

The Dickinson Unit

Heart Division

Pick-Sloan Missouri Basin Program

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Pick-Sloan Missouri Basin Program The Dickinson Unit

The Missouri River is 2,460 miles in length and traverses parts of ten states—Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming--and a small part of Canada. Together the land and the River are known as the Missouri River Basin. Plans to develop the Basin had been on the national agenda when the United States entered World War II. Originally development was to be coordinated by a Missouri Valley Authority (MVA), an organization similar to the Tennessee Valley Authority (TVA). However, the governors of the ten states, among others, were violently opposed to the MVA idea; as a result the Bureau of Reclamation and the Army Corps of Engineers, who both had their eye on the Basin anyway, were asked to write their own proposals for development. What came out of those proposals has become known as the Pick-Sloan Missouri Basin Program.

The Pick-Sloan Missouri Basin Program (PSMBP) is a cooperative project between the Bureau of Reclamation and the Army Corps of Engineers. The PSMBP which was intended as a compromise between the two agencies resembles a marriage of convenience rather than a true effort to reconcile the two offices. Each agency presented an independent plan to Congress outlining their intentions in regards to the resources of the Missouri River. In 1944, the Corps' report was outlined to the House by Major General Lewis A. Pick; the Bureau report was presented to the Senate by William G. Sloan. In an effort to avoid favoritism between the offices and promote coordination between Federal agencies, Congress ordered a compromise of the two plans. The outcome of Congress' directive little resembles a compromise, but rather a

melding of the two proposals resulting in each agency getting what it originally wanted.¹

Project Location

A part of the Heart Division, Missouri River Basin Project, the Dickinson Unit is a multipurpose unit which provides storage for irrigation and municipal water, flood control, fish and wildlife conservation, and recreational opportunities. Dickinson Dam is located about two miles west of Dickinson, North Dakota, on the Heart River. The county seat of Stark County and the primary city in the Heart River Basin, Dickinson is located in the center of southwestern North Dakota. Theodore Roosevelt Memorial Park lies thirty-five miles west of the Project.

Historic Setting

Located sixty miles from the Montana border and seventy miles from the border of South Dakota, Dickinson, North Dakota was established in 1881, when the Northern Pacific Railroad built its line through the western part of the state. Adjacent to the Heart River, one of the major western tributaries of the Missouri River, the City lies at an elevation of about 2,400 feet above sea level. Currently the City is served by the Burlington Northern Railroad; additionally, State Highway 22 and Interstate 94 intersect within the City limits. Four-hundred and five square miles of the Heart River's total watershed area of 3,662 square miles, lie above Dickinson Dam.² The present source of municipal water for the city is Dickinson Reservoir, renamed Edward Arthur Patterson Lake in 1959.³

Originally, Dickinson was established as a community of large ranches. Encouraged by adequate moisture and high agricultural prices, an influx of new settlers in the early 1930's chose

1. Warne, William E. *The Bureau of Reclamation*. Praeger Publishers, Inc., 1973; reprint, Boulder: Westview Press, 1985., 162.

2. Denver Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of the Bureau of Reclamation, Record Group 115, "Appendix A—Engineering, to Feasibility Report, Municipal and Industrial Water Supply Study for Dickinson, North Dakota," April 1975, 51.

3. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. XII, 1959, 1.

to cultivate much of the land. Unfortunately, the 1930's soon turned into disaster for most of the agricultural community across the nation. The 1929 Stock Market Crash followed by several years of drought severely impacted the farming community nationwide, including Dickinson, resulting in a significant decline in the farm population. The decline in the farm population begun in the 1930's was furthered by the technological advances made in agriculture in the 1960's; machinery made traditional farm hands unnecessary.

