Society for Industrial Archeology · New England Chapters

VOLUME 38 NUMBER 2 2017

CONTENTS

CONTRIBUTORS

Marc N. Belanger, Bruce Clouette, Dave Coughlin, David Dunning, John Johnson, Michael Raber

NORTHERN CHAPTER OFFICERS

David Dunning, President
Ray Breslin, First Vice President
David Coughlin, Second Vice President
Dennis Howe, Secretary
Richard Coughlin, Treasurer

SOUTHERN CHAPTER OFFICERS

Marc N. Belanger, President
Vice President (vacant)
Leonard Henkin, Secretary
Sara E. Wermiel, Treasurer

EDITOR

David Starbuck
PO Box 492
Chestertown, NY 12817-0492
dstarbuck@Frontiernet.net

to obtain more information and membership details
See New England Chapters of the Society for Industrial Archeology on the Web at
http://nec-sia.org

Call for Papers
for the 31st Annual New England Industrial Archeology Conference Hosted by the Northern New England Chapter of the Society for Industrial Archeology

March 3, 2018

at Plymouth State University,
Plymouth, New Hampshire

The Northern New England Chapter of the Society for Industrial Archeology invites proposals for papers to be presented at the 31st Annual Conference on New England Industrial Archeology.

Student Papers are welcomed.

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

Deadline for paper proposals: January 20, 2018

E-mail PDF format proposals to:
ykforestry@yahoo.com
or US Postal Service to: Dave Coughlin
276 Back River Road
Bedford, NH 03110

SNEC-SIA Spring Tour Report, May 20, 2017

Tom Bonomi discusses the history of Granite Rail Quarry.

On Saturday May 20, 2017, SNEC-SIA members met in Quincy, Massachusetts, for a tour of the Granite Rail Quarry, the Granite Railway Incline and the Lyons Turning Mill site. The event was held in conjunction with the Quincy Quarry and Granite Workers Museum, led by President Al Bina, and historian Tom Bonomi. Members met in the DCR Reservation parking lot on Ricciuti Drive, which was once part of Swingle Quarry property, acquired by Ohio-native Jonathan S. Swingle in 1902. Swingle was known as the "extra dark man," not for his complexion, but for the highly-desired variety of granite obtained from his quarry. He also owned other quarries in the area, enabling his company to sell four different classes of granite. The Swingle Quarry was the deepest in the city at 300 feet, and was well below sea level. It was also one of the last quarries in the city to close in 1964.

Very little remains of the quarry industry, but you can see traces such as bases for derricks, foundations, and items such as steel cables and hooks. However, Al and Tom have put together an excellent walking tour of the quarry area with sixteen laminated historic photos of different points in the quarry showing what used to be there. Nearby is the former Granite Rail Quarry (also known as Pine Hill Ledge), which was once one of the largest in Quincy. It opened in 1828 and operated until about 1938. Both quarries have been filled in with excavated material from the Big Dig in Boston (visited by SNEC-SIA in May 2001). Now, only a portion of the rock faces remain. The area has become extremely popular with rock climbers, hikers and graffiti artists.

We crossed through the quarry to get to the granite railway

SNEC-SIA members explore the Granite Incline.

View of the recently-stabilized ruins of the Lyons Turning Mill.

incline, built in 1828-29 to provide a connection from the Granite Rail Quarry to the Granite Railway, which opened in 1826 as the "First Commercial Railroad in America" to provide granite for the Bunker Hill Monument in Charlestown. Granite for the monument came from the nearby Bunker Hill Quarry. At the bottom of the incline, the Museum has installed an interpretive panel. The incline has also been designated a Civil Engineering Landmark by the American Society of Civil Engineers (ASCE). Near the bottom of the incline, there is also a large granite block that was once part of a road crossing for the railroad. Portions of the Granite Railway were excavated by local archeologist Richard Muzzrole in 1950s during construction of the Southeast Expressway. Unfortunately, much of the railway remnants were destroyed by the construction. However, the Museum maintains a collection of photographs, documents and artifacts from the Muzzrole research.

After lunch, the group reconvened at the nearby Lyons Turning Mill site. The turning mill was built in 1893 by James Lyons to manufacture architectural columns, balusters, and spheres. The facility included a rail siding that passed through the building. The turning mill used granite not only from Quincy but from various other locations throughout the country. This is evidenced today by the variety of granite fragments covering the site today. In 1906, five hundred Milford Pink granite balusters for Penn Station in New York were made here.

The turning mill had various owners during its lifetime and operated until 1917. The machinery was removed and the site was abandoned and gradually fell into ruin. It became overgrown with vegetation and forgotten. The land of the turning mill and surrounding quarries was later acquired by the City of Quincy for a landfill. In 1976, there were plans to expand the landfill over the turning mill site. However, this was stopped by efforts of the Quincy Historical Commission and the site was placed on the National Register of Historic Places in 1980. In the past several years, the Museum has led efforts to stabilize the crumbling walls of the mill with funding provided by the Community Preservation Act. They have recently installed a storage container and small shed to contain the many artifacts in their collection. The site occasionally opens to the public with a variety of interpretive panels and photos, tools and other artifacts.

For more information, visit the Museum's website: http://www.quincyquarrymuseum.org/

Marc N. Belanger
Reno, NV
mb_cyc1@yahoo.com

NNEC-SIA President's Report
Fall 2017

The NNEC annual meeting was held at lunchtime on the Fall Tour. Officers David Dunning, Dave Coughlin, and Rick Coughlin were in attendance. All offices were extended for another year. Rick gave the treasurer's and membership report that are included here.

Treasurer's Report:
SAVINGS

Current Balance in Savings Account as of August 31, 2017:	$4,476.54
Current Balance in Savings Account as of August 31, 2016:	$4,716.12
Current Balance in Savings Account as of August 31, 2015:	$4,805.95

MEMBERSHIP

Number of 2017 Paid Annual Members:	49
Number of 2016 Paid Annual Members:	39
Number of 2015 Paid Annual Members:	37
Number of Lifetime Members in 2017:	39
Total Membership in 2017:	87

The amount of our savings continues to decline. As postage and printing costs most likely will not drop, the savings decline can only be reversed by either stopping the mailing of the newsletters and sending them by email (which I would not want us to do) or by increasing our membership fee.

As can be seen above, membership has increased from 2016. I have attempted to increase membership by sending several email reminders to those that have not yet paid the annual membership, by encouraging renewal payments at the conferences and the Spring tours, by mentioning the organization to others and by placing flyers at various locations.

The SIA is a great organization and we should inform more people about it. Just this morning I sent email copies of our Spring and Fall 2015, 2016 and 2017 tours to an interested potential member with an invitation to join us at the Fall 2017 tour.

Existing SIA members can recruit new SIA members by placing SIA flyers in local libraries, museums and historical societies (flyers are available from President David Dunning) and by inviting potential members to join us at the tours and conferences. We can continue to increase membership if we all make an effort.

Respectively submitted on September 18, 2017
by Treasurer Rick Coughlin

Planned Tours:
Spring 2018 will feature a tour of the Ely Copper Mine site in Vershire, VT (just NW of White River Jct.). It's abandoned and grown up now but the guide has all the pictures to show and history to explain. It's all on Google for anyone who wants a preview. After lunch, there will be a tour of a grain elevator which is part of an agricultural feeds mixing and distribution center. The day will end with another process tour. This will be at G.W. Plastics in Bethel, VT. They do injection molding.

The Fall 2018 tour will be combined with a canal history group in New York's Champlain Canal Valley. Following is the invitation that they sent; our board agreed to join in on this:
Jeannie Williams here, Executive Director of the Feeder Canal Alliance (FCA), stewards of the Glens Falls Feeder Canal and Towpath Trail. Our board would like to extend an invitation to the New England SIA to have the next Fall Tour (2018) here in Glens Falls. In celebration of the Bicentennial of the NYS Canals and also the celebration of the Feeder Canal Alliance's 30th Anniversary, we thought a tour through the Glens Falls Feeder Canal and northern Champlain Canal might be a great fall tour for NE Chapters of SIA. (We understand that the Glens Falls Feeder Canal is a significant artifact of NYS history as it is the last surviving part of the original Erie Canal period system remaining intact and still in operation.)

FCA is a life member of New England SIA and we just haven't had the opportunity to support SIA other than with our membership at this time. ……so are offering this opportunity to you. If fall 2018 is already planned, let us know if 2019 would work. We cannot commit to a Columbus Day Weekend, though. There is the potential for seeing our Flight of Five, a recently preserved coal silo site, old lime kilns that need preservation and more. Our web site is www.feedercanal.org but I am embarrassed for you to view it as it is not up to date, but we have applied for a grant to remedy that shortly.

David Dunning
NNEC President

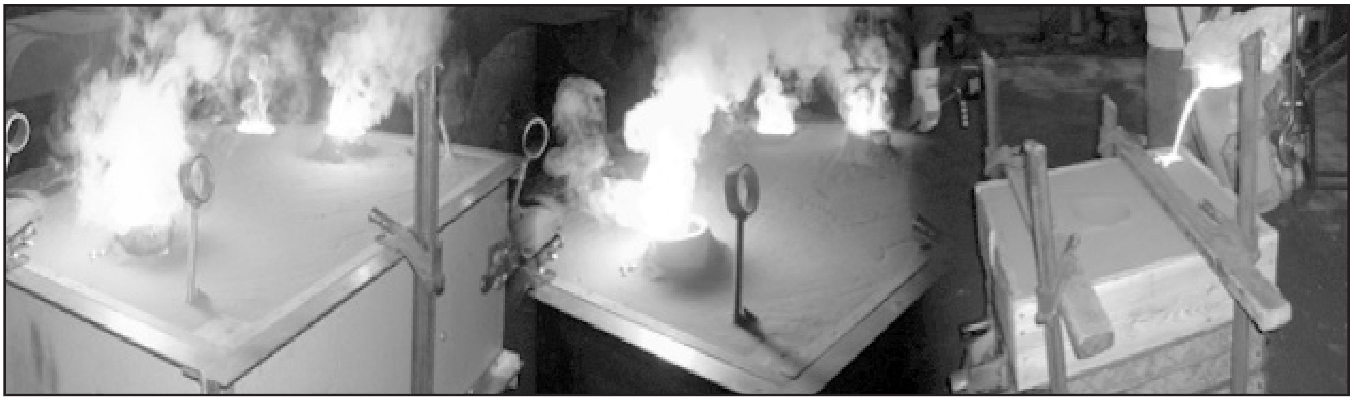
NNEC-SIA Spring Tour Report

May 13, 2017

About 30 people met at Hebert Foundry & Machine in Laconia, NH, for a great educational tour. We saw castings being made, the patterns used in the process and the machining done after.

"Hebert Foundry & Machine, Inc. has 95 years of extensive experience as a family owned and operated foundry and machine shop. Hebert Foundry & Machine opened in 1912 as an iron foundry supplying split piston rings for the automotive industry. Since that time, the company has undergone steady growth that allows HFM to service a variety of industries including; transportation, food preparation, marine, communications, submersible pumps, laboratory instrumentation, and

30 people met at Hebert Foundry & Machine in Laconia to begin the NNEC Spring Tour.



Sand casting bronze at Hebert Foundry & Machine in Laconia.

general mechanical components. HFM offers a full range of services to address all casting and machining needs." (From Hebert's web site) For a review of the process, google "Sand casting process". The first piston rings were made of cast iron. In 1915, Napolean Hebert got a patent on a significant improvement over earlier designs. His piston rings better kept the combustion above the piston and the oil below it, improving both compression and pollution. See 1915, US patent number 1,144,474, at Google patents.

After lunch, we visited The Boulia-Gorrell Lumber Company. Besides the usual lumber supply and hardware store, they have a woodworking shop where they do custom millwork. Some of their machines are over 100 years old, but still work fine. The craftsman there said that the youngest thing in the shop is him, and he's about 60. Boulia-Gorrell Lumber Company has been in business since 1872 and is one of the oldest independent lumber companies in the US. They have survived two world wars, the great depression and countless changes in the lumber and home-improvement industry. It has been in the Veazey family for four generations. Long before the world was aware of Franklin D. Roosevelt's inability to walk, Boulia-Gorrell was asked to create special crutches for the 32nd president.

