Society for Industrial Archeology · New England Chapters

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NNEC-SIA President's Report

The spring tour of Franklin, N.H.'s former mills and mill sites occurred on a nice spring day. Much to my surprise, the morning speaker and tour leader, Glen Morrill, was an old college fraternity friend whom I hadn't seen in over 30 years. You never know whom you might meet on our tours! A slide presentation on the Laconia Car Company took place after lunch, followed by a tour of the Belknap Mill. A few members then walked around the site of the Car Company plant observing the remaining brick buildings. David Dunning, who organized the day for us, has a far more informative description of the day in this issue.

In last spring's president's report, I discussed the need to reverse our deficit of approximately $500 per year. The idea was to discuss the matter at the spring meeting, but due to time constraints, a misunderstanding, and late lunches, a full meeting did not take place. However, we did discuss the issue informally among some members, and a few ideas were brought up. Overall most preferred to increase membership $5 per year rather than charge a tour fee. If this takes effect (not at this time) we hope to provide additional benefits to members by letting them know through email of related events that may be of interest to them.

This fall we did not have a fall meeting and tour due to the National SIA Tour taking place in Vermont. The final decision on raising membership rates to reduce the deficit will be discussed at next spring's meeting. No specific location has been chosen, so if any members have a suggestion, please let one of our chapter officers know about it. See you then.

Dave Coughlin
President, Northern New England Chapter

NNEC-SIA Spring Tour Report
Franklin & Laconia, NH

On May 22, 2010, members from both the Northern and Southern New England chapters toured industrial sites in these two central New Hampshire towns. Although the weather was good, turnout was very light. Those who couldn't or didn't get there missed a good tour.

Franklin had two diverse industries, textiles and paper. In the mid 1800's, the Stevens mills made woolen and cotton textiles. The Aikens made hosiery. The presence of the railroad, coupled with the availability of hydropower, served as a catalyst for a remarkable period of industrial growth as it provided for secure and speedy transportation of raw materials and finished products between Franklin and its markets. The civil war took many of Franklin's young men, but also brought forth many new orders. Franklin saw tremendous growth between 1850 and 1900. With the turn of the century, though, times changed; the mills began to close and relocate. The Stevens mill was the last to close, in 1970.

While the Winnipesaukee River powered the textile mills on the west side of Franklin, upstream it powered several paper mills. Our tour began with a textile mill picture show in the library and then proceeded on foot upriver to view the many remnants of the paper mills. At one point we pondered and together speculated about the curious, short, identical s-curves in train rails, concluding that they must be the result of when teens burned the wooden covering of the bridge's underpinnings. We tried to figure out just why they curved the way they did. The fire must have started here…

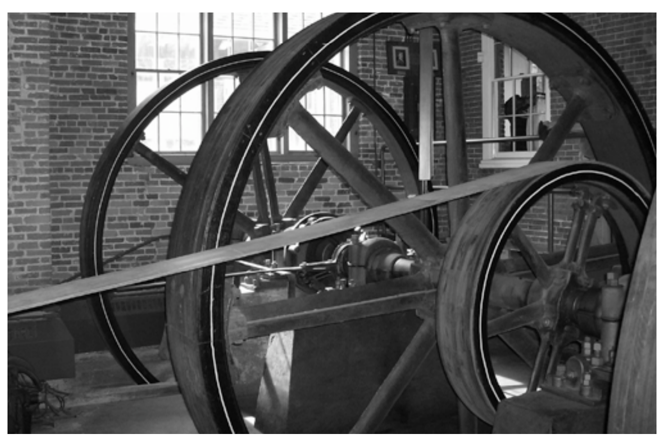
Next we walked downstream to the historic Franklin Falls Hydroelectric Station, which is still generating power. The Larter family's restoration of this site is a wonderful example of preservation and sustainability of industrial archeology. The value of historic Franklin Falls Hydroelectric Station is very important for today's carbon-free clean energy needs.* This one historic site, during the last 25 years, has offset (or not produced) 120,000 tons of the toxic air pollutant carbon dioxide and such airborne toxins as nitric oxide, sulfur dioxide and mercury into the local atmosphere as it would if the kilowatts were produced by coal.

