Society for Industrial Archeology · New England Chapters

VOLUME 33 NUMBER 2 **2012**

CONTENTS

CONTRIBUTORS

Craig Austin, Marc N. Belanger, Bruce Clouette, David Dunning, Robert B. Gordon, Michael S. Raber, Rick Russack, Robert Stewart, Sara Wermiel, Fern Wildman-Schrier, Ronald D. Williams

Call for Papers for the: 26th Annual New England Conference on Industrial Archeology

February 23, 2013
at Clark University
Worcester, Massachusetts

Deadline for paper proposals: January 26, 2013

The Southern New England Chapter of the Society for Industrial Archeology invites proposals for papers to be presented at the 26th Annual New England Conference on Industrial Archeology. The conference is alternately hosted by the Southern New England and Northern New England Chapters as a forum for presenting research of our industrial past. The conference is to be held at Clark University in Worcester, MA, on Saturday, February 23, 2013. Papers are welcomed on all topics related to industrial history, archeology, manufacturing, preservation, engineering, architecture, etc., in New England and elsewhere. Proposals may be submitted for individual papers, team papers, or reports on works-in-progress. The time limit for each presenter will be 30 minutes. Student Papers are welcomed.

Format: Each presentation proposal must include:
(1) title; (2) an abstract of not more than 300 words; (3) a brief resume of the author(s), including postal address, telephone, and e-mail; and (4) a list of the presenter's audio-visual requirements.

Deadline: Proposals must be received by January 26, 2013.

Send via E-mail: proposals in PDF or MS Word format to:

mnbelanger@comcast.net

or via USPS to:

Marc N. Belanger
161 Highland Street
Taunton, MA, 02780

Call for Candidates to Run for SNEC Officer Positions:

SNEC Elections at the February 2013 New England Conference on Industrial Archeology

SNEC will hold elections for 2013 officers at the New England Conference on Industrial Archeology on February 23rd, to be held at Clark University in Worcester (more information about this will be forthcoming).

If you have enjoyed and benefited from SNEC, and want to do your part to support New England industrial archeology – research, preservation of historic sites, tours – and assure that the hard work of past volunteers will be carried forward into the future, now is your chance to give back! Candidates are needed for all positions: President, Vice-president, Treasurer, and Secretary. (See the by-laws that follow in this newsletter for a description of the responsibilities.)

If you would like to run for office, please send your name, a brief biography relative to your qualifications for the position, and your ideas for activities (or reason why you want to hold the position) to Sara Wermiel, (acting) SNEC Treasurer, at swermiel@verizon.net. You do not need to be present at the conference to run for office.

As you know, SNEC did not hold elections in 2012 and there were votes for only two officers in 2011. There are no official officers now. My efforts to organize a mail-in election have been unsuccessful. The future of SNEC is at stake. You can make a difference! Step up and be part of the glorious tradition that is New England archeology!

Sara E. Wermiel, PhD
Construction Historian/Historic Preservation Consulting
Jamaica Plain, MA

SNEC-SIA Bylaws

Article I. Name.
The name of the local chapter of the Society for Industrial Archeology representing Connecticut, Massachusetts, and Rhode Island shall be the "Southern New England Chapter."

Article II. Purpose.

The purposes of said local chapter are in accord with those of the parent Society, to wit: to encourage scholarly study of, and to provide the dissemination of information about, industrial archeology; to foster the documentation, preservation, and interpretation of industrial artifacts, structures, sites, and their contexts in the region; and to obtain the cooperation and support of interested organizations and groups in order to further the goals of the national and local organizations.

Article III. Membership.

Section 1. Membership in the Chapter is open to all persons who wish to participate with other members in achieving the purposes of the Chapter and the Society, in accordance with its bylaws.

Section 2. There shall be three classes of chapter membership: life, regular, and student. Chapter dues shall be established by majority vote of the Chapter membership attending an annual meeting.

Section 3. Members delinquent in paying dues for one year shall be dropped from the rolls of the Chapter.

Section 4. Chapter members are encouraged to become members of the Society for Industrial Archeology.

Article IV. Meetings.

In accordance with the national bylaws, the Chapter shall hold a minimum of two (2) meetings a year, one of which shall be held during the Fall and shall be the Annual Meeting of the Chapter. Minutes of the Annual Meeting shall be sent to the Chairperson of the Local Chapter Committee of the national organization within 45 days of the meeting. An annual report and financial statement shall be forwarded to the Chairperson of the Local Chapter Committee during the month of January.

Article V. Officers.

Section 1. There shall be four officers of the Southern New England Chapter, namely, the president, the vice-president/program coordinator, the secretary, and the treasurer. The offices of secretary and treasurer may be combined or separated at the discretion of the Chapter membership.

Section 2. The officers shall constitute an executive board which may meet as determined by, and as called by, the president to conduct the business of the Chapter as authorized by the membership. The executive board may appoint committees to assist the board in furthering the purposes of the Chapter.

Section 3. The president shall preside over all meetings of the membership and shall bear responsibility for the preparation and presentation of the annual report of the Chapter at the annual meeting of the national society. The president shall also have check-signing powers relative to the authorized conduct of the Chapter's financial affairs.

Section 4. The vice-president/program coordinator shall be responsible for the organization of all field trips, recording parties, or other scholarly activities undertaken by the Chapter, and shall keep a record thereof. He/she may appoint project coordinators. In the absence of the president, the vice-president shall preside over the affairs of the Chapter.

Section 5. The secretary shall keep and maintain the minutes of all meetings of the Chapter; shall attend to any necessary correspondence; and shall notify the membership of meetings and projects. In the absence of the president and vice-president, the secretary shall preside over the affairs of the Chapter.

Section 6. The treasurer shall have custody of all Chapter funds; shall be responsible for maintaining accounts; and shall annually submit a written financial report and bank statements to the membership. In January the treasurer shall submit a written report to the President for submission to the Chairperson of the Local Chapter Committee of the national organization. The treasurer shall maintain an official list of the Chapter's membership. He/she shall also have check-signing powers relative to the authorized conduct of the Chapter's financial affairs.

Article VI. Authority.

Section 1. The Chapter may undertake any activities consistent with the purposes of the Chapter set forth in Article I. The Chapter shall not take any action in the name of the national organization without the prior approval of the Board of Directors of the national society.

Section 2. These bylaws may be amended by a majority vote of those present and voting at the Annual Meeting.

NNEC-SIA President's Report

Our chapter has had two big accomplishments this year that will help us grow. The first is the establishment of a professional web site. It's tied to the national site. Check it out at www.sia-web.org; click on Chapters and select ours. Thanks to Dave Coughlin and to Marc Belanger (of SNEC) for getting us up to date with this.

The second is the design and production of a promotional flier for our chapter. These will be handed out to visitors at tours, mailed to prospective members, and wherever else we can distribute them. Thanks to Dennis Howe.

To bolster our membership, we are also sending tour invitations to the many national SIA members who are not NNEC members but live in our area.

Make it your New Year's resolution to pay your dues promptly this year. Remember that you're not just a small number in a huge database; instead you are a key member of a unique small group of industrial historians. Your ideas, input, assistance, and financial support are essential. Also consider serving on the board. How much time it takes is variable depending on how much you have. We only meet once or twice per year; most of our communication is by e-mail or phone. However, your input is valued and board members are exposed to lots of very interesting information. It's the kind of fun that we joined for.

DIY Industrial Archeology – Part 2

In the last report, we learned how to find out about industrial skeletons from local sources. That was primary research. Secondary research reaches out to find information that has already been gathered and documented somewhere. The first place to look (ask) is the local library. It's often surprising to find articles and even books written about old local industries. (You can save yourself much time by asking the reference librarian in the first place instead of trying to find the information yourself and coming up dry.)

Big libraries, especially city and college libraries, have electronic access to 19th century detailed town and city maps that were produced for fire insurance companies. These are called Sanborn Maps. For the Bellows Falls tour, the city library was able to pull up maps from many different years and print out the ones I wanted. As fire insurance maps, they give a lot of details about every shop, mill and factory, even up to how many fire buckets they had. Only libraries have access to these. They shouldn't really be photocopied but it's common practice since our use is not cheating them out of income.

Have a great Christmas season, send us your new tour ideas, step up to our board and pay your dues. Thanks.

David Dunning
NNEC President
dunmark@tds.net
603-526-6939

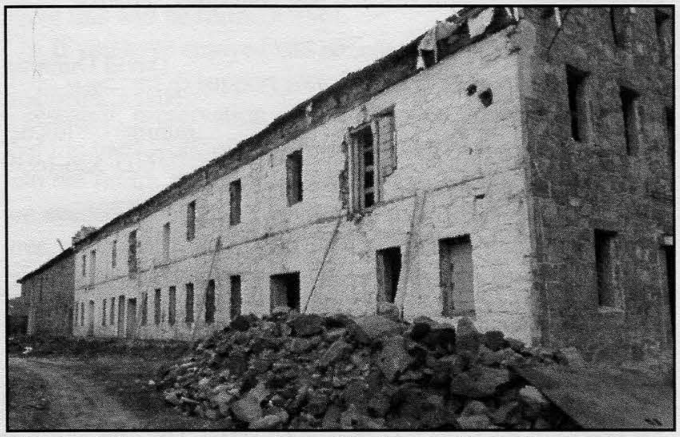
SNEC Ames Shovel Shop Tour

Light to heavy rain fell as the Southern New England Chapter and the Vernacular Architecture Forum had a joint tour of the former Ames Shovel Shop factory complex and other buildings in North Easton, led by SNEC member Greg Galer and Ed Hands of the Easton Historical Society. The tour began at the factory complex itself, which is located in the village of North Easton in southeastern Massachusetts.

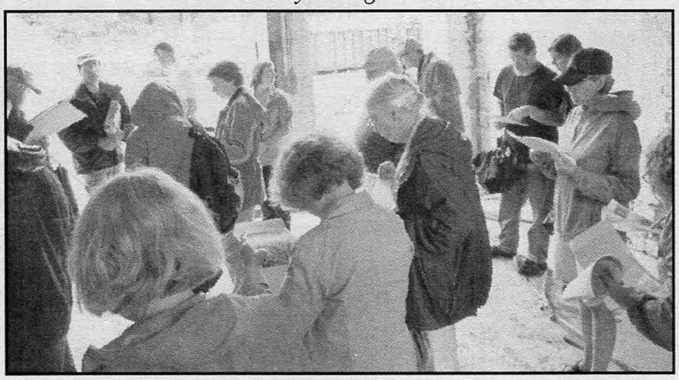
The Oliver Ames Company, later known as the Ames Shovel Works, came to Easton in 1803 and moved to the site visited in 1853. It produced shovels and tools on this site until the early 1950s, growing to become the world's largest shovel manufacturer. Three-fifths of the world's shovels were made by Ames in the latter 19th century. Here Ames produced millions of shovels and employed upwards of 500 people at its peak. This unique 13 building complex is at the center of the North Easton National Register District and H.H. Richardson National Landmark District, and the income generated here allowed the Ames' family's involvement in a host of nationally significant enterprises, including funding the Union Pacific Railroad and the renowned designs of H.H. Richardson, F.L. Olmsted and others which permeate Easton. However, the Shovel Works was nearly lost to demolition. Through an multi-year, coordinated, local effort, supported on the state and national levels (including listing on the National Trust's 11 Most Endangered Resources list in 2009), the purchase of the site by the Beacon Communities, and significant contributions from the Community Preservation Act, the site is currently undergoing a $40 million redevelopment into housing, with preservation oversight of the Easton Historical Commission and the NPS under Secretary of the Interior Guidelines due to state and federal historic tax credits. [From the tour announcement]

The tour first wandered through the construction zone where the factory was located. We started in the long shop (easily the longest building in the complex) and proceeded through the hammer shop and then through the boiler house. Along the way, the history of the company was related as well as the plans for development of this property, which will include residential and commercial space. At the time of the visit, most of the insides were gutted, leaving great brick caverns that showed the roof supports and numerous holes where windows once were.

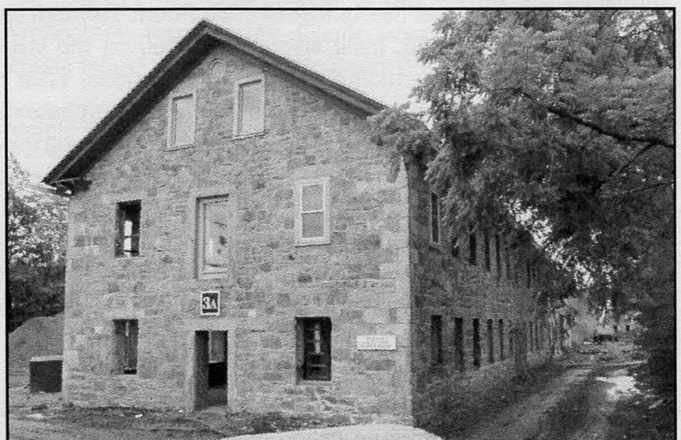
The tour next walked to the mansion of Oliver Ames, Jr. This house is an example of a Victorian era structure with Italian Renaissance architectural style. Behind and beside it were beautifully landscaped lawns. On the other side of the street



This building was once the boiler house. Extensive work was being done both inside and outside the buildings. Photo by Craig Austin.



Greg talking before the group about the history of the site, while within the Long Shop.



Looking South to the end of the Long Shop from Oliver Street. Most of the buildings in the complex were made of stone, with the exception of the steel beam building, of which the steel frame has been retained. Photo by Craig Austin.

were workman homes, and along Elm Street were examples of duplex tenement houses. We briefly walked into property formerly part of another Ames Mansion – now Trustees of Reservation property, before heading down Washington Street. Along the way, we passed by a factory once operated by a rubber shoe heel manufacturing company, then walked around to see more company houses and back to the start just as the heavy rain came in.

Some members visited the Easton Historical Society museum that is in the old North Easton Depot, a beautiful stone structure designed by H. H. Richardson, who designed many buildings in North Easton.

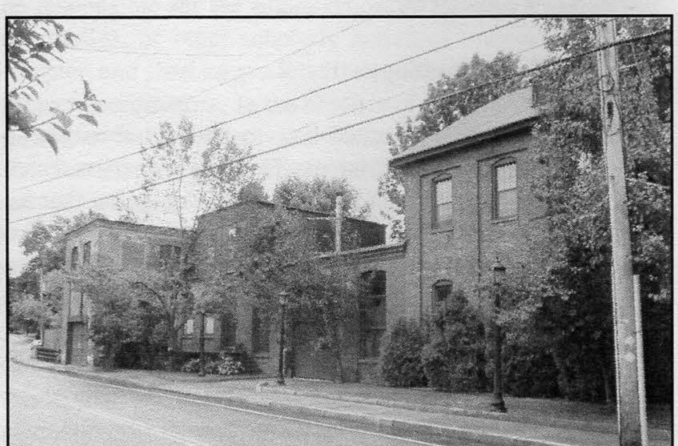
This was a rare opportunity to be able to see the buildings exposed, to see the buildings in process of development, and to see the structure underneath. Thanks go out to Greg Galer for organizing the tour and being one of our guides, and to Beacon Properties for allowing us on the property during construction!

Continued Drive Through Easton

Subsequent to the tour of the shovel shop in Easton and a visit to the Easton Historical Society headquartered in the railroad depot, I took a drive through other parts of Easton to learn about other industries there. I learned that while the shovel shop dominated the northern part of town, a bottling plant, an automobile factory, and early iron forges were located in other parts of town.

My first stop was about a mile south of North Easton, near the intersection of Central and Washington Streets, known as South Easton. Here, the Easton Machine Company produced the Morse Car from 1902 to 1917. Alfred B. Morse held 80 patents for machinery including the first thermostat for home heaters. The main building is situated along the south side of a pond and appears to have been converted to residences. The building on the south side of the road was for the Crofoot Gear Company and is now vacant and in poor shape.

My second stop was about a half mile south of this location to Simpson Spring Company. This company started in



The Easton Machine Company Building on Central Street, where the Morse Car was produced. Photo by Craig Austin.

Simpson Spring Company. Photo by Craig Austin.

1878 and claims to be the oldest bottler in the country. They are still bottling at their original spring south of Washington and Depot Streets. In addition to spring water, they make several flavors of soda.

The third stop, a few miles west of the Simpson Spring Company in Furnace Village, was where two ponds were located next to each other. Today, there is a turnout on the Old Pond, with a historical plaque and millstone that mark the area where early mills existed along the two brooks that included gristmills, sawmills, cider mills and early iron forges that dated back to 1751.

Though I did not know it at the time, iron foundry activity continued at that location for many years. The longest lasting of which was the Belcher Malleable Iron Company, which was active until 2007, when its parent company closed the company. As of the end of July, the buildings were in the process of being demolished.

References

Easton Historical Society, *History of Easton*, accessed on the web site for the Ames Free Library at http://www.amesfreelibrary.org/Popups/History_easton.html.

Map: Easton Historical Society, *Historic Easton Welcomes You*, Easton MA.

Massachusetts Historical Commission, *MHC Reconnaissance Survey Report, Easton, MA,* accessed on the MHC web site at http://www.sec.state.ma.us/mhc/mhcpdf/townreports/SE-Mass/est.pdf .

