

NORWICH WATER POWER COMPANY, DAM
(Norwich Water Power Company,
Greeneville Dam)
West bank of Shetucket River
approximately opposite Fourteenth Street
Greeneville section
Norwich
New London County
Connecticut

HAER No. CT-147-A

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

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Location: West bank of Shetucket River,
approximately opposite Fourteenth
Street
Greeneville section, Norwich
New London County, Connecticut

USGS Norwich Quadrangle
UTM Coordinates: 18.745980.4602560

Date of Construction: 1882; rebuilt 1886, 1915

Engineer: Hiram Cook (1882)
Chandler and Palmer (1915)

Present Owner: City of Norwich, Connecticut
City Hall
Norwich, Connecticut 06360

Present Use: Raising and impounding water for power
canal

Significance: The dam is significant as a major
component of an 1882 rebuilding of the
Norwich Water Power Company's
facilities. The project reduced the
length of the canal and improved the
flow of water, thereby better meeting
the needs of the numerous manufacturers
who had located their factories along
the company's canal. As modified in
1886 and again in 1915, the 1882 dam is
representative of two common 19th-
century techniques, massive stone
masonry and timber-crib construction.

Project Information: This documentation was undertaken in
1994-1996 in accordance with a
Memorandum of Agreement among the
Federal Energy Regulatory Commission,
the Connecticut State Historic
Preservation Office, and the Advisory
Council on Historic Preservation. The
dam will be modified to accommodate a
fish passage.

Bruce Clouette
Historic Resource Consultants
Hartford, CT 06106

Description

The Greeneville Dam, built in 1882 as part of the Norwich Water Power Company's reconfiguration of its power canal, is a part-masonry and part-timber-crib gravity dam across the Shetucket River, approximately opposite Fourteenth Street in the Greeneville section of Norwich, Connecticut. The spillway extends for 399 feet, the entire width of the river, between abutment retaining walls built of large-scale granite rubble. The dam provides a head of about 17 feet in the canal, which extends downstream along the west bank of the river for about 0.7 miles.

As originally built in 1882, the entire dam was of granite rubble, with an inclined upstream face and a nearly vertical downstream face. The dam was 15 feet wide at the base and 7 1/2 feet wide at the crest, where it was finished with dressed granite capstones. The dam had a height of 15 feet, with about another 5 feet that was sunk below the river's gravelly bed. The back of the dam was sealed with concrete to prevent seepage, planked in wood, and then filled with earth and stone to create a gentle slope. The base of the dam was protected with a planked apron that extended downstream 22 feet, where it terminated with an upwardly sloped lip; the apron was rebuilt in 1885 without the lip.

In 1886 a disastrous flood ripped out the middle of the dam, carrying away about 200 feet of the stonework and seriously scouring out the river bed. The gap was immediately rebuilt as a timber crib filled with stone and gravel. The back slope of the new part continued the slope of the older masonry parts on either side and capstones were reinstalled on top of the crib to give the dam a uniform appearance. The new work was a total of 68 feet in width, including a gently sloping downstream face and a 25-foot-wide two-step apron, both of which were covered with planking. Because of the extent of the erosion, the crib had to be 24 feet in height. The cribwork and planking for the downstream face and apron was extended across the surviving portions of the masonry dam, effectively hiding all the original stonework (except for the capstones) from view.

In 1915 the timbers of the 1886 crib were found to be deteriorated and so the top seven or eight courses were reconstructed, including the downstream facing and aprons on both the timber-crib and masonry portions. The upstream face was also re-planked and a higher level of fill established

behind the dam. Although the crest of the dam was slightly wider and the downstream slope a little steeper, overall the reconstruction duplicated the profile of the 1886 crib dam, including the two-step apron. It is this planked structure that is visible today. According to the drawings and verbal description submitted with the permit application for the 1915 reconstruction (recently confirmed when the interior of the dam was exposed during construction of a fishway), the cribwork consists of alternating courses of heavy timbers, 8 x 10 and 8 x 14 inches in section, spaced 4 feet on center and packed with stone and gravel of various sizes. The top and face planking is of oak, 4 inches thick. The capstones were reset in concrete.