After lunch we motored to Laconia for a video presentation about the historic Laconia Car Company. They built freight and then passenger rail cars. Laconia Car Company was the largest manufacturer in the area in the mid-1800's, employing over 500 men. They had a reputation for building high-quality railroad cars. The business closed in 1923 as the automobile age took over.

From the library we walked a short distance to Belknap Mill, the oldest unaltered brick textile mill in America. This mill is especially interesting because they designed and built most of the special equipment they needed right in Laconia at neighboring machine companies, the most prominent of which was the famously inventive Aiken family's shop.

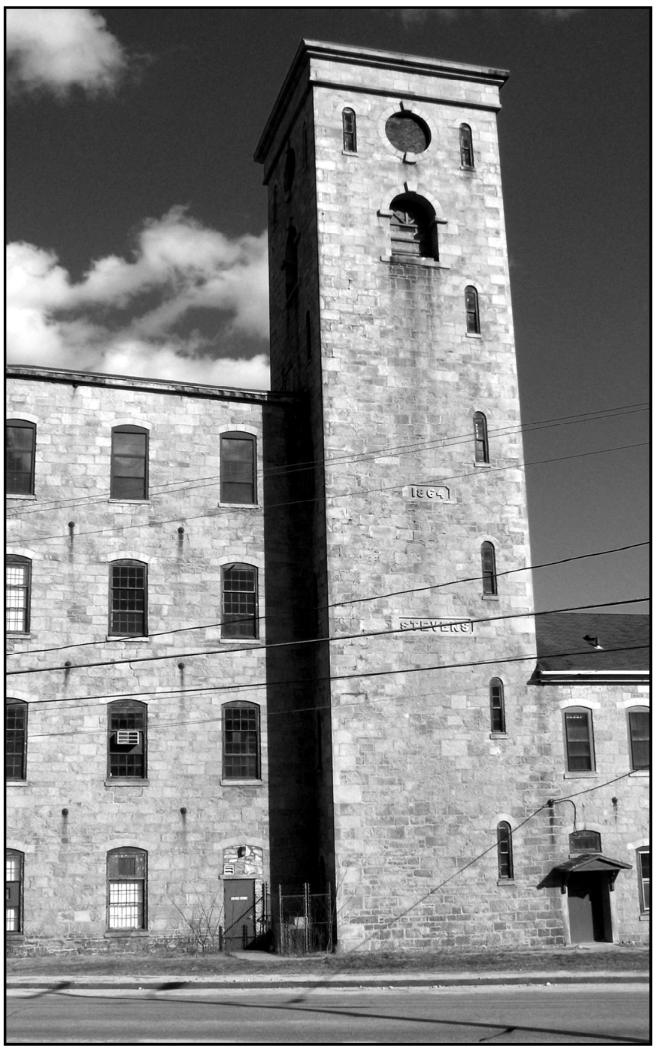
David Dunning

*According to Gerry DeMuro, SIA member and President of Heritage Mills and the Society for Preservation of Old Mills (Northern Chapter), non-profit educational institutions.



Tour of Stevens Linen Works Historic District, Dudley, Massachusetts

Last April 24th, on a sunny Saturday, about 30 to 40 SNEC members gathered for a tour of Stevens Linen Works Historic District, in Dudley, Massachusetts. Located on the border of Connecticut, south and a little west of Worcester, Dudley was an early site of textile manufacturing. Once the Slater family located in this region and built their textile empire, it became a major textile manufacturing center. Yet its history and resources are less well-known than those of the joint-stock mill cities (Lowell, Lawrence) or even the Blackstone River Valley. As SNECers who were able to visit some of the mills and mill housing sites listed on the Early Bird Tour, the area is rich in IA resources connected with textile manufacturing.



