Wildman

Archaeological Assessment of Dams within the Naugatuck River Basin Anadromous Fish Restoration Project

Prepared for:
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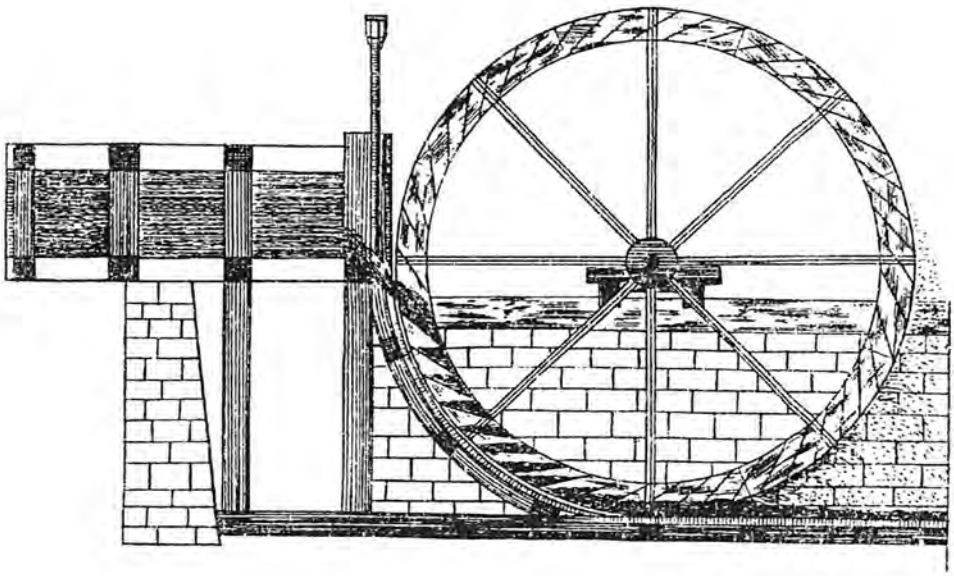

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Cover illustration: Illustration of an undershot water wheel. Scanned from Oliver Evans, The Young Mill-Wright & Miller's Guide (Wallingford, PA: The Oliver Evans Press, 1990 reprint of 1795 edition), Plate I, Figure 3. This book was produced in fifteen editions from 1795 to 1860. Its chapters on hydraulic engineering data were applicable to the trade of millwrighting and design of water powered machinery in the growing industries of the early 19th century. It is most probable that Evans' designs were used at several dam sites on the Naugatuck River.

TABLE OF CONTENTS

NAUGATUCK VALLEY INDUSTRIAL DAMS: Project Summary

LOCATION: The seven dams are located along the Naugatuck and Mad Rivers in the municipalities of Thomaston, Litchfield County; Waterbury, Naugatuck and Seymour, New Haven County, Connecticut.

UTM COORDINATES: Tingue: USGS Naugatuck, Connecticut Quadrangle, UTM: 18.660820.4583930

Union City: USGS Naugatuck, Connecticut Quadrangle, UTM: 18.665540.4595305

Platts Mill: USGS Waterbury, Connecticut Quadrangle, UTM: 18.662545.4598060

Bray's Buckle: USGS Waterbury, Connecticut Quadrangle, UTM: 18.663705.4600935

Freight Street: USGS Waterbury, Connecticut Quadrangle, UTM: 18.662300.4401850

Anaconda: USGS Waterbury, Connecticut Quadrangle, UTM: 18.662220.4603930

Plume & Atwood: USGS Thomaston, Connecticut Quadrangle, UTM: 18.665545.4595280

DESCRIPTION: The dams represent a variety of dam construction techniques typical of the late 19th century. Reinforced concrete, concrete gravity, stone masonry and timber crib construction are evident. The dams provided process water and/or power to a diverse group of factories in the region.

DATES OF CONSTRUCTION: Circa 1770s to 1955 with episodes of modification, and repair.

PRESENT OWNERS: Tingue Dam - State of Connecticut

Union City Dam - Town of Naugatuck, Connecticut

Platts Mill - Platt Brothers Company

Bray's Buckle - Atlantic Richfield Delaware Corporation

Freight Street Dam - City of Waterbury

Anaconda Dam - Atlantic Richfield Delaware Corporation

Plume & Atwood - Railroad Station Realty Group, LLC.

PRESENT/PAST USES: All dams are unused and substantially abandoned. Formerly they impounded process power for nearby mills and factories.

SIGNIFICANCE: The group of dams provides a fundamental view of how 19th century industry modified an existing river with seasonally varied flows, to provide a relatively steady source of water for factory processes, steam generation, and power. The availability of power and water enabled the establishment of metalworking, textile and, rubber industries in the Naugatuck Valley and contributed significantly to its prosperity.

PROJECT INFORMATION: The Connecticut Department of Environmental Protection is planning to restore anadromous fish populations to the Naugatuck River watershed. The objective of this project is to restore anadromous fish passage and free flow conditions to the Naugatuck River Basin. Initial steps in the restoration process is the provision of fish passage around dams in the targeted portion of the river so that spawning populations will be able to access upstream habitats.

To complete this project, the engineering studies have recommended that these dams be removed or modified. To mitigate adverse effect, the State Historic Preservation Office stipulated investigation and documentation of dams and associated mill race plans in the project area. This documentation was undertaken to fulfill the requirement.

I. INTRODUCTION

Project Background

The Connecticut Department of Environmental Protection is planning to restore anadromous fish populations to the Naugatuck River watershed. Initial steps in the restoration process are the provision of fish passage at some dams or the removal of other dams in the targeted portion of the river so that spawning populations will be able to access upstream habitats.

The rationale for this narrative report is to provide partial mitigation for a series of proposed changes to the subject dams to allow passage of anadromous fish. These range from complete or partial removal and sediment management to installation of fishways or bypass channels. The complete report on engineering and environmental aspects, recommended methodology and technical supporting data are contained in *Anadromous Fish Restoration - Naugatuck River Basin*, Milone & MacBroom (1998).

Regional Historical Context

The Naugatuck River forms one of the major water systems in Connecticut (Figure 1). The river cuts through the Northwest Highlands and Western Uplands of the State, geographic regions characterized by rugged hills with relatively steep and narrow valleys. The latter helped to create rapidly flowing streams, including the Naugatuck.

The Naugatuck is formed by the confluence of two Connecticut streams. The headwaters of the West Branch are located in Norfolk and Goshen where they drain the waters of North Pond. The East Branch drains the waters of Lake Winchester in Winchester. The streams join to form the Naugatuck in Torrington. The river flows north to south for a total length of about 45 miles, emptying into the Housatonic River near its head-of-tide in Derby. Its total watershed area measures 310 square miles. Major tributary streams are Leadmine Brook, Hancock Brook, Steele Brook, Mad River, Hop Brook and Little River (Gephard 1996; Rossano 1996).

According to Eunice Mauwee, the daughter of the Schaghticoke Indian Joseph "Chuce" Mauwee (AKA Chuse Mauwehu), who once lived on the lands now owned by the American Copper Company in Seymour, the original form for Naugatuck was "Naukotunk" in the Algonkian dialect. Naukotunk translates as "one big tree." The tree referred to once stood where the New Haven Copper Company is located. It marked the fishing place of the local Native Americans at the falls of the Tingue Dam (Anderson 1896:48). The natural falls forming part of the Tingue Dam have been known as an important fishing place since early historical times (e.g., Campbell 1902; Kemmish 1995).

The portion of the Naugatuck River Valley which this project documents has been a center of commercial manufacturing and industrial production from the colonial period to the present. Waterbury, Naugatuck, and surrounding towns were leaders in the brass and rubber industries. The small, rapid tributary streams furnished the power for the first water-driven colonial saw and grist mills in the Naugatuck Valley. With water power readily available,

fulling and carding mills replaced cottage industries in the early 19th century. Manually powered looms and hand spinning gave way to integrated cotton and woolen mills as the factory system achieved predominance.

Small metal working industries such as button, nail, and farm tool manufacturing plants also sprang up at dam sites on the tributary streams. Between 1798-1800 Abel Porter began to explore the possibility of setting up a button manufactory in Waterbury. He teamed up with other craftsmen who could contribute to the enterprise. In 1802 he took steps to form a partnership with Silas Grilley and Daniel Clark (SMC 1952a:5). David Hayden, a button maker from Attleboro, Massachusetts was also called in to join the business. He came to Waterbury in 1804 (SMC 1952a:4). Grilley contributed rights to his invention of the wire eye pewter button. Four partners and nine employees began to cut or stamp hard buttons from brass and copper scrap. They succeeded in raising the heat of their pit fires high enough to melt scrap brass alloys. Sources were old stills, kettles, sugar boilers, ship sheathing and the like (SMC 1952a:6). They learned to cast "hard" copper alloy buttons in individual button molds. They used Porter's fire gilding process to apply gold to their buttons (SMC 1952a:7). The technology rapidly advanced from the casting of low temperature soft tin and pewter alloys to casting "hard" buttons of scrap brass and copper.

Abel Porter & Company were hard-working craftsmen, proficient in metal working and button making. Together they formed a pool of skills and capital to pioneer the establishment of a brass industry in America (SMC 1952a:3). Between 1806 and 1809 the firm began experiments with casting brass into small ingots. Casting brass bars required new types of molds. Cold rolling required considerable power. The first successful bar castings used for subsequent cold rolling were produced in this shop sometime between 1806 and 1809 he War of 1812 shut off the supply of rolled brass from Great Britain and stimulated domestic production.

Water wheels powered these small factories. Until 1849, the power of the Naugatuck River itself was not utilized except at Platts Mills in southern Waterbury (Anderson 1896:579). By that time, however, the importance of water power to the economy of the region was well understood. Timothy Dwight, president of Yale College, had this to say about the manufacturers in Waterbury:

> Several manufactures have been carried on in this town with spirit and success, particularly that of clocks. These are considered as keeping time with nearly as much regularity as those which are made from customary materials. They also last long; and being sold at a very moderate price, are spread over a prodigious extent of country, to the great convenience of a vast number of people, who would otherwise have no means of regulating their various businesses. Gilt buttons have also been made here in considerable quantities; not inferior in strength and beauty to those which are imported (Monagan 1993:20).

Clocks and buttons were the first major manufactured products in this portion of the Naugatuck valley. Several firms produced silver, pewter, copper, and brass buttons. Brass

button manufacture eventually led to the Naugatuck Valley's becoming a major center of the brass industry. Rolling mills such as those at Scovill Manufacturing Company and Benedict and Burnham Manufacturing Company, located along the Mad River in Waterbury, The American Copper Company on the Naugatuck River in Seymour, and Plume and Atwood on the Naugatuck in Thomaston began to produce brass for buttons and numerous other consumer and industrial goods.

Waterbury clocks were originally manufactured from wood. Wood clock parts were sensitive to humidity and swelled or cracked. Brass had been used for clock gears for centuries, yet mechanized brass clock manufacturing had not developed, largely because of the high cost of quality brass. By 1830 manufacturers marketed quality rolled brass at competitive prices. In 1833, Joseph Ives of Bristol, Connecticut started manufacturing clocks made entirely of rolled brass sheet and rejuvenated the clock industry which had suffered in the panic of 1837 (Hounshell 1984:57-59). Brass clocks, made using jigs, fixtures and particularly, more precise manufacturing techniques, became the industry standard.

By the 1880s Waterbury was churning out 1,000 watches per day (Monagan 1993:26). Thomaston was producing 100,000 clocks annually in 1880 (Rossano 1996:58). By 1895, the State of Connecticut produced 70 percent of America's rolled brass and copper. Seventy-five percent of the production was centered in the Naugatuck Valley (Kemmish 1995:38, citing the Valley Regional Planning Agency).

> A partial inventory, taken in 1897, of the manufactured goods pouring out of Waterbury and into the world at large reveals a fascinating and bedazzling array: oil burners, lamps, clocks and watches; plain and elastic webbing, buckles and garters; upholstery nails, drawer pulls, hinges; dress pins, safety pins, and buttons (ivory, cloth, and brass); bicycle pumps, valves, name plates, cyclometers, spoke nipples, chains, pedals, and other parts; rivets and burs, eyelets; ornaments for the millinery trade, for bookbinders, for makers of fancy leather goods; every variety of metallic trimming, powder flasks, fulminate caps, steel traps and cow bells; house boilers and plumber's fittings, harness trimmings; machinery for working sheet metal and wire into every possible shape, form and conditions, ranging from the heaviest rolling mills work down to delicate machines for minute screws and tiny articles of wire; sash, doors and blinds; sand-cast articles in brass and German silver; parts for incandescent lights; paper boxes, perfumery, silverware, stationery, drugs, and toilet articles (Monagan 1993:27).

The Naugatuck River once supported a populous and diverse assemblage of aquatic life, including several anadromous fish species. Anglo-American colonization of the river valley in the 17th and 18th centuries, culminating in the industrial revolution of the late 18th and 19th centuries, resulted in severe river degradation. Water was the major source of power, cooling and cleansing for mills and factories that sprang up within the valley. The resultant dam construction and pollution from tailraces and industrial sewage effectively destroyed the ecology of the watershed.

Project Objectives

During the late 20th century, public and governmental cognizance of the need for increased protection and preservation of the natural environment led to the creation of state and federal regulatory agencies to help enforce stricter environmental codes and procedures. Consequently, water quality within the Naugatuck River has improved to the extent that local fish and plant life are being restored (Gephard 1996; see also Gephard et al. 1994).

In 1981 the Fisheries Division of the Connecticut Department of Environmental Protection (DEP), in conjunction with the U.S. Fish and Wildlife Service undertook a project addressing the management of fishways around dams, and management of salmon in Salmon Brook and the Farmington River. The goal was eventually expanded to include management of all anadromous fish species in 1987 when the Fisheries Division initiated a long-term plan for fish restoration to Connecticut rivers (Gephard et al. 1994).

In that year it participated in the DEP/Water Management Bureau's establishment of water quality standards, the first step in restoring riverine ecology. In 1994 it developed a plan to restore anadromous fish passage and preferably free flow conditions to the Naugatuck River basin. The plan presently projects an annual run of 23,000 American shad and 220,000 alewives and blueback herring as well as benefits to other species such as sea-run brown trout, American eel, sea lamprey, white perch, small mouth bass, and white sucker.

Secondary goals include reduction of sediment deposition in impoundments; removal of safety hazards; reduction of flood levels; and improvements to recreational boating. The targeted geographic area is a 27-mile stretch of the Naugatuck River (Figure 2). It extends from the Kinneytown Dam in Seymour, about 4 miles upstream from the confluence of the Naugatuck and Housatonic rivers, to the Plume and Atwood Dam in Thomaston, about 31 miles from the river's mouth (Gephard 1996; Anonymous 1996; Milone and MacBroom 1998a:1-1- 1-4, 5-1-5-6,1998b:1-1-1-4,5-1-5-6, 1998c).

To facilitate this plan, DEP has contracted with the firm of Milone and MacBroom, Inc. (MMI) to coordinate efforts to eradicate physical obstructions to fish passage through the modification/removal of seven obsolete dams, or construction of fishways about them. Six dams are within the Naugatuck River, while the seventh one is situated within its tributary, the Mad River.

From downstream to upstream the dams are: the Falls Dam, Rimmon Dam)in Seymour; the Union City Dam (AKA Rubber Shop Dam) in Naugatuck; the Platts Mill, Freight Street, and Anaconda Dams in Waterbury; the Plume and Atwood Dam in Thomaston; and the Bray's Buckle Dam on the Mad River in Waterbury (Milone and MacBroom 1998a:1- 1, 1998b:1-1, 1998c). With the exceptions of Bray's Buckle dam and Tingue, medium head structures, these dams are low head designs.

Some of the dam sites date to the 18th century while the extant construction is 19th and early 20th centuries. They were built to divert water for industrial uses such as power generation, cooling, and/or rinsing activities within factory environments. All of the dams are obsolete;

none are in use and several are partially breached and/or in disrepair.

The Connecticut Historical Commission/State Historic Preservation Office (CHC/SHPO), the State regulatory agency for cultural resources (that is, archaeological sites), has reviewed the dam project. Noting that the proposed project area possesses moderate to high sensitivity for industrial archaeological resources, CHC has recommended that a professional assessment survey be undertaken to identify and evaluate archaeological resources that may exist within the project limits. Specifically, the Commission recommends that the construction and industrial history of each dam be explicitly detailed and pertinent photographic views be taken of each facility (Maddox 1997). The study is to be undertaken in accordance with the CHC's *Environmental Review Primer for Connecticut's Archaeological Resources* (Poirier 1987). Consequently, MMI contracted with American Cultural Specialists, LLC to conduct an Archaeological Assessment Survey of the project area. This report documents the implementation of the subsequent archaeological investigation, its results and conclusions.

It is presented in chapter form, beginning with a chapter on the general procedures, or methodology, of the assessment study. The Methodology chapter is followed by seven chapters, each of a specific dam site. Each of these chapters describes the surficial inspection and history of the dam and its adjacent properties, culminating in the archaeological conclusions regarding site significance and recommendations for further study. The final chapter summarizes the results of the entire dam study.

II. METHODOLOGY

On September 11, 1998 a surficial inspection of each dam site was conducted by Principal Investigator Dr. Lucianne Lavin, industrial archaeologist Robert Stewart, and MMI project manager Laura Wildman. Both color photographs and archivally processed black and white photographs were taken of the dams and their surrounding project areas.

Each dam and its locale were subjected to an intensive documentary study. The study included informant interviews, a search of archaeological site files, and research of primary and secondary written sources. Specifically, town historians, archaeologists, and local residents were consulted. The site files of the State Archaeologist were checked for the location of cultural resources within or adjacent to the project area. Detailed searches of town land records were performed for the respective properties.

Historical, insurance, and topographic maps were perused, as were other primary and secondary sources such as manufacturing censuses, state dam surveys, atlases, town and regional histories, archaeological literature, geological literature (i.e., USGS water power and water supply papers, unpublished soil boring analyses), newspaper clippings, unpublished materials on file with town agencies and historical societies, and aerial and vintage photographs. Repositories for the latter include The Seymour Town Library; The Whittemore Memorial Library in Naugatuck; Bronson Memorial Library in Waterbury; Sterling Library at Yale University, New Haven; Connecticut State Library in Hartford; Seymour Historical Society, Mattatuck Museum in Waterbury and the Naugatuck Historical Society. Historic aerial photographs were obtained from the Earth Center, U.S. Geological Survey, Reston, Virginia.

These sources enabled the authors to reconstruct the industrial history of each project area, particularly as it related to the origin and use of the associated dam. Judgments on archaeological significance and recommendations concerning additional archaeological investigations were based on this information, in conjunction with the projected impact within each area and the degree of site disturbance noted during the site walkover. The individual histories of each dam site and its associated properties are detailed below.

III. NAUGATUCK VALLEY DAMS

The Naugatuck Valley abounds in historic waterpower sites. Except for one site in this study, every dam studied had an associated system for conducting, storing and sometimes sharing water. In some cases headache canals carried water several thousand feet from a dam into large mill ponds or lakes. In other cases several short races distributed water to several industries concentrated in a small area. One observation is common to all sites; the waterpower systems indicate that, at least during the first two-thirds of the 19th century, industrialists used every bit of water power that could be developed at reasonable cost. As the factories grew and energy requirements exceeded the power available in the river, the mills went to steam engines for running their equipment; but most of them kept their old turbines and water wheels on line well into the 20th century. While the research did not uncover evidence of a watershed-wide agreement concerning water impoundment and use, land use records indicate that on a site specific basis, understandings as to the division of water rights were concluded among the owners.

Gradie and Poirier's study on *Small-Scale Hydropower Development* which concluded that New England industrialists understood waterpower in terms of systems of reservoirs controlling drainage flow through the watershed, is borne out in the Naugatuck Valley. On each individual site there is ample evidence of planning and cooperation designed to obtain maximum use of the available water power. Additionally, most of the sites exhibit the characteristics of a system used to control the available water. Dams are one component in that system which includes headwater, canals, headaches, penstocks, tunnels, control gates, governors, turbines, waterwheel, tail races and flow measuring devices. This report focuses on the dams and associated canals and races used to deliver water to the industrial sites.

This section details information on seven Naugatuck Valley Dams. For photograph identification, the dams have been assigned a letter identification as follows: Tingue Dam (A), Union City Dam (B), Platts Mill Dam (C), Bray's Buckle Dam (D), Freight Street Dam (E), Anaconda Dam (F), Plume & Atwood Dam (G).

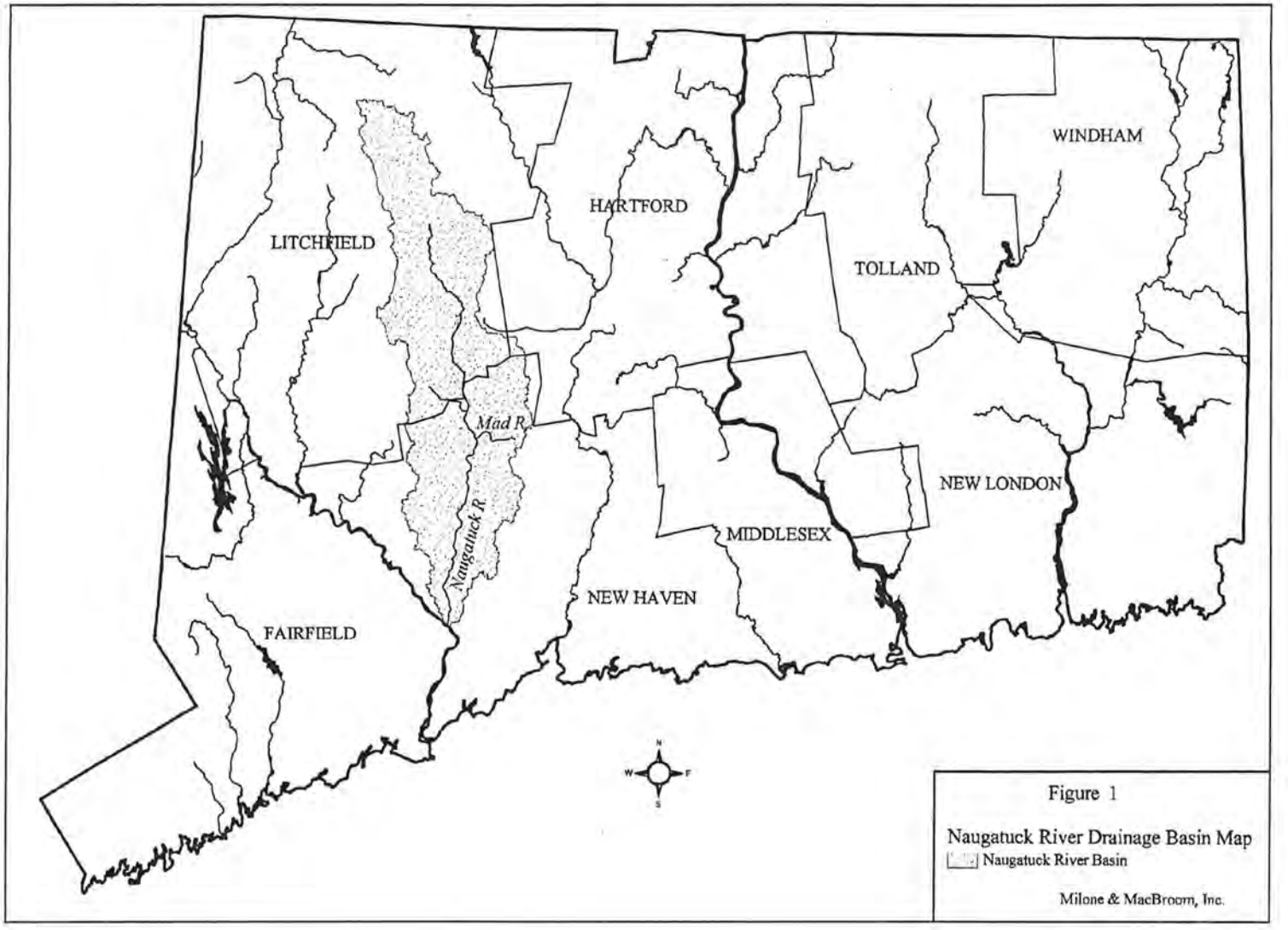

Figure 1

Naugatuck River Drainage Basin Map

Naugatuck River Basin

Milone & MacBroom, Inc.

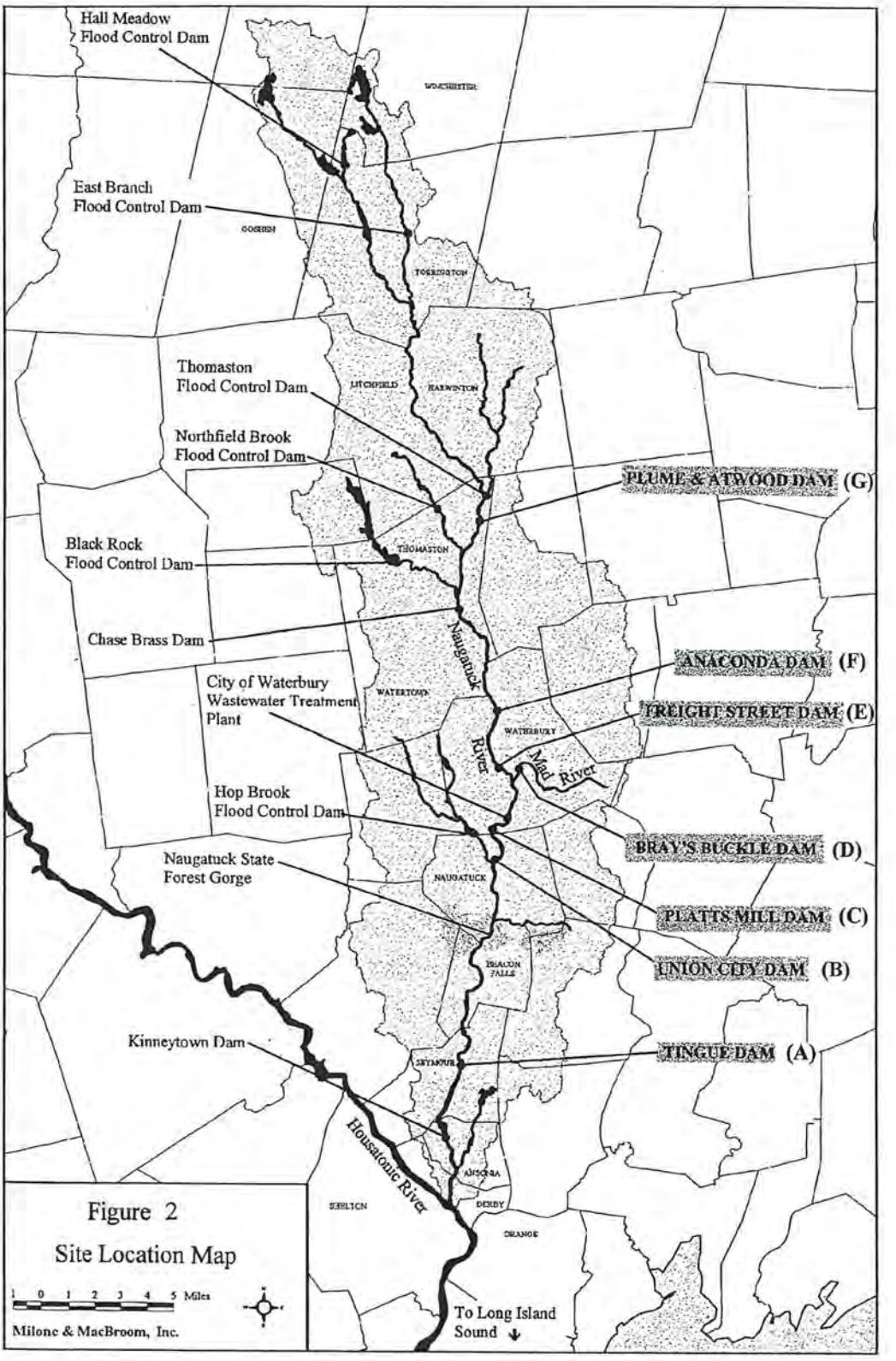

Figure 2

Site Location Map

Milone & MacBroom, Inc.

TINGUE DAM
(FALLS DAM, RIMMON FALLS DAM, RIMMON DAM)

Location: The Tingue dam is located on the Naugatuck River, at the place where Connecticut State Highway 8 crosses the Naugatuck River. City of Seymour, New Haven County, Connecticut.

UTM Coordinates: USGS Naugatuck, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.660820.4583930

Description: The Tingue dam is a run-of-the-river dam. It has a central stone masonry spillway, concrete spillway and intake structure constructed on irregular ledge. The 152-foot stone masonry spillway varies in height from five to 20 feet, averaging approximately 14 feet high. On the southwestern end of the dam is a 57-foot wide section of natural ledge spillway that varies in elevation, but is a maximum of three feet lower than the crest of the stone masonry spillway. To the northeast of the central stone masonry spillway the crest of the dam turns 90° to the east along a small section of exposed ledge. The crest of the dam than continues along a 26-foot long reinforced concrete wall. Directly to the east of this wall is an abandoned factory intake structure. The factory that utilized the water impounded by this dam has been demolished and replaced with a paved parking lot.

Dates of Construction: circa 1763 (1803) to 1955,

Present Owner: New Haven Copper Company owns riparian rights, contingent on their use. The State of Connecticut owns the land on which the dam is located.

Present Use: Unused and abandoned.

Significance: The Tingue Dam provided power and process water to a small but significant 18th and 19th century industrial complex. In the late 1700s the site provided power for a grist-mill, sawmill, paper mill, woolen and cotton mills. In the last quarter of the 19th century, Tingue Manufacturing Company used the water impounded by the dam for generating power and for scouring, bleaching and dyeing woolens. Water power was used by G. French (Railroad) Car Spring factory, William Smith's Machine Shop and the Excelsior Staple Company. The U.S. Pin Company used water power as did The Norman Sperry Auger Manufactory. The New Haven Copper Company used both water power and process water for refining, stamping and rolling copper and brass products. The site is significant as it is an unusual example of intensive development and full use of water resources on a small site for manufacturing.

A. TINGUE DAM

Historical Context

In the early centuries of colonization this area was originally part of the Town of Derby. The dam has been referred to as the Falls Dam, Rimmon Falls Dam, and the Rimmon Dam in some of the cited literature. Rimmon Dam is a confusing term, as it has also been used to refer to the later dam located north of the Tingue Dam (pronounced Tin-you); the Rimmon Pond Dam which formed the large lake-like Rimmon Pond. That dam was destroyed in the 1955 flood; vestiges of the old factory pond are still extant. Figure 3 shows the location of Tingue Dam and the surrounding topography.

The original waterfall at the site was referred to as *Rimmon Falls* prior to its damming. The name *Falls Dam* refers to the fact that the dam was built into some natural falls in the river. The dam connects two natural bedrock ledges, as shown in a sketch of the area included in the Dam Survey Form attached to a 1996 DEP Interoffice Memorandum (1998c; see Figure 4).

The rock ledges that extended across the river formed a natural falls of almost 20 feet at their peak. They acted as a natural bottleneck to anadromous fish swimming upstream to spawn; the high concentration of shad and herring during the spring runs was a major food source for Native Americans who congregated at the falls. The Indians supposedly frequented caves under the Falls that once connected with Castle Rock to the southwest, the highest lookout point in the area (Ales Summer, curator of the Seymour Historical Society, personal communication September 21, 1998).

Even after selling their lands in the north Derby area (now the Town of Seymour), the Indians still reserved the right to camp and fish at the Tingue Falls. Joseph "Chuse" Mauwehu, a Schaghticoke Indian, had a house and planting fields on the east side of the river, along with several other Native American families. This section of town was originally known as Chuse town, after Chuse Mauwehu. The Indian property extended from the river to the hill on the east known as Indian Hill. An Indian burying ground was located nearby on the flat of the river. Originally the graves were marked by heaps of stones, but plowing by later Euro-American owners destroyed the markers. A second Native burying ground was supposedly located halfway up the north side of Indian Hill (Campbell et al. 1902:25-26).

In 1760 Mauwehu and, John How, apparently the chief men, conveyed to Thomas Perkins of Enfield and Ebenezer Keene, Joseph Hull Jr., and John Booster of Derby an acre of land on the east side of the river near the Falls, including water rights for the purpose of building an ironworks which was never established. In 1763 they conveyed to Keene, Hull and Booster a one and a half acre parcel of land in their planting fields (Campbell et al. 1902:152). It was located *"near the east side of the Naugatuck River, near the place called the Falls; all the land that lieth eastward, northward and southward except the plain that lieth near the Falls up to the foot of the hill."* The italicized portion of the deed indicates that the Indians retained control of the Falls, burying ground, and a portion of the planting fields (Kemmish 1995:5, 26-27,citing the Derby Land Records; italics added for emphasis).

Sometime thereafter, the owners built a dam and a fulling mill, then a saw mill and a grist mill. The original dam was built with timber and plank. In 1785 John Wooster and Bradford Steele leased for 999 years a parcel of land at the Falls on the east side of the river for the purpose of establishing a blacksmith shop. The shop equipment included a water powered trip hammer. The shop also produced scythes. According to Campbell et al., the deed stated that the property was next to the river with fifty feet of it fronting the flume. About five years later, Nathan Stiles bought Wooster and Keeney's rights to the property at the Falls. This tract contained a saw mill, grist mill, two fulling mills and clothiers shop upon it. The stockholders in this company consisted of Stiles, George Steele, and Bradford Steele Sr. and Jr. (Campbell et al. 1902:152-53, 166).

In 1803 Bradford and George Steele conveyed to Col. David Humphreys "one certain piece of land lying in said Derby at a place called Rimmon Falls -- it being the same tract of land formerly deeded by John Howd and Joseph Chuse, Indians, to John Wooster, Ebenezer Kinney and Joseph Hull, Jr. As may appear a particular description refer to said Records; together with all the privileges, together with the sawmill, two fulling mills, clothier's shop and all the utensils, implements, and apparatus belonging to and used in the appendant and appurtenant in and to said mills and clothier's shop on said land, together with the whole mill-dam across said Rimmon Falls (from the Derby Land Records, as cited by Katherine Matthies, n.d.:2 and by Campbell et al. 1902:153)."

As the United States Minister to Spain from 1797 until 1802, Humphreys discovered the high quality of merino wool. He imported merino sheep to Derby and, to encourage their use by local farmers, bought and expanded George Steel's fulling mill complex in what is now the town of Seymour. Humphreys formed a partnership with Thomas Vose and English woolen specialist John Winterbottom, specifically for the manufacturing of merino woolens. In 1806 they constructed a four-story factory building which is shown in a woodcut of Seymour (Humphreysville) in 1812 (Figure 5). The 18th century saw mill was located "a little west" of the woolen factory (Anonymous 1907). The business was known as T. Vose and Company.

The factory produced some of the finest broadcloths in America. The enterprise was so successful that a small village grew up about it. Called Humphreysville, it consisted of boarding houses and residences for the mill workers, three stores, a post office, a cotton factory, the area's first paper mill and a grist mill as well as the Woolen factory.

President Thomas Jefferson bought five and a half yards of deep blue broadcloth for his suit to be worn at the 1809 New Year's reception at the White House. In 1810 Humphreys and his partners incorporated under the name The Humphreysville Manufacturing Company (Anonymous 1907, 1909; Campbell et al. 1902:59-60, 155,163; Kemmish 1995: 27-32; Matthies n.d.).

Timothy Dwight, President of Yale College, described the Company holdings after a visit in 1811:

> At this place a ledge of rocks twenty feet in height crosses the river, and forms a perfect dam for about two thirds of the distance. The remaining third is closed by an artificial dam. The stream is so large as to furnish an abundance of water at all times for any works which will probably ever be erected at this spot.
>
> Those already existing are a grist-mill, a sawmill, a paper-mill, woollen manufactory, and a cotton manufactory, with all their proper appendages, and a considerable number of other buildings, destined to be the residences of the manufacturers, and for various other purposes.
>
> A strong current of water in a channel, cut through the rock on the eastern Side, sets in motion all the machinery employed in these buildings. By this current are moved the grist-mill; two newly invented shearing machines; a breaker and finisher for carding sheep's wool; a machine for making ravellings; two jennies for spinning sheep's wool, under the roof of the grist-mill; the works in a paper-mill; a picker; two more carding machines for sheep's wool; and a billy with forty spindles in a third building; a fulling-mill; a sawmill, employed to cut the square timber, boards, laths, etc. for the different edifices, and to shape many of the wooden materials for the machinery; two more fulling mills on improved principles, immediately connected with the clothier's shop; and the various machinery in a cotton manufactory, a building about one hundred feet long, thirty-six wide, and of four stories, capable of containing two thousand spindles with all their necessary apparatus.
>
> The houses can accommodate with a comfortable residence about one hundred and fifty persons. Ten others in the neighborhood will furnish comfortable residence for upwards of one hundred and fifty more (Campbell et al. 1902:155-156, citing Dwight's Travels (3):37).

Two years after the death of Humphreys in 1818, his widow sold the land on the west side of the dam to his nephews John and William Humphreys. In 1822 she sold the mills for $10,000 to John DeForest, Lewis Waln, and J. Fisher Leaming, who became the shareholders and officers of The Humphreysville Manufacturing Company (Kemmish 1995:34-35). The latter company consisted of a complex of buildings devoted mainly to the production of augers and bits (Campbell 1902:174). The remaining mills passed through a series of owners who continued to utilize them as a saw mill, grist mill, paper mill and textile mill for the manufacture of cotton cloth, brocatelle (jaquards), worsteds, and silk.

In 1845, William Buffum bought the cotton factory and paid an annual lease for water rights sufficient to drive a waterwheel (Derby Land Records 1845 (32):98). In 1850 the Eagle Manufacturing Company constructed a brick textile mill with a cupola near the dam; it produced silk, cotton and wool cloth. In 1853 the cotton factory was sold back to Humphreysville Manufacturing Company. Also in 1853 George DeForest bought the grist and saw mills. In that year at least six water wheels were in operation at the industrial complex at the Dam. The Eagle Manufacturing Company went out of business and its brick

mill was leased to James Leigh for the manufacture of silk goods, after which it lay dormant for several years.

In the 1860s the mill was taken over by the Zurcher brothers under the company name Kalmia Mills, a manufacturer of worsteds. The 1868 Beers Atlas of New Haven County shows the Tingue Dam with the Kalmia Mills complex adjacent to it, consisting of the long brick mill, two smaller office buildings and a third small unidentified building. In 1870, Kalmia Mills went out of business. In 1880, its buildings were sold to the Tingue Manufacturing Company, a manufacturer of plush from mohair, the fleece of the Angora goat native to Asia Minor. It was the first American company to produce such goods (Campbell et al. 1902:Kemmish 1995:36- 39). Figure 6 shows a well developed industrial complex with a system of canals providing water for power and process use to the Kalmia mill, a railroad car spring factory, the New Haven Copper Works, U.S. Pin factory, Humphreysville Auger & Tool Co. and the Vulcan Nail Co.

Other parts of the Humphreysville Manufacturing Company property became the sites of major metalworking complexes. In 1844 the firm of Dwight, French and Company acquired a portion of the property. In 1848-49 it formed The Humphreysville Copper Company, the forerunner of the New Haven Copper Company, and built a large stone mill for the manufacture of braziers and sheathing copper on former Native American planting fields (Campbell et al. 1902:157, 179). The property may also include the old Indian burying grounds on the flat (Alese Kummer, curator, Seymour Historical Society, letter dated September 21, 1998). The Humphreysville Copper Company held a 999 year lease from The Humphreysville Manufacturing Company on land and water rights. The latter included the right to one fourth of the water power generated by the dam and mill pond, and the right to construct canals and raceways to facilitate the water power.

The Federal Census of Manufactures for 1850 listed the Humphreysville Copper Company as producing 300 tons of rolled copper by water power. In 1860, its production rate doubled (Kemmish 1995:38, citing the Federal Census for Manufactures). By 1900 the company's holdings were quite extensive (Figure 7). The principal buildings included a main rolling mill 100 x 200 feet with ten rollers; the stamp shop was 50 x 70 feet, the polished copper shop was 50 x 90 feet, and the forging room-bit and auger shop was 60 x 125 feet. The main sources of power were turbines; the rolling mill also had a steam engine and boilers, and the auger shop included two gasoline engines (Campbell et al. 1902:180).

In 1845 Raymond French and his associated purchased land and water rights near the Falls and built a large brick mill and office building to accommodate the manufacture of augers, bits, plane irons, chisels and knives. In 1847 they formed the firm of French, Swift and Company. In 1850 French rebuilt the dam in "solid masonry" (Campbell et al. 1902:161,166). In 1852 the American Car Company, a manufacturer o put up five large buildings on the flat below the dam. The Company moved to Chicago in 1855, and its buildings were used by a number of small industries and commercial ventures such as retail stores and a hotel known as The Windsor. The American Car Company power shop eventually became a mill for the manufacture of pins known as The United States Pin Company in 1860.

Other small businesses in the mid-19th century dam industrial complex included a corrugated car spring manufactory (located in the basement of Humphreys old cotton mill), a manufacturer of tools for turning ivory, brass and rubber, and a factory for the manufacture of augers and bits operating at mid-century as Dwight and French and in 1890 as Norman Sperry, Auger Manufactory. James M. Smith's Machine Works, located in the Humphreys mill, produced lathes and tools for turning hard rubber, ivory and brass, patent drill chucks, patent boring tool holders and other special machinery.

Gilbert and Wooster forged the bits in the blacksmith shop located near the rear of the copper mill. The polishing was conducted with machinery in the nearby saw mill. In 1900 The Horn Button Works was established by George C. Lees in the Humphreys mill (Campbell et al. 1902:158-159, 161,171, 186, 187; Kemmish 1995:39).

In 1866 The Fowler Nail Company was founded for the manufacture of Vulcan horseshoe nails. The company originally worked out of the Humphreys mill. But the reputation of the machine pointed nails created such a national demand that by 1900 the company consisted of several discrete buildings (Campbell et al. 1902:174-175).

Also in 1866, the H.P. and E. Day Company was founded by brothers Henry and Edmund Day. They were cousins of Charles Goodyear, who invented the process of vulcanizing rubber (that is, the process by which hard rubber is produced). The Days, with their brother Austin who invented a substance for insulating wires known as Kerite and founded the company of that name in Seymour, collaborated with Goodyear on improving the processes of rubber manufacture. The Days specialized in cleaning East Indian and Central American varieties of rubber by a patented process to facilitate its manufacture by other companies.

Goodyear was more interested in the manufacture of soft rubber. Future developments in hard rubber manufacture he entrusted to the Days. The Day factory was originally located in the brick shop southwest of the pin factory. It manufactured a variety of vulcanized hard rubber goods. The invention of the steel nib (dip) pen spurred the Days to invent a hard rubber pen holder with removal cap for use with the new nib.

The invention brought the H.P. and E. Day Company into the writing instrument field. Other inventions and designs, such as the first mechanical pencil and all rubber fountain pens, placed the company in the forefront of the Stylograph and fountain pen industries.[1] (Anonymous n.d.; Campbell et al. 1902:185, 246, 282, 288; The Evening Sentinel 1921:17). However, F.S. Waterman's invention was superior to other fountain pen designs, regulating the flow of ink and air to produce a more reliable pen. The Days collaborated with Waterman to produce the famous Waterman fountain pens with hard rubber parts, which were first manufactured in the factory in Seymour.

A 1917 pamphlet published by the L.E. Waterman Company on the 34th anniversary of its

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[1] A stylograph was a pencil-like pen whose body contained a reservoir of ink that flowed through a tube to its writing point; the forerunner of the "ball point" pen.

inception includes a photograph of its "first factory", which is in fact a photograph of the Humprheys woolen factory (L.E. Waterman Company 1917:4). In 1907 the old Humphreys woolen mill was scheduled to be torn down to make way for the erection of a four story concrete building by H.P. & Day, Inc. (Anonymous 1907). The H.P. and E. Day Company was purchased by L.E. Waterman Company in 1946. Three multi-story cement structures were built and, at one point, all of the Waterman manufacturing operations were consolidated at Seymour (Anonymous n.d.).

