

Glendo Unit
Oregon Trail Division
Pick-Sloan Missouri Basin Program

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The Glendo Unit

The Glendo Unit is part of the Pick-Sloan Missouri River Basin Program. The unit consists of six major project features: Glendo Dam, Glendo Reservoir, Glendo Power Plant, Gray Reef Dam, Gray Reef Reservoir, and the Fremont Canyon Power Plant. The Glendo Unit was designed as a multi-purpose natural resource system which is adjacent to, and works in conjunction with, the North Platte and Kendrick Projects, which are not part of the Missouri River Basin Program. Glendo provides supplemental irrigation water to 37,251 acres in Nebraska and Wyoming, and the two powerplants which have a combined generating capacity of 104.8 megawatts, supply electrical power to Colorado, Nebraska, and Wyoming. In conformity with the 1953 stipulation and order modifying the 1945 North Platte River Decree, in addition to providing power generation and irrigation water, the unit provides flood control, sediment retention, water storage and recreation, and fish and wildlife enhancement, as well as pollution control to improve the quality of both the municipal and industrial water supply in the North Platte River Valley between Gray Reef Dam and Glendo Reservoir.¹

Project Location

The Glendo Unit is in eastern and central Wyoming on the North Platte River. Although Glendo Dam and most of Glendo Reservoir are located in northern Platte County, Wyoming, portions of the reservoir extend into southeastern Converse County, Wyoming. About four and one half miles north and west of the dam site sits Glendo, Wyoming, the town nearest the dam. The town lies 80 miles east and south of Casper, and 100 miles north of Cheyenne, Wyoming. The Fremont Canyon Powerplant is located approximately four miles below Pathfinder Dam at

1. Water and Power Resources Service, *Project Data*, (Denver: Government Printing Office, 1981), 877. Department of the Interior, Bureau of Reclamation, "Project Histories: MRBP: Oregon Trail Division, Glendo Unit," 1979, 24 (hereafter referred to as "Project History" followed by the year and page).

the backwaters of Alcova Reservoir. Gray Reef Dam is also on the North Platte River. It is 27 miles southwest of Casper, and about four miles downstream from Alcova Dam.²

Winters are long and cold with little snow accumulation, and springs are cold with only moderate precipitation. Summers in the region often consist of frequent periods of extreme temperatures. Year-round temperatures range from -46 degrees to 107 degrees Fahrenheit, and rainfall averages just under twelve and one-half inches. These abrupt changes in temperatures and unpredictable levels of precipitation limit the growing season to approximately 133 days.³ The project lands are within the Great Plains Region of the Bureau of Reclamation. This region consists mostly of dry land farming and cattle grazing. The most important crops grown in the area are dry edible beans, corn, sugar beets, and alfalfa hay.⁴

Historic Setting

The region's first known inhabitants arrived in the area more than 11,000 years ago. Because of the region's harsh climatic conditions, many of these Indians did not make permanent settlements, but rather extracted what they needed for survival and moved on. The site now referred to as the Spanish Diggings, extending from Manville, Wyoming in the north to Guernsey, Wyoming in the south, and from the North Platte River in the west, to present day Highway 85 in the east, was an important semi-permanent settlement used by the long succession of migrating Indian groups. The trend of temporary occupation continued with the coming of the white man. Explorers from Spain, Great Britain, and Mexico, passed through the area because of its location near the upper end of the North Platte and Sweetwater River systems

2. Water and Power, *Project Data*, 877, 879; "Project History," 1949, 1; "Project History," 1954, 5.

3. US Department of Interior, Bureau of Reclamation, *Missouri River Basin Project, Oregon Trail Division, Glendo Unit, Wyoming, Glendo Dam and Powerplant, Basic Design Control*, (Denver: Bureau of Reclamation, December 18, 1952), 2, 4; "GLENDON - Profile information 1993-4, Community Profile," <http://www.wyoming.com/%7EPlatte/GLENDOP.HTM>, September, 1997.