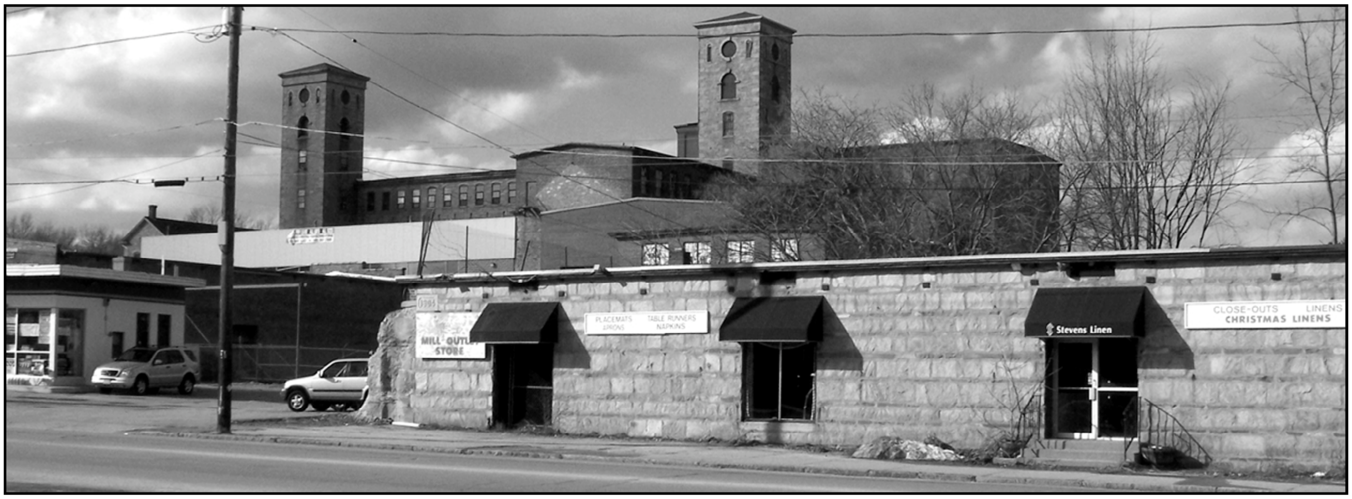
Former Stevens Linen Works west tower, with "Stevens" and the date "1864" on the side. The main mill is to the left, and the office wing is to the right.

One of these resources is the former granite mill of Stevens Linen Works. This beautiful building was the third mill erected at the site, the first one being a woolen mill in 1812. On the site of a second mill, mill-owner Henry Hale Stevens erected his monumental, stone mill (1862-65), with its distinctive pair of tall towers. Stevens began manufacturing linen in the old woolen mill in 1846. Using imported machinery and workers, he became the first manufacturer in the U.S. to spin flax and weave linen cloth by machine. Stevens began improving his plant before the Civil War, but the cotton famine during the war encouraged him to undertake a major expansion. Indeed, many people at the time thought that flax or other plant fibers might supplant cotton. But after the war, cotton recovered its place as the main fabric produced in the U.S. Linen never got a foothold here. Many linen mills started up, none survived for long. Stevens Linen was the only long-lived linen mill in the U.S., and it continued in operation until the early 21st century. At the end of the 19th century, the mill began to concentrate on the production of dishtowels, and it continued to make this product fairly exclusively until the 1930s. In 1939, the business became Stevens Linen Associates, and the products made at the plant changed over time. Production finally ceased in 2003.

The mill is remarkably well-preserved. It consists of the original Civil War-era factory, with wings for shops, storage, and offices and its pair of tall towers. Over the years, one wing was extended, and floors were added to the east wheelhouse and the east wing. Other parts of the factory include a Carding and Hackling Mill (1913), East Mill (1927-28), and storehouses. Nothing remains of that old 1812 mill any longer, except for a date-stone and lintel carved with the saying, "ALL WAS OTHERS, ALL WILL BE OTHERS," now preserved in the yard of the Black Tavern Historical Society.

