

## HISTORICAL DOCUMENTATION

### WISWALL DAM NEW HAMPSHIRE STATE NO. 700

**Location:** Lamprey River, south of Wiswall Road, Durham, Strafford County, New Hampshire  
USGS Newmarket, New Hampshire 15' Quadrangle  
Universal Transverse Mercator Coordinate: 19.340244.4774026

**Date of Construction:** 1912

**Present Owner(s):** Town of Durham

**Present Use:** Dam for public water supply

**Significance:** The Wiswall Dam is associated with early twentieth-century attempts to harness the Lamprey River for hydroelectric power generation. The concrete gravity dam was constructed by the New Market Electric Company in 1912 on a water privilege at Wiswall Falls that had hosted water-powered industrial operations since 1835. Parts of the historic industrial infrastructure, including a power canal, were reused in the development of the hydroelectric plant. The Wiswall Dam is a contributing structure within a potential Wiswall Falls Historic District that encompasses the adjacent Wiswall Falls Mill Site and related industrial and residential properties and structures.

**Project Information:** The Town of Durham, in cooperation with the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), is proposing to construct a fish passage and make other alterations to the Wiswall Dam in order to improve safety and protect the local water supply. The project calls for the construction of a Denil dish ladder at the east end of the dam, an emergency spillway on the west side of the dam, repair and reconstruction of the dam's downstream training walls, and re-grading existing ground surfaces. The USDA-NRCS, as the lead federal agency responsible for complying with Section 106 of the National Historic Preservation (36 CFR Part 800), determined, in consultation with the New Hampshire State Historic Preservation Officer (NHSPO) and other consulting parties, that the project would have an adverse effect on historic properties. The consultation resulted in a Memorandum of Agreement (MOA) that stipulated the preparation of this documentation to provide a permanent record of the property.

**Author:** John J. Daly  
The Public Archaeology Laboratory, Inc.  
210 Lonsdale Avenue  
Pawtucket, Rhode Island 02860

### **Descriptive Information**

The Wiswall Dam (NHDES No. 71.04) is located on the Lamprey River in Durham, Strafford County, New Hampshire approximately 2.75 miles southwest of Durham center and .57 miles east of the Durham-Lee town line. The dam is within the hamlet of Wiswall Falls (a/k/a Wiggins Falls) within the larger Packer's Falls district in southern Durham. Wiswall Road crosses the Lamprey River on the Wiswall Bridge approximately 175 feet (ft) upstream of the dam.<sup>1</sup> The Wiswall Falls hamlet is a low density residential area consisting of houses arranged in a linear pattern east and west of the river along Wiswall Road. Excepting Wiswall Road, the immediate area surrounding the dam and upstream impoundment are predominantly undeveloped woodlands.

Wiswall Dam traverses the Lamprey River on an east-west axis. Its impoundment extends approximately 1.3 miles upstream within the Lamprey's natural channel. The dam is reached via short dirt roads that lead south from Wiswall Road along the west (river right) and east (river left) banks of the river. The area immediately east of the dam is a public park that features the Wiswall Falls Mill Site, an industrial-archaeological complex that includes the ruins of nine buildings and structures, including a power canal, sawmill, paper mill/hydroelectric powerhouse, boiler room, and ancillary sheds and store rooms (see Stott 1987 for a full description of the site). The Wiggins Sawmill foundation is incorporated into the dam's east abutment and training wall. The power canal begins north of the dam, runs parallel to the river and passes 50 ft east of the dam's east abutment, then exits back into the river approximately 180 ft downstream of the dam via tailrace within the sawmill/power house ruins. A public parking area for the park and an interpretive kiosk are located at the south end of the east access road.

The Wiswall Dam is a concrete gravity type, run-of-the-river structure consisting of (from west to east) the right core wall (dike), right abutment, spillway, sluice gates (waste gates), left abutment, and left core wall. The structure measures approximately 250 ft in length from the outer ends of the core walls, is 17.8 ft high, and creates about 11 ft of head (fall). A concrete flood gate that is contemporaneous with the dam is located due east of the dam in the power canal.

The concrete spillway is 110 ft long, 13 ft high, and traverses almost the entire width of the river channel. In section, the spillway has a near-vertical upstream face, ogee-profile downstream face, and is 3.5 ft wide at the crest. Three 1-x-1-ft, 6-ft tall, concrete buttresses project from the downstream face of the spillway. Pipe sockets for flashboards are cast into top of spillway, but no flashboards are currently installed. The western two-thirds of the spillway is built atop a granite ledge. The toe of the dam along the eastern third of the structure rests on what appears to be a course of split granite blocks.

The waste gates are located at the east end of the spillway and consist of a pair of vertical-lift gates set within a 28 ft long, 13 ft high, and 4 ft thick concrete wall. The downstream face of the wall has a concave curve and the concrete has been coated with shotcrete (pneumatically applied mortar) that dates to a 1967 rehabilitation of the dam. The aluminum and steel stem gates slide within integrally-cast concrete gate frames lined with 1 inch wide aluminum channels. The gate leaves are 6.5 ft wide between the channels and 5 ft high. Two crank-operated floor stands for gate control are set atop the gate frames

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<sup>1</sup> Details and dimensions contained in this description are derived from field measurements plans and descriptions contained in the U.S. Army Corps of Engineers, New England Division National Dam Inspection - Phase I Inspection Report for the Packers Falls Dam [USACOE-NED 198] and existing conditions plans (Stephens Associates 2010).

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and cast with the manufacturer's name, "Rodney Hunt". The two gate apertures on the downstream side of the waste gate are each 5.5 ft high and 6.5 ft wide.

The two dam abutments flank the west end of the spillway and the east end of the waste gate. These concrete substructures are both covered with shotcrete. The east abutment is 4.5 ft wide, 25 ft long, and rises approximately 13 ft above the downstream river channel. Just downstream of the gate, the abutment transitions to a 30-ft long, 7-ft high, dry-laid, split stone slab and boulder retaining/training wall that is the former foundation of the Wiggins Sawmill. The upstream end of this wall is covered with shotcrete. Stones in the wall range from 6 to 36 inches in length and have numerous visible 0.75-inch diameter drill marks and holes for lifting tongs. The west abutment is 4 ft wide and 21 ft long and rises about 13 ft above the river channel. Downstream of the abutment is a 30 ft long, 5 ft high retaining/training wall. This irregular, dry laid stone wall is constructed of random split granite blocks. Some 0.75" diameter drill marks are visible in the stones.

Unreinforced cast concrete core walls extend from the longitudinal midpoints of the east and west abutments. Each core wall is about 1 ft proud of their respective abutment and surrounding grade, 1 ft thick, and has a structural height of 8 ft. The east core wall is 40 ft long. The west core wall is 30 ft long.

The power canal flood gate is located 50 ft east of the dam's east abutment. This plank-formed, reinforced concrete structure has three 5-ft-wide gate apertures and two angled buttresses projecting downstream between the apertures. The concrete is reinforced with twisted metal rebar. The original timber gate leaves are missing, and the operating mechanisms and concrete headframe have been removed from the top of the gate, which is now covered with a timber deck. The power canal is completely filled upstream of the gate and earth covers the north elevation of the gate structure. Downstream of the gate, concrete lines both walls of the raceway. About 4 ft downstream of the gate, the walls transition to random, dry-laid, split stone and fieldstone walls, which make up the remainder of the raceway.

**Historical Information:**

**Industrial Development of the Wiswall Dam Site, 1835-1899**

The Lamprey River, which descends 1,000 feet over its 60-mile course from its source in the Saddleback Mountains to the head of tidewater at Newmarket, hosted numerous water-powered industrial operations. Newmarket's Great Falls were harnessed for power as early as 1650. In the late seventeenth century the town of Dover granted Captain Thomas Parker and four other men rights to "the whole stream of Lamprey River for the erecting of sawmills or mills" and Packer himself received 50 acres of land on the south side of what became known as Packer's Falls in present-day Durham. Wiswall Falls, located about 1,300 ft upstream, were also included in the grant (Thompson 1900:165-166).<sup>2</sup>

Revolutionary War General and New Hampshire Governor John Sullivan began developing Packer's Falls for water-powered milling operations in the late eighteenth century. Prompted in part by the construction of the first New Hampshire Turnpike (now U.S. Route 4) between Portsmouth and Concord in 1796, Durham's population rose modestly during the first decades of the nineteenth century, from

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<sup>2</sup> Until the early twentieth century, Packer's Falls and Wiswall Falls were often referred to collectively as Packer's Falls.

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1,247 in 1790 to 1,600 in 1830. In 1835 brothers Moses and Issachar Wiggin purchased the Wiswall Falls privilege and constructed a dam and sawmill on the east side of the river. They later added grist and flour mills at what became known as Wiggins Falls and also rented space to other manufacturers who produced a range of goods, including gingham cloth, shoe knives, hoes and pitchforks, wooden measures, nuts and bolts, bobbins, axe handles, carriages and sleighs, chairs, and matches, that reflected the growing diversity of the local economy. (Stott 1987; Thompson 1900:238).

In 1853, Thomas H. Wiswall (1817-1906) and Isaac Flagg, Jr., leased the dam, mills, and water rights from Moses Wiggin, who had taken sole possession after Issachar's death in 1844, for \$350 per year. A stipulation of the lease was that Wiggin would build them a two-story paper mill measuring 34-x-80 ft with two water wheels to be powered by a new power canal. Wiswall made paper in the existing facilities for a short time after entering the lease before the promised new facilities were provided in 1854. At this time, the power canal was constructed and Wiggin moved a machine shop from Newmarket to the southern end of the canal to serve as the paper mill. By various accounts, the machine shop measured 80 ft in length and somewhere between 30 ft and 34 ft in width. Soon after the completion of the building, Wiswall and a new partner, Howard Moses, leased the mill under the name T.H. Wiswall & Company (Stott 1987).