The New Haven Copper Company, purchased the Waterman Pen plant, demolished parts of it and expanded their mill into the former factory site. New Haven Copper retains most of its original 1890 site, but the original buildings have been replaced or extensively modified. One of the old Waterman Pen Company buildings is presently the Fallview Apartments. According to Alese Kummer, curator of the Seymour Historical Society, the old canal remnants still exist below the building (Kummer, personal communication September 21, 1998).

In 1958 the State of Connecticut (Department of Transportation) acquired rights to the dam and properties on both sides of the river from Tingue Mill Inc. for relocating Route 8. The State-owned property on the west side of the river is adjacent to the dam and on the east side it is just north of the dam but includes a portion of the old gate house.

The land south and east of State property in the project area belongs to New Haven Copper Company (Town of Seymour Land Records 1985, 137:961). The present owner of the water rights to the Tingue Dam is the New Haven Copper Company (New Haven Copper Company 1989; State of Connecticut, Department of Environmental Protection 1988; State of Connecticut, Department of Transportation Memorandum 1995).

Ownership is contingent, however, upon its building a hydroelectric power facility on its property adjacent to the dam (CT Department of Transportation, Office of Rights of Way 1994a; Koontz 1994; Orvis 1995). Otherwise the dam and water rights revert back to the state, which owns the property within the Route 8 Right of Way (State of Connecticut, Department of Transportation, Office of Rights of Way 1994b). In a 1998 meeting with the Town First Selectman and a representative of Milone & MacBroom, Inc., an agent of the New Haven Copper Company stated that the firm does not intend to build a hydroelectric facility at this dam (Laura Wildman - personal communication May 27, 1999).

According to the 1985 quit-claim deed, the State of Connecticut released "those certain water rights, storage water rights Falls Dam rights, together with appurtenances, and permanent flow rights on both sides of the Naugatuck River, appurtenant to land of The New Haven Copper Company situated in the Town of Seymour, County of New Haven and State of Connecticut, on the easterly side of Route 8 in order that The New Haven Copper Company may construct a power facility. In the event that said water rights are not used for said power facility, or said power facility is not constructed, this Deed shall become null and void (New Haven Copper Company 1985; Town of Seymour Land Records 1985 (36):242-243, (37):254-255)." The map attached to the deed shows the location of remnants of the old canal system on the east side of the river.

The abandoned canal extends from the ruins of the old intake building within the project area eastward beneath the parking lot and beneath buildings on New Haven Copper Company property, outside the project area (Figure 8). In 1994 Southern New Hampshire Hydro, Inc. (SNHH) and Keegan Construction had proposed to construct a hydroelectric power plant at the dam (Gephard et al. Department of Transportation Office of Rights of Way Memorandum 1994).

Surficial Inspection

The first dam at the site was built in 1763. Major modification and reconstruction occurred in 1803. Other episodes of repair and renovation followed with the most recent proposal being installation of a hydropower generating station in 1994. The 25-foot fall at Tingue gives a power potential of 400 hp. In 1880 310 hp was being generated at the dam (Kemmish 1995:21).

The present dam is located in Seymour, Connecticut on a sharp channel bend of the Naugatuck River. A Route 8 highway bridge stands over the dam. Nine six-foot diameter concrete piers which support the highway are located within the general locality of the dam. These piers and the highway bridge were constructed in the 1950s.

Four hundred and ninety feet downstream of the dam, Broad Street crosses the river. River Street borders the western edge of the river. Several office, residential and factory buildings and a large parking lot, located on the site of the former industrial complex are situated to the east of the dam (Milone & MacBroom 1998:7-1). The eastern end of the dam is at the point of the concrete wall washed out during the 1955 flood. There is no evidence that the stone masonry spillway has been patched and the reinforced concrete wall does not seem to be consistent with the rest of the dam's construction (Milone & MacBroom 1998:7-3).

The present Tingue Dam is a 270-foot long run-of-the river dam of stone masonry and concrete construction which incorporates a central stone masonry spillway, concrete spillway, and disintegrating intake structure built on an irregular ledge. It impounds an area of six acres. The 152-foot stone masonry spillway varies in height from five to 20 feet, averaging approximately 14 feet high. The southwestern end of the dam is characterized by a 57-foot wide section of natural ledge spillway that varies in elevation, but exhibits a crest three feet lower than the crest of the stone masonry spillway. To the northeast of the central stone masonry spillway the crest of the dam turns approximately 90° to the east along a small section of exposed ledge. The crest of the dam continues along a 26-foot long reinforced concrete wall that is in poor condition (Milone & MacBroom 1998:7-1).

Two low-level outlet structures go through the stone masonry portion of the dam about 12-feet below the top of the dam. These are 30-inch wide by 60 inch wide rectangular steel conduits recessed back six feet from the downstream face of the stone masonry. One recess is a four foot high by six-foot wide box and the other is a 16-foot wide arch (Milone & MacBroom 1998:7-2).

Conclusions

Milone & MacBroom recommends the construction of a bypass channel to provide fish passage around the dam. The bypass channel would also furnish recreational boating opportunities. Perusal of the archaeological site inventory of known archaeological sites located in the Office of State Archaeology indicates no known prehistoric sites within 1.5 miles of the project area (OSA:nd). The project does fall within the recently proposed Seymour Historic District.

Borings conducted by General Borings, Inc. (1998) of Prospect, Connecticut for Milone and MacBroom, Inc. in the project area on the east side of the dam in several cases contained brick. Hole #B-3 contained traces of brick within its uppermost two feet of soil below blacktop. Hole #B-6 contained bricks within its upper five feet of soil. Hole #B-15 included brick traces within its uppermost few feet. The borings indicate the presence of factory buildings within the area. Unfortunately they do not indicate the degree of soil disturbance since they do not provide the exact provenance of the brick within the boring.

The dam provided water for process and power to a medium-sized industrial complex in the late 19th century. Consequently the area is heavily disturbed and it is unlikely that an significant artifacts of an industrial nature could be recovered by excavation. Turbines are the exception to this generalization. They have low salvage value as the cost of removal usually exceeds scrap value. They are often built over or buried in place. In general, significant industrial artifacts such as old machinery have high scrap or resale value and are salvaged.

However, a small area of the site that may be undisturbed might possibly yield significant prehistoric cultural remains. The area was part of lands once belonging to Joseph "Chuse" Mauwee, a younger son of the first recorded Schaghticoke sachem Gideon Mauwee. According to Campbell, Sharpe and Bassett (1902:26-27), Chuse lived with several other families on this plot in "wigwams" in the mid-1700s. The falls area was an important fishing place, so much so that when the Paugussets sold the adjacent lands to the English in 1678, they reserved the "fishing place" for themselves, along with the hill and plain adjacent to it (Ibid pp. 20-21). The deed suggests that the falls area was probably an important fishing area during prehistoric times as well.

There is a roughly triangular piece of land about 100 feet on a side that may not have seen significant development or disturbance other than several feet of earth fill (shaded area on Figure 9). This observation is based on examination of insurance maps from the late 19th century and aerial photographs dated 1949. This area was landfilled, leveled and covered with paving. This possibly undisturbed section of land has a high archaeological sensitivity as a prehistoric and early historic Native American site. However, it is covered by several feet of fill and paved. Current plans call for removal of the paving and creation of a grass covered picnic area. Careful removal of the asphalt with minimal disturbance of the underlying fill would make subsequent archaeological excavation practical prior to contouring and landscaping the proposed park.

Recommendation

If the above triangular piece of land will be impacted by construction activities under the current or future design plans, we recommend a Phase I archaeological reconnaissance survey to locate and identify any undisturbed material remains of prehistoric or historic Native American activities.

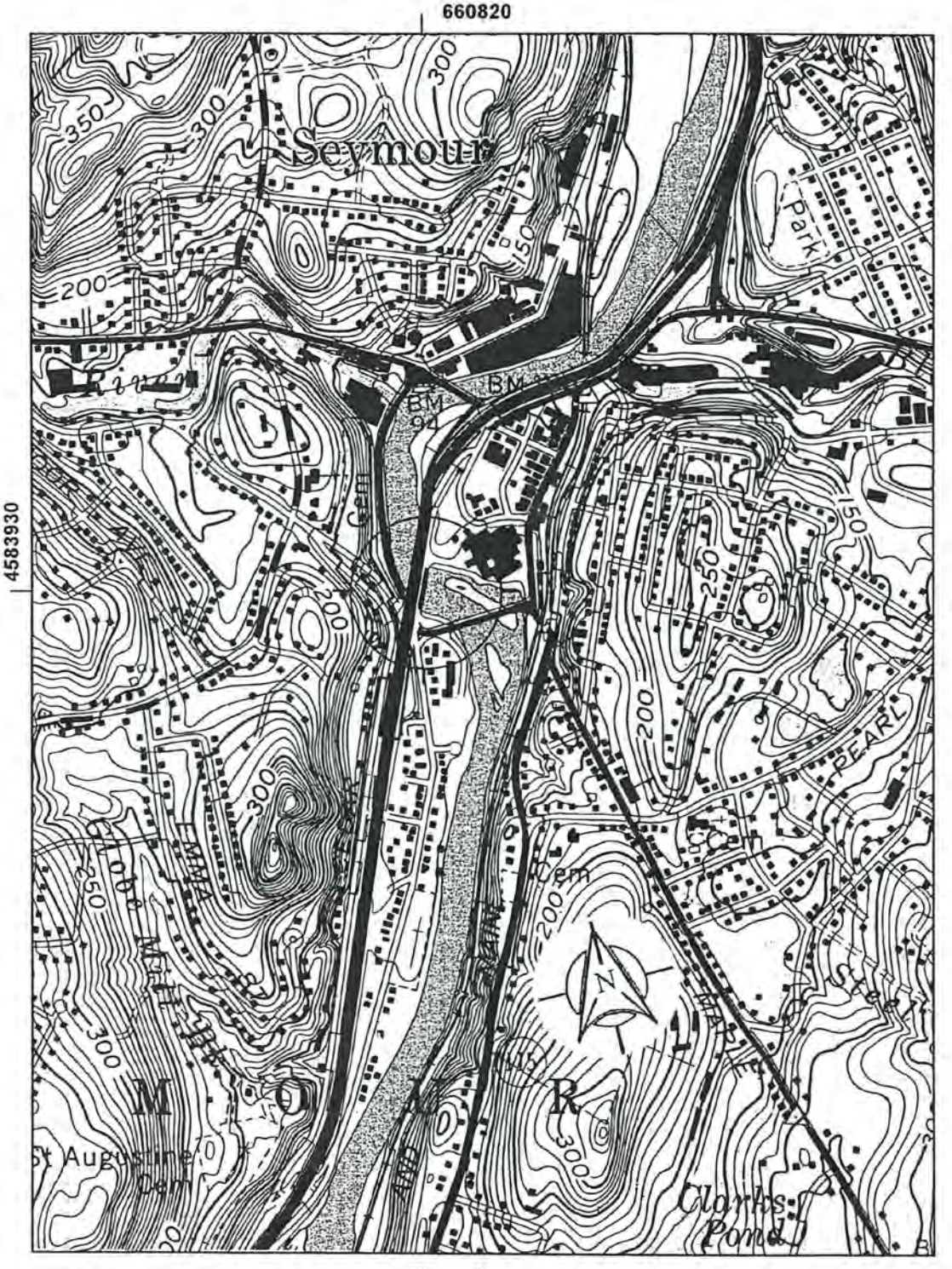


Figure 3

Location Map: Tingue Dam, Seymour, Connecticut - Quadrangle: Naugatuck, CT - 1:12000

DAM SURVEY SUMMARY FORM

Fish Passage Field Sheet

Dam name Tingue Dam (AKA "Rimmon") Dam No. 12413

Stream NAUGATUCK RIVER Town SEYMOUR

Dam owner CT DOT Use ABANDONED

Approx. Height 19' Approx. Length ?

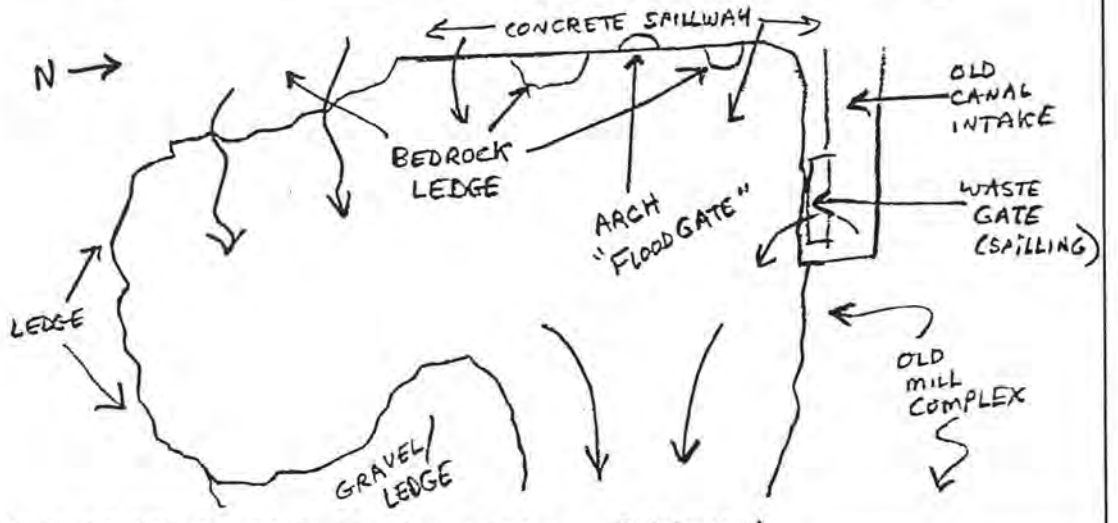
Construction material of dam/spillway CONCRETE / LEDGE

Is this structure currently a barrier to fish passage? YES

If yes, at all flow or just some? ALL

Sketch Dam:

RT. 8 overpass



Type of likely fish passage action FISHWAY

If fishway, what type and where? SOUTH BANK, 4 Ft. Denil *

Other fisheries issues?

Indicate location on a map photocopy, attached.

SG 5/14/96

* COST ESTIMATE: $260,000 – $400,000

Figure 4

Tingue Dam - Survey Summary Form. Source: File Number 124-94-23B - Connecticut Department of Transportation.

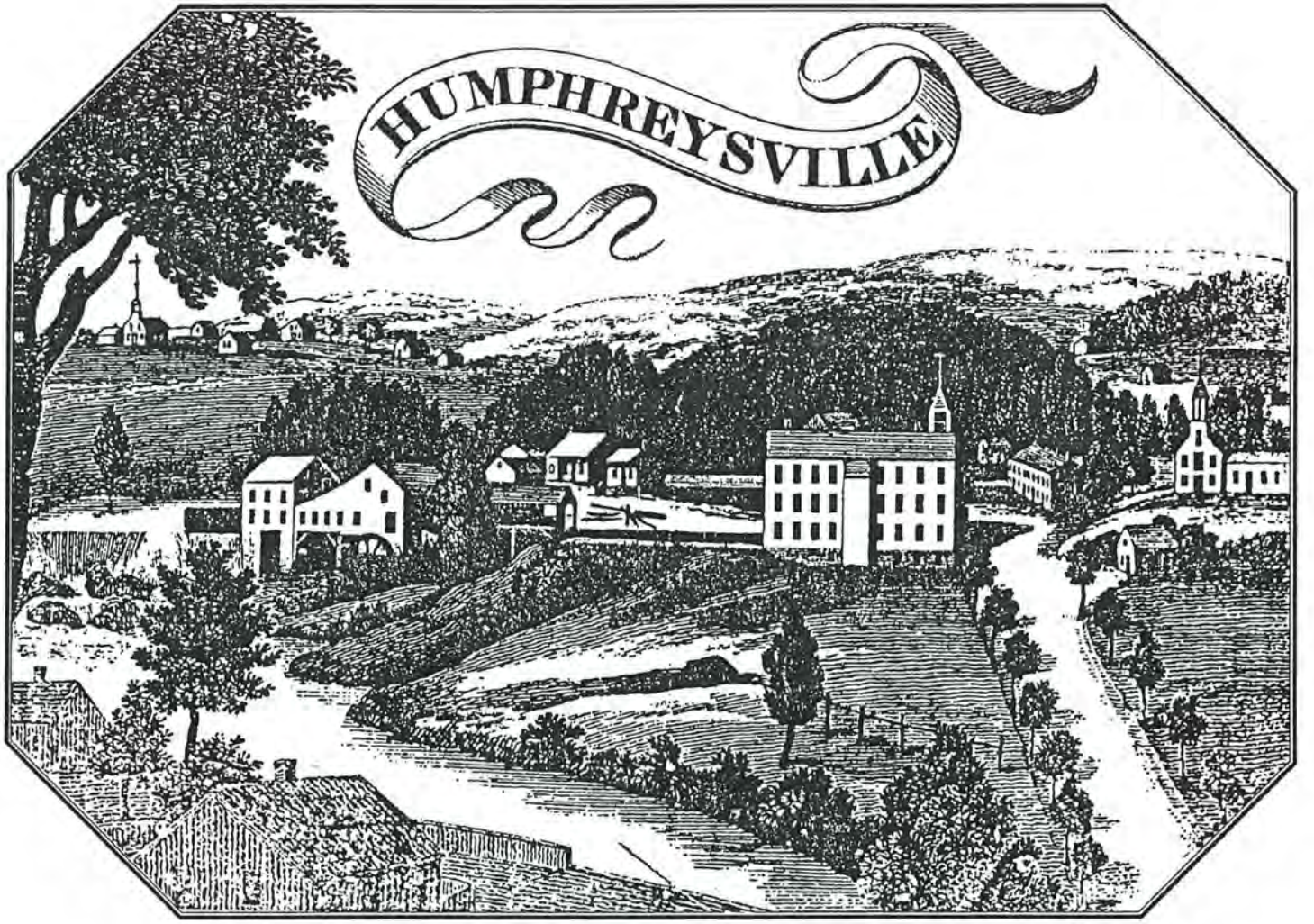


Figure 5
Woodcut of Seymour (Humphreysville) in 1812. The building at right center was erected by David Humphreys, Thomas Vose and John Winterbottom in 1806 to manufacture woolens using fine Merino wool. Falls Dam (later Tingue) provided power for the mills in the area (Kemmish 1995:1).

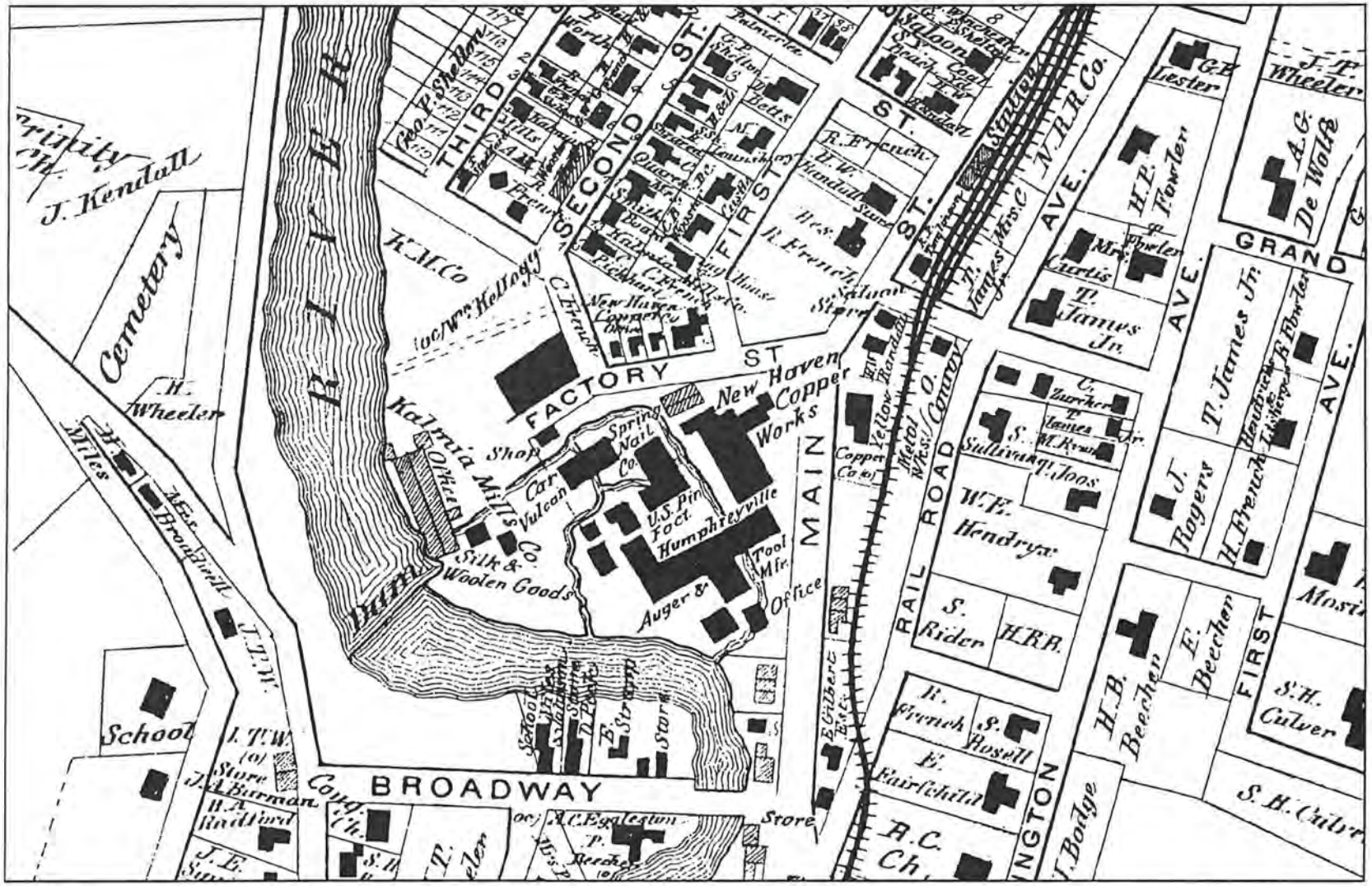


Figure 6 - Industrial complex - Seymour, Connecticut, 1868. Note that Kalmia Mills Co. is the predominant textile manufacturer. Kalmia Mills made fine worsted fabrics. Kalmia failed in 1870 and in 1880, the buildings were sold to the Tingue Manufacturing Company. Tingue manufactured plush fabric from mohair. Also note the well developed system of canals providing water for power and process use to the buildings in the complex. (Beers Atlas of New Haven County - 1868)

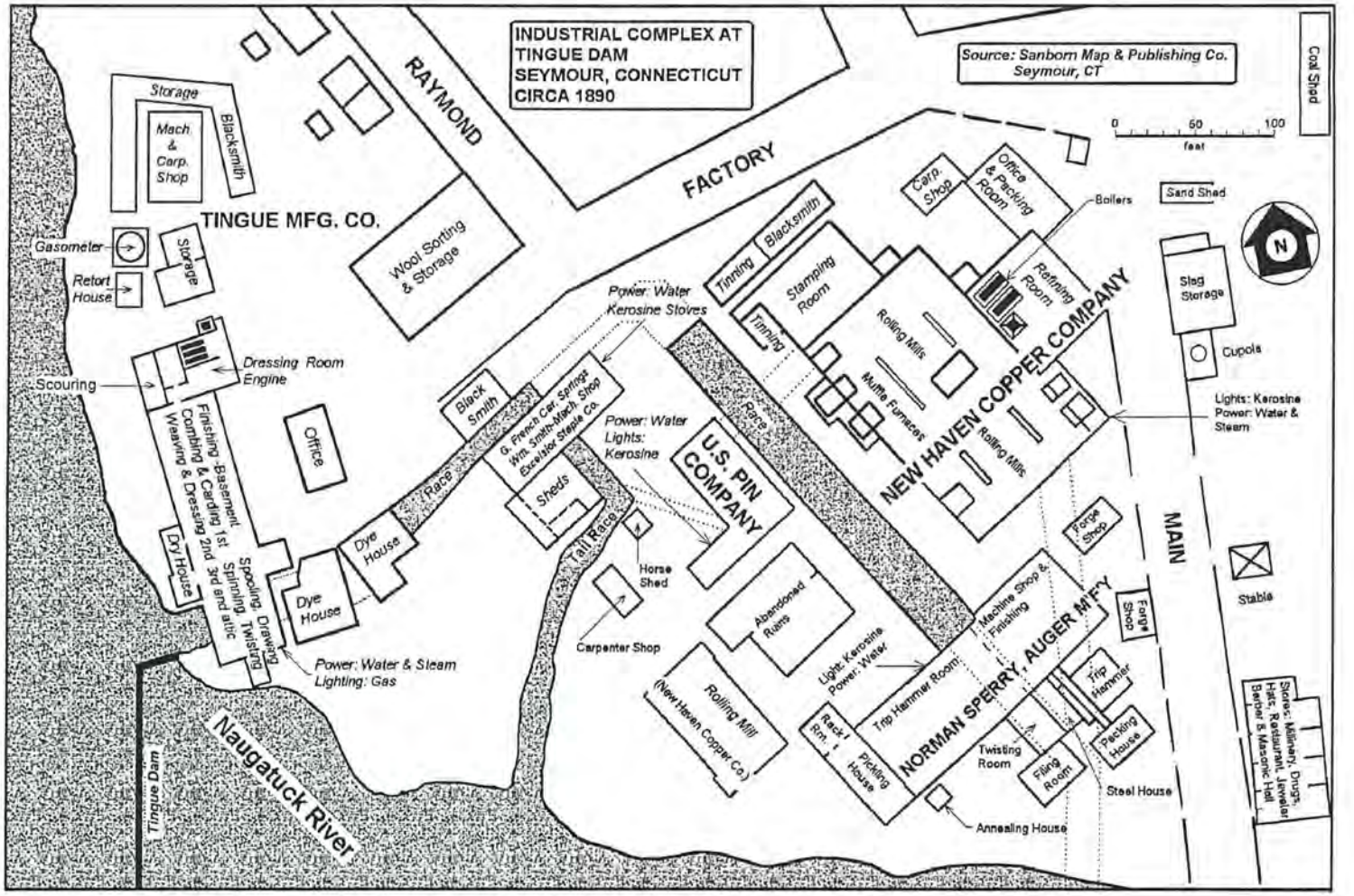


Figure 7 - Reconstruction of industrial complex at Tingue Dam c. 1880. Note that the former open canal system has been partially replaced by closed penstocks. The Tingue mill has its own gas generating plant for lighting. Other factories are using kerosine for lighting. Water power, probably generated by turbines, predominates but is being replaced by steam in some plants. The location of the New Haven Copper Company's tailrace is conjectural - based on Sanborn's information that water power was used in the mill.

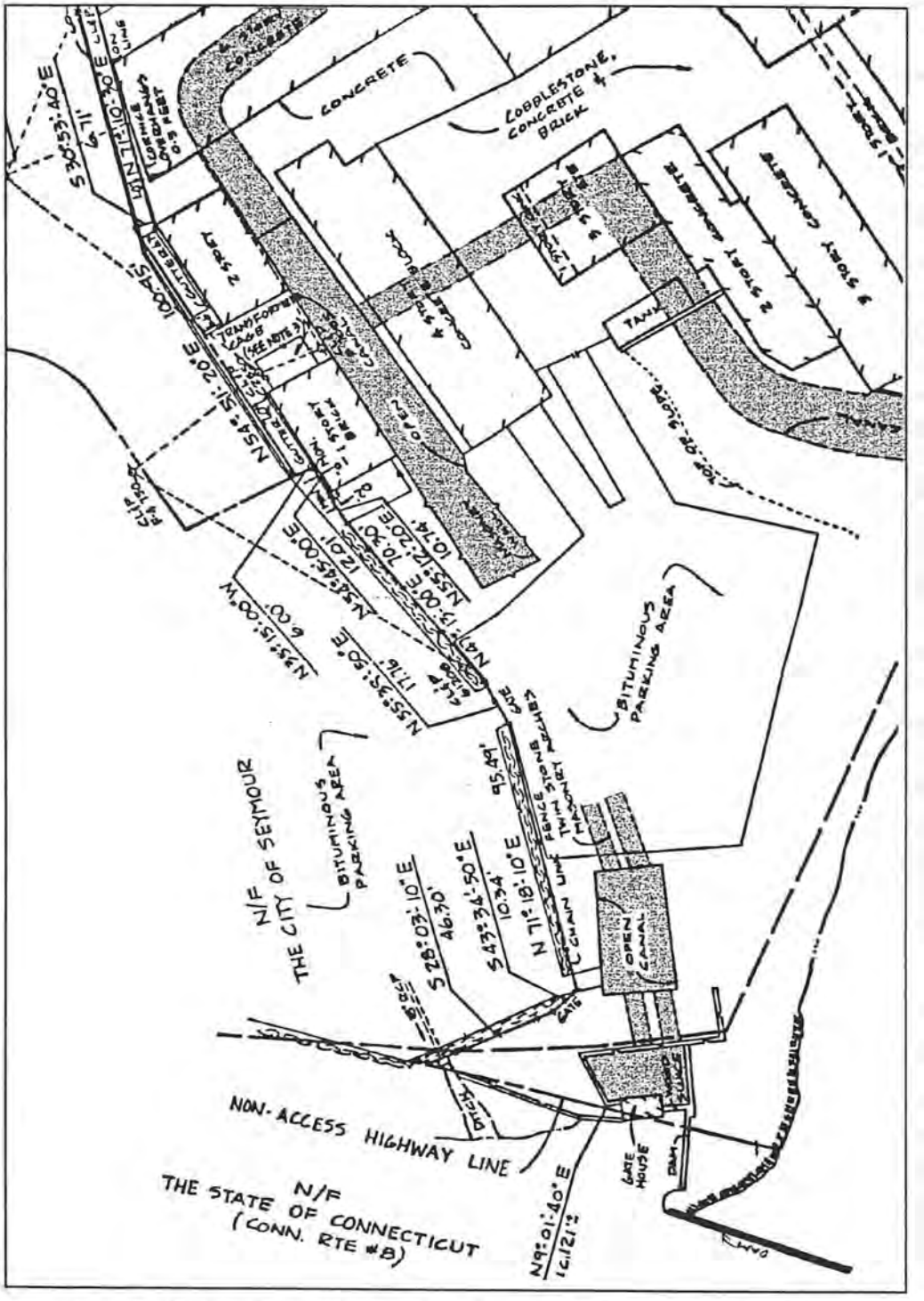


Figure 8 - Map from Town of Seymour Land Records 1985 (36) : 242-243, (37) : 254-255). The map shows that in 1985 remnants of the canal system were open and the location of some buried sections documented. Except for the intake structure, all portions of the canal system are now (1999) covered or removed.

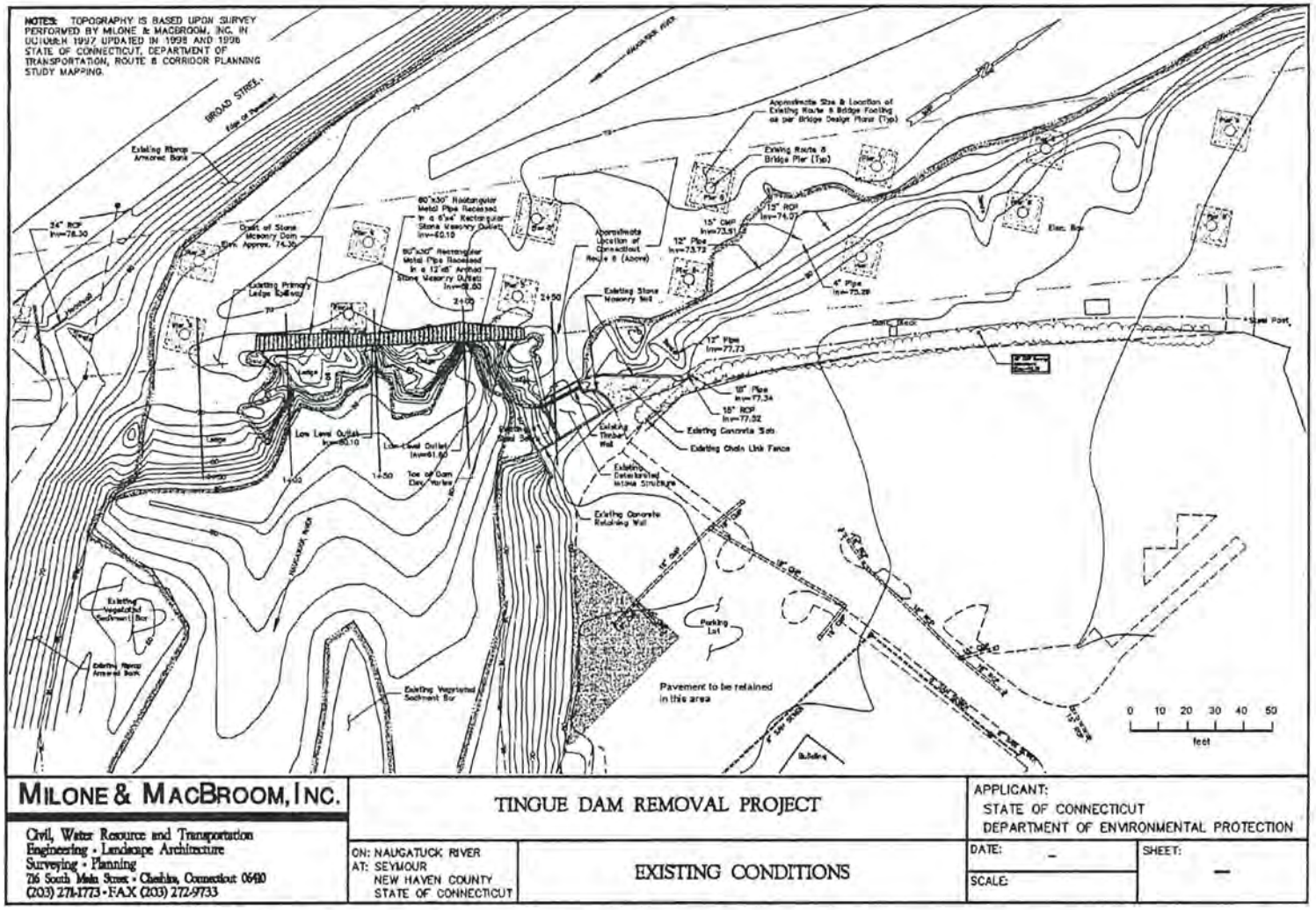


Figure 9 - The shaded area represents a site of possible archaeological sensitivity. Examination of insurance maps, tax maps and aerial photographs shows that this area did not undergo industrial development. Adapted from a Milone & MacBroom map of extant conditions.

INDEX TO PHOTOGRAPHS

Tingue Dam
(Falls Dam, Rimmon Falls Dam, Rimmon Dam)
Naugatuck River, at crossing of Connecticut State Highway 8 Bridge
City of Seymour
New Haven County
Connecticut

Photographer: Robert C. Stewart, September - November, 1998.

A-1 View North of Tingue Dam from the western embankment downstream of the dam. Route 8 crosses over the Naugatuck on a series of reinforced concrete piers.

A-2 View Northwest of Tingue Dam and Route 8 highway bridge from Broad Street Bridge. Note semicircular stone masonry arch surrounding low-level outlet structure at right center and low-level rectangular outlet at the center of the photograph.

A-3 View South of the crest and cap stones of Tingue Dam from the eastern side intake structure.

A-4 View of semicircular stone masonry arch surrounding a low-level outlet at the eastern end of dam.

A-5 View of Tingue Dam timber intake structure on the eastern end from downstream of the dam.

A-6 View of timber intake structure, east end of Tingue Dam from upstream of the dam.

Historic Photographs:

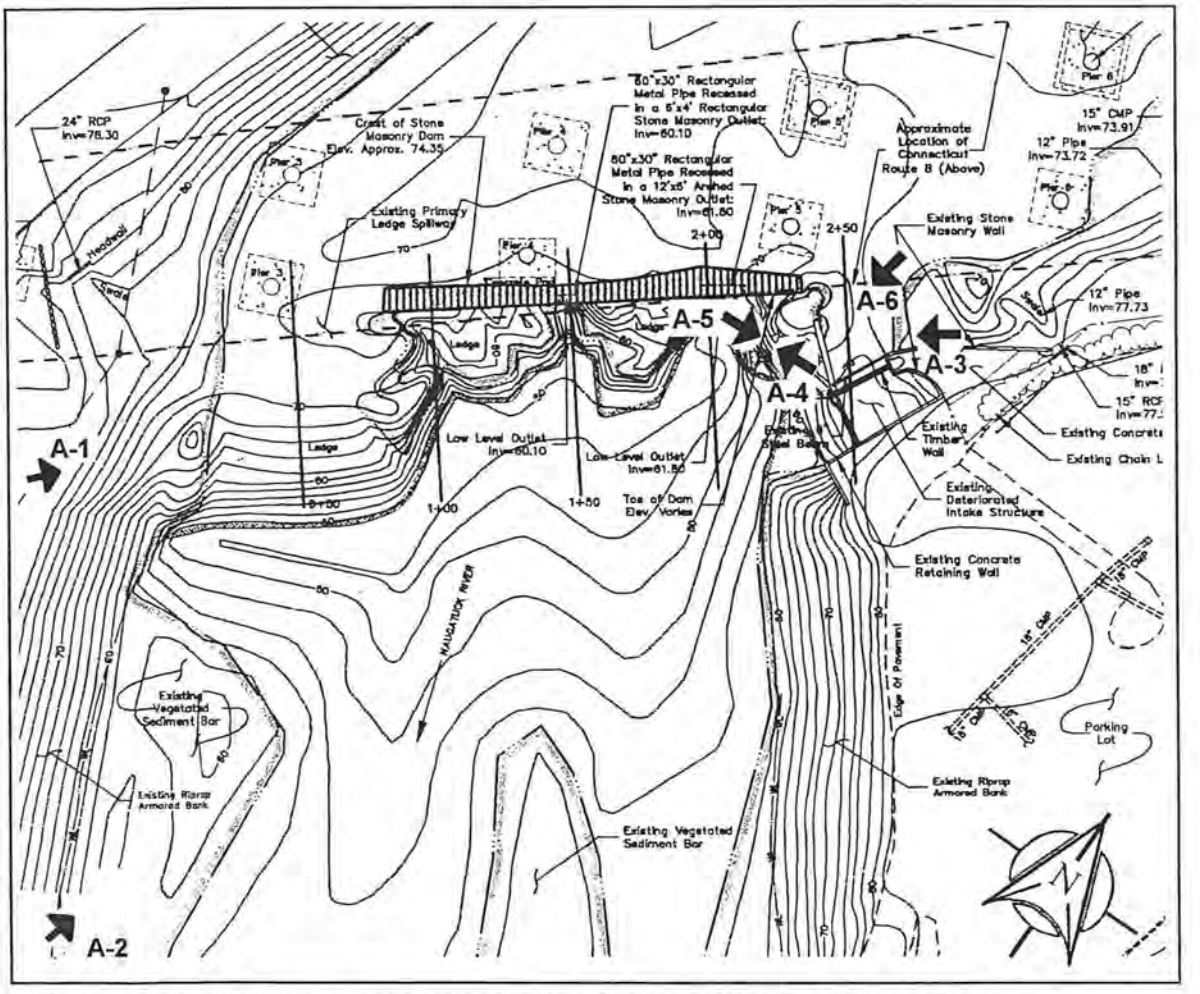
A-7 Aerial photograph of Tingue Dam, Seymour, Connecticut, July 1, 1949. In 1949 the Tingue Dam industrial complex with the canals and tailraces virtually unchanged from the Sanborn survey made in 1890. (Source GS-IM 7-149 - USGS Reston, Virginia)and the dam

A-8 Enlargement at 1000x of aerial photograph of Tingue Dam, Seymour, Connecticut, July 1, 1949. Note canal intake at left center and main canal at center of the photograph. Tailraces are shown just left of center and at the point where the Naugatuck turns south, (Source GS-IM 7-149 - USGS Reston, Virginia)

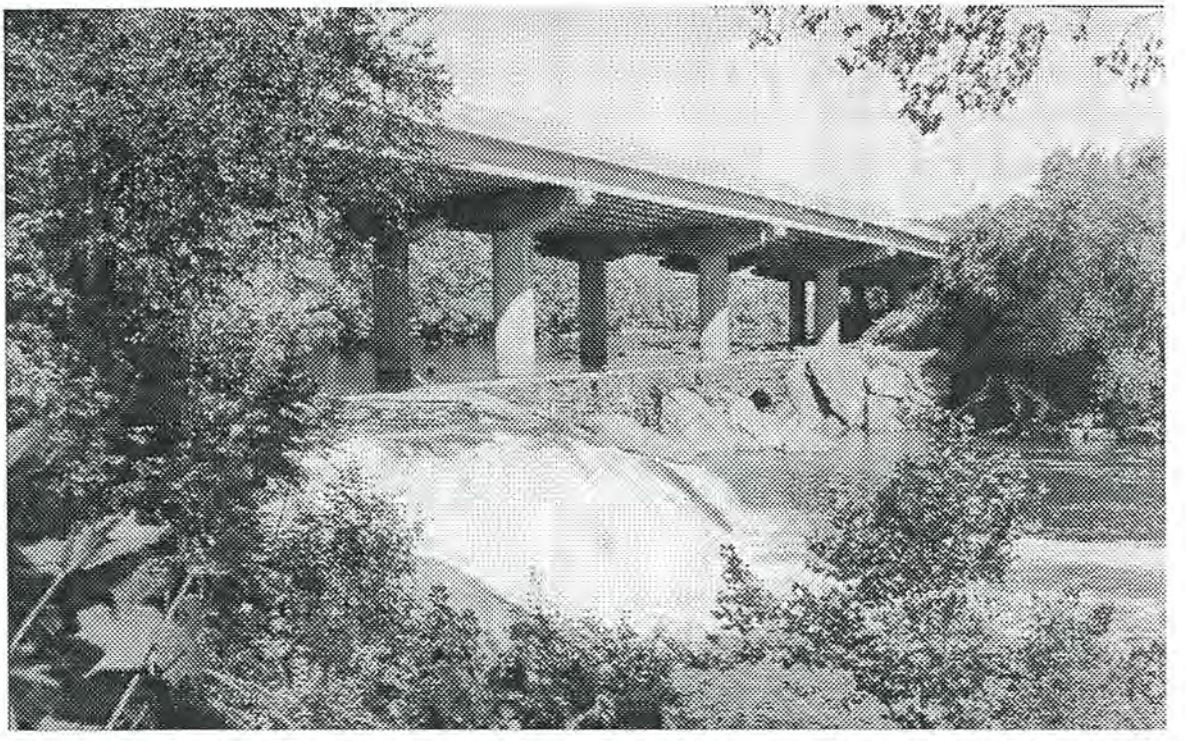
A-9 View Northwest of Tingue Mill, Seymour, Connecticut c. 1900.

A-10 View Southwest of Tingue Mill, Seymour, Connecticut c. 1900.