We visited sections of the main mill and its appendages, and the East Mill; we walked around the north, west, and south sides of the mill site. Then we walked about 1/5 mile, past Low Pond, to Merino Pond, where we saw the remains of the former Bleachery mill and the dam at Merino Pond.

After the site tour, the program continued at the nearby historic Black Tavern in Dudley Center, where the Black Tavern Historical Society provided us a place to gather and refreshments. Sara Costa, niece of the last owner of Stevens Linen Associates, created a display of the fabrics produced by the mill, including photographs and other items connected with the mill. Sara Costa and



Former Stevens Linen Works seen from West Main Street in Dudley, Mass. In the foreground, right, is the former SLW warehouse, most recently a Stevens Linen Mill outlet store. Behind this, center and left, are the mill, its towers and wings. A modern addition – a loomshed – unfortunately fills the courtyard once created by the mill and its perpendicular wings.

Michael Branniff, a member of the Dudley Historical Commission, each gave presentations about SLW. Mike spoke about the character and achievements of Henry Hale Stevens and his admiration for the man, who during his career as owner and manager of the mill lived in a house across the street from it. Sara Costa spoke about the Crawford family (to which she is related on her mother's side), which was long connected with the mill, as employees, managers and owners, and the mill in the 20th century.

On behalf of the SNEC-SIA, I'd like to thank George Peterson, current owner, for giving the SNEC access to the mill, and the Black Tavern Historical Society for its hospitality. Special thanks to Sara Costa and Mike Branniff for their contributions to making the day informative and enjoyable, and for helping to organize the program. Sara Wermiel organized and led the mill tour, and created a list of sites with a map for an Early Bird Tour.

In June, the Massachusetts Historical Commission voted Stevens Linen Works Historic District eligible for listing on the National Register of Historic Places. The nomination was forwarded to the National Park Service in Washington, and it should be officially listed soon. In addition, this coming October, the mill and Hugh W. Crawford, Jr., the last owner of Stevens Linen Works, will be inducted into the American Textile Hall of Fame.

Sara E. Wermiel,
Program Organizer

SNEC tourons in front of the SLW Storehouse No. 5. Rumor has it that there are remnants of water turbines in the cellar of this building (brought there when the mill converted to water power} and we tried to get access to them, but did not succeed.

Tomac Avenue Bridge, Old Greenwich, CT
Metro-North New Haven Railroad

The Tomac Avenue Bridge carries the four tracks of the Metro-North New Haven Railroad over Tomac Avenue in Old Greenwich, CT. It is a through-girder deck bridge, originally constructed in ca. 1895 and rehabilitated in 1943, using new materials to replace original components of both the substructure and the superstructure that had deteriorated over time. Today, the existing bridge is in poor condition and it has been determined that a major rehabilitation effort is now required including the replacement of the superstructure, which will be undertaken by the Connecticut Department of Transportation (CTDOT). In 2007, the Connecticut State Historic Preservation Office indicated that the existing bridge, known as Bridge No. 03955R, possesses historic and engineering importance, and appears to be eligible for listing in the National Register of Historic Places. Prior to its rehabilitation, Historical Perspectives, Inc. prepared a state-level documentation of the bridge, a summary of which is presented here.

The railroad line that includes the Tomac Avenue Bridge was constructed in the late 1840s, as part of the New York and New Haven Railroad. The New York and New Haven Railroad was chartered in 1844 with the intention of building a railroad along the north shore of Long Island Sound from New York City to New Haven, CT. From there, it would connect with other railroads and ultimately reach Boston. The route was surveyed in 1845, and construction of the line, which initially was two tracks wide, began in 1847. The railroad opened for business in 1849. In 1872, the New York and New Haven Railroad merged with the Hartford and New Haven Railroad to form the New York, New Haven, and Hartford Railroad, better known simply as the New Haven Railroad (NHR). By the turn of the twentieth century, this company had acquired most of the smaller independent railroads in Connecticut as well, through consolidations and mergers, creating a vast system of trackage through the state that linked both the big cities and the smaller towns to one another (Stanford 1976; Dodd Center 1989/2001; Lynch 2003).