Boston.com, "Demolition work roils neighbors" accessed at: http://www.boston.com/news/local/massachusetts/articles/2012/07/29/neighbors_get_reprieve_from_soot_but_remain_wary_after_state_halts_demolition_of_easton_foundry/

Craig Austin,
SNEC Acting Secretary

NNEC-SIA Spring Tour
Claremont, NH: May 19, 2012

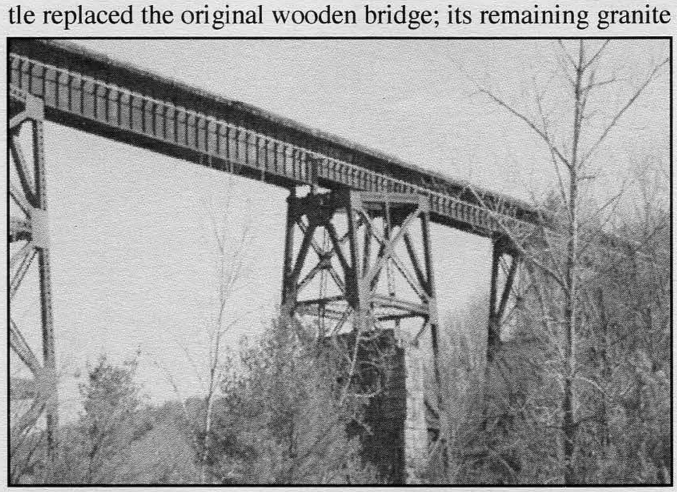
On a perfect spring day, about 40 history enthusiasts came to learn about Claremont's early industries. From NNEC about 15 came and another 5 from SNEC; twenty more local people responded to the newspaper and radio promotions. It was hoped that some of them would join but none did, although they were all given our new flyers. The tour began with the usual refreshments and visiting of fellow members; that was enhanced by visiting with locals, many of whom either worked in these mills or their parents or grandparents did. About 50 historic pictures were displayed on panels along the city park fence overlooking the river and the mills. These made an interesting preview of the tour and later were props for the talks.

A picture of the Newbury cut along the route of the old Concord to Claremont Railroad showed how the two ends didn't meet until a new steam drill could bore into the granite hilltop. It could then be blasted and hauled away. We then saw how the Sugar River drops 30+ feet through Claremont, powering several mills along the way.

The Monadnock Mills history was presented by Colin Sanborn of the Claremont Historical Society. Monadnock Mills produced some of the nation's finest Jacquard quilts and cotton and linen fabrics for almost 90 years. Colin displayed samples of many of those fabrics. He also showed us samples of some of the tools used in the manufacturing processes.

Walking a short way to the Claremont Gas Light Company remains, we learned how the Monadnock Mills were lighted and later some of Claremont's stores and streets. It was part of the mill at first but was legally separated with the mill's demise so that it could continue to provide gas lights for the community. Today it is an EPA-condemned site.

James Garvin gave us an excellent detailed history of the Moseley tubular bowstring bridge, one of only three remaining in the US. The bridge is just above one of the falls so the setting was ideal. At the end of the day, James took us to the High RR Bridge west of town. This 1880's iron trestle replaced the original wooden bridge; its remaining granite

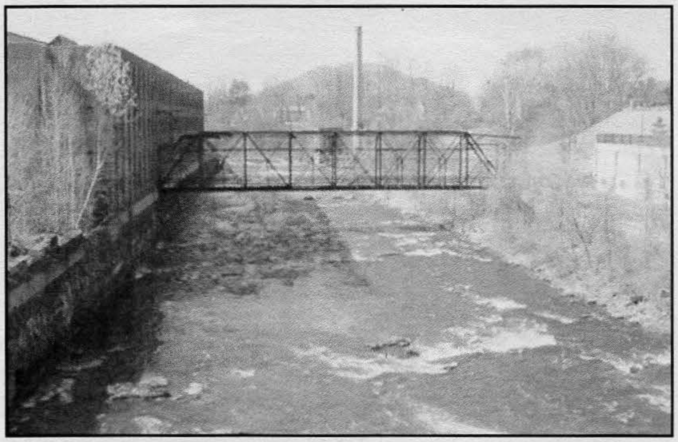


Iron trestle high railroad bridge with older granite piers.

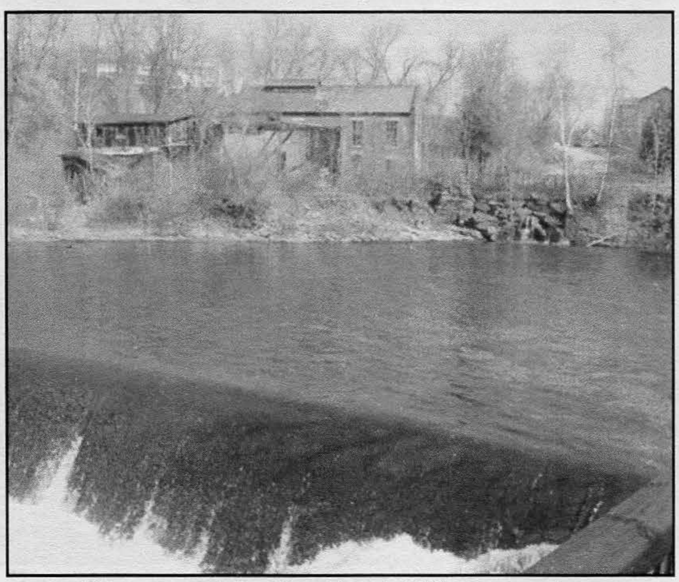
piers are still alongside. The two tracks ran side by side for a while. Anyone who missed this or any other tour missed a lot of great detail that they could only get by being there, seeing the sites and asking questions of the speakers. (Don't miss the next tour.)

Lunch at The Common Man was historic too because the restaurant is in the old Monadnock card house overlooking the river and falls. Many blown up photos of the old mills are on the restaurant walls and can't be seen anywhere else. After eating, many people strolled back to the park to continue perusing the other old photos on our display boards.

The Sullivan Machine Company was the most interesting part of the tour. What began as a general machine shop and foundry before 1851 became The Claremont Machine Works when it was purchased by James P. Upham, a recent Dartmouth graduate. At that time it produced engine lathes, planers, paper mill machines and circular saw mills. It was also producing The Tuttle Water Wheel. That was soon superseded by the Tyler Turbine Water Wheel, invented by John Tyler of Claremont. Over 3000 of them were produced there in 30 years time. In 1856, this wheel was exhibited at the Crystal Palace in New York where it received the highest prize medal awarded to water wheels. Also, during the 1860's thousands of water wheel regulators were built and lines of agricultural machinery were added to the Claremont Machine Works.



The Sugar River, looking west with the Sullivan assembly buildings on the left and the foundry site on the right. Mount Ascutney, in Vermont, is seen in the center beyond the Sullivan power plant stack.



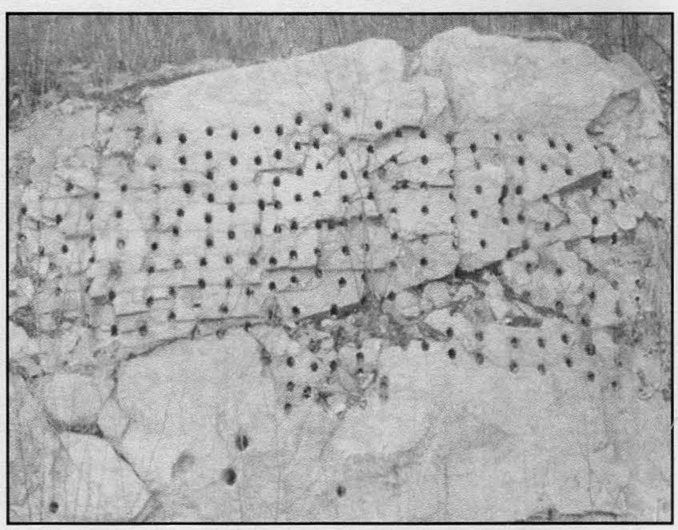
Remnants of the Manadnock Mills power plant.

In 1868, while Mr. Upham was pruning apple trees along his Connecticut River property, two men from Windsor, VT (a few miles upriver) stopped by in their buggy asking where Mr. Upham lived. They had drawings of a newly invented and patented diamond channeling machine for quarrying stone, especially marble. This meeting over a stone wall resulted in a signed agreement which became the inception of the Sullivan Machinery Company. One of those two men, Albert Ball, became Mr. Upham's Chief Engineer and received 130 mining equipment patents over his career. The first diamond channeler, completed in 1868, was a six spindle variable speed core drill, movable on a track with a gauging device to space the holes and set them at any angle.

By the 1920's, Sullivan had become New Hampshire's largest machine company and Claremont's largest employer with over 1200 workers. In 1946, Sullivan merged with Joy Machinery Company. We grew up seeing Joy rock drills and compressors building the interstate highway system all over the county. Besides having other plants in other states, Joy moved from the old high brick mill buildings along the river to a new larger single story plant below town in the 1960's. Their foundry followed about ten years later to a new state of the art facility. However, alas, by the 1980's this like most other large equipment could be made much cheaper overseas by other companies; the Claremont operations were closed, idling the last 800 workers.

Today, that already huge building has been doubled in size and height and houses CANAM Steel Corp. a company that fabricates giant I-beams for bridges.

David Dunning
NNEC President



A Sullivan test drill sight for their rock drills.

The Dam at Beckley Furnace, North Canaan, Connecticut:

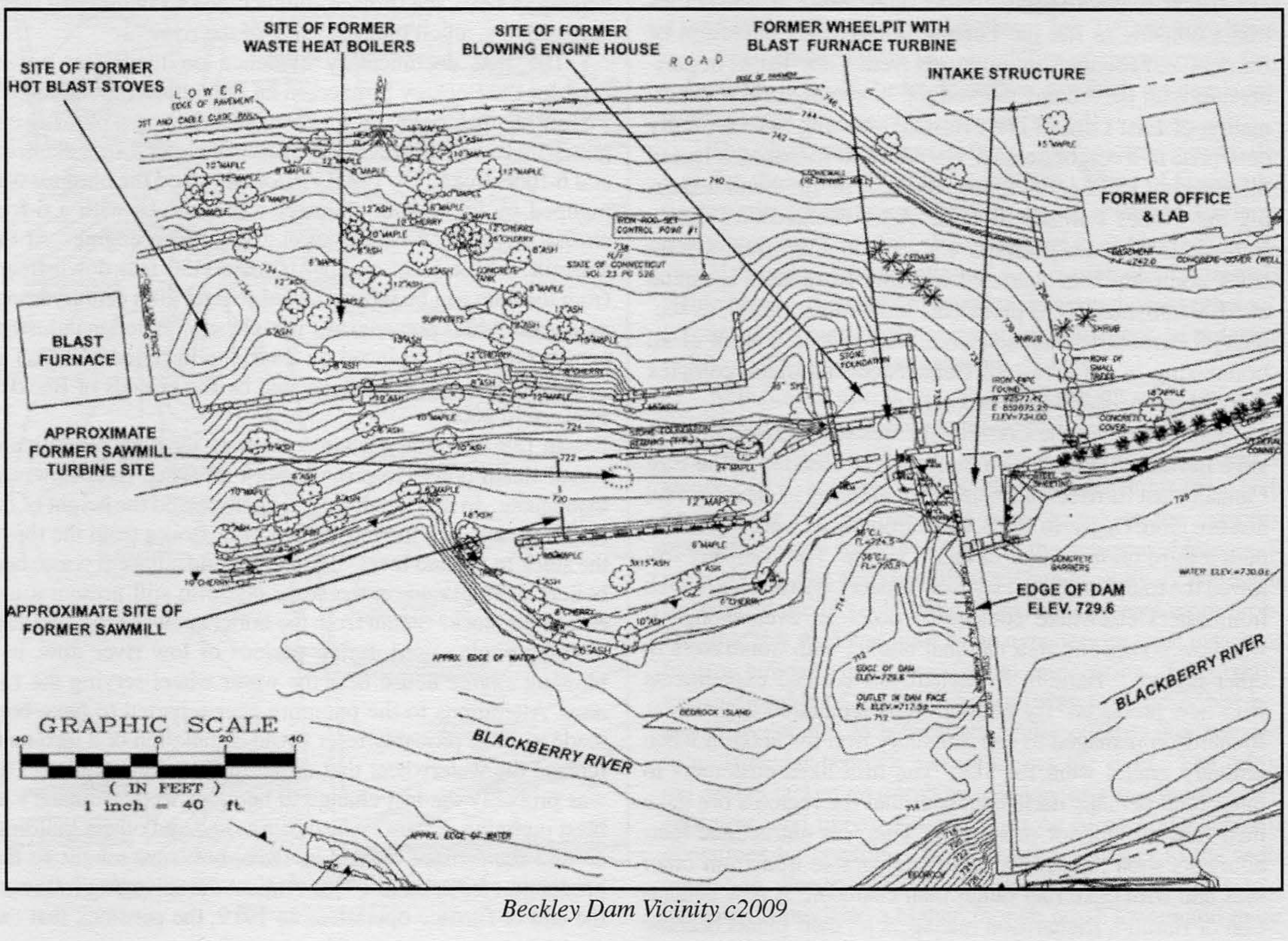
Documentation of Vernacular Engineering and Waterpower Issues

Introduction and Summary of Blackberry River Ironmaking, c1739-1923

Beckley Furnace (East Canaan Iron Furnace Industrial Monument) is a state-owned property listed on the National Register of Historic Places, and is one of the best-preserved sites of its kind in Connecticut. In 2010, the Connecticut Department of Environmental Protection repaired the dam serving the furnace. The Connecticut State Historic Preservation Office requested historical documentation to mitigate project effects on the historical and engineering character of the dam. Documentation included mechanical excavation and monitored construction activity to record buried dam components.

The Blackberry River is a major Housatonic River tributary, with a 47-square-mile drainage originating in Norfolk, CT, and including parts of Canaan and North Canaan, CT, as well as New Marlborough, MA. Glaciated marble bedrock underlies almost all of the drainage's irregular terrain in North Canaan, which includes steep slopes as well as broad, relatively level areas. Approximately a mile below the confluence of the Whiting and Blackberry rivers near the village of East Canaan, the Blackberry drops some 50 feet over half a mile, beginning at the impoundment created by the dam built to serve the Beckley Furnace. Terrain along this reach allowed for relatively easy creation of waterpowered mills, forges, and furnaces which became one of the most important industrial complexes in the upper Housatonic River region. These developments began in 1739, when Richard Seymour of Hartford built a bloomery forge at the lowest waterpower privilege on the Blackberry River, smelting iron ore from Salisbury's recently-opened mine at Ore Hill, and forging it into products needed by the area's settlers. A few years later he partnered with John Forbes (1695-1759), who acquired ownership of the forge in 1751. His son Samuel Forbes (1729-1827) soon established himself as one of the region's principal ironmaster and property owner. He enlarged the works on the Blackberry River into a manufacturing complex that made saw and grist mill machinery, screw presses, and ship's anchors that agents sold in the principal colonial cities. Samuel Forbes helped add cast iron to the region's products when he built a blast furnace in 1762 at later Lakeville in Salisbury, with John Hazeltine and Ethan Allen.

In 1780, Samuel Forbes made John Adam, Jr. (1755-1836), his business partner. John married Samuel's daughter



Beckley Dam Vicinity c2009

Abigail and established a family that continued the region's industry for two more generations. Forbes & Adam enlarged the forge on the Blackberry River, and by c1785 built a rolling and slitting mill for making nail rods somewhere at the uppermost East Canaan privilege. In 1798, they sold Eli Whitney equipment for his Hamden armory along with the rolled iron and gun barrels that allowed him to begin production of muskets for the federal government. At the same time, they supplied the Springfield Armory with rolled plate for musket barrels. The partners added a store, saw and grist mills, and anchor shops to the East Canaan works. By the 1820s, nailmakers began to use machines that cut nails off of rolled iron plates, instead of cutting, heading and pointing nail rod. The partners produced these plates as well as nail rod, though by this time the rolling and slitting mill being run by one or more of Forbes' sons was in poor condition.

John Adam, Jr.'s heirs carried on farming and grain milling along with iron smelting and anchor forging through the 1850s. His son Samuel F. Adam (1783-1854) built the first of the East Canaan blast furnaces, named the Forbes, upstream of the old forge in 1832. His grandson John A. Beckley (1808-1874) and his granddaughter Jane Adam's husband William G. Pierce (b.1814) added the second furnace, the Beckley or Canaan No. 2, in 1847 at the uppermost privilege. In 1856, Samuel F. Adam's sons joined William H. Barnum (1818-1889) and Leonard Richardson (1808-1864) in the Forbes Iron Company to run the Forbes furnace. The inclusion of Barnum and Richardson, investors from Lime Rock, in partnership with the Adams marked the beginning of a transformation of East Canaan blast-furnace smelting from a family enterprise to a corporate one. Barnum and Richardson leased the Beckley Furnace in 1856, buying it in 1858 and acquiring the Forbes Furnace in 1862. After Richardson's death, Barnum formed the Barnum Richardson Company, a joint stock company headquartered in Lime Rock with a capital of $200,000, himself as president, and Sydney Ensign as secretary. Barnum Richardson eventually gained control of all ironmaking in northwestern Connecticut through a complex array of partnerships and corporations.