Thomas Wiswall was born in Exeter, New Hampshire. His family, which came to have wide associations with papermaking in New England, had established a paper mill at Newton Lower Falls in Newton, Massachusetts by 1790 and had briefly owned a paper mill at Packer's Falls. Wiswall had worked in his father's paper mill and other mills for more than 13 years before he decided to open his own mill in 1853. Moses was some 14 years younger than Wiswall. Both men enjoyed a good reputation, but had no property outside the mill. Moses managed the financial portion of the business, but died in 1858 and his share of the company was transferred to his father C.C.P. Moses. The elder Moses served as the firm's junior partner until his death in 1883 (Stott 1987).

After Moses Wiggin died with outstanding debts in 1856, the mills, water rights, and paper mill lease were auctioned May 1857. An advertisement that appeared in the Dover *Enquirer* in advance of the sale provided a description of the Wiggin property, and in combination with nineteenth century photographs, allows for a general understanding of the site's configuration. The sawmill, located adjacent to the dam, was a 60- x-24-ft building with a log haulway into the millpond. Downstream of the sawmill was a 50-x-24-ft gristmill. Each of these was powered by two water turbines. Also included in the property were the 1854 paper mill, a 40-x-12-ft shed for "planning [sic] and jointing", and an 18-x-28-ft shingle shed, all on 4 acres of land (Stott 1987).

Wiswall and Howard Moses were able to maintain occupancy of the mills, and bought the property outright in July of 1857. After some difficulties brought about by the financial panic of 1857, Wiswall's business expanded enough to justify an expansion of the mill. In 1868, Wiswall constructed a new dam, erected worker housing, and opened a store. The paper mill was lengthened by 10 ft and an ell measuring 13-x-30 ft was added. Two turbines powered the mill machinery, which consisted of five washers, 2 beaters, and a 48-inch cylinder machine. In 1870, census records reported that the mill employed seven men and one woman and manufactured 309 tons of wallpaper valued at \$30,000. While the owners focused their attention on the profitable paper mill, saw and grist milling activities declined. By 1870 the grist mill had largely ceased operation and the saw mill only operated three months of the year (Stott 1987).

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Wiswall's mill represented a large proportion of industry in Durham and of the wallpaper manufacturing of the state. As of 1860, Wiswall's mill was the largest manufacturing industry in Durham, and his capitalization, \$25,000, represented 60 percent of the town's total. Only one other sawmill and gristmill operated in town, and Wiswall's were the largest of each of these. At this time Durham's overall industrial health was in decline and its population had declined steadily since its peak in 1830. Wiswall's wallpaper manufacture, which operated under the trade name Pawtuckaway Mill, was one of only two mills in the state producing wallpaper. The second mill, located in West Claremont, was the smaller of the two and had a maximum production capacity of 2.5 tons per day. W.W. Page and John N. Coffin briefly ran a paper mill in Durham at Packer's Falls as of 1878, but this was a marginal and short-lived operation (Stott 1987).

The paper mill continued to operate successfully until November 1883 when the building caught fire and burned to the ground. The total loss amounted to \$25,000, but Wiswall only had \$14,000 of insurance coverage. Faced with bankruptcy, Wiswall disbanded T.H. Wiswall & Company and put the property up for sale the following month. At that time, the property consisted of the burned mill, six tenements, a private residence, and thirty acres of land. Some of Wiswall's former employees continued to operate a sawmill there until a flood in 1896 breached the dam. (Laprey et al. 2010; Stott 1987).

#### **Hydroelectric Development at Wiswall Falls, 1900-1955**

In November 1899 James W. Burnham purchased the water rights at Wiswall Falls, the mill site, and land on the west bank of the river. Burham (1856-1908) was born into a prominent New Hampshire seacoast family that had lived in the region since the first Burnham had arrived from England in 1614. He had operated a lumber business and a livery business in town, served as a selectman between 1897 and 1901, and was elected to the state legislature in 1898 and 1900. In 1891, Burham incorporated the Newmarket Electric Light, Power & Heat Company (NELP&H Co.) and obtained permission to generate and sell electricity in Newmarket and Durham. In May 1900, he transferred the Wiswall Falls privilege to his company and began adapting the remaining paper mill infrastructure for hydroelectric generation. The 1868 dam was repaired and a small powerhouse was constructed at the foot of the power canal. The company began selling electricity on February 20, 1900. Among its first customers were Burham himself; the Highland House, a former farmhouse in Packer's Falls that was converted to an inn in the 1890s by its owner Sarah J. Woodlawn and became a well-known resort among writers, actors and musicians; and the Griffith Brothers, who operated a cider press on Packer's Falls Road (Bolian and Maymon 1985:8; Durham Historical Association 1985:107; Laprey et al. 2010; New Hampshire State Legislature 1891:578-579; Stackpole et al. 1994:40,309, 365).

It appears, however, that the NELP&H Co. was only marginally viable. Within five years, the company went into receivership, but was able to continue operating for a time. In 1907 it was awarded a contract for street lighting from the Town of Durham. After Burnham's death in 1908, the company's treasurer Fred B. Philbrick continued to operate the company until 1917. In March 1911 the receiver was discharged and the plant was leased to the Newmarket Electric Company at an annual rental of \$1,000. The lease included the conditions that the Newmarket Electric Company was "to make all repairs, extensions and permanent improvements without expense to the lessor" (Public Service Commission of New Hampshire 1914:381).

The Newmarket Electric Company undertook a series of improvements to increase the capacity of the hydroelectric facility in 1912. It constructed the present Wiswall Dam south of Wiswall's 1868 dam and

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erected a concrete gate within the power canal.<sup>3</sup> The new dam was an example of a concrete gravity dam, the most common design and material employed in dam construction in the United States during the twentieth century. It incorporated portions of the east wall of the Wiggins Sawmill into its east abutment. Unfortunately, no data beyond the construction date has been recovered that identifies the name of the engineer or contractor for the work, nor has information describing the hydroelectric plant has been located<sup>4</sup> (Diver Services 1994; Stackpole et al. 1994:309; NH DES – Water Resources Branch 2008; NH DES Water Division ca. 1994; NH DES Water Resources Division 1988:Photograph Sheets).

A plan of the electrical grid drawn about the time that the new dam was constructed shows the company's limited service area. Power lines extended from the hydroelectric plant at Wiswall Falls along Bennett and Newmarket roads to Main Street, through a switching station near the old Town Hall, and then extended west along Main Street as far as the Boston & Maine Railroad Depot, a distance of over 4 miles. The plan shows twenty-five municipal, residential, and business customers, as well as what appears to be street lighting on Newmarket Road, Main Street, Madbury Road, Mill Road, and Garrison Avenue. The company also supplied electricity to the Town of Newmarket (Anonymous ca. 1912; Laprey et al. 2010).

As of 1914, Public Service Commission reports show that the NELH&P Co. was still incorporated with a capital stock of \$22,000, but was "non-operating" (Durham Historic Association 1985:107; Public Service Commission of New Hampshire 1914:379-381, 414). The same report also provided a brief overview of the Newmarket Electric Company's corporate structure and finances. The company had been organized in April, 1911 in Maine and served 350 customers in Newmarket, Durham, Newfields, Epping, and Brentwood. The firm's stock value was estimated at \$100,000. Operating revenues were \$12,810, but the firm was not profitable because of outstanding debt obligations and operating deficits from previous years (Public Service Commission of New Hampshire 1914:379-381).

In April 1917, the Newmarket Electric Company obtained permission from the State of New Hampshire to obtain full ownership of the NELP&H Co., in exchange for assuming \$16,000 bond debt obligations.<sup>5</sup> In that year, the Newmarket Electric Company was considering a substantial increase in the scale of the Wiswall complex. It proposed to abandon the existing power house and convert the facility into a divided-fall type generating plant. The Wiswall Dam was to be raised 18.5 ft to create a larger impoundment contained within a dike system. The dikes would be used in combination with canals to divert impounded water about 3,800 ft to the east into the Woodman Brook, and thence back to the Lamprey River at Packer's Falls, where a new power house would be built (Lawyers Cooperative Publishing Company 1917:1004; Newmarket Electric Company 1917).

The Newmarket Electric Company's expansion was never constructed. Instead, in 1919, the entire company was sold to the Rockingham County Light & Power Company (RCL&P) of Portsmouth, New Hampshire. Incorporated in 1900, the RCL&P initially provided electricity from a large coal-fired plant in Portsmouth. The company was controlled by Massachusetts entrepreneur Wallace D. Lovell and later

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<sup>3</sup> Various sources provide conflicting date of 1911 or 1912 for the dam's construction. The date "1912" was cast into part of the concrete gate frame (now demolished) within the power canal, so this is the date used here (Water Resources Division 1988:Photograph continuation sheets).

<sup>4</sup> A possible candidate for the dam's contractor is Daniel Chesley, the Durham builder and stonemason who also built the concrete Durham Falls Dam (a/k/a Durham Falls Dam, Dam No. 71.03) on the Oyster River in 1913 and reconstructed the Wiswall Road Bridge in 1914-1915 (Mackie 2011; Stephens Associates 2009).

<sup>5</sup> Other sources claim that this purchase took place in April, 1912 (e.g. Stackpole et al. 1994:309).