Dickinson is the principal retail center in southwestern North Dakota. Dickinson's primary functions are trade and services and it is likely that this will continue in the future. Dickinson is in the center of a trade area approximately sixty miles from east to west, and forty-five miles from north to south. Because of its relative isolation, the city is able to dominate the surrounding trade area with little difficulty. Despite a lack of significant manufacturing, the city boasts a diverse economy. Dickinson's status as a major regional service center in southwestern North Dakota is not likely to change in the near future; it is expected that recreation, Dickinson State College, and manufacturing will all continue, with modest growth to contribute to the economy of the city and region.⁴

Project Authorization

In 1903 and 1904, the Reclamation Service made a reconnaissance survey of the Heart River Basin. The excessive cost of development and lack of interest by the land owners led to the conclusion that further work was not justified. In 1926, in the interest of irrigation and flood control, the Bureau of Reclamation rechecked the area. Despite the fact that the study showed that 12,000 acres could be irrigated and floods could be controlled, the project still did not

4. Denver Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of the Bureau of Reclamation, Record Group 115, "Appendix A-Engineering, to Feasibility Report, Municipal and Industrial Water Supply Study for Dickinson, North Dakota," April 1975, 51.

appear to be particularly attractive.

By 1942, agricultural requirements in the United States had far exceeded farm production. In the subhumid area farmers were developing an interest in irrigation. Along the Missouri and Mississippi Rivers and in the Heart River Valley damaging floods were recurring. Additionally, population in the city of Dickinson increased while the water supply diminished. River basin development as a concept was taking shape. In 1936, the President's Great Plains Drought Area Committee prepared a report stressing the need for conservation of Great Plains resources. The Bureau of Reclamation, prompted by all of these things, initiated a new detailed survey inclined toward maximum development of all the Basin resources. The detailed survey then led to plans for two units on the Heart River, the Heart Butte Unit and the Dickinson Unit; the Heart Butte Unit was presented in the Heart Butte Development Report while the Dickinson Unit was presented in a detailed report in October of 1947.⁵

Despite the fact that the detailed survey of the Basin was not completed until 1947, authorization for the Dickinson Unit was included as a part of the Pick-Sloan Missouri Basin Project. Among other things, the Flood Control Act of December 22, 1944⁶ authorized the Pick-Sloan Plan for construction in the Missouri River Basin.⁷

Construction History

A rolled earthfill dam across the Heart River and a combined spillway and outlet-works structure at the right abutment are the principal features of the Project. The Dam itself was originally had a crest length of approximately 2,275 feet and a crest width of thirty feet at

5. Denver Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of the Bureau of Reclamation, Record Group 115, "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. I, 1948, 1.

6. Senate Document 191, 78th Congress, second session.

7. United States Department of Interior, Water and Power Resources Service, *Project Data* (Denver: U.S. Government Printing Office, 1981), 831.

elevation 2,434 feet. The maximum height was about sixty-one feet above the lowest foundation. Modifications were made to the structure in 1982. The embankment was raised 2.6 feet to an elevation of 2436.6 with a crest width of twenty-four feet.⁸ The upstream slope of the embankment, above elevation 2,404 is covered with a layer of rock riprap; the downstream slopes have been seeded on twelve inches of topsoil. In addition, a forty-foot wide cutoff trench was excavated to a firm foundation for approximately 2,000 feet of the length of the dam. The spillway is an ungated structure 200 feet wide with a design capacity of 33,200 cfs. A combined spillway and outlet works structure consists of an approach channel, an uncontrolled open channel spillway 200 feet wide, a stilling basin, and an outlet works adjacent to the left wall of the spillway consisting of a trashrack, a gate structure, a twenty-four-inch pipe and a valve box.⁹ Additionally, in 1982 bascule gates were added to the service spillway and an auxiliary spillway was constructed.

Adler Construction Company, of Madras, Oregon, began construction on Dickinson Dam March 30, 1949.¹⁰ Final construction of the Dam was completed exactly a year later in March 1950, well ahead of schedule.¹¹ Construction also included restoring parts of the railroad embankment of the Northern Pacific Railway Company, which was accomplished through placement of earthwork and riprap protection. Additionally, relocation and conditioning of about 6,900 feet of gas-transmission pipeline and telephone lines, proved necessary.¹²

8. United States Department of the Interior, Bureau of Reclamation, GEI Consultants, Inc, "Safety Evaluation of Existing Dams Analysis Summary (SEED Report): Dickinson Dam, April 10, 1992," Denver: 1982, 1.

9. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. IV, 1951, 1.

10. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. II, 1949, 1.

11. United States Department of the Interior, Bureau of Reclamation, *Repayment of Reclamation Projects*, (Washington: U.S. Government Printing Office, 1972), 283.

12. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. IV, 1951, 1.