4. "Project History," 1969, 20; "Project History," 1979, 9.

and its proximity to the Continental Divide.⁵

The United States came into possession of the land when the region was included within the Louisiana Purchase of 1803. American explorers, and then settlers, used the North Platte River Valley as a passage through the Rocky Mountains. The region also saw much activity as a route for the Overland Stage, Pony Express, and the first transcontinental telegraph. At this point more people began settling in the region on a permanent basis, rather than just passing through. In order to sustain agriculture in the arid region, settlers built the valley's first irrigation systems, without large storage reservoirs, in the early 1880s. The region has been under cultivation ever since.⁶

Project Authorization

Original project authorization occurred as part of the Flood Control Act of December 22, 1944, Public Law 534. This approved the general plan stated in Senate Documents 191, and 475, revised and coordinated by Senate Document 247, 78th Congress, second session. However, controversy over project details prevented construction under its original authorization. Reauthorization occurred ten years later on July 16, 1954, under Public Law 503, 83rd Congress. On August 20, 1958, Public Law 85-695 authorized construction of Gray Reef Dam and Gray Reef Reservoir as part of the Glendo Unit.⁷

Construction History

Preliminary investigations for the Glendo Unit began in 1944. At that time studies showed that water originating in streams and drains above Glendo was being wasted when it

5. T. A. Larson, *Wyoming: A Bicentennial History* (New York: W. W. Norton and Company, Incorporated, 1977) 3-4; US Department of Interior, *Basic Design Control*, 1; National Park Service for the Bureau of Reclamation, Region 7, *Supplemental Reconnaissance Report on Recreational Potentialities of the Glendo Reservoir North Platte River, Platte County, Wyoming*, A Supplement to the *Missouri River Basin Recreation Survey*, (Denver: Bureau of Reclamation, May 1948), 7-8; Dale Austin, telephone interview by author, 10 October 1997.

6. Water and Power, *Project Data*, 879; US Department of Interior, *Basic Design Control*, 1.

7. Water and Power, *Project Data*, 880; "Project History," 1961, 17.

could be captured and used for new irrigation. With that idea in mind, the Glendo Dam was conceived. As originally authorized, the Glendo Dam and Reservoir was to provide 150,000 acre-feet of storage space for retaining silt and conserving tributary run-off and return flow from the Kendrick project. The purpose of the dam and reservoir was to help reduce loss of capacity in Guernsey Reservoir due to silting, and to allow more power production at the North Platte River hydroelectric powerplants by storing additional water for power production and restoring water from releases made through upstream powerplants at Fremont Canyon and Alcova, thus allowing year round operation of these plants. No additional irrigation development was included in the original plan for the Glendo Unit.⁸

Reclamation and the Corps of Engineers did detailed studies and surveys which determined that the original planned capacity for the reservoir was insufficient. In 1947, Reclamation discovered the overall Pick-Sloan Missouri River Basin Program plan could incorporate the Glendo Unit more effectively by increasing Glendo Reservoir's capacity to provide storage space for hydroelectric power delivery and flood control. Thus, nine alternative project plans varying in their utilization of the Glendo Reservoir were developed. Plans five and nine received the most consideration.⁹

Plan five called for the reservoir to store surplus water for the Whalen-Tri-State Dam area. Stored water under this plan could be used under Warren Act contracts for canals that did not receive adequate water supplies from their natural flow rights. Plan nine called for maximum power production with only slight alteration of the existing program on the North Platte River below Guernsey Reservoir. However, neither plan could be put into action because of controversy among the technicians of several states as to the method of operation for Glendo

8. *Ibid.*, 877; "Project History," 1950, 16; "Project History," 1949, 3.

9. *Ibid.*, 3, 8.

Reservoir.

Colorado's interest in Glendo dealt with the idea that if any additional water supply became available downstream from the reservoir, then they might have grounds for requesting an increased use of water in the North Park area. Central Nebraska's interest in the project stemmed from a fear that construction of Glendo Reservoir would reduce the flow of water into Lake McConaughy, thereby adversely affecting their water rights. As a result, Congress passed Public Law 841 which stated that no appropriation money could be used for any construction on the Glendo Unit until a definite plan report was agreed upon by Colorado, Nebraska and Wyoming, and then approved by Congress.¹⁰

