HAER No. MT-90-D

Thompson Falls Hydroelectric Project,
Main Channel Dam
Clark Fork River
Thompson Falls
Sanders County
Montana

PHOTOGRAPHS

HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
Rocky Mountain System Support Office
National Park Service
P.O. Box 25287
Denver, Colorado 80225-0287

HISTORIC AMERICAN ENGINEERING RECORD
THOMPSON FALLS HYDROELECTRIC PROJECT,
MAIN CHANNEL DAM

1. INTRODUCTION

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Location:	The main channel dam is at the Thompson Falls Hydroelectric Project in the small city of Thompson Falls, Sanders County, Montana. The dam spans the Clark Fork River just upstream of the river's Thompson Falls, a series of low falls and rapids. The project's powerhouse is about ¾ mile downriver (west).
Quad:	Thompson Falls, MT
UTM:	Zone 11; 624042 Easting; 5272086 Northing (NAD 83) 623975 Easting; 5272222 Northing 623849 Easting; 5272231 Northing
Date of Construction:	1913-15
Present Owner:	Pennsylvania Power and Light-Montana (PPL -Montana) 45 Basin Creek Rd., Butte, Montana
Present Use:	Hydroelectric dam
Significance:	The main channel dam contributes to the historic district at the Thompson Falls Hydroelectric Project. It is a fairly well-preserved example of a concrete arch dam, one the most common types of dam utilized for new hydroelectric development in the early-twentieth-century American West. Two of the dam's more notable engineering features are a concrete gravity section, in addition to the arch, and log sluice.
Historian:	Renewable Technologies, Inc. 8 W. Park, Suite 313 Butte, Montana 59701 November 2008

The Thompson Falls Hydroelectric Project is on the Clark Fork River at the small western Montana city of Thompson Falls (Figure 1). The Clark Fork River is a major tributary in the Columbia River drainage system west of the Continental Divide. It basically flows in an east-to-west direction at Thompson Falls. The city lies along the north bank of the river.

The Thompson Falls Hydroelectric Project has two dams (see Figure 1). The larger of those two structures, the main channel dam, spans the river just upstream of the Thompson Falls, a series of small falls and rapids which drops the river about 30 feet in elevation over a distance of about ½ mile. The reservoir impounded by the main channel dam occupies a former channel or bend in the river which was dry at the time of project construction. That former dry channel had its inlet on the north side of today's river channel just upstream of the dam, while the outlet was about ½ mile downriver near the lower end of the falls. The facility's second and much smaller dam impounds the reservoir in the dry channel. It is known as the dry channel dam.

This narrative is the first HAER document prepared for the main channel dam. It records the dam's west abutment and its associated structures only. The west abutment is tied to a rock outcrop on the eastern slope of the main island at the hydroelectric facility. The main island is bounded by the reservoir on the north and the Clark Fork River on the southeast and south sides of the island. The dry channel is along the island's southwest side.

II. HISTORICAL INFORMATION

A. Brief Background to the Thompson Falls Hydroelectric Project

Planning for the design and construction of the Thompson Falls Hydroelectric Project began in earnest after the Thompson Falls Power Company entered into an electric power contract with the Chicago, Milwaukee, and St. Paul Railroad (Milwaukee Road) in February 1913. The Milwaukee Road intended to use hydroelectricity generated at Thompson Falls as one source of power for a proposed project to electrify the Rocky Mountain Division of its new "Pacific Coast" transcontinental mainline. The Rocky Mountain Division was a difficult, 440-mile-long section of rail line that passed through the mountainous country between Harlowton, Montana and Avery, Idaho. Officials of the railroad believed that the steep grades and mountain passes on the division could be more efficiently handled by electric power than steam. It was hoped that the improved service would generate increased traffic for the line.[1]

The engineering team of Henry Herrick and Max Hebgen held charge of the design of the Thompson Falls Hydroelectric Project. At the time, Herrick headed the Western Office of the

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[1] Michael P. Malone and Richard B. Roeder, *Montana: A History of Two Centuries* (Seattle: University of Washington Press, 1976): 129-140; Renewable Technologies, Inc, "Hydroelectric Generating Facilities on the Missouri and Madison Rivers in Western Montana" National Register of Historic Places Multiple Property Documentation Form, Section E, pp. 4-5, prepared for The Montana Power Company, Butte, 1991.