At the Belknap Mill, Warren Huse gave us a very interesting and informative tour; he's the Laconia historian. The first stop was the Avery Dam Hydro Station, at the mill. In 1790-91, Dan Avery first built the stone-filled timber crib dam. Over the years, successive dams washed out and had to be replaced/improved. In 1949, a new concrete dam was built. A coffer dam was installed to bypass the flow during construction. The Guild-Northland Mill, downstream from the dam, required up to a million gallons of water a day for textile drying and washing. There were flumes running down both sides of the river from the dam, as well as a flume running under the Busiel Mill and under the Belknap Mill.

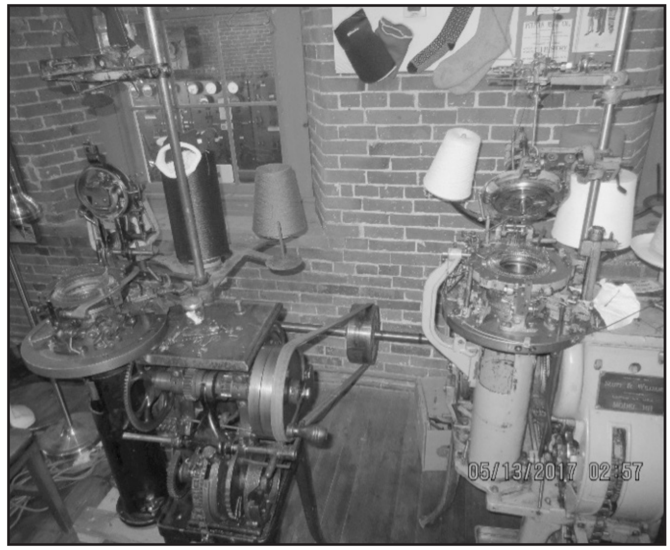
At one time, at least six mills used waterpower from the flumes on the south side of the river. There were tailraces on the north side for those mills. By 1985, the only waterpower being used from the Avery dam was through a canal to power the Allen-Rogers Ltd. Woodworking mill (a remnant of the old Laconia Car Co.). In 1985, work began on the new power generating dam that we saw there. It is relatively low power and it is controlled from Scarsdale, NY, except for the local man who cleans the trash out of the rack.

From there we went inside to tour the Power House Museum. It is a set-up of old power generating equipment for educational purposes. See the included pictures. Then to the knitting machinery room where many old machines are set up and some still running to watch. Some of the machines were invented right in Laconia. Finally, we observed a

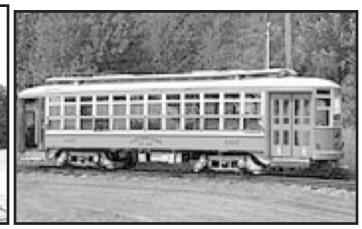
Viewing the woodworking shop at the Boulia-Gorrell Lumber Company.

The Avery Dam Hydro Station.

The Power House Museum at the Belknap Mill.



Stocking knitting machines exhibit at the Belknap Mill.



(Left) Boston Elevated Railway streetcar built by Laconia Car Company in 1911. (Right) Laconia Car Company streetcar built in 1918 preserved at the Seashore Trolley Museum.

slide presentation about the historic Laconia Car Company (which will be shown again at the Fall Conference). They made street cars and trolleys and once employed about 1500 people. The following information is supplied by Laconia historian Warren Huse.

Laconia Car Co. manufactured railway cars in Laconia, NH, from 1848 to 1928. Gilford native Charles Ranlet, an expert clockmaker from Exeter, NH, started the company in 1848, the same year that the railroad reached Meredith Bridge, as Laconia was earlier known, it being then a part of the town of Meredith. Initially, he turned out up to three freight cars a week, these being about 24 feet long and seven feet high, constructed of oak, pine and spruce and having four wheels. Ranlet had located here because of the abundance of softwoods and hardwoods, plentiful labor and, with the opening of the railroad, shipping to and from Boston and beyond. In 1849, Ranlet's brother Joseph, who had been employed for 20 years as foreman of the machine shop of the Newmarket Manufacturing Co., joined the Laconia firm. Charles died in October 1861 and Joseph formed a partnership with John C. Moulton, a local entrepreneur and industrialist. Business soared during the Civil War, due to demand for rolling stock for the Union's military railroads.

Another Laconia industrialist, Perley Putnam, joined the company in January 1865. It then expanded into passenger cars on a large scale in 1870. Joseph Ranlet retired in April 1878. Early in 1894, the company began manufacturing rolling stock for electric street railways.

In 1897, Frank Jones of Portsmouth, beer brewer and industrial entrepreneur, purchased the company, modernized and expanded the plant. Jones died in 1902, but the trustees of his estate continued the management of the firm until 1912, when it was sold to three banking houses of Boston and New York City, which continued to operate it until the company went into liquidation in 1930-1931. The last streetcar production was in 1928, although the firm attempted briefly to build and market two models of boats.

Over the 80 years of its existence, the Laconia Car Co. produced thousands of railroad cars, both freight and passenger, and hundreds of trolley and subway cars, the vast majority of which went to rail and trolley lines on the East Coast, although there were a few orders to Nevada, Indiana and other states at some distance from Laconia. The company built at least two coaches for the Mount Washington Cog Railway. The company did not, however, build any cable cars for San Francisco or anywhere else.

Initially, the bodies of the cars were of wood, but eventually the Car Shops converted to manufacturing steel bodies. The company performed all the various processes necessary to building a coach, from casting of iron and brass, carpentry and cabinetwork, machining, electrical wiring, lights, plumbing, manufacture of seats, upholstery, decoration, glass, painting, varnishing, etc. A bronze "Laconia Car Co." plaque was installed in each of its products.

Laconia cars are still in service on certain tourist railways, such as the one in Conway, N.H. There are a number of Laconia-built trolleys in operation at the Seashore Trolley Museum in Kennebunkport, Maine.

NNEC tour participants inspect old boat motors in the museum at Fay's Boatyard.

The last stop of the day was Fay's Boatyard old motor museum. Jeffrey Fay (owner) could not join us but left his collection open for us to explore. That was fun as we put our heads together to figure out what we were looking at in some of those old motor designs.

David Dunning
NNEC President

Portland, Maine Exhibit

A new exhibition at the Maine Historical Society explores creativity and ingenuity through trade banners painted by members of the Maine Charitable Mechanic Association (organized in 1815 and still an active organization). Creative Maine: Trade Banners and the Crafts That Built Maine shares the stories of individuals who led the MCMA, who were skilled in their crafts and who created successful industries for Maine. All of the 17 colorful and preserved 1841 parade banners, depicting 54 trades, are displayed with an historical account of the craftsman, an example of that historic trade and a contemporary object of that same trade that is still being practiced in Maine.

June 23, 2017-January 13, 2018, Maine Historical Society, 489 Congress Avenue, Portland.

See www.mainememory.net/banners for images and historical information.

John Johnson
330 Spring Street
Portland, Maine 04102
jpjhistory@netscape.net

Three examples of the 17 colorful 1841 parade banners depicting 54 trades in the Portland exhibit.

“Mystery” Stones at the Narrows South Watuppa Pond

Fall River – Westport, Massachusetts

A group of grindstones along the shore of South Watuppa Pond, Westport, Massachusetts.

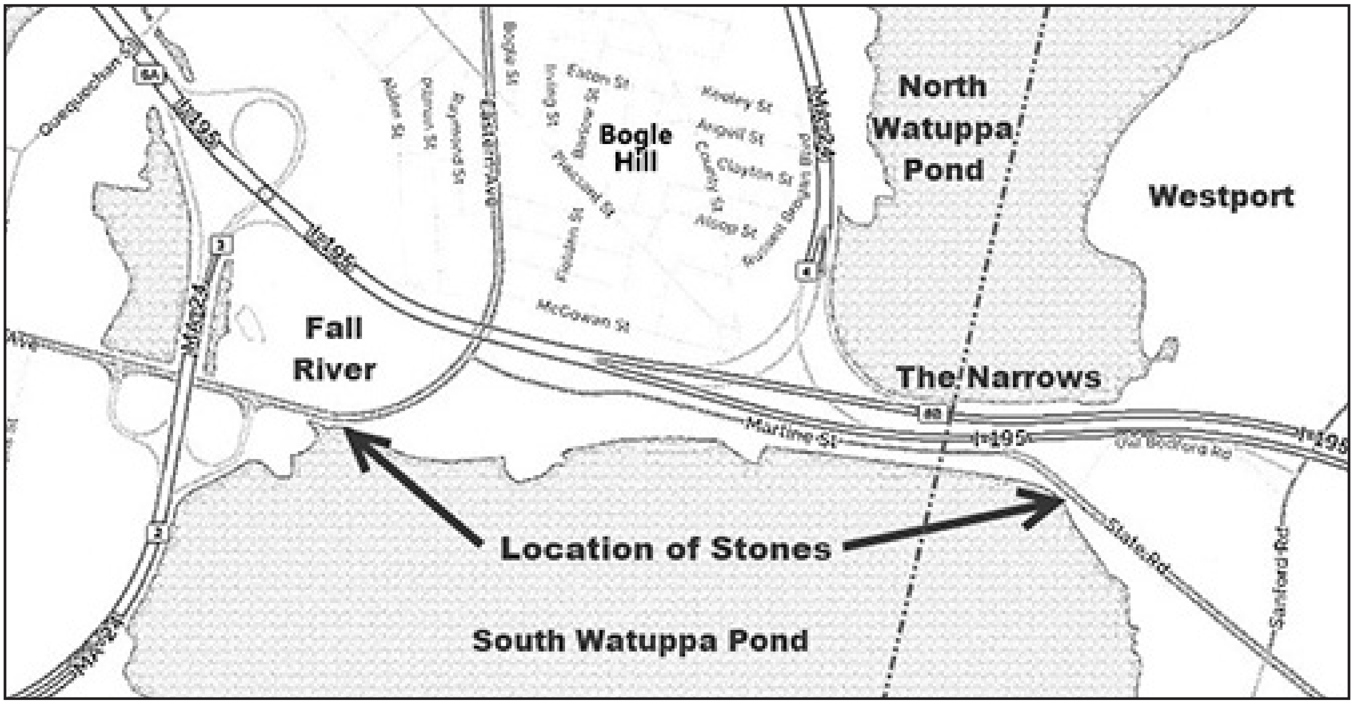
Along the northern shore of South Watuppa Pond in Fall-River and Westport, Massachusetts, in an area known as “the Narrows,” there exists a large number of round flat stones that have been there for many years. I have been aware of the “unusual” round stones from an early age, growing up in the Bogle Hill section of Fall River, just a few blocks from the pond. South Watuppa Pond is one of the largest naturally-occurring water bodies in the state. It was once directly connected to North Watuppa Pond via a narrow stone channel. The ponds are the main source of the Quequechan River, which provided power for most of the early cotton mills in the city. The causeway area between the ponds has been filled in various stages over the years for roadway and railroad construction.

The railroad opened in 1875 as the Fall River Railroad to provide a connection from the port city of New Bedford, to serve the textile mills located in the eastern part of Fall River, which could not be easily accessed from main Fall River-Boston line due to challenging topography. The line became part of the Old Colony Railroad system in 1882, and then part of the New York, New Haven & Hartford in 1893. It operated until the late 1970s under Conrail. The Fall River portion of the rail bed has been converted into a bike path. The tracks still remain in the Westport portion from the town line to State Road, although some sections have eroded and are not passable.

It appears that the round stones were placed by the railroad at some point to provide protection for its track that runs directly along the shore of the pond. However, most of the railroad embankment along the pond consists of a variety of quarried stone from various sources, along with natural rounded boulders.