In 1954, Reclamation developed a plan, based on plan nine, which designed Glendo Reservoir with a capacity of 800,000 acre-feet. They divided the capacity into: 100,000 acre-feet for irrigation, 115,000 acre-feet for sediment control, 275,000 acre-feet for flood control, and 310,000 acre-feet for power production. The irrigation segment of the plan provided that 40,000 acre-feet of any one year's runoff could be stored in the reservoir in addition to evaporation losses, with irrigation accumulation totaling 100,000 acre-feet. It declared that from this storage, up to 40,000 acre-feet could be used annually for irrigation, providing lands in Wyoming with 15,000 acre-feet, and lands in Nebraska with 25,000 acre-feet. The plan also stated that the Fremont Canyon and Glendo Powerplants would supply the existing and expanding commercial, industrial, and domestic need for power in Colorado, Nebraska, and Wyoming. Additionally, the plan specified that repayment for the project would be made from the sale of irrigation water and electrical energy in accordance with Reclamation law and provisions as authorized by Congress. Once the three states examined the plan and determined

10. *Ibid.*, 3, 8, 8-10.

that it benefitted all, they agreed to it, and Congress approved the plan and reauthorized the building of the Glendo Unit in 1954.¹¹

Glendo Dam is an earthfill structure with a structural height of 190 feet, and an embankment height of 167 feet. It has a crest length of 2,096 feet, and a spillway capacity of 10,335 cubic feet per second. The outlet works consists of an intake structure with trashracks, an upstream tunnel and twenty-one foot wide conduit, a twenty-one foot surge tank, and a sixteen and one-half by twenty-one foot fixed-wheel gate. The penstock has a branch for the outlet works and a branch for the powerplant. Control for the outlet works consists of three regulating gates and three emergency gates. The outlet works was designed to pass 5,500 cfs with water surface elevation at 4570, and 10,000 cfs with water surface between elevations 4635 and 4653. Its maximum discharge is 11,200 cfs.¹²

Approximately 2,440 feet of dikes are needed on the south side of the reservoir across a low area one and one-half mile west of the dam. Glendo Dam impounds the fourteen mile long Glendo Reservoir. At elevation 4653, the top of the reservoir's flood control capacity, the reservoir's total capacity equals 789,402 acre-feet. This provides space for storing an estimated 100-year sediment accumulation of 115,000 acre-feet. It also provides an allotted 271,917 acre-feet for flood control, 454,337 acre-feet for irrigation and power generation, and 329,251 acre-foot surcharge capacity.¹³ A surcharge capacity is "the reservoir capacity provided through the reservoir. It is the reservoir capacity between the maximum water surface elevation and the highest of the following elevations (1) top of exclusive flood control capacity, (2) top of joint use capacity, or (3) top of active conservation capacity."¹⁴ Current capacities in Glendo Reservoir

11. "Project History," 1954, 6; "Project History," 1957, 15.

12. *Ibid.*, 20; "Project History," 10.

13. Water and Power, *Project Data*, 879.

14. *Ibid.*, 1366.

differ some from the original designations due to the amount of sediment accumulation which has already occurred in the reservoir.¹⁵

Bids for construction of Glendo Dam, powerplant foundation, and accompanying access roads opened on November 9, 1954. Out of fifteen bids, the contract went to C.F. Lytle Company and Greene Construction Company on November 27, 1954. They received notice to proceed November 29, 1954, and began excavation operations by mid December. Work on the fabrication of the penstock, surge tank, and outlet pipes began on-site in May of 1955, and concrete placement for the outlet works and powerplant occurred in June of the same year. The contractors finished fabrication of the penstock and outlet pipes in January of 1956, and installed them in March. By September of 1956, they completed construction of the contracted access roads and finished the powerplant foundation and switchyard grading. November and December of the same year saw completion of concrete placement for the spillway and erection of the 205 foot surge tank. The contractors finished Glendo Dam in the early fall of 1957, and completed all work for their contract March 13, 1958.¹⁶

Construction of the reservoir required relocation of three miles of the Chicago, Burlington, and Quincy Railroad, and relocation of four miles of State Highway, U.S. 87. A contract to perform the earthwork and structures for the railroad relocation went to Morrison-Knudsen Construction Company in November 1955. They completed the contract exactly one year later. The process of removing the old track and laying the new, was performed by the railroad company, and was finished the end of December 1956. Bids for relocation of the highway opened in June of 1955. The contractor received notice to proceed in July, and began

15. *Ibid*, 879.