The original Tomac Avenue Bridge was built in ca. 1895 in response to major system-wide changes. In 1893, the Connecticut Legislature ordered the elimination of at-grade crossings along the railroad in Fairfield and New Haven counties for safety reasons. From 1884-1897, the NHR expanded its two track line to four tracks through this area. The combination of these two changes meant an enormous building effort, including the creation of hundreds of new bridges to accommodate the grade crossing eliminations (Lynch 2003). Archival documents indicate that expansion of the railroad right-of-way to four tracks through Greenwich was under contract in June 1894, and slated for completion within a year. The original Tomac Avenue Bridge was built at that time (Board of Directors 1894). By the 1930s, the bridge was in need of rehabilitation, and plans preserved on microfilm at CTDOT show that beginning in 1934 a series of drawings were made by the NHR showing work to be completed for the Tomac Avenue Bridge, although the actual rehabilitation did not occur until 1943 (Young 2009). Thus, the majority of the existing Tomac Avenue Bridge components date to 1943. According to CTDOT there has been no additional rehabilitation work, other than routine maintenance, since 1943.

The information that can be gleaned from a review of the rehabilitation specifications in 1934 includes the following detail on the tracking, which appears to have been concentrated on the south side of the line:

- All loose rivets were identified and replaced with new [head] rivets.
- Swedge bolts replaced anchor bolts to secure new materials to old materials. [Swedge bolts often are used when space in the footing is limited.]
- New connection angle plates were installed.
- At least three stringers were replaced.
- The diaphragm – spiral easement used to connect tangent straight track to curved sections – was replaced.

In addition to the specifications for the track work, the 1934 rehabilitation designs for the massive masonry abutment walls include the following:

- Directions for the foundation excavations indicate that the abutment walls were, at least in part, new elements and did not date wholly from the original installation.
- Street grade changes were necessary, including more extensive grading on the south side of the bridge.

Currently, the Tomac Avenue Bridge is 36 feet

Vertical X braces of steel angle with central cross girder.

Riveted through-girders and cross girders.

(ft) long (11 meters (m)) and has an out-to-out deck width of 49 ft (15m). The superstructure is supported by two stone masonry abutments. Minimum vertical clearance was measured to be 10 ft - 8 inches (in) (3.25m) and clearance warning signs of 10 ft - 5 in (3.2m) are posted on and at both sides of the structure. Beneath the bridge, the north/south-oriented Tomac Avenue is two lanes wide, with one northbound and one southbound lane, respectively.

The bridge, which supports four tracks, is a single-span structure comprised of five built-up riveted steel through girders, floor beams, and stringers. The interior through girders are common to adjoining tracks. The primary structural members are five built-up riveted through girders with top of flange elevation at approximately the top of rail elevation, two located at the sides of the bridge and one between each set of tracks. Built-up riveted floor beams spaced approximately 8 ft (2.4m) apart on center frame are inserted into the girders with built-up riveted steel stringers spaced approximately 6 ft (1.8m) on center located beneath each track and framing into the floor beams. These girders are built up with web plates stiffened by angled flanges, and continuous top and bottom plates. At the two main panel points, shorter floor beam girders with gusset connections span the five primary girders, and support built-up stringers, or track girders. Each pair of track girders is connected at the main panel points by vertical X-braces of steel angle, and steel-angle, lateral X-bracing on the bottom chord. East and west abutments support the superstructure. Each abutment is a gravity-type high abutment with cut stone masonry veneer. The foundation of each substructure unit is presumed to be a shallow spread footing of cement (CT DOT May 18, 2007). The abutments are simple, with stepped ends and rest on a concrete bridge seat. The bridge number (3955R) is stenciled on one of the granite blocks on the west abutment on the north side of the crossing.