Completion of the Connecticut Western Railroad in 1871 gave Barnum Richardson a direct rail connection at the East Canaan blast furnaces, allowing them to bring in charcoal fuel and ore more easily. In 1872, when iron prices were high, they built a third blast furnace in East Canaan. The company followed the traditional local style of furnace construction, which ironmasters elsewhere considered obsolete, even though it was now competing in a national market with ironmakers in other regions. Barnum & Richardson avoided experiments with new products. By trading on its reputation, Barnum & Richardson managed to sell Salisbury iron for $60/ton when ordinary grades went for $18. The firm liked customers to think (and perhaps itself believed) that the region's ore gave their iron its superior properties. This was untrue, and metallurgists soon learned to make comparable iron from other ores and with coke fuel rather than charcoal. A new generation of Barnum Richardson managers let their plants become more obsolete year by year. They began a belated attempt to modernize operations during the iron industry's last period of prosperity in World War I, including construction of a new blast furnace on the Blackberry, but in 1919 the firm went bankrupt and a salamander stopped Beckley Furnace operations. Salvagers carried away everything they could remove from the site, including the brick from the casting house, but despite losses of equipment and some buildings, this furnace remained the best preserved of the Blackberry River iron industry sites. It stood abandoned until concerned citizens raised money to buy the site for the state in 1946, and was later named as the only State Industrial Monument.

Beckley Furnace Site History Summary

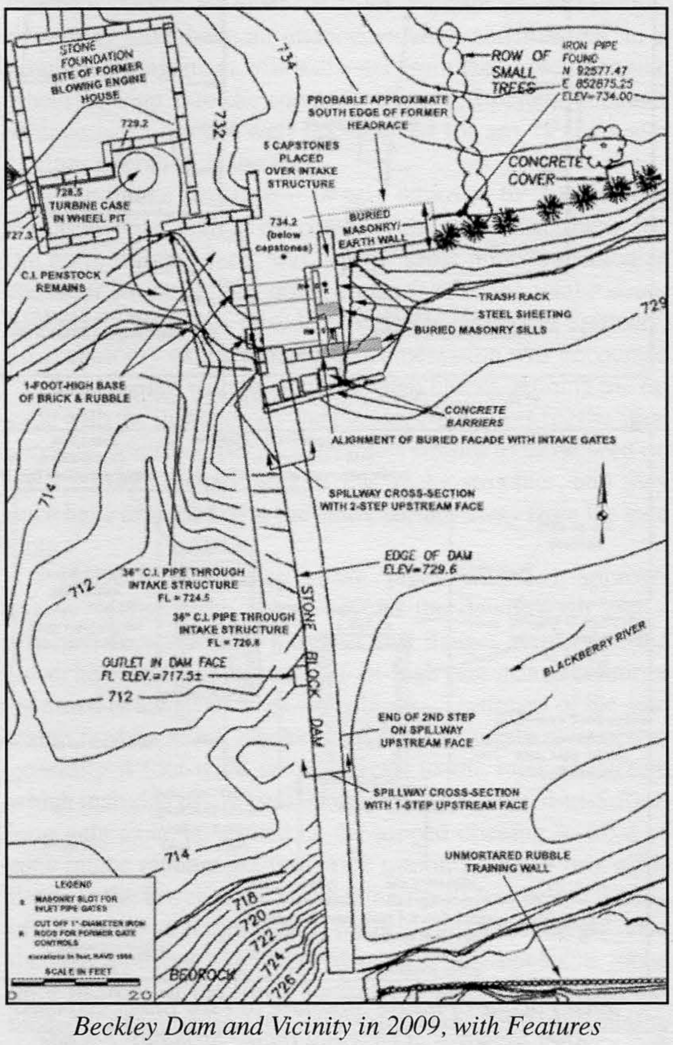
John A. Beckley and William G. Pierce built what became known as the Beckley Furnace with water privileges and land leased in May 1847 from Leonard C. Adam (1826-1897), Beckley's first cousin and Pierce's brother-in-law. The site may have been used for the 18th-century rolling and slitting mill, but evidently had no dam or other surviving industrial features. Available evidence suggests that Beckley and Pierce may have built most of the present gravity dam during initial development of the furnace site, on a bedrock outcrop across the river. The furnace may have been among the first in the United States to use hot air blast to make pig iron with charcoal fuel. When leased to the Barnum and Richardson partnership in 1856, the furnace site included a sawmill and other outbuildings, all on the north side of the river.

The first documentary evidence on the water power used for the Beckley furnace, in an 1866 description, noted a 17-foot-diameter overshot waterwheel, driving a blowing engine with two vertical wind cylinders of about 5-foot diameter and 6-foot stroke. By 1885, visitors reported the blast air was pumped by two 6-foot-diameter wooden tubs with a 6-foot stroke, driven by a water wheel and a steam engine. At the sawmill, whose location approximately 50 feet downstream from the dam can be inferred from several 20th century images, a waterwheel powered an "upright saw" noted in industrial census data until replaced by a turbine installed c1877. The turbine was located and excavated by the Friends of Beckley Furnace in 2005.

In 1880 Barnum Richardson rebuilt the blast furnace, and added steam power to provide blast air when river flow was inadequate. In this rebuilding, they increased the height of the furnace stack, and moved the hot blast stoves from the top of the stack to ground level. The stoves and adjacent waste heat boilers were placed on the stone platform still present to the east of the stack. Steam from the boilers powered an auxiliary blowing engine used during periods of low river flow, in a blowing engine house near the water wheel serving the furnace. Alterations to the pumping gear reported to have been made in 1886 probably refer to the installation of a turbine to replace the waterwheel that drove the blowing engine. This was probably the last change to be made to the furnace's air blast pumping system. The casting shed and others buildings around the furnace burned in 1896, but were rebuilt so that production resumed in 1898. Amidst the salvaging following the end of furnace operations in 1919, the penstock that carried water to the blowing engine turbine was not removed, as discussed below.

Dam History and Design

No records of the design or dates of construction of the Beckley Furnace dam have been found. Limited graphic and documentary evidence indicate at least two stages of construction: the existing spillway and poorly-documented original abutments and waterpower delivery structures; and one or more episodes of intake reconstruction to accommodate the two turbines installed c1877-1886. To provide water to the 17-foot-diameter waterwheel described in 1866, a dam as high as the present one would have been needed. Hence the existing spillway must have been in place by this time, and was likely built no later than c1856 when Barnum Richardson took over operations. An undated, visually-ambiguous photograph pre-dating the intake structure in place in 2010 appears to show the present spillway meeting a headrace and/or flume serving the waterwheel on the north side of the river. In early 2010, the 117-foot-long impoundment consisted of a 98-foot-long spillway, a 20.5-foot-wide north abutment including the intake structure and a 7-foot-wide training wall, and a low 62-foot-long rubble south embankment built on or very close



Beckley Dam and Vicinity in 2009, with Features Exposed in 2110

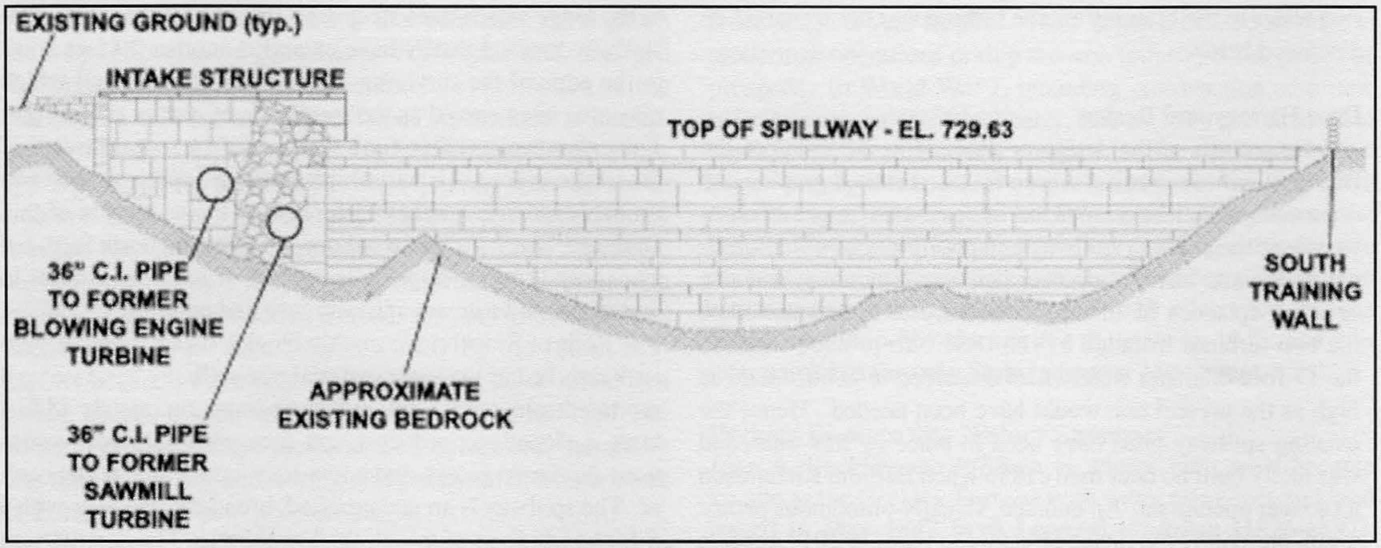
to the ledge which rises steeply on this side of the river. The spillway may originally have extended another 20 feet north to the edge of the surviving 7-foot-wide training wall which may also have served as the south side of part of a headrace. The extant wall, visible for a distance of 16 feet upstream of the intake structure, is 5 feet higher than the spillway crest and probably extends another 15 feet along the north side of that structure. The wall has an unknown height and north face, but as exposed to date appears to consist of masonry similar to that of the downstream spillway face and earth fill

Built of Stockbridge marble blocks, on an irregular bedrock riverbed of the same material, the spillway has a vertical mortared-ashlar downstream face up to approximately 18 feet high, a sloped/stepped upstream face with numerous variations discussed below, and a low-level outlet pipe at the center. The spillway is an uncontrolled, broad-crested weir with a 5-foot-wide crest of 6-inch-thick capstones. The downstream face has quarry-faced marble blocks, backed by what appear to be similar material in a solid masonry mass to the upstream face. To resist damage from high water, the upstream side of the capstones was pinned to the uppermost spillway course with straight-sided iron staples, most of which were missing. Below the visible spillway face, the structure probably extends at least 1 foot into a trench cut in the bedrock, and has a base approximately 10 feet wide which is mortared along the edges of the trench. The upstream face does not have a uniform profile, but in most places has 1:10 to 1:8 slopes, with one or two steps. The variability of the upstream face reflects the irregular bedrock surface, to which the dam's masons adapted their work as they proceeded.

The choice of a vertical-faced, all-masonry gravity design for the spillway, rather than some variant of vernacular timber-crib construction which remained common for large projects at this time, probably reflects at least two factors:

- high bedrock which allowed for creation of an extremely stable base with limited excavation, but which was sufficiently porous to warrant concerns about resistance to potential uplift or sliding with non-masonry designs;
- well-funded operators who would pay for substantial initial construction to minimize future maintenance issues.

The vertical spillway face used less material than a stepped face, and resembles somewhat later dams for which engineering calculations were made to assure the masonry was sufficient to withstand water at the anticipated impoundment height. The Beckley Furnace Dam most likely pre-dated the earliest use of such calculations, and it seems more probable that this dam was built by an experienced local mason or furnace builder with limited formal engineering. The highly-variable profile of the upstream spillway face, described below, also appears to reflect vernacular construction adapted to an irregular bedrock surface across the river. The original design lacked an overflow spillway or a significant south abutment, and imposed some limits on furnace and sawmill operations by creating a small reservoir subject to the sedimentation discussed below. Terrain at the dam site might have accommodated a higher, though much longer and more

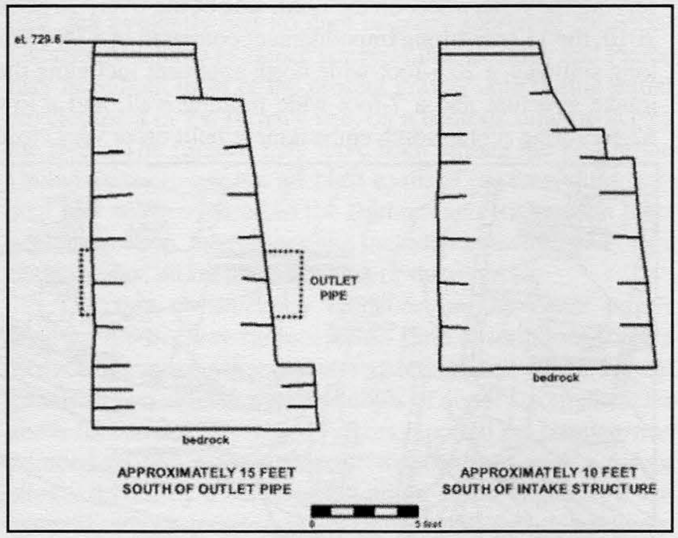


Beckley Dam Elevation c2009

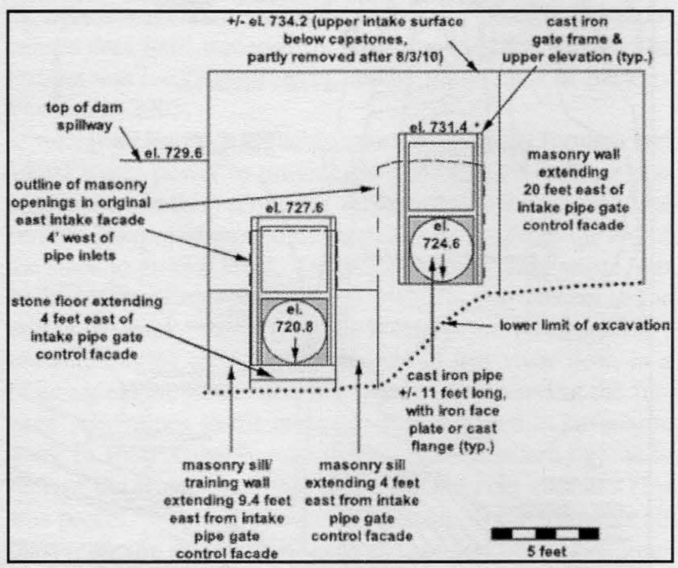
expensive structure, but this would have required flowage rights the furnace operators do not seem to have had. Land records reviewed for this documentation did not indicate any purchase of such rights associated with the site from the mid-1840s onward.

The original blowing engine waterwheel would have been in a substantial pit. However, the existing dam is not high enough to supply water to an overshot wheel of 17-foot diameter. The highest possible position of the top of a 17-foot wheel, one foot below the dam crest, would leave the bottom of the wheel in three feet of tail water at ordinary river level. It would have been necessary to use a pitchback or breast wheel at Beckley Furnace. Some of the existing 23-foot long wheel-pit structure at the north end of the dam, with its large tail-race arch, was probably part of the original dam structure. Since the surviving pit is only 7.5 feet wide at its western end, the pit must have been narrowed when the wheel was replaced by a turbine, probably in 1886. Evidence for the rebuilding of the wheel pit is found in features of its stonework, and indicate that its upper part was modified when the turbine was installed. Stone blocks with drill holes are present on the top of the west wall of the wheel pit, and in the dam face above the wheel pit, but not below. These blocks were made by drilling short holes that were then fitted with feathers and hammered to split the rock. Some of the drill holes extend the full depth of the blocks. Evidence of this quarrying technique is found on the blast furnace only in the stone used for addition made to the raise stack height in the 1880 rebuilding of the furnace. The stone with these features therefore probably dates from a time after 1880, and so could be the material used in the 1886 rebuilding done to accommodate the turbine that replaced the blowing engine waterwheel.

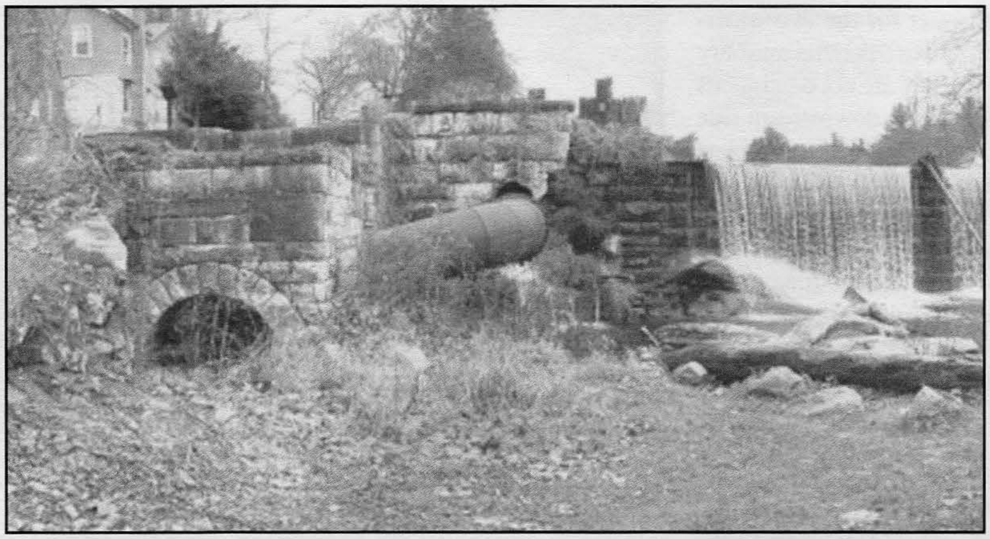
The wheelpit modifications were almost certainly contemporary with construction of most or all of the existing intake structure, which does not appear in the undated historic view. Built behind and above the north end of the original spillway, the approximately 13.5-foot-square masonry struc-



Schematic Nrth-Facing Spillway Sections

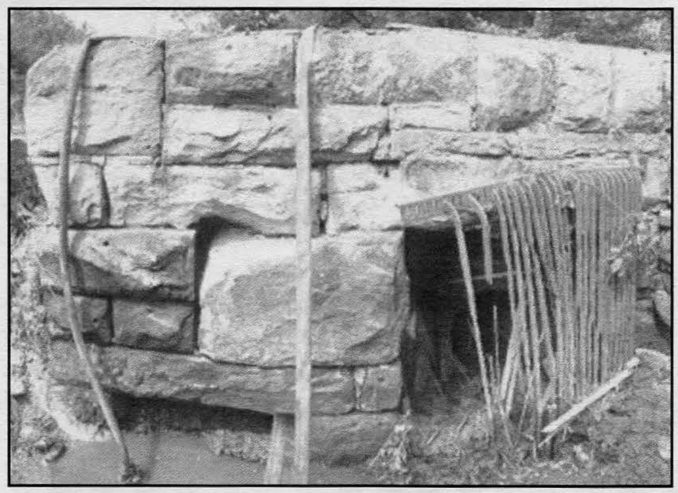


East Facade of Intake Structure at Pipe Inlets, Exposed After Removal of Original Intake Structure Facade



Left: View East of Wheelpit and Tailrace Arch (Left). Intake Structure with Penstock for Blowing Engine and Lower Pipe for Removed Penstock to Sawmill (Center), and North End of Spillway (Right)

Below: View West of Partislly-Watered Intake Structure East Façade, with Trash Rack and Entrance for Intake to Blowing engine Turbine at Right



ture had two 3-foot-diameter pipes, controlled by wooden gateboards, feeding the surviving 4-foot-diameter penstock to the blowing engine turbine and a now-vanished penstock to the sawmill turbine. The latter, lower-level penstock must have been supported on piers which have not survived. There is no evidence as to how the pre-c1877 sawmill waterwheel was fed. Given the distance from the dam to the sawmill, there may have been an undocumented wooden flume, or a possible arrangement with tailwater from the blowing engine wheel flowing into the sawmill. As noted below, tailwater arrangements are not well documented for any of the water engines operating at the site.