16. "Project History," 1954, 7; "Project History," 1955, 7; "Project History," 1965, 7; "Project History," 1957, 7; "Project History," 1958; 23.

work in August. All work for the contract was completed in September of 1957.¹⁷

The Glendo Powerplant is connected to Glendo Reservoir by a twenty-one foot wide, and 2,100 foot long diversion tunnel. The plant has two units with a maximum head of 130 feet, each capable of generating 19,000 kilowatts of power. From 1958 to 1993 the Glendo Powerplant has generated an average annual gross of just over 82 and one-half gigawatts of power.¹⁸

Construction bids for the Glendo Powerplant and switchyard opened In October 1956, and the contractor received notice to proceed in November of the same year. Work began in 1957, and by August, the powerplant's superstructure had been erected. By year's end most of the second and third stage concrete in the powerplant had been placed, much of the piping, pumping equipment, and electrical equipment had been installed, a number of transformers and circuit breakers were placed, and the construction of a river gaging station 4,000 feet below the plant had been completed. In 1958 the contractor completely installed the plant's two generators and initiated the plant's power operations. All work under the contract specifications, except painting and clean-up, was finished December 19, 1958.¹⁹

The Fremont Canyon Powerplant derives its names from General John C. Frémont, the explorer who, in 1842, explored the canyon in which the powerplant now sits. The canyon also bears the General's name. The powerplant is located within the canyon on the left bank of the North Platte River. The Fremont Canyon Powerplant and power conduit are part of series of Reclamation developments in the North Platte drainage area. The power conduit is 35 miles southwest of Casper, Wyoming. The three mile long, eighteen foot wide power conduit's inlet

17. "Project History," 1955, 9; "Project History," 1956, 9; "Project History," 1957, 9.

18. Water and Power, *Project Data*, 879; "Glendo Powerplant," 1.

19. "Project History," 1956, 9; "Project History," 1957, 9; "Project History," 1958, 23.

taps Pathfinder Reservoir. Its outlet works consists of two penstocks leading to the powerplant located in Fremont Canyon near the upper end of Alcova Reservoir. The powerplant contains two generators driven by two 33,500-horsepower Francis-type hydraulic turbines, which operate at a maximum head of 350 feet, and have a combined generating capability of 66,800 kilowatts. The conduit is controlled by a fourteen by eighteen foot fixed-wheel gate downstream from the inlet.²⁰

Bids for construction of Fremont Canyon Powerplant opened in January 1957. Reclamation awarded the contract to Coker-Kiewit-Cunningham, who received notice to proceed in February and began work in March by excavating the unit's tunnels. The contractor began work on installing Fremont Canyon area telephone and power lines in October of 1957. By year's end they had cleared the right-of-way, completed the structures and strung the phone lines from Alcova to Red Hill, Wyoming, and erected the structures and strung the power lines from Fremont Canyon to Pathfinder. The contractor completed excavation of both tunnels in 1958. Concrete placement for the powerhouse began November 22, of the same year. During 1959, Coker-Kiewit-Cunningham completed installation of the trashracks and fixed-wheel gate in early January. They placed concrete in the powerplant from January through September, and placed the concrete section of the surge tank from May to July, finishing work on the steel section in September. Additionally, during this same time period the contractor completed the concrete work in both the tunnels. They finished all contractual work June 3, 1960.²¹

Bids for completion work on Fremont Canyon Powerplant opened April 9, 1959. The contract went to the low bidder, Flora Construction Company and Argus Construction Company,

20. "Project History," 1963, 7; US Department of Interior, Bureau of Reclamation, *Technical Record of Design and Construction Fremont Canyon Powerplant and Power Conduit, Constructed 1956-1961*, (Denver: Bureau of Reclamation, March 1963), 1; "Fremont Canyon Powerplant," 1.

21. "Project History," 1957, 11; "Project History," 1958, 23, 26; "Project History," 1959, 24; "Project History," 1960, 15.

on May 11, 1959. They received notice to proceed two days later. However, the original notice to proceed did not include provisions for work inside the powerhouse. They received the notice to proceed that specified the inside work on October 21, 1959. The contractors began work in November, but by the end of the year Reclamation declared that progress on the contract was generally unsatisfactory.²² Throughout 1960, Reclamation felt the situation did not improve much, stating that the contractor was “plagued by lack of organization, inadequate supervision, inexperienced personnel and rapid labor ‘turnover’.”²³ The year ended with the contractor having completed less than 82 percent of the work in over 85 percent of the time allotted. However, all contractual requirements were completed by the contractor by March 5, 1961. Once the Flora and Argus Construction Companies progressed far enough with their work in 1960 for additional work to be done, General Electric Company received a contract to furnish and install the powerplant’s two generators. They completed work in mid-January 1961, and by January 27, 1961, both generators were released for commercial power and generation.²⁴