Historical Background and Technological Significance

The record does not explicitly indicate why the Norwich Water Power Company decided to build this dam as a replacement for its original timber dam, built in 1829 some 1,200 feet upstream. The old dam was still intact; indeed, it served as the cofferdam for the construction of the present structure, diverting nearly all the flow of the river into the canal in the summer months. Despite costing some \$60,000, the new dam offered several advantages. Its six wide headgates provided greatly improved flow of water into the canal compared with either the original headgates or their subsequent enlargement. By abandoning some 1,200 feet of canal, the company also proportionately eliminated problems associated with long headraces: retarded flow, water seepage, upkeep, and ice formation. The potential mill sites along the northern end of the canal, which had a relatively narrow embankment, had not been utilized during the first 50 years of operation, so little was lost by bypassing the northern part with a new dam further downstream. Finally, although its crest was at the same level as the old dam, the new dam provided another 10 acres of pondage, an important consideration during times of low water, when the level of the water behind the dam would be allowed to rise at night and be drawn down to power the mills during the day.

The Norwich Water Power Company's 1882 dam incorporates two methods of dam construction commonly used in New England and throughout much of the rest of the country in the 19th century: massive masonry and timber cribwork. Both represent the scaling-up of vernacular techniques used since the earliest days of settlement for mill dams across small streams, though the construction of dams of this size required sophisticated surveying and the capability of undertaking large-scale

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excavation and movement of materials. Both types continued to be built until concrete became the dam material of choice.

Although masonry gave the appearance of solidity and strength, it was not inherently superior to the filled-crib method. Its overall density was somewhat greater, but its robustness depended not only on the stone but also the strength of the joints. The crib method was faster and less expensive. As was typical in this period, concrete was used as a sealant, not a structural material.

Few dams failed in this period because of inadequate structural strength; most gave way because of erosion of the downstream side of the base. Consequently, engineers experimented with various types of aprons, designed to protect the river bed just below the dam, and with various profiles of the spillway itself, in order to reduce the angle and energy of water cresting over the dam. As originally built in 1882, the Norwich dam staked everything on its apron. The raised lip was intended to create a pool of water that would help break the impact of water overtopping the dam. Although some smaller masonry dams in the area had stepped faces that cascaded the water, dissipating its energy, the steep incline of the Greeneville dam's downstream face was common in the period. A stepped face across its 399-foot length would have entailed nearly 50% more material and a great deal more trouble setting the stone in precise courses, and so it probably represented an unacceptable expense. At the time of the dam's construction, the builders knew that the layer of gravel and boulders that made up the bed of the Shetucket River was as much as 30 feet deep and would offer little resistance to erosive forces.

Although the apron was wide, thick, and well-constructed, it was severely damaged during a flood in 1886 when debris cresting over the dam crashed into the apron and smashed holes in the planking. As the water continued pouring over the dam, it excavated a progressively larger void underneath the apron and the dam itself, resulting in its collapse. It is not surprising, then, that the rebuilt structure used a much more inclined downstream face, thereby addressing the erosion problem with both an improved profile and a stepped apron to absorb whatever vertical impact remained. (A similarly sloped downstream crib had been added to the Holyoke, Massachusetts, dam in 1870; however, without the horizontal apron, the erosion of the river bed, though reduced in intensity, continued at the base of the Holyoke dam's new crib.) The 1886 construction at Greeneville, therefore, can be seen as a continuation of the