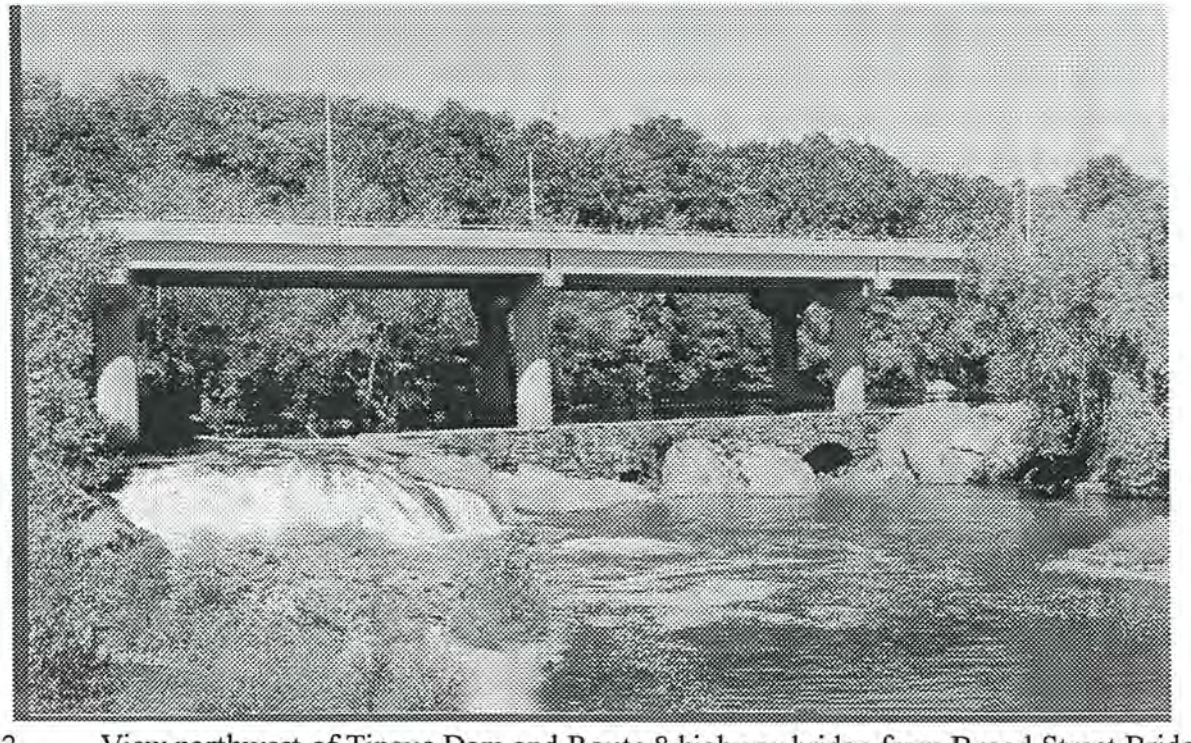
KEY TO PHOTOGRAPHS
TINGUE DAM
(FALLS DAM, RIMMON FALLS DAM, RIMMON DAM)



Photograph Key is based on: TINGUE DAM REMOVAL PROJECT - Milone & MacBroom



A-1 View North of Tingue Dam from the western embankment downstream of the dam. Route 8 is carried over the Naugatuck River and the dam on a series of reinforced concrete piers



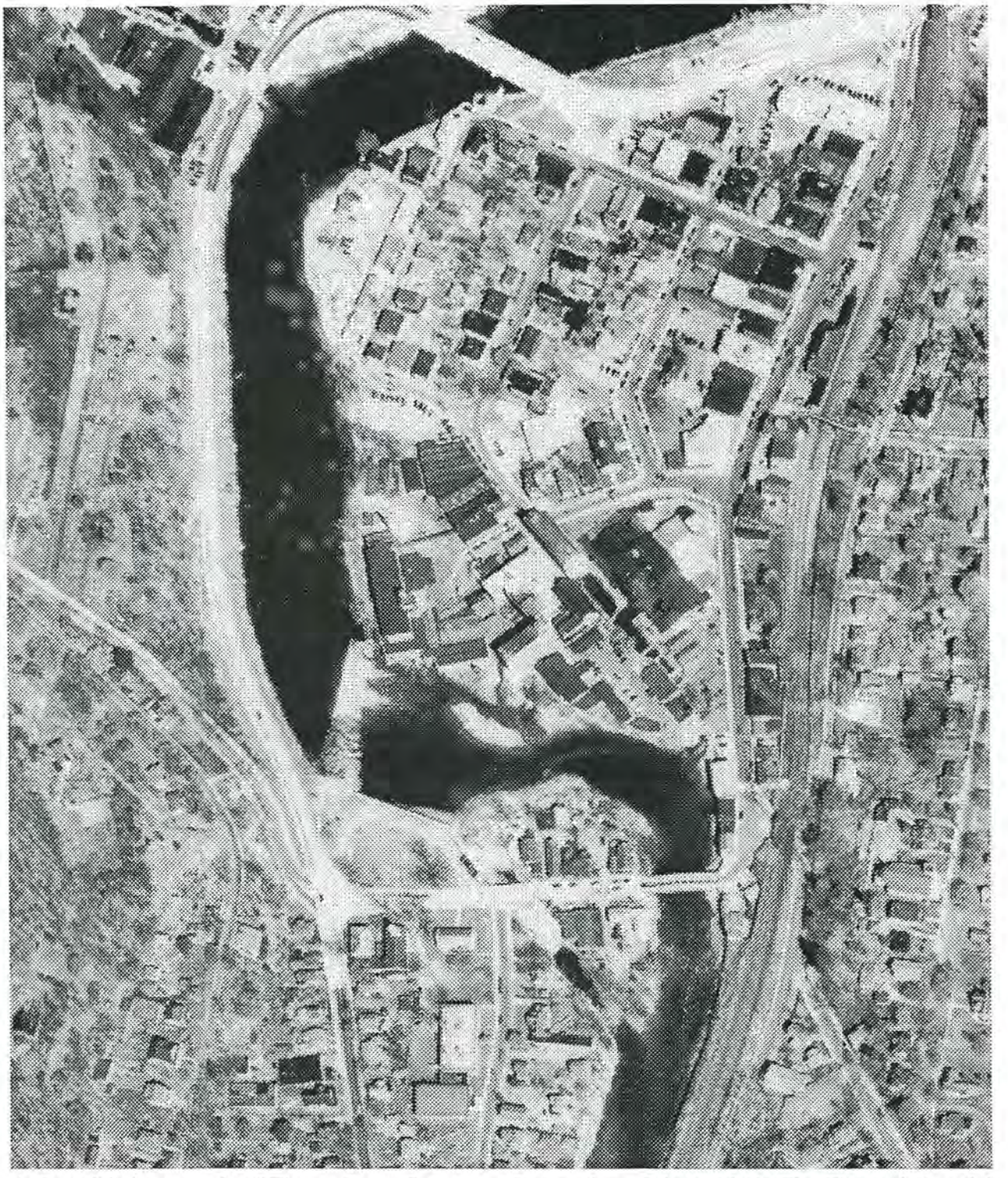
A-2 View northwest of Tingue Dam and Route 8 highway bridge from Broad Street Bridge. Note semicircular stone masonry arch surrounding low-level outlet structure at right center and low rectangular outlet at the center of the photograph

A-3 View South of the crest and cap stones of Tingue Dam from the eastern side intake structure.

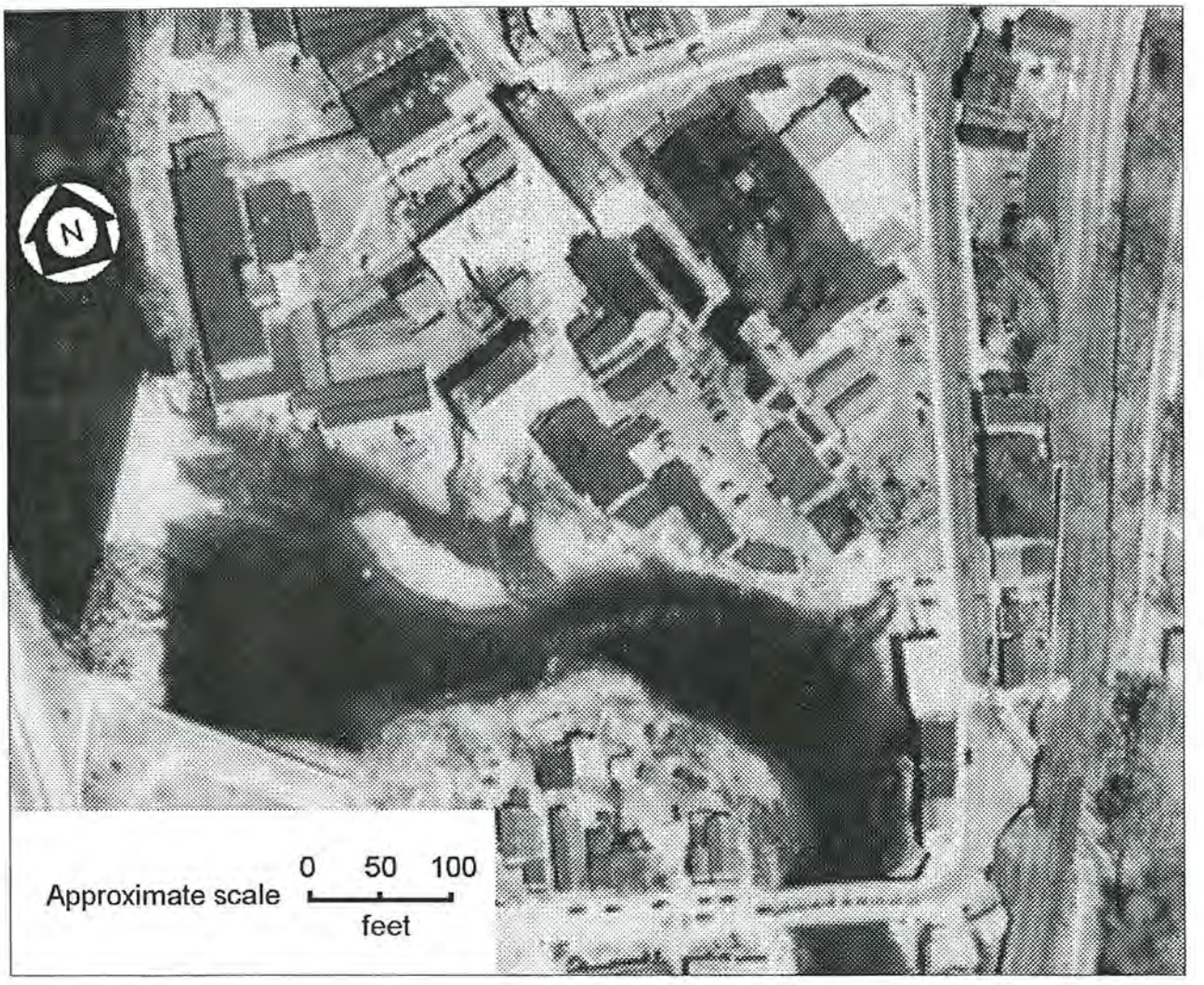
A-4 Semicircular stone masonry arch surrounding a low-level outlet at the eastern end of dam.

A-5 View from downstream of Tingue Dam timber intake structure on the eastern end.

A-6 View from upstream of timber structure on the eastern end of Tingue Dam.

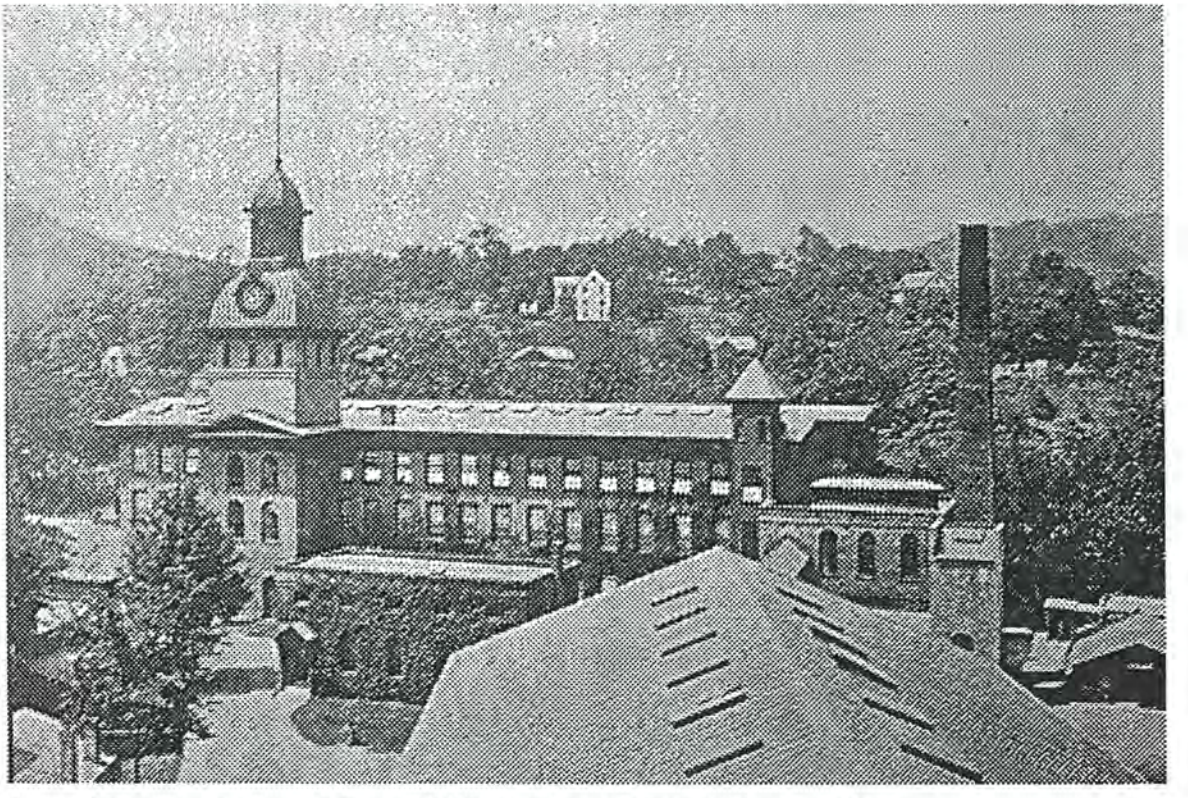


A-7 Aerial photograph of Tingue Dam, Seymour, Connecticut, July 1, 1949. The Tingue industrial complex, its canals and tailraces were essentially unchanged from the Sanborn survey of 1890. (Source GS-IM 7-149 - USGS Reston, Virginia).



A-8 Enlargement of aerial photograph of Tingue Dam, Seymour, Connecticut, July 1, 1949. Note the canal intake at left center and main canal at center of photograph. Tailraces are shown just left of center and the point where the Naugatuck turns south. (Source GS-IM 7-149 - USGS, Reston, Virginia).

A-9 View northwest of Tingue Mill, and Rimmon Falls, Seymour, Connecticut, c. 1900



A-10 View southwest of Tingue Mill, Seymour, Connecticut, c. 1900

UNION CITY DAM
(Rubber Shop Dam)

Location:	Union City Dam, .08 miles west of Connecticut State Highway 8, .34 miles north of Maple Street Bridge. Town of Naugatuck, New Haven County, Connecticut.
UTM Coordinates:	USGS Naugatuck, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.665540.4595305
Dates of Construction:	Circa 1845 to 1955 with numerous episodes of alteration, addition, modification, and repair.
Present Owner:	Town of Naugatuck, Connecticut
Present Use:	Unused and substantially abandoned. The associated water distribution system, largely disturbed and covered over, provided water for power generation and industrial processes to factories in the immediate area.
Significance:	The Union City Dam is a 190-foot long and 7-foot high run-of-the-river timber crib structure filled with stone. Its construction is typical of early 19th century timber crib dams. Water impounded by this dam flowed through a system of canals, penstocks and mains to factories located in the industrial area along the west bank of the Naugatuck River. The industrialists intensively developed the water resources of this part of the Naugatuck River from 1825 to 1865, installing penstocks, digging canals and storage ponds to create an extensive water distribution system. The canal complex is an interesting example of how water could be harnessed to supply power, cooling, boiler, process and fire fighting water to an early industrial complex primarily devoted to rubber manufacturing.

B. UNION CITY DAM

Surficial Inspection

The Union City Dam, also known as the Rubber Shop Dam, is located on the Naugatuck River, 0.08 miles west of Connecticut State Highway 8 and 0.34 miles north of the Maple Street Bridge in the Borough of Naugatuck, New Haven County, Connecticut. Figure 10 shows the location of Union Dam and the surrounding topography.

The dam's dates of construction range from circa 1845 to 1955 with numerous episodes of alteration, addition, modification, and repair (see below). The associated water distribution system, largely disturbed and covered over, provided process water to several factories in the area. The dam is now unused and substantially abandoned. Its present owner is the Borough of Naugatuck, Connecticut.

The Union City Dam is of rock-filled timber crib construction. It had been breached during the 1955 flood (Corps of Engineers, U.S. Army 1956:Table A-1) and later patched with riprap and grouted concrete fill. A sewer line passes through it. The present dam is 190 feet long.

The spillway runs the full length of the dam; it is also of timber crib construction and it has been capped in places with concrete and stone riprap, as is also the dike. The height of the embankment and the pond above the stream bed is 7.0 feet. The impoundment area is 6.1 acres (Connecticut Dam Inventory 1973,1993; Milone and MacBroom 1998a:1-5, 1998c).

Virtually full removal of the dam has been recommended by Milone & MacBroom (MMI). The west side of the dam contains the head race; a canal extended under the adjacent railroad tracks and southward into the town. The stone wall bolstering the adjacent railroad embankment was part of the intake structure. According to the final design map of the project supplied by MMI, this stone structure will remain in place. The evidence of building and rebuilding on the west bank of the river suggest major stratigraphic disturbance in this portion of the project area.

The stone masonry training wall on the east side of the dam has potential for partial removal.
The eastern portion of the project limits will be the staging area. Much of it is covered by a macadam parking lot. Between it and the river is a narrow strip of grass and the sloping riverbank, much of which is covered with boulder riprap. The final design map by MMI calls for minimal disturbance beyond the installation of a construction access road from the parking lot to the dam.

In any case, the surficial inspection indicated that this area, too, appears to have been previously disturbed. There is virtually no topsoil in the grass-covered areas. The riverbank cut shows sandy gravel with no evident stratigraphy; in one locale, plastic sheeting emerges from the soil profile. Grading activities for the parking lot and the ball fields of Linden Park to the macadam, as well as construction activities for Route 8 appear to preclude stratigraphic integrity. The highway lies immediately to the east; its embankment and a culvert for it abuts the eastern edge of the parking lot.

Historical Context

Historically, Naugatuck was originally part of Waterbury. The proprietorship of Waterbury began in 1673 when 26 men from Farmington petitioned the General Court of the Colony of Connecticut for

a plantation at "Matetacoke" or "Mattatuck". In 1674 they purchased a tract 10 miles long and six miles wide lying on both sides of the Naugatuck River. In 1686 the Town was incorporated as Waterbury. Additional tracts were purchased for the plantation in 1684. These tracts were purchased from both the Tunxis and the Derby Indians. According to Constance Green (1949:14) this plot was nearly identical with the modern township of Naugatuck.

By 1686 the "Town Plot" or center of the plantation, had moved to the east side of the River. The area known as "Deacon's or Gads Meadow," which eventually became the location of the mills of the India rubber factories, was in the late 17th and early 18th century pasture lands and hay fields, then farmsteads. A 1735 map of the Meadow shows neither a dam nor a mill on the west side of the Naugatuck River. There were no houses in the project area.

A bridge across the Naugatuck connecting the Meadows with the town center was not built until 1753; in 1759 it was washed away by a freshet (Green 1949). It was rebuilt and called Salem Bridge, after a new Ecclesiastical Society called the Salem Society, which was formed in the village in 1773. The village itself eventually became known as Salem Bridge (Bailey 1980:37). The Deacon Meadows area continued to be an outlying district of the village into the early 1800s. In 1844 Salem Bridge separated from Waterbury and became incorporated as the town of Naugatuck.

Throughout the 19th century Naugatuck remained a farming region. Manufacturers continued to own farms that were often worked by boy labor while the owners kept shops. Most of the mills were located on tributary streams to the Naugatuck River (Green 1949).

The 1825 Button Factory Dam

The water distribution system associated with Naugatuck's industries came into being over several decades. Its evolution has been traced through examination of historic maps and field work. Some complexity arose from evidence that the Union City Dam was preceded by another dam, designated by this report as the "Button Factory Dam." This dam was about 1600 feet south of the Union City Dam. It formed an important part of water power development in Naugatuck and parts of its canals were integrated into the Union City Dam canal system. It has been included in this report.

In 1825, Silas Grilley and Chauncey Lewis acquired water privilege for "as long as grass grows or water runs" to build a dam on the Naugatuck River (Green 1948:73; see also Anderson 1896 (1): 579). According to Rev. Edwin Lines (1926:1), Ashbel Stevens gave a deed to Silas Grilley and Chauncey Lewis on March 14, 1825 granting the privilege of erecting a dam across the river. This was the Button Factory Dam.

Study of the original 1856 Beers maps of Naugatuck Center (Figure 11) shows diversion of the Naugatuck at a point about 240 feet north of what is now the Maple Avenue Bridge. Significant features of the Figure 11 map have been enhanced and shown in Figure 12. While no dam is shown on the original map, a simple weir, or perhaps a partial dam made of rubble and boulders could have been built here. It diverted water through the canal into a mill pond bordering the west side of Water Street. This canal is identified in this report as the 1825 canal. The water drained into "an old tail race ... crossing Maple Street and into an old tail race or pipe tunnel ... crossing Water Street to the Naugatuck River (Naugatuck Land Records Vol. 0425, page 30).

There is an approximate ten foot drop in elevation between the mill pond west of Water Street and the end of the tail race at the point it enters the Naugatuck. The route described is clearly shown on the Beers map of Naugatuck Center dated 1856 and in Figure 12. Traces of it exist. A storm drain outlet is visible in the river bank at the old canal inlet location. There is a manhole just west of Water Street where the perimeter of the mill pond would have verged on the street. The site of the mill pond, which was filled in and served as a factory site for many years, is now a vacant lot. Tracing the canal route west over the filled in pond, a recent accidental washout and cave-in revealed a small section of an old drainage tunnel lined with stone blocks. When the mill pond was filled in and a new canal dug to provide water from the Union City Dam to the north, parts of the old eastern headrace were likely retained for storm drainage. The new canal routing and site of the cave-in are shown in Figure 14.

Around 1825 Grilley and Lewis constructed a stone factory building for the manufacture of gilt buttons on the west bank of the Naugatuck River. The shop was located on about three acres of property in the center of the village, near the bridge. Naugatuck Town Historian Dana Blackwell pinpointed its location fronting Water Street just north of the Maple Street Bridge (personal communication, December 3, 1998; see also Bailey 1980:45 and Figure 12). Milo Lewis joined the company, eventually holding a five-year mortgage of $1,000 on the property (Bailey 1980:37). The Naugatuck Historical Society (NHS) has in its possession a variety of the gilt buttons once produced by Naugatuck button shops.

The button shop building was temporarily used by J.M.L. and W. H. Scovill after their Waterbury factory was destroyed by fire in 1830. In 1831 Milo Lewis sold the property "with all water privileges, shop and buildings on said land together with the dam, ditch & raceway extending to the river" to Sylvester Clark, a manufacturer of eight-day brass clocks.

Clark's clocks had an excellent reputation for time-keeping, and were peddled by packmen throughout western Connecticut and adjacent areas. A Clark clock is shown in the report photo section (B-6). In 1832 John Tillou bought the property and manufactured spinning machinery. He was unable to meet the mortgage payments and the property reverted back to Clark, who sold it to John Tatlow in 1835 for manufacturing looms and carding machinery.

In 1838 Asher Riley of New York City bought the building (Bailey 1980:37-38; Green 1948:73, 74). In the early 1840s the building housed L. Bradley and Company - Pocket Knife Manufacturing. This was the earliest pocket knife company in the United States, according to Naugatuck Historical Society member Marilyn Nichols (personal communication November 18, 1998).

The 1845 Union City Dam (The Rubber Shop Dam)

In 1844 the citizens voted to break away from Waterbury and become the separate Town of Naugatuck. About this time the Naugatuck India Rubber Company was formed by Milo and Samuel Lewis, Deforest and a few other backers. The company, which manufactured rubber clothing, began buying land from several individuals for the purpose of building a canal (Green 1948:146; Borough of Naugatuck Land Records 1844 (1):30, 1845 (1):56, 57, 65, 66, 69, 305, 1845 (2):17-18, 24-25, 32, 33, 1845 (1):114, 1850 (2):42, 44).

One of these was Henry Hine et al., who on August 10, 1844 sold property that included dam and

canal rights; the deed noted the water privileges were the same as those of Grilley and Lewis (Borough of Naugatuck Land Records 1844 (1): 9). Another individual, Bennet Beecher, gave a 999 year lease to cut a ditch through his property south to Hial Stevens' property; Stevens' property and that of the two landowners south of him was also bought by Naugatuck India Rubber (Ibid (1): 56- 57; (2): 17-18). The canal was completed in 1845 (Ibid 1846(2): 43-48). The Naugatuck India Rubber Company eventually merged with The Goodyear's Metallic Rubber Shoe Company (Green 1948:146).

On January 26, 1848, the Naugatuck Rubber Company gave Thomas Lewis the right to water from the canal, which was located west of the India rubber factory, at a point south of the road leading from Naugatuck Bridge west of the factory to the churches (Maple Street). He was also given the right to discharge the same into the tail race of the factory, or into the tail race of the Naugatuck Rubber Company (Ibid 1848(2): 168-172). This canal is shown on the Beers 1856 map (Figure 11) running between Church Street on the west and Water Street on the east.

Green (1949:51) shows an undated photograph of the Daniel Beecher Inn and tollgate house along the old toll road on the west bank of the Naugatuck; the dam is in the foreground. The original photograph is presently in the possession of the Naugatuck Historical Society. Accordingly and his wife Verna Blackwell, the Beecher Inn went out of business by 1834 and the house was pulled down in the 1880s or earlier (personal communications, December 3, 1998). Thus, the photograph must predate the 1880s.

Green (1949:76) notes that Grilley and Lewis's dam supplied power by water diversion to the finishing shop of William DeForest and Company, whose buildings were located along the brook on what is presently Rubber Avenue. The 1856 map does not substantiate this point. It clearly shows water being supplied to factories along Rubber Avenue by a race fed by a mill pond drawing water from Long Meadow Brook. The finishing shop was originally the "clothier"[2] shop of Leverett Candee, and later in 1813, a textile mill. DeForest became a partner in 1820. Candee's interest was transferred sometime between 1822 and 1825, at which time the business became known as William Deforest and Co. until it closed in 1846. The finishing shop was located at the lower end of the brook (i.e., the eastern portion of what is now Rubber Avenue).

Naugatuck's first rubber factory was that of Samuel J. Lewis and Company in 1843, established by Milo Lewis, his son Samuel and Milo's brother-in-law William DeForest. It was reincorporated as The Goodyear Metallic Shoe Company in 1845 and manufactured rubber footwear produced under the vulcanizing patent of Charles Goodyear. Goodyear and other producers of India rubber made Naugatuck a major rubber manufacturing center.

Lewis also ran a woolen mill. In the 1850 census the function of Lewis's shop was listed as "Satinette Manufacturing" (Federal Manufacturing Census 1850).[3] In the 1860s he began to manufacture

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[2] A clothier shop would be engaged in finishing cloth. Processes such as bleaching, dyeing, fulling, napping and shearing might be typically used.

[3] Satinette was an inexpensive but not very durable textile produced by pressing wool fibers into cotton cloth (Green 1948:76).

cashmere and other light-weight woolen fabrics. In 1876 Lewis conveyed the premises to the Dunham Hosiery Company, which produced knit goods such as underwear, hosiery, sweaters, and net for rubber linings (Green 1948:158). The Satinette Factory location is shown in Figure 12.

The railroad came to Naugatuck in 1849, increasing land values and initiating rapid population growth. A bridge to Union City and additional street layouts followed. The improvements in communication and transportation systems and the increased labor force led to rapid expansion of the rubber factories. Factory buildings and worker's tenements sprang up along Maple and Rubber Avenues and the streets between them.

In 1853 Naugatuck India Rubber sold the property in question to Union India Rubber Company (Borough of Naugatuck Land Records 1853 (4): 595). From 1861 to 1863 Phoenix Rubber Company bought land including the project area in four separate instances. Specifically, James H. Ackerman et al. sold to Phoenix land, tenements, buildings, machinery, waters, water wheels, shaftings, tools and fixtures "as an India Rubber Factory." The deed also mentioned the "reservoir or factory pond" to which the main canal led, evidently still being fed by the old Button Factory Dam. The rights included half of the canal leading from the dam and half of the water. The remainder of the water went to Thomas Lewis and Henry Goodwin (Ibid. 1862 (6): 237-244).

Soon after Lewis gave up his rights from the Naugatuck India Rubber Co. to Phoenix (Ibid. 1862 (2): 172). The 1868 Beers Atlas shows the location of the T. Lewis Woolen Factory located off Rubber Avenue; a canal runs through the complex, suggesting that Lewis had again obtained canal rights by that time (Figure 12).

On August 27, 1866 Phoenix Rubber Company conveyed about 2 and ½ acres "with all the buildings, machinery, waters, waterwheel, shafting, tools, fixtures and everything in said premises appertaining to the same as an India Rubber factory except the manufacturer's stock at hand" to Star Rubber Company (Borough of Naugatuck Land Records 1866 (6): 423). The deed also conveyed all rights and title to "one half the dam across the Naugatuck River with one half the canal after deducting one foot of surplus water heretofore leased to Henry Goodwin and also the tail race or ditch leading from said factory across the road westerly and east of the factory of Henry Goodwin and thence to the Naugatuck River (Ibid.)". The 1868 Beers Atlas for New Haven County depicts a lengthy canal system running south from the locality of the dam for about 3,500 to 4,000 feet until it converges with Long Meadow Pond Brook and empties back into the Naugatuck River, east of present Scott Street.

There are several headraces off the main trunk. The mill pond and inlet just north of Maple Street were filled in, sometime between 1853 and 1881, and a feeder canal cut through to the east, parallel to Maple Street, servicing the Star Rubber factory at Water and Maple Streets. (Figure 13) By doing this the head pressure at Maple Street would have been increased, perhaps as much as by 10 feet. The elevation at the Union City Dam, some 1800 feet north of Maple Street, is about 10 feet higher that the elevation at the Mill Pond inlet. There is a 10-foot drop between the link just north of Maple Street and the tailrace about 1720 feet south at Long Meadow Brook.

Another canal, referred to as the 1845 canal in this report, runs south fairly parallel to the original canal through the property of the Goodyear India Rubber Glove factory, which had moved to Naugatuck from Litchfield in 1847 (Green 1948:149), eventually emptying into the Naugatuck River.

The glove factory originally manufactured gloves and mittens. The Civil War initiated a demand for rubber ponchos, blankets, and other rubber clothing as well. In a period when clothing was not washed as frequently as is done at present, dress shields were another important product in the 1860s (Green 1948:150).

A third canal joins the main trunk at its south end, where it continues southeasterly through the property of the Tuttle Manufacturing Company (located at the corner of Water St. and Rubber St.) and into the river (B-7). The Tuttle Company produced metal products such as hoes, rakes, and pitchforks (Federal Manufacturing Census 1850, 1870; Green 1948:159). A fourth canal leads from the latter one west, paralleling Rubber Street, servicing the T. Lewis Woolen Factory and the Goodyear Rubber Shoe Company.

An 1877 map on display at the NHS entitled "View of Naugatuck Conn. 1877" depicts Goodyear's India Rubber Glove Manufacturing Company, Goodyear's Metallic Rubber Shoe Company, and The Tuttle Manufacturing Company, among others. The map shows the canal passing through the center of the Goodyear's India Rubber Glove Company complex, at the south end of which is the Tuttle Manufacturing Company. The canal passes through the latter property and merges with Meadow Brook, which runs west from Goodyear's Rubber Shoe Company (located on Rubber Avenue) to the Naugatuck River.

On April 8, 1881 the Star Rubber Company conveyed to The Goodyear India Rubber Glove Manufacturing Company its interest in the premises, which included one half the dam and one half of the canal, "together with all the buildings, machinery, Waters, Water Wheels, Shafting, tools, fixtures and everything in said premises pertaining to the same as an India Rubber Factory" with the exception of one steam engine, boilers and connections and appurtenances thereto, and a new set of four roll callenders (Borough of Naugatuck Land Records 17:173-175). And we do also hereby grant and convey one half the dam across the Naugatuck River with one half the Canal leading from said dam to the centre of the highway between the bridge and the Churches[4] and one half the water passing through said canal together with the one foot of water leased to Thomas Lewis, and one foot of surplus water leased to Henry Goodwin with all the rights and privileges in said Goodwins lease as recorded in Naugatuck Missalaneius (sic) deeds Vol. 1 page 141 to 147 said lease having been transferred by Jonathan Thorne to Phoenix Rubber Co. June 10th, 1863 - (Borough of Naugatuck Land Records 1881(17):174)." On November 15, 1886 The Goodyear's Metallic Rubber Shoe Company conveyed to The Goodyear's India Rubber Glove Manufacturing Company its interests in the dam (i.e., one half) and the land thereto, and the canal extending from the dam to Maple Street and south of Maple to the Glove Company land. The Major Naugatuck industrial sites of this period are shown in Figure 13.

The deed included all of the interest in the property and water privilege previously conveyed to the Shoe Company by the Tuttle Manufacturing Company (Borough of Naugatuck Land Records 1886 (17): 525- 27). In 1892 The Goodyear's Metallic Rubber Shoe Company merged with members of the Rubber Shoe Association to form the United States Rubber Company. The years from 1893 to 1921 witnessed the expansion of U.S. Rubber; four new buildings were erected for the shoe division and

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[4] This is the 1825 canal. Refer to Figures 11, 12, 13 and 14 to trace the evolution of the canal system in Naugatuck.

nine new buildings for the glove division. A rubber regenerating plant was set up; old tires and junked rubber were piled up for a half mile along the Naugatuck. Tenements and houses for workers sprang up along Rubber Avenue and adjacent areas (Green 1948:150,222, 223). By 1915 the town's rubber mills were producing 60,000 pairs of rubber shoes and boots a day (Monagan 1993:36).

On February 1, 1917 The Goodyear India Rubber Glove Manufacturing Company sold to the United States Rubber Company the dam and its properties adjacent to the dam on both the west and east sides of the river. It deeded all buildings, appurtenances, machinery, furniture, fixtures, leases, flowage and canal rights (Borough of Naugatuck Land Records 1917 (56): 484-496, 526, 527, (213):249). A 1929 map on file at the Naugatuck Historical Society and entitled "Map Showing Property of United States Rubber Company, Naugatuck, Conn Dec. 1929" shows the dam and properties on both sides of the dam. The main "ditch" is depicted passing under buildings on the corner of Maple and Water Streets, with an inlet just above the Maple Street Bridge. This map may not have been corrected to show that the inlet had been filled in. A Sanborn insurance map of 1887 clearly shows the inlet filled in and water being supplied by the 1845 canal and Union City Dam. The Canal continues south through buildings between Maple and Water and Rubber streets, with two outlets (Figure 13). A large building marked "Warehouse Building #223" also has a ditch beneath it, which meets Long Meadow Brook in that area and passes east into the Naugatuck River.

On November 15, 1933 United States Rubber Company conveyed the eastern half of the dam and property adjacent to its northern boundary to the Borough of Naugatuck (Borough of Naugatuck Land Records 1933 (81): 681-682). On March 1, 1933 the United States Rubber Company conveyed an easement to Connecticut Light and Power company to maintain a line of poles, cables, wires, etc. on its property located just south of the end of the dam on both sides of the Naugatuck River (Borough of Naugatuck Land Records 1933 (81): 489). In 1941-42, World War II created a business boom, and U.S. Rubber built a synthetic rubber plant (Green 1948:269). The United States Rubber Company eventually changed its name to Uniroyal, Inc. On March 13, 1979, Uniroyal Inc. quit claimed property adjacent to the west end of the dam, including "all right, title and interest of Uniroyal, Inc. in or to a head race and all rights, interests and privileges appurtenant thereto running in a northerly direction from the southerly side of Cedar Street to the dam" to Equities Holding Corporation (Borough of Naugatuck Land Records 1979 (213): 249).

In the Certificate of Foreclosure dated April 22, 1983 Equities Holding Corporation et al. turned over the property and canal and flowage rights to Uniroyal Inc. (1983 (242): 354-60). The document did not specifically mention conveyance of the dam *per se*. Specifically, it conveyed "all right, title, interests and privileges appurtenant thereto running in a northerly direction from the southerly side of Cedar Street to the dam . . . " but not the dam. It also conveyed the "tail race or tunnel under Rubber Avenue" as well as "the intake and pipe conduits under the railroad to the Naugatuck River" (i.e., the old canal or "ditch" which ran west from the river and then south to the Goodyear Glove Company below Maple Street). Apparently, the latter was extended westward under Rubber Avenue at some point in time as the rubber company expanded.

The "old tail race," or pipe tunnel, extended under Water Street and emptied into the Naugatuck south of the dam; another "old tail race" is mentioned as crossing Maple Street (Borough of Naugatuck Land Records 1983 (246:477, 480). They are shown on the Beers Atlas of 1868. On August 19, 1983 Uniroyal, Inc. quit claimed the relevant property with all rights, tenements and appurtenances to the

Borough of Naugatuck (Borough of Naugatuck Land Records 1983 (246): 481-486; see also 242:354,356, and 359 for additional description of land parcel).

With Uniroyal's complex vacant and deteriorating, the Borough sought means of revitalizing the area. On August 25, 1983, the Borough of Naugatuck quit claimed the property on the west side of the Naugatuck River adjacent to the dam to the Naugatuck Renewal Associates II (Borough of Naugatuck Land Records 246:491-494). On April 1, 1985, the Naugatuck Renewal Associates II quit claimed the property adjacent to the west side of the dam and all appurtenances back to the Borough of Naugatuck (Borough of Naugatuck Land Records 1985 (263): 640-645; see also 1993 (380): 887-896).

In September 1984 the Borough entered into a redevelopment plan with the State Department of Economic Development and General DataComm industries to create a mini-industrial park on the former Uniroyal property. On April 19, 1985, The Borough of Naugatuck granted to General DataComm Naugatuck, Inc. a five-year option to buy the tract of land adjacent to the west end of the dam.

There is no mention of the dam, canal or water rights. The association soured and, on February 29, 1996 the Borough of Naugatuck regained property with all appurtenances including the canal, the old tail races, and the head race and rights thereof (Borough of Naugatuck Land Records 1996 (425): 30-34). A title search performed June 26, 1997 confirmed that the Borough of Naugatuck was the present owner of the dam (Security Title Search and Abstract, P.C. 1997).

East Side of the Dam

According to Naugatuck Town Historian Dana Blackwell, the area along the east side of the dam was a low-lying flood zone and for that reason it never was used for industrial or commercial purposes (Blackwell, personal communication December 3, 1998). Naugatuck resident and NHS member Marilyn Nichols concurred (personal communication November 18, 1998). A map of New Haven County published by A. Budington & B. Whiteford (1852) show neither the dam nor buildings in the area in 1852. It does, however, show a pond-like enlargement of the river at the dam locus, suggesting the existence of a factory pond. The 1856 (Smith 1856) and 1868 (Beers 1868) maps for New Haven County illustrating Naugatuck, and the 1877 map of Naugatuck (n.d. 1877) also show neither dam nor buildings on the property. An 1883 Map of Naugatuck hanging on the wall of the Naugatuck Historical Society does show a bowling alley (identified by Mr. Blackwell) located on the east side of the river, but it is set further back and northeast of the project area.

By 1896, the property belonged to the Goodyear Rubber Glove Company (Anderson 1896 (1): 579). Two postcards from the files of the Naugatuck Historical Society contain photographs of the east side of the dam and adjacent property. The latter are meadowlands devoid of buildings. The cards appear to date from the turn of the century. One card was dated 1917 (although the photograph may be earlier). The other was entitled "G.I.R. [Goodyear India Rubber] Dam, Naugatuck, Conn. " The card must date somewhere between November 1886 and February 1917, as these are the years in which Goodyear India Rubber Company owned the dam (see above).

Timber Crib Dam Construction

The timber crib dam was a cost-effective solution for damming New England's rivers to provide power and process water. Abundant timber close to most building sites and plenty of boulders and stone left behind by retreating glaciers minimized the need for transporting materials over the area's poor roads to dam sites. The design makes good use of native materials, human skills, man and animal power to provide water for a burgeoning industrial economy. Figure 15 shows construction details of a typical timber crib dam.

Timber crib dams would generally be built during the months of the year when water levels were lowest. In the early 19th century, they had to be built with manual labor using horses and mules for hauling, scraping and scooping earth. Rudimentary wood derricks aided placement of the larger components and rocks.

In general, construction took place in two phases, half of the river being barricaded in each phase. These dams consist of two identical wooden ramps, projecting slightly upstream from abutments on each bank and meeting in the approximate center of the river. The timber framework would be assembled on the river bank while a temporary dam, termed a coffer dam, was built out from one bank to the center of the river, curving downstream around the construction site for the permanent timber crib dam.

Large wooden baskets, dragged into position and sunk with rocks formed the structure of the coffer dam. Clay packed into the spaces between the baskets sealed the coffer dam. Once the work area behind the coffer dam was dewatered, the timber framework would be moved into trenches cut in the river bed, assembled with crosspieces and pinned into place with iron rods.
Stones would then be placed within the timber frame and the top of the structure covered with a layer of planks. A cap log on the crest of the dam reduced wear on the exposed edges of the planking. After completing the first half of the dam, the coffer dam would be rebuilt on the other half of the river and the construction process repeated to form the remaining half of the dam. The combined weight of water and rocks served to hold the dam in place (Macauley 1983:33).

Development of the Rubber Industry

The construction of canals to provide water to the nascent rubber factories in Naugatuck is significant in the areas' industrial history. Until Charles Goodyear developed the process for vulcanizing rubber in 1841, its use was severely limited by ambient temperature. Raincoats, boots and rubberized clothing collapsed into sticky blobs when temperatures climbed. These items became rock hard and brittle in winter conditions. Goodyear discovered that the addition of sulphur to raw rubber and heating to 270° Fahrenheit for several hours produced a product that would not stick to itself nor embrittle in cold or melt in heat. Chemically the process is called polymerization. The addition of carbon black (lampblack) gave other useful properties to the new product which Goodyear called vulcanized rubber.

Goodyear sold licenses to use his process cheaply, preferring to design inflatable rubber rafts, balloons, baptismal pants, rubber bands, wheelbarrow tires and a multiplicity of rubber goods. He profited little from these ventures, spent most of the royalty fees he received on litigation to protect his patents and died broke, probably from lead poisoning contracted during his experiments. The rubber companies of Naugatuck profited from Goodyear's work and two bore his name as process licensees. The

Goodyear

India Rubber Glove Manufacturing Company and the Goodyear Metallic Rubber Shoe Company produced vulcanized goods.

Historic rubber processing requires relatively large volumes of process water. Much of this is filtered, treated and used to produce steam. Rubber compounding involves intimately mixing the raw rubber, tough and resilient at room temperature, with curing agents, fillers and lampblack or coloring agents. To do this, the rubber is worked into a pasty mass on steam heated compounding rolls or in machines called "Banbury Mixers." These machines are capable of producing a homogenous mass of compounded rubber. The uncured rubber might then be molded into shoe soles, heels etc. using heat to complete polymerization.

The rubber gloves were made by dipping glove forms into a tank of rubber dissolved in naphtha. Sanborn Insurance maps show a building designated as naphtha storage on the premises of the rubber glove factory. The coated forms would then be dried, cured and the gloves stripped off. A detailed documentation of the Naugatuck rubber industry and factory building construction is contained in HAER Report No. CT-21, *Naugatuck Rubber Footwear Plant* by Matthew Roth.

Conclusions and Recommendations

The project area of the Union City Dam is located within 1.5 miles of one known prehistoric archaeological site, a Late Archaic Native American camp site near Hop Brook. However, the industrial area shows evidence of severe disturbance and change. Physically, little remains that would contribute to any possible past Native American activities or to recordation of the industrial sites and canals served by the Union City Dam. Mill buildings have been demolished, new buildings have been erected, canals filled in and penstocks removed on the west side. On the east side, where the Archaic camp is located, the project area shows severe disturbance from both Route 8 construction activities and grading and landscaping activities associated with Linden Park ball fields and parking lot.

The canal system can be better understood from examination of early 19_{th} century Beers maps and Sanborn Insurance maps dating from 1887 to 1968. Historical aerial photographs may provide a clearer view of the canal system and its relationship to the dam. Archival 35mm photographs have been taken of the dam. In our opinion, there is no impediment from a historical documentation standpoint to immediate removal of the dam.

