused property and structural damage.⁴³ The winter of 1973-74 saw heavy snowfall, and a warm spring caused rapid runoff throughout the Bitter Root Valley. By mid-June of 1974 the Bitterroot River and its tributaries were all at or above flood stage. On June 15 the main river flow under Siphon 1 undermined the left-hand pier of the left truss which crossed the Bitterroot River. This truss supported a 60 inch wide, 4,000 foot long siphon, and when the truss dropped it took a large portion of the siphon with it. Shortly after the first pier failed, the weight of the dangling siphon and the speed of the river flow caused three additional piers on the left-hand bank to fail as well. Within four days about 90 linear feet of the slope section of Siphon 1 was hanging over the river unsupported with the siphon separated at its expansion joint. Immediate repairs were needed. Reclamation stepped in and granted the Bitter Root Irrigation District \$300,000 to make emergency repairs. Reclamation awarded the repair contract to Morrison Knudsen, who began preliminary work on June 23, 1974, and started repair work June 30. The siphon break terminated water service through the canal for three weeks. However, on July 9, 1974, the contractor finished all repair work and normal service through the Main Canal resumed.⁴⁴

In 1976 a small siphon which ran under Siphon 1 failed during the spring runoff. This failure allowed water to get under the empty Siphon 1, thus causing it to float. Therefore, the district reset Siphon 1, and compacted and covered it with additional material. Then they replaced the smaller siphon and installed a weed rack at its inlet.⁴⁵ However, this did not end the district's problems with Siphon 1 which failed again on August 7, 1979. This time the break

43. "Project History," 1971-1972, (a).

44. "Project History," 1973-1974. (a), (e).

45. "Project History." 1975-1976, 3.

required district forces to replace a 60 foot section of the siphon and caused a fifteen day shut-down of the system.⁴⁶

Despite constant efforts to prevent such problems, the Main Canal experienced another break in 1980. The rock ledge on the canal's upper side had to be drilled, blasted and removed. The district then moved the canal further into the hillside in an effort to thwart future breaks. However, even after moving the canal, seepage occurred on the canal's downhill side through the reaches where rock ledges were located. District workers determined that the problem stemmed from the fact that the seepage followed the cracks in the rock and flowed under the canal and surfaced at the toe of the slope. In subsequent years the district has continued to repair breaks as they have occurred.⁴⁷

Another constant concern for the district since the 1970s has been Como Dam. In 1971 the dam was investigated under Reclamations's Examination of Existing Structures Program. Reclamation found very marshy conditions near the toe of the dam, indicating leakage problems. Further investigations showed that a severe flood could pose a threat to the dam's integrity if all stoplogs were in place. This discovery led to watertightness tests, which revealed the competence of the upper ten feet of the dam to be somewhat marginal. Neither Reclamation or the district, however, believed immediate action was necessary at that time.⁴⁸

However, after subsequent inspections, in 1976 Reclamation decided that Como Dam needed rehabilitation work. They determined that the dam should be raised adjacent to the spillway, which was the low point in the fill. They furnished the Bitter Root Irrigation District with a design for concrete walls on each side of the spillway. The district completed installation

46. "Project History," 1979-1980, 16.
47. "Project History," 1981-1982, 15.
48. "Project History," 1971-1972, 77, 66.

of the protective walls prior to the end of year.⁴⁹ Results of Reclamation's Safety Evaluation of Existing Dams (SEED) report for 1984 showed further deterioration of the dam, and marked safety concerns by both Reclamation and the district. By this time seepage and sand boils through the dam's foundation had greatly increased. Safety officials feared that this seepage could cause piping that would endanger the dam's embankment. Additionally, the downstream portion of the outlet works conduit had settled, which meant if the conduit ruptured it could have caused the dam to fail.⁵⁰ Reclamation monitored these problems, and by 1988 they classified Como Dam's overall safety as poor.⁵¹

The dam received its poor rating because Reclamation determined that the dam had a high failure potential of the embankment from overtopping during probable maximum floods and lesser events, the dam's inadequate reservoir evacuation capability, the potential for piping causing the foundation to fail, and the fact that the embankment's static and dynamic stability was unknown. At this time Reclamation also classified Como Dam as a high-hazard facility because of the potential for a great loss of life and property downstream should the dam actually fail. These new classifications moved the dam from number 90 to number 29 on the Dam Safety Task Force's priority ranking list.⁵²

By 1992 the problems at Como Dam prompted Reclamation to place it under intense observation from May to July of that year. At the beginning of the observation period the reservoir had already been restricted to a maximum elevation of 4,234 feet, fifteen feet below the dam's maximum elevation. Even at that low level the dam showed signs of increased seepage

49. "Project History," 1975-1976, (N-2), 2.