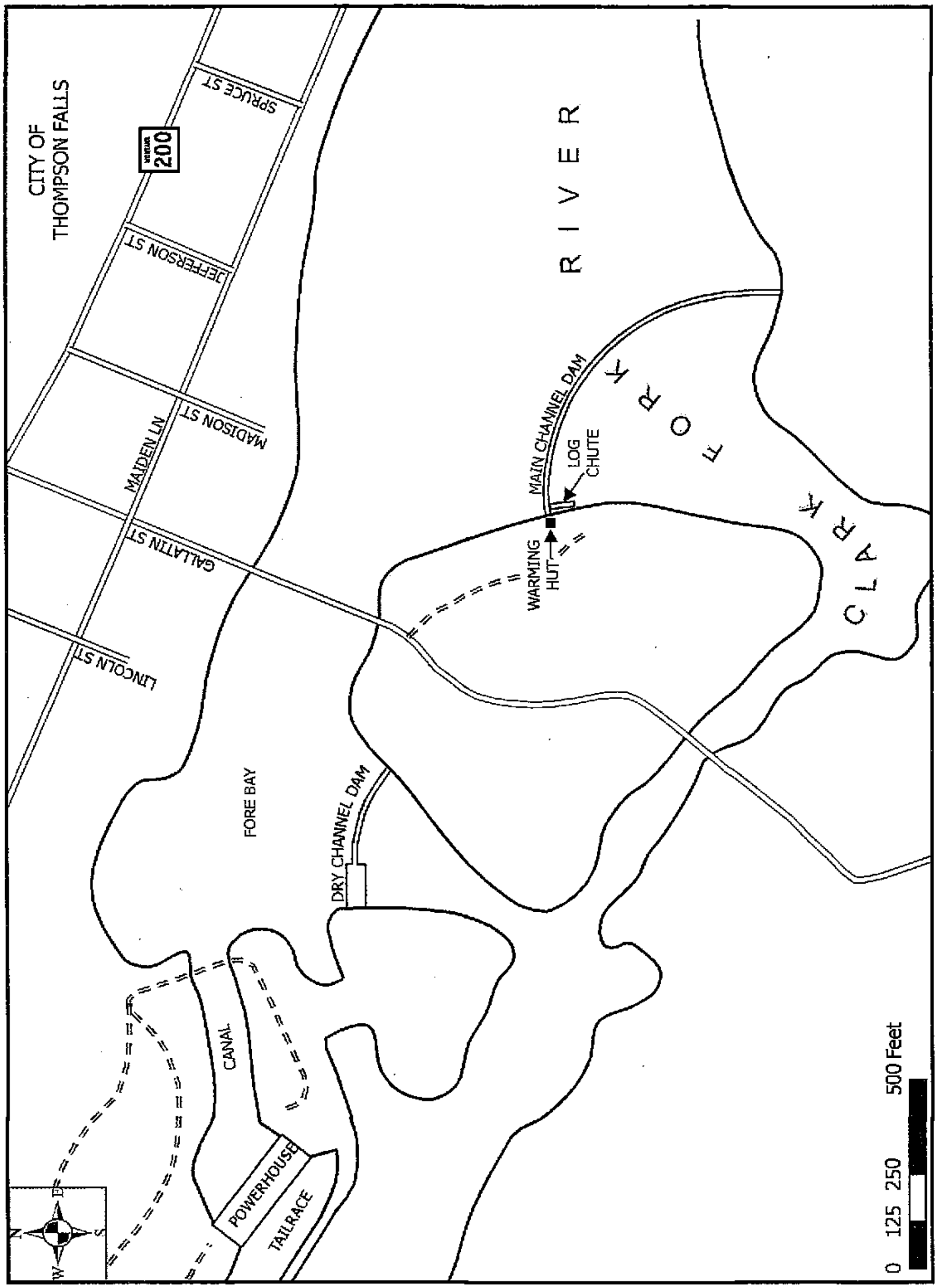

Figure 1. Map of Thompson Falls Hydroelectric Project, 2008.

Charles T. Main Company, a Boston-based engineering firm retained by Thompson Falls Power for project design and construction. Max Hebgen, in turn, was the lead engineer and manager for the Great Falls Power Company. The same parties controlled Thompson Falls Power and Great Falls Powers by early 1913, and the two firms were soon to become more closely aligned under the corporate umbrella of the new Montana Power Company.