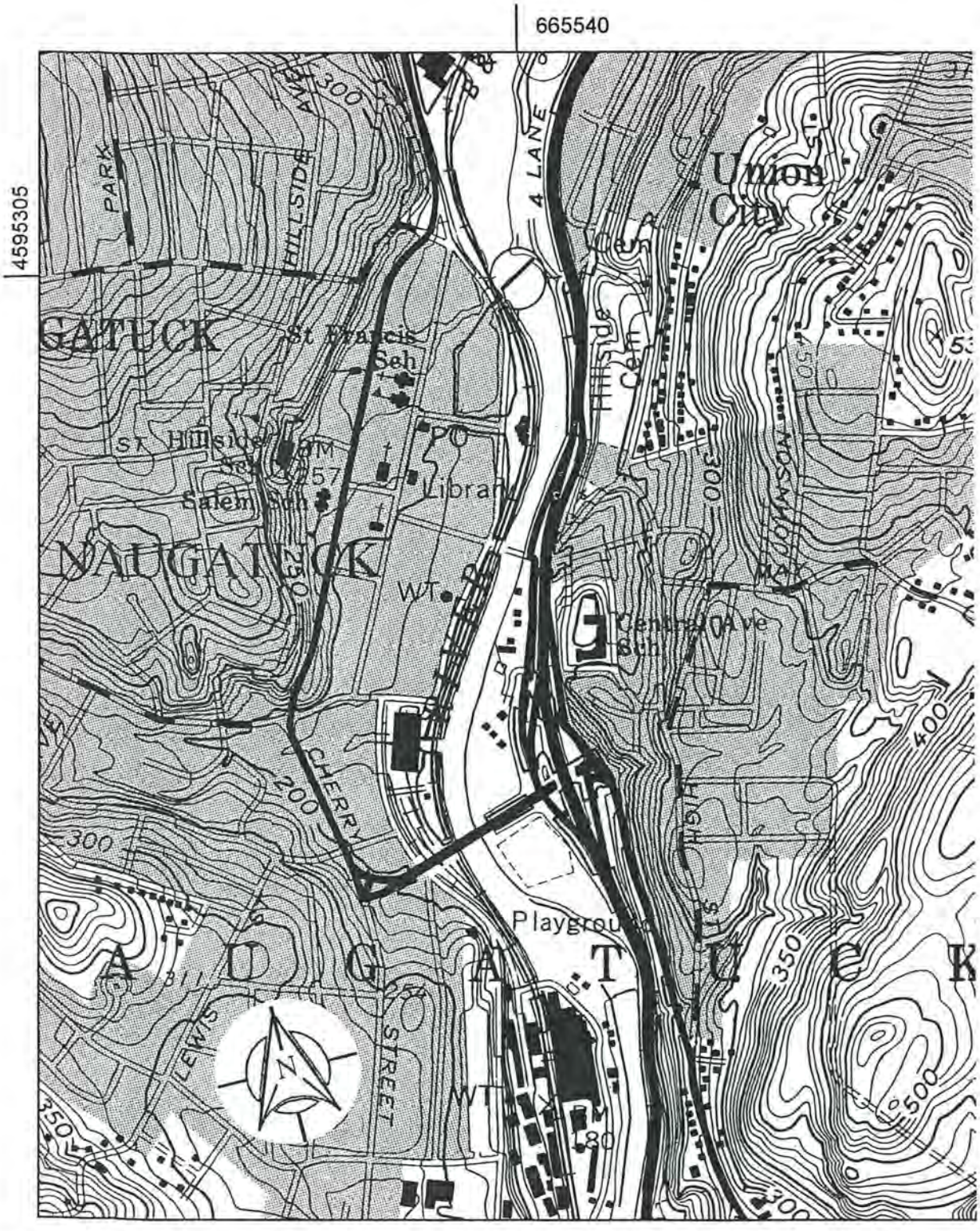


Figure 10 Location Map - Union City Dam, Naugatuck, Connecticut
Quadrangle: Naugatuck, Connecticut - 1:12000

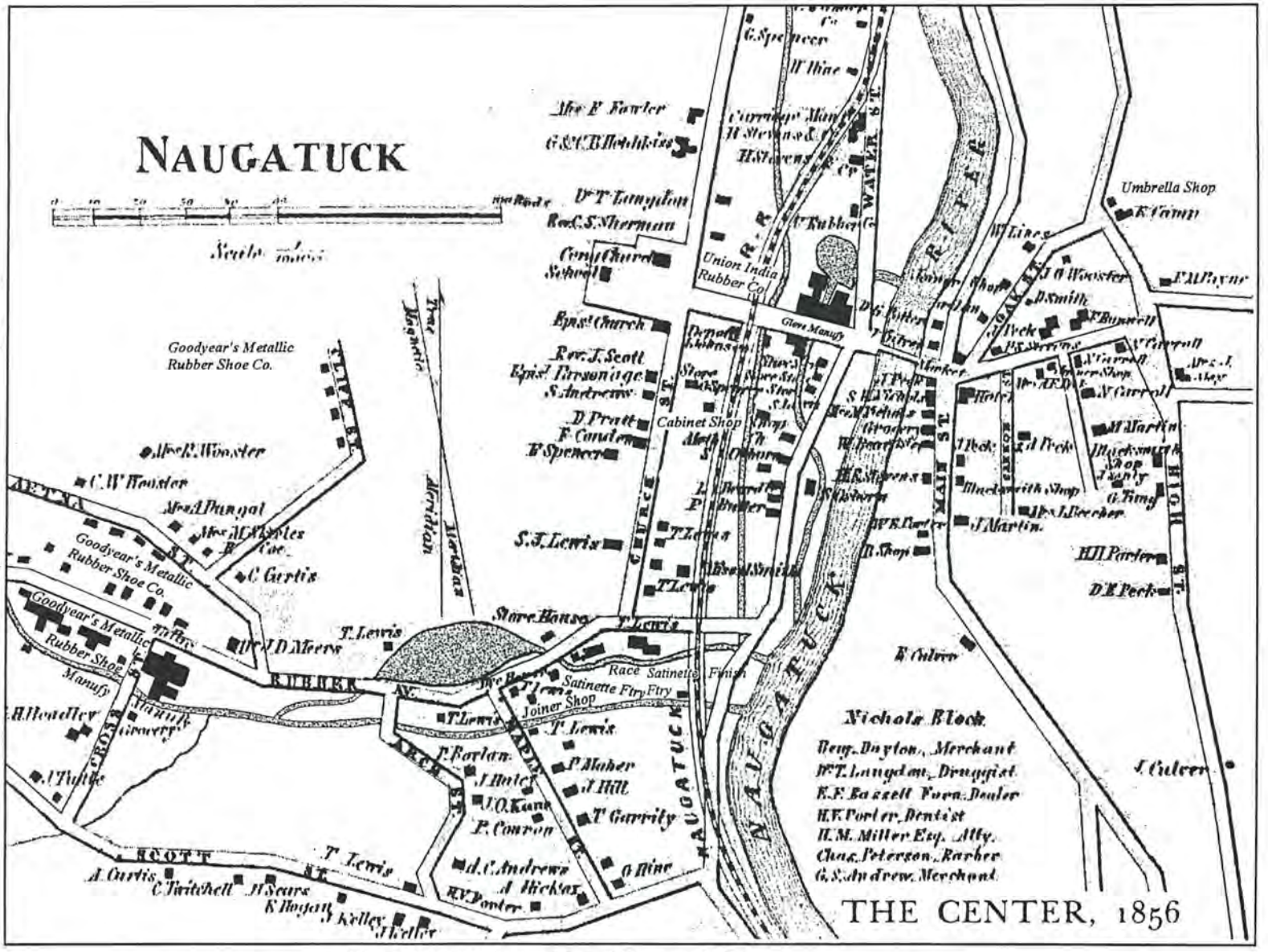


Figure 11: 1856 Beers Map of Naugatuck Center

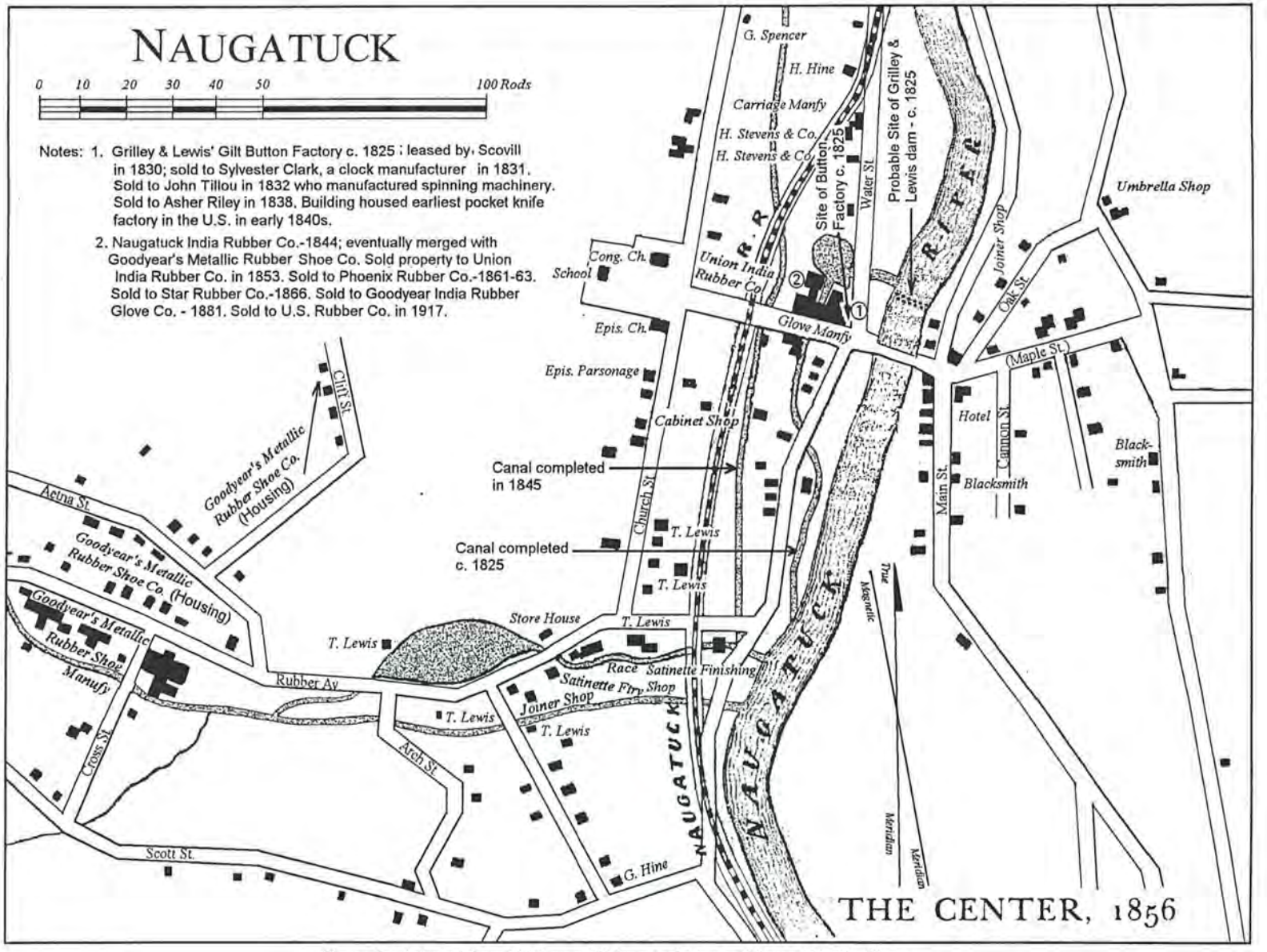


Figure 12: Adapted from 1856 map of Naugatuck Center (Figure 11). Significant elements have been identified and highlighted.

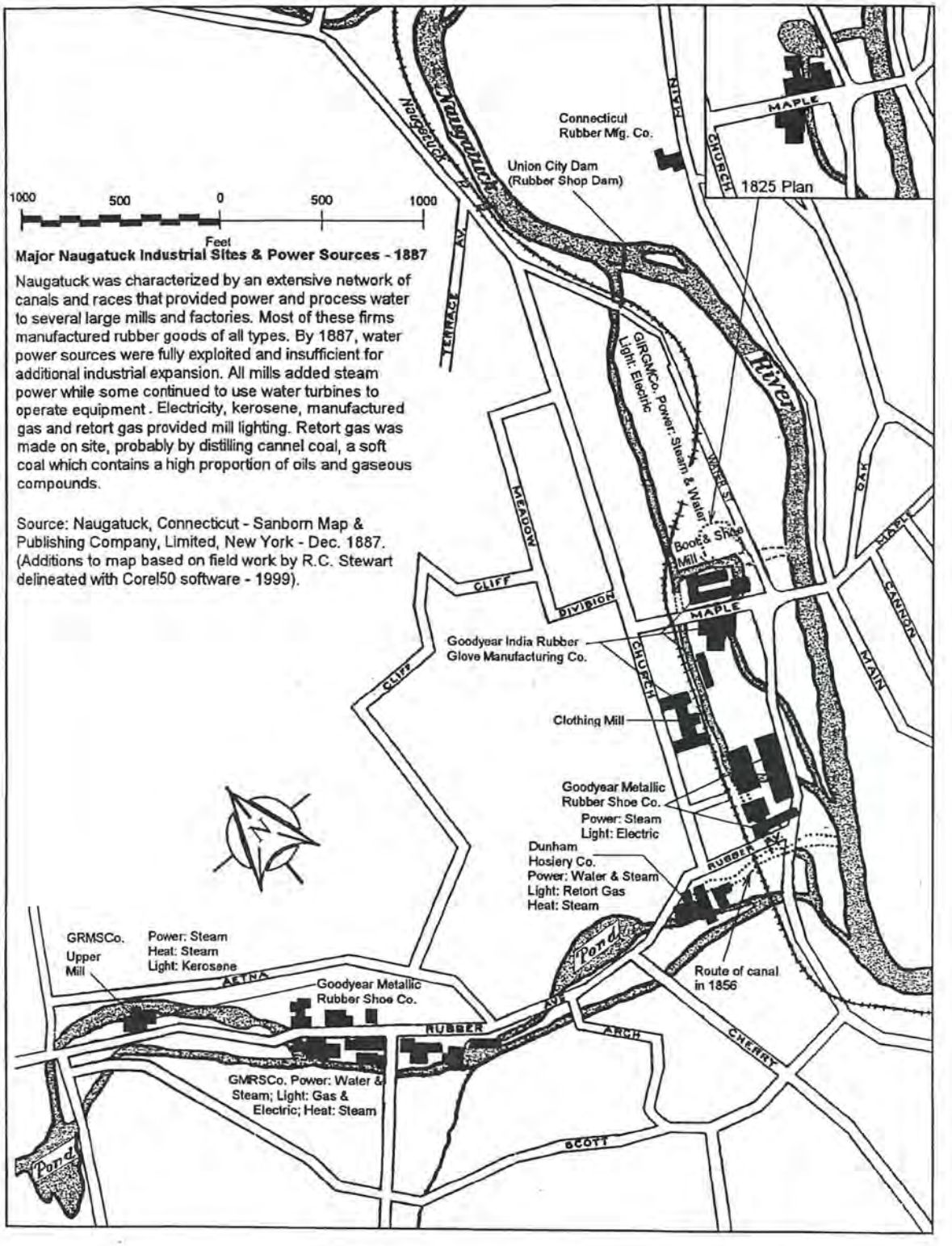


Figure 13: Major Industrial Sites in Naugatuck - 1887

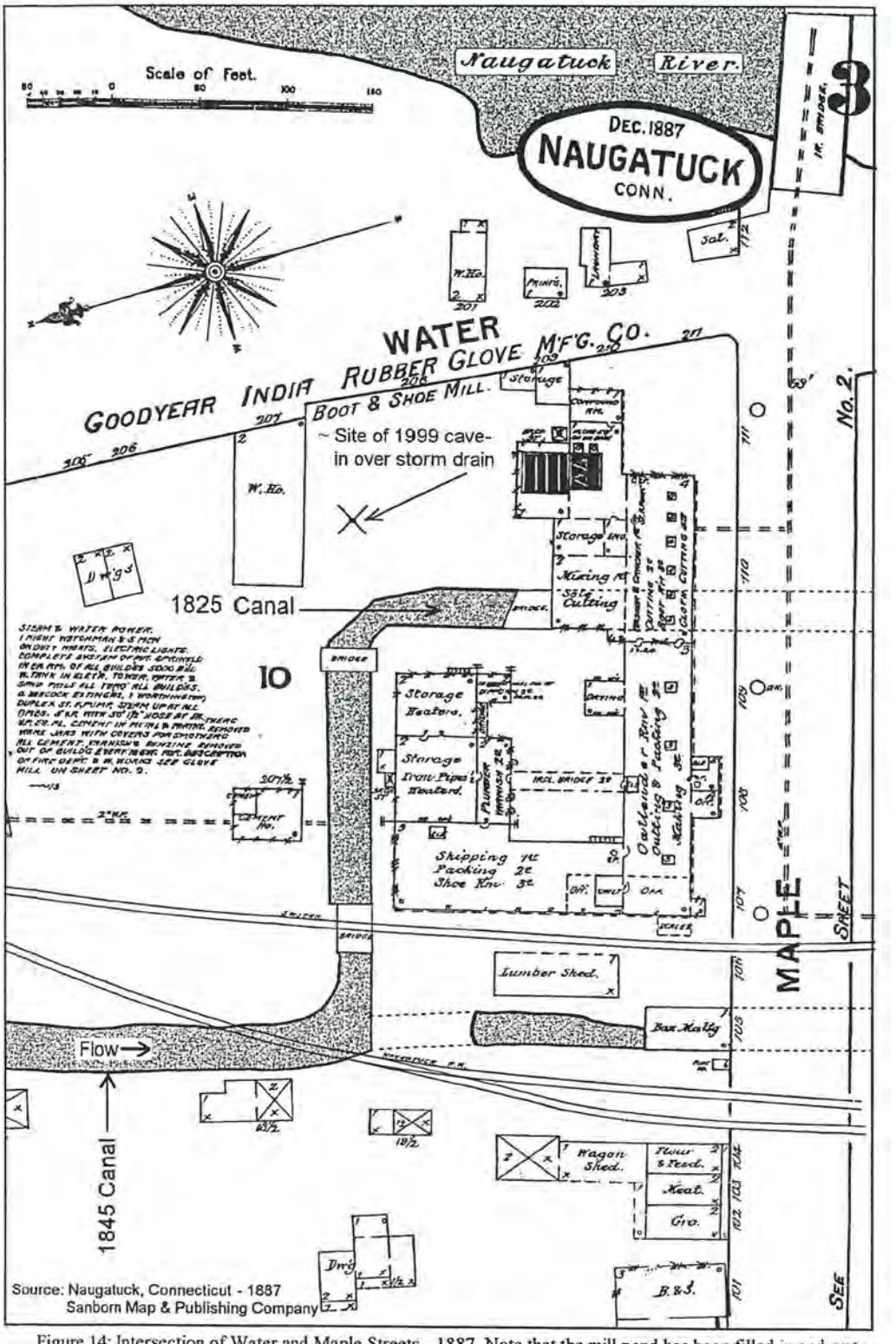


Figure 14: Intersection of Water and Maple Streets - 1887. Note that the mill pond has been filled in and water is being fed to the 1825 canal from the 1845 canal. Portions of the original 1825 headrace were probably retained for storm drainage once the old dam was removed. A stone lined drain was found at the marked site.

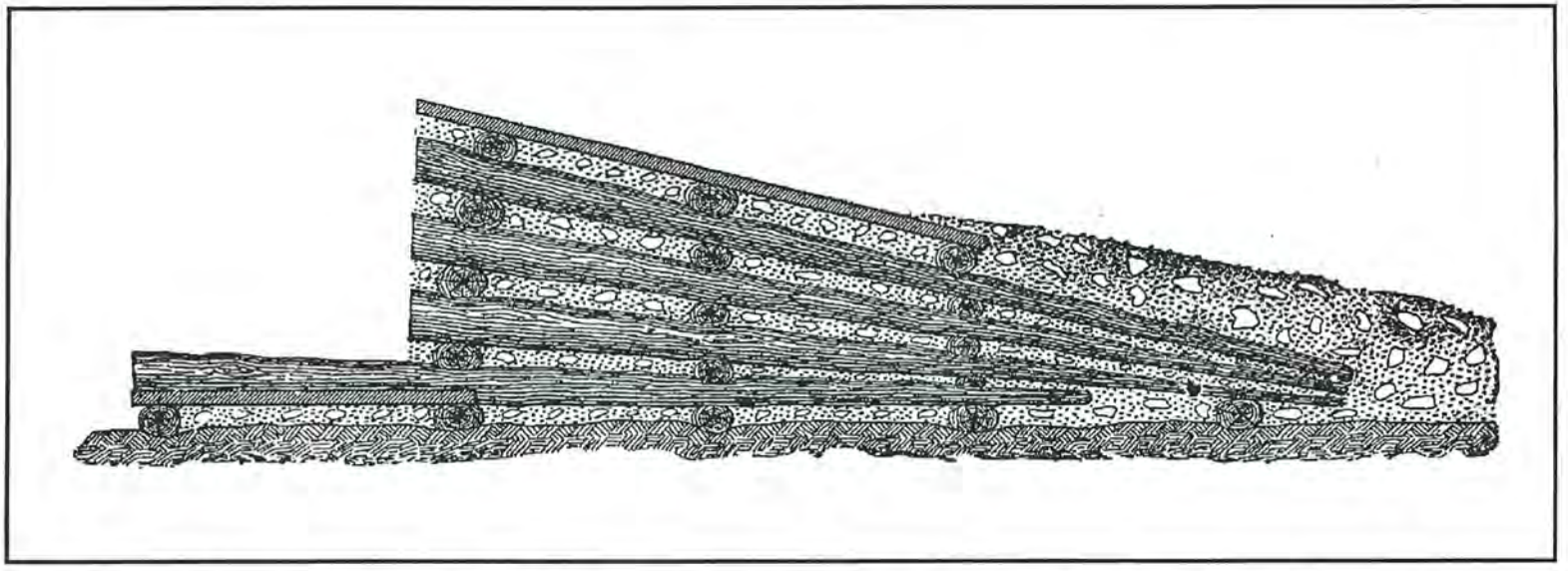


Figure 15: Cross section of a typical timber crib dam. The foundation course is formed of large logs, placed at right angles to the stream, and carried into the bank at both sides. The logs are laid in trenches excavated to a depth such that the tops of the logs project just above the river bed. The second course of logs is placed at right angles to the one below it. The crib is held together by wood tree-nails or iron drift bolts at the intersections of the logs. The triangular section of the dam is obtained by making the logs across the river smaller at the upstream end than at the downstream side of the crib. A course of planks, at least 4 inches thick, is securely spiked to the logs on the upstream side of the crest of the dam and continued upstream by a slope of gravel or earth (Wegman 1911:283).

INDEX TO PHOTOGRAPHS

Union City Dam

Naugatuck River, 0.08 miles West of Connecticut State Highway 8, 0.34-mile North of Maple Street Bridge.
Town of Naugatuck
New Haven County
Connecticut

Photographer: Robert C. Stewart, September - November 1998.

B-1 View South of Union City Dam dike portion and upstream side which is of timber crib construction capped with concrete and rip-rap.

B-2 View Southwest of dike portion, Union City Dam.

B-3 View Southwesterly of Union City Dam showing top course of planks capping timber crib construction.

B-4 View North of masonry intake structure of Union City Dam on west bank of the Naugatuck River.

B-5 View Northeast of downstream side of Union City Dam across intake structure.

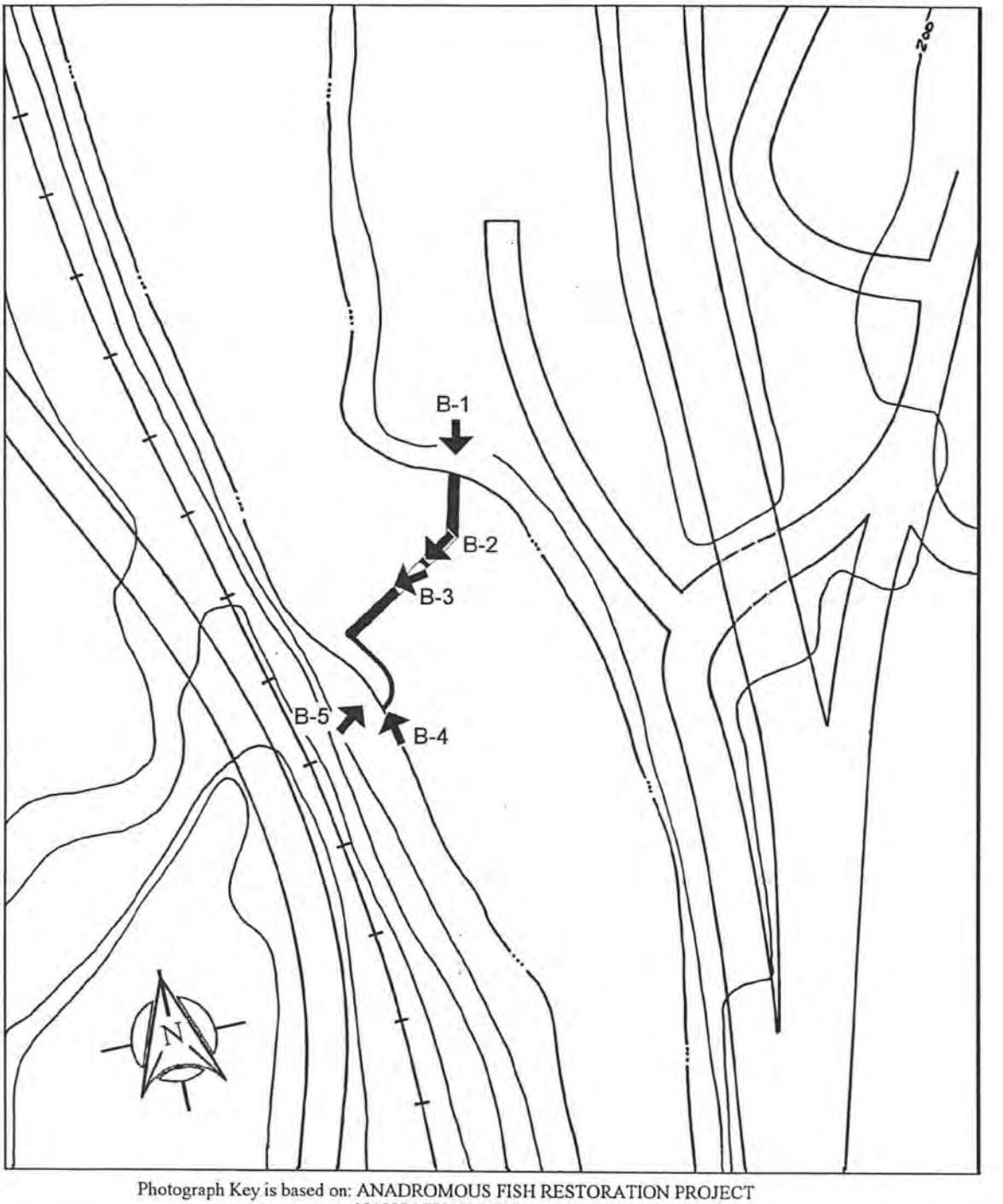
Historic Photographs:

B-6 Copy of a photograph of an eight-day brass cylinder clock manufactured by Sylvester Clark in the early 1800s.

B-7 Copy of a photograph of the Tuttle Manufacturing Company on Rubber Avenue at the foot of Church Street - 1880s.

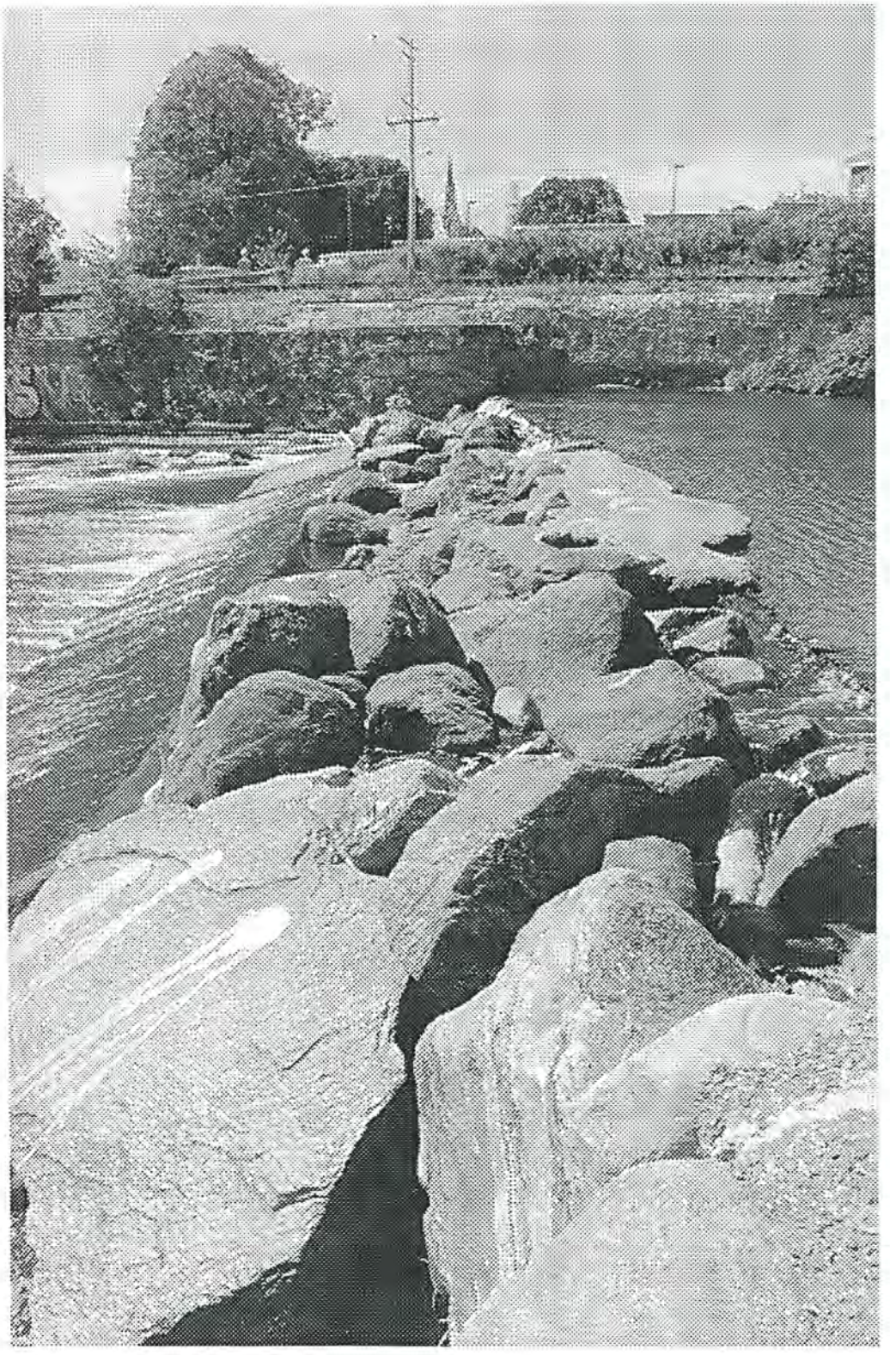
B-8 Aerial photograph of Union City Dam, Naugatuck, Connecticut, May 5, 1949. (Source GS-IM 9-141 - USGS Reston, Virginia).

KEY TO PHOTOGRAPHS
UNION CITY DAM



Photograph Key is based on: ANADROMOUS FISH RESTORATION PROJECT
NAUGATUCK RIVER BASIN - Milone & MacBroom

B-1 View south of Union City Dam. View emphasizes the dyke portion on the upstream side. This section is of timber crib construction capped with concrete and rip-rap.

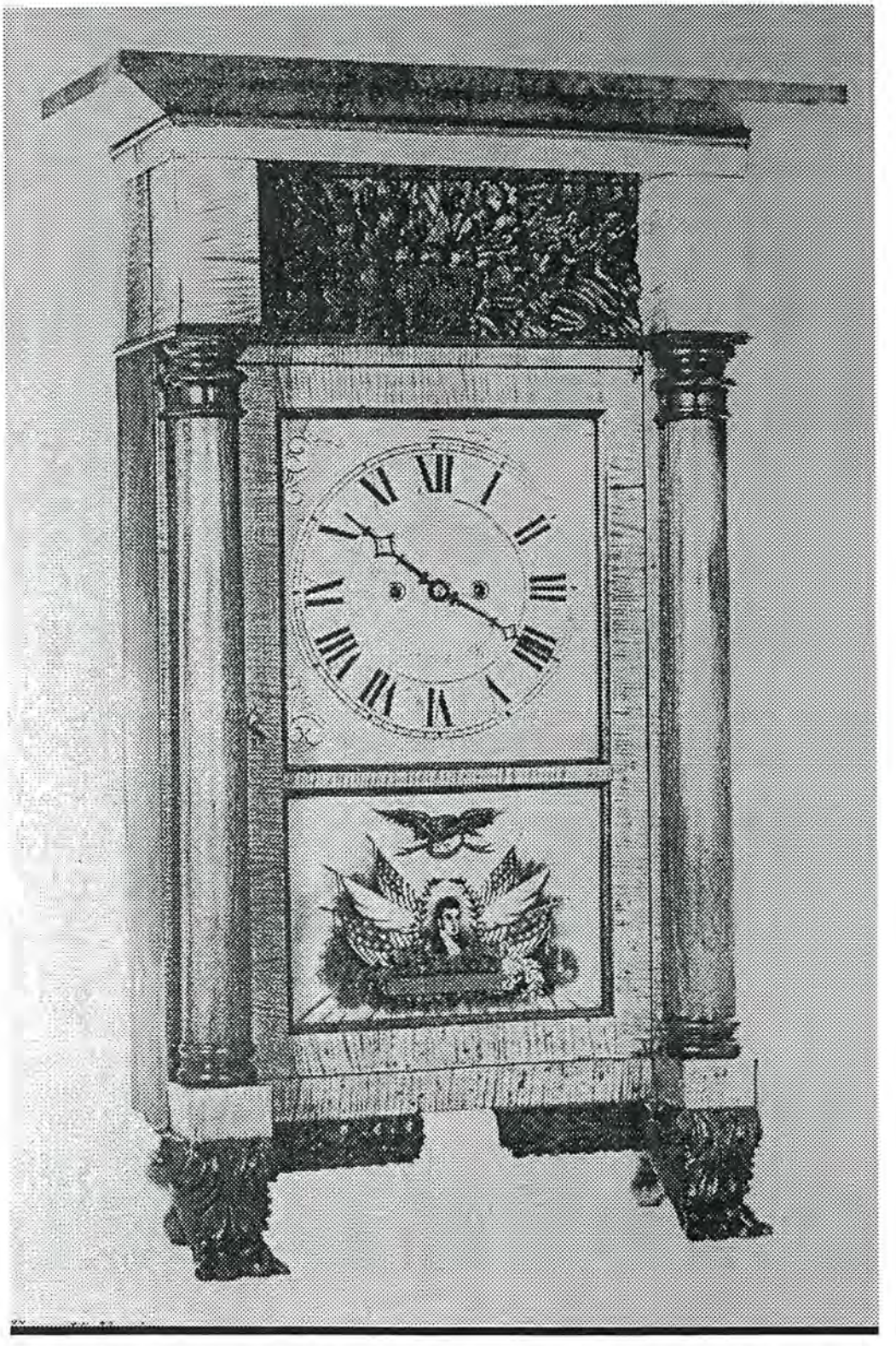


B-2 View southwest of dike portion, Union City Dam.

B-3 View southwesterly of Union City Dam showing top course of planks capping timber crib construction.

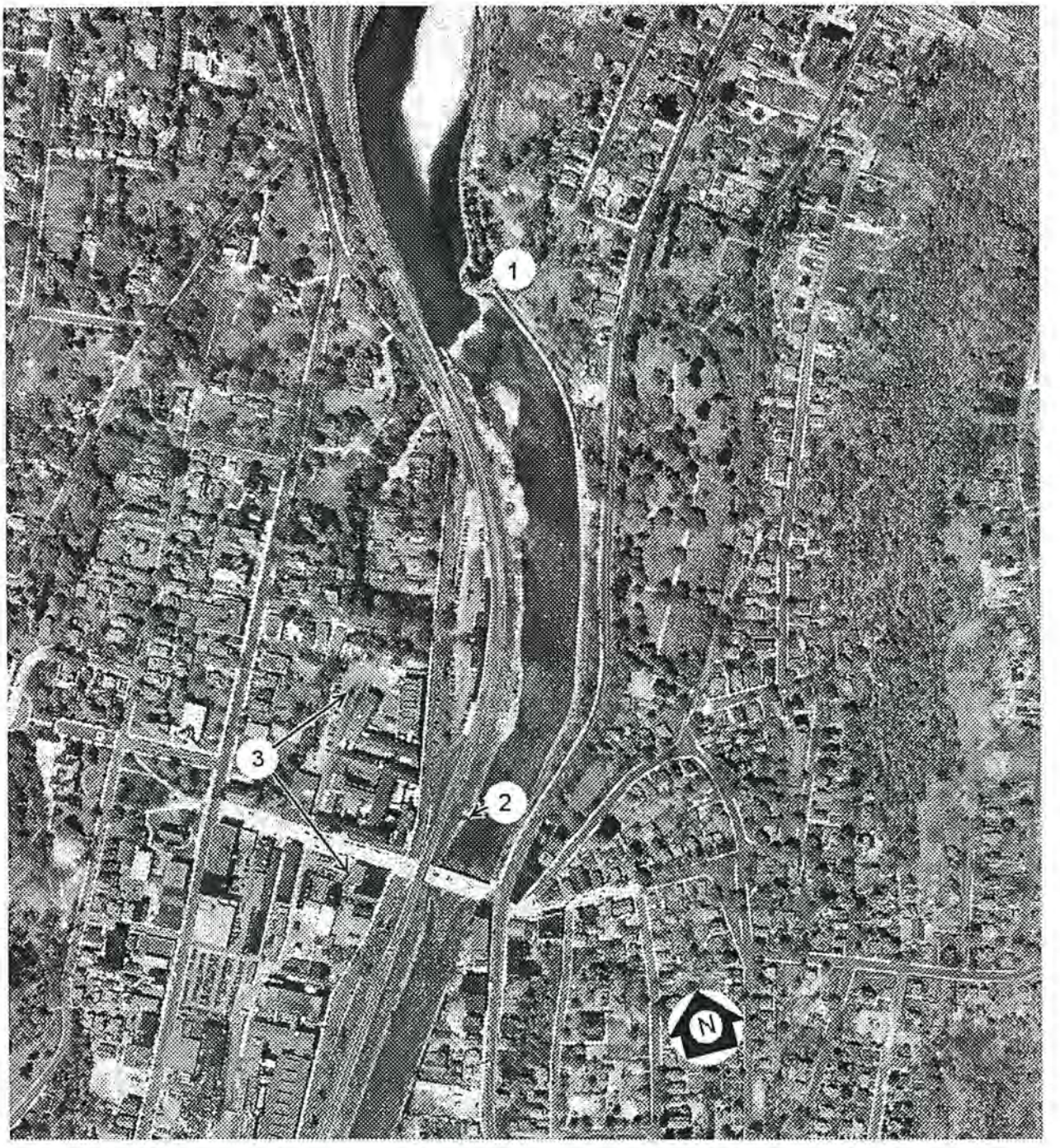
B-4 View north of masonry intake structure of Union City Dam on west bank of the Naugatuck River.

B-5 View northeast of downstream side of Union City Dam across intake structure.



B-6 Copy of photograph of eight-day brass cylinder clock manufactured by Sylvester Clark in the early 1800s. (Source: Bailey No. 13, 1980)

B-7 Copy of photograph of the Tuttle Manufacturing Company on Rubber Avenue at the foot of Church Street - 1880s.



B-8 Aerial photograph of Union City Dam, Naugatuck, Connecticut, May 5, 1949. (Source GS-IM 9-141 - USGS Reston, Virginia).
1. Union City Dam; 2. Outlet of storm drain - located at original 1825 canal inlet to factory mill pond (see Figure 12); 3. Remains of 1845 and 1825 canals.

PLATTS MILLS DAM

Location:	The Platts Mills Dam is located on the Naugatuck River, 0.18 miles west of Connecticut State Highway 8, 0.12 mile northeast of South Leonard Street Bridge. City of Waterbury, New Haven County, Connecticut.
UTM Coordinates:	USGS Waterbury, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.662545.4598060
Description:	The dam is a partially breached, run-of-the-river, timber crib dam overlain on its downstream face and crest with grouted riprap. The dam is about 10 feet high. Its plan form incorporates two shallow arches, 100 feet and 95 feet in length. A 37-foot spillway has been breached and no longer exists. The eastern end of the dam is masonry and may be the remains of a training wall that bordered the former spillway to the west. Another training wall lines the stream bank on the eastern side of the breach. The lowest point on the remaining dam has been topped with concrete and acts as a spillway during periods of increased flows.
Dates of Construction:	An earlier dam was built at the site in 1772. The extant dam dates from 1853. In 1853 Alfred Platt and his sons William and Clark built a new water power system on the Naugatuck which would provide separate sources of power to their grist/sawmills and to the metal-working and button making part of the business. In 1895-1896 the waterpower system was augmented to provide power for a new, more efficient, zinc processing plant, eyelet plant and button factory.
Present Owner:	Platt Brothers Company
Present Use:	Unused and abandoned. The dam formerly impounded water for generating power and use in industrial processes for Platt Brothers Company, a producer of brass products. Except for one building, the factory was destroyed by the 1955 flood.
Significance:	The dam provided power and water for an entrepreneurial family of 19th century industrialists. The company is currently a leader in fabrication of zinc, copper and brass products. The remaining traces of the dam and headrace reveal intensive and ingenious use of water to operate a metalworking business.

C. PLATTS MILL DAM

Surficial Inspection

The Platts Mill Dam is located on the Naugatuck River in the City of Waterbury, New Haven County, Connecticut. The dam's dates of construction range from circa 1772 to 1895. The dam is a partially breached timber crib dam that is overlain by grouted riprap on the dam's downstream face and crest. A few portions of the timber cribbing and planking are visible at the impoundment water line. The dam is about 10 feet high and in plan form appears as two shallow arches, 100 feet and 95 feet in length. The distance from the tip of the eastern arch to the breach is 36 feet, consequently the remaining portion is 231 feet. A former 37-foot spillway has been breached and no portion remains. The eastern end of the dam, close to the breach, is masonry. This masonry section appears to be the remains of a training wall that bordered the former spillway to the west. There is another masonry training wall along the stream bank on the eastern side of the breach. The low point on the remaining dam, which acts as a spillway during higher flows, has been topped with concrete. Most of the dam crest is covered with large trees and brush. The impoundment area is about an acre. Three feet of timber were ripped off by the 1955 flood (Milone & MacBroom 1997a:8-1).

Ownership

In 1772 Lemuel Hoadley bought what was to become the Platts Mills property from Ezekial Upson. No mill is mentioned in the deed to this parcel (Anderson 1896:579). According to Anderson, a few years later a mill is mentioned as a landmark in a deed, suggesting that Hoadley built the first mill on the property. Circa 1800 Jesse Hopkins ran a nail factory on the property, empowered by Naugatuck River water funneled through a canal (Ibid.).

Anderson gives a description of the project area in the early 1800s: "The road to it [Hopkins' nail factory] was over the hill almost west from the turnpike passing near Elijah Nettleton's house. The mill stood on the east side of the present road, which was opened about fifty years ago." A canal ran parallel with, and near to, the river along the west side of the present road. Between this and the river were several small shops, including a saw mill, a flax breaker and a wire bench.

There were various other industries pursued here, mostly in a small way (Anderson 1896:579)." Various members of the Platt family have owned the dam, its canal leading to the Platt Brothers factory, and water rights since the mid-19th century at which time Alfred Platt began to buy up land parcels (Borough of Naugatuck Land Records 1849 (3):476, 1850 1852 (4):26, 1854 (4):499, 1873 (10)571). The 1850 census listed an A. Platt as a "Button Maker" whose source of power was the Naugatuck (Federal Manufacturing Census 1850:287). An 1852 map of New Haven County depicts three Platts living on the east side of the river in the project area: A. Platt, Wm. Platt and W.B. Platt. The west bank of the river was bordered by two railroad lines (Budington and Whiteford 1852). An 1856 map of New Haven County continued to show three Platts living on the east side of the river in the project area: A. Platt, W. S. Platt, and M.C. Platt. West of the Platts and along the river were listed a button factory and a grist mill. The project area on the west side of the river is vacant except for a railroad (Smith). The Beers Atlas of 1868 shows only Platt family members inhabiting the east side of the Naugatuck River in the project area. The map depicts a structure for "A. Platt" and one for "W. Platt," as well as a third structure entitled "A. Platt and Sons." Two buildings appear to represent "Platts Mills." All of the Platt structures were located east of the highway. Four buildings

entitled saw mill, grist mill, buttons and nails were located just west of the Platt structures and west of the highway, along the river (Beers 1868:56). The Waterbury Business Directory for 1868 lists A. Platt & Sons as a button manufacturer and A. Platt is listed under "Flour and Feed" as a "merchant miller (Beers 1868:57)."