Reclamation dedicated the Dam on August 13, 1950 in a ceremony attended by North Dakota governor Fred G. Aandahl.¹³ In 1951, the spring run-off filled Dickinson Reservoir for the first time.¹⁴ Late in 1951, the city connected water mains to the outlet works of the Dam and subsequently, in the spring of 1952, completed the municipal water plant. The first water through the new plant arrived from Dickinson Reservoir in May 1952. After May 19, 1952, regular daily diversions from the Reservoir provided the City's water supply.¹⁵

Post-Construction History

In 1952, a problem with algae, in the water being diverted for municipal and industrial use, was discovered. Varying amounts of living and dead products were being drawn into the supply line and conveyed to the City Water Treatment Plant. As one engineer described it: "this material [algae] was coagulated in the chemical mixing chamber with lime and alum resulting in heavy mixtures of organic thread like materials with an appearance of boiled rhubarb." The algae in the water, in addition to having an appearance of boiled rhubarb, resulted in taste and odor problems.¹⁶ In 1953 there were fewer problems with algae, but measures still were taken to correct the problem including the installation of a temporary chlorinating applicator assembled at the dam, and the addition of sodium hypochlorite to the diverted water. Moreover, in times of heavy algae growth copper sulphate was applied to the reservoir with good results. In 1953 a permanent chlorination plant was constructed and put into operation by the City Water Department; the plant is located a short distance below the dam over the water supply conduit. To further address the problem the city installed a pipe in 1954 to draw water from inside the

13. "Dickinson Dam Dedication." *Reclamation Era*. October 1950, 191.

14. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. IV, 1951, 5.

15. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. V, 1952, 7.

16. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. V, 1952, Appendix F, 2.

Reservoir instead of from its edge. Both measures proved successful and the algae problem dissipated.¹⁷

Problems continued on the Unit in 1954. The spillway was damaged on April 7 and 8, 1954, during high run-off. The Schultz and Lindsay Construction Company began emergency spillway repair on June 16, 1954 and work was completed November 19, 1954. It was necessary to remove and replace twelve of the large concrete panels which form the spillway (four of which had been moved entirely out of position); further work included, the construction of cut-off walls and anchors, installation of drains, and placement of a thicker layer of pervious material underneath the slabs.¹⁸

Reclamation completed a revised inflow design flood (IDF) study on Dickinson Dam in April 1975. Accumulated precipitation and streamflow data along with current procedures and structural information were taken into account in evaluating the capability of the Dam to safely withstand extreme conditions. It was determined that the IDF would have a peak flow of about 106,700 cfs which is more than three times the 33,200 cfs design capacity of the existing spillway. A flood of this magnitude, under existing conditions, would result in a reservoir water surface elevation three and a half feet above the crest of the dam, resulting in erosion and possible structural failure of the embankment. Modifications were necessary to ensure that the Dam could withstand the IDF. Because Reclamation, constructed, owned, operated, and maintained the facility, the Federal Government was responsible for initiating action and providing a safe structure. Reclamation estimated three years to complete the necessary modifications. Proposed construction did not noticeably impact recreation facilities. In fact, the

17. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. VI, 1953, 5, Appendix 1, 2.

18. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. VII, 1954, 1.

city of Dickinson expressed interest in using the emerging spillway to expand its golf course.¹⁹

Modifications to Dickinson Dam were authorized by Public Law 94-228 dated March 11, 1976; modifications included installation of bascule gates²⁰ on the existing spillway, to increase storage, and addition of a new auxiliary spillway to ensure the safety of the dam.²¹ The contract for Dickinson Dam auxiliary spillway was awarded to Wagner Brothers on July 13, 1979.²²

Award of a second contract, for construction and installation of the bascule gates, and modification of the service spillway occurred on April 16, 1980. Indecision on the part of the city of Dickinson as to whether they wished to continue with the bascule gate concept slowed the subcontract for design work on the gate.²³ The city decided to proceed with the bascule gate plan early in 1981. Modifications to the service spillway began on May 7, 1981. On July 21, 1981, Reclamation accepted work on the auxiliary spillway, to meet the safety of dams criteria, and accepted the boat ramp and parking area on September 24, 1981.²⁴

On February 21, 1982, a large ice floe passed over the bascule gates causing operations malfunctions. Late in the afternoon a massive chunk of ice caused hydraulic system failure. The gates were forced open reducing spillway capacity and allowing water to flow unchecked, peak flow reached 4,846 cfs. The failure brought to light other problems; and Reclamation identified the need for additional engineering design and construction on the gate to improve general

19. United States Department of Interior, Bureau of Reclamation, Upper Missouri Region, "Report on Safety of Dickinson Dam, North Dakota," Dickinson Unit, Heart Division, Pick-Sloan Missouri Basin Program, April 1975, 2, 15, 18.