Gray Reef Dam and Gray Reef Reservoir, located on the North Platter River, two miles downstream from Alcova Dam, derived their names from the nearby geographical landmark known as Gray Reef. The dam is an earthfill structure with a structural height of 36 feet, an embankment height of 30 feet, and a crest length of 650 feet. Near the center of the dam there is a concrete chute spillway with a capacity of 20,000 cfs, that is controlled by two radial gates. The dam contains no outlet works. However, the dam does form the Gray Reef Reservoir, which was designed to reregulate releases from Alcova Dam. The reservoir has a maximum water surface elevation of 5,332, with a surface area of 182 acres. Its total capacity equals 1,800 acre-

22. “Project History,” 1959, 24.

23. “Project History,” 1960, 17.

24. *Ibid.*, “Project History,” 1961, 17.

feet.²⁵

Bids opened for construction of Gray Reef Dam on August 13, 1959. The Government received eleven bids on the project, and granted the contract to Davis Construction Company, Incorporated, on September 18, 1959. The contractor began work at the site in December. Before the end of the year Davis Construction Company, Incorporated, hired an electrical subcontractor, C. S. P. Engineering Company, to install the transmission line to the dam site. By March 14, 1960, the subcontractor had installed and energized a 4160 volt transmission line to the dam site. In 1960, the prime contractor constructed the sump and drainage ditches, excavated the spillway, and placed the concrete for the spillway. That same year the prime contractor also hired Hammond Wyoming Company as a subcontractor to install the dam's reinforcing bars, and the two radial gates with their corresponding gate hoists. All work progressed smoothly, and the prime contractor completed construction on May 12, 1961. Reclamation Commissioner Floyd E. Dominy officially dedicated the Gray Reef Dam and the Fremont Canyon Powerplant in a ceremony the morning of April 28, 1961.²⁶

Post-Construction History

With construction completed on the Glendo Unit, Reclamation began maintaining and operating all works in the unit. The Wyoming Area Office Manages water storage, drainage, recreation, and fish and wildlife enhancement for flood control and power production.²⁷

Several maintenance tasks required continual Reclamation attention after completion of the project features. The most common tasks included spraying noxious weeds at regular intervals and planting native grasses along reservoir banks to help curb erosion. Additionally,

25. *Ibid.*, "Project History, 1963, 7; "Project History," 1960, 13; Water and Power, *Project Data*, 879.

26. "Project History," 1959, 25; "Project History," 1960, 17, 19; "Project History," 1961, 20.

27. Water and Power, *Project Data*, 880; "Project History," 1979, 17.

Reclamation performed normal protective maintenance such as painting metal structures to prevent rust problems and installing fences on project lands to keep vehicles from causing off-road damage. Two of Reclamation's on-going maintenance programs have been the need to thin cottonwood trees along the shoreline of the reservoirs and a continual need to repair and maintain access roads to the project works.²⁸

Since completion of the Glendo Unit circumstances have necessitated that Reclamation make modifications and improvements to some of the project works. During the 1960s, most of these modifications were relatively minor. Reclamation made a few modifications to Glendo Dam's outlet works stilling basin, and contracted with the Alemite Company to install a centralized grease lubrication system for the Fremont Canyon Powerplant. Additionally, in order to combat an acute problem that developed which involved fish becoming trapped in the outlet shaft house at Glendo Dam during irrigation seasons, Reclamation installed fish screens on the dam's trashrack. This successfully prevented fish from being passed through the penstock and powerplant and being maimed or killed. During this period Reclamation also curbed some seepage which occurred below Gray Reef Dam and left the affected area covered in white leached salts.²⁹

During the early 1960s one serious problem recurred constantly. The wall of Fremont Canyon near the powerplant continually threatened rockslides which would endanger employee safety and reduce plant performance. In early December of 1962, Rognstad-Olsen Construction Company received a contract to strip the canyon walls around Fremont Canyon Powerplant, and to construct a protective net to help curb damage from rockslides. By January 1, 1963, the

28. "Project History," 1959, 25; "Project History," 1961, 25; "Project History," 1962, 10; "Project History," 1965, 8-10, 14, 15; "Project History," 1970, 32; "Project History," 1973, 26; "Project History," 1976, 22, 28; "Project History," 1979, 21; "Project History," 1980, 29.