The Tomac Avenue Bridge represents a typical example of a through-girder railroad deck bridge, of a type originally constructed around the turn of the twentieth century, and which was very common both along the NHR and along other contemporary railroad lines. Many of the bridges constructed on the NHR in the 1890s as part of the at-grade elimination work were of this same type, and a number of them are still standing. The Tomac Avenue Bridge, even with its rehabilitation in 1943, is more than 50 years old, and remains an integral component of a historic railroad system. Although many of the elements of the original ca. 1895 bridge were replaced in 1943, the work done at that time clearly meets the definition by the Secretary of the Interior's Standards for the Treatment of Historic Properties for "rehabilitation," in that the "property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships" (1995). The Tomac Avenue Bridge survives as a distinct engineering example of railroad bridge construction technology from the late nineteenth and early twentieth century that is an integral part of a significant transportation system that is recognized as critical to the mid-nineteenth century industrial expansion of the Northeast, the suburbanization of urban cores in the twentieth century, and continued development of the Northeast coastline.

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Cece Saunders
Historical Perspectives

Membership Application to the Northern and Southern NE Chapters of the Society for Industrial Archeology

The Society for Industrial Archeology promotes the identification, interpretation, preservation, and modern utilization of historic industrial and engineering sites, structures and equipment. For information or to apply for membership to the Northern NE Chapter (ME, NH, VT) contact Richard Russack at RickRussack@gmail.com; or,
to the South NE Chapter (MA, RI, CT),
contact Sara Wermiel at swermiel@verizon.net

Northern New England Chapter (ME, NH, VT) Dues Schedule

Member Renewal	$15,00
Student Member	$10.00
New Member	$15.00

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

Southern New England Chapter (MA, RI, CT) Dues Schedule

Member Renewal	$18.00
New Member	$10.00 First Year

Mail to: Sara E. Wermiel
SNEC-SIA Treasurer
70A South Street
Jamaica Plain, MA 02130-3143

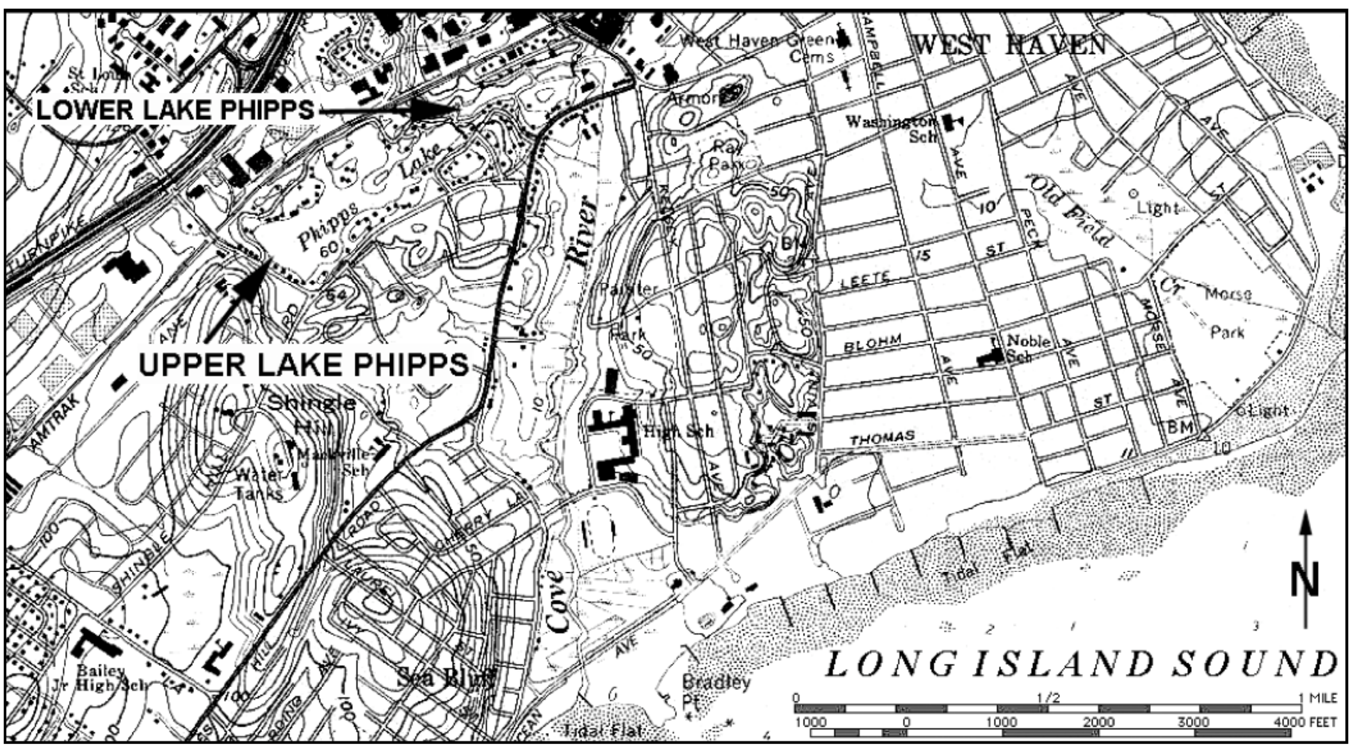
The Lake Phipps Dams, West Haven, Connecticut