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provided electricity to Lovell's New Hampshire Electric Railways consortium. This group of street railways was established in 1912 and serviced the southern Merrimack River Valley and seacoast regions of southern New Hampshire and northeastern Massachusetts. By 1914, the RCL&P had a service area that included Exeter, Hampton, Newcastle, Newington, North Hampton, Portsmouth, and Rye, New Hampshire, plus Kittery and Eliot, Maine (Commonwealth of Massachusetts Public Service Commission 1917:130; Electrical World and Engineer 1902:71; Electrical World 1919:110; Public Service Commission of New Hampshire 1914:287; Willey 1903:440-442).

In July 1919, the RCLP filed a proposal with the New Hampshire Public Service Commission to enlarge and reconfigure the hydroelectric plant at Wiswall Falls along the same lines as proposed by the Newmarket Electric Company in 1917. Plans for improvements continued into 1920, when a trade publication wrote that "preparations are being made by the Rockingham County Light & Power Company for a hydroelectric development on the Lamprey River in the town of Durham" (Electrical World 1920:246). The 1919 filing provides the only information available regarding the hydroelectric plant at the Wiswall Dam: that it contained two turbines with a 6,000,000 kilowatt hour (kWh) annual capacity, or 342.5 kilowatts (kW, 255.5 hp) momentary capacity from each turbine (Rockingham Light and Power Company 1919).

For unknown reasons, RCL&P failed to act on its proposed development. By 1935 ownership of the Wiswall Dam and hydroelectric plant had been transferred to the Lamprey River Improvement Company (LRIC). The LRIC was comprised of a group of investors from Cambridge, Massachusetts and Newmarket and Dover, New Hampshire. It was incorporated in Nottingham, New Hampshire in 1915 with a capital stock of \$25,000 and its stated mission was the "development, improvement and distribution of the water power of the Lamprey River and its tributaries" (Bean 1915:95). No corporate or personal connection between this company and its predecessors at the falls has been identified. Dam inspection reports for the period only state that the facility was used for "power and conservation" and was in fair condition (New Hampshire Water Resources Board 1935).

Like its predecessors, the LRIC was unable or unwilling to make the substantial improvements at Wiswall Falls. By 1938 electric generation at the development had halted and the turbines were in "ruins" (New Hampshire Water Control Commission 1938). In December 1945, the New Hampshire Gas and Electric Company (later New Hampshire Electric Company) purchased the Wiswall Dam and privilege. Ten years later, the company sold the property, including the ruined hydroelectric plant and land on both sides of the river, to Carl and Ruth Spang of Wellesley, Massachusetts. This sale to private citizens ended the dam's 56-year history of electrical utility ownership (Laprey et al. 2010; Smith 1960; Stott 1987).

### **History of Wiswall Dam Since 1953**

Carl and Ruth Spang owned the Wiswall Dam for 10 years before selling the structure and flanking tracts of land, including the mill site, water rights, and flowage rights to the Town of Durham for \$15,000 in 1965. The town used this foothold on the Lamprey to incorporate the river into the Town of Durham's and University of New Hampshire's public water supply system, now called the University of New Hampshire/Durham Water System (UDWS). Increasing demand within the UDWS system in the late 1950s and early 1960s prompted a study in 1962 that recommended the purchase of the dam. The town subsequently petitioned the New Hampshire State Legislature for permission to use the Lamprey as a public water source and, in July 1965, the legislature passed an act granting the Town of Durham the right

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to divert waters from the Lamprey River by means of a dam at Wiswall Falls (Laprey et al. 2010; Morong n.d.; New Hampshire State Legislature 1965).

After the Town of Durham acquired the dam, it took steps to address structural deficiencies that had resulted from deferred maintenance over the course of the preceding 30 years. In 1965, it hired the engineering firm of Camp, Dresser & McKee of Boston and contractor A. Belanger & Sons, Inc. of Cambridge, Massachusetts to rehabilitate the dam. In 1967 the concrete surfaces of the abutments, spillway, and waste gates were covered with shotcrete applied over wire fabric reinforcement. The timber gate leaves in the waste gate were replaced with new metal gates and lift mechanisms manufactured by Rodney Hunt Company of Orange, Massachusetts. The upper portion of the power canal was filled (Board of Selectmen 1966; Lewis 1966; Mackey 1967; Town of Durham and Camp, Dresser & McKee 1967; Venett 1993).

In 1970, the Town of Durham built the necessary infrastructure to incorporate the Lamprey River into its water system. A pumping station and intake within the dam's impoundment were built approximately 2,700 ft upstream of the Wiswall Dam. An underground raw water main transferred the withdrawn water into the Oyster River, upstream of the University of New Hampshire's (UNH) Arthur Rollins Water Treatment Plant (ARWTP) in Durham. A second raw water main was built in 2002 and connected to the original pipe at an intermediate location. From 1970 to 2002, water from the Lamprey River supplemented the Oyster River supply during high demand, low supply (drought) conditions. Following experiments and studies completed between 2002 and 2008, the Lamprey River became the principal source for water in the UDWS during high rates of flows on the Lamprey River (in excess of 45 cubic feet per second). Annual water use from the Lamprey River has ranged between 1993 and 2008 from as little as 0 gallons to as high as 121 million gallons and averages 21.9 million gallons annually (UDWS 2011:1-2).

Beginning in 1982, the Wiswall Dam became as a catalyst for natural resource conservation efforts on the Lamprey River that resulted in important and long-term changes in the management of the river and watershed. In July of 1982, John N. Webster and the Southern New Hampshire Hydroelectric Development Corporation (SNEDHC) filed applications to restore the dam and install new hydroelectric generation equipment. Neither Webster nor the SNEHDC owned the site, but Webster was operating under an obscure point of Federal regulation as it applied to Federal Energy Regulatory Commission (FERC) permitting that allowed citizens to request a development license from FERC regardless of who owned the water rights and associated dam (Cooke 1982; NHDES – Water Resources Branch 2004; NPS, Division of Rivers and Special Studies 1995:12).

In response, the Town of Durham filed a competing hydroelectric development application with FERC in July 1983, but the license was granted to Webster in June 1989. A series of appeals and interventions were filed with the FERC by the Towns of Durham and Lee, the State of New Hampshire Attorney General's Office, and the Spangs (who still owned abutting property) in an attempt to defeat Webster's application. The matter garnered significant local press. Opponents of the dam cited environmental concerns for wildlife habitat and the plight of recreational sport fisherman as chief objections to the dam and identified the National Wild and Scenic Rivers Program (established 1968) as a potential means to short-circuit the FERC license (NHDES – Water Resources Branch 2004; NPS Division of Rivers and Special Studies 1995:12-13; Sheehan 1989a:9; Sheehan 1989b:9).



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The Lamprey River Watershed Association (LRWA) spearheaded the conservation effort in coordination with the towns of Lee and Durham and began the process of applying for Wild and Scenic designation for the Lamprey River in 1987. The Towns of Lee and Durham passed resolutions in favor of a Wild and Scenic River Study for the Lamprey in 1989. Congress approved the Lamprey River Study Act in 1991. The FERC issued a stay in Webster's license in February, 1992, pending the outcome of wild and scenic river study. The *Lamprey Wild and Scenic River Study* was completed by the National Park Service's Division of Rivers and Special Studies in 1995. It recommended various segments of the river, including the Wiswall Falls area, for Wild and Scenic designation. After its findings were made public, Webster surrendered his FERC license in July 1995 and the Lamprey was designated a Wild and Scenic River the following year (Lamprey River Advisory Committee 1995:1-2; Laprey et al. 2010; NHDES – Water Resources Branch 2004; NPS, Division of Rivers and Special Studies 1995:12, 13).

**The Wiswall Falls Hydroelectric Plant and Hydroelectric Power Generation in New Hampshire**

The hydroelectric development at Wiswall Falls was typical of the type of small plants that were erected during the late nineteenth and early twentieth centuries to provide electrical power for local consumption. The invention of the incandescent bulb in the 1880s and its subsequent widespread adoption for commercial, industrial, municipal, and residential lighting purposes spawned ever-increasing demand for electricity. During the period before the establishment of robust long-distance transmission grids and large-scale generating facilities, the demand was met by small localized energy producers. Hydroelectric power provided a large share of the early electricity market. The first American hydroelectric plant was established in Appleton, Wisconsin in 1882. In 1891, Westinghouse constructed the first hydroelectric generating station and long-distance transmission system at Willamette Falls, Oregon, supplying electricity to the city of Portland some 13 miles away. Soon thereafter, in 1895, Westinghouse constructed a large scale hydroelectric generation plant at Niagara Falls transmitting power a distance of 26 miles to Buffalo. This highly-publicized installation initiated a "hydromania" that prompted investment in plants throughout the country to supply local demand. By 1900, there were more than 300 hydroelectric plants in the United States. Between 1902 and 1917, the percentage of American homes wired for electricity increased from 8 percent to 24.3 percent. By 1920, these households had risen to 34.7 percent of the total. National production of electricity increased from almost 6 billion kilowatt-hours in 1902 to over 23 billion in 1920 (DeGraff 1990:5; Glover and Cornell 1951:674; Kirby et al. 1956:363-364; Landry and Cruikshank 1996:18-23; Marcus and Segal 1989:150).