The intake structure -- largely removed by 2010 reconstruction – was built at the corner of the original spillway and the north training wall, and had the same upper elevation as the latter structure. The downstream face of the intake structure appears to be a raised section of the original spillway; other masonry exposed during documentation was uncoursed mortared ashlar, with particularly large blocks defining the façade with the intake pipes and the associated slots for the slide gates, as described below. Capstones similar to those seen on the spillway covered parts of the intake structure, and may once have extended over the entire surface away from the gate slots.

The 3-foot-diameter intake pipes extended approximately 11 feet from points beyond the downstream intake structure façade to face plates or cast flanges attached to the lower halves of 4-foot-wide, 7-foot-high cast-iron gate frames mounted in a wall of large stone blocks. Upstream of the gate frame façade, stone blocks were used to create a complex, generally 4-foot-wide upstream end to the intake structure which included two approximately 16-inch-wide, 4-to-5-foot-long gate slots, an arched or flat-topped opening in front of each intake pipe, and 2-foot-wide masonry sills or low walls flanking the lower gateframe beginning 10 feet below the top of the intake structure. These walls, of unknown height, also flanked a 4-foot-long, approximately 1.2-foot-thick stone floor in front of the lower intake. The southernmost sill extended 9.4 feet beyond the intake structure, creating a training wall to guide water into the pipes. There was a surviving trash rack at the entrance to the upper intake in 2010, and presumably once a similar set of hardware at the lower intake. The only evidence of the gate operators, long since removed, were pairs of 1-inch-diameter partially threaded bolts set on either side of each gate slot. The bolts extended approximately 4 feet below the intake structure upper surface, and were secured at bottom by 1-inch-thick, 1-by-2-foot iron plates.

It is likely that no further changes were made to the dam and wheel pit configuration during furnace operations after 1886. In 1986, a whirlpool reportedly developed at the intake to the low-level outlet in the spillway, sending considerable quantities of the sediment impounded behind the dam downstream. The Connecticut Department of Environmental Protection made emergency repairs including sealing the intake to the low-level outlet, installing a non-operating wooden gate at the inlet to the pipe which once fed the sawmill turbine, and disconnecting the penstock to the former blowing engine turbine to provide an ungated low-level outlet. In 2010, the Friends of Beckley Furnace removed the blowing engine turbine from the wheelpit.

Waterpower System Operation and Pond Siltation Issues

There is insufficient information to reconstruct the Beckley Furnace waterpower operations prior to installation of the two turbines. Even the path of tailwater for the two waterwheels remains undetermined. There are two parallel masonry walls downstream of the wheelpit, but they are not continuous or aligned with a single wall adjacent to the downstream side of the wheelpit, and it is not clear if they defined a complete tailrace. The location of the two parallel walls appears to correspond to the location of the sawmill superstructure, and an early 20th-century sketch of the sawmill suggests these walls supported the building on posts. A small, now-buried trench could have taken tailwater from the sawmill to the river. At the wheelpit serving the blowing engine, it is possible that tailwater from the water wheel and the turbine passed through the arch in the downstream and dropped directly into the river over a steep, rocky bank.

There is more information available for the waterpower operations during the period when the turbines were in use. When the furnace was in full production making iron at the rate of 16 tons per day it required an air supply of 1090 ft3/ minute. The power required to pump this air flow is estimated to be between 6 and 9 horsepower (hp). The turbine driving the blowing engine has been identified as a Holyoke Hercules with a 27-inch wheel diameter, operated with an estimated 12-foot head. To develop 9 hp at a 12-foot head and efficiency of 60% the required water flow would be 11 cubic feet/second (cfs); at 70% turbine efficiency the flow would be 9.4 cfs.

The early 20th-century sketch of the sawmill shows that the mill was equipped with a circular saw, and lists a planer, joiner, and grinder possibly used as a de-barking machine. An estimate of the power required to operate this set of mill machinery suggests the sawmill turbine needed a capacity of about 20 hp for simultaneous operation of all the mill equipment. The sawmill turbine removed in 2005 was identified as a 40-inch Leffel vertical-shaft turbine, a type with efficiencies ranging from 78% to 84% depending on the operating speed and gate The measured elevation of the turbine base shows that it would have operated at about a 15-foot head at ordinary river level. With this head, a water flow of 15 cfs would have been needed to generate 20 hp.

The flow of the Blackberry River would have to be about 25 cfs to supply the water needed to operate both the furnace blowing engine and all the machinery in the sawmill. The drainage basin area above the Beckley Furnace dam is 41 square miles. The flow-duration curve for the Blackberry River at Canaan corrected for a basin area of 41 square miles gives the following average availability of water:

% of time each year	10	20	30	40	50	60	70	80	90	95
cfs	145	100	71	57	43	30	19	11	5.6	3.7

These data indicate that adequate water flow to power the furnace and all the sawmill machinery in run-of-the-river operation would have been available for about 65% of the year under average flow conditions. Blowing the furnace alone with water power was possible about 80% of the year on average. Since the furnace ran continuously, drawdown of the water stored in the pond behind the dam would have been of little value as supplementary water in periods of low flow, because there would be no opportunity for refill of the pond until river flow exceeded that required for the furnace. Thus, the water power was at best marginal for operation of the furnace. Pond limitations discussed below exacerbated this situation. Auxiliary steam power, introduced in 1880, was needed to assure continuous furnace operation at the rated iron production rate.

View West of Partially-Excavated Intake Structure Gate Frame Façade, After Removal of East Façade, with North Training Wall at Right, Lower Intake at Left with Immovable 1986 Gate That Served Sawmill Turbine

The additional flow of water required for the sawmill turbine would have been available only about half of the year, unless the furnace was out of blast. This timeframe matches limited available census documentation for the period just prior to installation of the turbine. Since the sawmill, unlike the furnace, did not need to be run continuously, some additional water flow could have been obtained by drawing down the pond behind the dam. Based on an estimate of pond capacity, use of stored water could have added about six hours of sawmill operating time in any given day, or more if not all the sawmill machinery were running. This additional water was not available once the pond was filled with sediment. It is likely that the sawmill was operated when water surplus to that needed for the blast engine was available, probably on a seasonal basis. After auxiliary steam-powered blowing was installed, sawmill operation could have been extended.

Pond size and siltation limited waterpower operations at Beckley Furnace from an early date in site history. At present the pond behind the dam is filled with sediment to a level a few inches below the dam spillway crest. The area of the Blackberry River drainage basin above the dam is 41 mi.2 which at the average denudation rate of upland New England land surface yields sufficient sediment to fill the pond in about 15 years if no sediment were intercepted by upstream dams and the trapping efficiency of the pond were 100%. Agricultural use or other land clearing in the drainage basin could have reduced the fill time. Once the pond was filled removal of the accumulated sediment would have been difficult. Thus, it is likely that that the pond was filled with sediment through most of its service life, so that both the furnace and sawmill had to operate in run-of-the-river mode.

The water flow in the river was only marginally adequate to sustain operation of the blast furnace after it was enlarged in 1880. The sawmill machinery could have fully utilized the power capacity of the sawmill turbine, but the requirements of the furnace could have been better served with a turbine of smaller capacity, which would have operated at higher efficiency. Barnum Richardson does not appear to have had much if any professional engineering advice on its operations until the early 20th century.

The Beckley Furnace Dam, pond, and associated water-power system is an example of the limits of vernacular engineering practice at complex industrial installations requiring a constant supply of power. Dam design proved significant for interpreting the waterpower limitations which affected Beckley Furnace operations. The dam as documented before recent repairs was also an excellent example of well-financed vernacular civil engineering shortly before the advent of detailed calculations used for design of gravity dams.

Selected Bibliography

Anonymous
1885 Narrative of the Sixth Annual Meeting. *Journal of the United States Association of Charcoal Ironworkers 6: 41-48.*

Gordon, Robert, and Michael Raber
2000 *Industrial Heritage in Northwest Connecticut.* New Haven: Connecticut Academy of Arts and Sciences.

Neilson, William G.
1866 *The Charcoal Blast Furnaces, Rolling Mills, Forges and Steel Works of New England in 1866.* American Iron and Steel Association.

Paddock, Richard
2005 Friends of the Beckley Furnace Inc., 2005 Activity Summary. Mss., Friends of Beckley Furnace, Inc.

2011Project Report, Hercules Turbine. Mss, Friends of Beckley Furnace, Inc.

Raber, Michael S., and Robert B. Gordon
2012 Documentation of the Industrial Monument/Beckley Furnace Dam, North Canaan, Connecticut. Prepared for Wengell, McDonnell & Costello, Inc., Newington, CT.

U.S. Department of Commerce, Bureau of the Census
1820 S. F. & S. Adam's Factory of Nail Rod, Barr Iron, Return No. 7, Canaan – Connect. Nov. 1820. Manuscript returns, Census of Manufactures,

1850 Manuscript returns, Census of Manufactures.

1860 Manuscript returns, Census of Manufactures.

1870 Manuscript returns, Census of Manufactures.

Wallace, William
2007 Notebooks of William Wallace, Richard. Paddock, ed., Friends of Beckley Furnace, Inc. (William Wallace was superintendent of Barnum & Richardson's East Canaan operations from 1911 to 1918.)

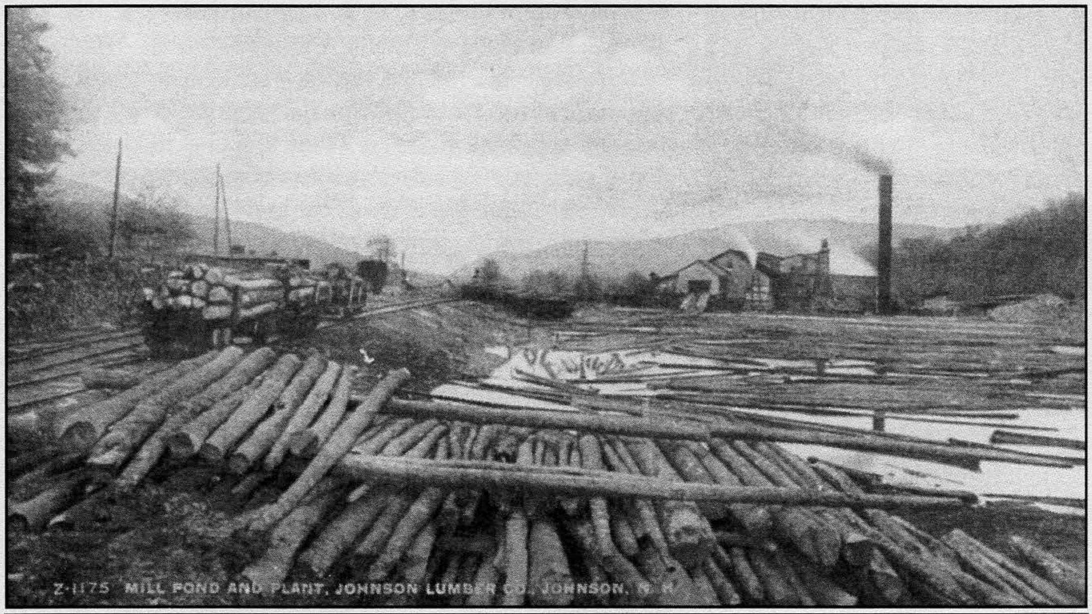
Michael S. Raber, Raber Associates
Robert B. Gordon, Yale University

The Abandoned Towns of Johnson and "Little Canada"

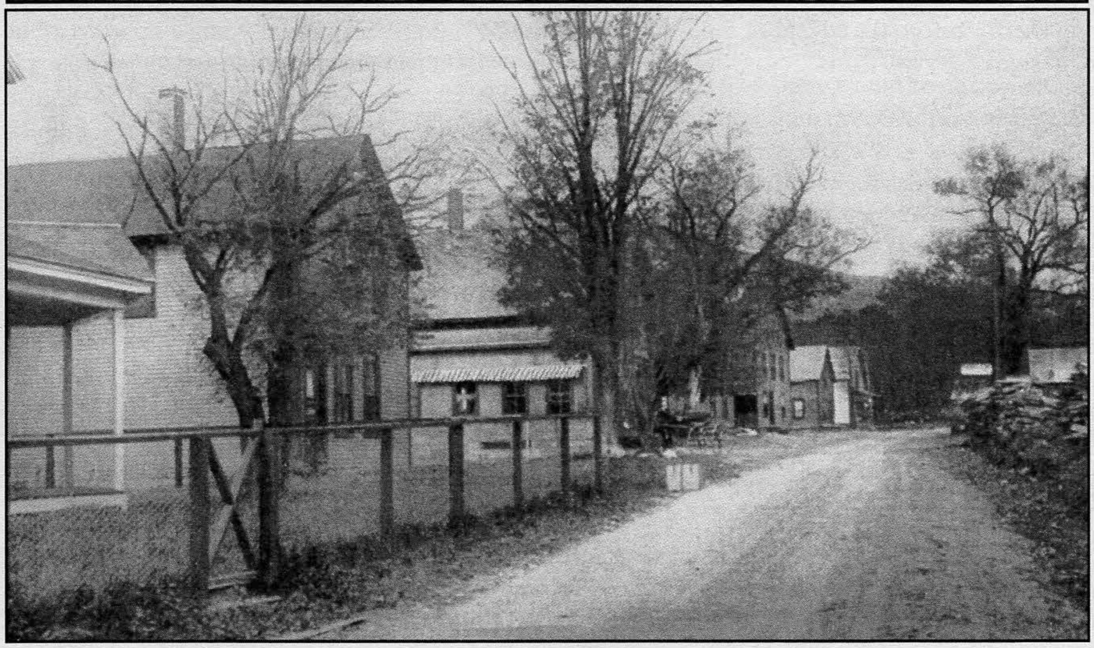
Although little remains of the town of Johnson today, not all traces are gone. In fact, some of the largest industrial remains in the White Mountain region relate to Johnson. These particular structures were part of the Matson Flooring Company enterprise (see below). The few surviving remnants of Johnson provide clues to the location of the dam and mill pond, powerhouse, and perhaps the mill itself. Construction of Rt. 93 and relocation of Rt. 3, unfortunately, destroyed much of what was there. There are steam engine bases behind a motel on Rt. 3 and additional artifacts are between Rt. 93 and Rt. 3.

The company-owned sawmill "town" of Johnson, NH, lasted only a few years. Although it had its own post office, Johnson was actually part of Lincoln and was just a short distance north of the J.E. Henry mill complex in Lincoln. George Johnson, an experienced lumberman from Monroe, NH, first appears on the Lincoln tax rolls in 1899, at which time he did not have a sawmill, being taxed only for logs, sawed lumber and store goods. The next year, he and his partner, Harry Stebbins, were taxed for a sawmill worth $8,000. In a few years, there would be several buildings in their town. In 1905, Johnson and Stebbins contracted to cut several thousand acres of prime timberland owned by the Publishers Paper Company of Maine. For $800 year, Johnson entered into a five year lease with the Boston and Maine Railroad, for an existing 2 1/2 mile spur line running north from N. Woodstock. Johnson also leased a 28-ton Shay locomotive from the Lima Locomotive Works. This rail spur would move finished lumber from Johnson's mill to the B&M line in N. Woodstock. It appears that Johnson arranged with the J.E. Henry Company in Lincoln to assist with the operation of this rail line. Johnson built a large sawmill and numerous other buildings. He successfully petitioned the Postal Service for a post office for his "town." The first postmaster, appropriately, was George Johnson. The post office operated from 1899 to 1915.