The exact origin and purpose of the round stones remains a mystery. In his book The Narrows, local author Carmen Maiocco suggested that the stones were once used as “counterweights” for the flywheels of the many mills in the city. Others claimed that the stones came from England as ballast on ships. I also knew early on that the stones were not traditional horizontal mill stones used in grist mills. The type of stone is incorrect and they lack the usual dressing associated with grist mill stones.

In November 2016, I visited the site to document and photograph the location of each stone. I counted a total of ninety-one (91) stones, in various clusters along a mile-long



Map showing general location of stones located along the north shore of South Watuppa Pond.

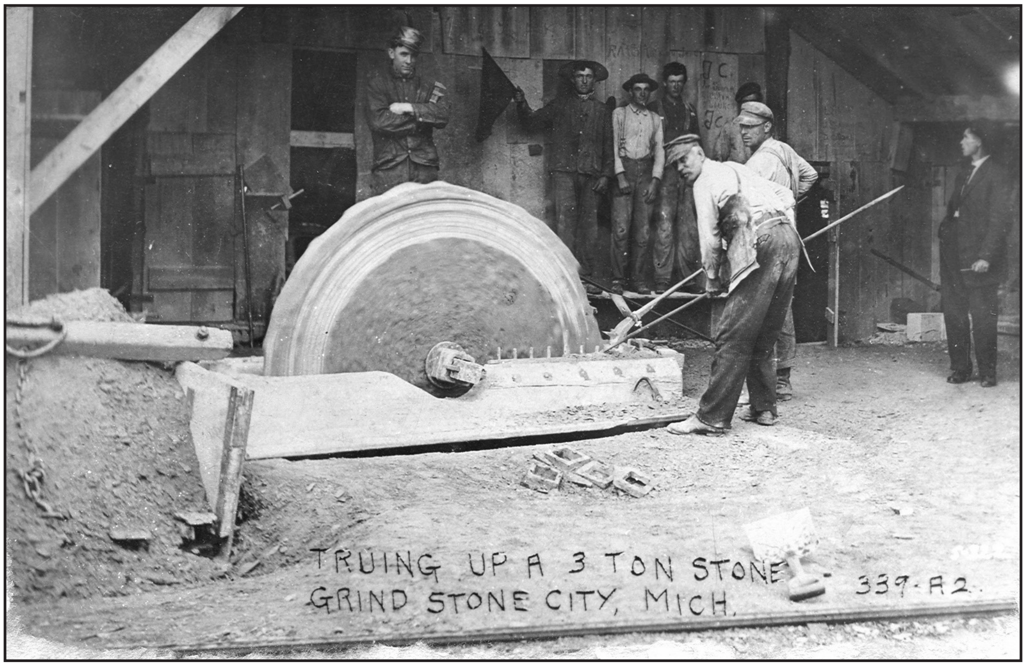
stretch between Brayton Avenue at the west end, and State Road (Route 6) in Westport, at the east end. A majority of the stones are located on the Westport side, with many stacked on top of each other along the shore line. Smaller clusters exist to the west of the municipal boundary. They become more scattered to the west. Two smaller stones have been moved to the end of the bike path at Brayton Avenue and placed vertically into the ground next to a memorial dedicated to workers of the former Kerr Mills who served in World War II.

The stones vary in diameter from 38 inches to 82 inches (most being at least 60 inches). The stones are generally about twelve-inches thick. Most have square holes (or eyes), roughly 5.5 inches, but a few have round holes, about the same size. Many stones have carved grooves or tool marks on either their face or edge. A few stones contain carved graffiti. Others have been smoothed and eroded over time by the lapping waters and winter ice of the pond. Most stones appear to be made of a coarse yellowish sandstone, but a few are a buff (tan) sandstone. Sandstone is not native to the area. Assuming a unit weight of 145 pounds per cubic-foot, the estimated weight of the stones ranges between 1,200 lbs to 5,300 lbs each. For the purposes of this research, I have numbered the stones from #1 to #91 from west to east. A total of six "small" stones were counted, ranging in size from 38 inches to 50 inches in diameter. The remaining eighty-five "large" stones vary in size from 60 inches to 82 inches in diameter. A number of stones are broken or incomplete, missing up to half their diameter.

The possible timeframe for the placement of the stones by the railroad ranges from 1874 when the line was originally constructed, to the early 20th century. It does appear that they were placed prior to 1930, judging by graffiti found on Stone #13 ("VANIE 1934"). The stones probably travelled by rail from New Bedford. They could have come overland from other points within the rail system, or they came through the seaport. Short of finding an article, photograph or railroad company records for the purchase of such a large quantity of "unusual" construction materials, determining the precise date of placement will probably be difficult. Perhaps there are scientific methods such as lichenometry that could be utilized. However, this is beyond my skill set.

A few years ago, I posted some photos on the SIA's Facebook page, and someone suggested that the stones were from an edge mill (also known as an edge runner mill or crush mill), where one or two vertically placed "runner" stones rotate on a central axis on a large "bed" stone. Edge mills have

Group of three large grindstones in Fall River.
The tops of these stones have been eroded by water and ice from the pond.



Historic photo of a large grindstone being turned. Grindstone City, Michigan.

been used since ancient times to process a variety of items including olive oil, apple cider, linseed oil, mustard seed, hemp, agave, gunpowder, paint, spices, ore, clay, chalk, glass making, bark mills, and paper pulp. Edge mills are still used today for various industries.

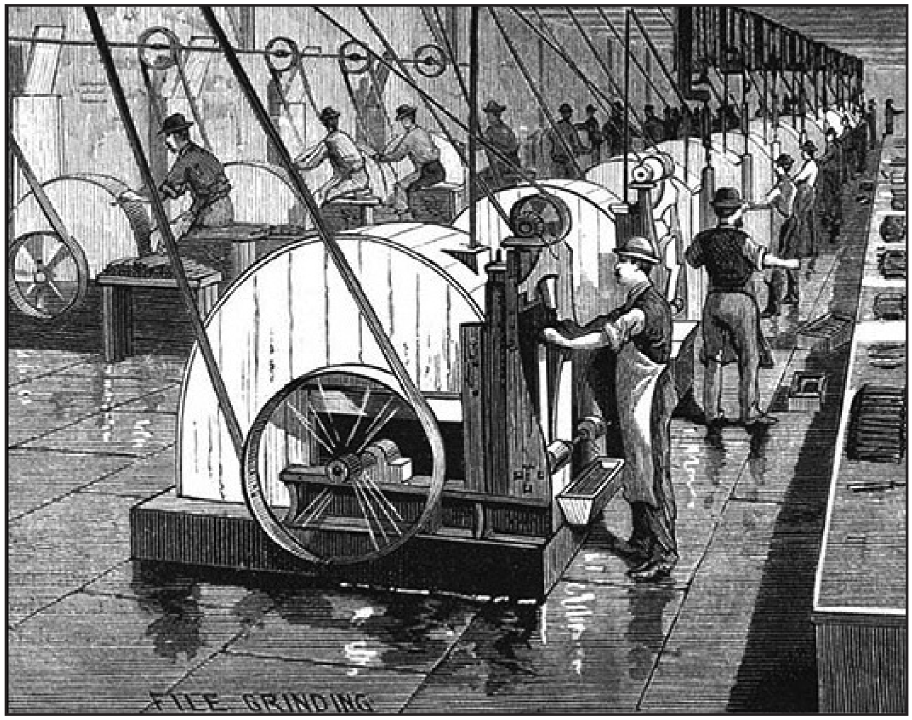
Other searches lead me to pulpstones, used to produce pulp for paper making. These stones were used in large numbers after the introduction of wood-pulp production, well into the twentieth century. However, pulpstones were typically of heavier and much wider that the stones located along the South Watuppa.

A third, more likely possibility is that the stones were used as grindstones, for grinding metals and sharpening edge tools. Most people are familiar with smaller grindstones, which were once essential equipment on farms and in workshops of all types. However, the large size of the stones at this location would likely indicate an industrial user. Grindstones were once quarried from sandstone in large numbers in Ohio and Michigan, as well as other places including England and Eastern Canada. In 1920, over 44,000 tons of grindstones (all sizes) were sold in the United States.

Prior to the development of artificial emery wheels and other types of abrasives, large grindstones were used extensively for a variety of industrial uses, including sharpening edge tools (knives, axes, etc.) and preparing rough metals for painting, polishing or other processes. Various types (or grits) of sandstone were used for specific purposes. Fine grits were ideal for sharpening blades. Coarse grits were used to prepare castings, and provide a uniform finish to metal parts or tools. Coarse grits were also used to sharpen the cutters used in the nail industry. The typical industrial grindstone was five to seven feet in diameter, and up to fifteen inches thick. For many quarries, smaller grindstones were essentially a byproduct of the production of large industrial grindstones.

There are a few types of coarse yellowish sandstone that could possibly be the source of the stone used for those along the South Watuppa. This includes Newcastle grit, from England, used for sad-irons, springs, pulleys, shafting, nail works and dry grinding of castings. Sandstone from Nova Scotia is blue or yellowish-gray and was used for hinges, springs and edge tools. Massillon grit, from Ohio is yellowish white and was typically used for grinding edge tools, springs, files, in nail works and for dry grinding foundry castings. There may be other possible sources. It would be great if I could obtain actual samples of known sandstones from various locations where grindstones where quarried to compare with the varieties found at South Watuppa.

Information on specific uses of industrial grindstones is relatively rare. However, one of the better-documented users is the Henry Disston & Sons Saw Works in Philadelphia. Once one of the largest makers of saw blades of all types, Disston also produced its own files for the manufacture of its saws. In the 1910s, they consumed about 2,500 tons of grindstones to produce about 30,000 dozen files annually. New stones were typically seven feet in diameter, and would be replaced after about two months, when they were about four feet in diameter. The company employed a crew of ten men whose sole task was to replace the grindstones. Assuming a new grindstone weighs about 5,500 pounds (2.75 tons), the company used about 900-1000 grindstones each year. The scrapped stones were used in interesting ways. Many were cut up and used to build a large stone wall around the factory property. In 1915, the company also donated used stones for the construction of the Tacony Baptist Church. A very large quantity of used grindstones were also stacked along the Delaware River to create a bulkhead. (See references below for links to photos of Disston site).



Historic image of the Grinding Shop at the New American File Company, Pawtucket, 1882. Large grindstones were used to give the forged file blanks a perfectly smooth finish prior to cutting the teeth.

Other specific information on the actual consumption of industrial grindstones is scant. Around 1870, the Collins Axe Company in Connecticut used about 600 tons of grindstones annually (roughly 300 stones). The Deere & Company plow works in Moline, Illinois used about 400 tons of grindstones in the year 1882 (roughly 200 stones).

There is some information available on the number of grindstones used at one time for different industries. In 1867, the Weed File Works in South Boston had "seventeen large grindstones, seven feet in diameter, twelve inches face, running at 240 RPM". In 1876, the Baldwin Locomotive Works in Philadelphia had "six grindstones of 4,000 pounds each running constantly on locomotive work alone…", to prepare rough castings and working parts of their engines.

Large grindstones were also used to sharpen the nail cutting blades used in the cut nail industry, such as those documented by HAER in 1990 at Labelle Iron Works in Wheeling, West Virginia. Given the fact that there were once a number of companies in Southeastern Massachusetts that made cut nails, it is possible that the stones at South Watuppa came from one of these firms – perhaps the Fall River Iron Works, which once had among the largest number of nail machines in the area that needed constant sharpening. This company also once had a large foundry, which also may have utilized large grindstones for their castings.

It is also possible to imagine that the stones came from one of several file makers in New England, such as the New American File Works in Pawtucket, which produced 400,000 dozen files in 1882, or perhaps the Nicholson File Works in Providence, often cited as the "world's largest file company", who in 1894 produced over 900,000 dozen files (thirty times that of Disston). I have not been able to find specific information on the consumption of grindstones from these file companies, but it must have been extremely large. Another notable saw maker, the Simonds Manufacturing Company in Fitchburg also produced its own files. There is a direct rail connection from Fitchburg to New Bedford. There are numerous other possibilities for the source of the South Watuppa grindstones, such as the many foundries and metal-working companies in the region, including tool makers, stove works and firearm manufacturers.