The Bureau of the Census began publishing aggregated data for electrical utilities in 1902 and 1912 that provides a general overview of New Hampshire's power generation infrastructure during the Wiswall Falls generation station and dam construction period. These records show that electrical generating stations were established in the state at a steady pace beginning in 1887, with between 2 and 5 stations typically coming on line each year up through 1902. By the latter year, 51 separate commercial and municipal generating stations supplied New Hampshire customers with electricity. The NELP&H Co.'s Wiswall Falls development was either the forty-seventh or forty-eighth electrical generating station established in the state. Hydroelectric power represented 55 percent of the total generated in the state. In 1912, the number of generating stations had grown to fifty-nine and water power represented 67 percent of electricity generated in the state. Hydroelectric plants supplied 22,752 customers in New Hampshire, out of a total population of just over 430,000. In 1914, 70 utility companies were furnishing electricity in NH (Bureau of the Census 1905:106-107, 120, 121, 136, 137; Bureau of the Census 1915:98-99; Public Service Commission of New Hampshire 1914:63).

A comparison of the Wiswall hydroelectric facility's stated capacity of 6,000,000 kWh with the New Hampshire census data shows in broad terms that the plant was typical for the period, but was becoming outclassed by the construction of larger, more powerful facilities.<sup>6</sup> In 1902, hydroelectric stations collectively held 78 turbine sets generating 15,406 horsepower (hp), or an average of 197 hp per turbine. This average capacity was less than half of the capacity of the 255.5 per turbine figure for Wiswall Dam. However, the majority of turbines for used for electrical generation in the state (76 of 78) were below 500 hp, and the general size of the Wiswall installation was therefore typical for the state when considered in this light. By 1912, however, there were 115 turbines and generating 56,937 horsepower (hp) in the state. The average power of a turbine had risen to 495 hp and there were twenty turbines above 500 hp. This overall increase in the quantity and power of hydroelectric facilities follows national trends for the period, when the number of hydroelectric turbines more than doubled and their average horsepower increased 463 percent. Implied in these statistics is a trend towards hydroelectric developments at locations with a higher available head and flow of water (Bureau of the Census 1905:120, 121, 136, 137; Bureau of the Census 1915: 98-99,113).

Financial statistics for New Hampshire utility companies for the period provide additional comparative data regarding companies active at the Wiswall Dam in the context of New Hampshire utility corporations. The Public Service Commission of New Hampshire annual report for 1911-1912 listed 80 utilities providing electrical service in New Hampshire. These companies were capitalized at an average of \$180,882 and averaged \$32,936 in gross income. Compared to its peers, the NELP&H Co. was a small company, capitalized at only \$22,000 and with profits of only \$1,000 coming from the lease of its plant(s). The Newmarket Electric Company's financial size was just over 50 percent of the average financial size for the state, with \$100,000 in capital stock and \$16,487 in gross income. The Rockingham County Light and Power Company was a giant among New Hampshire companies for this period, with \$1,000,000 in capital stock and \$278,734 in gross income. This company was one of only five electrical utilities in the state with capital stock of \$1,000,000 or more (Public Service Commission of New Hampshire 1913:1006-1008).

The incorporation of the Wiswall Falls into ever-larger power companies exemplifies an historical trend toward regionalization of electric power companies and grids and the development of larger hydroelectric facilities between 1920 and 1945. The larger markets and increased capitalization of such companies allowed for the development of some of the largest falls in the state. This maturation of the industry is exemplified by the New England Power Company's Comerford Station and McIndoes Falls (megawatts) developments along Fifteen Mile Falls on the Connecticut River between 1926 and 1931. These stations had a combined 170 megawatt capacity, with 160 megawatts from Comerford Station alone. A third development in this reach of river was completed in 1957 and produced 190 megawatts of electricity at full capacity using a reservoir that covered 3,500 acres (Landry and Cruikshank 1996:87-90,149-150).

Following World War II, aging small hydroelectric generation facilities were increasingly unprofitable when compared to large, coal and oil-fired plants until the oil shocks of the 1970s. The resulting energy crisis prompted an American reevaluation of hydroelectric generation. The United States Department of Energy (DOE) and the Army Corps of Engineers performed an inventory of all dams in the United States during the Carter Administration. Subsequently, the DOE allotted \$10 million for small-scale

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<sup>6</sup> Unfortunately, census data was not tabulated by plant, but by turbine, so direct plant-to-plant comparisons are not possible.

hydroelectric redevelopment and established a grant programs for feasibility studies at such dams (Broad 1978:42-44). John Webster's attempt to redevelop the Wiswall Falls may be seen as typical for a period when hydroelectric facilities were attractive to entrepreneurs because of a changing economic calculus for electrical generation.

Currently, six electrical companies supply New Hampshire. As of 2008, hydroelectric generation accounted for 11.6 percent of New Hampshire's overall electrical supply capacity of 30,526 megawatts (State Energy Policy Commission Final Report 2008).

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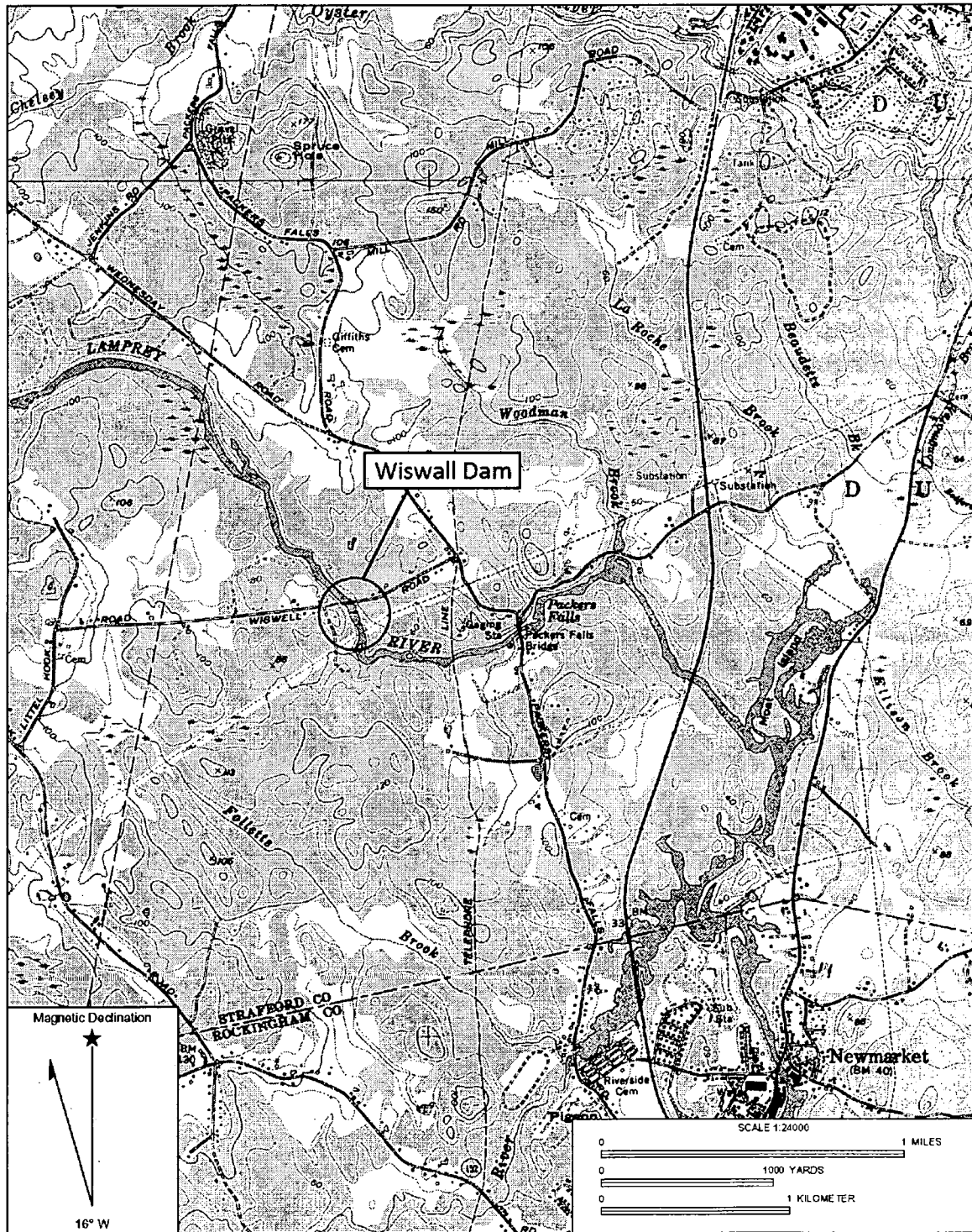
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Location Map. USGS Portsmouth, NH 1:24,000 Quadrangle 1956 (Photo revised 1988).