The west side of the river shows the Naugatuck Rail Road running adjacent to the River and west of its tracks are those of the Boston, Hartford and Erie Rail Road. No structures are shown within this portion of the project area. In the 1870 federal manufacturing census (1870:646) A. Platt was listed as a Miller whose mill stones were powered by water, producing flour.

In the third quarter of the 19th century several Platts founded the Platt Brothers Company (AKA The Platt Brothers and Company). A number of Platts sold their portions of the dam and water rights to the Company (City of Waterbury Land Records 96:12, 117:73, 252; 122:205; 132:291-194) For example, in 1876 William S. Platt and Clark M. Platt conveyed 1/3 water privilege and dam across the Naugatuck River with 1/3 part of the water power, water rights, rights of flowage, easements and privileges appurtenant to said dam and water power (96:12).

In 1892 Alfred L. Platt, Alfred S. Platt and Oliver G. Camp deeded "2/3 of water power, water privileges, dams anon the Naugatuck River, ditches, canals, new way rights easements and privileges thereunto appertaining to and of said Platts Mills in said Waterbury" to the Platt Brothers Company (City of Waterbury Land Records 132:291).

In 1955 the factory, now known as the Platt Brothers and Company, extended about 500 feet along the east bank of the Naugatuck River. The flood of 1955 destroyed 300 feet of the plant. The buildings were abandoned and a new factory was built on higher ground well away from the river bank.

The present owner of the dam and water rights is the Platt Brothers. The company also owns the property on the eastern bank of the river (City of Waterbury Assessor's Map 558, Block 346, Lots 3 & 4). The property on the western side of the river is owned by Bristol St. Enterprises (Ibid.: Map 558, Block 1159).

The Platts Mills Dam and Waterpower

Waterpower had been in use near the site of Platts Mill Dam since 1772. Lemuel Hoadley bought the property, built the first dam, dug races and erected a sawmill, gristmill, flax breaking mill and nailworks (Roth 1994:23). This complex became the Platts Mill District in 1797 when Nathan Platt bought 30 acres of land which included these mills, a house and barn. The purchase included riparian rights on the Naugatuck River (Fishman 1994:5). In 1804 Platt bought a neighboring nail factory from Jesse Hopkins and established the family in Waterbury's growing metal-working industry.

Alfred Platt, Nathan's second son, was born in 1789. He participated in the mill and water power operations as a youth and became a skilled millwright. He became a school teacher and ran several businesses, ultimately starting up a button manufactory in 1822 on the family property (Fishman 1994:9). The button works upset the distribution of water power along the race and increased power demand. Platt expanded and built another race to the east. It was built along the side of a hill which

formed a natural wall for one side. He also built another gristmill in 1824 (Roth 1994:39). This millrace may be seen in historic aerial photo C-11.

Alfred Platt and Aaron Benedict formed a partnership during this period. Benedict owned and operated a brass casting and fabricating shop which had the capability of producing sheet brass. Producing quality brass was a difficult process to achieve in the early 19th century. Brass, an alloy of zinc and copper, required a lot of practical knowledge to form. Copper melts at 1083 degrees C (1981 degrees F) while zinc vaporizes at that temperature. Unless the ingredients were added at the right time and rate, with due regard for temperature, the zinc would vaporize off as 'spelter smoke' and leave a copper rich alloy. Worse, the zinc could vaporize within the melt and cause porosity, voids in the metal or precipitate a dangerous boil over. Alloying brass required a high degree of know-how and the ability to work in hazardous conditions.

Through his association with Benedict, Alfred Platt was able to obtain hands-on experience in manufacturing brass. His button shop had the equipment needed to punch out button blanks, stamp and form them, then assemble parts of the button, polish, plate or finish them and send them off to garment industry commission houses (Fishman 1994:12). Platt left the partnership with Benedict and established a primary metal-working plant. By 1842 he built a casting shop and rolling operation. He also established a tool and die making facility and expanded the assembly and finishing operations (Fishman 1994:13).

Around 1853 the company started making zinc weather stripping, seamless zinc pipe and zinc strip. This fortuitous diversification probably insured the company's survival to this day; they avoided head-on competition with the brass barons of Waterbury and developed expertise in manufacturing useful items of zinc (Fishman 1994:18).

Increasing power demands required modifications to the dam and races. The present shallow arched planform of the dam dates to 1856. The shape maximizes the length of the spillway. The 1856 reconstruction installed a stone apron on the downstream side to eliminate undercutting. The west headrace was filled in but was still visible in aerial photographs taken in 1944. The east headrace was rebuilt and fitted with new headgates. At this time an arched masonry culvert was constructed to conduct the race under the present Platts Mills Road. The changes resulted in a gain of 3 feet of head for a total of 17 feet. Platt dug a whelped, tailrace and installed a turbine to drive the button machinery (Roth 1994:74).

John Tyler of West Lebanon, New Hampshire supplied the 14" diameter turbine which developed five horsepower when fully submerged. Unlike waterwheels, turbines were relatively immune to high water and backflooding. The turbine ran at 316 rpm, a number which minimized gearing usually necessary to match speed to machine requirements. This turbine was critical to operation and allowed the plant to operate in times of either low or high flow (Roth 1994:75).

The Civil War provided a major customer for the company's zinc suspender buttons. Samuel Porter suggested that they be used for fastening together the two halves of Army shelter or "pup" tents. The military demand for these buttons forced the Platts to hire people unrelated to employees or family for the first time (Fishman 1994:24).

The water power system operated for almost forty years. In 1895 the grist mill burned down and a new waterpower system was installed. By July of 1895 the headrace channel had been expanded for higher capacity, new headgates installed at the dam and outlet gates at the headrace. A new culvert passed under Platts Mills Road and a new forebay and wheelpit completed the renovations. Brick

Factories went up between Platts Mills Road and the Naugatuck River over the next eight months (Roth 1994:156). See historic aerial photograph C-11 to locate these features.

The increased water supply allowed additional turbines to be brought on line some of which were dedicated to producing electricity. A 40 x 50 foot planform turbine hall stood over the wheelpit and housed governors, generators and switchgear. Electricity was primarily used for lighting (Roth 1994:156). To the north of the powerhouse a 160 x 55 foot planform building accommodated brass rolling and slitting mills. South of the powerhouse an 80 x 40 foot planform building housed the casting shop and breakdown mill which reduced castings to thinner billets.

The machinery on the north side received power from two 24" turbines while the machinery on the southern side ran on power from two 30" turbines. One small turbine was dedicated to producing direct current for powering arc lights. A second small turbine powered a line shaft in the northern mill for general small machine use. All turbines were made by the Holyoke Machine Company. The Platts spent $26,000 for the new facilities (Roth 1994:157).

The only remaining building from the complex is a sawtooth roof structure, illustrated in photograph C-10, that was erected in 1929 for manufacturing eyelets. The flood of 1955 swept away the other buildings along the Naugatuck.

Detailed studies of the Platt Brothers and Company have been written. *The Platt Brothers and Company - Ingenuity Innovation & Integrity - A Chronicle of the Entrepreneurial Spirit* by Susan Fishman and *Platt Brothers & Company - Small Business in American Manufacturing* by Matthew W. Roth detail the company's history.

The following time-line lists the innovative products manufactured by Platt:

Products:	1849	Buttons, 'strap', 'suspenders' and fronts - japanned buttons, rolled strip for internal use
	1853-1856	Zinc weather stripping, seamless zinc pipe, rolled zinc strip and the machinery needed to manufacture these items
	1858	Tin-plate buttons, brass & "gilt" buttons, customized buttons, 4-holed buttons (previously only 2-holed buttons were made)
	1861	Buttons for uniforms, pup tent and equipment buttons; "Hatch-type" buttons (smooth holes to eliminate damaging the thread)
	1866	Rivet-attached buttons per William Reid's patent

1869	Platt's patent rivet-attached button
1871c	Ring, eyelets, collets
1877	'Tipping zinc' for tips of shoelaces
1879-1883c	Experimental battery electrodes, battery plates & connecting clips; 'burrs' (reinforcing pips for pockets in work clothing)
1883	Patent machines for attaching rivet-attached buttons
1914-1918	WWI uniform and tent buttons
1920	Improved rolling mill design enables production of precise thickness zinc for use in electrical fuses
1929	Plant addition for substantial increase in eyelet production
1930s	Continue to produce: tipping zinc, commercial rolled strip, electrical fuse strip, wire and eyelets
1941	Precisely rolled zinc strip for use in artillery shell fuses (detonators); zinc for other war production uses
1950-1951	Zinc cathodes for corrosion protection, (sacrificial electrodes)
1953-1954	Developed continuous rod casting
1959	'D-shape skid wire' for insulated electrical cable; steel cored 'diamond-shaped' zinc rod for cathodic protection for oil tankers and pipelines
1966	Development of other continuous cast alloys; rectangular zinc strips for divider strips in terrazzo floors
1969	Tin-plated zinc alloy strip for spade automobile fuses
1975	Hazelett continuous casting machine installed for production of zinc strip; zinc wire for shot blasting, battery anodes, electrical fuse strips, strip and wire solder; sputtering target
1980s	Zinc wire for thermally spraying zinc as a protective coating for bridges and other steel structures
1983	Continuous rod casting and tandem rod rolling mill installed

1985	Properzi continuous casting machine goes on line; Additional eyelet manufacturing machines added
1992	Acquisitions add a large variety of drawn metal parts, lamp bases, caps, collars, etc. to the product line

Conclusions and Recommendations

Review of the archaeological site inventory files in the Office of State Archaeology show no archaeological sites located within 1.5 miles of the project area. The area/location of the original headrace has been covered over by Platts Mills Road. The flood of 1955 scoured out the 1856 headrace and removed most of the buildings. A few stone walls remain to indicate the location of the head gates. A lone hydrant dated 1876 is located near the head gate in a wooded area east of Platts Mills Road (Photograph C-9). Physically, little remains that would contribute to any possible past Native American activities or to recordation of the industrial sites and canals served by the Platts Mills Dam.

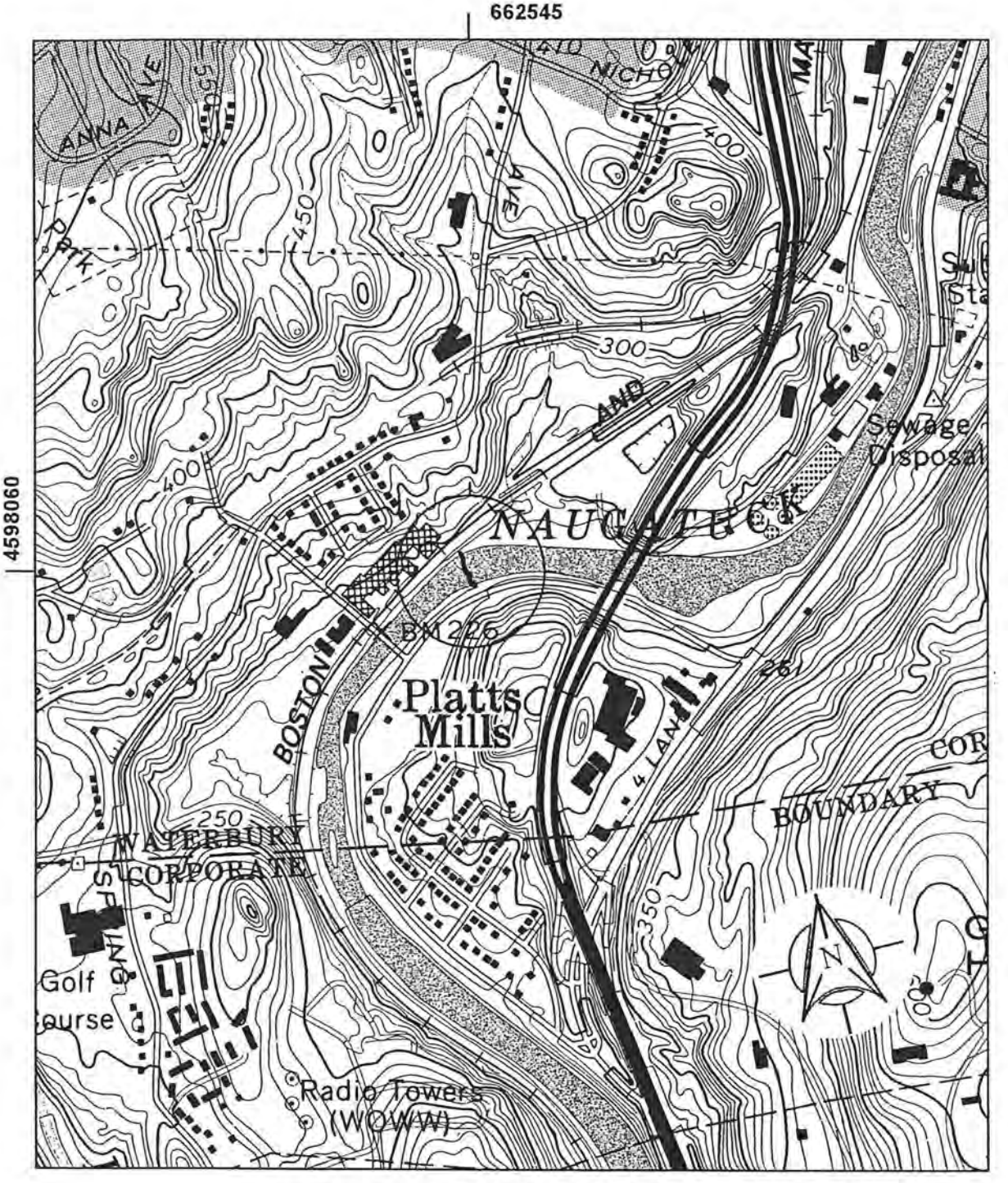


Figure 16: Location Map: Platts Mills Dam
Quadrangle: Waterbury, Connecticut 1;12000

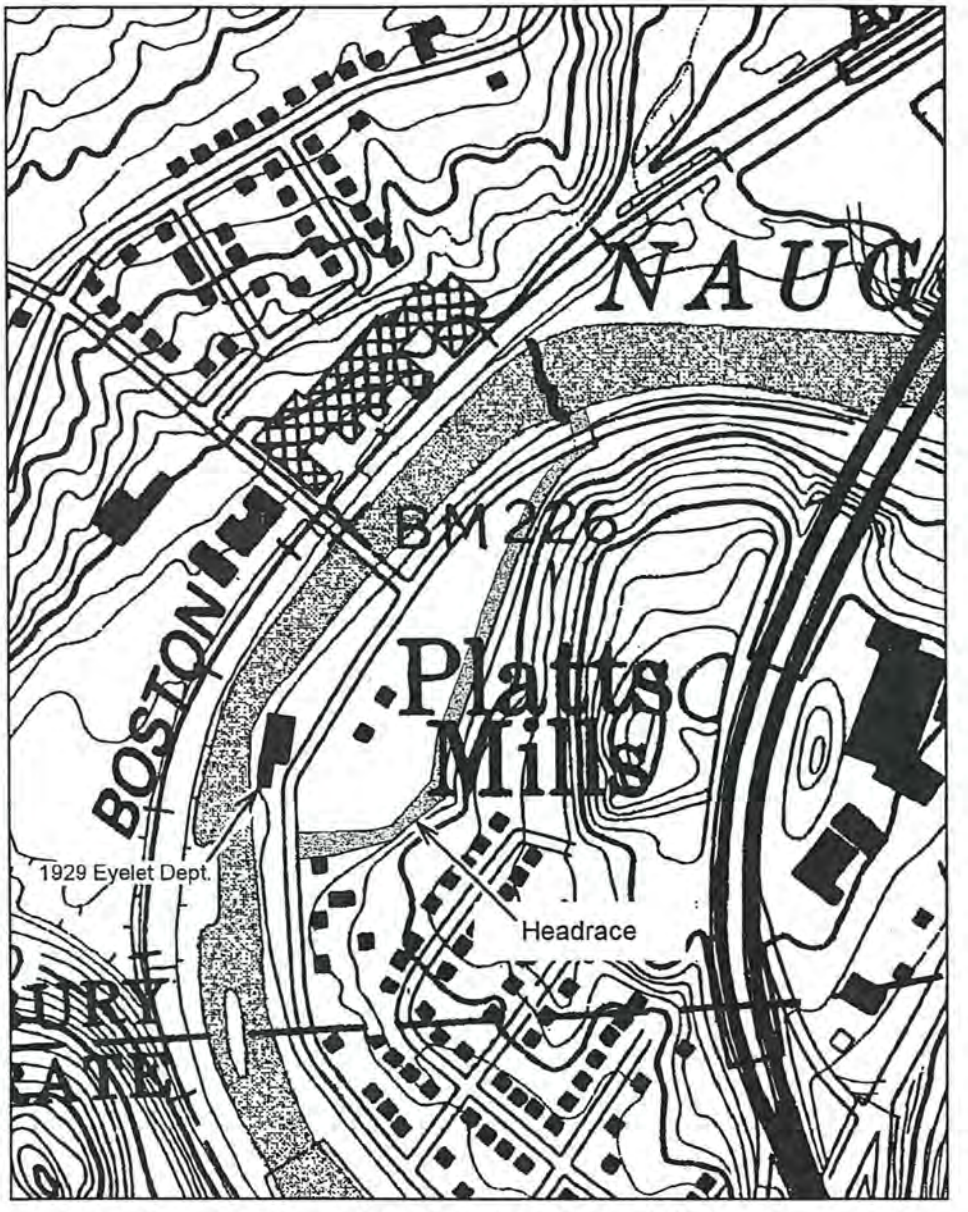


Figure 17: Location Map - Platts Mills Dam and Headrace
The race/canal location was positioned based on aerial photographs taken in 1944 and superimposed over Naugatuck, Connecticut Quadrangle 1:6000 dated 1984.

INDEX TO PHOTOGRAPHS

Platts Mills Dam

Naugatuck River, 0.18 miles west of Connecticut State Highway 8, 0.12-mile northeast of South Leonard Street Bridge
City of Waterbury
New Haven County
Connecticut

Photographer: Robert C. Stewart, September - November 1998.

C-1 View north of the downstream side of Platts Mills Dam from South Leonard Street Bridge.

C-2 View north of the downstream side of Platts Mills Dam.

C-3 View south, downstream, of breach in Platts Mills Dam.

C-4 View south of the downstream side of Platts Mills Dam.

C-5 View south of downstream face of Platts Mills Dam showing rip-rap and concrete fill.

C-6 View northwest, upstream, of breach in Platts Mills Dam.

C-7 View southwest of trash gate and remaining intake structure in Platts Mills Dam.

C-8 View northwest of a storm drain, west side of Naugatuck River, upstream of Platts Mills Dam. Drain appears to discharge from abandoned Bristol Company grounds.

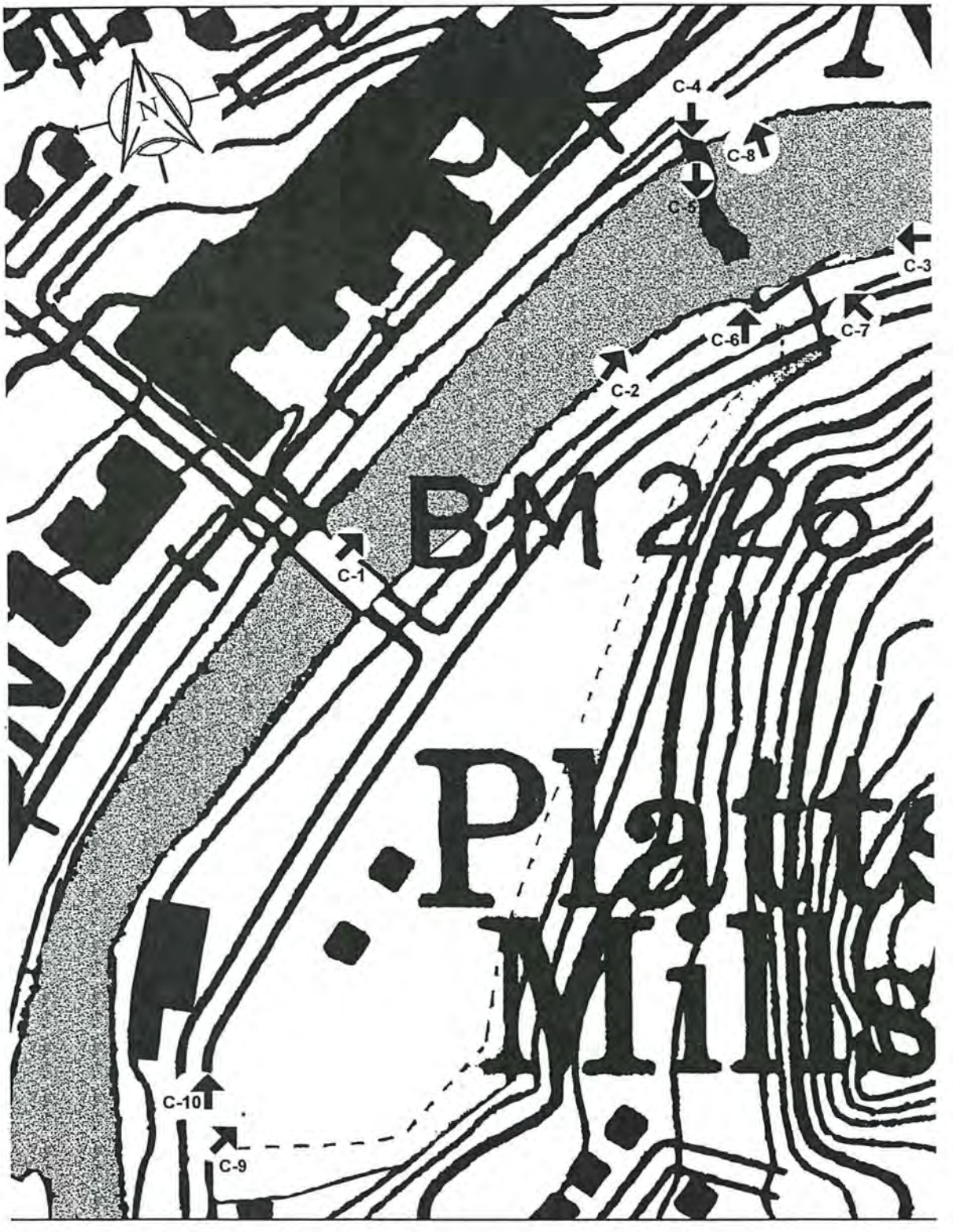
C-9 Hydrant found in wooded area adjacent to headgate of race at the southern end of Platt Brothers & Company complex. The hydrant bears a patent date of 1876.

C-10 View north of former Platt Brothers & Company eyelet plant. The building was erected in 1929 and was the only Platt facility to survive the 1955 flood. The sawtooth roof allowed abundant light into the plant.

Historic Photograph:

C-11 Aerial photograph of Platts Mills Dam, Naugatuck, Connecticut, February 10, 1944. The 1856 headrace had its origins in a ditch cut in 1822. Both east and west headraces were used 1822-1856. In 1856 the west race was abandoned and the east race enlarged. (Roth 1994:39) (GS-AX 5-200 - USGS Reston, Virginia).

KEY TO PHOTOGRAPHS
PLATTS MILLS DAM

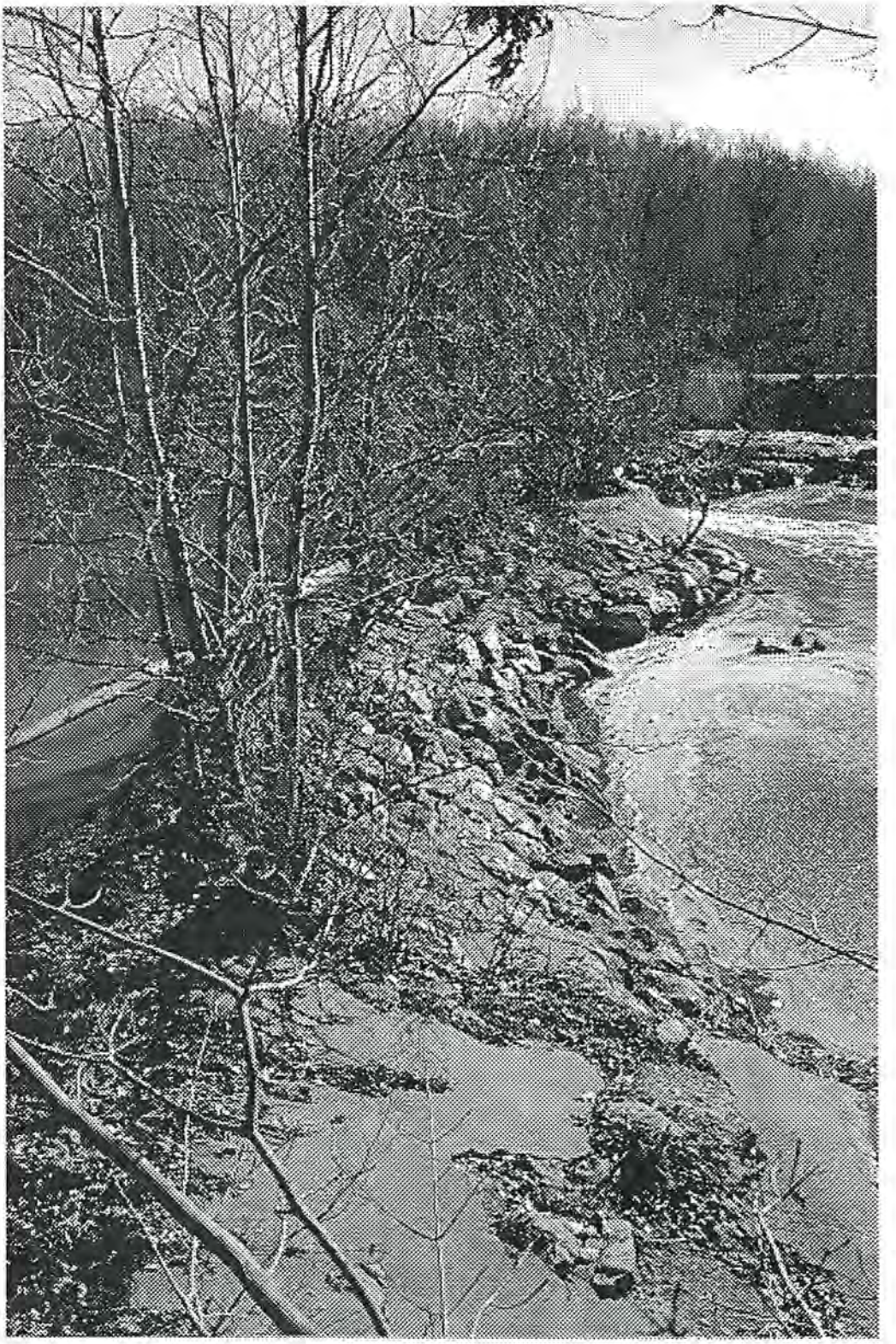


Photograph Key is based on: Quadrangle: Naugatuck, Connecticut - 1984

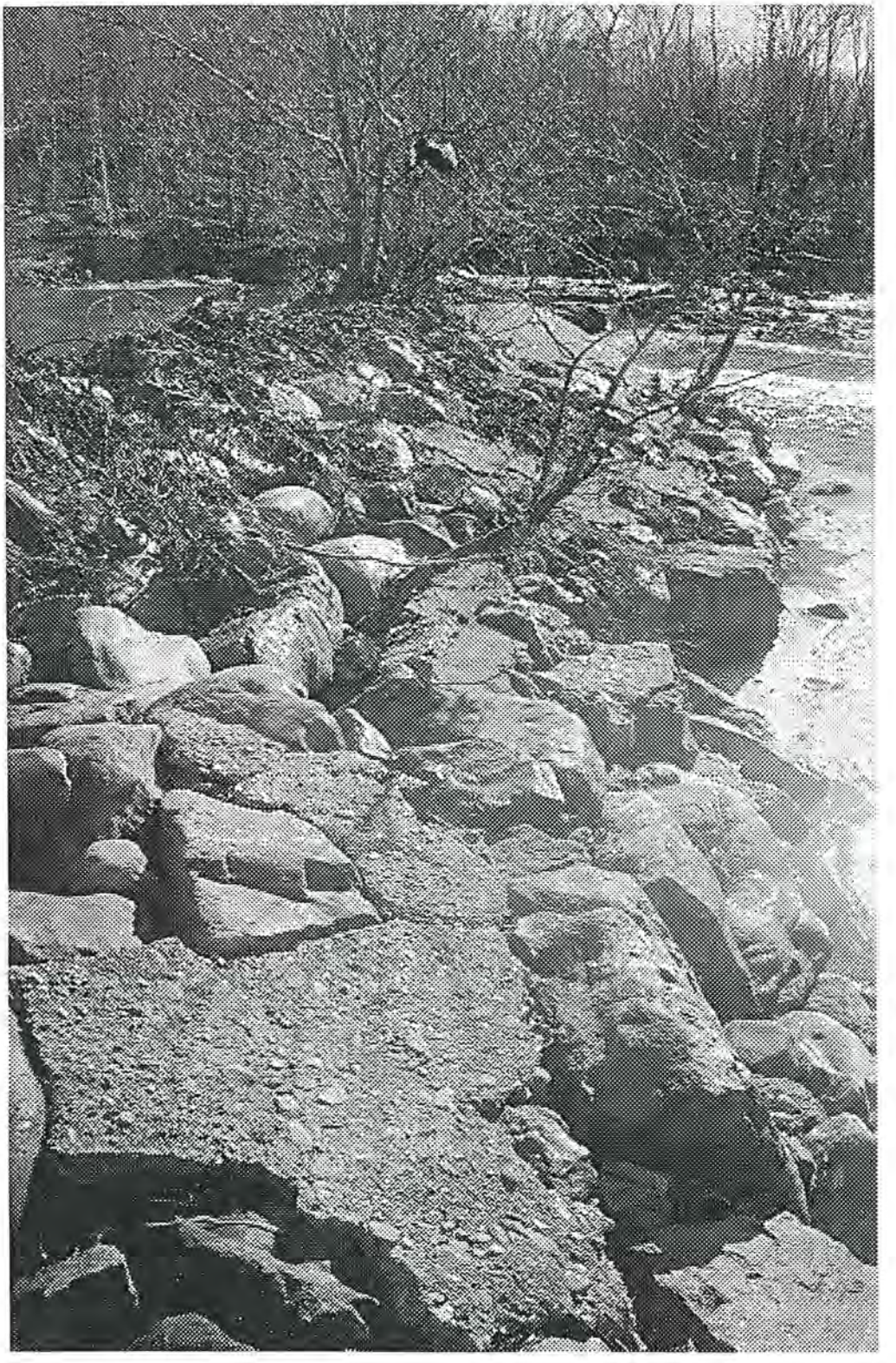
C-1 View north of downstream side of Platts Mills Dam from South Leonard Street Bridge.

C-2 View north of downstream side of Platts Mills Dam.

C-3 View south, downstream, of breach in Platts Mills Dam.



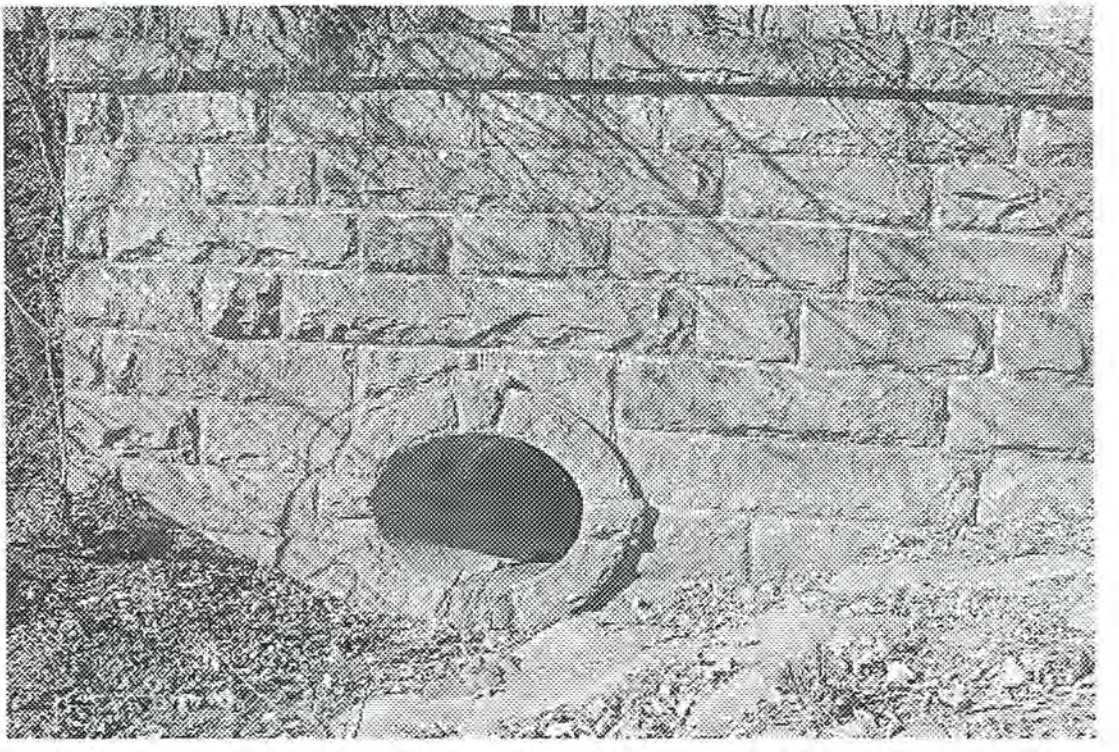
C-4 View south of downstream side of Platts Mills Dam.



C-5 View south of downstream face of Platts Mills Dam showing rip-rap and concrete fill.

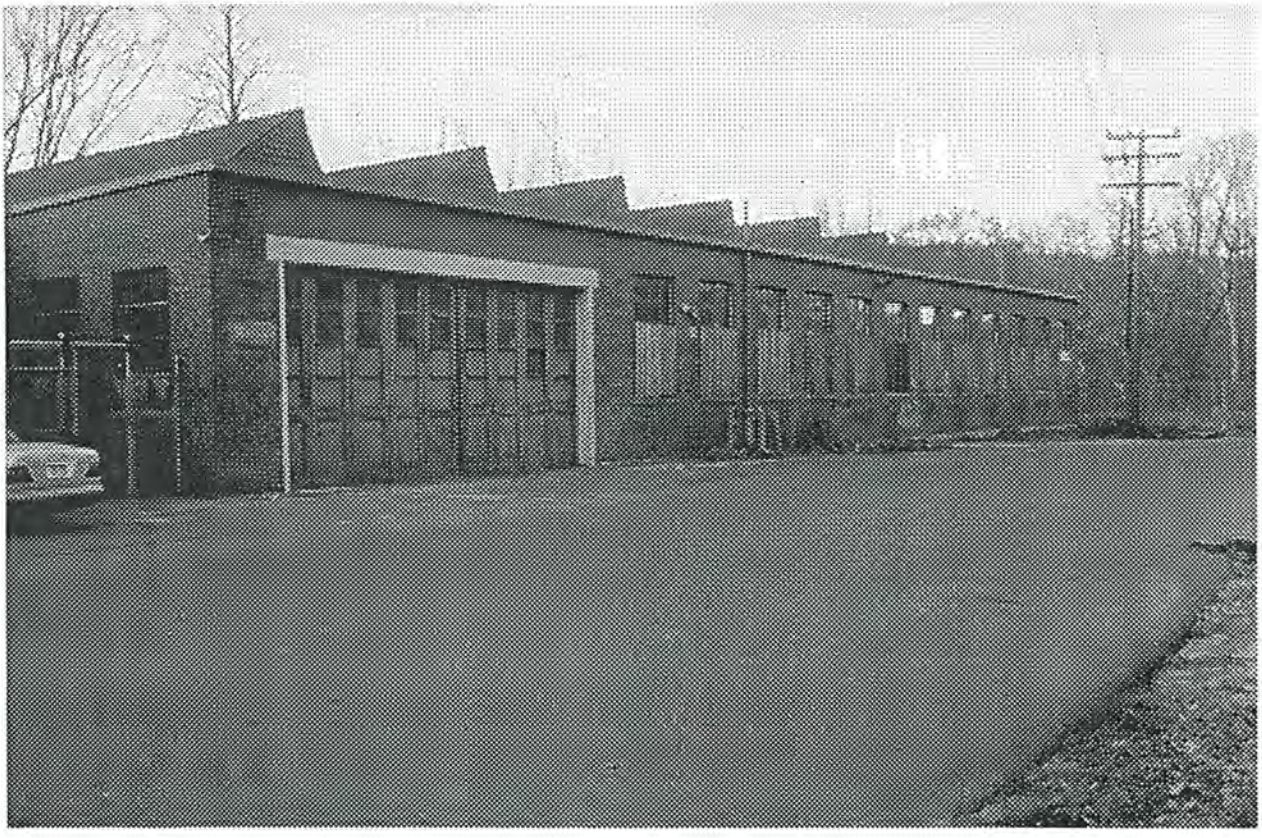
C-6 View northwest, upstream, of breach in Platts Mills Dam.

C-7 View southwest of trash gate and remaining intake structure in Platts Mills Dam.

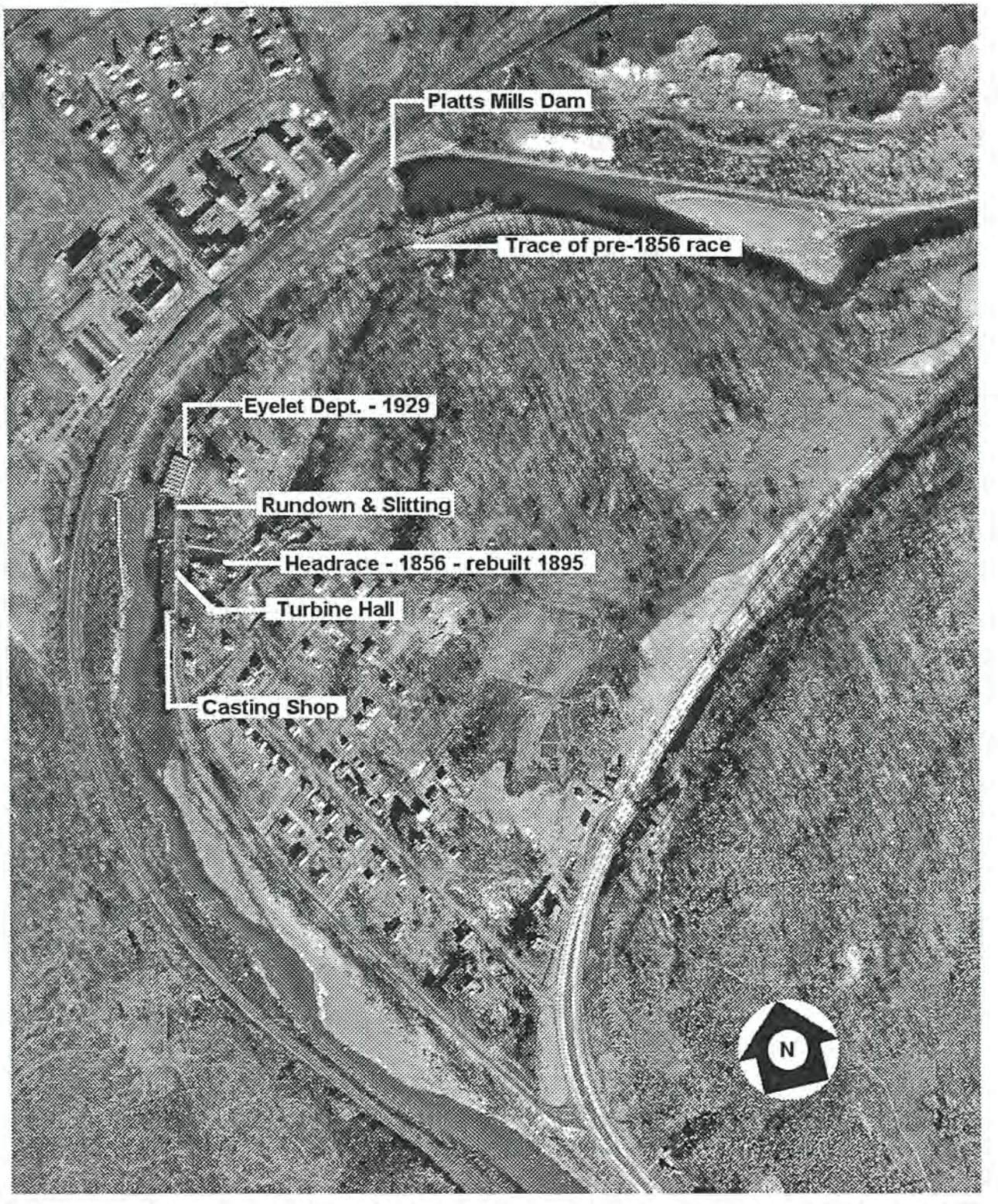


C-8 View northwest of storm drain, west side of Naugatuck River, upstream of Platts Mills Dam. Drain appears to discharge from abandoned Bristol Company grounds.

C-9 Hydrant found in wooded area adjacent to headgate of race at southern end of Platt Brothers & Company complex. Hydrant bears patent No. 85576.



C-10 View north of former Platt Brothers & Company eyelet plant. The building was erected in 1929 and was the only Platt facility to survive the 1955 flood. The sawtooth roof allowed abundant light into the plant.



C-11 Aerial photograph of Platts Mills Dam, Naugatuck, Connecticut, February 10, 1944. The 1856 headrace had its origins in a ditch cut in 1822. Both east and west headraces were used 1822-1856. In 1856 the west race was abandoned and the east race enlarged. (Roth 1994:39) (GS-AX 5-200 - USGS Reston, Virginia).

BRAY'S BUCKLE DAM

Location:	The Bray's Buckle Dam is 0.05 miles east of South Main Street, and 0.1 mile north of Washington Avenue on the Mad River, City of Waterbury, New Haven County, Connecticut.
UTM Coordinates:	USGS Waterbury, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.663705.4600935
Description:	Bray's Buckle Dam is a 14-foot high stone masonry arch dam with a vertical downstream face. From training wall to training wall, the dam is 100 feet long. The stone masonry capstones are 4.5 feet long, nine feet thick and vary from two to four feet in width.
Date of Construction:	c. 1851
Present Owner:	Atlantic Richfield Delaware Corporation
Present Use:	Unused and substantially abandoned. The dam formerly impounded water for cooling, processes, power and steam generation at the Benedict & Burnham branch of the American Brass Company which later merged with Anaconda Brass. Anaconda later was bought by the Atlantic Richfield Delaware Corporation. The dam will be the centerpiece of a proposed Mad River Community Park planned by the Southend Neighborhood Revitalization Corporation, Waterbury, Connecticut.
Significance:	The Bray's Buckle Dam is on a major tributary of the Naugatuck, the Mad River. At a height of 14 feet, it has more power generating potential than any other dam in the study. Its power was extensively used by the Benedict & Burnham Company which harnessed water power to some of its rolling mills through a 30-foot diameter water wheel. This was in use through the 1880s and perhaps later. Additional mills were powered by steam engines powered by boilers producing 550 HP. Many other water power users had converted to turbines by this time. While there were other factories adjacent to Bray's Buckle Dam which could have, from a practical standpoint, accessed its power, the water privilege was owned by Benedict & Burnham which employed it exclusively.

D. BRAY'S BUCKLE DAM

Surficial Inspection

Bray's Buckle Dam is located on the Mad River north of Washington Avenue, east of South Main Street and west of River Street, in the City of Waterbury, Connecticut (see location map, Figure 18 and map of A Hispanic cultural center & Mad River community park, Figure 21).

The Bray's Buckle Dam is a 14-foot high stone masonry arch dam with a vertical downstream face. From training wall to training wall, the dam is 100 feet long. Its chord is 86 feet. The stone masonry capstones are 4.5 feet long, nine feet thick and vary from two to four feet in width (Milone and MacBroom 1998a:10-1).