In 1906, Johnson entered into another contract with Publishers Paper Co. to cut additional timber, and this contract included the lease of a sawmill and other buildings owned by Publishers Paper Co. near the Lost River Gorge and Caves, in Woodstock. A small village existed around this mill, with a store, boarding house, and homes. (A concrete dam across from the Lost River campground indicates the location of this mill.) As Johnson's operations grew, he decided that he



Johnson Lumber Company mill pond and plant as shown by a historic post card.



Main Street of Johnson, New Hampshire, looking north, as shown by a historic post card.

needed his own logging railroad. In 1907, he incorporated the Gordon Pond Railroad, which was to be a 6 ½-mile logging railroad that would be used to move timber from the woods to his two mills. In 1908, his Gordon Pond Railroad was in operation. The Johnson Lumber Co. was logging a large area extending from Mt. Lafayette almost out to Lost River Gorge. (Actually, he owned the Lost River Gorge and later sold it to the Society for the Preservation of NH Forests. Several anecdotes indicate that he regretted this decision when he saw so many people paying to enter the Gorge.)

The 1910 tax invoice for Lincoln (since Johnson was actually part of Lincoln) provides details and values for the Johnson enterprises: A mill and machinery was valued at $6,000, a small mill at $300, the railroad engines and cars at $6,000, twenty buildings at $5,100, merchandise in the company store at $3,000 and 1,000,000 board feet of uncut logs worth $6,000 together with 800,000 board feet of sawn lumber worth $8,000. In 1912, the tax invoice tells us that there were 30 buildings valued $8,125 in addition to the mill. The 1911 Sanborn Fire Insurance Company map of Lincoln includes a page for Johnson and it provides a few more details. It shows a large sawmill, powerhouse with three boilers, an engine house, a blacksmith shop, a school, a store and post office, a boarding house, harness shop, grain storage buildings, a large horse and cattle barn and several tenements for workers and their families. This map is on-line at http://whitemountainhistory.org/uploads/Johnson_sanborn_1911.jpg The map also includes the Matson Flooring Co. mill and the Pennsylvania Hub Co.

The 1910 Lincoln tax invoice also gives us some indication of the number of employees in the town. Seventy-eight men were listed by name and 28 "Polanders" were listed by number. This method of identifying foreign-born employees was not uncommon. Town clerks could not spell the names and probably could not pronounce them. Sometimes they're identified as "Polanders," sometimes as "Poles" and sometimes as "Russians."

During parts of 1906 The Plymouth Record had a correspondent in Johnson. We see that, although a company-owned logging town, the residents lived the same life as folks in more traditional towns. For example, the Jan. 27 issue notes that "wedding bells are soon to ring again" and that James McGraw had a telephone installed. The Feb. 24 issue tells us "Several boys and girls are attending school this winter in Lincoln because there is no school in Johnson in the winter." On Dec. 8, we learn that "Mrs. Gigner has moved here for the winter" and that Edward Pichette, the "young son of Joseph Pichette is quite sick."

By 1916, the town of Johnson was deserted. The large mill had burned in 1915, and since most of the available lumber on the leased lands had been cut, the mill was not rebuilt. The Johnson lands became the second parcel acquired for the newly formed White Mountain National Forest. The name Johnson survived on maps of the area for quite some time. The 1925 AMC map still shows the town. Some of the buildings, including the schoolhouse, were moved to Lincoln, and some to North Woodstock. The schoolhouse was moved a short distance down Rt.3 and today is part of a private home. Much of the old Gordon Pond Railroad bed remains and, in fact, some of it is still an active railroad. The White Mountain Central Railroad, part of Clarks Trading Post, is built on portions of George Johnson's railroad.

"Little Canada"

There is one more piece to the story of the town of Johnson and the Gordon Pond Railroad. In 1909, and again in 1910, George Johnson sold the hardwood trees on his land to Edward Matson, of Pennsylvania. Matson was in the hardwood flooring business and he built a large mill and kiln on land not far from Johnson, along the line of the Gordon Pond Railroad. Matson built homes for his workers, a boarding house, and a wagon hub factory on this land. Matson called the settlement "Little Canada" and it was so identified in Lincoln records. (Many towns had sections known locally as "Little Canada" but Matson appears to be the only company that used the term in its official documents.) Matson's buildings were valued at $3,100 in 1911 and in 1912 the settlement had 32 residents. Much more of this enterprise remains visible in the woods today than does any of Johnson itself. There are large, impressive, concrete stanchions, stone foundations, debris from the powerhouse and the likely location of the boarding house has recently been uncovered. On the hill, just west of the remains of the kiln, are a few reminders of the other enterprise on the site, the Northern Pennsylvania Hub Company. The exact relationship of Matson and the Northern Pennsylvania Hub Company, although it had to be a close one, is not yet known. The 1911 Sanborn map, mentioned above, shows that the Hub Company drew its power from the powerhouse of the Matson mill and kiln. In 1912, the value of the Hub Co. was listed as $1,500 with "stock in trade" worth $250.00. Presumably, the Hub Co. workers shared the facilities of "Little Canada". Johnson's Gordon Pond Railroad ran alongside of the Matson buildings, brought in the raw materials, and hauled out the finished product. The Matson enterprises lasted only a few short years. Some say that George Johnson took advantage of Matson's lack of knowledge, and that Matson was doomed to fail. Be that as it may, Matson's enterprises were ended by 1916. A short walk down the railroad bed from Bog Brook Road in Lincoln will bring a visitor to the site of the Matson kiln and the impressive remains of the kilns and mill.

These massive poured concrete stanchions forming a corner are part of the impressive remains of Edward Matson's large flooring mill in "Little Canada."

A view of the remains of the Matson Mill's wood flooring kiln.

Rick Russack
WhiteMountainHistory.org

Naugatuck's Parcel "C"

A Vital 19th Century Industrial Development Site

Summary

This report focuses on the industrial archeology of a major portion of the former U.S. Rubber Company (Uniroyal) rubber factory complex in Naugatuck, Connecticut. It includes the history of one of the company's major factory locations, a 2.2 acre site known as Parcel "C" that is located at the northwest corner of Maple Avenue and Water Street. As early as 1825, small factories located on this site. However, traces of the remains of infrastructure, canals, water supply routes, a well and 19th century drainage systems were located. A scrap rubber deposit used as fill was also found. The site was contaminated with residual chemicals from almost two hundred years of manufacturing activity, primarily materials used in fabricating rubber products. Manufacturing on Parcel "C" ceased in 1979 and machinery was scrapped or sold. Although the soil was very heavily disturbed during demolition of the Uniroyal factory in 1984-1985, this project encompassed concurrent on-site examination during extensive excavation and chemical treatment of contaminated soil.

The plan for decontamination of the site required excavating up to twenty feet of sub-surface soil and rubble. Then this material was chemically treated on site to passivate chemical contaminants. This documentation was initiated to locate industrial artifacts and confirm the location of the water supply canals and infrastructure that originally supplied a heavily disturbed site.

Historical and Contemporary Description: In the sixty-five mile length of the Naugatuck River it was naturally attractive for supplying water for power and manufacturing processes. Local entrepreneurs intensively developed the water resources of the Naugatuck flowing through what was known as South Waterbury, from 1825 to 1865. They installed penstocks, raceways and storage ponds to create an extensive water distribution system for power, manufacturing processes and steam generation. The earliest dam supplying the Parcel "C" site in Naugatuck was built in 1824, when Silas Grilley and Chauncey Lewis acquired a water privilege and built the first local dam across the Naugatuck River. This was called the Button Factory Dam and was located about 240 feet (73.2 meters) north of the present Maple Avenue Bridge. This structure was probably a simple weir or dam that partially obstructed the flow of the Naugatuck and diverted water through a canal to the Button Mill pond bordering the west side of Water Street. The water drained out of the pond into an "old tail race crossing Maple Street and into an old tail race or pipe tunnel crossing Water Street (and into) to the Naugatuck River."

The Button Mill dam and pond was inadequate to supply the growing industrial site adjacent to Maple Street. The water supply system was improved by creating an impoundment at Union City Dam located 1640 feet (500 meters) north of the Parcel "C" site. The canal raceways on Parcel "C" were delineated on Sanborn Maps produced in the late 19th century.

Industrialization in Historic Context

Early manufacturing activity in South Waterbury, which became Naugatuck in 1824, centered on Fulling Mill Brook. By 1825 six shops produced buttons and other products. A historically significant factory was started in 1824, when Silas Grilley and Chauncey Lewis built a stone building on Parcel "C" close to the intersection of present-day Maple and Water Streets. They manufactured gilt buttons. But the business failed and the property changed hands frequently with various manufacturers utilizing the building and available water power.

Historically, products produced in Naugatuck industries included rubber, synthetic rubber, plastics, chemical products, iron castings, candy, cutlery, clocks, metal stampings, buttons, cosmetic cases, household hardware and fabricated glass components. Large quantities of waste dyestuffs, chemicals and heavy metals from brass and rubber production were

Figure 1. *Location Map – Parcel C South Site – Naugatuck, Connecticut Quadrangle: Naugatuck, Connecticut*

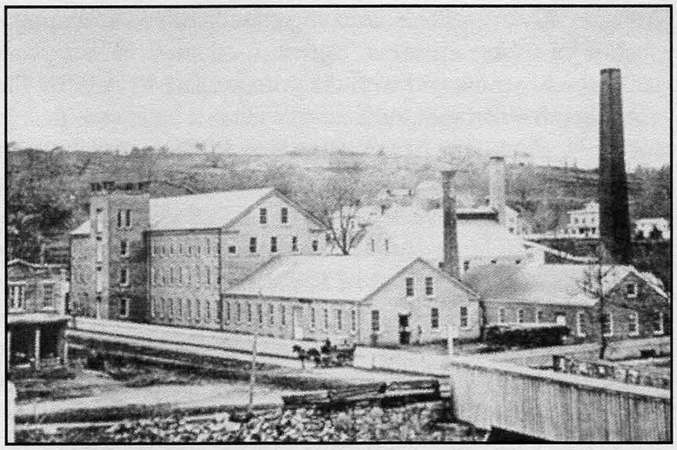


Figure 2. *View northwest of the Star Rubber Company in 1870. The building at far right center is the original "Button Shop" built by Grilley and Lewis in 1824. Maple Avenue is the street running in front of the building with the tower, and the gable end of the "Button Shop" fronts on Water Street. (Source: Naugatuck Historical Society)*

discharged into the river.

Eli Terry, the "father" of the American clock manufacturing industry, produced limited numbers of hand-crafted brass and wooden clocks in Plymouth, Connecticut, c. 1793. Heman Clark, an apprentice to clockmaker Eli Terry, produced wooden and brass shelf clocks under Terry's supervision until 1817. Clark had his own shop in Naugatuck on the parcel "C" site and was producing durable brass and steel "eight-day clock movements" by 1831. "Yankee notions" sold by peddlers included pocket knives made by Lyman Bradley & Company at the old button shop building in 1841.

Rubber (also known as India rubber, Caoutchone) was a popular, but imperfect, waterproofing material used in the early 19th century. In cold weather it cracked and in warm weather it melted. In 1843, Charles Goodyear discovered that by compounding rubber with sulfur and heating it to 150o F, it would retain its elasticity and neither melt or crack in ambient temperatures. This process, called vulcanization, made rubber less sensitive to temperature extremes. It opened the door for an enormous market for rubber goods. The first commercial product was trade-named "Vulcanite." The product was not pliable. Later chemical additions increased flexibility.

Goodyear's patented process as used by the India Rubber Glove Company lasted without major modification for about forty years. Raw rubber was obtained by dipping bottle shaped ceramic forms in the rubber tree sap (latex) until a thick coating formed. This coating was solidified at the plantation over smoky fires and the form broken and removed, leaving a hollow rubber "bottle" or "biscuit." The rubber "bottles" were shipped to the factory, soaked in hot water, then crushed and rinsed to remove impurities. The rubber was then rolled into large, thin sheets which were hung in free flowing air to cure for several months.

These sheets were then pressed, pulled, stretched and mixed with chemicals on heated rollers until the required degree of elasticity is obtained. After molding or sheet forming the vulcanization proceeded in steam ovens under careful 6
monitoring. For some products, a fabric layer was applied with calendar rollers.

In 1844 the Naugatuck India Rubber Company was formed by Milo and Samuel Lewis, Mr. 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. The canal was completed in 1845, providing additional hydropower to the manufacturers south of Maple Avenue.

One of the four original rubber companies in Naugatuck was Goodyear's India Rubber Glove Company. It manufactured rubber gloves for telegraph linemen. In 1853, the Naugatuck India Rubber Company sold the entire property to Union India Rubber Company, a New York City corporation with licenses to produce druggists' sundries as well as rubber goods for the Army and Navy.

Goodyear India Rubber Glove Manufacturing Company

On April 8, 1881 the Goodyear India Rubber Glove Manufacturing Company acquired the assets of a predecessor, which included one half the dam and one half of the canal and partial water rights and power transmission equipment. The company no longer specialized in rubber gloves for linemen, but had diversified to include shoes, boots, coats and wraps.

Artifacts on the Parcel "C" Site

The 1887 Sanborn map clearly shows rooms dedicated for these processes: storage, mixing, calendar, rinsing, and sole cutting (see Figure 3). The Button Shop mill pond was filled in by this time. The use of process water was still required for rubber production and the canal system was modified to meet the need. The original 1825 headrace leading from the Naugatuck River to the Button Shop mill pond was filled in, but the tail race remained, submerged below the "Cutting Room" and Maple Avenue. The 1845 canal continued to supply water to the system from the Union City Dam, but ended at the Goodyear India Rubber Glove Company, where it was diverted into the 1825 canal system (see Figure 3).

Figure 4 shows the developed site in 1906 with most available space occupied by mill buildings. Recent excavations conducted to remove chemical wastes from the soil on Parcel "C," revealed that this diversion ran over the site of the Button Shop mill pond via a masonry aqueduct (Figure 5). Traces of this system can still be observed as the final fill material for the submerged canal under Maple Street. This fill is medium grey-colored sand unlike the surrounding soil (Figure 6). During 1885 the Button Shop mill pond was filled in. The old Button Shop was torn down between 1887 and 1910 and the site was then used for a steam-power plant.

U.S. Rubber Company

The United States Rubber Company was founded in 1892 by Charles R. Flint, a self-described "international merchant, financier and negotiator" dealing in rubber produced in the

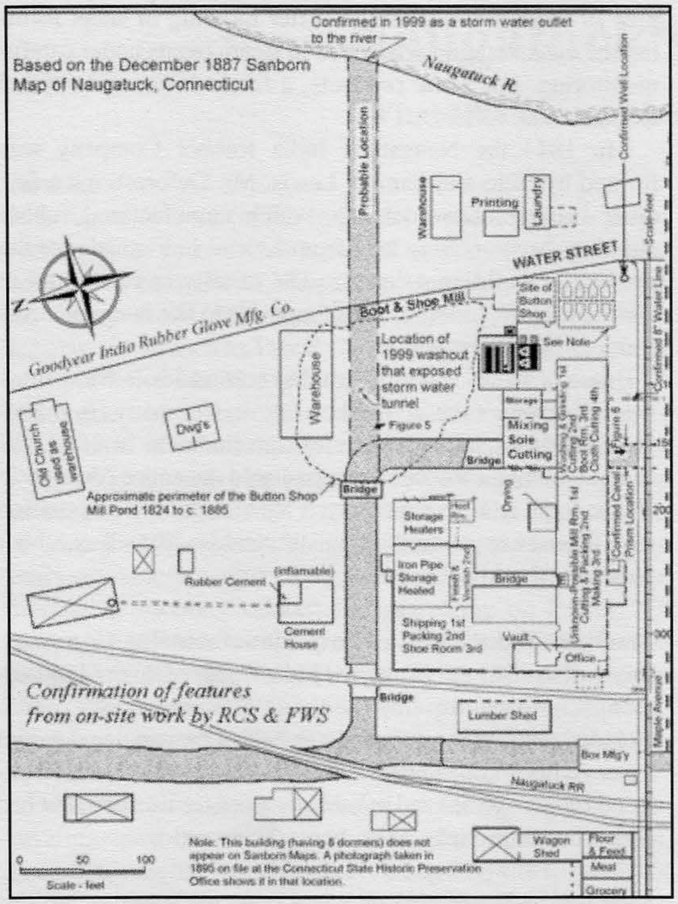


Figure 3. *Plan of the Goodyear India Rubber Glove Manufacturing Company showing water supply canals as they existed in 1887. Additions to the map show the location of artifacts including the main well that replaced much of the canal systems supply. Other confirmations included an 8" water supply line, a storm water duct that had been laid over the filled Button Shop pond and the prism of the canal that exited the site under Maple Avenue 150' west of the intersection of Water Street and Maple Avenue. (Source: 1887 Sanborn Map with additions and measurements by R. C. Stewart & Fern Wildman-Schrier)*

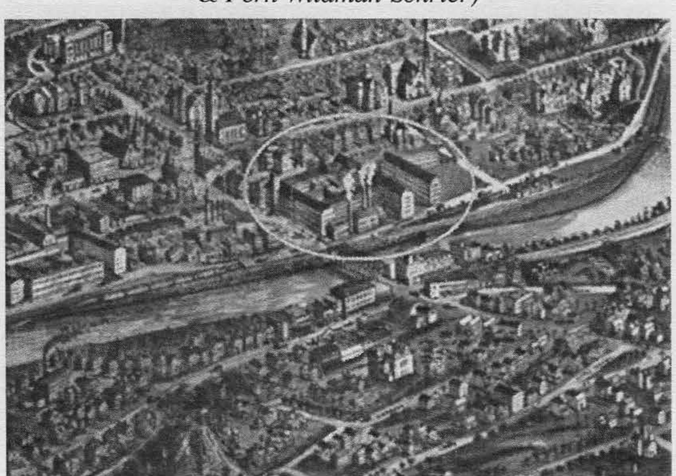


Figure 4. *Hughes and Bailey "Birds-eye" view northwest of the Parcel "C" industrial site in 1906. (Source: Naugatuck Historical Society)*

Amazon River basin. Nine companies involved in the production of rubber footwear, (the most common rubber product at the time) merged with the primary goal to stabilize the volatile price of crude rubber, providing a balanced income for the stockholders. At this time, U.S. Rubber was a holding company and each company retained its name, property and corporate structure.