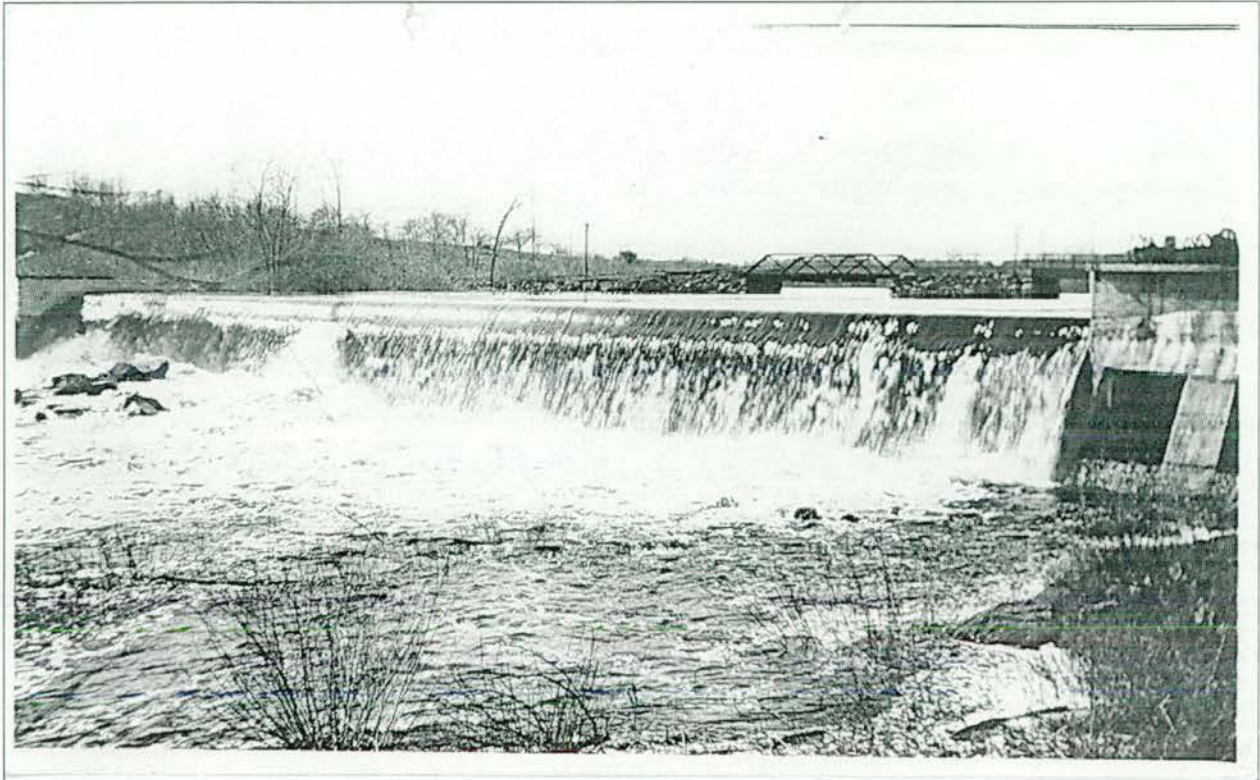
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1935 view of the Wiswall Dam, with sluice gates in foreground. East bank of the Lamprey River, looking west (source: New Hampshire Water Resources Board 1935).



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Pre-1967 photographic view of the Wiswall Dam. East bank of the Lamprey River, looking northwest  
(source: Durham Historic Commission, accession no. XXI. 7.B.2).



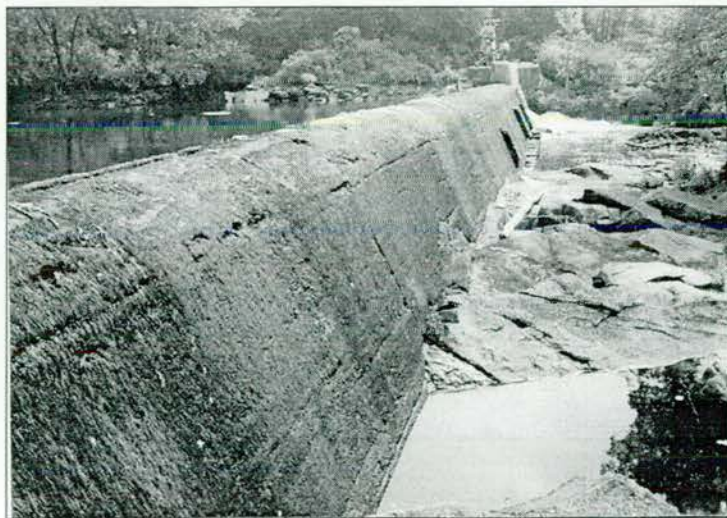
**WISWALL DAM**  
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1980 photograph of flood gate in power canal showing intact wood gate leaves, looking north  
(source: New Hampshire Water Resources Board 1980).



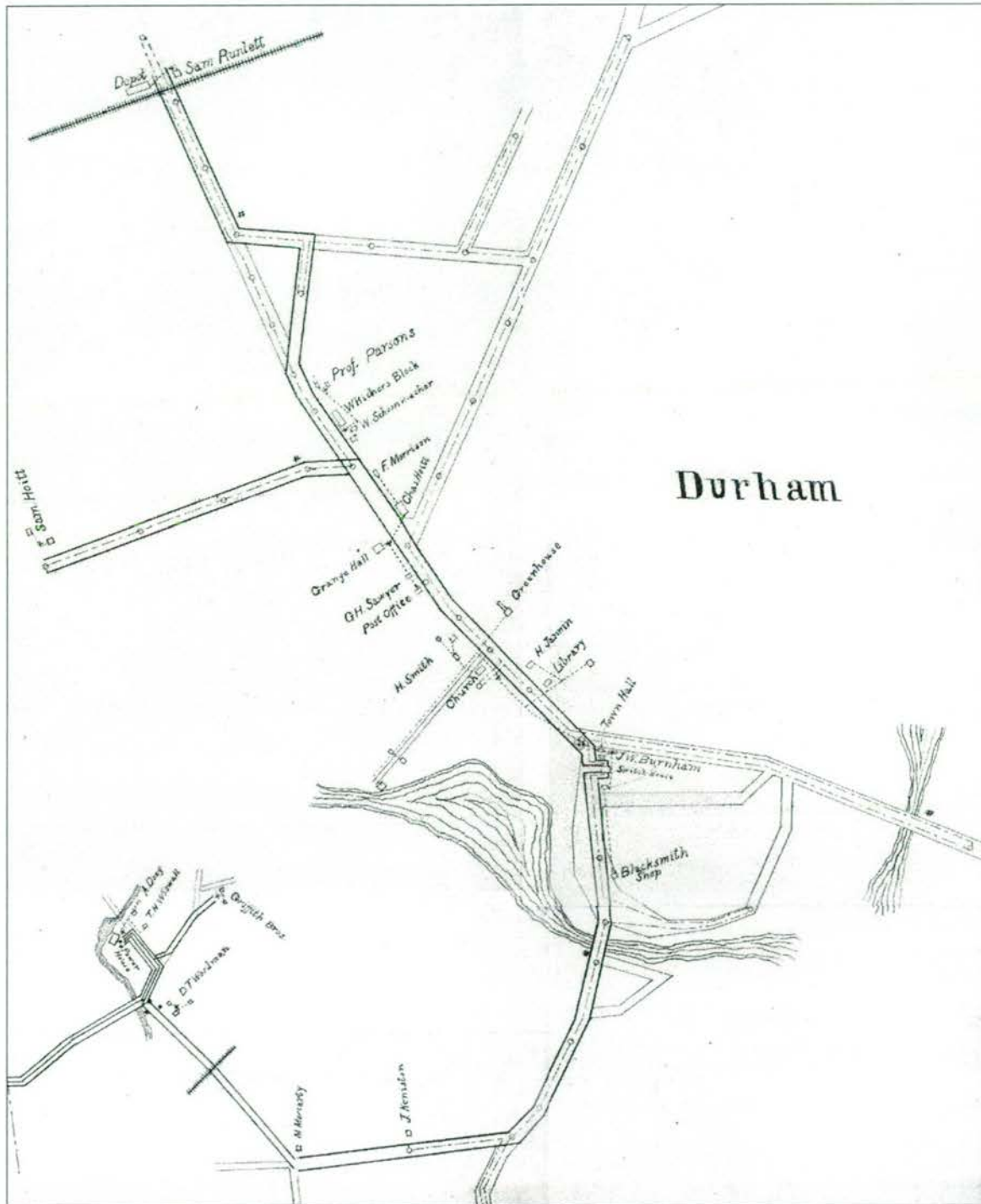
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Ca. 1994 photos of the Wiswall Dam during drawdown. Upper left: west bank, looking east across impoundment with 1868 dam remains visible. Upper right: east bank, looking west showing buttresses on downstream face of dam. Bottom: downstream face of spillway, west bank looking east (source: NH DES – Water Division ca. 1994).