It would appear that most of the grindstones at South Watuppa Pond were "lightly used", since most are at least 70 inches in diameter. Many have chips and cracks, so perhaps they were discarded as defective. Or perhaps the chips occurred during the moving process. Each of the six smaller stones show signs of extensive wear / tool marks on their faces, indicating that they were likely "heavily used," similar to those at the Disston site.

There are a number of other locations, particularly in Ohio and Michigan with piles of abandoned grindstones, mostly associated with historic quarrying activities. The group of stones at Grindstone City, Michigan, on the edge of Lake Huron, looks surprisingly similar to those along South Watuppa Pond. Given the large number of industrial grindstones once used in New England and in other places, I'd be curious to find out where else there may be large grindstones lying around.

References and Further Reading:

Avery, Ron, "The Grindstone Church", *Philadelphia Oddities* (website), http://www.ushistory.org/oddities/grindstone.htm

Benjamin, Park, Ph.D., Ed., “Grindstones”, *Appleton’s Cyclopaedia of Applied Mechanics*, D. Appleton & Co., p. 12, 1895.

Belanger, Marc N, photographs and notes, November 2016.

Bradsby, Henry C., (Deere & Company info), *History of Bureau County, Illinois,* Unigraphic, p. 224, 1885.

Brown, Coombs & Company, “Sketches of American Manufacturers – File Making”, *American Artisan and Illustrated Journal of Popular Science*, p. 261. 1867.

Clark, David, “Early Cutlery Grindstones”, www.queencutlery.com/uploads/Early_Cutlery_Grindstones_3-25-2016.pdf, March 2016.

Disston & Sons, Henry, “Impressions of the Disston Plant”, *The Disston Crucible*, Philadelphia, 1915.

Felch, W. Farrand, “Canton” (memoir of Samuel W. Collins), *The Connecticut Quarterly,* Volumes 1-2, Connecticut Quarterly Company, p. 247, 1895.

Federici, Joe, “Watery View of Keystone Saw Works” (website), http://positiverake.com/watery-view-of-keystone-saw-works/, June 22, 2017. (Photos of used grindstones along Delaware River).

Girard, Henri, pub, “Business Items” (Nicolson production info), *The Manufacturer and Builder*, Volume XXVI, p. 284, 1994.

Google image search: Grindstone City postcards.

Google Maps / Street View search: 5200 Unruh Avenue, Philadelphia (view of stone wall made of grindstones).

Hieb, James A., *Sandstone Center of the World – Images and stories of quarry life in Amherst, South Amherst and Lorain County, Ohio,* www.quarrytown.net, (2007).

Hockensmith, Charles D., e-mail correspondence, November 21, 2016.

Hoyt, Frank W., ed., Volume 42, “Grindstones and Pulpstones”, *Stone,* Stone Publishing Company, p. 315, 1921

Kuc, Wiktor, ed., “US Tools & Makers” (website), www.wkfinetools.com

Maddex, Lee, “La Belle Iron Works”, Historic American Engineering Record, 1990.

Maiocco, Carmen J., *The Narrows,* self-published, 1992.

Mitchel, J.E., “Grindstones” (Baldwin Locomotive info), *The Metal Worker – Stove and Tin Trade Journal*, July 29, 1876.
Read, Herbert C., “Grindstone History”, *The White Fence*, Issue #8 (March 1999), Tantramar Heritage Trust, Sackville, New Brunswick. http://heritage.tantramar.com/wfnewsletter_8.html

Marc N. Belanger
Reno, NV
mb_cyc1@yahoo.com

Job Posting: Industrial Historian

PAL, New England’s leading cultural resource management (CRM) firm, is seeking an experienced Industrial Historian to join our team of CRM professionals. PAL offers a wide variety of services, including all phases of archaeological and historic architectural survey, Section 106 consultation, National Register nominations, HABS/HAER and state level documentation, historic preservation tax credit certifications, historic preservation planning, and interpretive materials. Our office is located in Pawtucket, Rhode Island, “The Birthplace of the American Industrial Revolution,” in the heart of a service area that extends throughout New England and the Mid-Atlantic regions. As a consequence, a large percentage of our projects require the talents of qualified Industrial Historians and Industrial Archaeologists with experience in identifying, recording, and evaluating the various types of historic industrial resources we often encounter. Typical resource types include historic mill and factory complexes, railroads, highway bridges, dams, and electrical generating plants. Due to PAL’s reputation in our region, the Industrial Historian will work on challenging, high-profile projects that offer unique opportunities for career fulfillment.

The Industrial Historian coordinates the technical and logistical aspects of research, fieldwork, data collection and analysis, and synthesis of data within project specific research designs and frameworks. Project responsibilities range from conducting archival research, photo-documentation, and survey mapping/recordation to the development and execution of site and building evaluations. The Industrial Historian conducts industrial structure, landscape, and artifact analyses, writes technical reports, and coordinates report preparation, delivering a variety of finished, professional work products with appropriate content and technical detail on time and within budget. Assigned projects primarily consist of locations with documented industrial resources (standing structures, archaeological sites, ruins, and landscapes) in a variety of urban, suburban, and rural settings.

Requirements:
• A graduate degree in history, architectural history, industrial history, or public history and at least four years of professional work experience that demonstrates a strong background in historic industrial resources.
• Knowledge and understanding of the laws and regulations relating to cultural resource management (CRM).
• Excellent organization, writing, and verbal communication skills.
• Demonstrated experience in the evaluation of industrial resources in accordance with National Register of Historic Places criteria, the completion of state inventory forms (historic buildings, structures, objects, sites), National Register nominations, HABS/HAER and state-level documentation, and the preparation of cultural resource management reports.
• Availability to travel for day and overnight trips, and occasional longer trips throughout the Northeast and Mid-Atlantic regions.

PAL offers competitive pay, a comprehensive benefits package, and a casual work environment that suits and rewards motivated self-starters who are willing to work hard, communicate effectively, and make a strong contribution to a professional team. Qualified applicants should send a resume, references, and a writing sample to Donna Callahan, Human Resources Director at dcallahan@palinc.com.

TWO DAMS DOCUMENTED ON THE QUINNIPIAC RIVER

Readers of this newsletter's Volume 37, Number 2 may have seen an article on removal of several Connecticut dams, part of a widespread effort to remove non-operating, often poorly-maintained dams in New England to restore river environments and fish passage. In many cases, these environmental improvements remove significant historic resources, often when a dam is a potential flood hazard or a poor candidate for fish passage via a ladder. Fish ladders or fishways, in use for over a century, vary greatly in effectiveness depending on design, species, and height of passage. They require maintenance, and will provide relatively limited benefits if installed on dams which are failing and unlikely to be repaired. Archaeological monitoring at two more recent Connecticut examples contributed new information on the wide variety of designs used by entrepreneurs at relatively small projects, usually without professional engineering assistance. These projects were completed by the Connecticut Fund for the Environment's Save the Sound program, with federal and local partners. Based on assessment studies or other information, the Connecticut State Historic Preservation Office concluded both dams appeared eligible for the National Register of Historic Places, and initiated steps leading to documentation studies at each site.

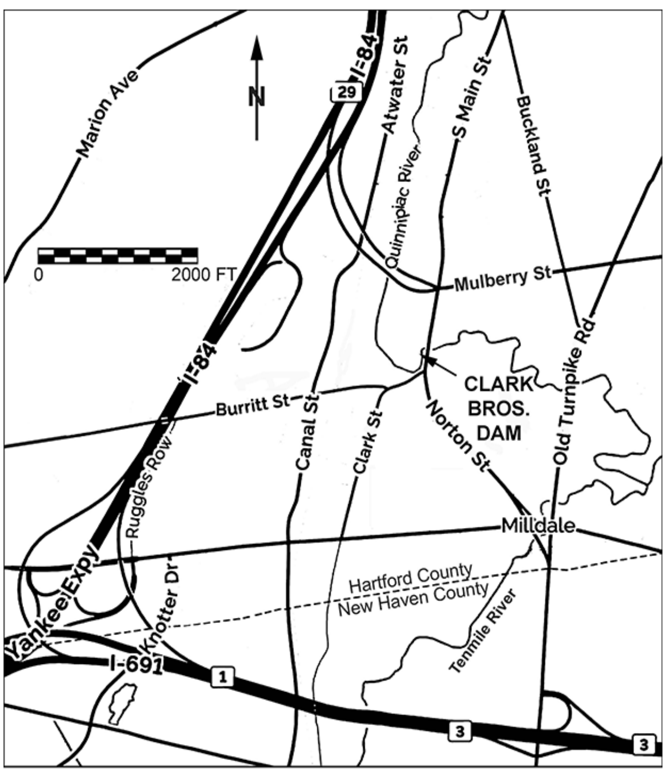


Figure 1. *Clark Bros. Dam location in Southington, CT.*

Dam Locations and Removal Project Objectives

Both dams are on the Quinnipiac River, which flows into Long Island Sound through a lowland of sandstone and arkose bedrock, with broad floodplains eroded by fluvial and glacial action. Clark Brothers Dam is on a relatively shallow-gradient reach of the river just west of South Main Street/State Route 10 in Southington, where the riverbed consists of deep sand and gravel deposits. The river here passes through broad, generally level floodplains of recent alluvial deposits with steep riverbanks approximately 5-20 feet above river levels. In the vicinity of Carpenters Dam, bedrock lies 5-10 feet below the riverbed and the relatively narrow floodplain, and rises sharply on the south and east side of the river at the dam site where bedrock is exposed. Bedrock configuration allowed for a late glacial ice dam to pond fine sediments in a broad area on both sides of the river. Late glacial and Holocene meltwater and streamflow created a riverbed of sand and gravel above the shallow bedrock (Figures 1-2).

Removal project objectives included restoring free-flowing river habitat, enabling passage of target anadromous fish species, and mitigating the danger of potential dam failure. The target species were alewife and blueback herring. Collectively known as river herring, these species form an essential

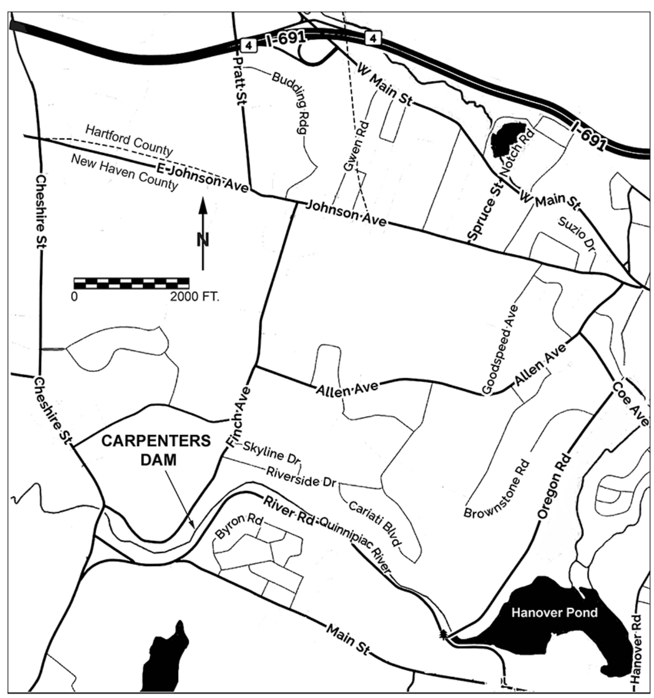


Figure 2. *Carpenters Dam location in Meriden, CT.*

part of the marine ecosystem. River herring are foraged by almost every creature in the marine environment, including cod, haddock, bluefish, tuna, dolphins, and whales, and are also eaten by gulls, ospreys, and eagles. Regional dam construction has greatly reduced the populations of river herring, which are now protected under the U.S. Fish and Wildlife Service Anadromous Fish Conservation Act. Removal of the Clark Brothers and Carpenters dam restores a natural migratory corridor for river herring and other anadromous and diadromous fish including gizzard shad, sea lamprey, and sea-run trout to the remaining 16.6 miles of habitat in the Quinnipiac River headwaters. The project was completed to compensate for, or restore, natural resources and associated uses lost or injured by discharge of hazardous substances from the Old Southington Landfill Superfund Site and the Solvents Recovery Service Superfund Site, also in Southington. The two dam removals expand and restore the range of migratory fish passage on the Quinnipiac River and reinforce other restoration efforts, including installation of a fishway downstream at Wallace Dam in Wallingford.