Three dams impound 24.5 acres of water in Lake Phipps, sometimes known as Upper Lake Phipps, within the Cove River drainage in West Haven, Connecticut. The Connecticut Department of Environmental Protection (DEP), the City of West Haven, and the Lake Phipps Special Taxing District undertook major repairs of the dams in 2008 which removed some earlier dam components. The repair project came under the purview of acts and regulations protecting cultural resources eligible for the National and State Registers of Historic Places from adverse project effects. The Connecticut State Historic Preservation Office (SHPO) determined that the Lake Phipps Dams had historic and engineering merit. Raber Associates assisted DEP's consultant, Macchi Engineers LLC, by meeting SHPO requests for documentation of the dams to SHPO standards and for preparation of this article for the SIA New England Chapters Newsletter.

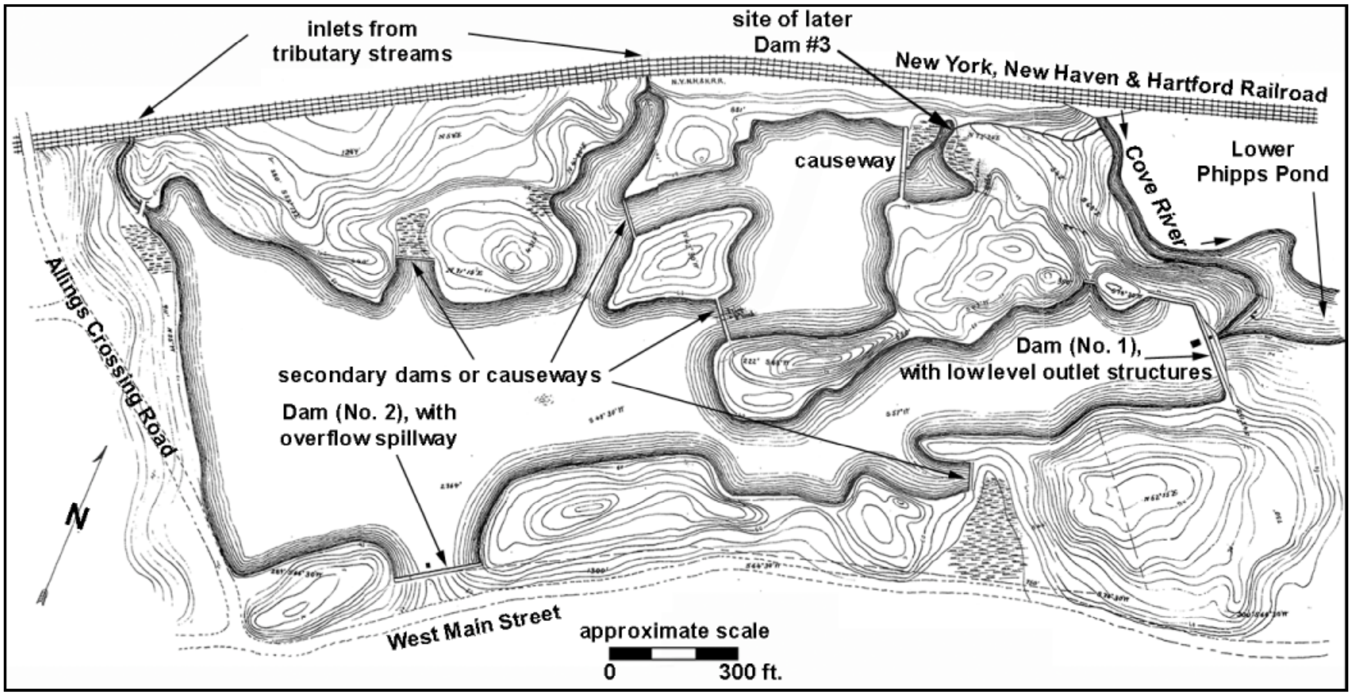
Lake Phipps has local and regional significance as part of the development of public water supply to the greater New Haven region. The West Haven Water Company represented the first attempt to supply most or all of what is now the City of West Haven, but failed due to insufficient capital and inability to construct large storage reservoirs at elevations well above the service areas. Absorption of this company by the New Haven Water Company in 1900 reflected the success of the larger organization, which had more service area and greater supply facilities. The dams at Lake Phipps also have significance as structures reflecting the capital limitations of the West Haven Water Company, notably one very narrow masonry structure with two generations of reinforcing buttresses.