Herrick and Hebgen came to Thompson Falls as construction work commenced on another major hydroelectric design project on which they had collaborated, the Great Falls Power Company's Ryan Development at the Great Falls of the Missouri River. In common with Thompson Falls, the Ryan Hydroelectric Facility was intended in large part as a source of power for the Milwaukee Road's electrified Rocky Mountain line.[2] The Great Falls by far was the most spectacular water power sites in Montana, having an undeveloped head of 78 feet. While Thompson Falls had a much lower head, dropping a mere 30 feet only, it was an important power site as well due to the tremendous volume of flow carried by the Clark Fork, in more so than the mighty Missouri.[3]

Determining the most feasible locations for the dam and powerhouse was the first and probably the most difficult issue tackled by Herrick and Hebgen at Thompson Falls. Hydroelectric engineers typically sought to locate a dam near the brink of a falls or rapids on a river, while establishing the powerhouse as close downstream as possible. Such a scenario allowed for a comparatively short and simple intake system. While readily adapted to the Ryan Development, it was not amenable to Thompson Falls due to the Clark Fork River's high volume of flow. Spring run offs in many years swelled the river's flow to as much as 180,000 cubic feet per second. The passage of such large amount of excess waters past the dam required a powerhouse somewhat removed from the river channel to protect the turbine-generator units from swamping.[4]

After much consideration and debate, by late-summer 1913 Herrick and Hebgen had devised a development scheme for Thompson Falls. The scheme took advantage of a former channel or bend in the river which basically looped to the north and west of the falls. A dam built just upstream of the falls would divert and impound the river into the former and long-since-dry channel, creating a large supply reservoir. A second but smaller dam necessarily was required to impound the reservoir at the lower or downstream end of the dry channel as well. Although requiring construction of two dams, the use of the dry channel as the reservoir site afforded a rather simplified intake system. An earthen canal only would be needed to convey water from the reservoir down the powerhouse (see Figure 1).[5]

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[2] Cecil H. Kirk, "History of Montana Power," typed manuscript, ca. 1969, vol. II: chapter 9, pp. 12-13, on file, Montana Historical Society Research Center, Helena.

[3] Ibid, vol. II: chapter 9, pp. 8-9, 12-13.

[4] Kirk, "History of Montana Power," vol. II: chapter 9, pp. 8-9, 12-13.

[5] Ibid., vol. II: chapter 9, p. 13; Chas. T. Main, Western Office, "Thompson Falls Power Company, Thompson Falls, Montana: General Plan of Development," 9 July 1915, on file in Hydro Engineering, Thompson Falls folder, PPL - Montana, Butte.

B. Design and Construction of the Main Channel Dam

Herrick and Hebgen chose to build a concrete arch dam with a gravity section for the main channel structure at Thompson Falls. As its name implies, a gravity dam functions under the principle of gravity, wherein the sheer mass or bulk of the solid dam acts to resist the hydrostatic pressure of the water behind it. Instead of gravity, an arch type dam depends on its arch form to transfer thrusts to the abutments. The first arch dams built in the late nineteenth century were made of stone masonry, but by the early twentieth century concrete came into almost universal use. Within a decade, concrete arch structures reportedly had become one of the most common dam types used at new hydroelectric developments in the mountain West.[6]

Hebgen and Herrick finished the design and construction specifications for the main channel dam during the spring of 1913.[7] The dam at its crest was to measure 913'33" long and average 32' tall (Figure 2).[8] The gravity section was next to the dam's east abutment on the south river bank. It consisted of a mere 63' long non-overflow wall. The dam's 800' plus arched section featured an ogee-shaped spillway. A flashboard system stood on the crest of the spillway. It had 16' tall timber flashboards supported in a framework of steel bents. The flashboard's steel framework also carried a plank walkway and traveling hoist run on a set of rails. The hoist was for raising and lowering the flashboards. A small wasteway incorporated into the east end of dam was to see use for passing river trash only. As noted above, wasting of flood waters from the reservoir was to be handled at the dry channel dam.[9]

Herrick and Hebgen provided the main channel dam with a structural feature not found at Montana's major hydroelectric plants on the Missouri River at the time, a sluice for handling logs (see Figure 2). Log sluices were a necessary component on rivers or sections of rivers such as the Clark Fork at Thompson Falls, on which the timber industry relied as a transportation corridor its harvest of logs from forests to timber mills. Log runs on a river typically occurred during the spring

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[6] Eric B. Kollgaard and Wallace L. Chadwick, *Development of Dam Engineering in the United State* (New York: Pergamon Press: New York, 1988): 225-234; Donald C. Jackson, *Great American Bridges and Dams* (Washington, DC: The Preservation Press, 1988): 48; Duncan Hay, *Hydroelectric Development in the United States, 1880-1940* (Washington, DC: Edison Electric Institute, 1991): 46-47.

[7] Chas. T. Main, Western Office "Thompson Falls Power Company, Thompson, Mont.: Tentative Design of Dam," 2 April 1913, drawing no. 40415- D3-198-0-0, Folder 3-15 591/296, on file, PPL - Montana, Billings; Kirk, "History of Montana Power," vol. II: chapter 9, p. 14.