Goodyear India Rubber Glove Manufacturing Company entered the consortium in 1893. All Naugatuck's rubber shops were now part of U.S. Rubber. Each superintendent ran his own shop, competing with other U.S. Rubber companies in Naugatuck. Significantly, rubber shops had local loyalty first, and U.S. Rubber loyalty second.

That rivalry was diminished after Colonel Samuel Colt (nephew of Samuel Colt, founder of Colt Manufacturing in Hartford) became president of U.S. Rubber. Colt consolidated

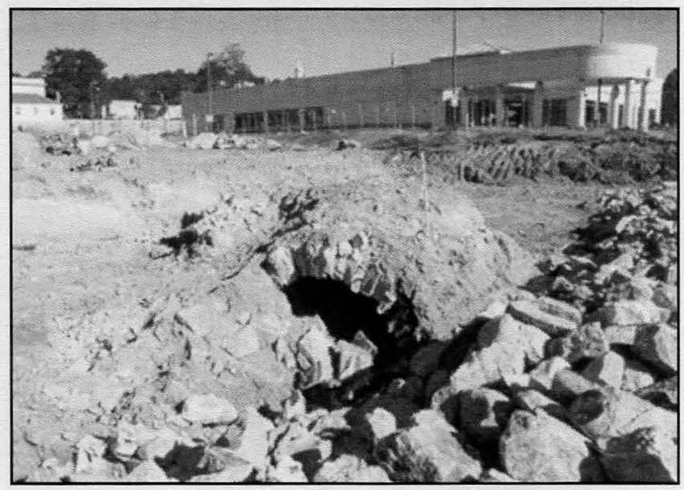


Figure 5. *View North with the new Post Office in the background. Note arched storm water aqueduct (center of photo) that was laid over the fill placed in the Button Shop Pond. (Source: Photo by R.C. Stewart & Fern Wildman-Schrier – October 2010)*

Figure 6. *View South of prism of canal that exits site 150 feet west of the intersection of Water Street and Maple Avenue. The canal was partially filled with a dark gray sand which is unlike any other spoil on the site. (Source: Photo by R.C. Stewart & Fern Wildman-Schrier – October 2010)*

factories and diversified production, adding tires for bicycles, and the new "horseless-carriage" to the inventory.

This period saw tremendous growth and expansion of the Goodyear India Rubber Glove Company with manufacturing of boots and footwear in the Parcel "C" plant. The 1910 Sanborn Insurance map shows the company built several large production buildings to the north of the old plant, completely covering the filled-in Button Shop Mill Pond and the submerged 1825 canal system and feeder line from the 1845 canal. 1917 was a pivotal year for the Goodyear India Rubber Glove Manufacturing Company on Parcel "C" as well as the Goodyear Metallic Rubber Shoe Company when Colt combined them into the Footwear Division of the United States Rubber Company.

Traditionally, each article of rubber footwear was individually assembled by a skilled "maker" from cut parts delivered from other departments in the factory. Each maker stamped his "maker number" on the finished article and was paid piecework rates. (See Figure 7.)

The period after World War I focused on improving productivity and reducing costs. "Making teams" of two, four or six people were substituted for the solitary "maker" with each team member responsible for only one operation. Piece-work pay was based on the team's output, not the individuals. But even with the cost-cutting measures, the Footwear Division and U.S. Rubber operated inefficiently and lost money. Francis Davis was elected president of the U.S. Rubber Company with practical experience and years of management philosophy training at the DuPont Company. The first decision was to consolidate all seven of the company's footwear manufacturing plants in Naugatuck and close the other factories to save money. Many employees from the closed plants were transferred, increasing the employment in the shoe shops from less than 2,000 in 1928 to almost 6,500 in 1937.

To produce the high volume and large variety of goods, new manufacturing methods had to be implemented to ensure an economic operation. The "making teams" were no longer sufficient. Making teams were replaced by "Making lines." Moving conveyor belts, carrying shoes from station to station connected different production processes and departments. This manufacturing model continued until the plant closed in 1979.

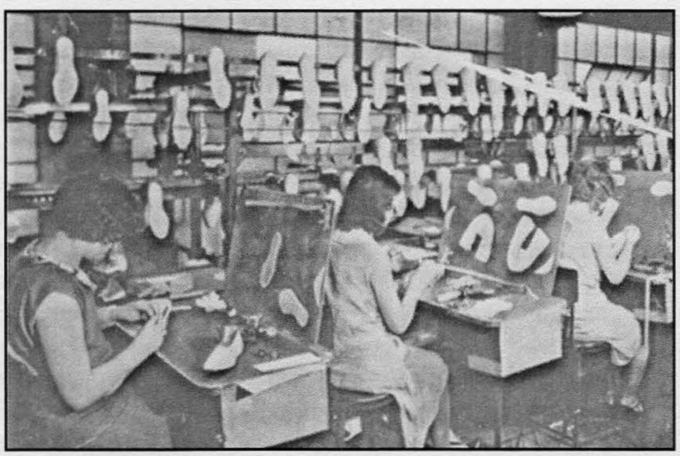


Figure 7. *"Makers" on the production line, c. 1930. The workers were paid piecework rates but at this time were organized into teams. Wages depended on team output. (Source: Naugatuck Historical Society)*

The consolidation proved successful with a 400% greater utilization of floor space (without any new building construction), reduced production losses and scrap, lower labor costs, reduction in training costs, lower overhead costs, and improved, faster customer service.

Keds Production

From 1892 to 1913, the rubber footwear divisions of U.S. Rubber were manufacturing their products under 30 different brand names, including the Wales-Goodyear Shoe Co. The company consolidated these brands under one name, Keds, in 1916. The word "sneakers" was first used by Keds. The term was coined by Henry Nelson McKinney, an agent for N.W. Ayer & Son for advertising, because the soles of the shoes did not make any sounds on different surfaces, thus the name sneakers.

The 1928 consolidation brought Ked's manufacturing to Naugatuck. The former Goodyear India Rubber Manufacturing complex in Parcel "C" was devoted to the assembly of Keds. The plant was retooled with modern conveyer belts and efficient production methods to make high-quality merchandise. They were the flagship product for U.S. Rubber.

World War II

The Naugatuck Footwear Plant retooled for military products during WWII, including barrage balloons and fuel tanks for aircraft. Natural rubber was in short supply.

U.S. Rubber developed dodecylmercaptan, which could make rubber of any desired viscosity, from liquid to hard solid. This chemical was coded "OEI", which stood for the "One Essential Ingredient." The company operated a government plant that supplied this synthetic rubber modifier during the war. U.S. Rubber also pioneered in synthetic rubber production, designing and building one of the first three plants (one in Naugatuck) that helped meet the military requirements. The wartime research on synthetic rubber led to a new line of postwar products. One of these was "Naugahyde," a woven fabric originally coated with a rubber compound. Its flammability was reduced for upholstery use by substituting a plastic compound for rubber.

Post-War Period

After World War II, Keds production resumed at Parcel C in Naugatuck, but U.S. Rubber focused its corporate resources on manufacturing tires. The Footwear Division in Naugatuck was not upgraded, nor modernized during the Post-War Period, and declined in importance. U.S. Rubber simply closed plants that were no longer profitable. The Ked's trademark was purchased by Stride-Rite in 1979, and production in Naugatuck terminated. Sneakers are still sold by Stride-Rite,

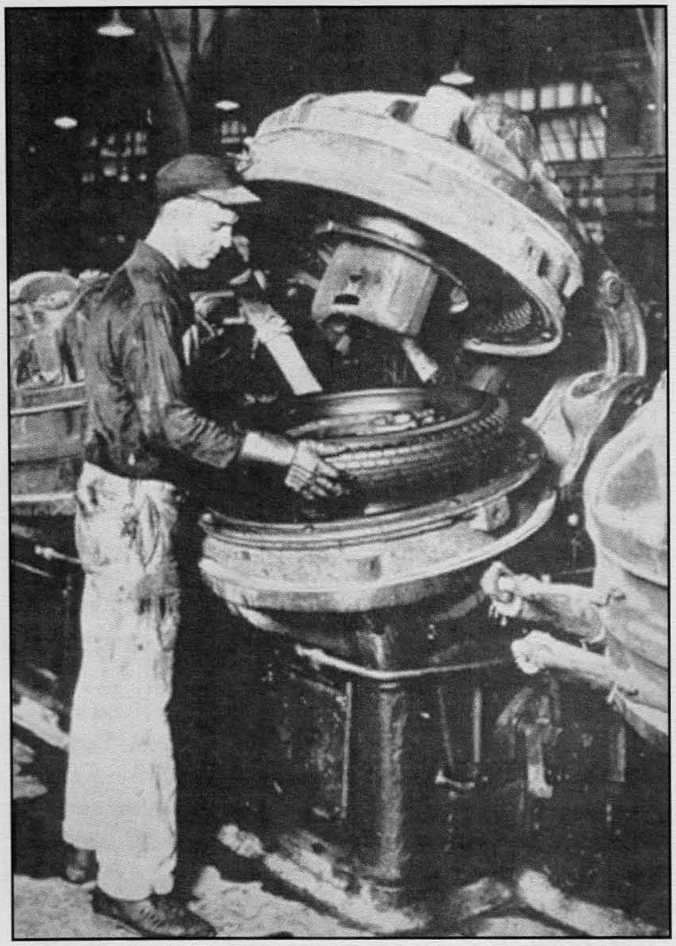


Figure 8. *Tire production replaced Keds sneakers as Uniroyal's major product. (Source: Naugatuck Historical Society)*

but are manufactured in China and Taiwan.

The company adopted the name UniRoyal ("Uni" from United States Rubber and "Royal" from the brand name of their tires) to reflect the broad scope of the company's manufacturing goals (see Figure 8).

The large industrial complex on Parcel "C" remained abandoned and vacant after 1979, a crumbling relic of Naugatuck's industrial past. Uniroyal, Inc. quit-claimed the property to the Borough of Naugatuck on August 19, 1983.

Post-Industrial Period

Naugatuck's revitalization plans for Parcel "C" have not proceeded smoothly. The deteriorating structures were removed in 1985, leaving "Building 25," the old office, as the only structure on the property. The contaminated brownfield site has been difficult to develop. The site contains both buried rubble and high levels of lead and petroleum products in some areas.

The current project, Renaissance Place, is a mixed use development supported by Borough citizens, State and Federal agencies. The contaminated soil was excavated and neutralized on-site. Soil that could not be cleansed to meet guidelines was consolidated and encapsulated on site.

Conclusion

Parcel "C" and the manufacturing developments and advances in rubber chemistry that originated there were vital in the growth of other 19th century American industries. A factory complex expanded from the original "button shop" building and produced buttons, knives, hardware and clocks. Not all businesses were financially successful but the experience of the entrepreneurs added to manufacturing know-how in subsequent years. Later, when rubber goods and chemicals were produced on the site, it became a profit center that provided numerous well-paid jobs for the Naugatuck area. Its decline, due in part to environmental guidelines and social change, paralleled the decay of manufacturing in New England.

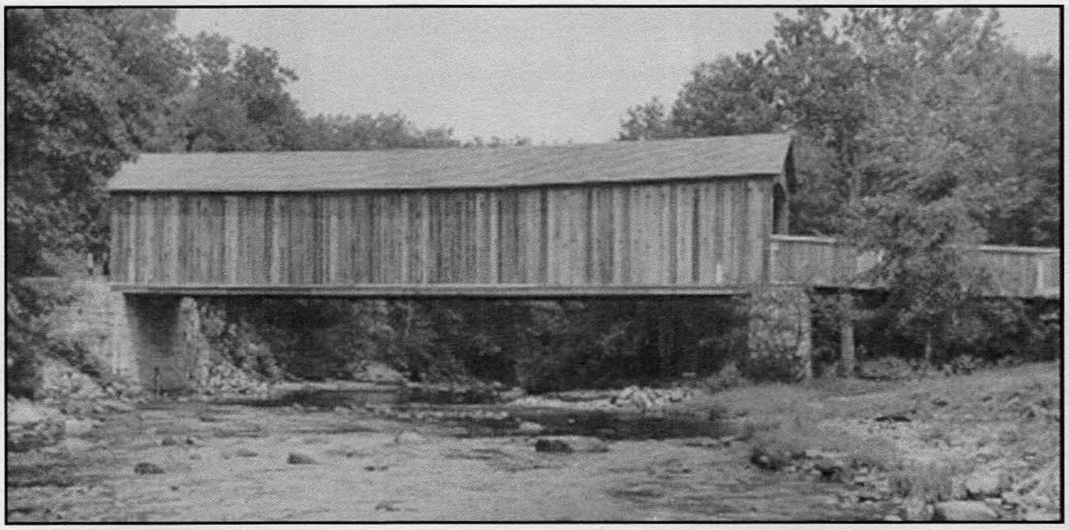
Fern Wildman-Schrier and Robert Stewart
Historical Technologies
1230 Copper Hill Road
West Suffield, CT 16093

Comstock's Bridge:

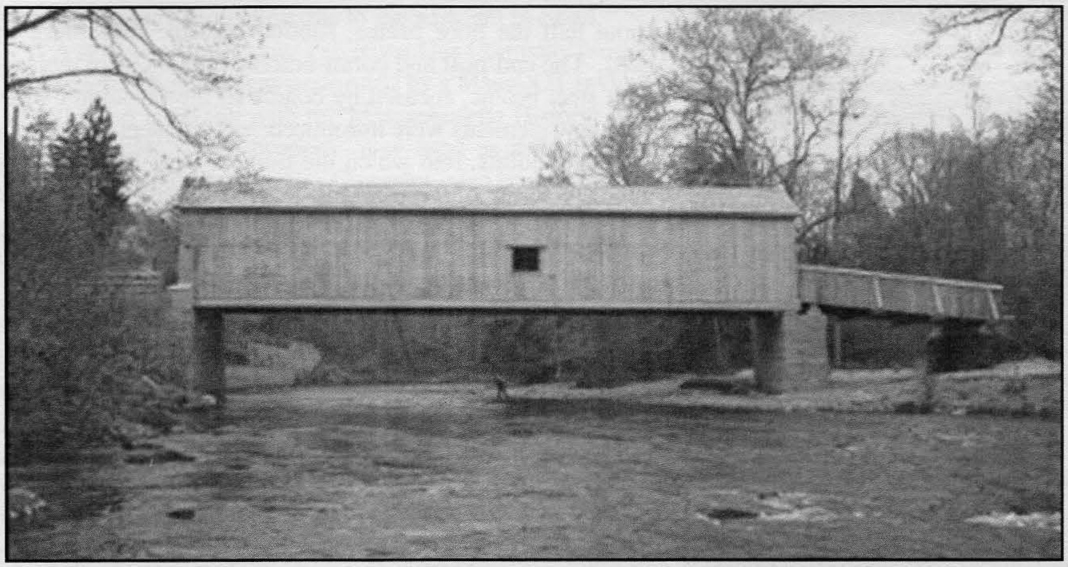
The Challenges Facing Historic Timber Trusses

The Connecticut Department of Transportation recently completed a rehabilitation project for Comstock's Bridge, an 1873 covered Howe truss that spans the Salmon River in East Hampton, Connecticut, near the town line with Colchester. With a main span of 80 feet and a pony truss of 30 feet over a secondary flood channel, Comstock's Bridge is one of three remaining historic covered bridges in the state and was listed on the National Register of Historic Places in 1975. It serves as a pedestrian bridge for fishermen and other visitors to the surrounding Salmon River State Forest, having been bypassed in 1932 by a concrete bridge just downstream.

When the Colchester Town Meeting authorized the bridge on April 7, 1873, the resolution called for an iron bridge, subject to the concurrence of the town of East Hampton, then known as Chatham (the Salmon River at the time was the boundary between the two towns). Apparently, the selectmen considered it within their power to substitute a wooden bridge for one of iron. Wooden Howe trusses (actually a composite, since the tension members were iron rods) had a thirty-year record of successful service with the railroads, if one overlooks their tendency to catch fire from passing trains. In contrast, iron bridges were relatively new to the American scene and may not have been considered entirely trustworthy. Less than three weeks after the two towns voted to rebuild in iron, an iron-truss bridge in Dixon, Illinois collapsed, sending 250 people into the Rock River, 50 of whom drowned. Economics may also have played a role in the selectmen's decision. Because the American iron and steel industry was still in its infancy, iron bridges had a higher initial cost than wooden ones.