There is a low-level outlet on the western side of the dam, about 12 feet from the western training wall. The outlet is about five feet above the toe of the dam and is three feet by three feet in size. The intake structure is located immediately upstream of the western training wall between the training wall and the corner of the former machine stamp and press building of the Steele & Johnson Manufacturing Company. A 16-foot long trash rack is located in front of the intake structure. It is positioned to deflect debris over the dam. The dam is a run-of-the-river structure which is normally full of water and offers no flood water storage. The impoundment area is about an acre (Milone and MacBroom 1998b:1-5). The dam was not breached during the 1955 flood.

The dam is surrounded by several abandoned factory buildings which housed the Steele & Johnson Manufacturing Company and the Waterbury Button Company (Figure 19). Water from the dam passed through a trash rack and head gate immediately adjacent to Steele & Johnson's Stamp and Press Room, into an underground penstock approximately 10 feet in diameter. The penstock led under South Main Street to a wheel pit and thirty-foot waterwheel which powered some of Burnham & Benedict's rolling mills (Sanborn Insurance Map - Waterbury, Connecticut - 1884). The elevation at Main Street, where the penstock tunnels under the roadway is the same as the elevation at the top of the dam. Consequently, the head of water available at Burnham & Benedict's wheel would be the dam height of fourteen feet plus the depth of the penstock below Main Street, estimated at seven feet for a total of twenty-one feet. Figures 19 and 20 show the relationship of the penstock to the dam and Burnham & Benedict's water wheel. The dam was constructed contemporaneously with the Benedict & Burnham works, about 1851. At the time the penstock and race were installed, the property, which later became the site of Steele & Johnson's works, was vacant.

Historical Context

The sole recipient of water and power from the Bray's Buckle Dam was the Benedict & Burnham Company which was formed in 1836. They were the first American Company to roll German silver, an alloy developed in Great Britain and formulated of nickel, zinc and copper. In concert with Scovill Manufacturing, they developed machinery and stamping presses for manufacturing butt hinges for doors and furniture in the late 1830s. Benedict and Burnham also provided sheet brass for Chauncy Jerome's clocks during the 1840s and set up their own clock making division in 1857 as the Waterbury Clock Company. In addition to clocks, Waterbury Clock made toys. In the 1860s they made clockwork-powered walking dolls and climbing monkeys (Bucki 1980:35). In 1842 Benedict & Burnham established a joint venture with Brown & Elton which became the American Pin Company. American Pin mass-produced pins from wire and later made safety pins, ornamental pins

and hair pins (Bucki 1980:28).

In the mid-1800s Benedict and Burnham bought up a number of land parcels and water rights within and adjacent to the project area to accommodate its expanding brass industry (City of Waterbury Land Records 1843 (53):157; 1851 (56):390, 394, 509; 1851 (57):146; 1859 (59):150; 1860 (69):485; 1872 (88):17). During the late 19th century the Benedict & Burnham plant had a casting shop, tube-casting shop, sheet metal mill, seamless tube mill, brass wire mill, brazed tube mill, rule mill, blanking mill, copper wire mill, copper rod mill, insulated wire mill and a fastener fabrication plant on its site. An expansion in 1914 added another seamless tube mill, packing and shipping building, carpenter shop and expanded the rolling mill building. A new general office building and machine shop were also built about his time. (Pape 1918:201). Various Sanborn insurance maps and a 1907 map produced by the office of A.J. Patton, Surveyor shows the dam located on property of Benedict & Burnham Mfg. Co., on the north and south sides of the river. The company's numerous factory buildings were situated on the west side of South Main Street (Figure 20).

East of Benedict and Burnham and adjacent to the mill pond was the Steele & Johnson Manufacturing Company. On the south side of the Mad River just below the mill pond was the Waterbury Button Company, which produced both metal and ivory buttons. Below it was located the Waterbury Buckle Company a fabricator of buckles, clasps, slides, small ornaments, notions and patented articles (Waterbury & Naugatuck Directory - 1901). The maps depict the race flowing below the main factory of Steel and Johnson and from thence flowing under the rolling mill at Benedict and Burnham.

In the late 19th Century, America's demands for brass continued to escalate, and by 1895 Waterbury was producing 61% of the nation's sheet brass (Rossano 1996:58). In the interests of efficiency, control over market share and greater profits the brass companies of Waterbury explored the possibility of a merger. In 1893 the State of Connecticut issued a special charter to allow the merger of the Coe Brass Manufacturing Co., Scovill Manufacturing Company, Benedict and Burnham, Waterbury Brass Company, Holmes, Booth & Haydens and Plume & Atwood. The full merger was never concluded, Scovill elected to remain independent as did Holmes Booth & Haydens and Benedict & Burnham. The first attempt at consolidation failed. Another, largely successful attempt at a merger occurred in 1899 when the American Brass Company was formed by the Coe Brass Company, Waterbury Brass Company and the Ansonia Brass & Copper Company.

Holmes, Booth & Haydens Company merged with Benedict & Burnham in 1905. Between 1909 and 1912, American Brass acquired Chicago Brass, Waterbury Brass and Benedict & Burnham. It had at this time seventy brass mills in its inventory and became an operating entity rather than a holding company (Pape 1918:200). The consortium acquired the Buffalo Copper and Brass Rolling Mills of Buffalo, New York in 1917.

In 1912 the American Brass Company acquired the rights to Bray's Buckle Dam, its canal, water rights, and all buildings and appurtenances, from the Benedict & Burnham Manufacturing company. The deed noted that American Brass also acquired the right to maintain the intake basin and penstock, which crossed the land of Steele and Johnson Manufacturing Company from a point above the dam to the penstock under South Main Street (City of Waterbury Land Records 241:357-363). A 1985 map entitled "Map of land belonging to Fleisher Finishing Inc. Waterbury, CT; A.J. Patton Surveyor"

(Patton 1985) was utilized to deed the properties on the north and south sides of the river to Philip J. O'Brien and Protect Securities, Inc., respectively (Connecticut Department of Environmental Protection, Interdepartmental Memo 1996).

In 1922 Anaconda Brass & Copper bought the American Brass Company (Marcosson 1957:200). Through various mergers and name changes, the Anaconda eventually became a part of the Atlantic Richfield Delaware Corporation, which is the present owner of the dam.

While not drawing water from the Bray's Buckle Dam, its privilege being owned by Benedict & Burnham, Steele & Johnson Manufacturing Company's property abutted the dam and accommodated the penstock leading to Burnham & Benedict's plant (Figure 19). As a non-using abutter, Steele & Johnson is included in this report. The firm was incorporated in 1857 as the Steele & Johnson Button Company. It erected its plant on South Main Street in 1888. The company made brass goods from sheet, wire, rod and tubing. It had the capability of fabricating goods by drawing, stamping and spinning. Steele & Johnson could stamp shells up to 24" in diameter, turn nuts, stamp washers and fabricate chain from brass and iron. They also made uniform buttons, ornaments and parts for lighting fixtures. The company made supplies and components for the electrical and plumbing trades and was a leader in producing products on automatic screw machines (Pape 1918:218).

Conclusions and Recommendations

Review of the archaeological site inventory files in the Office of State Archaeology show no prehistoric archaeological sites located within 1.5 miles of the project area. There is, however, the historic industrial area around the dam and north of it. It merely confirms what the documentary search has demonstrated -- that the waters of the Mad River powered numerous industrial mill complexes during the 18th and 19th centuries.

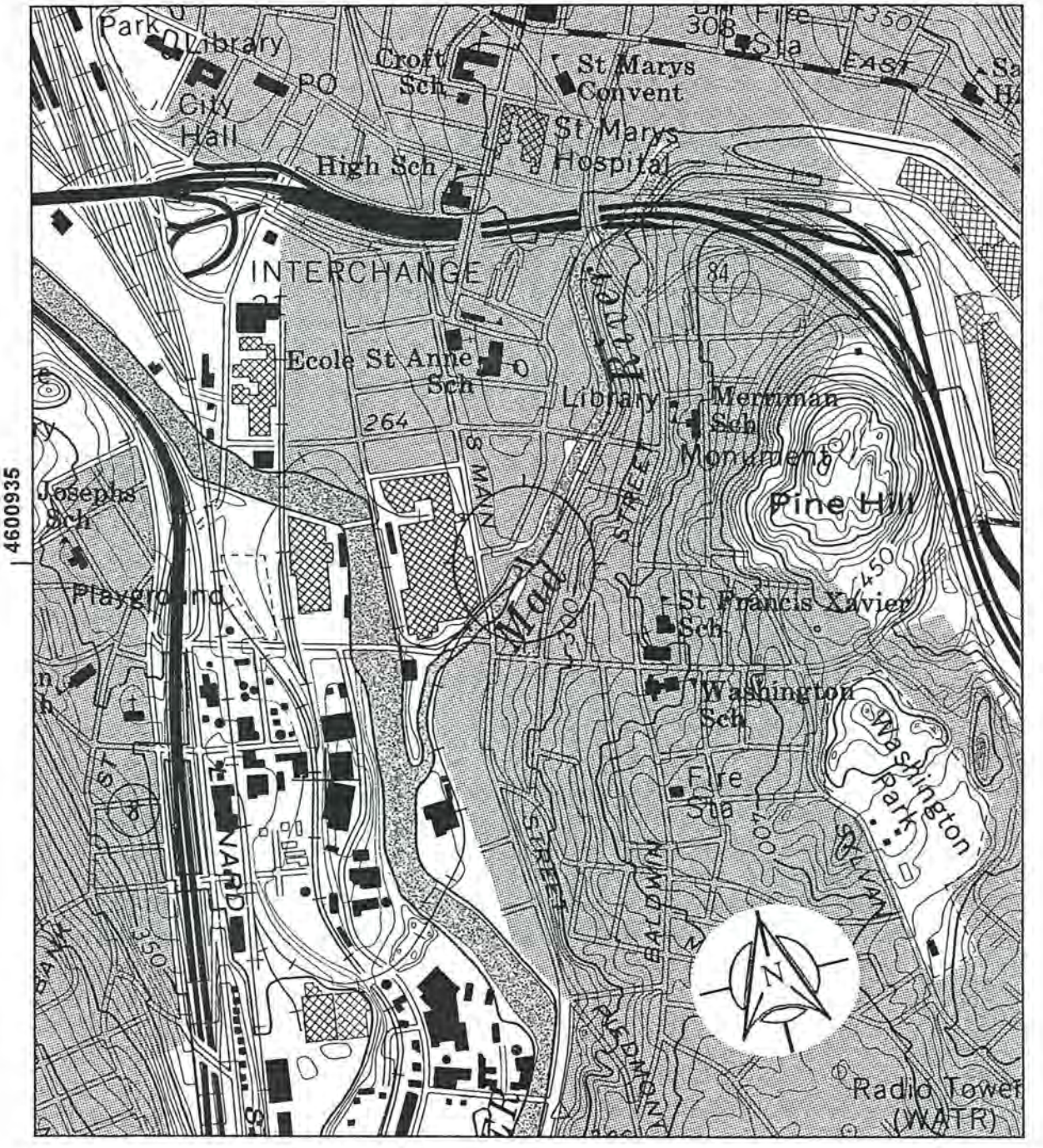


Figure 18
Location Map: Bray's Buckle Dam - Quadrangle: Waterbury, Connecticut 1:12000

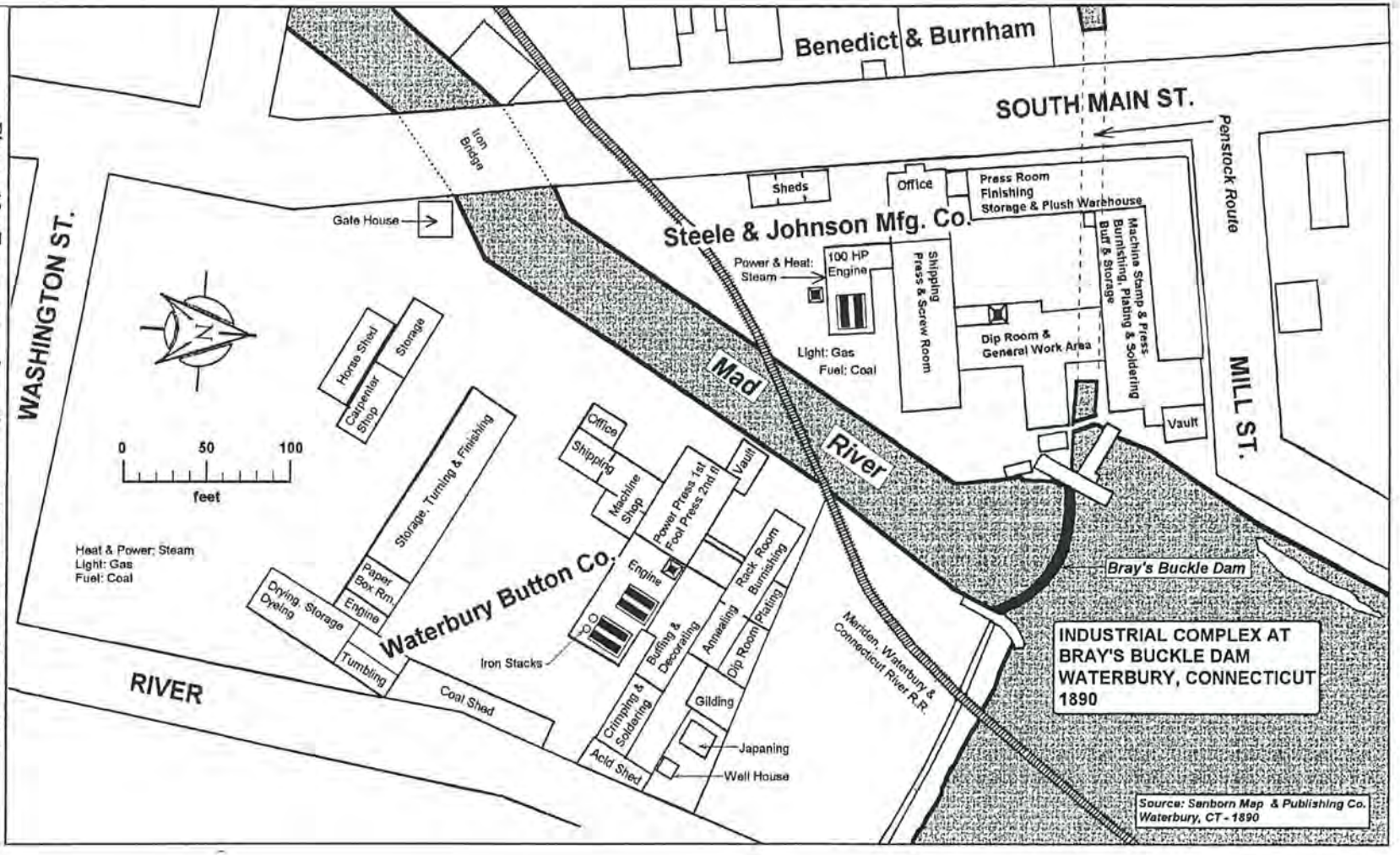


Figure 19 - Factory complex adjacent to Bray's Buckle Dam - 1890

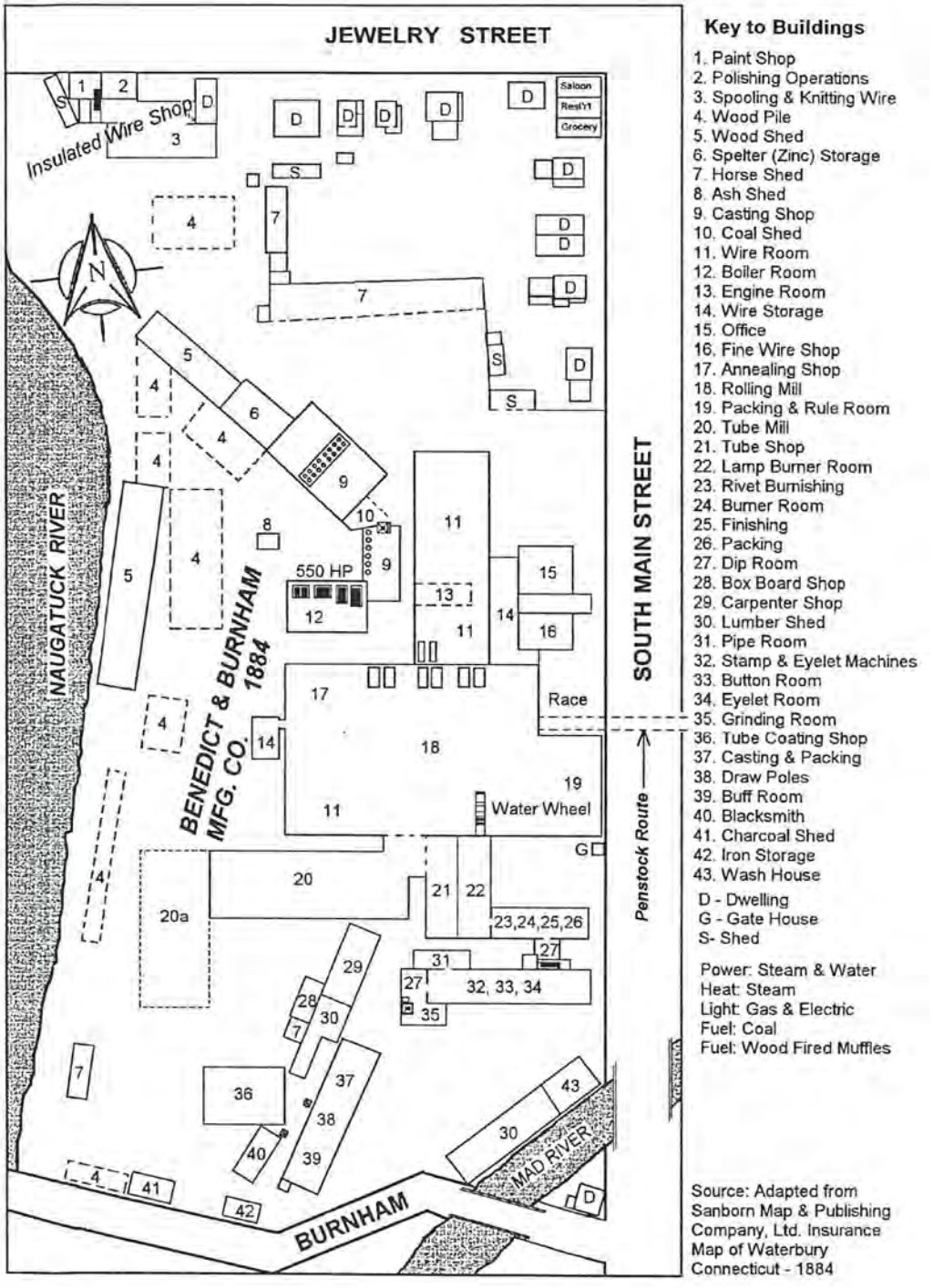


Figure 20: Benedict & Burnham Complex west of Bray's Buckle Dam - 1884

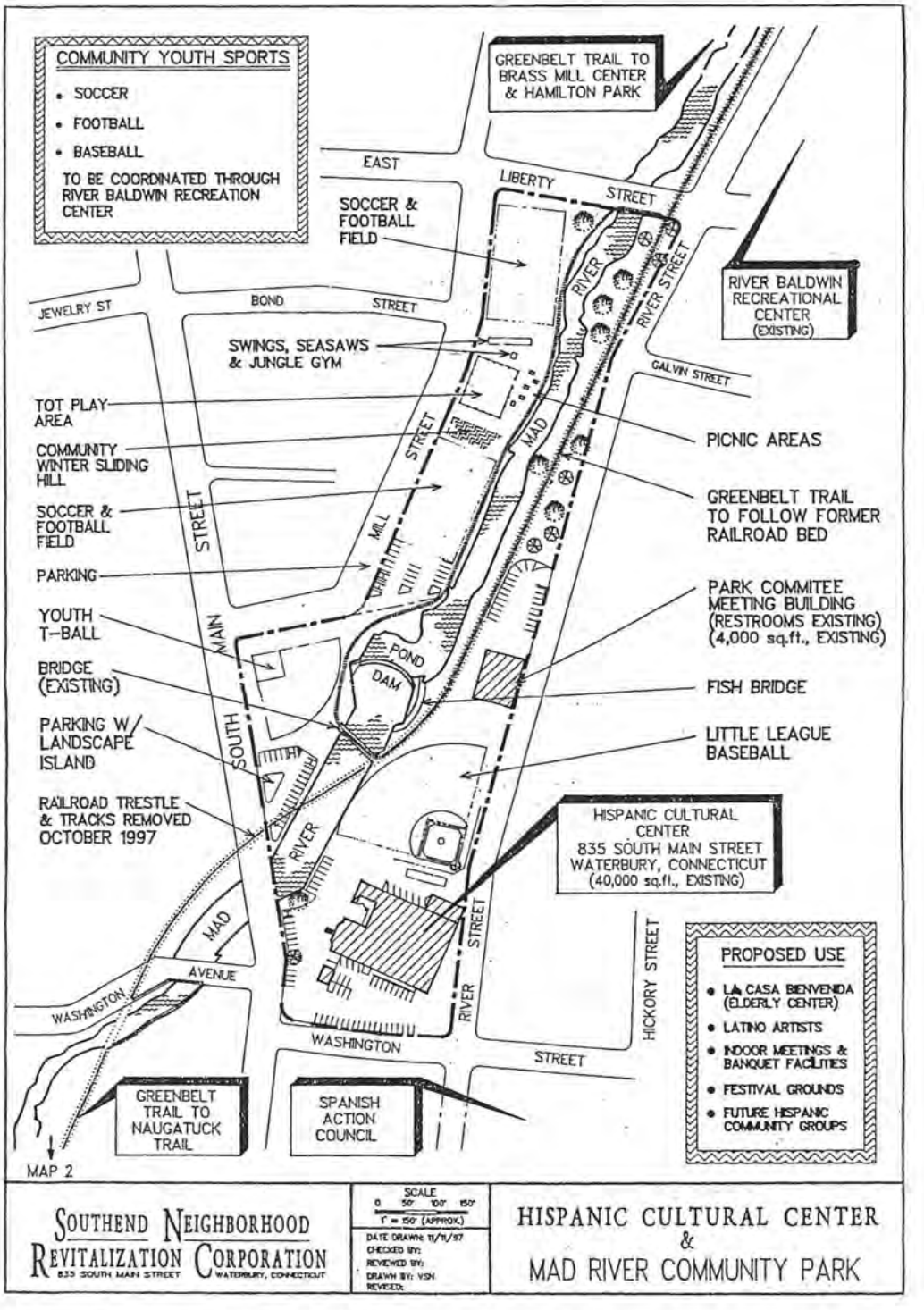


Figure 21: Plan for proposed Hispanic Cultural Center at Bray's Buckle Dam
Source: ANADROMOUS FISH RESTORATION (Milone & MacBroom - 19

INDEX TO PHOTOGRAPHS

Bray's Buckle Dam

Mad River, 0.05 miles east of South Main Street, and 0.1 mile north of Washington Avenue City of Waterbury
New Haven County
Connecticut

Photographer: Robert C. Stewart, September - November 1998.

D-1 View northeast of the downstream side of Bray's Buckle Dam.

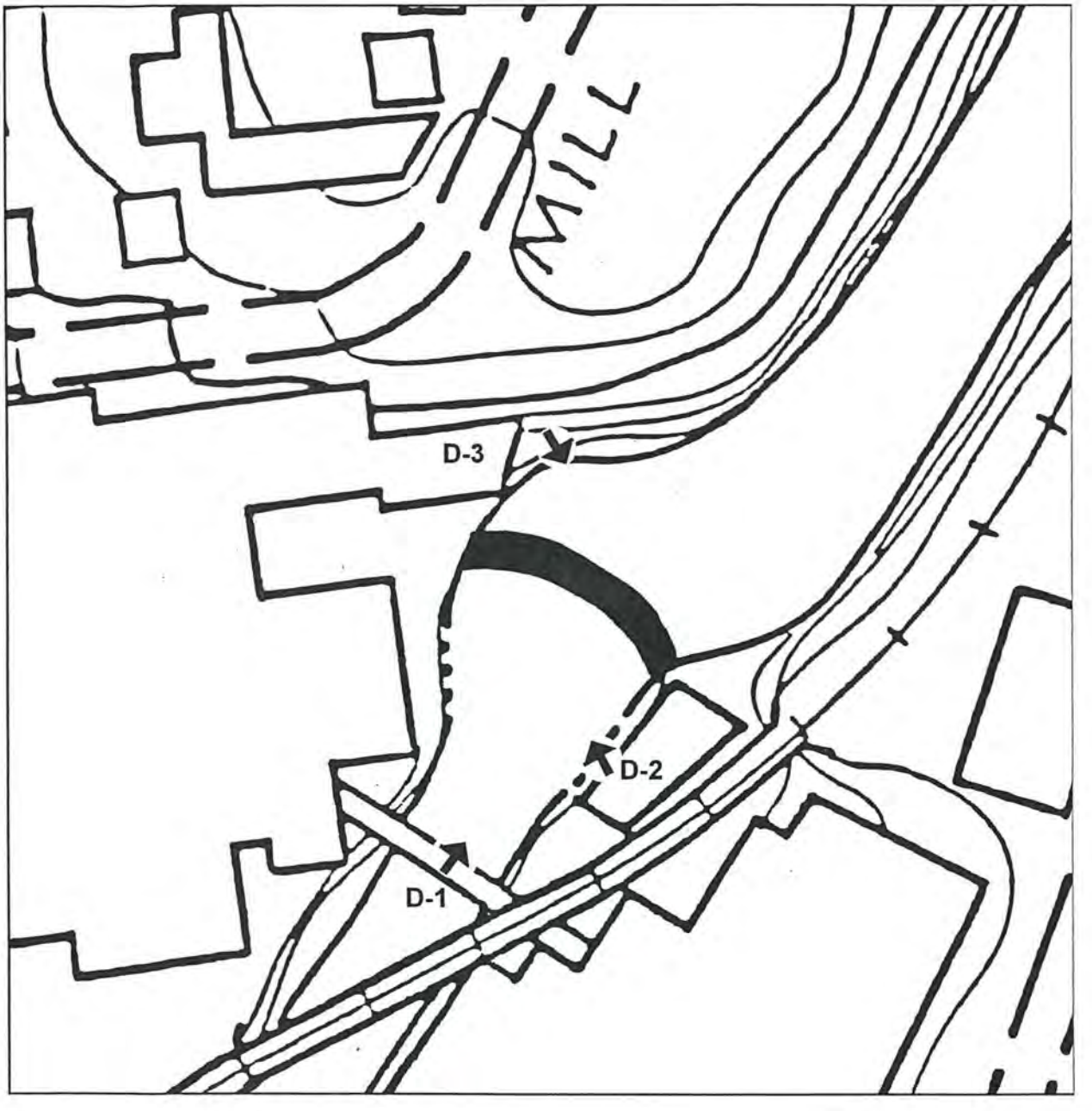
D-2 Close up view of the downstream side of Bray's Buckle Dam.

D-3 View of crest of Bray's Buckle Dam from upstream side.

Historical Photograph:

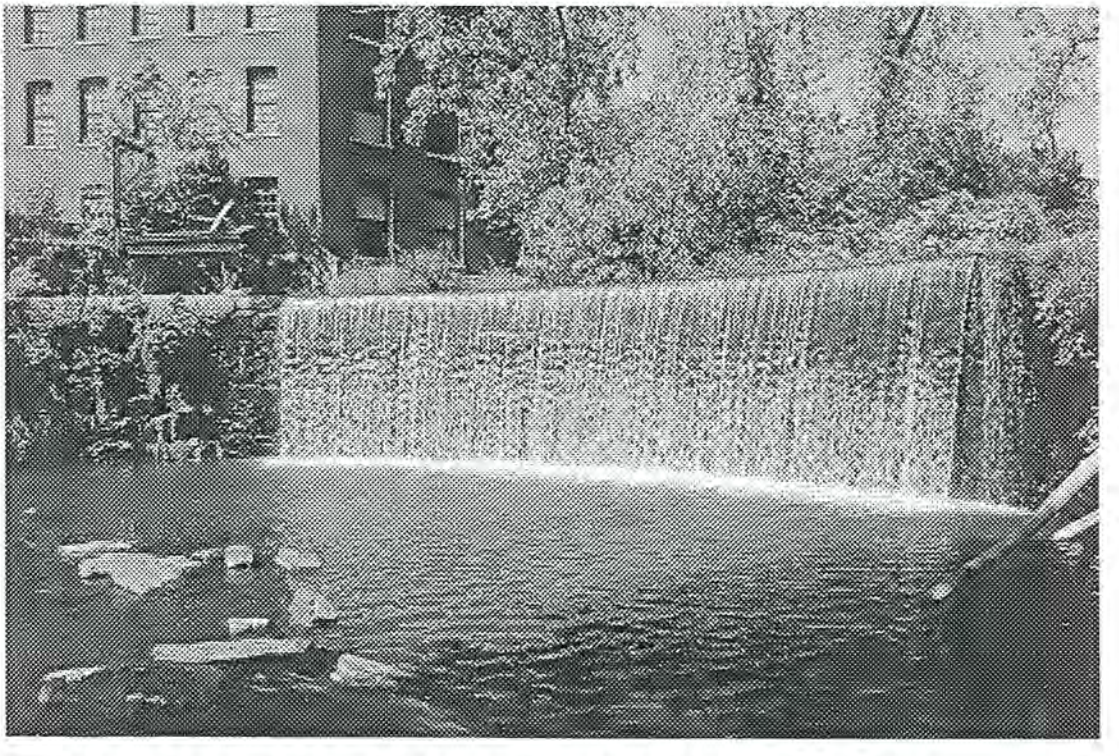
D-4 Aerial photograph of Bray's Buckle Dam, Waterbury, Connecticut, February 10, 1944. (Source GS-AX 6-70 - USGS Reston, Virginia).

KEY TO PHOTOGRAPHS
BRAY'S BUCKLE DAM

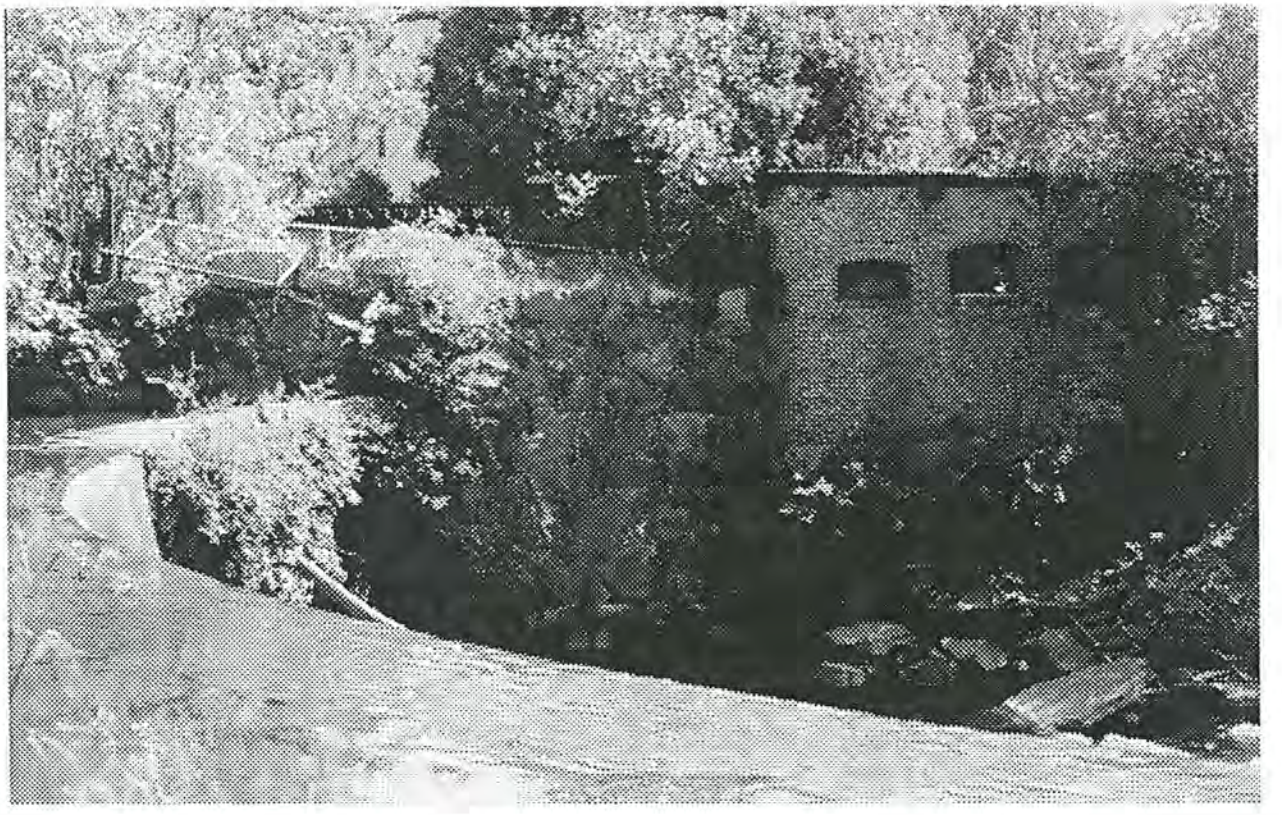


Photograph Key is based on ANADROMOUS FISH RESTORATION
(Milone & MacBroom - 1998)

D-1 View northeast of the downstream side of Bray's Buckle Dam.



D-2 Close up view of the downstream side of Bray's Buckle Dam.



D-3 View of crest of Bray's Buckle Dam from upstream side. Building at right center of photograph is on a small parcel formerly owned by Benedict & Burnham. The property gave the company access to the eastern end of the dam for maintenance and inspection. Sufficient area existed for a small storage building to be erected.

D-4 Aerial photograph of Bray's Buckle Dam, Waterbury, Connecticut, February 10, 1944. (Source GS-AX 6-70 - USGS Reston, Virginia).

FREIGHT STREET DAM

Location:	The Freight Street Dam is located adjacent and west of Connecticut State Highway 8, 0.05 miles north of Freight Street Bridge, City of Waterbury, New Haven County, Connecticut.
UTM Coordinates:	USGS Waterbury, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.662300.4401850
Description:	The Freight Street Dam is a two-foot high, 158-foot long, run-of-the-river, concrete weir with a 17-foot square concrete platform on its western end. The downstream face is inclined at a ratio of approximately 6 Horizontal: 1 Vertical, with a drop off varying from one-half to two feet at the toe. The man-made upstream channel is protected with a one to two foot layer of large cobbles and boulders embedded in fine to coarse brown sand.
Date of Construction:	1910
Present Owner:	City of Waterbury
Present Use:	Abandoned, in good condition. Originally constructed to impound water for a steam powered electrical generating station.
Significance:	The Freight Street Dam was constructed at a time when the use of electrical energy, generated by steam turbines at a central power station, was replacing power from independent, dispersed water and/or steam powered plants. Its construction also reflects the expansion of electrically powered street railways for public transportation; the primary use was for powering part of Waterbury's trolley system. A low dam does not impound a large volume of water, but it was significant for proper operation of the plant. The fact that it was built confirms that a constant and dependable water supply was absolutely critical for the generating station's boilers. Running out of water was not an option - the station could not be shut down instantaneously. Low water could result in damage or a boiler explosion. The Freight Street Dam provided sufficient reserve to shut down the boilers safely if the river flow suddenly plummeted. It insured that water level remained above the plant's intake pipes.

E. FREIGHT STREET DAM

Surficial Inspection

The Freight Street Dam is located on the Naugatuck River just north of Freight Street in central Waterbury, New Haven County, Connecticut (Figure 22). To the east it is bounded by a low-lying bank heavily covered with shrubs, bushes and a 20 foot high retaining wall. To the west a steep earth embankment, also heavily vegetated, forms its boundary. Riverside Street and Route 8 lie immediately to the west of the earth embankment. Thirty-five feet south of the dam's toe the twin span Freight Street Bridge allows vehicles from downtown Waterbury to access Route 8 and streets in western Waterbury. One bridge abutment extends upstream and forms the retaining wall along the eastern end of the dam. The western abutment extends to the downstream face of the dam where a 17-foot square concrete platform abuts the dam. The Freight Street Dam is an abandoned public utility dam that was used to assure a water supply to steam generators in periods of low water flow on the Naugatuck. Remnants of wooden flash boards pivoted on steel hinges still remain along sections of the dam (Milone and MacBroom 1998a:9-1).

The Freight Street Dam is a two-foot high, 158-foot long, run-of-the-river, concrete weir. An outlet pipe is visible on the downstream face of the concrete platform. The downstream face of the dam is sloped at approximately 6 Horizontal : 1 Vertical, with a drop off varying from one-half to two feet at the toe of the dam. The impoundment area is about five acres (Milone and MacBroom 1998a:9-1; 1-5).

History

In 1906 The Connecticut Railway and Lighting Company leased the property where the dam was built for 999 years to The Consolidated Railroad Company. In 1907 The Consolidated Railway Company merged with The New York, New Haven and Hartford Railroad Company (AKA NYNH&HRR), the latter becoming the lessee for the 1906 lease. In 1910 The New York, New Haven and Hartford Railroad Company sublet the leased property and franchises therewith that were "used in or particularly connected with the generation or distribution for sale of gas and electricity within the State of Connecticut" to the Housatonic Power Company.

In that same year The NYNH&HRR Company sublet to The Connecticut Company all of the remaining property and franchises not sublet to the Housatonic Power Company. At that time The NYNH&HRR Company owned both the Housatonic Power Company and the Connecticut Company (City of Waterbury Land Records 354:633). The NYNH&HRR, in addition to its main line steam operations, was heavily involved in street railway transportation (i.e. trolley cars) throughout southern New England as well as electrified operations on its line from New York City to New Haven. It also owned power plants for generating electricity for its operations, most notably the Cos Cob power plant in Greenwich, Connecticut.

In 1910 the City of Waterbury agreed to allow the New York, New Haven and Hartford Railroad Company to build a dam across the Naugatuck River just north of Freight Street. In 1917 the railroad company assigned all of the estate, rights, title and interest of the Housatonic Power

Company to The Rocky River Power Company, later known as The Connecticut Light and Power Company (AKA CL&P).

There was some confusion as to the location of the boundary line between the properties of The Connecticut Company and those now assigned to CL&P, and so in 1924 the boundaries were clarified in a Partition Agreement between the interested parties. The Agreement assigned the dam and its appurtenances, and all water privileges to CL&P (City of Waterbury Land Records 354:632-638).

CL&P diverted the impounded water into its steam generating station on the east side of the river. After the demise of the station, CL&P no longer needed the dam. In 1929, the Connecticut Light and Power Company granted "the dam and flash boards" to the City of Waterbury (City of Waterbury Land Records 439:49-50; City of Waterbury Real Estate Department 1929; City of Waterbury, Office of Town Clerk 1929; see also Chevalier 1997).

The property on the eastern side of the river is presently owned by Connecticut Light and Power Company (City of Waterbury, Assessor's Map 292, Block 22, Lot 1). The property on the west side of the river is within a road right-of-way. The assessor's maps are unclear as to the property owner, but it appears to be either the State of Connecticut as Route 8 right-of-way or the City of Waterbury as Riverside Street right-of-way.

Conclusions and Recommendations

Review of the archaeological site inventory files in the Office of State Archaeology show no archaeological sites located within 1.5 miles of the project area. There are no significant industrial remains associated with the dam.

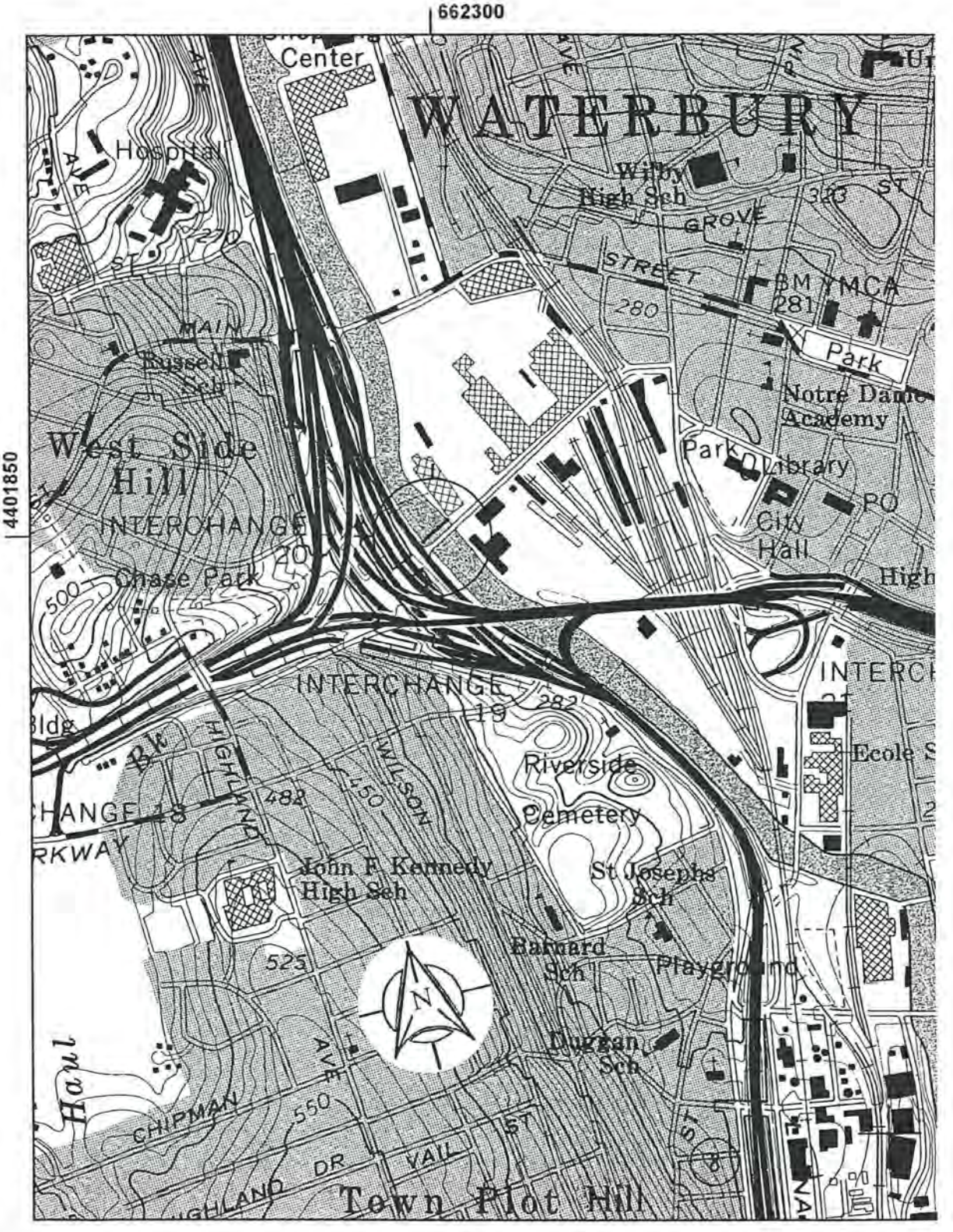


Figure 22: Location Map - Freight Street Dam Quadrangle: Waterbury, Connecticut 1:12000

INDEX TO PHOTOGRAPHS

Freight Street Dam

Naugatuck River, adjacent to and west of Connecticut State Highway 8, 0.05 miles north of Freight Street Bridge
City of Waterbury
New Haven County
Connecticut

Photographer: Robert C. Stewart, September - November 1998.

E-1 View north of the downstream side of Freight Street Dam

E-2 View northeast of the downstream side of Freight Street Dam

E-3 View northeast of crest of Freight Street Dam and Freight Street Bridge

E-4 View northeast of crest of Freight Street Dam

Historic Photograph:

E-5 Aerial photograph of Freight Street Dam and vicinity, February 10, 1944 (Source GS-AX 6-81 - USGS Reston, Virginia).