[8] The Figure 2 drawing of the main channel dam is based on an historic drawing, Chas. T. Main, "General Plan of Development," 9 July 1915.

[9] Chas. T. Main, "General Plan of Development," 9 July 1915; "Missouri River Electric & Power Co. and the Thompson Falls Power Company," typed manuscript, ca. 1939, on file, MPC Predecessor Collection - Unprocessed, Box 5, Folder 1, Montana Historical Society Research Center, Helena.

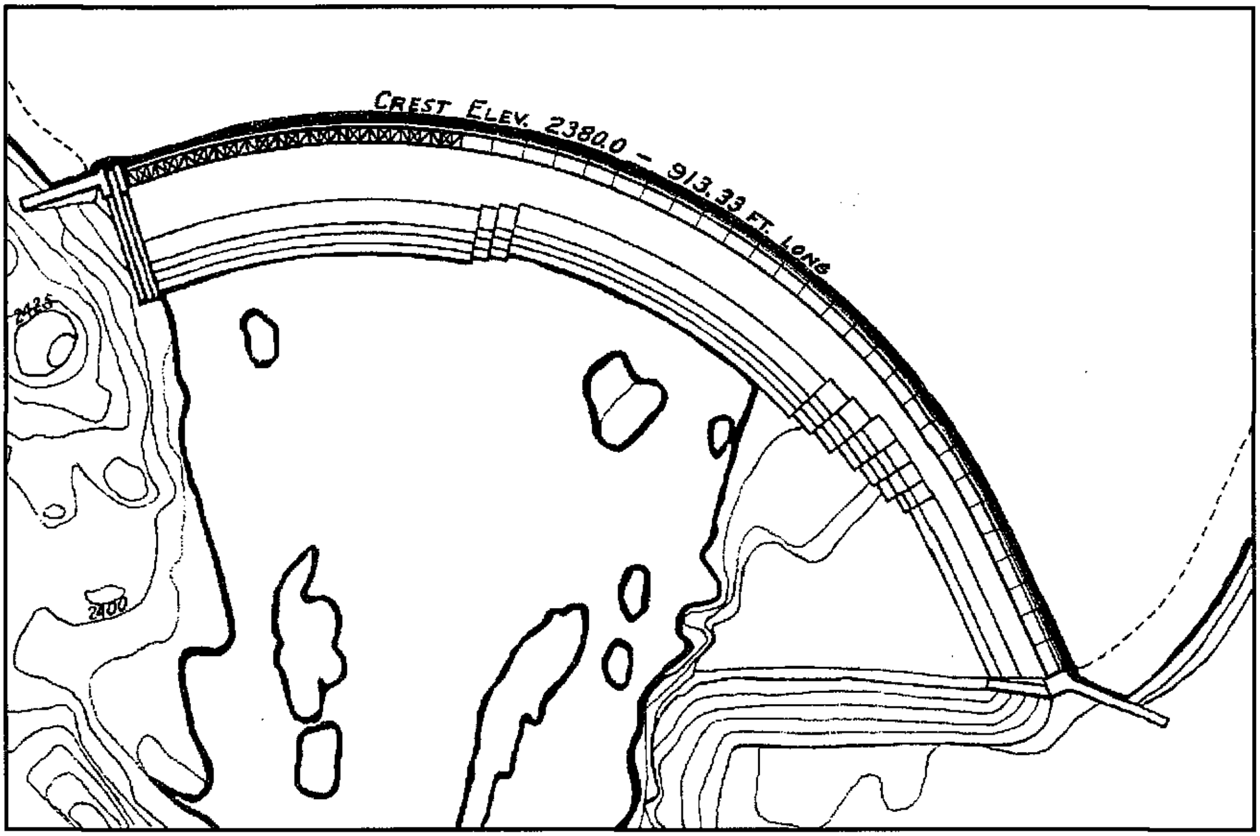

Figure 2. Tracing of main channel dam from Chas T. Main, "General Plan of Development", 9 July 1915 drawing.

run-off so as to take advantage of the high and fast-flowing water.[10] The main channel dam's log sluice was to be at the west abutment.