1. *Comstock's Bridge, a few years after its repair by the CCC (Lewis Mills photograph, 1941, Connecticut State Library).*



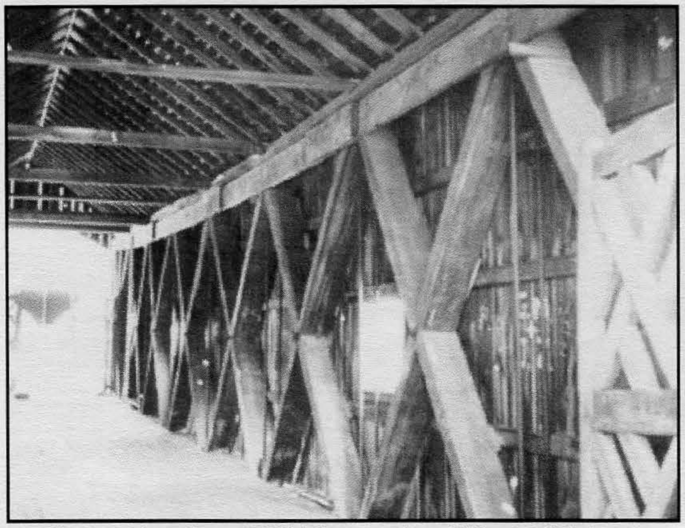
2. *The same view today, following the recent rehabilitation (AHS Photograph, 2012).*

It is not recorded why the earlier bridge on this site needed to be replaced. Exceptionally high rainfall caused a disastrous flood throughout central Connecticut in October 1869, and it may be that the predecessor to this bridge was one of the dozens of bridges heavily damaged or washed away in that event. Whatever the reason, there is a good chance that the pony span, the Queen-post trusses of which were enclosed by board siding rather than covered by a roof, represents a remnant of an earlier bridge. It is apparent from surviving photographs that small pony trusses, both enclosed and open, were once a common feature of the Connecticut countryside. This example, with its hard-pine timbers and machine-made tie rods, appears to date from ca.1840 or later.

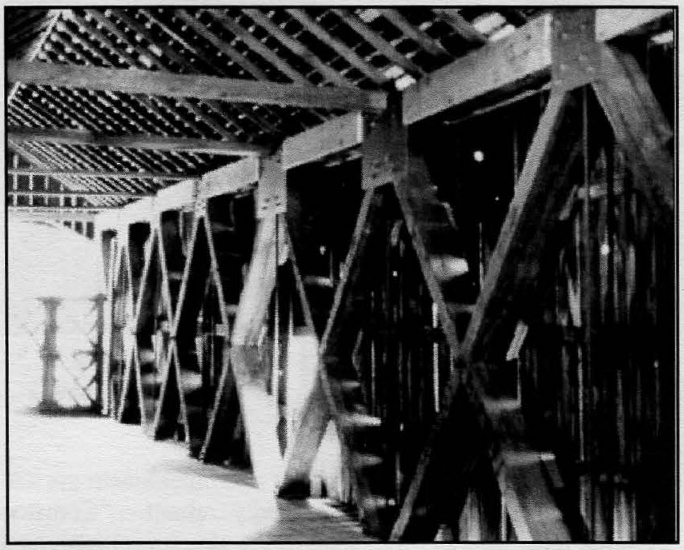
In the 1700s and 1800s, bridges took on the name of some family that lived nearby. People may have initially referred to it as "the bridge near where Comstock lives," and it then got shortened to "Comstock's Bridge" or "Comstock Bridge." Christopher Comstock was a long-time resident on the East Hampton side of the river in the 18th century, dying at his farm in 1808 at the age of 82. He and his younger brother, Abner, at one time owned a sawmill and gristmill located a short distance upstream from the bridge. Bridges kept the same name despite being repeatedly rebuilt. "Comstock Bridge" was not only the name of the structure, it also came to be applied to the small settlement that grew up around the various mills at this point on the river; for a time, the village even had its own post office.

The first recorded major episode of repair to the bridge occurred in the 1930s, when the Civilian Conservation Corps worked on the bridge as part of building the trail system at the Salmon River State Forest. Known as Camp Stuart, the CCC unit had an authorized strength of 200 young men. From the biennial report of the State Parks and Forests Commission, it is apparent that the CCC replaced the roof, siding, and floor, using in whole or in part boards from a nearby old barn, and added gates just inside the portals. It is likely that some structural work was undertaken at this time as well, since Richard Allen, in his Covered Bridges of the Northeast (1957), reported that "a piece of a replaced main stringer is on exhibit in the dark interior, demonstrating how the unknown builder compactly lapped and bolted his timbers;" it appears that by "main stringer" Allen meant a part of the top chord.

The bridge was again rehabilitated in 1974, at which time large steel gusset plates were added to the joints as reinforce-



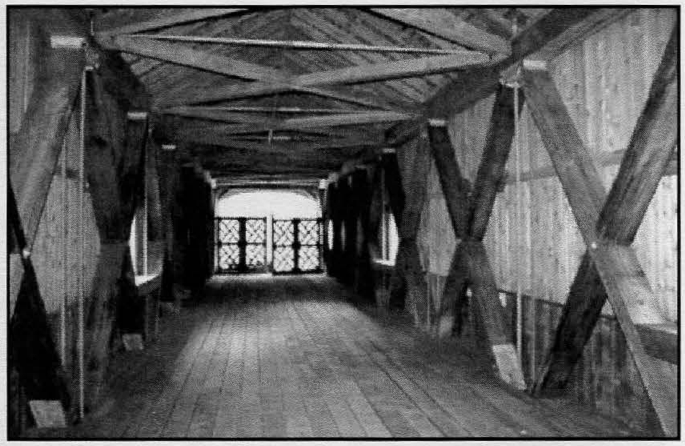
3. *Interior view, 1966 (Connecticut Offices of Culture and Tourism).*



4. *Interior view, 1975, showing the steel reinforcement plates added in 1974 (National Register nomination photograph by D. Clouette).*

ment. Portions of the lower chords were replaced, and the bridge was given a completely new roof and exterior covering. After temporary intermediate supports were removed, the bridge's tie rods were re-tensioned to eliminate any sagging. (One of Howe's chief claims for his patent was the ease by which camber could be corrected by means of the tension rods).

The current project was undertaken to once again address the negative camber of the bridge, but also to deal with deterioration in the timber structural members. This time, the bridge was jacked up, rolled onto the west bank of the river, where there was a parking lot, and disassembled so that deteriorated components could be replaced with similar materials. A majority of the timber diagonals were saved, though some had to have material spliced in at their lower ends. The wrought-iron tie rods were replaced with galvanized steel rods. The lower cross-bracing was replaced in kind, and



5. *Interior view, following the recent rehabilitation (AHS photograph, 2012).*

about half the floor beams, subflooring, and deck were reused. The end-post and portal-bracing timbers were replaced with steel beams, encased by boards so they wouldn't show. Two new elements were introduced: welded steel junctions at the panel points, into which the timbers were fitted, and top lateral bracing where formerly there had been simple cross struts between the two trusses. After rehabilitation, the bridge was repositioned on its abutments. The roof shingles and rafters were again replaced, as was the board siding.

A number of positive aspects to the recent rehabilitation, designed by the engineering firm McFarland Johnson, are evident: the bridge continues in service as a self-supporting truss, the only one of Connecticut's three covered bridges to stand on its own; the steel reinforcements added in 1974 are no longer needed, having been replaced by the less visually intrusive welded junctions; and its overall character closely duplicates the appearance evident in historical photographs from the 1930s and later. At the same time, the project has added to the total of in-kind substitutions and modern replacement materials that occurred in the two earlier episodes of rehabilitation, begging the question of how much remains of the original bridge and how the loss of original material affects its historic significance.

One answer is to accept the extent of modernization as an evitable part of ongoing preservation. Exposed wood, even when somewhat shielded from the elements, is eventually going to deteriorate, requiring replacement of members or substitution of another structural system for the timber truss. If we think of timber bridges being more in the category of historic wooden ships, rather than buildings, we can reconcile the loss of integrity of materials with the retention of integrity of design and function. Like the ax in Howard Mansfield's The Same Ax, Twice (three replaced handles, two new heads), keeping a covered bridge in service may require repeated iterations of rehabilitation with new materials.

Bruce Clouette
Historian, Public Archaeology Survey Team

1907 Reinforced Concrete Oil Tank Containment Building Proposed for Demolition

A rare and unique early reinforced concrete engineering structure is currently threatened for demolition by the Massachusetts Department of Transportation (MassDOT) as part of a major project to remove the aging Route 79 viaduct system at the junction of Interstate-195 in Fall River, Massachusetts. The conical concrete building located off the end of Pond Street is to be removed for the proposed "Water Street Connector," which is intended to provide better access to the city's waterfront. The project is expected to begin in early 2013. The structure was built in 1907-1908 by the Fall River Gas Works Company to contain a steel oil tank and provide fire and leakage protection due to the adjacent railroad.

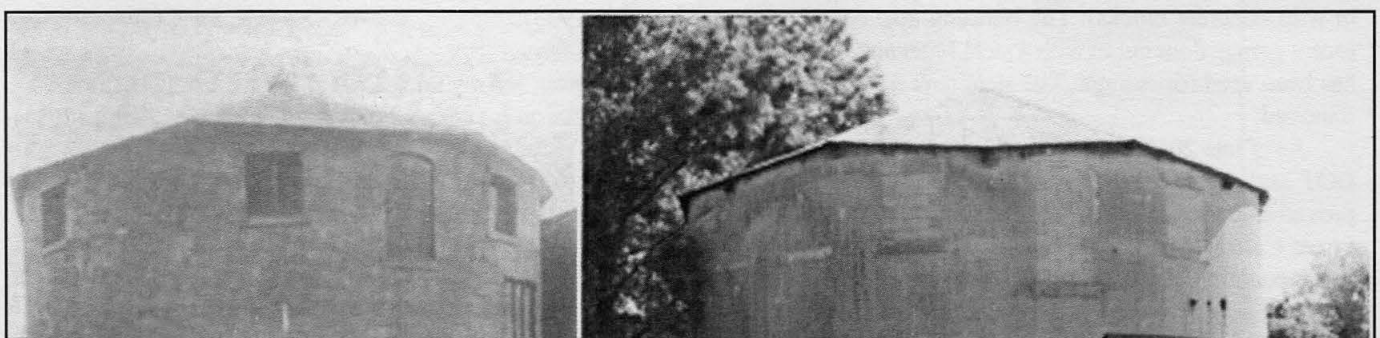
A review of the former Fall River Gas Company property for historic resources was performed by a MassDOT reviewer in 2011 and is on file with the Massachusetts Historic Commission (MHC). The property, now used as a maintenance yard by the New England Gas Company, also contains several other historic gas works structures, including an engine room, coal house and purifier building, along with three mid-century buildings. Despite its historic importance, the site has been deemed "not eligible" for listing in the National Register of Historic Places by the MHC.

The Fall River Gas Works was established in 1847 by the Fall River Iron Works for the manufacture of coal gas. The company began the manufacture of carbureted water gas in 1877. The site became part of the new Fall River Gas Works Company in 1880, upon the divestment of the Iron Works. In 1891, the coal gas equipment was removed for the production of water gas exclusively. A new, 120-ft diameter, 750,000 cubic-foot steel gasometer was built in 1898. The utility engineering firm of Stone & Webster began management of the gas works in 1902. Several additions were made to the facility that year, including a 150,000 gallon oil tank near the center of the site, along with a new purifier, power plant, and new meter and condenser buildings.

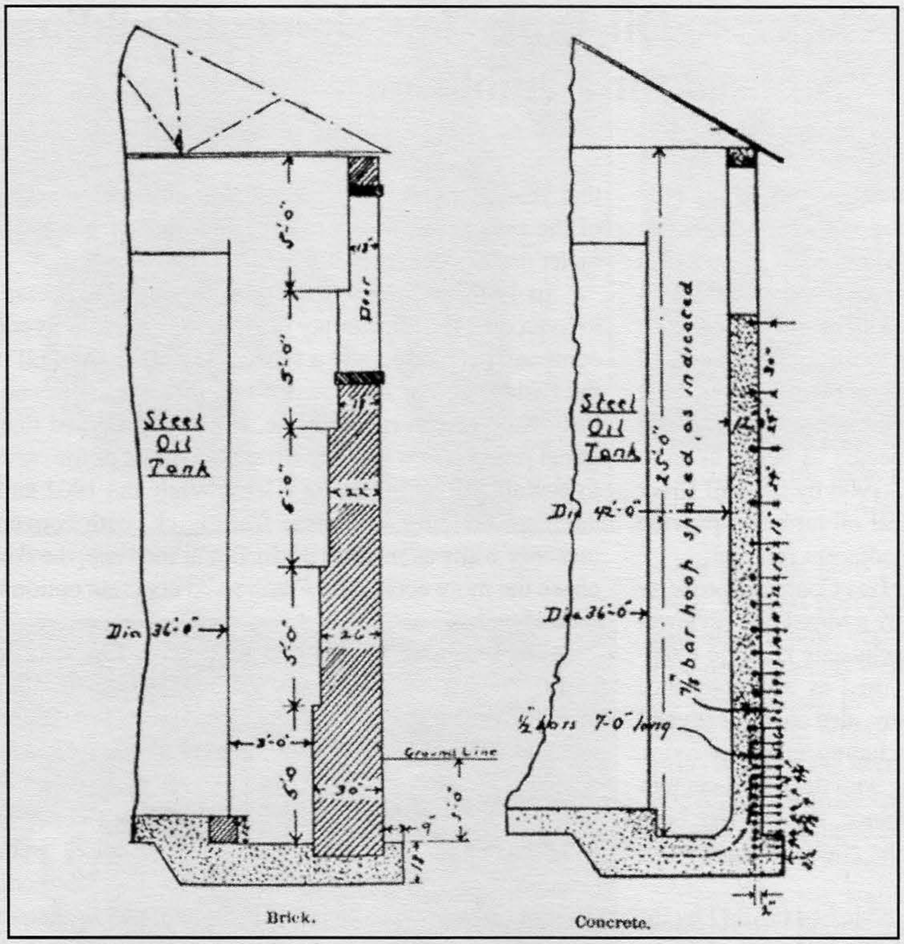
In 1907, in order to keep up with increased demand, and to overcome the uncertainty of winter oil barge deliveries, the company decided to add a second 150,000 gallon oil tank at the eastern end of its crowded two acre site, adjacent to the busy New Haven railroad line. It was determined that additional protection was needed from the threat of fire, as well as to contain the oil in case of a leak. While the 1902 tank containment building was made from brick, with conventional masonry walls as thick as 30-inches at the base, the company chose the more economical reinforced concrete option for the second tank.

The concrete building has an outer diameter of 44 feet with 1-ft thick concrete walls designed to contain a 36-ft diameter steel tank, with 3-ft clear space between the tank and the concrete walls. The top of the steel tank was concave and designed to hold a 6-inch pool of water to prevent evaporation of the oil in hot weather. The building's concrete floor is 18 inches thick, set approximately 4-ft below grade. The steel tank was placed on about 1-inch of sand to account for irregularities in the concrete base. The walls of the structure are connected to the floor with 1/2 inch diameter, 6-ft long Ransome bars, bent at right angles and placed radially every 18 inches. Horizontal reinforcement of the walls is provided by 7/8 inch steel hoops, variably spaced from 3-1/2 inches at the bottom to 24 inches at the top of the wall. The hoops were suspended on 1-1/4 inch vertical pipes spaced at roughly 9-ft intervals.

The building's roof was built by the American Bridge Company, with a low-pitch system of trusses covered with



1908 vs. 2012 photos of the Fall River Gas Company's concrete oil tank containment building.



Comparison showing required wall thicknesses of 1902 brick containment building with 1907 concrete option.

corrugated metal sheeting. It originally had a small cupola at the top for ventilation. Oil was delivered to the tank from a nearby wharf via a 1,700 ft long 6-inch pipeline. The site continued to produce gas until 1922, when the company expanded its Charles Street plant which it had opened in 1916. The Water Street site was thereafter used only for storage. The concrete containment building contains several original door and window openings with cast concrete lintels (now filled in with concrete blocks). The building also contains a more recent garage door cut in with a steel lintel and for many years has been used for storage. The steel tank has long since been removed.

As of late 2012, the project is still under review by MassDOT and the Federal Highway Administration. If it is approved as currently proposed, the construction of the "Water Street Connector" is to be one of the first phases of the project, according to the MassDOT project website, in order to maintain access to the waterfront while the nearby viaduct is demolished, and replacement roadways and bridges are built.

References

"Fall River's Greatness and the Effect on the Gas Industry," *Stone & Webster Public Service Journal*, Vol. 2, p. 30. (1908)

Leonard, Charles F., "A Reinforced Concrete Oil Tank Building: Design Construction and Cost," *The American Gas Light Journal*, Vol. LXXXVIII, p. 576, (1908).

Leonard, Charles. F, "A Reinforced Concrete Oil Tank Building," *Stone & Webster Public Service Journal*, Vol. 2, p. 499, (1908).

Sanborn Fire Maps, Fall River, Massachusetts, (1888, 1893, 1905, 1933).

Shrimpton, Jeffrey, MassDOT: Massachusetts Historical Commission Inventory Form, *Fall River Gas Works* (2011).

Shrimpton, Jeffrey, MassDOT, email to author, September 2012.

"To Build New Water Gas Plant," *Gas Age-Record* , Vol. 49, p. 118, Robbins Publishing Company, (1922).