29. "Project History," 1959, 23; "Project History," 1961, 17; "Project History," 1960, 21, 26; "Project History," 1962, 8.

contractor had already removed more than 400 cubic yards of rock. They installed the protective net, but the falling rock collapsed the net when an anchor failed, and the contractor had to install a stronger cable barrier net. On June 10, 1963, after having removed over 1,630 cubic yards of rock, and installing the new protective net, Rognstad-Olsen Construction Company completed their contract.³⁰

This work did not, however, completely eliminate the problems posed by the rocks. In 1964, Reclamation approved a plan to shape and remove loose rock from around the powerplant's tailrace area. Apparently, the loose rock caused the plant's turbines to intermittently raise and lower on their bearing seats near full gate openings when the lake level at Alcova was normal and the elevation at Pathfinder Reservoir was significant. This caused a pounding action which was detrimental to the plant's operation. Reclamation tried installing vent systems and guides, as well as other protective measures, but this action did not seem to correct the problem. However, rock removal did improve the situation.³¹

The 1970s and 1980s saw Reclamation making bigger repairs and improvements to the project works. On June 10, 1970, Charles M. Smith Construction Company received a contract to install a sewage treatment plant at Fremont Canyon Powerplant. The contract called for them to install a 600-gallon-per-day package sewage treatment plant. They installed the new unit inside the Fremont Canyon Powerplant as specified, and completed work on December 7, 1970.³² Two years later Reclamation had Lower and Cool, Incorporated, install the same type of sewage treatment facility in the Glendo Powerplant. The contractor completed work on November 16, 1972.³³

30. "Project History," 1962, 13; "Project History," 1963, 14.

31. "Project History," 1963, 15.

32. "Project History," 1970, 9.

33. "Project History," 1972, 30.

Another problem occurred when heavy runoff in 1971 caused Glendo Reservoir's level to rise over elevation 4650. This led to a significant amount of seepage downstream from the dikes. This high water damaged the dikes enough to cause a significant increase in seepage every time the reservoir rose above elevation 4646. By late June of 1973 the problem grew significant enough for Reclamation to negotiate a contract with Golden Drilling, Incorporated, on an emergency basis. Contract specifications called for the contractor to perform foundation grouting work on the dam's three dikes. During work, on July 24, 1973, the contractor had to cease operations due to an inability to acquire sufficient cement to complete the job. The Government terminated the contract on November 23, 1973.³⁴ On April 11, 1974, Reclamation granted a contract to Whalen and Company to continue work on the foundation drilling, sampling and grouting of the dikes at Glendo. The new contractor encountered no problems, and successfully completed all work in August of the same year.³⁵

However, this work did not eliminate the seepage problem with the dikes. In 1983, the reservoir again rose too high and caused seepage. Reclamation then restricted Glendo's allowable reservoir level to prevent additional problems with the dikes. By 1988, Reclamation wished to be able to lift restrictions in order to operate the reservoir at full capacity once again. In order for that to happen, Reclamation had to modify the design of the dikes. By the end of the 1980s, dike seepage ceased to be a constant worry for Reclamation.³⁶

The other continuous maintenance problem in the 1970s and 1980s, stemmed from the access road near Glendo Dam's left abutment. From the completion of its construction, the road faced problems with both rockfall from above and fill material sliding downhill and causing vast

34. Chief, Office of Programs Management, to Chief, Geotechnical Engineering and Embankment Branch, on Project Plan for Glendo Dike Seepage Repair, 29 July 1988. US Department of the Interior, Bureau of Reclamation, RG 115, NARA, Denver, Colorado; "Project History," 1973, 23.

35. "Project History," 1974, 24, 25.