Construction work at Thompson Falls began in earnest on October 1, 1913, with the main channel dam the first project at hand. It was to proceed in two distinct phases. The first phase entailed work on the west half of the dam. A coffer dam was erected mid-river to divert the flow away from and past that area of the river that fall, and early in the following year labors completed the concrete work on the dam's west half. By then, a new coffer dam was in place and the east half the dam site dewatered. Unlike the west half, a significant amount of gravel, estimated at 50,000 tons had to be removed from the east before construction could proceed. This proved to be much more arduous and time consuming task than expected. Excess flood waters set work back further that spring. Thereafter, crews were run round the clock all seven days of a week with the goal of

[10] Charles H. Mitchell, "Canadian Hydraulic Power Development," Paper 145, *Transactions of the International Engineering Congress, 1915: Electrical Engineering and Hydroelectric Power Development* (San Francisco: Neal Publishing Company, 1916): 361-62.

completing the project before the 1915 spring flood. That schedule was met, but only with a few days to spare.[11]

The main channel dam has sustained few alterations over the years. Most significantly, a large section of the flashboard system at the west end of the spillway was removed and replaced by two large taintor gates. The log sluice also has been shortened considerably.

III. PHYSICAL DESCRIPTION OF MAIN CHANNEL DAM'S WEST ABUTMENT

The main channel dam's west abutment is a 69' long by 8' wide wall made of poured concrete. It has a straight upstream face, while the downstream face is slightly battered. The top or crest of the abutment is contiguous with the walkway that extends across the crest of the flashboard structure. The walkway has channel-section railings on both sides. The log sluice and hoist house are at the abutment's east end.

The log sluice appears as a concrete walled chute that runs down the downstream face of the dam from top to bottom and another 50' or so downriver.[12] One drawing from project construction indicated that the dam's designers intended the sluice to extend as much as 200' further downriver then that.[13] While the sluice never reached near that length, it seems that about 40' was removed from the lower end of the structure in recent years. The sluice's water channel measures 6' wide and about 5' deep. The upper end of sluice is very steep at a 3:2 slope. Near the toe of the dam, the sluice curves and continues for about 10' at a near flat grade of only 1%. The lower 40' of the sluice is at a 5% grade. It bends ever so slightly toward the island.[14]

A sliding gate controls the flow of logs into the sluice. It hangs on the upstream side of the sluice's entry "chute," a 6' wide by 18' long by 16' deep flat bottomed channel.[15] The entry chute's inlet on the upstream side of the dam is framed by concrete nose piers (one each). A manually-operated screw stem raises and lowers the gate.[16]

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[11] Kirk, "History of Montana Power," vol. II: chapter 9, p. 14, "Missouri River Electric & Power Co. and the Thompson Falls Power Company."

[12] PPL -Montana, "Thompson Falls Hydro-Electric Development: Main Dam and Plan and Elevation," 2002 revision, drawing no. 41523-4339-D7-1-1, Folder 4-03 350/599, on file, PPL - Montana, Billings.

[13] Chas. T. Main, Western Office, "Thompson Falls Power Co., Thompson, Mont.: Final Details of Log Sluice," 15 April 1914, drawing no. 40415-D3-176-0-0, Folder 3-17 591/228, on file, PPL - Montana, Billings.

[14] Ibid.; Chas. T. Main, Western Office, "Thompson Falls Power Co., Thompson, Mont.: Details of Log Sluice," 8 January 1914, drawing no. 40415-D3-175-0-0, Folder 3-17 591/227, on file, PPL - Montana, Billings; PPL - Montana, "Main Dam and Plan and Elevation," 2002 revision.

[15] Chas. T. Main, Western Office, "Thompson Falls Power Co., Thompson, Mont.: Log Sluice in Main Dam," 4 March 1914, drawing no. 40415-D3-37-0-0, Folder 3-15 590/396, on file, PPL - Montana, Billings.

[16] Chas. T. Main, District Office, "Thompson Falls Power Company., Thompson Falls, Mont.: Log Sluice and Bear Trap Gate in Main Dam," 20 November 1915, drawing no. 40415-D3-198-0-0, Folder 3-18 591/251, PPL - Montana, Billings.

The hoist house stands over the log sluice's entry chute. It probably was erected not too long after the dam's initial completion in the spring of 1915. The hoist house (9' by 12') is of metal-frame construction and has a front gable roof. Exterior walls sport vertical wood siding with a 7" exposure. The roof has board decking, corrugated metal roofing, and slightly overhanging eaves. There is a pair of heavy, metal-framed wooden doors (3'4" wide each) on the east elevation. A set of 5" gauge rails run in and out of the doors, and from the hoist house they continue east down the walkway over the crest of the dam. The rails accommodate a flat-bed metal cart which carries the hoist used by plant operators to raise and lower the flashboards, and presumably for other maintenance activities. The hoist is a modern replacement, but the flat-bed cart appears to be the original. The hoist and cart are sheltered in the hoist house.

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