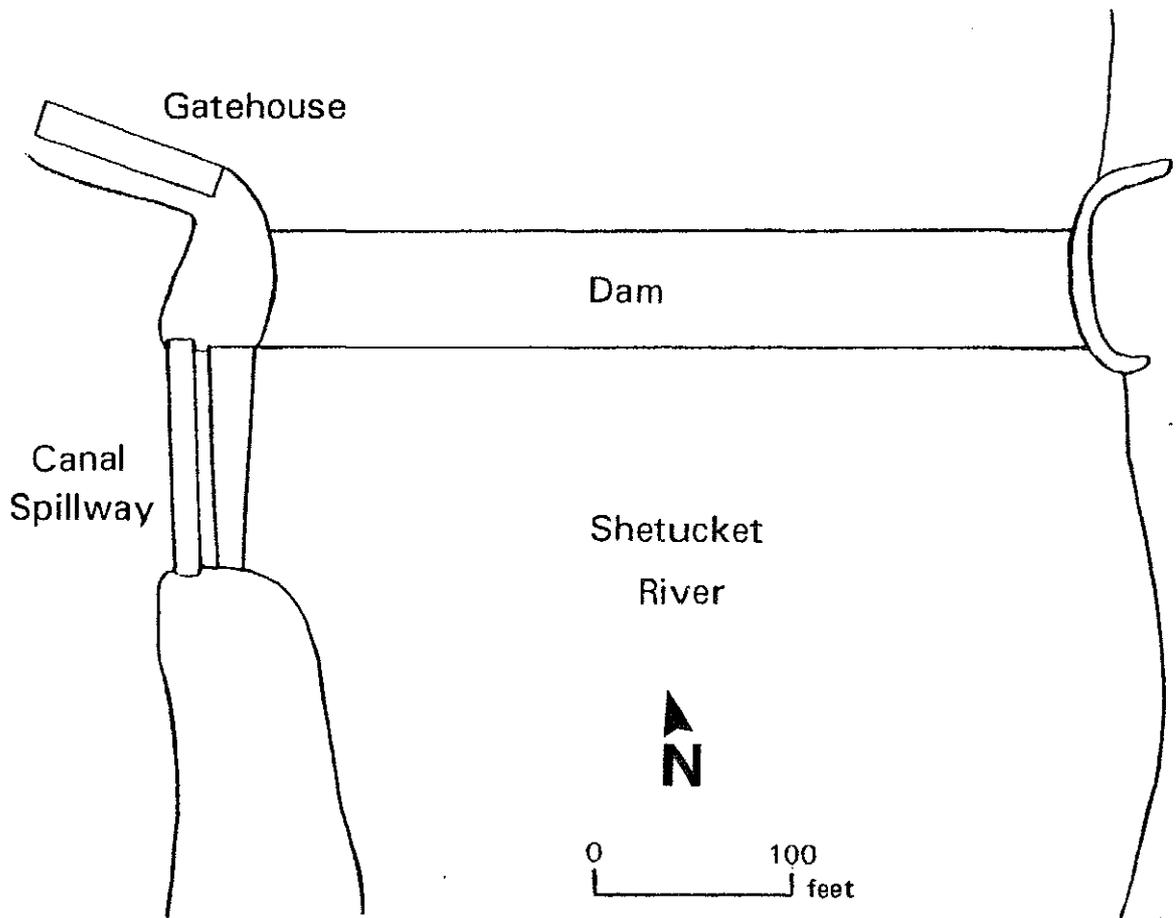
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experimentation by which American dam engineers refined their designs. Considering it was reproduced in the rebuilding of 1915 and survived 20th-century flood such as those of 1936, 1938, and 1955, which destroyed many other New England dams, the timber-crib modification of the Greeneville dam must be judged a success.

The engineer for the 1882 dam was Hiram Cook (1825-1927), who also served as president of the Norwich Water Power Company. Presumably Cook also had a major role in dealing with the disaster of 1886; however, the only documentary material from the episode is a copy of the profile of the dam signed J. Herbert Shedd, about whom little could be learned. The engineers for the rebuilding of the dam in 1915 were Chandler and Palmer, Norwich's leading engineering firm of the period.

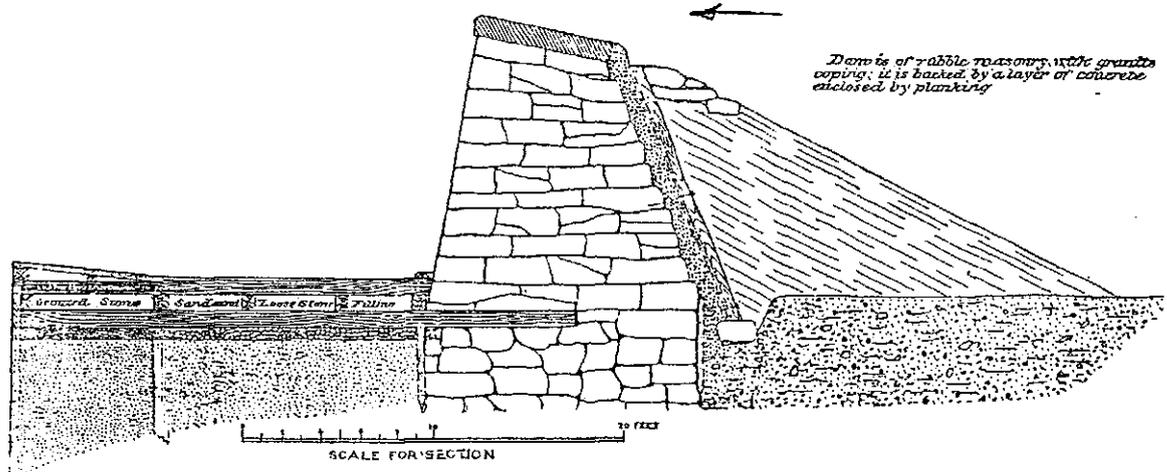
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Site Plan

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Section of dam as built in 1882, from W. P. Trowbridge (comp.), Reports on the Water-Power of the United States (1885)