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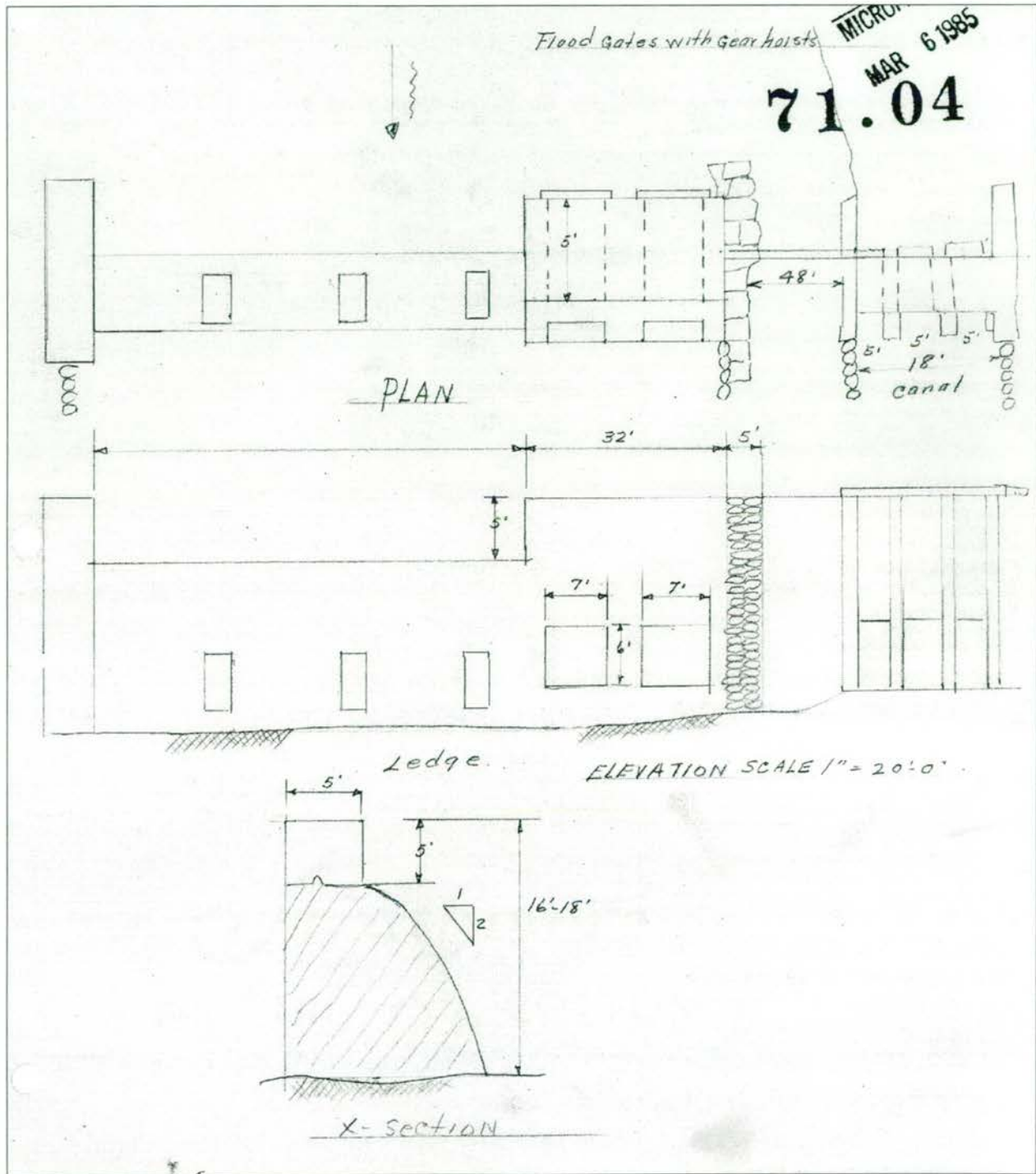
Ca. 1912 plan of the Wiswall hydroelectric plant and associated power grid. Heavy black lines probably represent the route of power lines and dashed lines with intervening circles may represent street lighting (source: Anonymous ca. 1912).



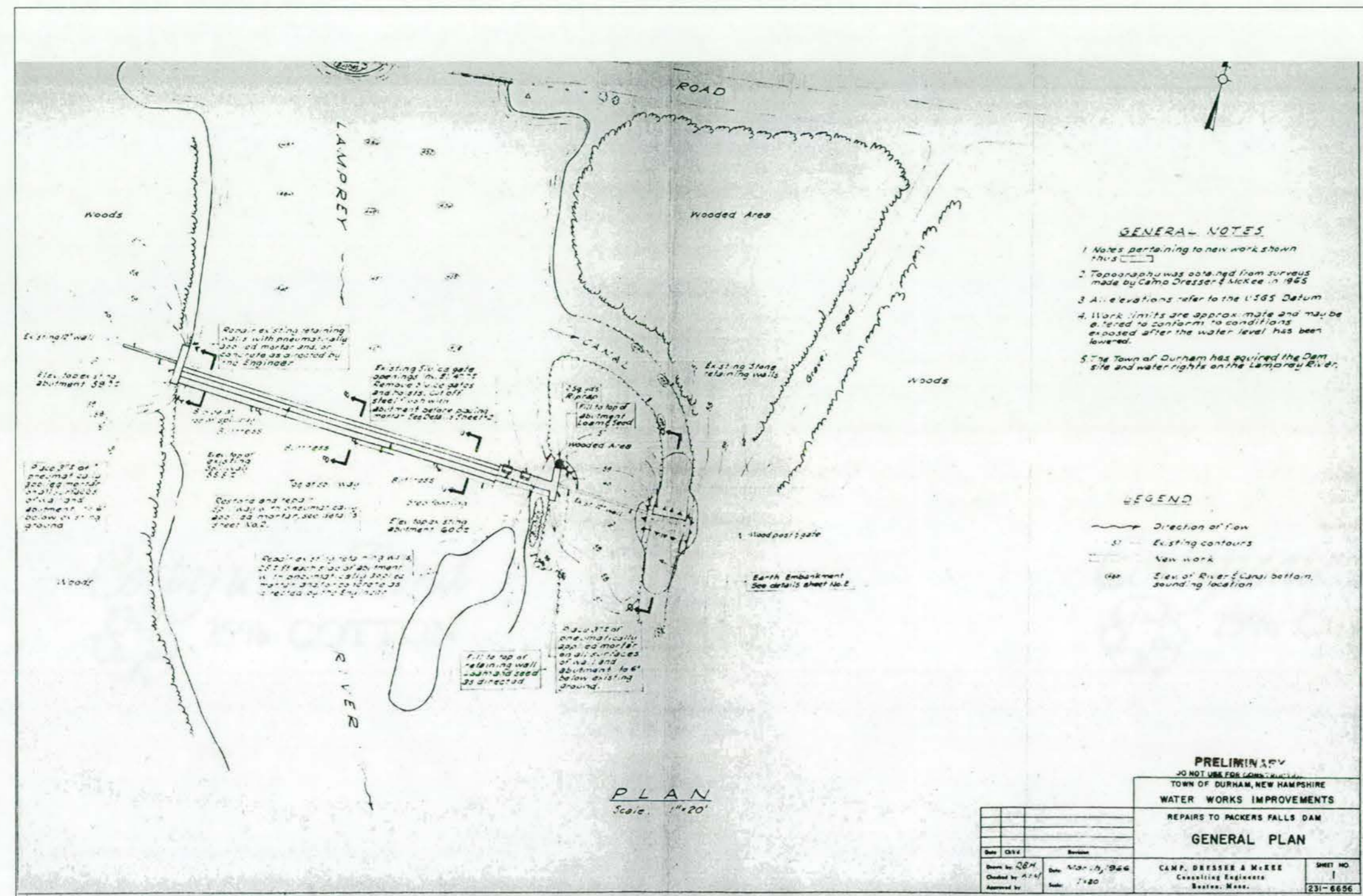


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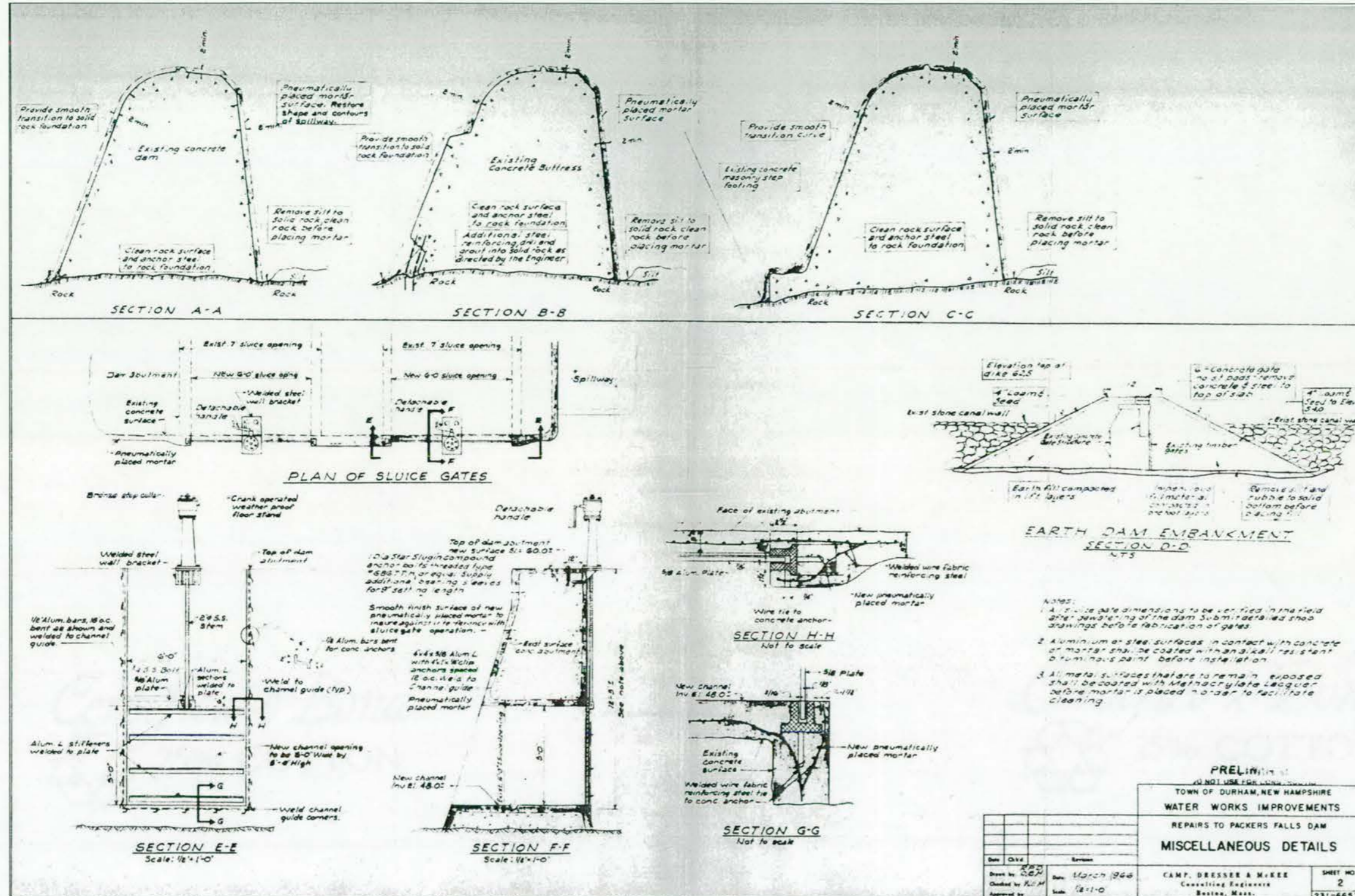
1939 reflected sketch plan and downstream elevation of the Wiswall Dam and power canal gate (source: New Hampshire Water Resource Board 1939).