50. "Project History," 1983-1984, 2-5.

51. Memorandum to Regional Director, Boise, Idaho, from Acting Chief, Dam Safety Office, 20 July 1988, Subject: *SEED Report-Como Dam, Bitter Root Project, Montana*.

52. Memorandum to Regional Director, Boise, Idaho, from Acting Chief, Dam Safety Office, 20 July 1988.

and boil activity, and an increase in the size of existing holes in the foundation. Additionally, the dam's downstream face showed some minor sloughing. These signs indicated the possibility of increased permeability of the foundation materials with the passage of time, and prompted Reclamation to declare a state of emergency at the dam on June 19, 1992. During this emergency Reclamation lowered the reservoir level to a less critical elevation of 4,220 feet, constructed stabilizing berms at the dam's toe, and increased the intense surveillance operations to twenty-four hours per day. When the reservoir reached the determined lower elevation on July 17, 1992, Reclamation canceled the dam's emergency status, but still kept it under close watch. Once the emergency ended, Reclamation made plans to rebuild the dam to safe standards.⁵³

Lake Como Reservoir was restricted to elevation 4220 feet until the dam was modified. In August 1992, Reclamation awarded a contract for modification of Como Dam to Barnard Construction Company which began work in September 1992. They completed all work before the irrigation season of 1993. Under this contract, the contractor stripped the upper five feet of the dam and the downstream face of the dam, installed a large, very deep, drainage system near the dam's toe, added riprap to the dam's upstream face, modified the spillway, repaired the outlet works tunnel, and raised the dam an additional five feet. This work greatly increased the dam's integrity.⁵⁴

53. Memorandum to Regional Geology Files, PN Region, Boise Idaho, from Consulting Geologist, D. N. Magleby, 7 August 1992, Subject: *Summary Report, Intense Geologic Observation Program, 1992, Como Dam, Bitter Root Project, MT. Re: Order for Geologic Services, Order No. 1425-2-PkG-10-12680, dated, 04/24/92*; D. N. Magleby, *Summary Report, Geologic Observations, Bitter Root Project, Montana*. (Denver: United States Department of the Interior, Bureau of Reclamation, August 1993), 1-4.

54. Don N. Stelma, *Final Construction Geology Report Como Dam - Safety of Dams Modifications: Bitter Root Project, Montana*. (Bend, Oregon: United States Department of the Interior, Bureau of Reclamation, Pacific Northwest Region, Bend Construction Office, November 1994), 1; D. N. Magleby, *Como Dam Modification, Bitter Root Project, Montana: Observations and Instrumental First-fill Surveillance, April 28 to August 13, 1993*.

(continued...)

Since completion of modifications the Bitter Root Irrigation District and Reclamation have kept the dam under observation.⁵⁵ In 1993 to 1994, the district added a three foot high parapet wall to the top of the dam to enhance the dam's capacity for instream flow and recreation purposes. Currently plans for modification of the upstream face of the dam are under consideration.⁵⁶

Settlement of Project Lands

Most all of the project lands were privately owned and settled previous to, or while the project was still under the ownership of the Bitter Root Valley Irrigation Company in the early 1900s.⁵⁷

Project Benefits and Uses of Project Water

Project water is used mostly as irrigation water for farms in the Bitter Root Valley; however, Lake Como Reservoir also provides locals and tourists alike with recreational facilities. The project's irrigation water is used to grow alfalfa hay, pasture for cattle and sheep, barley, wheat, corn, oats, beans, potatoes, sugar beets, seed peas, and apples. The production of these crops is what gives the valley its livelihood. Rehabilitation of the project provided local farmers with a much more reliable source of water, with less threat of danger of property damage from canal breaks and dam failure. The reservoir also provides the surrounding communities with campgrounds, fishing, hunting and boating activities, and tourist dollars.⁵⁸

54. (...continued)

(Denver: United States Department of the Interior, Bureau of Reclamation, August 1993), 1-4, 9.

55. Performance Parameters Team, *Focused Summary*, 1.

56. Gary Shatter, Bitter Root Irrigation District Operation Director, interviewed by author, 21 November 1997, phone interview.

57. "Project History," 1931-1962, 7.

58. *Ibid.*, 128; "Project History," 1973-1974, (g); "Project History," 1963-1964, 4, 18-20; "Project History," 1931-1962, 31, 122, 140.

Conclusion

The Bitter Root Project rehabilitation has been very important to the water users in the Bitter Root Irrigation District. Project rehabilitation has allowed district water users to continue to pursue their livelihood and help keep them safe from disasters brought about by possible project failure. The Bitter Root Project is the backbone to the agricultural industry in the Bitter Root Valley.

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