KEY TO PHOTOGRAPHS
FREIGHT STREET DAM

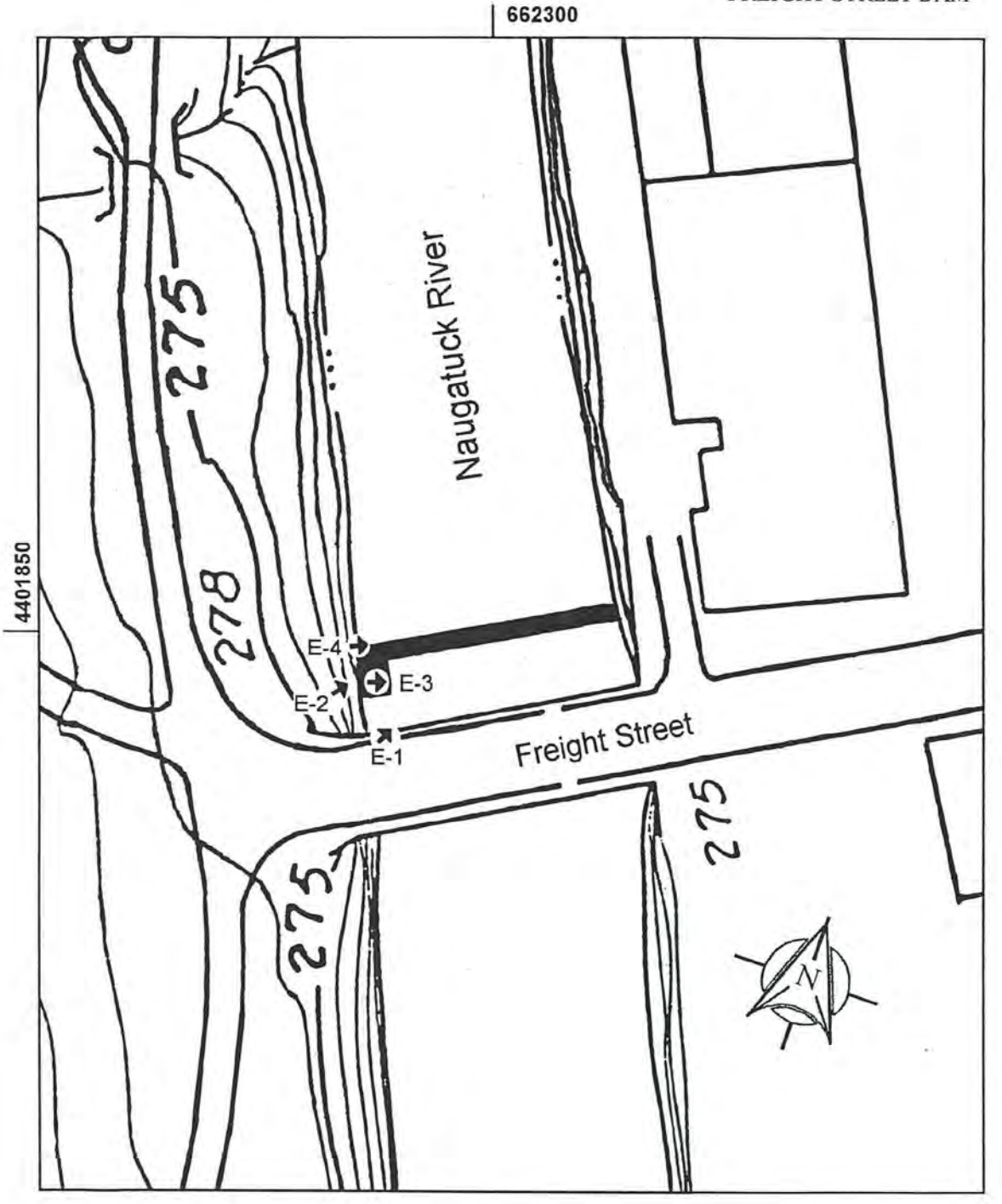


Photo Key based on: ANADROMOUS FISH RESTORATION PROJECT
Naugatuck river basin - (Milone & MacBroom - 1998)

E-1 View north of the downstream side of Freight Street Dam

E-2 View northeast of the downstream side of Freight Street Dam

E-3 View northeast of the crest of Freight Street Dam and Freight Street Bridge

E-4 View northeast of the crest of Freight Street Dam

E-5 Aerial photograph of Freight Street Dam and vicinity, February 10, 1944 (Source: GS-AX 6-81 - USGS Reston, Virginia).

ANACONDA DAM
(Brown's Farm Dam)

Location: Anaconda Dam is 0.05 miles west of Connecticut State Highway 8, 1.05 miles north of West Main Street Bridge. City of Waterbury, New Haven County, Connecticut.

UTM Coordinates: USGS Naugatuck, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.662220.4603930

Description: The Anaconda dam has two main components. The eastern section is a 137-foot timber crib spillway. The spillway was 10 feet high and 24 feet wide. The timber crib spillway was filled with rock and covered by a timber deck. The western side is an embankment faced by interlocking sheet steel piling. The steel is backed by an earth and rock fill which extends about 14 inches above the spillway crest. This embankment may have been up to eight feet higher than the timber crib spillway. It may have been overtopped and breached during the various floods along the Naugatuck. The spillway was in imminent danger of being breached and was removed in March of 1999.

Dates of Construction: Circa 1848 to 1955 with episodes of modification, and repair. The associated intake structure is located three feet upstream of the spillway in the eastern training wall. A steel plate blocks the intake trash rack and prevents flow into the intake canal. The intake structure is a 17-foot wide masonry-lined canal that passes under a railroad overpass then turns south and extends for about thirty-feet. At the southern end of this canal two semicircular stone-masonry arches feed into penstocks which provided water to the Anaconda plant through a long reservoir formerly known as Lake Manhan. The reservoir was filled in the 1920s.

Present Owner: Atlantic Richfield Delaware Corporation

Present Use: Unused and substantially abandoned. The dam formerly impounded power and process water for the Anaconda mill and its predecessors, producers of brass and copper sheet and tube products.

Significance: The spillway was an outstanding example of timber crib construction. The dam provided water which powered a rolling mill at the Waterbury Brass Company in the 1880s and continued to furnish process water to the company and its successors into the early 20th Century.

F. ANACONDA DAM (AKA BROWN'S FARM DAM)

Surficial Inspection

The dike portion of the dam is built of earth and rock fill construction reinforced with steel sheet pile. The spillway is of timber crib construction. The U.S. Army Corps of Engineers reported that an abutment was washed out during the 1955 flood on a Waterbury rock-filled timber dam north of Platts Mills, owned by the American Brass Company (Corps of Engineers, U.S. Army 1956:Table A-1). The description fits that of the Anaconda Dam. The present dam is 330 feet long and seven feet high. The impoundment area is about 12 acres (Milone and MacBroom 1998b:1-5). The location of the Anaconda Dam is shown in Figure 23.

Historical Context

In 1848 the Waterbury Water Company was formed for the purpose of harnessing the power of the Naugatuck River. A canal was built for this purpose. The water privileges were first owned by Manhan Manufacturing Company, which produced felt cloth. Water rights were later conveyed to the American Flask and Cap Company a producer of percussion caps and powder flasks (Anderson 1896:580). During the fourth quarter of the 19th century, the Waterbury Brass Company bought several properties within and adjacent to the project area, including the premises of the American Flask & Cap Company in 1873 (City of Waterbury Land Records 1873 (88):495).

A 1909 map on the wall in the Waterbury Town Clerk's Office shows the location of a dam called Brown's Farm Dam within the project area. The owner of the adjacent property at that time was Robert Brown. In 1911, the Waterbury Brass Company sold the property adjacent to the dam on the east side of the river to the American Brass Company "together with the dam, gate-house and canal thereon constructed and all water rights appurtenant thereto" as well as its major factory buildings located 1.15 miles south of the dam in the areas of Freight Street and West Main Street. Water was conveyed through penstocks, Lake Manhan and several races within the Waterbury Brass mill complex to provide water for power, steam generation and treatment processes. (City of Waterbury Land Records 1911 (241):346-349). As noted above in the section on Benedict & Burnham, the American Brass Company subsequently underwent mergers and name changes.

A plan of the reservoir and canals serving the Waterbury Brass Company and the American Flask and Cap Company as they were in the 1870s is shown in Figure 24. The site developed rapidly after American Flask was bought by Waterbury Brass. Waterbury Brass continued to make percussion caps. The factory plan of 1884 (Figure 25) shows they also made eyelets and brass tapes. The company had a broad-based brass fabrication facility with the capability of making foundry patterns, alloying brasses, founding, machining, rolling forming wire, annealing and coating brass products with lacquer (Japanning). Waterbury Brass became a part of American Brass as indicated in the section on Burnham & Benedict under Bray's Buckle Dam. It was later bought by the Anaconda Company in 1922 and later by the Atlantic Richfield Delaware Corporation.

Based on a review of the land records, the present owner of this property and the dam appears to be Atlantic Richfield Delaware Corporation (see also Milone and MacBroom Inc. 1998b:8-2-8-4).

Conclusions and Recommendations

Review of the archaeological site inventory files in the Office of State Archaeology show no archaeological sites located within 1.5 miles of the project area.

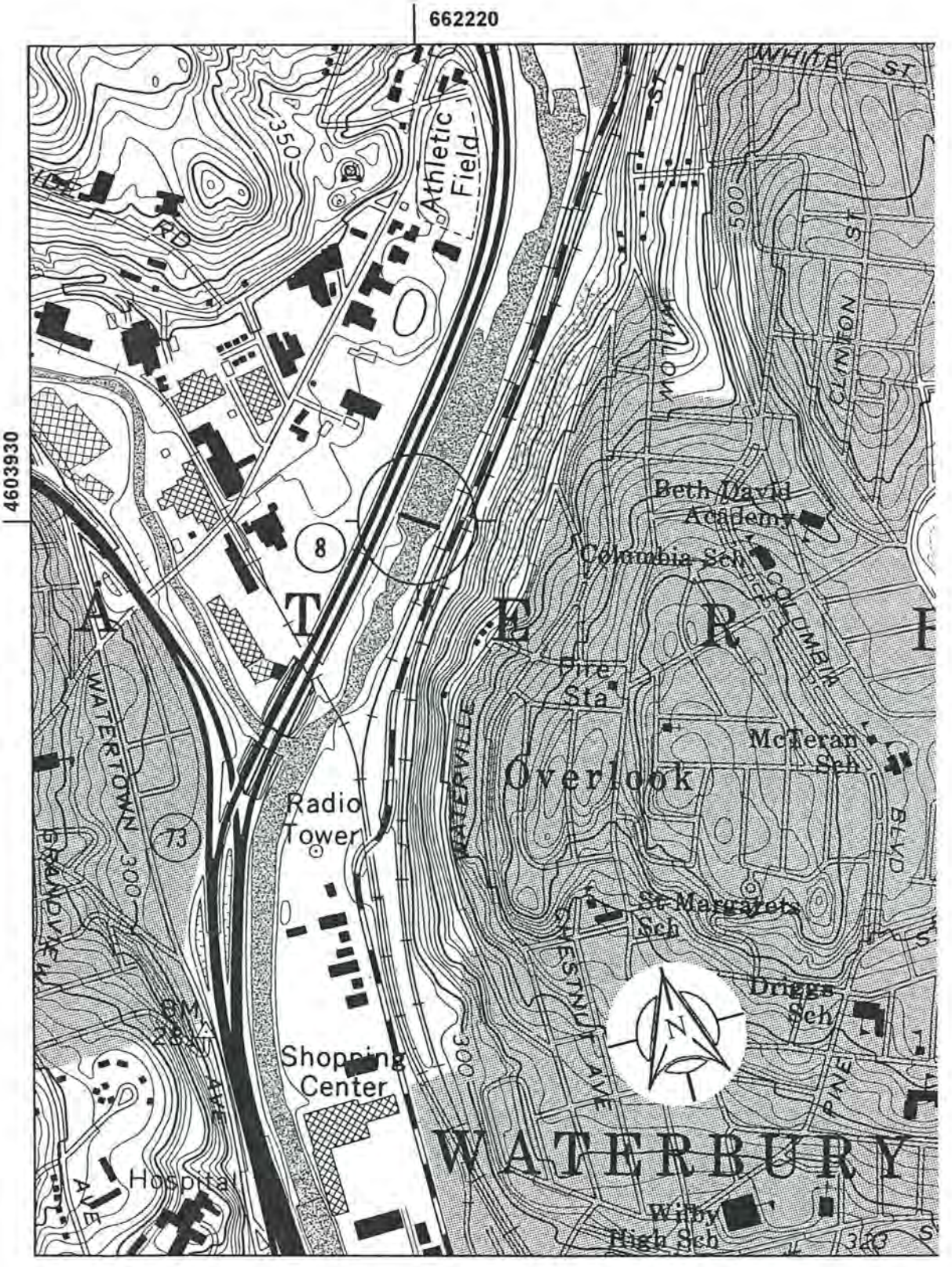


Figure 23: Location Map - Anaconda Dam - Quadrangle: Waterbury, Connecticut - 1:12000

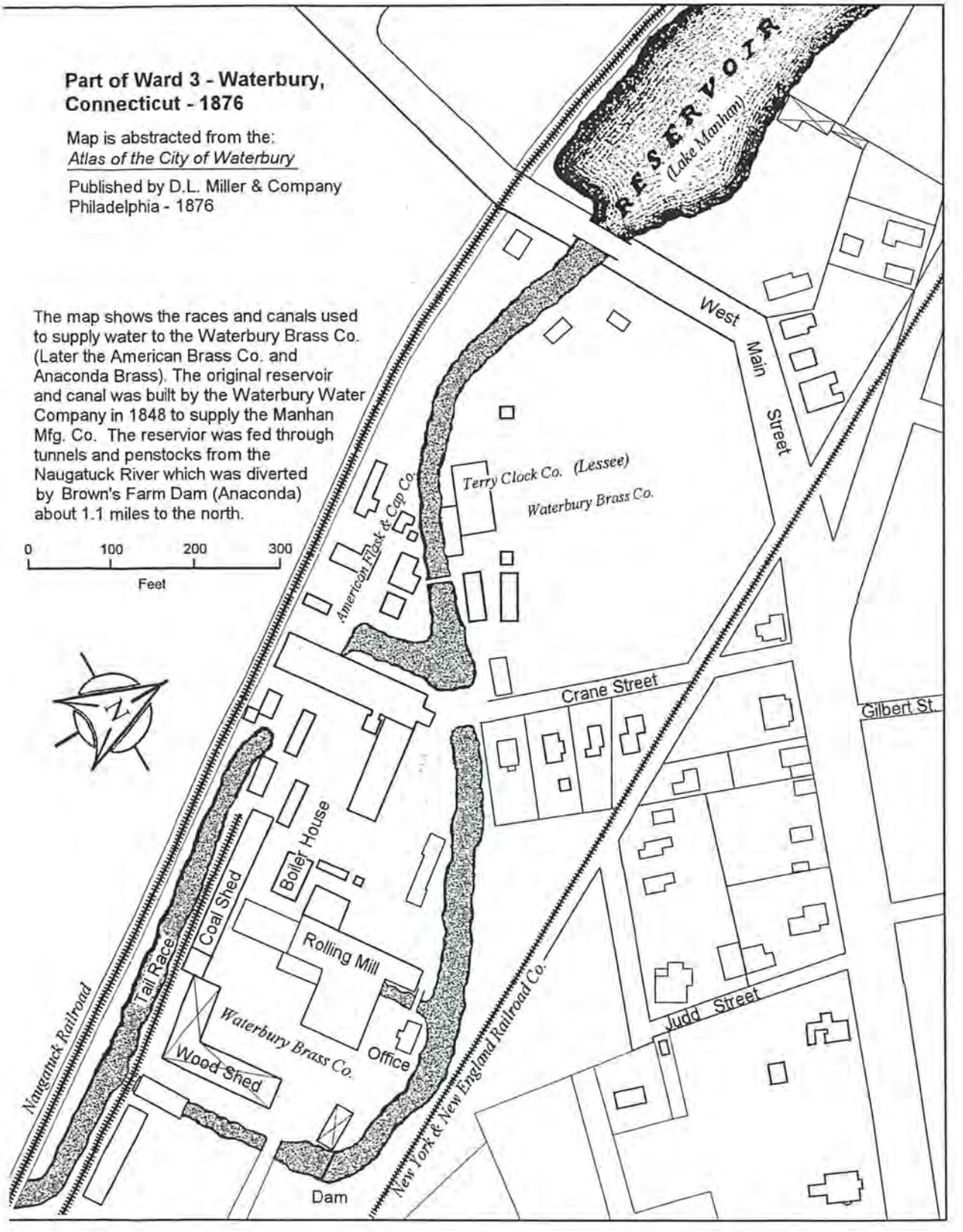
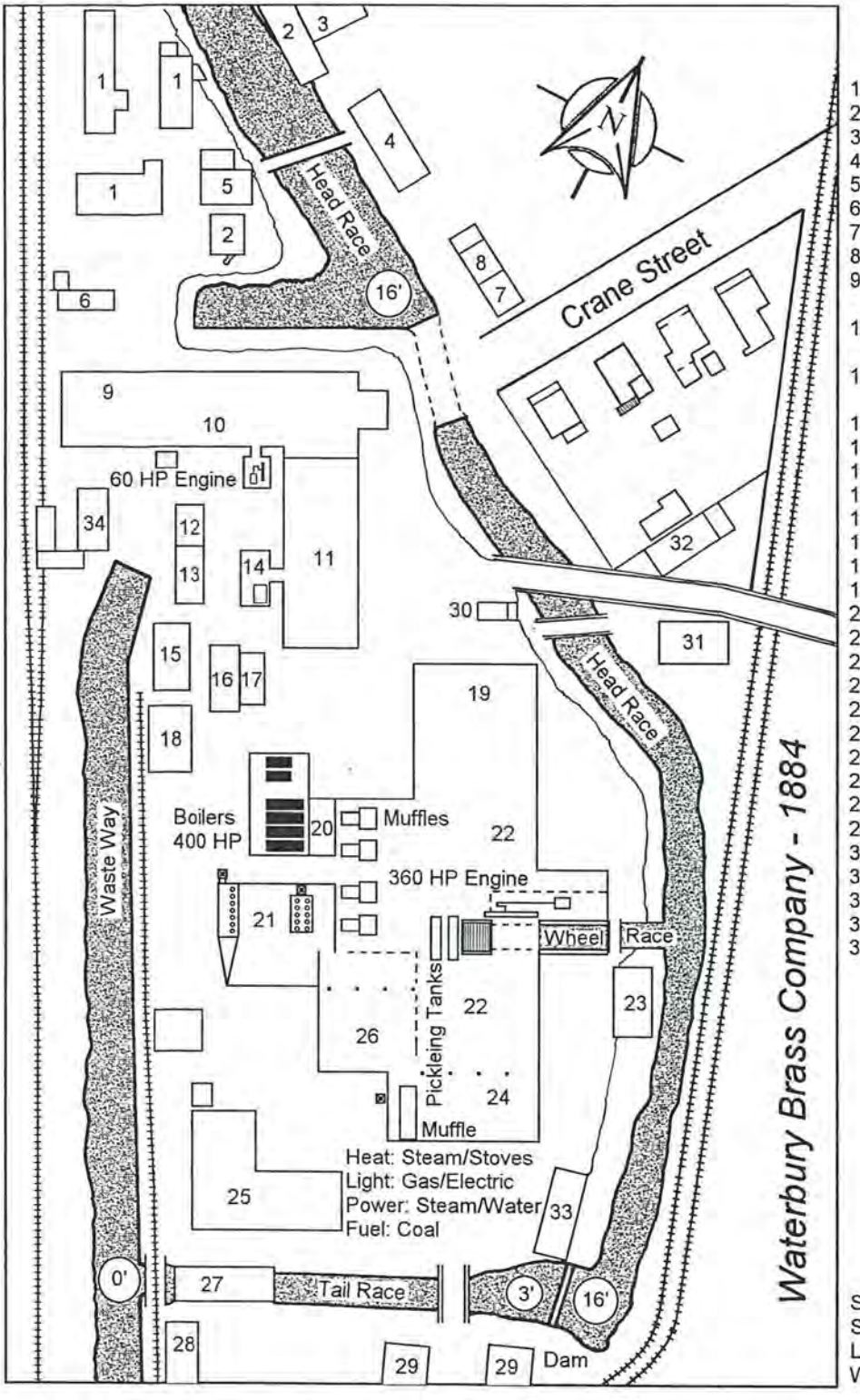


Figure 24 - 1876 Canal and Race system providing power and water to the Waterbury Brass Co.



Key to Buildings

1. Percussion Cap Charging
2. Cap Tumbling
3. Cap Punching Operations
4. Cap Storage / Paint Shop
5. Dry House for Caps
6. Eyelet Blacking
7. Pattern Shop
8. Sheds
9. First Floor: Machine Room Press Room, Shipping
10. Second Floor: Tape Shop Eyelets, Brass Turning
11. Press Room, Stamping Room & Polishing
12. Blacksmith
13. Brass Foundry
14. Annealing Muffles
15. Sawdust Storage
16. Charcoal Storage
17. Chemical Storage
18. Pound & Dirt from waste
19. Wire Mill
20. Brass Smelter
21. Brass Foundry
22. Rolling Mill
23. Office
24. Machine Shop
25. Wood Shed
26. Scrapers
27. Shipping House
28. Coal Sheds
29. Wood Shed
30. Gate House
31. Carpenter Shop
32. Lumber Storage
33. Horse Shed
34. Annealing & Japan Room

Source: Adapted from Sanborn Map & Publishing Co. Ltd. Insurance Map of Waterbury, Connecticut - 1884

Figure 25 - Layout of the Waterbury Brass Company - 1884

INDEX TO PHOTOGRAPHS

Anaconda Dam (Brown's Farm Dam)

Naugatuck River, 0.05 miles west of Connecticut State Highway 8, 1.05 miles north of West Main Street Bridge
City of Waterbury
New Haven County
Connecticut

Photographer: Robert C. Stewart, September - November 1998.

KEY TO PHOTOGRAPHS
ANACONDA DAM

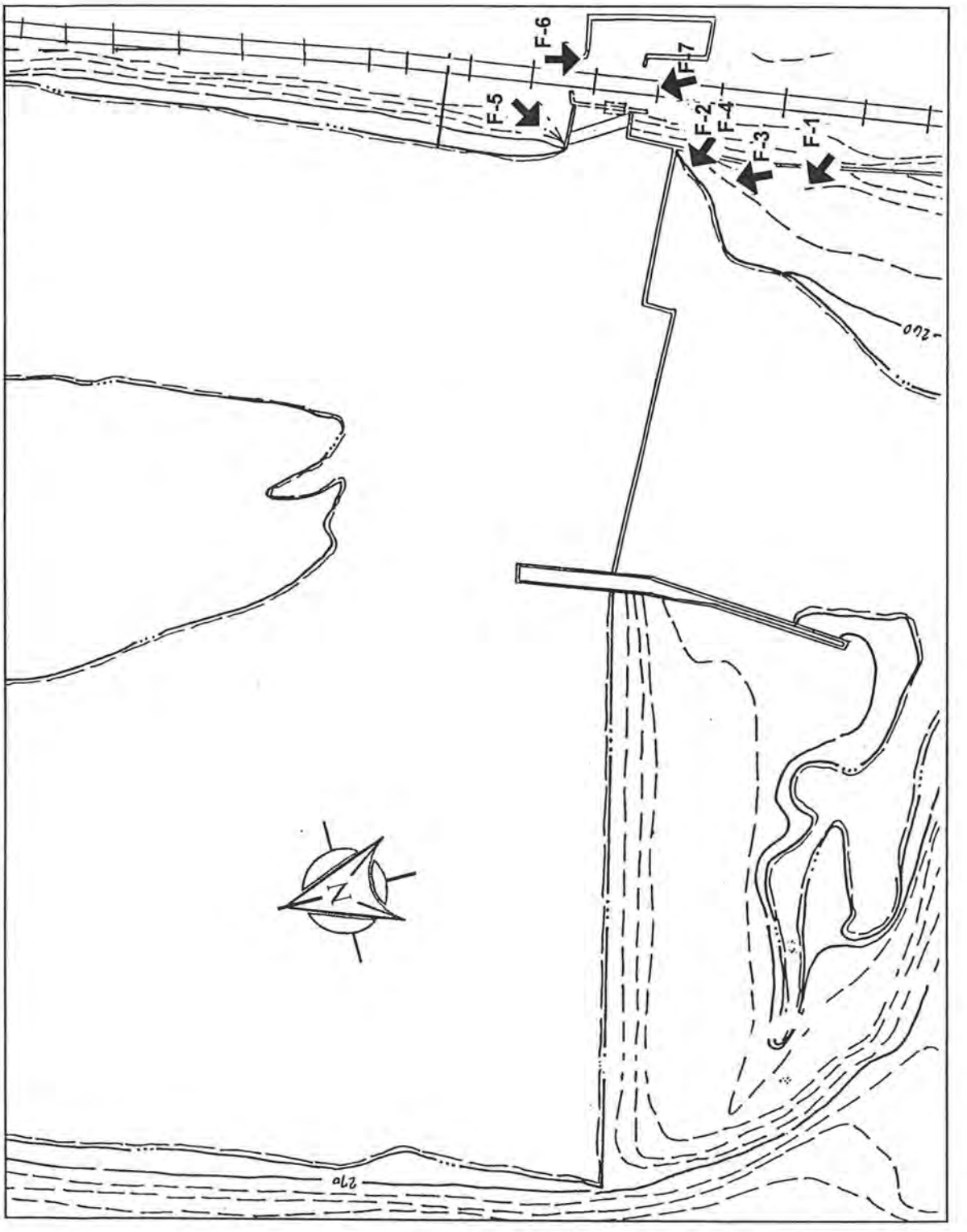


Photo Key based on: ANADROMOUS FISH RESTORATION PROJECT
NAUGATUCK RIVER BASIN (Milone & MacBroom - 1998)

F-1 View northwest of the downstream side of spillway and training walls

F-2 View northeast of the downstream side of the spillway of Anaconda Dam

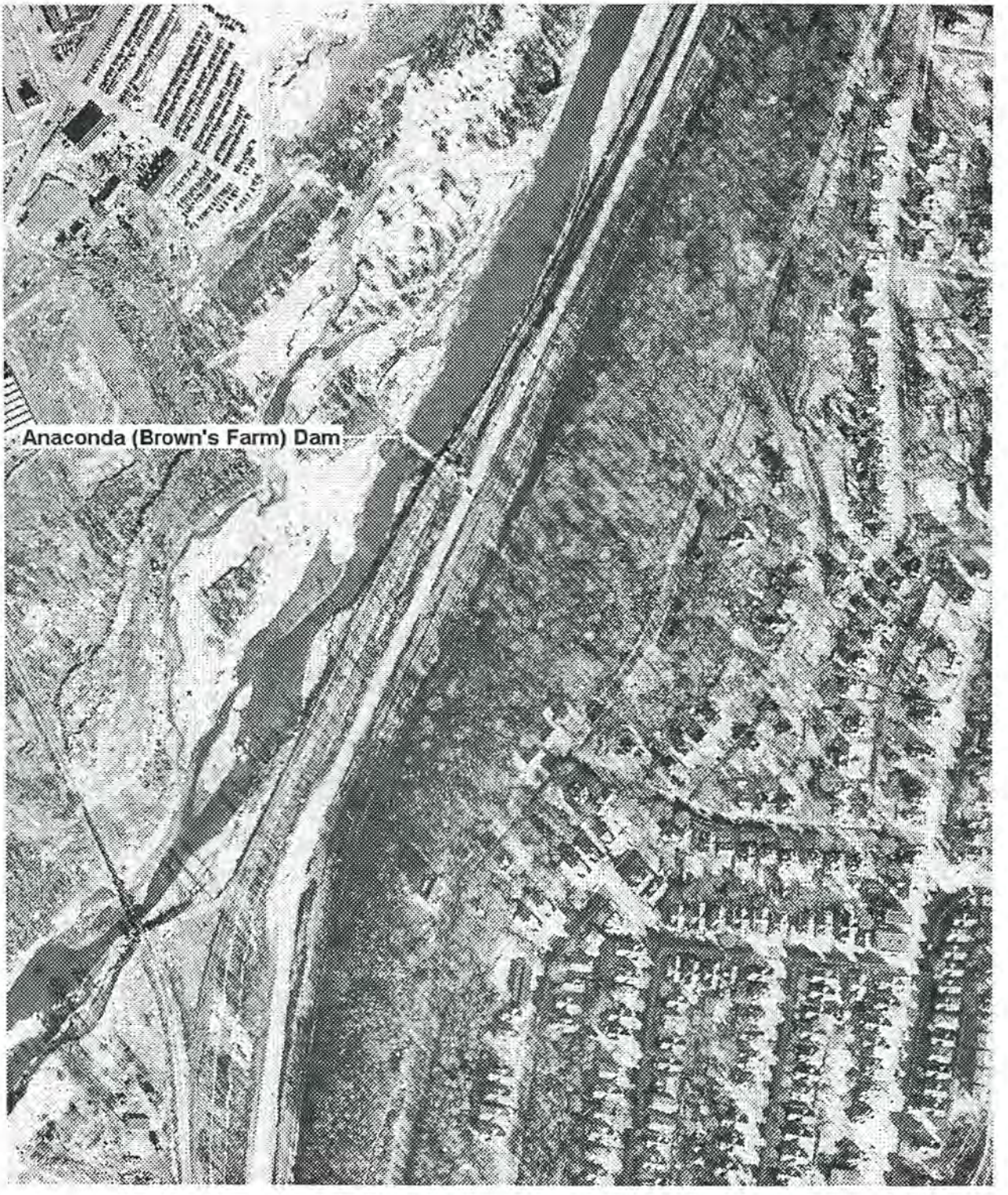
F-3 Exposed timber crib construction on the spillway - Anaconda Dam

F-4 Exposed timber crib construction and planking of Anaconda Dam

F-5 View southwest of the crest of the spillway of Anaconda Dam

F-6 View south of intake structure of Anaconda Dam

F-7 View north of intake gate valve housing and stem at intake structure of Anaconda Dam



F-8 Aerial photograph of Anaconda Dam and vicinity, February 19, 1944 (Source GS-AX 805 - USGS Reston, Virginia)

PLUME & ATWOOD DAM

Location: Plume & Atwood Dam is 0.12 miles west of Connecticut State Highway 8, 0.61-mile northeast of East Main Street Bridge. Town of Thomaston, Litchfield County, Connecticut.

UTM Coordinates: USGS Naugatuck, Connecticut Quadrangle, Universal Transverse Mercator Coordinates: 18.665545.4595280

Description: The dam is a reinforced concrete, 143-foot long run-of-the-river spillway positioned between two training walls. The impoundment area is about 10 acres. Its concrete spillway has a 24-inch wide crest, a rounded downstream edge and a sloping downstream face. A concrete apron extends downstream 12 to 16 feet from a point two feet below the spillway's crest. The apron inclines downstream and drops another two to five feet vertically into a scour hole at the base of the dam. There is an outlet structure through the concrete downstream face of the dam about 35 feet from the western training wall. The crest of the dam is about three and one-half feet wide over this outlet. A concrete pump house is sited on the western bank approximately 40 feet upstream of the dam. An intake structure about 120 feet upstream of the dam penetrates the western training wall and leads to three settling tanks and a sump under the pump house. Two sets of electrically driven pumps supplied water for fire protection and process water for a modern plant addition built on the western side of the river. An intake structure and trash rack are visible approximately 10 feet upstream of the dam on the eastern training wall. The Plume & Atwood dam was breached during the flood of 1955, according to the Army Corps of Engineers. There is no evidence of the breach at the existing dam which is an indication that a substantial part of the extant dam was rebuilt after the flood.

Dates of Construction: The dam was built between 1890 and 1895. It was breached in the flood of 1955 and there is no sign of that breach or its repairs. The repairs of 1955 may have been so extensive as to obliterate most of the original dam structure. The associated main factory intake structure is located upstream of the dam along the eastern bank.

Present Owner: Railroad Station Realty Group, LLC.

Present/Past Use: Unused and substantially abandoned. The dam formerly impounded process and fire fighting water in a mill pond adjacent to Plume & Atwood's factory which produced sheet brass and brass products. The factory's equipment was sold to foreign producers and finally abandoned in the spring of 1994. A watchman and offices of the

present owner are currently maintained on the premises.

Significance: The dam is a typical design of a concrete gravity dam. This type of dam is proportioned so that its weight provides the major resistance to the forces that the water pool exerts on it. It impounded a mill pond which supplied process water for the operations of the Plume & Atwood Company. Water was used to produce steam, cool equipment, mix chemicals and wash pickling bath residues from metal.

G. Plume & Atwood Dam

Surficial Inspection

The Plume & Atwood dam is a gravity dam. This type of dam is proportioned so that its weight provides the major resistance to the forces that the water pool exerts on it. It impounded a mill pond which supplied process water for the operations of Plume & Atwood. Gravity dams of uncemented masonry date back to the dawn of recorded history. Evidence found in sites dating back to 5000-6000 BCE indicates base widths as much as four times the height (DOSD 1987:315). The type is common today and its design and construction is discussed in detail in *Design of Small Dams* (U.S. Department of the Interior, 1987).

The Plume & Atwood Dam consists of a 143-foot long spillway positioned between two training walls. The spillway is concrete and has a 24-inch wide crest, a curved downstream edge and a sloping downstream face. There is an outlet, about one and one-half feet square, through the concrete downstream face of the dam about 35 feet out from the western training wall. The crest of the dam widens to about three and one-half feet over this outlet. Two feet below the crest of the spillway is a concrete apron that extends downstream 12 to 16 feet. The apron slopes downstream and drops another two to five feet vertically into a scour hole at the base of the dam. The entire concrete structure is approximately three feet high. The concrete dam is in good condition with some minor erosion damage on the downstream face. It impounds a mill pond of about 10 acres (Milone and MacBroom 1998b:1-5).

Evidence provided by Sanborn insurance maps of 1884, 1890 and 1895 indicates that the dam was built between 1890 and 1895, when the dam first appears on a map. Prior to that time a Sanborn insurance map shows that water was supplied to the boilers by two pumps which raised the water from the river to the boiler room. The 1895 map shows the dam in place and no pumps in the boiler room. Pumps would still have been used but they would not have had to raise water from the river as far as before the dam was installed, and thus may have been smaller and not rated in the assay of insurance risk.

The remains of an intake structure are located upstream of the dam along the eastern bank adjacent to the factory building. This consists of a bar trash rack and a conduit. This intake is under the boiler room of the Plume & Atwood factory (Sanborn - Thomaston:1895). There is a 20-inch reinforced concrete pipe in the factory wall approximately 40 feet downstream of the dam that possibly returned used process water and surface drainage to the river. It is under a structure marked *Cinder House* on the 1895 Sanborn map and may have been the outlet of a system for flushing cinders out into the river prior to enaction of antipollution laws.

There is a burned-out concrete building shell on the western bank about 40 feet upstream of the dam. The building houses remains of four pumps. On March 3, 1954, Plume & Atwood opened a new plant on the western side of the river to house plating and buffing operations (Vertical File Thomaston Library). These concrete buildings and the pumps probably supplied process water to the new plant. Adjacent to the building are three interconnected concrete settling lagoons and the remains of a concrete block building housing electrical switchgear.

Historical Context

The construction of dams to provide power in Thomaston, part of the town of Plymouth or Church Hollow until 1850, predates the present Plume & Atwood Dam. A power dam was built in 1834 about $^1/_4$ mile north of East Main Street. This provided water through a canal and millrace to a large overshot wheel near East Main Street which powered a cotton mill owned by Seth Thomas (Figure 27). Thomas's dominant business activity soon centered on clock making (Hist. Thomaston 1975-1834).

Brass clock making developed rapidly after 1837 and quickly surpassed wooden clock making in production volume (Hounshell 1984:57). The Plume & Atwood Company was started in 1850 when Seth Thomas, by this time a successful manufacturer of clocks, organized the company to provide brass for his clock manufacturing plant. Thomas, who had been buying his brass from Waterbury suppliers, became irritated when the City of Waterbury allowed a clock manufacturing company to locate there in competition with his operation. Thomas built a brass mill on the east bank of the Naugatuck and named it the Seth Thomas Manufacturing Company. The business supplied Thomas' clock business, other area manufacturers and also made bullets and cartridges. The new mill burned down in 1856 but was quickly rebuilt. The town's name was changed to Thomaston in 1859 to honor Seth Thomas for his activities in bringing prosperity to the area. A Waterbury brass mill bought Thomas' mill in 1869, agreeing to provide all of the brass needed for Seth Thomas Clocks. The name was changed to Atwood, Boothe and Holmes; however the name was similar to another Waterbury firm and was changed when David S. Plume joined the firm in 1871, to Plume & Atwood Manufacturing Company. The firm manufactured pins, lamps, cosmetic cases, eyelets grommets and rolled sheet brass, nickel and German silver. Figure 28 shows the layout of the plant in 1895.

In 1900 Seth E. Thomas conveyed the property on the west side of the dam to Plume & Atwood, whose "Rolling Mills" were situated across the river (Town of Thomaston Land Records (9):422, map rack 13:198). The mill was successful for many years. In 1933 Plume & Atwood added a wire mill to its machinery and expanded its product line. The Great Depression created unemployment at Plume & Atwood, which went to a five-day week in 1933. Conditions rapidly improved to the point where the company added a night shift in 1934 and increased pay substantially in 1936. The Thomas interests decided to terminate operation of the original northerly dam in 1933. Traces of this dam can be seen at the northern end of the Plume & Atwood property at the end of Railroad Avenue extension. At that time the Innes Brothers bought the canal, leaving a right of way along the canal for a future sewer system (Hist. Thomaston 1975-1933).

Like many companies of the period, Plume & Atwood had provided company housing for many employees from the start of operations. The company sold off this housing in 1949 (Hist. Thomaston 1975-1949). The company still retained some of its old product lines. They continued to make lamp burners which contained 14 parts assembled with no solder or screws (Hist. Thomaston 1954)

In 1954 The Plume & Atwood Manufacturing Company conveyed the land on the west side of the dam to the Naugatuck Realty Corporation (Thomaston Land Records 1954 (38):422-24). The deed provided the grantee with the right to use the dam "in common with the Grantor," and stipulated that "it being understood that the Grantee and its successors and assigns shall at all times and at its own expense maintain in good state of repair that half of said dam nearest the herein described premises

and the entire length of the concrete wall which bounds said premises on the southeast and is connected with said dam." Naugatuck Realty Corp. is presently A. George Oneglia Family Trust (Assessors Map 32 Block 3 Lot 1; see also DEP 1996). The company expanded capacity and built a new plant at a cost of 1.25 million dollars, for plating and buffing operations. The flood of 1955 breached the concrete dam at the plant but did not cause extensive damage to the main plant buildings (Corps of Engineers, U.S. Army 1956:Table A-1).

The early 1960s was a period of profitability, expansion and diversification for Plume & Atwood. They were first in the brass industry to add x-ray spectrography to their quality control capability in 1962. In 1967 they added 45,000 square feet to their manufacturing area. The company bought a cinema chain, Saxon Theater Corp. of Boston in 1968 and changed its name to Plume & Atwood Industries. In 1969 the plant was acquired by Diversified Industries and became The Plume & Atwood Brass and Copper Division of that corporation. In 1970 Plume & Atwood conveyed the land, buildings and "the appurtenances thereof "on the east side of the dam to Diversified Industries Inc. (Town of Thomaston Land Records 1970 (62):69-71; see also Assessors Map 32 Block 4 Lot 1). Diversified Industries quit claimed the property on the eastern side of the dam to RR Station Realty Group in 1995 along with "the improvements thereon and the appurtenances thereto" (Town of Thomaston Land Records (173):677-678).

The downturn in the brass business and invasion of traditional brass markets by plastics in the 1970s forced the firm to the brink of bankruptcy. Yet the company continued to modernize and added a continuous casting line at its Waterbury plant in 1986. The company borrowed and spent a total of 12 million dollars to buy new equipment and restructure its financing (Waterbury Republican 8-20-86). It's president optimistically reported that it was about to turn profitable in 1986. At this time its products were limited to rolled strip of brass, copper, phosphor bronze, nickel and silver (Smaller Mfgrs. Association of Greater Waterbury - Directory 1987). Problems with a shrinking market for its products continued and a new infusion of capital to upgrade equipment and increase productivity was provided in 1991. A Swiss bank - Augustus Beratung und Beteiligungs AG - loaned 5 million to Plume & Atwood's parent company. In July of 1992 Plume & Atwood got a state of Connecticut grant of $250,000 in a vain attempt to save 85 jobs (Waterbury Republican 7-30-92).

The outlook continued to be bleak and in March of 1993 the company entered Chapter 11 bankruptcy proceedings and the workers mounted an unsuccessful drive to buy the plant (The Litchfield County Times-March 1993). The plant was closed on January 1, 1994 and finally abandoned on March 21 of that year (Register Citizen 1-1-1994). The machinery was purchased by Guiyang Freight Car Works, a manufacturing plant in southwestern China (Journal Inquirer -Manchester, CT - Monday, March 28, 1994)

Conclusions and Recommendations

Review of the archaeological site inventory files in the Office of State Archaeology show no

archaeological sites located within 1.5 miles of the project area. Assuming access to the Plume & Atwood buildings can be secured, an analysis of water usage within the complex would be of benefit to our understanding of non-power uses of water on a 19th Century industrial site.