20. Hinged gates which extend the spillway increasing reservoir storage. Gates can be opened and closed as necessary.

21. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. XXIX, 1976, 1.

22. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. XXXII, 1979, 62.

23. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. XXXIII, 1980, 1.

24. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. XXXIV, 1981, 1.

operation and insure safety during the winter and spring seasons.

Likewise in 1982, the contract for Dickinson Dam modifications, which included raising the dam 2.6 feet, was completed. Reclamation accepted the contract for raising the dam and other embankments as substantially complete on August 6, 1982 (remaining work consisted of fertilizing, seeding and mulching) and as complete on October 1, 1982. The city leased surface management of land and water surfaces (the reservoir area) on July 20, 1982. Finally, construction was completed on the ice boom, Modification No.4.²⁵ After 1982, no further work has been necessary on the Project.

Settlement of the Project

Construction of Dickinson Dam did not significantly influence the Dickinson farming community. In the first year of operation, 1951, water from the Reservoir was used to irrigate three preexisting farms, a number expected to increase in future years. All irrigation from Dickinson Reservoir is accomplished by pump operated sprinklers; canals and pumps have been privately constructed by the farmers for their individual irrigation efforts.²⁶ However, the abundance of municipal and industrial water did significantly impact the town by encouraging growth, and eventually the population far exceeded any of the original growth projections.

Uses of Project Water

The primary usage of Project water is for municipal and industrial purposes. The water stored in the Dickinson Reservoir provides the primary source of water for the city of Dickinson. The original water service contract between the Bureau of Reclamation and the city of Dickinson, signed September 24, 1949, provided for the delivery of 1,100 acre-feet of water

25. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. XXXV, 1982, 1, 38, 51, 54, 62.

26. "Dickinson: Missouri River Basin Project, Annual Project History, Heart Division, North Dakota," Vol. IV, 1951, 1, 5.

annually for domestic, commercial, industrial, and municipal purposes. The contract has since been amended, May 8, 1969, to make an additional 900 acre-feet of water available to the City.

A second contract with the water users, organized under the Dickinson-Heart River Mutual Aid Corporation, allows for irrigation of approximately 400 acres downstream. The water users have constructed individual pumping plants and distribution systems. Water is furnished, for irrigation, at the rate of \$400 per year for 400 acre-feet, with additional water not to exceed 500 acre-feet at 50 cents per acre-foot. The Corporation's right to receive water is subordinate to that of the City of Dickinson. During the calendar year 1969, 410 acres were irrigated with an average per acre value of \$50.87.²⁷

The project continues to be operated and maintained by the city of Dickinson through an agreement with the Bureau of Reclamation. City Water Department personnel, under the terms of Contract No. I79r-2246 and amendment No. 1, operate the gates, read and record the water releases for municipal and irrigation uses, record the daily water stage elevations and do minor maintenance and inspection work, for which the water district is paid \$60 per month. Occasionally, the Reclamation damtender at Heart Butte Dam visits Dickinson Dam and Reservoir performing weed control work, installing and removing the floating safety rope across the front of the spillway, and performing other maintenance and inspection work as required.²⁸

About the Author

Toni Rae Linenberger, a Colorado native, received her B.A. in History from The Colorado College in Colorado Springs, Colorado in 1996. In 1998, she earned a M.S. in Western American History from Utah State University in Logan, Utah. Ms. Linenberger's final paper, a case study entitled *A Dam for All Seasons: Hollywood, the Bureau of Reclamation, and Construction of Parker Dam*, explored the relationship between the growth of a small town in California and

27. *Repayment of Reclamation Projects*, 283.

28. Denver Colorado, National Archives and Records Administration: Rocky Mountain Region, Records of the Bureau of Reclamation, Record Group 115, "Report on Safety of Dickinson Dam, North Dakota," April 1975, 3.

the development of the Colorado River.

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