Dam Designs, Histories, and Documentation Results

Clark Brothers Dam

Clark Brothers Dam was a 50-foot-long overflow wier with a spillway at least 5.5 feet high and 5.5-6 feet wide, built primarily in 1868 with sandstone blocks and rubble which appeared unmortared prior to demolition. The east abutment consisted of mixed-size rubble masonry associated with a mid-19th-century factory building discussed below, and the west abutment was an approximately 12-foot-long, 7-foot-wide spillway extension built with partly-cut blocks. The dam had a slightly curved plan with the center extending more upstream, and a 6-inch-thick concrete cap at the upstream side of the crest and on the west abutment. A 1-inch-wide slot visible on top of the cap on the west abutment likely accommodated flashboards. Any footings at the bottom of the dam base were undocumented prior to removal. Earthen or rubble fill extended upstream of the spillway. The downstream face was slightly angled. There appeared to be a possible undocumented low-level outlet near the center of the dam, marked by two 6-inch-diameter concrete-filled metal posts and unmapped stone blocks extending upstream. On the west bank, a 30-foot-long row of large boulders extended downstream from the dam, and may represent the base of a former retaining or training wall base. On the east bank, the factory building walls include a large notch which may be the in-filled site of the building's tailrace. Beginning just upstream of the spillway on the east bank, there is a 40-foot-long pile of large concrete slabs which reflect the 1970s infill of a long mill headrace which once extended under Route 10 to serve the late-19th-century Clark Brothers plant, also discussed below (Figures 3-5).

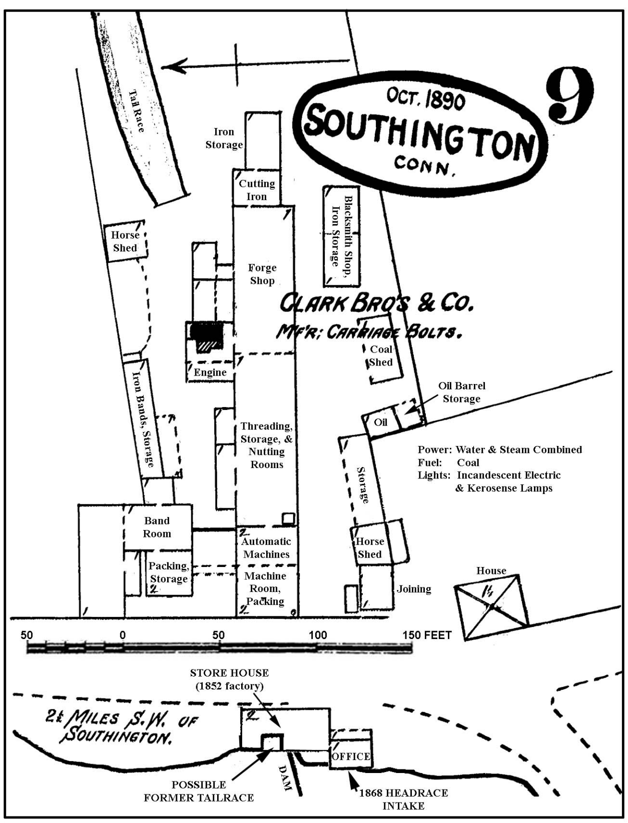


Figure 3. *Clark Brothers Plant No. 1 c1890 modified base image. Sanborn Map Company 1890.*

The growth of New Haven's carriage-making industry in the early 19th century required a vast amount of hardware including forged axles, many kinds of bolts, and other wrought-iron fittings. Southington became one of the largest American centers of carriage bolt manufacture, based initially on the work of Micah Ruggs and Martin Barnes who developed the first machine-made carriage bolts and nuts c1839-40. Their attempts to turn this work into a profitable venture failed by 1847, and they later worked for one of the most successful bolt and hardware companies in the state created by William J. Clark (1825-1909) and his brothers in the 1850s. After the Civil War, Southington became a center for the production of carriage fittings, nuts and bolts, pocket knives, sheet-metal (tinners') tools, bicycle parts, and a wide variety of other hardware. Several of the approximately half dozen large firms who thrived in this period continued operations into the 20th century, supplying the automobile industry, but the Clark Brothers operation was the most successful and at one time was the largest manufacturer of nuts & bolts in New England. Starting in 1839, at least eighteen bolt and nut companies began in and around Southington, of which only nine survived in 1904. By 1954 only the Clark Brothers were in business.

William J. Clark began his producing cold-pressed nuts in 1851 at an undocumented carding mill he purchased at the present dam location, in Southington's Milldale section. The carding mill was probably built c1812-25, with the mill building and an undershot water wheel on the east side of the Quinnipiac River. The mill burned in 1852 but was quickly rebuilt, as a 2-story factory with an adjacent forging shop. In 1854, Clark joined with his brothers Henry H. Clark (1829-

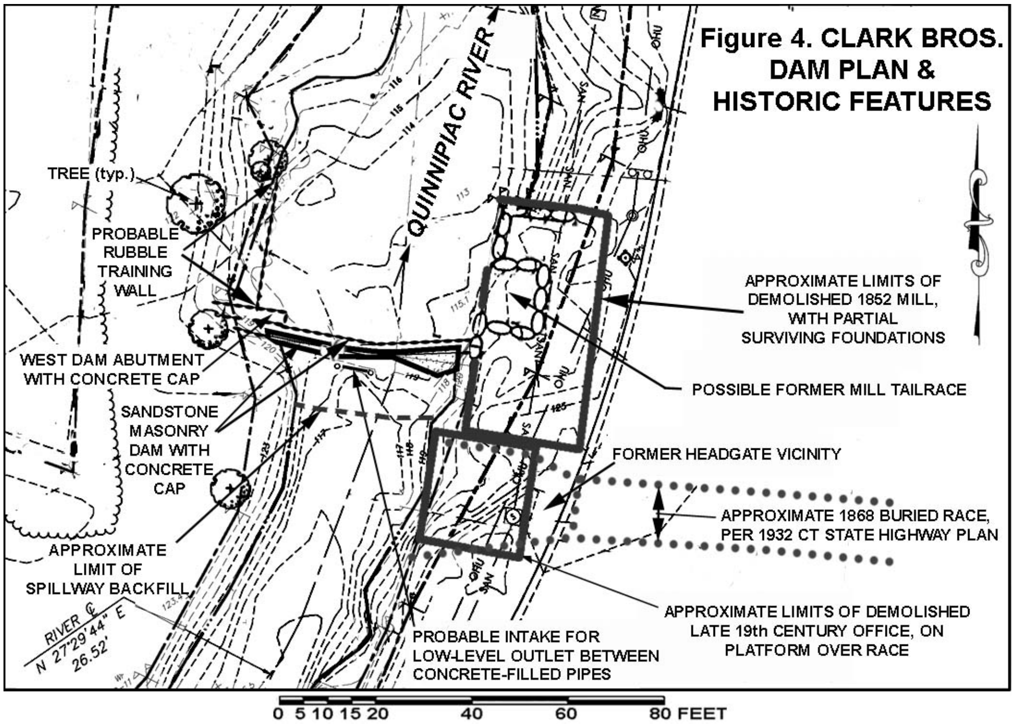


Figure 4. *Clark Bros. Dam plan and historic features.*

1906) and Charles H. Clark (1832-1925) to form William J. Clark & Company. The firm introduced specialized machinery to make hot-forged carriage, machine, and plow bolts as well as coach screws, but their waterpower was not sufficient to run the plant. In addition to the undocumented but limited head at the former carding mill site, the water privileges here were controlled by upstream factories with reservoirs, reaching the Clark's plant after being liberated from these impoundments. By 1855 they had moved some nut-making operations to two other leased spaces supplied with steampower. During the Civil War, William J. Clark & Company added artillery gus screws to their product line, improved their methods with significant innovations, and began planning for improvement of the power supply. In 1862, William J. Clark purchased rights to build a new dam with flashboards to be deployed during low water periods, but evidently did not exercise these rights until after the war, when the firm's assets allowed for a significant plant expansion. In 1868, the Clark company spent over $8,000 on a new dam, upstream from which a quarter-mile-long race was excavated east under South Main Street to re-join the river. The headrace began immediately south of the 1852 factory, and may have started in an earlier headrace used by that factory and its predecessor carding mill; the 1852 forging shop may have been removed at this time. The 5.5-foot-head produced by the dam and race helped power a 6-foot-diameter 28-hp Fourneyron turbine which doubled the output of water power, supplemented by a 38-hp steam engine. A new, larger wood-frame factory complex built above and around the race east of South Main Street allowed for consolidation of all operations. The 1852 factory remained in operation for a time, powered by a leather drive belt running above South Main Street, but by 1890 this factory was used for storage as the Clark complex expanded and a second steam engine was deployed. A small office was built by 1890 adjacent to the 1852 factory, on a platform over the intake to the headrace (Figure 3).

In 1871, William J. Clark sold his interests to his brothers, who re-organized the firm as Clark Bros. & Company. The plant burned in late 1893, and was rebuilt east of South Main Street in brick. The 1852 factory was demolished or burned in this period, and was never replaced. In 1903, the company was incorporated as Clark Brothers Bolt Company, Inc., with Charles H. Clark as president. In 1911, Clark Brothers moved all their operations to a newer plant on Canal Street near the railroad (Clark Brothers Factory No. 2), where they remained in business until 1987. By 1923, they sold the older complex to the Hartford Battery Manufacturing Company, which in the 1930s was succeeded at the site by Alsop Engineering Corporation. Waterpower was abandoned in the later manufacturing operations, and by the 1970s the headrace was deteriorating and threatening the integrity of Route 10 (South Main Street). The Department of Transportation filled in some of the race as part of road reconstruction, including the intake now blocked with large concrete slabs. The 1893 Clark Brothers Factory No. 1 plant was demolished c2000, removing virtually all visible traces other than the dam of a resource listed on the National Register of Historic Places. Partial rubble foundations immediately downstream of the dam on the east side of the river appear to reflect a corner of the 1852 factory, as well as the infilled tailrace of that plant which may date to the earlier, undocumented carding mill. The mill foundations could include buried components of the earlier waterpower system used by the carding mill and the pre-1868 Clark Brothers plant (Figures 3-4).