1966 site plan of the Wiswall Dam showing existing conditions and proposed work (source: Camp, Dresser & McKee 1966).



1966 cross sections and details of the Wiswall Dam showing existing conditions and proposed work (source: Camp, Dresser & McKee 1966).



- NOTES:**
1. Sluice gate dimensions to be verified in the field after pouring of the dam. Submit detailed shop drawings before fabrication of gates.
  2. Aluminum or steel surfaces in contact with concrete or mortar shall be coated with an alkali resistant aluminum paint before installation.
  3. All metal surfaces that are to remain exposed shall be coated with Methacrylate Leaguard before mortar is placed in order to facilitate cleaning.

PRELIMINARY  
 DO NOT USE FOR CONSTRUCTION

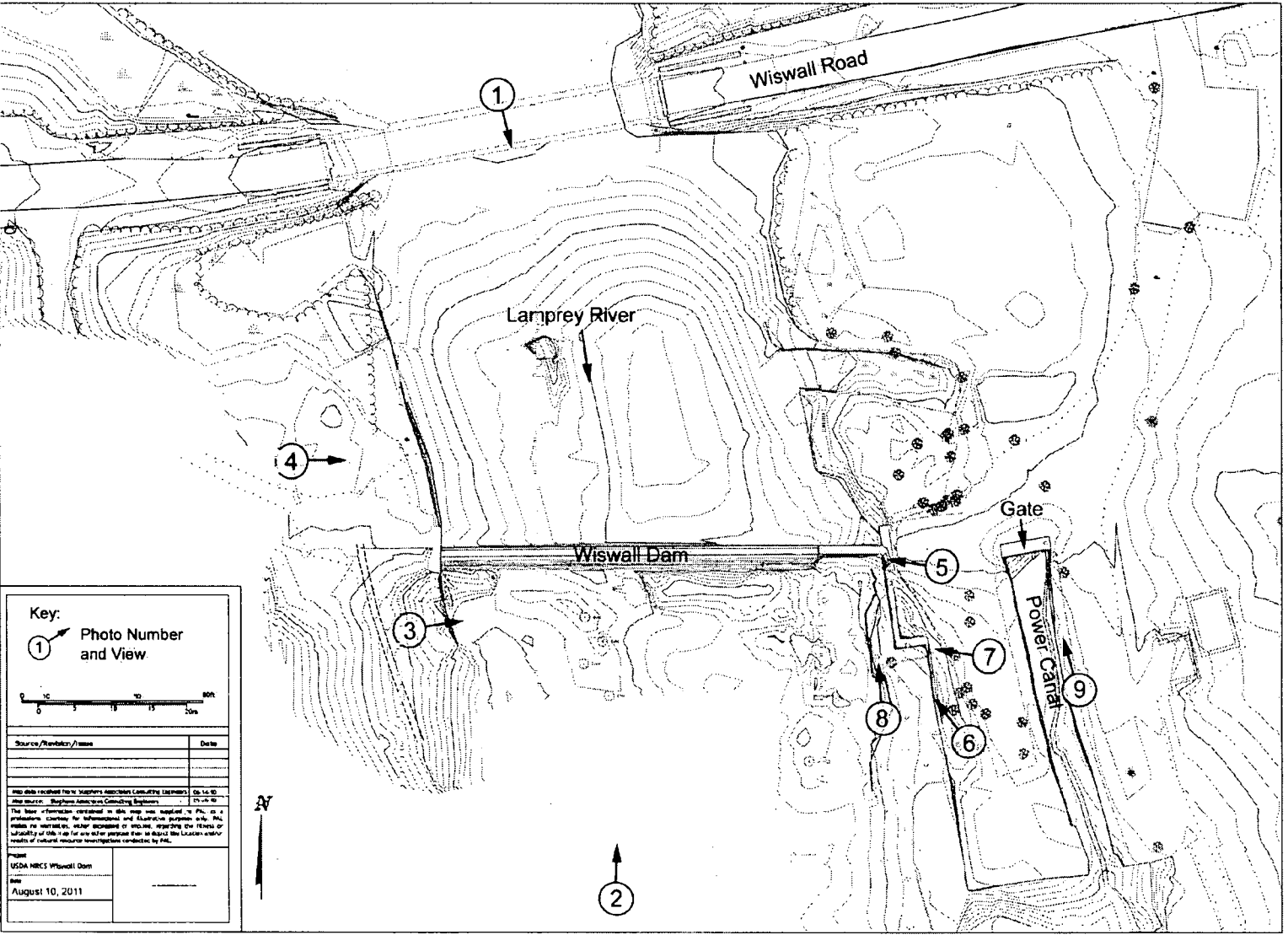
TOWN OF DURHAM, NEW HAMPSHIRE  
 WATER WORKS IMPROVEMENTS  
 REPAIRS TO PACKERS FALLS DAM  
 MISCELLANEOUS DETAILS

|      |       |  |                            |
|------|-------|--|----------------------------|
| Date | Drawn | Checked  | Approved                   |
|      | CKM   |  |                            |
|      |       | Date: March 1966   | Scale: 1/2" = 1'-0"        |
|      |       | CAMP, DRESSER & MCKEE<br>Consulting Engineers<br>Boston, Mass. | SHEET NO.<br>2<br>231-6657 |

**Photo Index**

Photographer: Robert Brewster, Warren Jagger Photography, Inc., Providence, RI, April 7, 2011.

1. General view of Wiswall Dam and impoundment, Wiswall Road looking south (downstream).
2. General view of Wiswall Dam, west bank of Lamprey River looking north.
3. General view of downstream side of Wiswall Dam, west bank of Lamprey River looking east.
4. General view of upstream side of Wiswall Dam with core wall in foreground, west bank of Lamprey River, looking east.
5. General view of Wiswall Dam with sluice gates in foreground, east abutment, looking west.
6. General view of downstream elevation of Wiswall Dam with Wiggins Sawmill in foreground, east retaining wall looking northwest.
7. Detail view of Wiggins Sawmill foundation, east retaining wall looking northwest.
8. Detail view of Wiggins Sawmill foundation and sluice gates, east bank of Lamprey river looking north.
9. Downstream view of gates in power canal, looking north.