Marc N. Belanger
SNEC Member

The Last Remaining Building of the Waterbury Brass Mill Collapses

Waterbury, Connecticut, became an industrial power early in the 19th century and by the mid-1850's it was known as the "Brass Capitol of the World." Although not the first brass mill in Waterbury, the Waterbury Brass Company was the first new business established specifically to manufacture brass and it was the first brass mill to incorporate. It was established in 1846 and in 1852 bought the rights to a new process of spinning brass, which made the manufacturing of round products possible. By 1855 the Waterbury Brass Company was producing 85% of the country's rolled brass and brassware and was the largest brass mill in the country. In 1899 it became part of the American Brass Company when it combined with two other companies. The Mad River manufacturing site continued to be a major producer of brass until 1905 when the mill closed.

The Mad River site housing the Waterbury Brass Company consisted of numerous buildings. At the center of the site was the Rolling Mill Building. This large building, approximately 150 feet by 120 feet, housed the water wheels, which powered the plant and it contained the majority of the brass manufacturing process. This building served as the heart of the facility. To the south and closer to the Mad River from the Rolling Mill Building was the Spinning and Finishing Building. This building was approximately 110 feet by 50 feet. Just to west and down river of where the Spinning and Finishing Building stood is the site of the approximately 60 foot long by 26 foot wide Brick Workshop/Storage Shed. On the historic Waterbury Brass Co. East Mill Map (see Figure 1) it is simply labeled "Storage." When the mill was in operation, there were also a number of other buildings on the site including the Foundry and a number of sheds. With the exception of the Brick Workshop/Storage Shed, the mill buildings were destroyed when the mill closed; however, ruins remained until the 1930's (see Figure 2). In Figure 2, the Spinning and Finishing Building can be seen in the background behind the ruins of the Rolling Mill Building. Although one of the less

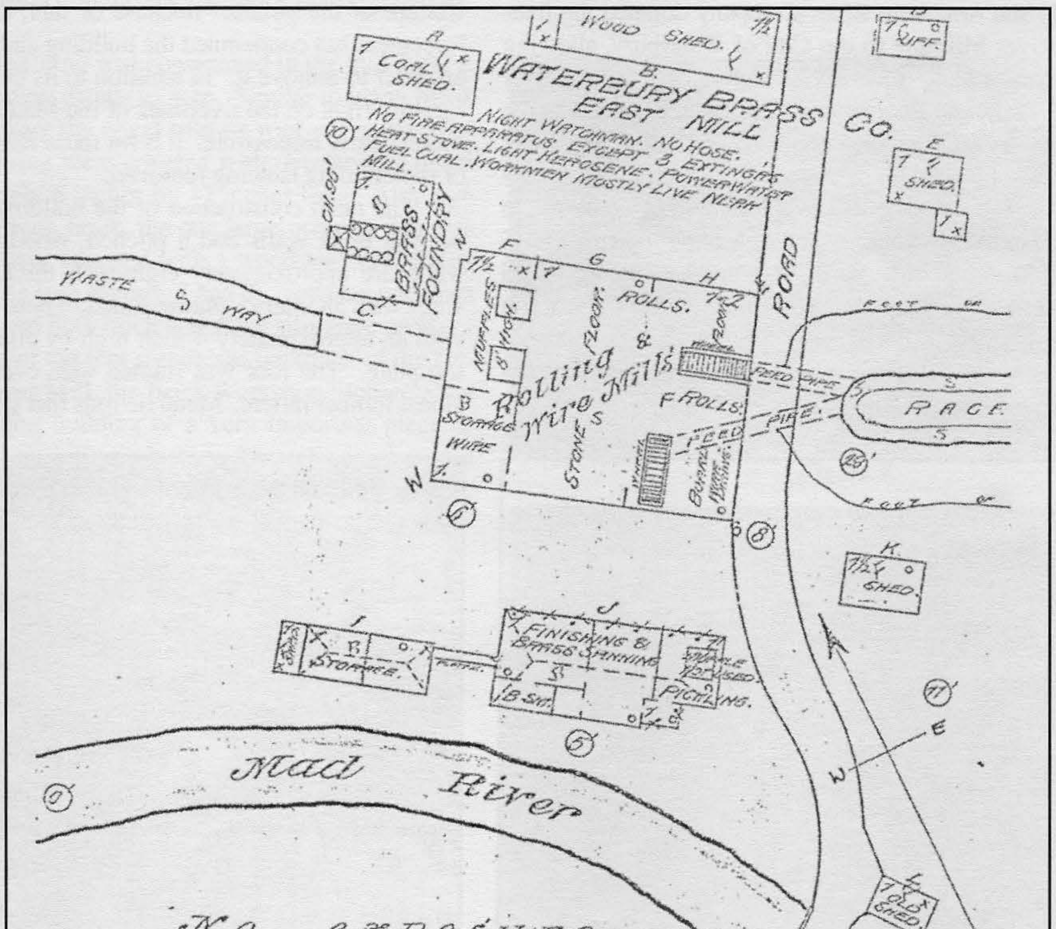


Figure 1

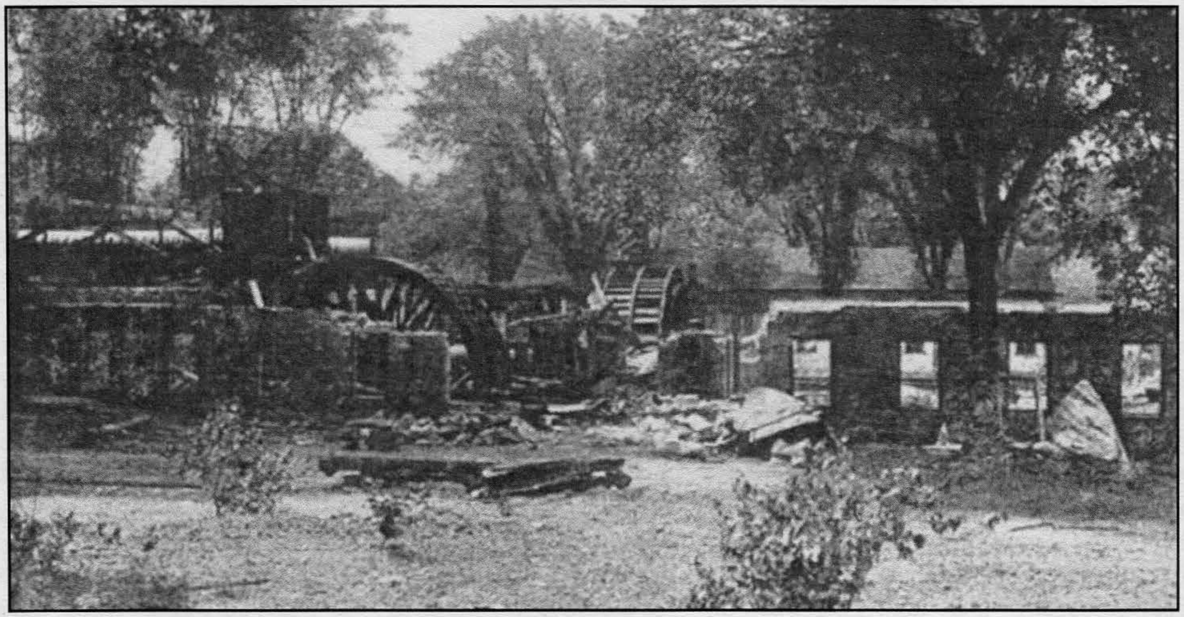


Figure 2

significant buildings of the mill complex, because it was the only surviving building of the historic Waterbury Brass Mill late into the 20th century, it was placed on the National Historic Register.

In 1917 the American Brass Company donated the five-acre Mad River Mill site to the City of Waterbury, allowing the expansion of Hamilton Park. Once under ownership of the city, the Parks and Recreation Department began using the Brick Workshop/Storage Shed building for storage, mainly of set designs associated with their summer theater program, until the late 1990's or early 2000's when the roof collapsed in the winter due to heavy snow loads. A photo taken in 1975 (see Figure 3) shows how the Brick Workshop/Storage Shed appeared before it collapsed. Currently most of the north wall, all of the west wall and only a portion of the south wall remain (see Figure 4). The roof and the east wall have completely collapsed (see Figure 5).

In its current condition, the Brick Workshop/Storage Shed is unsafe and the remaining portions could collapse at any time. Due to its location in Hamilton Park and near public ball fields, its condition creates a danger to the safety and welfare of the public. Because of this, the City's code enforcement has condemned the building and put the City under an order to remove it. In addition to its current condition, its location right on the riverbank of the Mad River makes restoration nearly impossible. It is for these reasons, what remains of the building is being removed.

The main construction of the building consisted of load bearing brick walls and a pitched, wood framed roof. The walls are approximately eight-inch thick, two-wythe brick walls with an interior plaster finish. These walls were capped with an approximately 4-inch high by eight-inch wide wood top plate. The roof was framed with evenly spaced dimensional lumber rafters. Metal tie rods that spanned between the

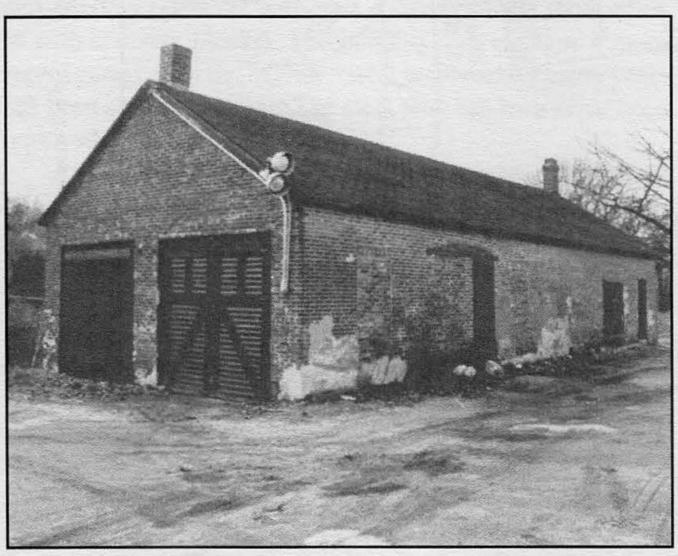


Figure 3

Figure 4

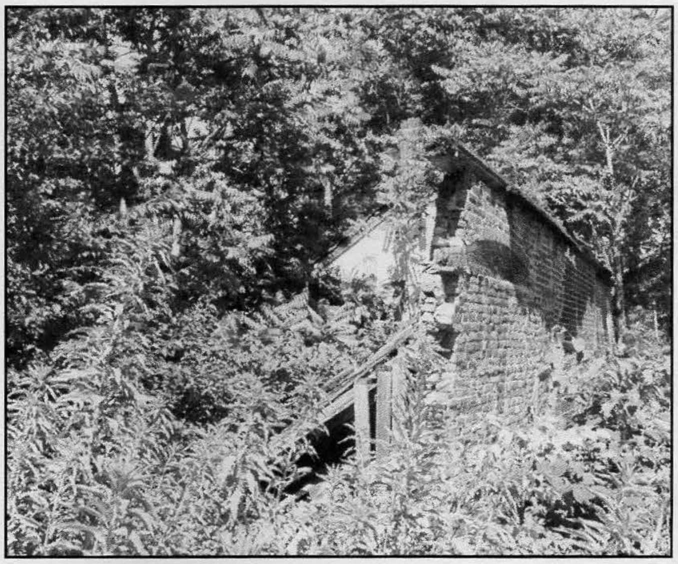


Figure 5

two long walls provided resistance for the lateral roof forces. These rods continued through the top plates and terminated with bolts on the exterior surface of the plate to hold the walls together. A detail of this termination can be seen in Figure 6 as can an iron tie used to reinforce the splice between two top plates.

Because the building was constructed in the mid 1800's, it has some interesting details to note. Similar to using break metal today to protect the wood trim on roof edges, the roof edges of this building were covered with overlapping metal pieces approximately 6 inches by 12 inches long. Although currently in-filled with brick, the one large opening that was on the north wall was spanned with a wood and steel lintel, which is still visible (see Figures 7 and 8). Smaller openings used brick lintels and both brick and stone sills were used.

Although one of the less significant buildings of the former Waterbury Brass Mill, the Brick Workshop/Storage Shed is the last remaining building of a very important piece of Waterbury's and Connecticut's history. Though no one argues that in its current condition and location the building must be removed, it is valuable to document the history of this structure.

Major Bibliographical References

Brockmeyer, Christine B., "Waterbury Brass Mill Archeological Site," *National Register of Historic Places Inventory – Nomination Form*, United States Department of the Interior, National Park Service, May 15, 1975.

http://www.freewebs.com/waterbury-ct/outeast.htm. Brad Brassity, Waterbury Time Machine II – More Vintage Views & Memories of the Brass City.

http://www.worthpoint.com/worthopedia/1907-ruins-of-east-brass-mill-waterbury-conn. 1907 Ruins of East Brass Mill Waterbury Conn largest.

Nemec, James T., "RE: History of the Brick Workshop/Storage Shed (P017)," Email to Ronald D. Williams, July 26, 2012.

Ransom, David F., "Hamilton Park, Waterbury, CT," *National Register of Historic Places Registration Form,* United States Department of the Interior, National Park Service, November 1995.

Ronald D. Williams, AIA, Project Architect
www.wright-pierce.com

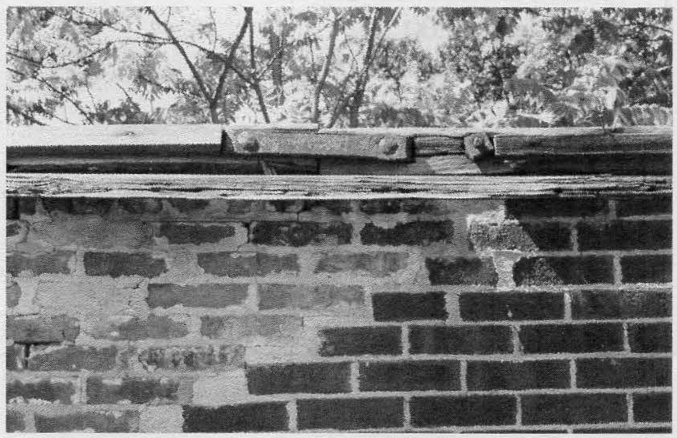


Figure 6

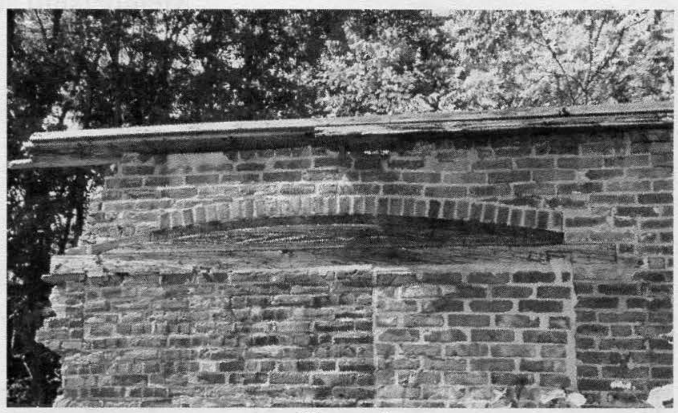


Figure 7

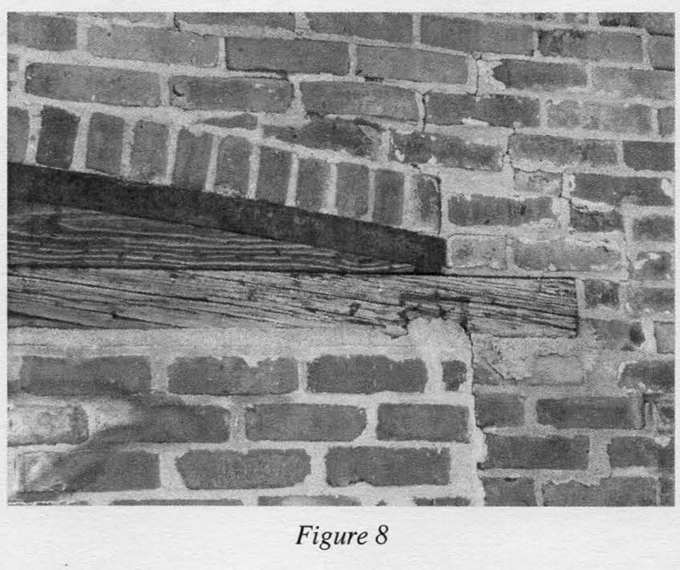


Figure 8

Northern New England Chapter (ME, NH, VT)

Membership and Dues for 2013

Member Renewal: $20.00
Student: $10.00
New Member: $15.00

Send to:
Carolyn Weatherwax, Treasurer – NNEC-SIA, 305 Heritage Way, Gansevoort, NY 12831

Name: ________________________________ Occupation: __________________
Address: ____
Phone: __________________________________ Email: ____________________

Southern New England Chapter (MA, RI, CT)

Membership and Dues for 2013

Regular: $10.00
Student: $8.00
Lifetime: $150.00
New member: $8.00

Two members at one address pay only one membership fee. As we are communicating increasingly by email, it is vital that we have your current EMAIL address.

SNEC-SIA is your best opportunity to gain a close-up on-site look at extraordinary technologies and exciting engineering history. Join us for another year of newsletters, tours and more. Complete and return this with your check made payable to SNEC-SIA.

Send to:
Sara Wermiel, Treasurer – SNEC-SIA, 70A South St, Jamaica Plain, MA 02130-3143

Name: ________________________________ Occupation: __________________
Address: ____
Phone: __________________________________ Email: ____________________