Demolition included removal of the spillway for its full

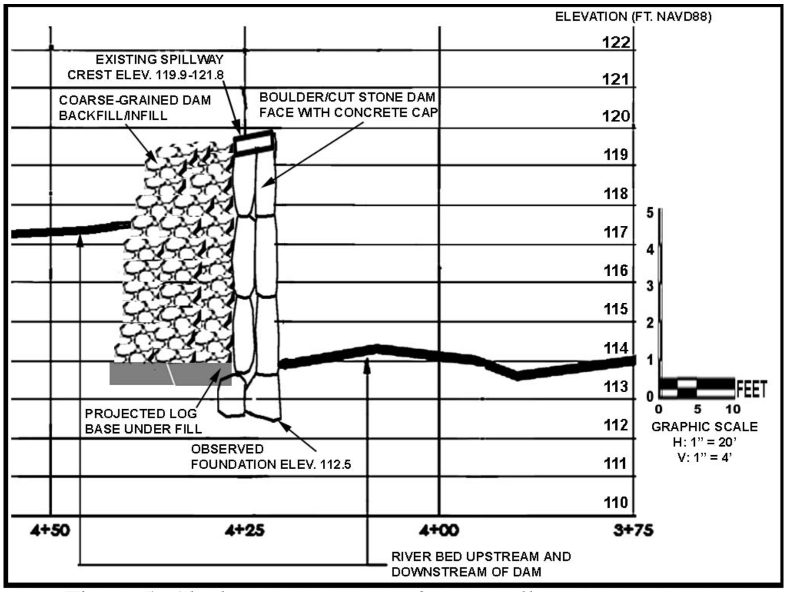


Figure 5. *Clark Bros. Dam west-facing spillway cross section.*

height to the extent possible, with retention of the west abutment, the row of boulders downstream of that abutment, and the masonry walls and concrete slabs on the east bank. These removal limits avoided any effects on cultural resources associated with the Clark Brothers complex other than the dam. High water conditions in early August 2016, and the spillway's relatively low height and short distance from face to upstream end of backfill, precluded any attempt to de-water the structure during demolition. It was not possible to observe all removed components in situ, although as the water level dropped through the initial breach it was possible to observe spillway face, crest, and backfill conditions. Boulders or cut stones in the spillway face appeared to be two courses deep totaling approximately 5.7 feet in width, with exposed face stones 2-2.5 feet high and 1.5-3.5 feet long with the longest stones at the spillway top. There was much concrete observed between the large spillway face stones and in at least the uppermost backfill. Spillway backfill consisted primarily of large boulders or sandstone fragments, and was revealed to extend approximately 20 feet upstream of the spillway face. Spillway bottom elevations, where very large boulders were observed behind the face, were obtained below water; total spillway height was approximately 7.5 to 9.5 feet. Excavation behind the spillway and under the backfill revealed two types of disarticulated dam components:

- A large number of 7-to-8-foot-long, 8-inch-diameter pine logs, each with one long beveled end, were excavated below spillway backfill. There were no spikes or notches in the logs, suggesting they were laid end to end on the riverbed, most likely parallel to river flow which as discussed below was common in some dams built in soft-bottomed streams. There was no evidence that the logs extended downstream of the spillway face, but project excavation did not require much work in that area.
- Two-foot high, 1-inch-thick steel plate fragments, up to 3 feet long and with a lip at one end, appeared to come from behind and below the spillway center, and were likely part of an undocumented low-level outlet.

Dam monitoring data indicated at least two and perhaps three undocumented episodes of spillway construction. It is not known if any of the early 19th-century carding mill dam was retained during the 1868 dam construction project, but as the two structures were at approximately the same location it is possible the log base for backfill dates to the carding mill built c1812-1825. The spillway base of large boulders may also be from the carding mill dam. The concrete observed in the face, and most or all of the backfill, may date to the 1868 construction episode. Portland cement concrete was common in American dams by the third quarter of the 19th century. As the concrete aggregate observed on Clark Brothers Dam stones appears crushed, however, it is possible the concrete including the cap was added later in the 19th century or in the 20th century. Aggregate used in the earliest American applications of Portland cement was often much coarser. It was not clear during demolition how much of the backfill was earth rather than boulders or rubble. The steel fragments and concrete-filled steel pipe suggest undocumented dam modification in the 20th century, apparently with a low-level outlet as noted above. Installation of an outlet would have required considerable excavation into the backfill and through part of the face, and it is possible that the concrete and much of the rubble backfill was added during this hypothetical episode.

Carpenters Dam

Carpenters Dam was an approximately 120-foot-long overflow weir. As discussed below, an impoundment was first built at or very near this location in the mid-18th century. Pre-demolition inspections suggested the undated extant structure originally consisted of an approximately 7-foot-high, 6-to-8-foot-wide flat-crested weir of unmortared sandstone blocks and rubble, with the southeast (river right) end tied to exposed bedrock in an undocumented manner. No bedrock was visible at the opposite end of the dam, suggesting a drop in bedrock elevation from southeast to northwest. Both faces of the exposed masonry section appeared to be nearly vertical. The bottom elevation was also undocumented, but appeared to rest on a grid of timbers and large rocks visible in the water at least 4 feet upstream of the dam. There appeared to be remains of a former low-level outlet 20 feet from the right end, with a wall of small rubble extending upstream approximately 8 feet from the outlet's west side, and a 4-foot-wide opening in the weir bridged by a single large block. At least the northern 74 feet of the weir was later raised 3.5 feet with a section of Portland cement concrete, poured over sandstone blocks smaller than those in the

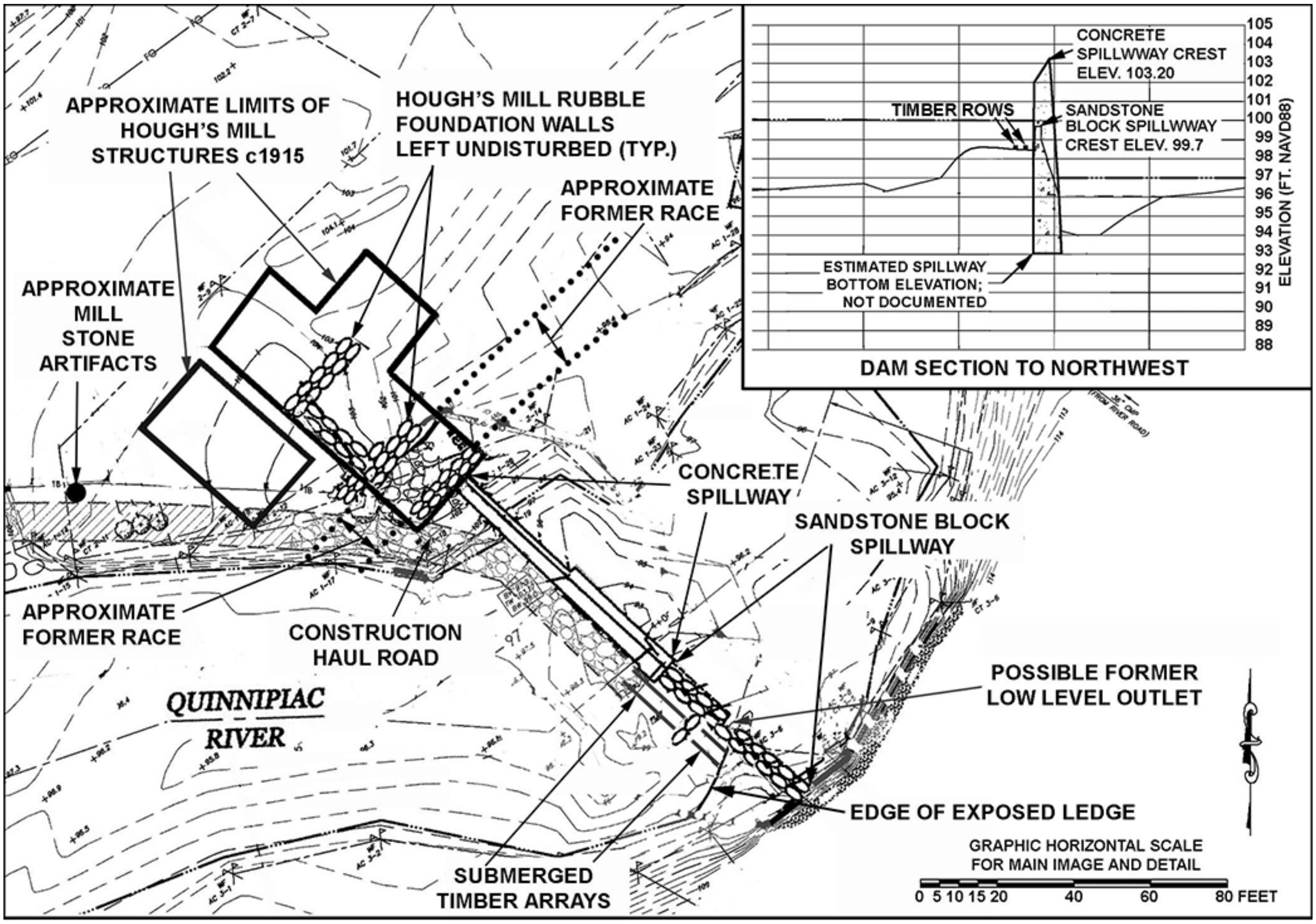


Figure 6. *Carpenters Dam plan, historic features and cross section.*

original extant structure. Approximately half of the concrete spillway section at the north end of the weir was 5 feet wide with a slightly-angled downstream face, while the 8-foot-wide remainder of the concrete section had an ogee-type downstream face with a slightly wider section at its southeast end suggesting a possible former finished edge which has since eroded. The higher concrete section obscured the north-west (river left) end of the dam, which appeared to be tied to unmortared rubble walls representing part of the Hough's Mill site discussed below. Two of these walls define a former race approximately 10 feet wide (Figures 6-10).

Located just downstream of the Cheshire border with Meriden, Carpenters Dam is far from the centers of either municipality. The name Carpenter is not associated with any of the documented mill operators, and may derive from a local family who lived in Cheshire near the dam after all industrial activities had ceased. By the 1760s, a dam here provided power for a small complex of saw, grist, and fulling mills established by the family of Ephraim Hough on the north side of the river adjacent to the dam. The mill buildings and adjacent property were known as Hough's Mill(s) into the 20th century, although the property changed hands several times after the Hough family sold their interests c1784-91. At different times into the early 20th century, a grist mill, saw mill, cider mill, blacksmith shop, and gravestone polishing shop operated at the dam or elsewhere on the property. By 1907 there were two buildings north of the dam, the larger of which had a small water turbine and electric generator. The short race running just north of the dam ran through the larger, 2-story mill, most likely representing the waterpower channel for at least the grist, saw, and fulling mill operations from the mid-18th century (Figure 6).

The last operator of Hough's Mill was George C. McKenzie (1858-1913), who purchased the property with a partner in 1890. In 1907, he sold the water rights to the New Haven Water Company, and leased the 2-story mill with its hydro-electric equipment to the American Manufacturing Company, which made brass goods. The lease included a smaller undocumented building immediately west of the mill, which had been owned by J.W. McKay. American Manufacturing evidently built a new factory near the Waterbury-Meriden branch of the New York, New Haven & Hartford Railroad, northwest of the dam, serviced by a 600-foot-long canal which left the river upstream of the dam. The possible closure of the factory after 1916 may relate in part to the end of most rail freight service on this branch in 1917. The canal does not appear on any available maps made prior to 1915, and may have been built to supply additional hydroelectric

Figure 7. *View south of rubbish-filled timber framing upstream of sandstone block and rubble spillway at Carpenters Dam.*

power to the factory with water perhaps leased from the New Haven Water Company. At least the northern two thirds of the dam, with a concrete crest poured over small sandstone blocks, was likely raised by George McKenzie or American Manufacturing c1890-1910. As discussed below, the concrete work may represent a repair. Water rights issues may have restricted a full-length raising of the spillway, either because of undocumented rights of downstream users prior to 1907, or due to the water rights sale to the New Haven Water Company.

The City of Meriden purchased the property associated with Hough's Mill in 1914. By 1934, the c1907 factory and the Hough's Mill buildings appear to have been demolished. There are no visible signs of the 20th-century factory or the upstream end of the 20th-century race. Based on the dimensions of the larger Hough's Mill building noted in the 1907 lease to the American Manufacturing Company, the undated rubble walls adjacent to the dam are part of that structure. The race at the ruins could include buried materials from one or more generations of waterpower components such as wheel pits.

Project actions in August 2016 removed almost all of the dam, but left intact approximately 5 feet of the northwest (river left) end of the spillway as well as all the rubble mill walls. High water conditions in August 2016, and the spillway's relatively long length with an outlet close to the southeast end, inhibited de-watering and documentation of the structure during demolition. A cross-section of concrete spillway components, including reinforcing materials discussed below, was documented. It was not possible to observe all removed components in situ, or to confirm that the bottom of the spillway was removed. Surface bedrock was fully exposed at, and just upstream of, the southeast end of the dam. Removed sandstone blocks near the northwest end of the dam were arrayed two blocks wide, and were 5-6.5 feet long, 32-36 inches wide, and 16-20 inches high. Many of these blocks had notched ends, and steel pins 1-1.5 inches in diameter set in 4-6-inch deep holes 42 inches apart, indicating the unmortared masonry spillway was tightly fitted in this section of the dam. Blocks southeast of the concrete spillway appear to have been more variable in size, and may not have been notched or pinned. Between the end of the ogee-section concrete spillway and the possible low-level outlet, large pieces of sandstone rubble were visible behind the cut sandstone and immediately downstream of visible timbers. The presence of some mortar or concrete on the top of this latter section, visible sandstone blocks in the river just downstream of this section, and a slight difference in masonry elevation on either side of the possible outlet all suggested the possibility that part of the masonry spillway had been partially breached (Figures 7-8).