36. Chief, Office of Programs, to Chief, Geotechnical Engineering, 29 July 1988.

amounts of damage to the road every year. Sixteen years worth of additional construction did little to halt the problem. However, disagreements as to whether the responsibility for finding and implementing a solution to the problem rested with Platte County or the Water and Power Resources Service, as Reclamation was then known, continually prevented much work toward fixing the problem.³⁷

The biggest improvement on the Glendo Unit by Reclamation in the 1990s occurred at Glendo Dam. Because of problems with the original outlet works, Reclamation installed a low flow outlet works at the dam in the early 1990s. Thus far, this improvement seems to have helped the dam's outlet works function more effectively.³⁸

Settlement of Project Lands

The development of the North Platte Project, including the Glendo Unit of the Pick-Sloan Missouri River Basin Program, raised land values and land use, and local improvements and utilities boosted the economy in the area below Guernsey Reservoir. Much of the land served by the project was privately owned prior to construction of the unit and remained so after its completion.³⁹

Project Benefits and Uses of Project Water

When the Glendo Unit was planned, not much change in land use was expected as a result of the project. The irrigation water was meant to help supplement an area which had already been under irrigation for more than 50 years. Prior to the project, the main crops grown in the region were dry edible beans, sugar beets, corn and alfalfa. These crops remain the

37. "Project History," 1980, 42.

38. US Department of Interior, Bureau of Reclamation, Great Plains Region, "Glendo Dam Low Flow Outlet Works, Pick-Sloan Missouri River Basin Program, Glendo Unit, Wyoming, 1991," Solicitation No. 1-SI-60-05160, RG 115, NARA, Denver, Colorado.

39. "Project History," 1960, 14; "Project History," 1962, 7; "Project History," 1966, 9; "Project History," 1976, 6.

primary crops produced in the region today. However, the supplemental irrigation for up to 50,000 acres of land, and reliable water storage provided by the Glendo Unit helped the region's farmers continually increase their crop production throughout the 1970s and early 1980s.⁴⁰

Additionally, the Glendo Unit regulates the stream flow below Alcova Dam. This re-regulation allows water releases to be made year-round without wasting valuable water resources. This re-regulation water also provides the area's fishing and boating industries with more constant water levels which bolster these industries, reservoir level annually fluctuates several feet. The constant stream regulation also provides the cities downstream from the dam with improved water quality.⁴¹

One of the main benefits provided by the Glendo Unit is its capacity for flood control. Prior to construction of Glendo Dam, the region was plagued with floods which caused millions of dollars in property damage. According to the Army Corps of Engineers, by 1981, the accumulated total of flood control damages prevented by Glendo Dam was \$11,384,000.⁴²

Power production is also one of the benefits of the Glendo Unit project. Between 1961 and 1992, the Fremont Canyon Powerplant produced 4,194,134,000 kilowatts hours of power, and Glendo Powerplant produced 2,819,383,000 kilowatts hours of power. The power generated by these two powerplants has benefitted areas in Colorado, Nebraska, and Wyoming.⁴³

The recreation facilities provided by Glendo and Gray Reef Reservoirs, are also a benefit of the Glendo Unit. Hundreds of thousands of tourists visit the recreation areas provided by the reservoirs to swim, boat, camp, hunt, and fish. The two reservoirs in the Glendo Unit have

40. "Project History," 1959, 18; "Project History," 1972, 31; "Project History," 1976, 25; "Project History," 1981, 8; Water and Power, *Project Data*, 880.

41. "Project History," 1957, 19; *Progress Report, Missouri River Basin, January-March, 1961* (Billings, Montana: Interior Missouri Basin Field Committee, 1961) 1.

42. Water and Power, *Project Data*, 880; "Project History," 1978, 11.

43. US Department of Interior, Bureau of Reclamation, *1992 Summary Statistics: Water, Land, and Related Data*, (Denver: Bureau of Reclamation, 1992), 132.

proven very popular over the years. In 1992, Gray Reef Reservoir recorded over 8,000 twelve-hour visitor days. That same year Glendo Reservoir recorded almost 682,500 twelve-hour visitor days.⁴⁴

Conclusion

The Glendo Unit has benefitted the region along the North Platte River in many ways. It has helped area farmers store and regulate their irrigation flows, and consequently helped to boost crop yields by combating the effects of the region's unpredictable weather and precipitation levels. The unit has provided areas of Colorado, Nebraska, and Wyoming with much needed electrical power as well as provided revenue derived from the sale of electricity. Additionally, the project furnishes the region with a valuable shield against the damages of devastating floods, as well as providing areas for recreation, wildlife enhancement, and pollution control.

44. Water and Power, *Project Data*, 880; US Department of Interior, *1992 Summary Statistics*, 116.

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