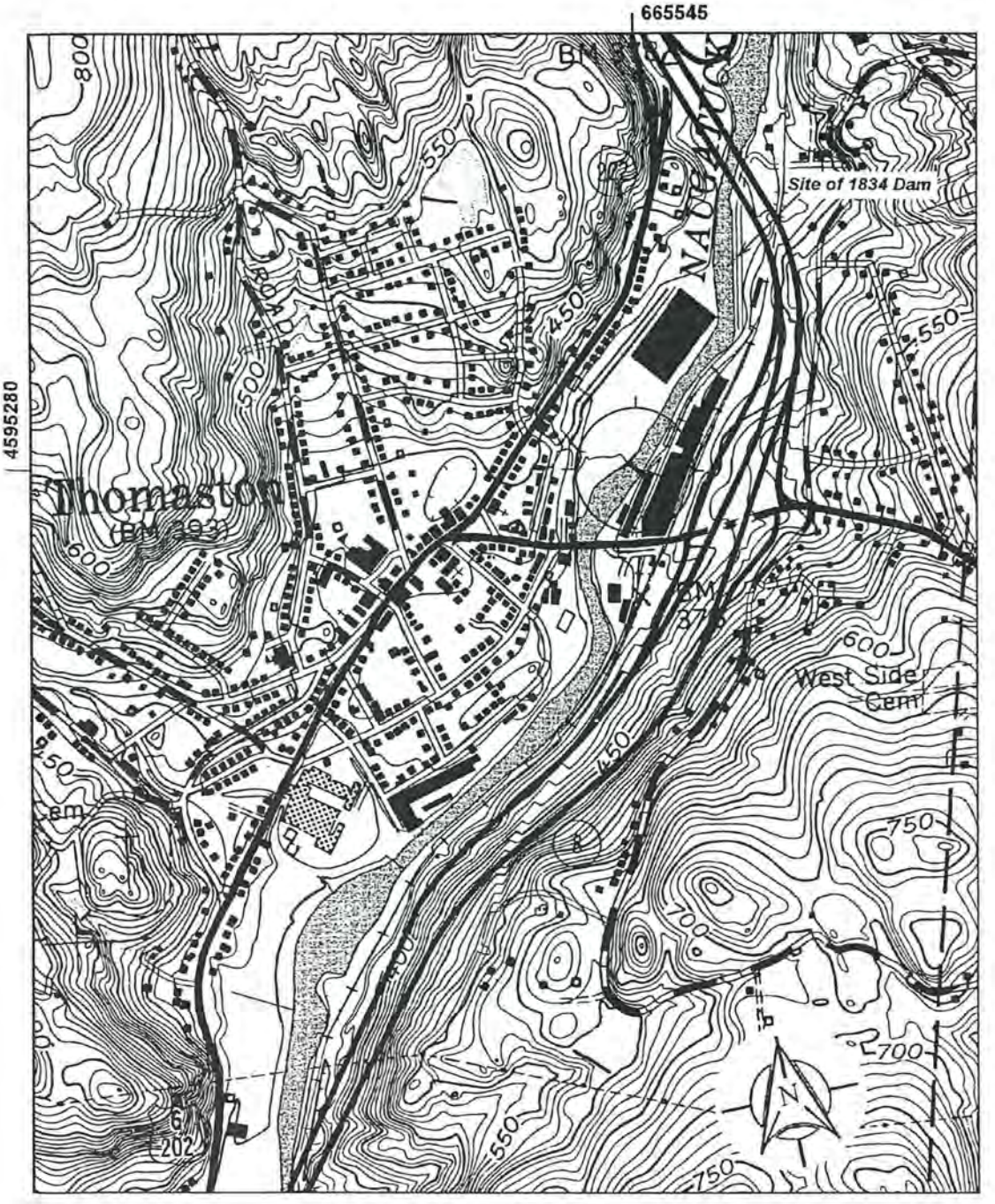


Figure 26

Location Map - Plume & Atwood Dam - Quadrangle: Thomaston, Connecticut - 1:12000

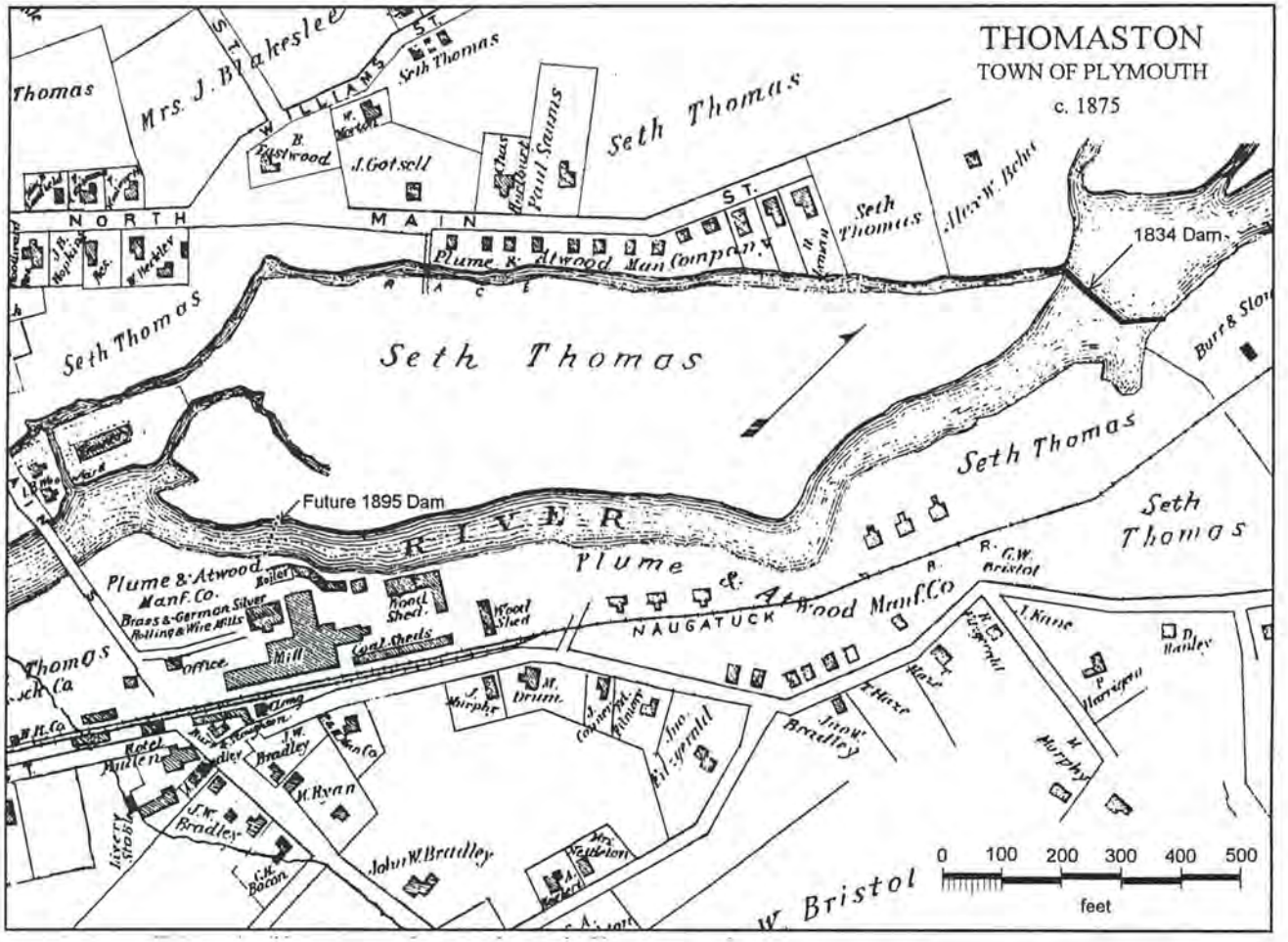


Figure 27 - Map of Thomaston, Connecticut c. 1875 (Thomaston Library)

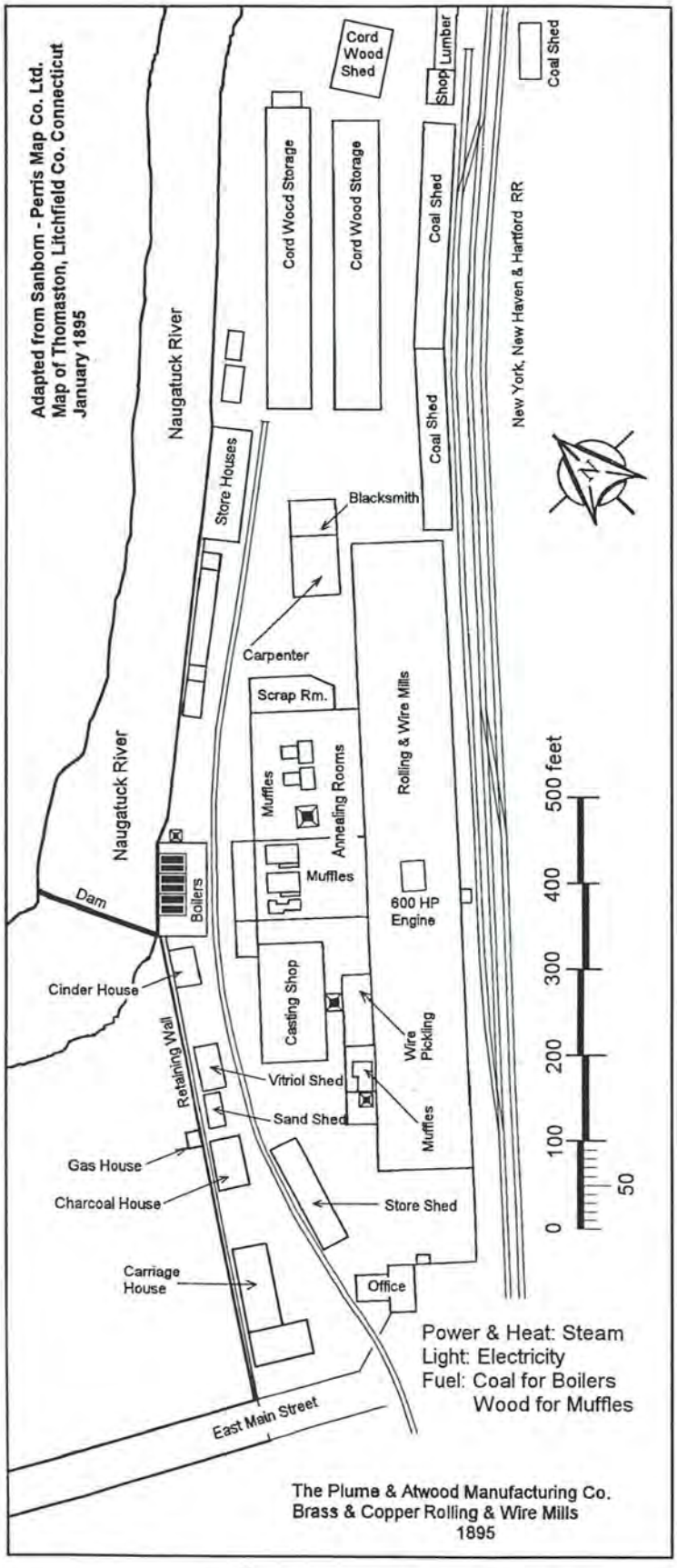


Figure 28 - Plan of Plume & Atwood works - 1895

INDEX TO PHOTOGRAPHS

Plume & Atwood Dam

Naugatuck River - 0.12 miles west of Connecticut State Highway 8, 0.61-mile northeast of East Main Street Bridge
Town of Thomaston
Litchfield County
Connecticut

Photographer: Robert C. Stewart, September - November 1998.

G-1 View northeast of the downstream side of the dam

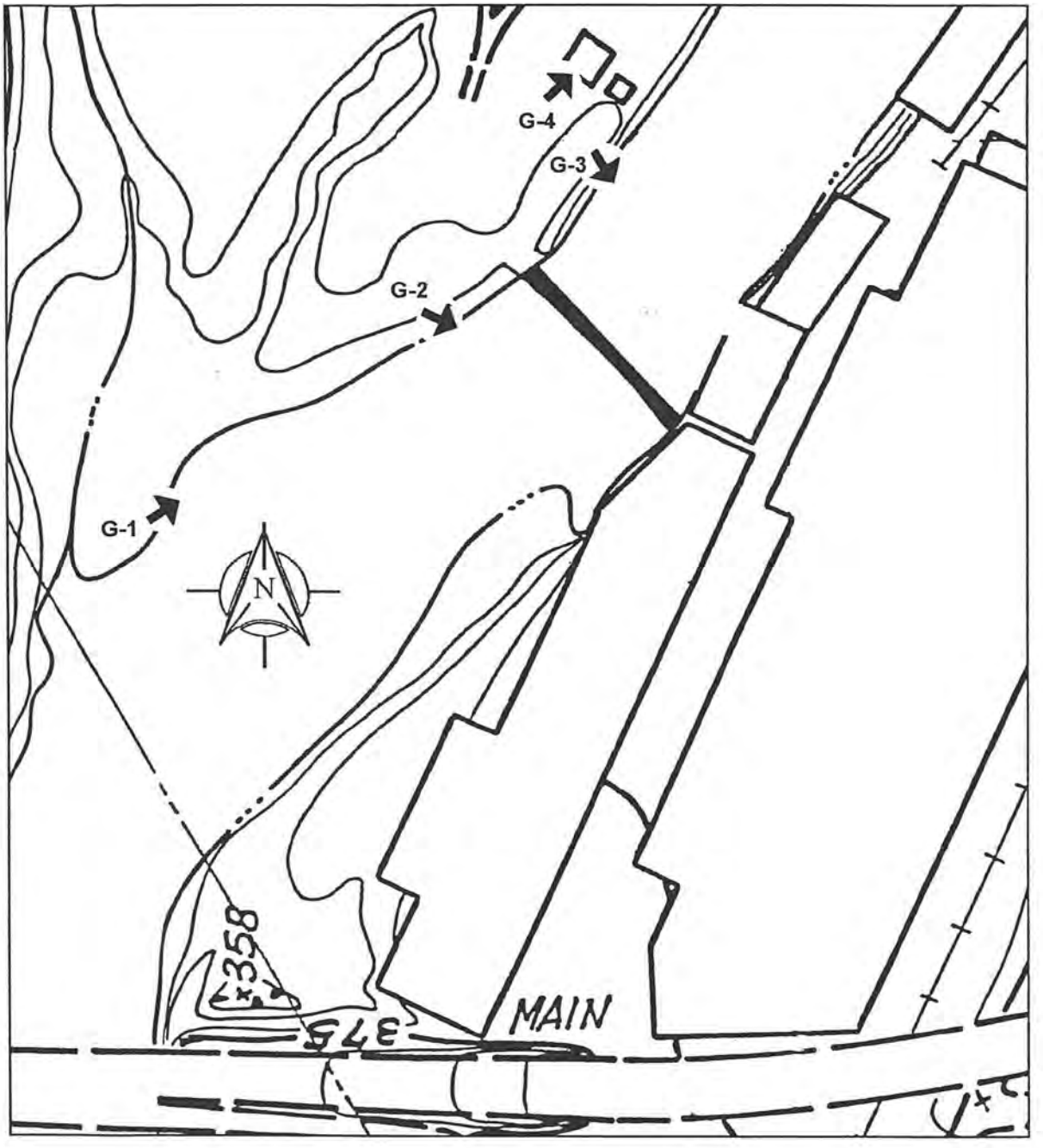
G-2 View southeast of the downstream side of the spillway

G-3 View southeast of the crest of the dam from upstream

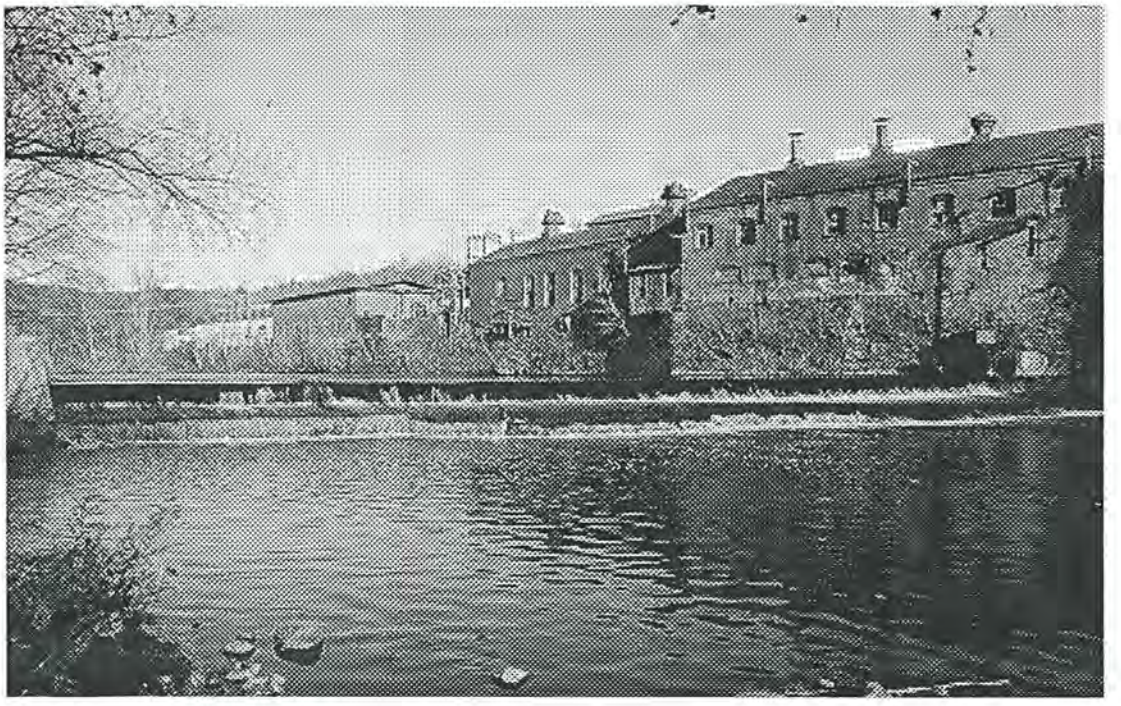
G-4 View of interior of the pump house

G-5 Aerial photograph of Anaconda Dam and vicinity (Source GS-AX 805 - USGS Reston, Virginia.

KEY TO PHOTOGRAPHS
PLUME & ATWOOD DAM



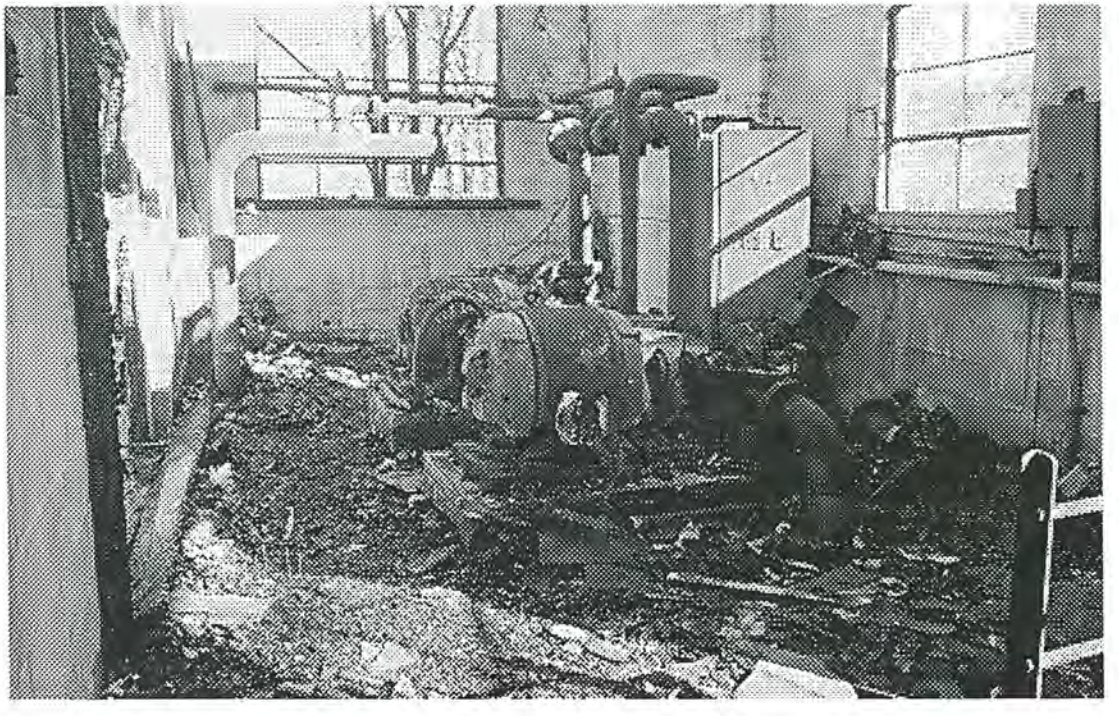
Photograph Key is based on: ANADROMOUS FISH RESTORATION PROJECT
NAUGATUCK RIVER BASIN (Milone & MacBroom - 1998)



G-1 View northeast of the downstream side of the dam

G-2 View southeast of the downstream side of the spillway

G-3 View southeast of the crest of Plume & Atwood Dam from upstream



G-4 View of interior of the pump house - Plume & Atwood Dam

G-5 Aerial photograph of Plume & Atwood Dam and vicinity, February 25, 1944 (Source GS-AX 10-08 - USGS Reston, Virginia)

APPENDIX A

Brass Processing Technology

The Historical Evolution of Brass Metallurgy

The technology of brass casting was vital to the Naugatuck Valley for the better part of two centuries. The dams in Seymour, Waterbury and Thomaston were indispensable to the establishment and early growth of the industry. This report has discussed the operations of New Haven Copper, American Brass Co., Waterbury Brass Co. Burnham & Benedict, Scovill, Platt Brothers & Company, Plume & Atwood and a number of smaller companies that produced brass or other copper and zinc alloys. Brass metallurgy and production were a consequential part of what made the Naugatuck Valley unique. To understand brass casting and the factors that shaped operations it is useful to explore the development of brass metallurgy. Most of the material on the manufacture of brass in this section was abstracted from Casting of Brass and Bronze by Daniel R. Hull[5].

Brass is primarily an alloy of copper and zinc. The metallurgy of copper alloys has a long history. Bronze was made and cast in China in prehistoric times. Copper and its alloys were found in Egyptian tombs which existed before 2000 BC (Lathrop 1909:8). Early man used copper and copper hardened with tin to make weapons and tools.

Brass is related to copper in the way that iron and steel are linked. Brass can be highly polished and is harder than copper. It is highly ductile and malleable. It is not a particularly good conductor of heat but melts readily. Brass exhibits outstanding resistance to corrosion. Brass is too expensive to be used in large castings or in heavy construction work. Brass cannot be tempered or hardened readily and will not hold a cutting edge.

Copper is softer than iron and was easily formed. It is probable that the method of hardening of pure copper with tin was the "lost art" of tempering copper (Lathrop 19097-8).

The origin of the English word "brass" is clouded in mystery. Determining the derivation is difficult because the Greeks and Romans used the same word for copper, brass and bronze, which is an alloy of tin and copper. The Roman Empire was well acquainted with brass and bronze. Pliny the Elder mentions that brass was used shortly after the founding of Rome. Roman brass workers were recognized as a trade guild. In Roman times the most widely used copper alloy was bronze employed as coinage. The alloy contained 80 to 85% copper with the remainder being tin. After the beginning of the Christian era increasing amounts of lead, zinc and antimony appeared in the alloy. This was not due to greater metallurgical sophistication but rather caused by impurities introduced from increasingly poor sources of ore (Lathrop 1909:7, 9).

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[5] Daniel Hull wrote Casting of Brass and Bronze in 1950 while he was Assistant Technical Manager of the American Brass Company. The material is not necessarily specific to operations at any particular brass works, but can be considered a good general overview of operations in a brass casting shop.

About A.D. 900, the art of casting bronze and other alloys of copper was lost for three centuries. After A.D. 1200, controlled composition brass appears once again. The skill of varying alloy proportions of copper with tin, lead, antimony and other metals was developed about this time. The effect of these elements on alloy properties was also determined (Lathrop 1909:9).

Technological Development

About the middle of the 18th century the chemical composition of calamine (zinc silicate) was understood and metallic zinc was made available for alloying with copper.[6] In 1781, James Emerson in England, developed the modern process for making brass by direct fusion (alloying) of copper and zinc (Lathrop 1909:10). It required much greater heat for a longer time than the old tinner's charcoal fire could supply.

Originally brass was melted in small crucibles carrying 5 - 10 lbs. per charge. After melting it was poured into little band and wedge cast iron molds having a cavity of 7 1/2" x 1 1/2" x 5/16". (HAER CT-153-121) This made a slab weighing about one pound after removal of the gate (SMC 1952a:9).

Plume & Atwood's mid-19th century process started out similarly with preparation of ingots (also called billets or bars). Depending on the ultimate use of the alloy, small amounts of metals besides zinc would be added to modify the properties to enhance rolling and wire drawing.

Casting of Brass and Bronze

The men who cast brass before the advent of 20th century scientific metallurgy were supreme masters of an arcane craft. They needed a great deal of practical but obscure knowledge to ply their craft. They sweated and labored mightily amid roaring fires, crucibles of molten metal, coal dust and the thick white fumes of zinc oxide. They trembled with the ills of 'spelter[7] shakes' from zinc poisoning. For most of the nineteenth century, the Naugatuck Valley supplied most of them. In the ante bellum years many of them were part-time farmers and combined work in the mills with agriculture.

Alloying copper and zinc to make brass was strenuous and exhausting work. In winter, zinc fumes would form a cloud close to the casting room floor. Breathing them caused a temporary palsy known as the 'spelter shakes'. In summer the heat stretched the limits of human endurance. The smells of lard oil smoke, hot iron and zinc fumes permeated the air. Shop workers were generally black with soot from the coal fires and grime that blanketed the shop floor. Yet, the risks, hardships and pay that went with the job inspired respect for the brass casters. Within its framework of medieval alchemy and a touch of wizardry, the caster's job was held in awe.

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[6] In the ancient world "native" (metal in the pure form) copper was found on the island of Cyprus and in Spain and Cornwall (England). Tin was found in Cornwall. The Phoenicians traded in both of these metals. Zinc was not known to the ancient metallurgists and was not an article of commerce until the 18th century. Zinc is always found as a mineral, it is extremely rare in the native form (Lathrop 1909:7).

[7] Spelter was the ancient name for zinc.

The Brass Casting Crew

The heart of the brass industry was the casting operation. Before brass could be made into sheet, strip, rods, bars wire or extruded shapes, it had to be formed as an alloy of zinc and copper, then cast into a suitably shaped billet. This fundamental process was performed throughout most of the nineteenth century by teams of men under the oversight of a brass caster. Each member of the team had specific skills and responsibilities and they worked together to produce cast slabs and rods for processing into mill products. The workers were dependent on each other for safe operation of the equipment, product quality and making the daily quota of cast metal.

The old-time brass caster was a true "boss" and leader of his crew. He alone decided what the mix in the furnace was. He judged heat intensity by "eye" and developed a "feel" for proper pouring time (SMC 1952a:17). In the earliest days of the industry, the caster hired his own helpers and paid them personally from his own wages. He contracted with his employer, hired his own helpers, and handled his casting team. By 1900 this custom had disappeared and operating companies paid the workers directly. The dominant role of the caster was further reduced when metallurgical controls and production supervision were established around 1908. Laboratory analysis of each batch circumvented the casters who had held the secrets of brass chemistry and alloying. Engineering Societies and manufacturing technicians were by then, setting up specifications and standards governing the chemical and physical properties of all commercial metals. Modern scientific methods and controls ultimately ended the authority of the old time brass men who had ruled the shop for three-quarters of a century.

By 1900 brass manufacture had been practiced for about 75 years in the United States. Yet methods were still primitive and product quality was dependent on the experienced 'eyes and ears' of the artisan. The pot casting method was highly labor intensive, yet it lasted in production work until circa 1918. Brass was made by melting scrap and copper in a crucible then adding zinc to the molten metals. It seems like a rudimentary process but it was intricate and dangerous. Estimating the right time and temperature when to add each component was a critical skill. Work was assigned by the 'stint' system. Under this setup a caster and two or three helpers were assigned eight to ten fire pits and the tools and equipment necessary to tend them. Their assignment was to make an established daily quota of metal.

The caster was responsible for weighing out copper, zinc and scrap. He assisted in tending the fires and in adding zinc to the batch, a process called 'speltering'. The fireman tended the hearth and charged the crucibles with scrap. He was responsible for preheating the copper ingots by carefully placing them around the top of the crucible and adding zinc at the right time. The third member of a crew was a 'puller' who assisted the fireman, oiled and banded the molds, removed castings from the mold and filed the edges left by the parting line of the mold (Hull 1950:4).

Alloying Copper and Zinc

Making the alloy of zinc and copper required a lot of practical knowledge. Copper melts at 1083 degrees C (1981 degrees F) while zinc vaporizes at that temperature. Consequently some zinc was always lost by volatilization or oxidation during the melting process.[8]

Unless the ingredients were added at the right time and rate, with due regard for temperature, the zinc would vaporize off as 'spelter smoke' and leave a copper rich alloy. Worse, the zinc could vaporize within the melt and cause porosity, voids in the metal or precipitate a dangerous boil over. Typically the crew produced four or five batches or 'rounds' from the group of fires under their supervision. They stayed on the job until the quota of metal had been made -- ten and twelve hour days were common.

Work in the casting shop started before daylight. Charcoal fueled pit fires for brass melting had been superseded after 1830 by anthracite coal fires. Coal was burned in a similar type of pit which was connected into a high brick square chimney to create a draft. Coal was shoveled onto the grate at the bottom of the fire pit. Then a layer of charcoal was added. This was ignited with live coals or kerosine and cotton waste. The fireman placed a pot or crucible on the burning coal and filled the space around it with more coal. While the fireman prepared the pit, the caster weighed out his batch of copper and zinc which weighed about 150 lbs. Using a sledge hammer and anvil, the junior member of the crew broke up zinc ingots into smaller pieces. Then he cleaned, oiled and assembled molds.

The crew might break for a quick breakfast. Then back to work -- the fireman added brass scrap to the pot and laid copper ingots around the rim of the pot to warm. More scrap and charcoal were added to the pot. The charcoal maintained a reducing atmosphere in the pot; it prevented oxidation of the metals. When the copper ingots were red hot, they were pushed into the pot along with additional charcoal. Experience played a major part in knowing when to add the copper ingots. If the caster waited too long, the ingots would melt and run into the coal bed surrounding the pot. Nothing would ruin a fire for the day more quickly than a mass of molten metal in the fire pit. It also made clean up time consuming; the fire pit had to be punched out with a heavy chisel-ended steel bar. Conversely, if added too soon, the ingots would not melt rapidly in the molten scrap brass; this would slow the work considerably.

Once the copper was 'down', zinc was added. This operation was called speltering. There was an ironclad rule that no zinc should be added until the temperature was high enough to vaporize[9] it. Shop lore held that a pot speltered when 'cold' would not produce acceptable uniformly alloyed brass. It took skill and strength to grasp the zinc slab in long handled tongs and lower it into a pot of molten metal quickly enough to prevent vaporization, boiling over and subsequent eruption of molten metal into the fire pit.

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[8] The volatile zinc formed fumes which were inhaled by the workers. In the short term, the fumes produced a palsy or tremors of the hands. It was observed that whiskey cured the shakes resulting from inhalation of zinc fumes; consequently some casters teetered between inability to work due to drunkenness or excessive zinc fume inhalation.

[9] Zinc melts at 419.4 degrees C. (787 degrees F.) and boils at 907 degrees C. (1665 degrees F.).

Molds and Casting

Once the brass had been alloyed, the molten metal was poured into a slab mold or formed into "pigs." The earliest slab molds were made out of soapstone but by the turn of the century cast iron was in common use. A grade of high-silicon, low manganese, low carbon iron was developed for all molds (Hull 1950:115). To form flat slabs a two-piece mold was used. The front and back sections were held together with surrounding metal bands and wedges. The wedges were forced between the band and the mold to drive sections of the mold tightly together. It was not possible to wedge the boxlike mold cover against the flat back of the mold tightly enough to prevent a small gap where the pieces of the mold met. Molten metal filled this gap and formed a fin at the edge of the slab. Usually the junior member of the crew was designated to file this fin off. Slabs varied from 3 ½ to 18 inches in width and were about 1 inch thick. Slabs destined for the strip and sheet mills ranged from 50 to 75 lbs. -- generally the weight which could be handled by one man. Two or three slabs could be made from the contents of one pot. Some 250 lb. slabs were cast for two man handling methods but the overall scale of operations did not change significantly until mechanical handling methods were introduced in the 1930s.

The molds used for forming slabs, rods and tubes when pot casting was the dominant technology, were made of iron. Iron molds were hard to clean and had to be cooled between pourings. Hot molds were a cause of surface blisters in the casting. The molds were 'dressed' or lubricated with lard oil which burned off as the mold was filled. The vapors of hot oil displaced air in the mold and reduced metal oxidation.

Oil also prevented dirt from becoming embedded in the surface of the casting. As the metal column rose in the mold, fresh areas of the oiled mold surface were covered with molten metal. This oil would vaporize and vigorously blast dirt to the pouring surface. If insufficient oil was used or if the column rose too slowly to keep the action at the mold/metal interface energetic, dirt inclusions would be embedded in the surface of the casing. Some of the zinc in the molten brass also escaped as vapor and oxidized, depositing zinc oxide on the face of the mold.

Too much oil could form a trapped bubble of gas and develop into a blister on the surface of the casting. Excessive oil could be trapped before it vaporized. When it did vaporize it could throw metal out of the mold with a spectacular explosion.

The old time caster used his senses to gage whether the pouring process was proceeding satisfactorily. His pouring rate was regulated by the sound of metal entering the mold. A gentle hiss was desired while a staccato vibration was an indication of too rapid a pour. He used his eyes to determine how the metal settled in the mold. If poured too fast, the metal was flung about by the rapid decomposition of the lard oil mold lubricant. Blisters would form on the surface of the casting. If poured, metal could solidify on the surface of the mold and leave internal voids. Narrower molds were poured directly from the melting crucible which was balanced on the edge of the mold. An iron skimmer or strainer was inserted in the stream of molten metal. This was a simple shallow pan with multiple small holes punched through it. The skimmer strained out dross, bits of charcoal and held back a block of wood that was sometimes placed on top of the molten metal in the pot to help prevent oxidation.

Several types of molds were developed to conform to the peculiarities of the alloy composition and the end product desired. The objective of mold design was to control solidification and thus make a bar free of internal voids. The shape of the casting was
Specifically developed for rolling into strip, making rods and wire or forming tubes. Besides the slab molds there were multiple compartment 'book' molds in which several bars could be cast with each pour.

Naval brasses were cast in a ring mold, a simple cast-iron ring 4 to 12 inches deep with a wall thickness of 2 to 10 inches (HAER No. CT-153-127). The inside diameter varied from 2 to 4 feet. The ring was heavy enough to bear solidly on a base plate of cast iron, mild steel or copper and prevent any leakage. The cavity formed by the ring would be filled with molten metal and skimmed of dross. A sprinkling of borax and fluorspar prevented additional dross or oxide formation. Before the casting was run through the rolling mill, the top surface would be machined off in a boring mill.

'Cake molds' were developed for producing billets destined for the strip mills. The edge poured cake mold formed blocks 6 to 8 inches thick, 3 to 4 feet long in the horizontal dimension, with a height not more than two or three times the thickness. In a cake mold, solidification proceeded simultaneously from the sides and bottom. The caster was able to continuously feed molten metal into the center of the casting as it cooled. This compensated for shrinkage and formed a billet free of voids.

Hollow cylindrical molds were used to cast rods. The one piece 'cannon' mold was developed around 1900 for cylindrical shapes. Cannon molds are cast iron cylinders with the center bored out. There was no need for banding and the mold swiveled on a trunion so it could be lowered into a horizontal position to remove the casting. It could be cooled between pours by sprinkling with water.

The Lawton mold was a variant of the banded mold. In a Lawton mold the cover section was hinged at the bottom. To close the mold the cover was swung up against the back. The back section protruded into the cover section for a fraction of an inch and there was a machined fit between components. The joint between the cover and back did not depend on butting two flat surfaces together tightly. Elimination of the gap between mold sections did away with the need for filing the fin at the parting line. The two sections were held together by substantial hooks (Hull 1950:139).

After cooling the resultant castings were given a set of "passes" through a rolling mill, with intermediate annealing sequences, until the finish thickness or gauge was reached. Rods had a tendency to distort and twist as they were processed. They were run through a set of straightening rolls to remove bends.

The first rolls were cast iron having a chilled surface. Greater compression with smaller roll gaps required alloyed cast iron rolls. Eventually cast steel became the standard for rolls. Bearing materials progressed through the years from babbitt metal to bronze to fibre and antifriction roller and ball types (SMC 1952a:18).

As strips became longer and longer it became necessary to develop mechanical coilers to collect the brass coming from the rolls. In 1886, hand "blocking" (aligning the edge of successive layers of sheet on the rolled coil) with a mechanical winder was introduced. By 1905 the automatic mechanical blocker was added.

The main skill of the roll mill operator was his ability to impart proper shape or "track" in the rolls by "stick grinding." Perfectly straight rolls evidently did not result in uniform sheet. The roll surface had to be shaped to optimize sheet flatness. This modification aided tangibly in holding strip thickness variation to a minimum, as well as controlling flatness and straightness (SMC 1952a:20).

Brass hardened as it was cold-worked by rolling, drawing, forging or other mechanical operations (SMC 1952a:16). The effects of work hardening had to be removed by annealing. Annealing softened the brass to permit additional rolling to a thinner gauge or stamping. Hardwood fired muffle furnaces were used to anneal brass at first. Later hard coal, oil, coal gas and propane were used successively as fuel (SMC 1952a:20).

The soapstone, cast iron, mild steel and copper molds were obsolete by the second decade of the twentieth century. Occasionally the old molds would be used for special alloys, development work or small orders. The copper water-cooled mold began to supersede the cast iron molds starting in the 1920s. These molds produced a better surface, could be cycled faster and required less skill to use.

Fork lift trucks, electric cranes and mechanized handling equipment reduced the need for heavy labor in the 1930s and allowed handling of larger quantities of materials and castings than could be handled by human labor alone. In the 1920s the industry experimented with electric powered high-frequency induction furnaces and carbon arc furnaces. They were expensive to install and in brass industry conditions, expensive to operate. Low-frequency induction furnaces were also used but because of refractory material limitations, could not be used with brass alloys containing more than 70% copper. Nevertheless they were efficient, cost-effective and began to replace pit fires. The electric furnaces displaced all but a few of the old pit fires by the mid-30s. By 1940 induction furnace and refractory technology advanced to the point where the low-frequency furnaces could be used at temperatures of 1350 degrees C. (2463 degrees F.). This was the highest temperature typically used in the brass industry (Hull 1950:39).

Continuous Casting

Casting evolved into a continuous operation. Engineers developed a unique flat-metal continuous casting machine which went into production together with an integrated continuous strip mill (SMC 1952a:23, 24). The concept of continuous casting was adapted from a continuous steel casting process developed in Germany. The Rossi-Junghans continuous casting machine turned out 2000 lb. slabs averaging 2 ½ inches thick, 24 inches wide and 10 feet long. The new continuous mills were an integrated operation and contained all necessary equipment for processing cold rolled brass, from the continuously produced slabs to the final packaged finished mill product.

At the core of the mill was the continuous flat-metal casting machine. Alloys were melted in three electric induction furnaces, each capable of producing 10,000 lb. per hour. Every half-hour each furnace discharged into a holding furnace of 9000 lb. capacity. This furnace fed a continuous flow of molten metal to the water-cooled mold below it. The mold opening defined the width and thickness of the slab being cast. The mold was oscillated vertically to keep the solidified skin of the casting from sticking to the mold. As soon as the molten metal contacted the cold mold, it formed a solid skin which contained the still-molten center. The slab then passed through a series of spray cooling rings which cooled the casting and induced solidification in the center of the casting.

As it emerged from the cooling coils, a horizontally mounted cut off saw assembly was hydraulically clamped to the moving slab, allowing the entire saw assembly to move downward in synchronism with the slab speed. The saw cut the slab to a set length of 10 feet. The hydraulic clamps then released and allowed the slab to drop into a basket. The basket rotated to place the slab on a roller table.

The edges and corners of the slab were trimmed on a milling machine. The slab then proceeded down the line through a series of rolling mills and annealing furnaces[10]. After several passes through the rolling mills it was thin enough to be coiled.

The rolling mills evolved into machines running at surface speeds of 1000 feet per minute producing roll coils weighing about 2000 lbs. (SMC 1952a:23). As of 1952, coil weights were going up to 3,000 lbs. each. At some mills, coils could be made up to a mile long without welds. The strip would also be cleaned and treated with acid ('pickled') to remove oxide scale and dirt during the rolling process. Coils were uncoiled for inspection and slitting to final width, then they were re-coiled and shipped.

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[10] The process of rolling causes the metal to "work-harden" and lose ductility. Heat treating or annealing eliminates the stresses built up in the metal by rolling or other process which deform it and allows additional rolling to be performed. To reduce a 2 ½ inch slab down to a strip a few thousandths of an inch thick many rolling - annealing cycles would be performed.

SUMMARY AND CONCLUSIONS

In our opinion, excepting the caveats on the Tingue Dam site, there are no barriers associated with archaeological sites, to removal, modification, repair or reconstruction of the Naugatuck dams cited in this report. Milone & MacBroom recommends the construction of a bypass channel to provide fish passage around **Tingue Dam**. The bypass channel would also furnish recreational boating opportunities. Perusal of the inventory of known archaeological sites located in the Office of State Archaeology indicates no known prehistoric locations within 1.5 miles of the project area. The project does fall within the recently proposed Seymour Historic District.

However, a small area of the site that may be undisturbed might possibly yield significant prehistoric cultural remains. The area was part of lands once belonging to Joseph "Chuse" Mauwee, a younger son of the first recorded Schaghticoke sachem Gideon Mauwee. Chuse lived with several other families on this plot in "wigwams" in the mid-1700s. The falls area was an important fishing place, so much so that when the Paugussets sold the adjacent lands to the English in 1678, they reserved the "fishing place" for themselves, along with the hill and plain adjacent to it. The deed suggests that the falls area was probably an important fishing area during prehistoric times as well.

There is a roughly triangular piece of land about 100 feet on a side that may not have seen significant development or disturbance other than several feet of earth fill (shaded area on Figure 9). This observation is based on examination of insurance maps from the late 19th century and aerial photographs dated 1949. This area was landfilled, leveled and covered with paving. This possibly undisturbed section of land has a high archaeological sensitivity as a prehistoric and early historic Native American site. However, it is covered by several feet of fill and paved. Current plans call for removal of the paving and creation of a grass covered picnic area. Careful removal of the asphalt with minimal disturbance of the underlying fill would make subsequent archaeological excavation practical prior to contouring and landscaping the proposed park. **State and regional planning agencies should recognize the worth of exploring this area and either avoid it or schedule subsurface testing if the area is scheduled for subsurface disturbance.**

Union City Dam project area is located within 1.5 miles of one known prehistoric archaeological site, a Late Archaic Native American camp site near Hop Brook. However, the industrial area shows evidence of severe disturbance and change. Physically, little remains that would contribute to any possible past Native American activities or to recordation of the industrial sites and canals served by the Union City Dam. Mill buildings have been demolished, new buildings have been erected, canals filled in and penstocks removed on the west side. On the east side, where the Archaic camp is located, the project area shows severe disturbance from both Route 8 construction activities and grading and landscaping activities associated with Linden Park ball fields and parking lot.

Union City's canal system can be better understood from examination of early 19_{th} century Beers maps and Sanborn Insurance maps dating from 1887 to 1968. Historical aerial photographs provide views of traces of some canals and their relationship to the dam. In our opinion, from the standpoint of historical documentation, there is no impediment to immediate removal of the dam.

In the vicinity of **Platts Mills Dam** the site inventory files in the Office of State Archaeology show no archaeological sites located within 1.5 miles of the project area. The area/location of the original headrace was covered over by Platts Mills Road when it's width was increased.. The flood of 1955 scoured out the 1856 headrace and washed away most of the buildings. A few stone walls remain to indicate the location of the head gates. A lone hydrant, dated 1876, is located near the site of the head gate in a wooded area east of Platts Mills Road. Physically, little remains that would contribute to knowledge of prehistoric or historic Native American culture or to greater understanding of the industrial sites and canals served by the Platts Mills Dam.

Review of the archaeological site inventory files in the vicinity of **Bray's Buckle Dam** in the Office of State Archaeology shows no prehistoric archaeological sites located within 1.5 miles of the project area. There is, however, a historic industrial area around the dam and north of it. These partially demolished and abandoned mills confirm what the archival studies have demonstrated -- that the waters of the Mad River powered numerous industrial mill complexes during the 18th and 19th centuries.

The site inventory files in the Office of State Archaeology show no archaeological sites located within 1.5 miles of the project area of **Freight Street Dam**. There are no significant industrial remains associated with the dam.

The Office of State Archaeology's site inventory files show no archaeological sites located within 1.5 miles of the **Anaconda Dam** project area. The industrial site associated with Anaconda's stored water was located about one mile south of the dam. While it was a major industrial site and some buildings are extant, removal of the dam will have no impact on the site of the Anaconda mills.

Review of the archaeological site inventory files in the Office of State Archaeology show no archaeological sites located within 1.5 miles of the **Plume & Atwood** project area. Assuming access to the Plume & Atwood buildings can be secured, an analysis of water usage within the complex would be of benefit to our understanding of non-power uses of water on a 19th Century industrial site.

Study of the Naugatuck Valley dams and their canals, mill races, penstocks, water wheels and turbines yield a valuable insight into how early millwrights, entrepreneurs and industrialists utilized a rather limited source of water power to its fullest. We did not specifically determine if the Naugatuck power was cooperatively controlled among its users, as were some water systems in eastern Connecticut. A study of riparian rights in the region might illuminate the existence of accommodations among some users. Union City Dam and its canals would represent a system amenable to cooperative usage. Scovill Brass, on the Mad River but not a part of this study, had an extensive series of storage ponds and managed its storage to maintain a steady supply of water.

In our opinion, the most valuable facet of this report is the series of enhanced graphics of the Naugatuck industrial complexes associated with the dams (See Figures 7, 12, 13, 14, 17, 19, 20 and 24). While these were based on earlier maps and surveys, the use of CAD software enabled creation of original delineations which show a detailed "snapshot in time" of thriving industrial complexes, areas of water usage, power and process water canals, production capability, and the state of manufacturing technology. The 19th century industries along the Naugatuck were diverse, creative,

entrepreneurial, mostly profitable and represented the quintessence of the period's "high-tech." Considerable current manufacturing practice can be traced to the Naugatuck Valley's pioneering factories.

This study, which focused on the dams, their construction and ownership raises additional questions outside of its original purpose of surveying and evaluating possible sites of archaeological value. Did the Naugatuck work as a system with cooperative agreements among the users? What types of wheels and turbines were used to extract power from the river? At what point did power from steam exceed power extracted from water? How much Naugatuck water went into steam production? What were the process uses for water? The Naugatuck Valley and its significance as an example of power development on a relatively small river is a subject worthy of further investigation.

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