The reduced water elevation during demolition allowed for more observation of timber framing behind the spillway, but the timbers and associated rubble remained underwater and could not be carefully measured in place. Disarticulated timbers and boards brought to the staging area, in conjunction with photographs and field observation, allowed for some reconstruction of likely framing construction and function. Timbers included 5-to-12-foot-long pieces, either sawed members 8-9 inches square or logs 7-12 inches in diameter. At least a few had iron spikes 1-1.5 inches in diameter. The timbers appeared to be set parallel to the spillway in two rows approximately 3.6 feet apart, beginning approximately 1 foot upstream of the spillway rubble backing and 1-1.5 feet below the top of the masonry. Large rubble lay between the timbers, and in at least some places especially near the high bedrock at the southeast end of the dam, the timber appeared to lie atop a layer of 12-inch wide boards to form a simple one-cell-wide structure. It could not be determined if the timber framing extended beneath the masonry, or if it extended the full length of the spillway. It is possible the

Figure 8. *View southwest of possible low-level outlet (left center), possible breached section with rubble backing (center), and end of ogee-type concrete spillway section of Carpenters Dam.*

rubble-timber feature was set on extremely shallow bedrock to support and protect the spillway masonry, but was not installed in the same way near the opposite end of the dam which may have had a deeper sand, gravel, and cobble bottom (Figures 4-7).

Removal of concrete spillway materials confirmed that the concrete was poured over the sandstone spillway blocks, which became visible beneath the concrete, and that smaller, mixed-size sandstone blocks were added atop the earlier masonry prior to concrete installation. The concrete had aggregate of large-sized crushed sandstone, and was reinforced approximately 2 inches below the spillway crest with a single horizontal row of steel T-rail laid sideways. The 3.75-inch-high rail had a 4-inch-wide base and 2-inch wide top, and was most likely used for street railways. There was also some vertical reinforcement of widely spaced 3.5-inch-diameter metal pipe set in 12-inch-diameter concrete bases, visible on both sides of the spillway during demolition (Figures 9-10).

As at Clark Brothers Dam, Carpenters Dam monitoring data indicated at least two and perhaps three undocumented episodes of spillway construction. The apparent contrast between the sandstone blocks in the two main spillway sections -- with notched, drilled, and pinned blocks visible only below the concrete spillway -- suggests that the spillway prior to the concrete construction was built with different designs relative to riverbed foundations, or perhaps more likely that the north half of the spillway failed and was rebuilt with pinned blocks prior to concrete construction. The composite nature of the section with the concrete overlay appears extremely unusual among examples of concrete spillways, and suggests that the concrete was added sometime after the pinned-block masonry section was built. The crushed stone aggregate as well as the rail reinforcement suggests the concrete spillway components were added later in the 19th century or in the 20th century.

During creation of a construction access track on the north side of the river, two large mill-related artifacts were observed approximately 80 feet upstream of the dam, and were moved to the staging area for documentation and measurement. They are currently arrayed on the Quinnipiac River Gorge Trail near the Hough's Mill site, and may be accompanied by future interpretative displays. Based on consultations with a number of geologists, historians, and millstone experts, both were almost certainly associated with operations at Hough's Mill, rather than the 20th-century American Manufacturing Company to the west. The first piece was a 52-inch-diameter, 17-inch-thick semi-circular piece of quartzite with a rounded upper surface and a flat lower surface. The quartzite may have come from northeast Connecticut. It appears the entire piece was carefully cut almost exactly in half, perhaps to facilitate removal from the mill during a demolition or millstone replace-

Figure 9. *View southeast of Carpenters Dam concrete spillway with angled and ogee-type downstream faces, and crushed stone aggregate in exposed section.*

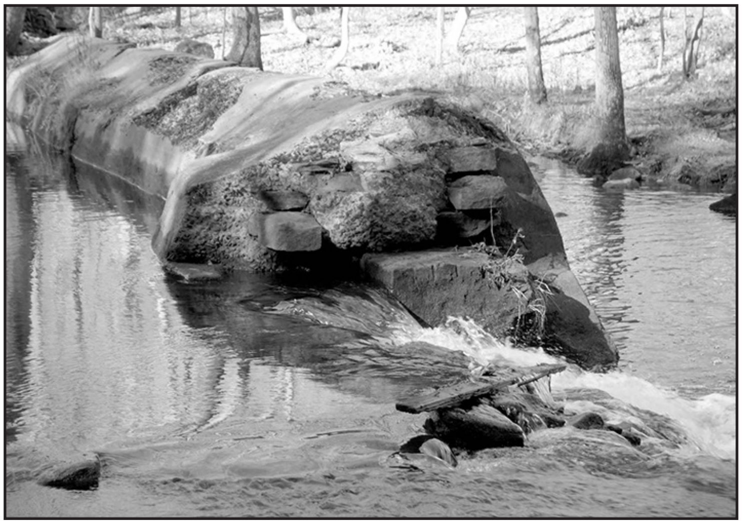


Figure 10. *Carpenters Dam detail northwest of eroded end of ogee-type concrete spillway and sandstone block fill.*

ment episode. At the center was the truncated remnant of a 9-inch-diameter hole with two 1-inch-deep, 4-by-3-inch rectangular slots or notches. The notches suggest this artifact was half of a gristmill runner stone, which turned above a second, stationary horizontal headstone. This artifact is an incomplete example of a common component of milling technology (Figure 11).

The second artifact consists of a 24-inch-diameter, 6.5-inch-thick piece of non-local fine-grained quartz sandstone with silica-cemented quartz particles, mounted on a 2-inch-diameter metal driveshaft with one end 10 inches from the stone. Deteriorated, hardened 2-inch-thick leather washers flanked the stone, presumably to inhibit slippage while the stone was being rotated. Part of the stone edge has broken off, and the remaining perimeter surface has numerous, mostly transverse crevices. These crevices probably represent the effects of post-industrial-use erosion by acidic rainwater. This artifact was most likely a grindstone, commonly made of sandstone, and found in many mills for sharpening knives and other tools by the miller and customers waiting for ground grain. Grindstones also served to touch up tempered steel mill picks, required to sharpen millstone furrows, until the tempered area was ground away. As the sharpening passed the tempered section of the pick, the steel required sharpening and re-tempering by a blacksmith. The presence of a blacksmith operation in Hough's Mill may reflect the manufacture and repair of the picks needed to sustain the milling (Figure 11).

Significance of Documentation Findings

The Clark Brothers and Carpenters dam spillways are examples of masonry overflow wiers, which must resist potential undercutting of the spillway by falling water or partial vacuum conditions created between falling water and the spillway face, as well as upward pressure on the upstream face which could lead to sliding in sandy streambeds. Potential undercutting on the downstream face is greatly reduced on rock foundations, requiring less if any protection relative to more vulnerable spillways on sand, gravel, or cobble streambeds. At Clark Brothers Dam, the upstream face problem was addressed primarily by the backing of rubble and perhaps earth on what appears to have been a simple timber mat, often seen at dams with similar streambeds. At Carpenters Dam, the rock-filled timber frame upstream of the dam's southeast half -- built on or close to bedrock -- protected against upward water pressure, and may have served to support spillway blocks although no data on spillway footings could be obtained. These were common vernacular solutions to the problem of upstream pressure. The original northwest

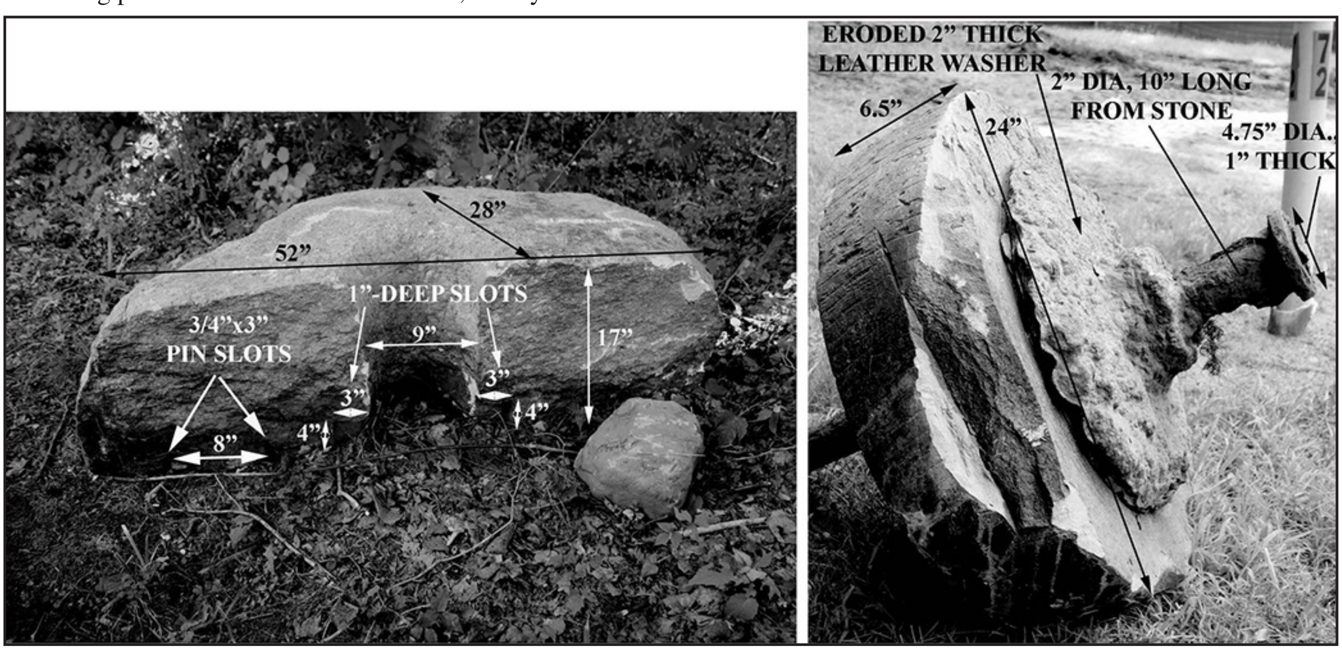


Figure 11. *Hough's Mill artifacts near Carpenters Dam: truncated runner stone (left) and probable grindstone (right).*

half of Carpenters Dam may have been more vulnerable to upstream and downstream undercutting or pressure issues, and may have failed as discussed above although there is no information on upstream defensive structures.

No aprons or other protective downstream structures were observed at either dam. In both cases the relatively high water during demolition might have obscured such structures. When timber mats were deployed as at Clark Brothers Dam, some late 19th-century sources on dam design recommended spillway construction near the upstream end of the log bed, leaving most of the bed to serve as a downstream apron. In the absence of such an apron at this dam, there may have been gradual deterioration of the face, and it is possible the steel plates suggesting a low-level outlet represented an attempt to reduce upstream pressure on the face without having to reconstruct the entire dam. The survival of the Clark Brothers Dam into the 21st century in relatively good condition may attest to the success of an added low-level outlet.