Kodak 400TMY-2

NH No. 900-1  
Wiswell Dam





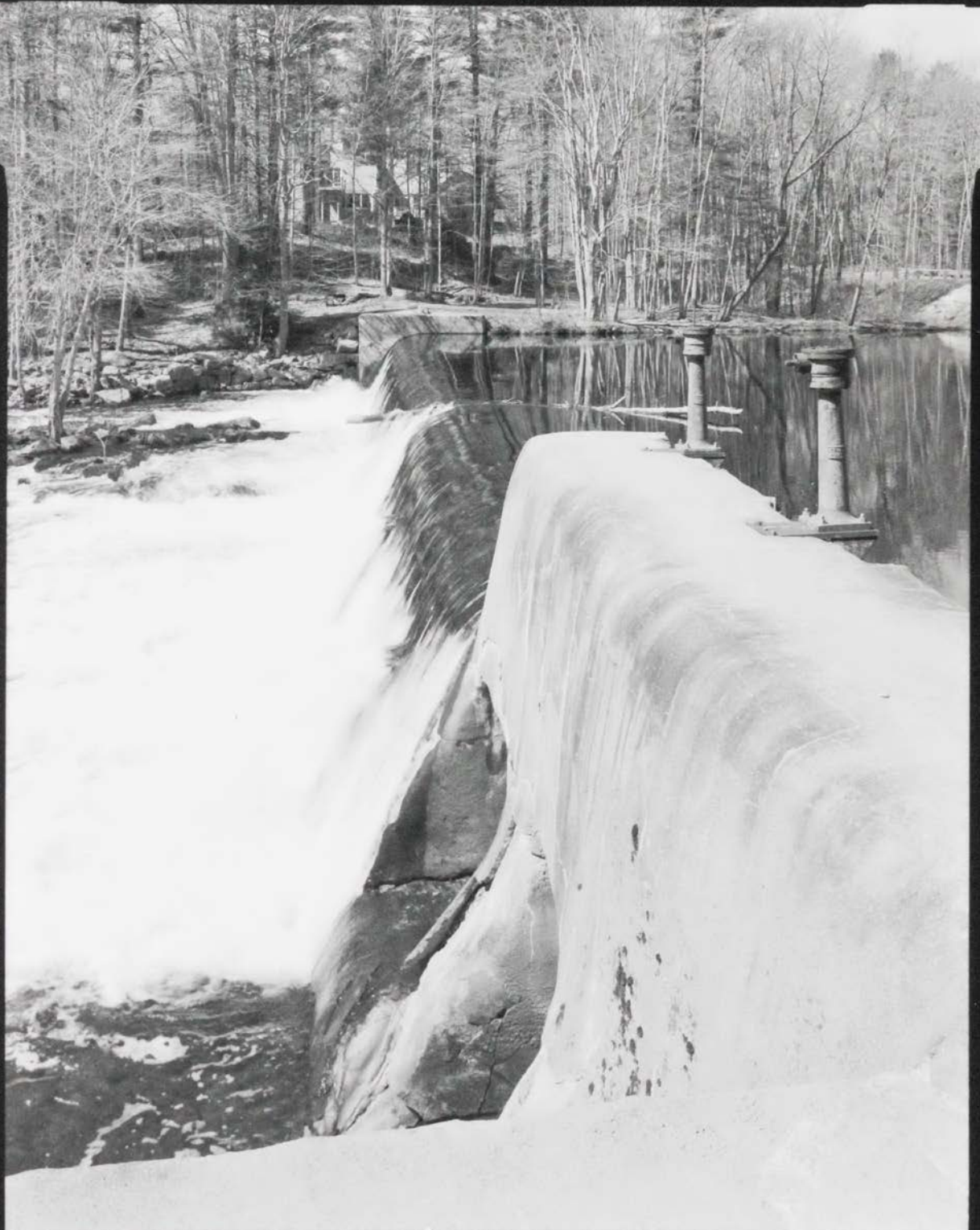
NH NO. 700-2  
Wiswall Dam



NA No. 700-3  
WISCONSIN DEPT.



NH No. 900-4  
Wiswall Dam

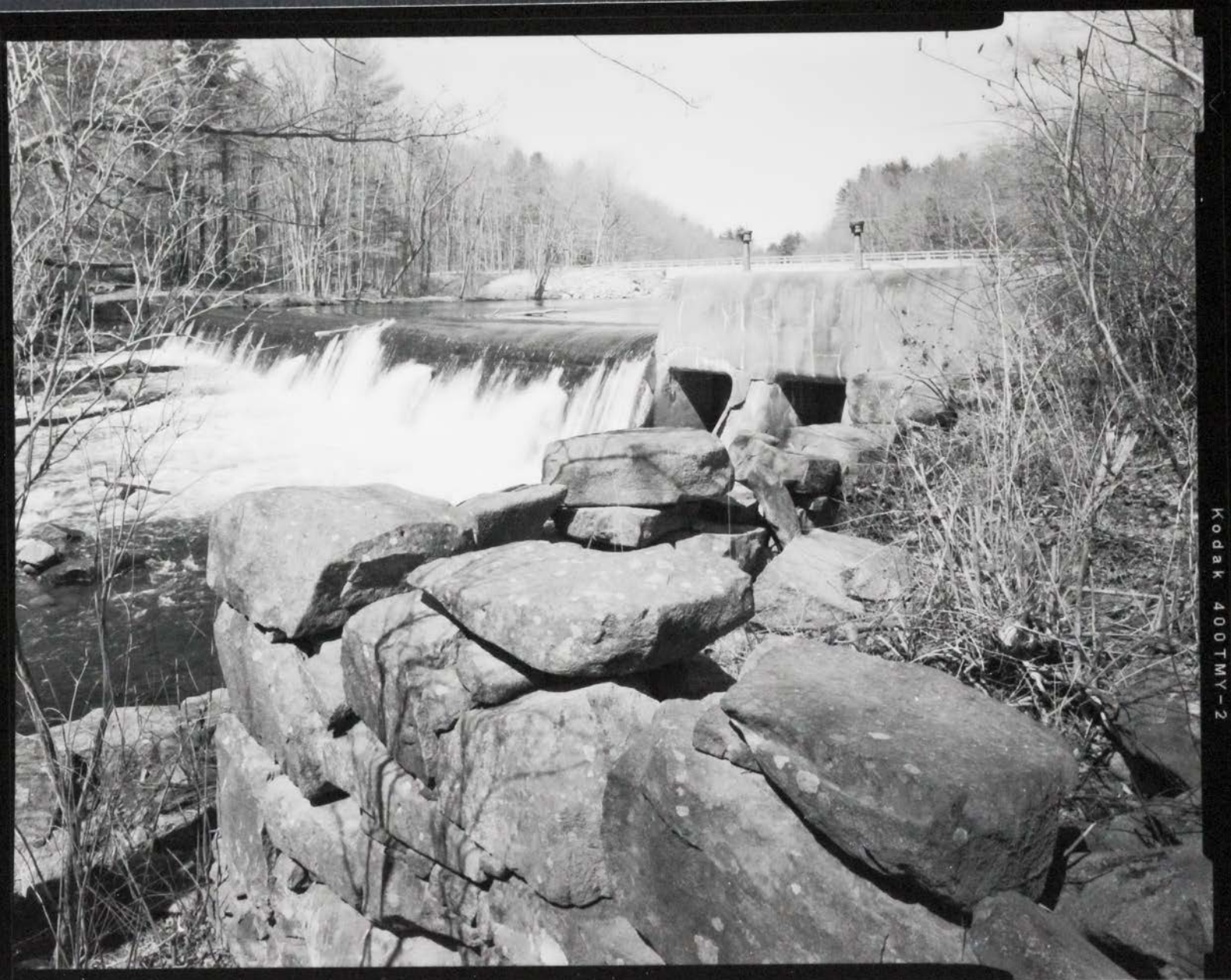


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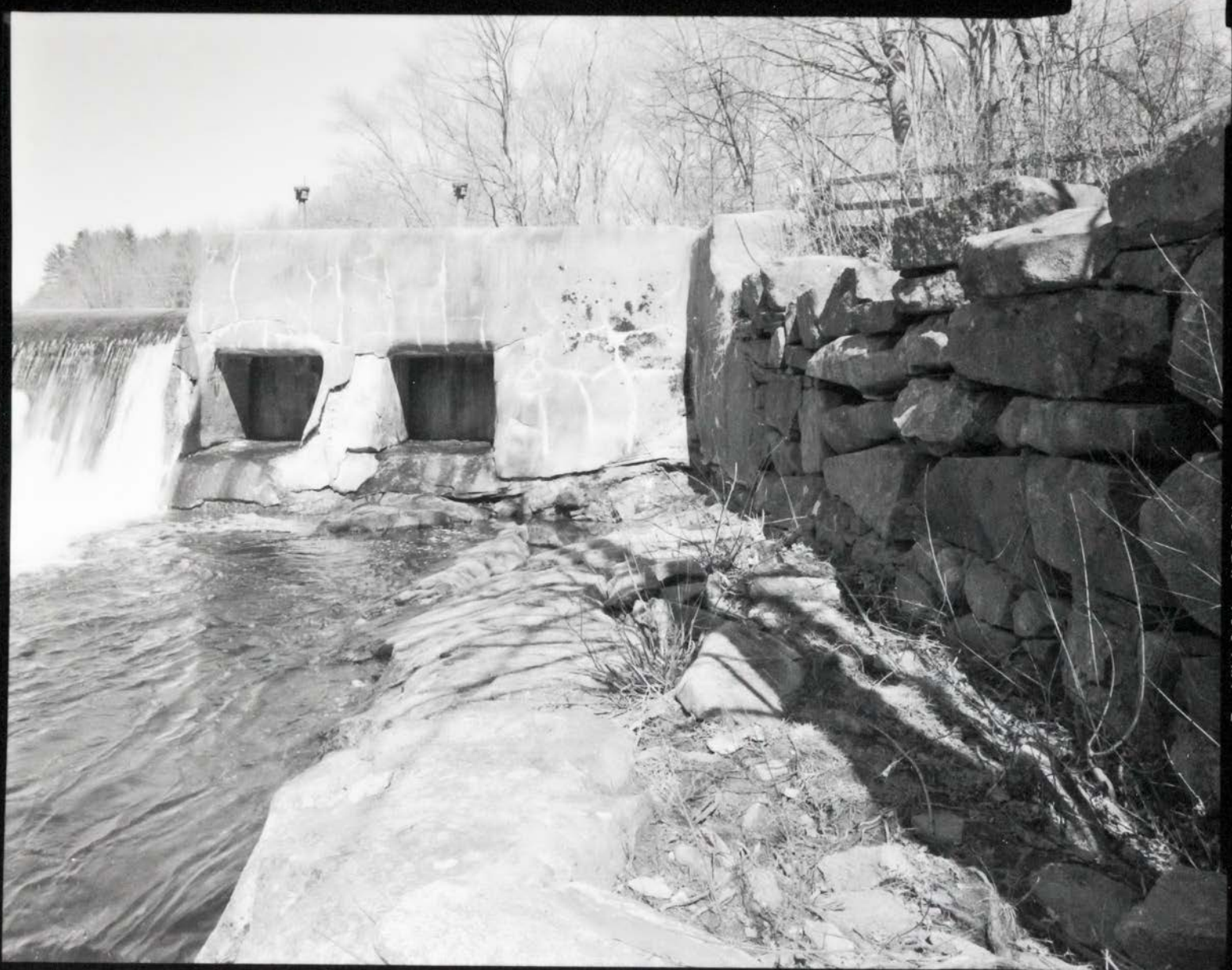




NH NO. 700-6  
Wiswell Dam



NA NO. 700-7  
Wiswell Dam



Kodak 400TMY-2

NH NO. 700-8  
Visuals Draw



NR No. 700-9  
Wiswell Dam