Like many contemporary mill dams in the northeastern United States, the two dams on the Quinnipiac River were almost certainly first designed and built without professional engineering assistance. Monitoring revealed that vernacular design may have left the 18th- or 19th-century spillway(s) somewhat vulnerable. At Carpenters Dam, vernacular design may include a rare example of concrete construction. The length and design of the concrete spillway section appear unusual. By the late 19th century, spillways with ogee-type downstream faces were a well-established design used to deter undercutting of the structure. Ogee-shaped crests reduce head and maximize discharge, but require armoring downstream to reduce undercutting. Armoring may include bedrock riverbeds or aprons of timber or concrete. No such armoring appeared visible at Carpenters Dam. Most examples of ogee-type spillways in early 20th-century engineering are structures extending the full length of a dam other than gateway openings, with uniform concrete-faced stone masonry or all-concrete construction. The nature and extent of steel reinforcement in these examples is not well documented. There are also some examples of concrete spillways built over earlier failed stone masonry structures. Unlike these examples, the Carpenters Dam concrete spillway appears to have been constructed in one episode with reinforcement near the upper edge and at some points along the sides, with two different cross sections and with the concrete poured over what appear to be loose multi-size pieces of sandstone. If the concrete work was installed to protect the section of the dam without good rock foundations, the two concrete cross sections, extensive use of large, loose fill, and apparent absence of a downstream apron suggest a strong desire to minimize cost, with the wider ogee-type section perhaps built where the spillway seemed most vulnerable to flood damage.

Principal References:

Atwater, Francis
1924 *History of Southington, Conn…..* Meriden: Journal Press.

Barrows, H. K.
1943 *Water Power Engineering*. 3rd edition. New York: McGraw-Hill Book Company, Inc.

Bunt, Christopher
2009 *Fishway Evaluations: Past, Present and Future*. Presentation at American Fisheries Society, Nashville, TN, August 31 2009.

Clark Bros. Bolt Company
1913 Manufacturers of Bolts, Nuts, Screws, Rivets, Washers. Catalog.
1954 100th Anniversary 1854-1954.

Gillespie, Charles Bancroft, comp.
1906 *An Historic Record and Pictorial Description of the Town of Meriden, Connecticut… .* Meriden: The Journal Publishing Co.

Gordon, Robert B., and Michael S. Raber
2012 Meeting the Challenge of a Renewable Energy Resource: Small-Scale Milling and Manufacturing in Southern New England. *Industrial Archeology* 36(2): 5-24.

James Leffel & Co.
1881 *Leffel's Construction of Mill Dams*. Springfield, OH.

Magilligan, Francis J.
2016 Dartmouth-Led Study Finds Removal of Dams in New England Can Help Reconnect River Networks and Increase Watershed Resilience. Available on World Wide Web at http://www.dartmouth.edu/press-releases/watershed-resilience-06716.html

McKee, Harley J.
1973 *Introduction to Early American Masonry: Stone, Brick, Mortar, and Plaster.* National Trust for Historic Preservation and Columbia University.

Raber, Michael S.
2016 Archaeological Monitoring and Documentation for Removal of the Clark Brothers Dam on the Quinnipiac River, Southington, Connecticut. Prepared for Connecticut Fund for the Environment. South Glastonbury, CT: Raber Associates.
2017 Archaeological Monitoring and Documentation for Removal of the Carpenters Dam on the Quinnipiac River, Meriden, Connecticut. Prepared for Connecticut Fund for the Environment. South Glastonbury, CT: Raber Associates.

Sanborn Map Company (and predecessors)
1890,
1895 Insurance Maps of Southington, Connecticut. New York.

Timlow, Heman R
1875 *Ecclesiastical and other sketches of Southington, Conn*. Hartford: The Case, Lockwood and Brainard Co.

Wegmann, Edward
1918 *The Design and Construction of Dams*....6th ed. New York: John Wiley and Sons.

Personal Communications
Robert B. Gordon, Professor Emeritus, Yale University Department of Geology and Geophysics

Charles D. Hockensmith, President, Kentucky Chapter, The Society for the Preservation of Old Mills

Christoph Henning, Schall & Staub Enterprises, Berlin, Connecticut

John Lovett, Owner, Falls Mill, Belvidere, Tennessee

Brian Skinner, Professor Emeritus, Yale University Department of Geology and Geophysics

Ivins Smith, Cooper Mill, Chester, New Jersey

Laura A.S. Wildman, Princeton Hydro Engineering, PC

Paul Woodworth, Princeton Hydro Engineering, PC

Michael S. Raber
Raber Associates

Anna Marshall
Green Projects Associate
Save the Sound, a project of Connecticut Fund for the Environment

---

Industrial Archeology along the Housatonic Railroad

The Housatonic Railroad line in western Connecticut has one of the densest concentrations of historic railroad features in the state, including at least ten station buildings ranging in date from 1837 to 1914, numerous historic bridges and culverts, and the 1840 Hawleyville rock tunnel in Newtown. In anticipation of rehabilitating or replacing four railroad bridges in a 29-mile stretch between New Milford and Canaan, the Connecticut Department of Transportation prepared written and photographic documentation to serve as a permanent record of the affected bridges. The bridges include two stone arches, an early 20th-century rail-top, and a 1933 timber-pile trestle. Collectively, the bridges typify the standard railroad bridge engineering of the 19th and early 20th centuries.

The Housatonic Railroad, or "Ousatonic," as it was spelled in the company's 1836 charter, is one of Connecticut's older rail lines. The concept was that the route would link Bridgeport with an east-west rail line then under construction in Massachusetts. The engineer for the line's construction was Roswell B. Mason (1805-1892), who is perhaps best known as the mayor of Chicago at the time of that city's Great Fire. Work on the Housatonic Railroad began in 1837 and reached the state line in late 1842, with the Massachusetts portion completed a few months later. For a time, it was the only all-rail route between New York City and Albany. The railroad line sustained the area's extractive and manufacturing industries and furthered the commercial development of places like New Milford and Pittsfield. Agriculture was also important; in the post-Civil War period, the railroad carried 100,000 quarts of milk a day to consumers in the New York metropolitan area. The Housatonic Railroad absorbed several other short lines before being consolidated into the New York, New Haven, and Hartford system in 1892. The present Housatonic Railroad was formed in 1984 to operate the state-owned portion between New Milford and Canaan. The company later extended its operations to Danbury and Hawleyville.

The four affected bridges are:

- ***Bridge 9200R,*** carrying an unnamed stream through the railroad embankment by means of a 6' stone arch and a 42" cast-iron pipe. The masonry is typical of the many stone bridges along the line: carefully cut voussoirs, with the spandrels constructed of rough courses of irregularly shaped pieces. The arch portion of the bridge could date to the line's original construction (1837-1842), or it could represent part of the extensive rebuilding of the line that occurred in the 1870s. The cast iron pipe was added sometime between 1901 and 1915.

- ***Bridge 9204R,*** a concrete-encased rail-top built in 1913. The underside of the structure is submerged by the waters of the surrounding swamp and so could not be observed. Typically, such structures consist of multiple parallel lengths of re-used T-rail spaced closely together or even having the flanges butted, with the whole encased in a poured-concrete monolith. The overall length of the structure is 14', continuous over a center pier. Rail-tops were an inexpensive and yet robust expedient for small bridges that was adopted by railroads throughout the country in the early 20th century. By combining used rail with concrete, the rail-top had very little material cost, was well within the capabilities of any maintenance-of-way department, and resulted in a reinforced-concrete slab of immense load-bearing capacity with little need for ongoing maintenance. The characteristics and advantages of rail-tops were analyzed by Alfred Reichmann in the January-February 1901 issue of the *Journal of the Western Society of Civil Engineers*.

• ***Bridge 9206R,*** a 16' stone arch that carries Cobble Brook in Kent under the rail line. The arch rings are carefully articulated, with the spandrels constructed of large, irregularly shaped stone. Some, but not all, of the voussoirs are rusticated, that is, they have smooth borders outlining a quarry-faced surface. The downstream (west) opening is partly lined with concrete. At one time the bridge also accommodated a narrow farm road. Like Bridge 9200R, it cannot be precisely dated to either the railroad's initial construction or its subsequent rebuilding.

• ***Bridge 9223R,*** a six-span timber-pile trestle, 73' long overall, over the Hollenbeck River in Canaan. Dated 1933 in the Penn Central bridge log, it is at least the third wooden bridge on the site (earlier ones were built in 1892 and 1908), and discarded timbers on the river banks suggest that the bridge's components have been subjected to a longstanding program of replacement-in-kind.

Of the four bridges, the 1933 timber trestle is arguably the most intriguing. Why were railroads still building wooden bridges at this late date? The answer must be that in cases where timber piles could be driven into highly stable soils, their low cost and ease of construction made an irresistible combination, particularly as most railroads after 1900 were only intermittently profitable. In 1905, the American Railway Engineering and Maintenance of Way Association issued standard plans for this exact type, known as a ballasted-floor trestle. Bridge 9223R is consistent with those plans in every way, confirming that railroads did in fact follow closely the model proposed by the Maintenance of Way Association.   The trestle had a Cooper rating of E60 in the railroad's ca.1960 capacity list, so it could not have been considered substandard. While there is no comprehensive survey of railroad trestles in Connecticut, anecdotal evidence suggests that this once-common type has become extremely rare.

Immediately upstream from Bridge 9200R are the remains of a small sawmill that operated from the 1840s through ca. 1900. Among the features at the site are a 13'-high stone dam; fieldstone foundations for the sawmill, including a narrow wheelpit; and foundations for an associated dwelling house. Because of the possibility of damage from construction activities, the features were photographed, measured, and mapped on a site plan, but no further subsurface investigations were undertaken. During the walkover of the dwelling house portion of the site, however, artifacts relating to domestic life were clearly visible on the surface, including sherds of plain and transfer-printed whiteware, yellowware, and domestic salt-glazed stoneware, as well as medicine and

Downstream (west) side of Bridge No. 9200R, a 6'-span arch, with the 42" iron pipe at the right dating to the early 1900s. The concrete liner within the arch was added about 20 years ago.

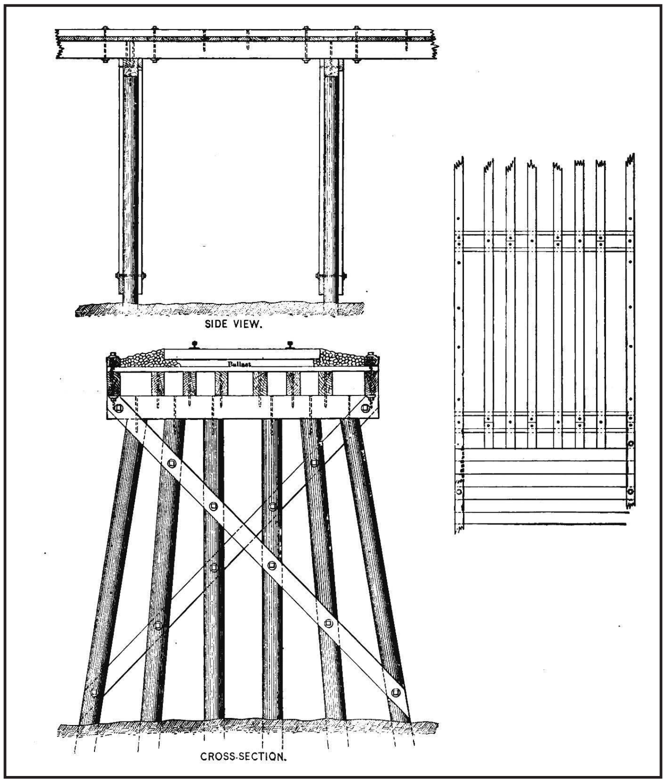
Upstream (east) elevation of Bridge 9206R, a stone arch of 16' span.

Downstream (west) side of Bridge 9223R, a timber-pile trestle built in 1933.

liquor-bottle glass fragments. These materials are consistent with an occupancy dating to the second half of the 19th century.

Known owners/operators of the sawmill were Ebenezer Garlick (ca.1790-1864); his sons, Henry and Seymour; his daughter, Emeline Garlick Hendrix; her husband, Clinton M. Hendrix; and his nephew, Clinton O. Hendrix.

Bruce Clouette
AHS Cultural Resource Management



Standard plan for a ballasted-floor trestle, as recommended by the Committee on Wooden Bridges and Trestles of the American Railway Engineering and Maintenance of Way Association, March 1905. Bridge No. 9223R follows this design in nearly every detail.

Dam at the upstream (east) end of the Garlick Sawmill site.

Foundation remains of the sawmill, with what is interpreted as a wheelpit at the left.