Summary of Lake Phipps History

English settlement of present West Haven began slowly in the 17th century, when the area was common land within New Haven after 1638. The marshes along the West and Cove rivers were val-



Location Map, USGS New Haven, Conn. Quadrangle



Upper Lake Phipps c1900. Base map: Hill c1900

ued as sources of pasture and salt hay, and were soon allotted to individual settlers. By 1650, parts of the West Haven coast were also used to harvest oysters. Permanent agrarian settlement within present West Haven and Orange led to establishment of separate parishes in 1719 and 1804, and to Orange's incorporation as a separate town in 1822 from North Milford Parish and part of New Haven's West Farms area. Although the rapid construction of railroads in the 1840s, including the 1848 opening of the New York and New Haven along the coast, stimulated dramatic urban industrial changes in many Connecticut towns and cities, most of Orange remained agricultural until well into the 20th century. The most commercially-developed section of Orange, in West Haven, became a borough in 1873 and, in 1921, one of the state's last incorporated towns.

Population growth in the Borough of West Haven led to increased demands for clean water, as residents faced disease in supplies from shallow, often-contaminated wells. The New Haven Water Company provided water service to limited parts of the borough after 1876, when the company acquired the Maltby Lakes reservoir completed in the early 1860s by the Fair Haven Water Company on the West River. The small Maltby Lakes watershed and the difficulties in laying pipe into West Haven discouraged New Haven Water Company from expanding service to the borough. Piping for New Haven Water Company service in this and other areas was provided for some years by D. Goff Phipps (c1837-1903), who served at the same time as the corporate secretary. Phipps used a patented, cement-lined wrought-iron pipe which was cheaper than cast-iron pipe, but which by the 1890s was known to fail under higher water pressure. Forced out as secretary c1880 because of the conflict of interest with his contracting business, Phipps became the principal organizer of the West Haven Water Company, incorporated in 1881 to serve the borough. The West Haven Water Company focused its water supply efforts on the Cove River, primarily south of the New York, New Haven & Hartford Railroad, successor to the New York and New Haven. Efforts to develop reservoirs on higher ground further north were limited, at least in part because of problems encountered by the water company in securing rights to run mains under the railroad, and perhaps because of resistance by the railroad to large dams in any areas just upstream of the line. Ultimately, topographical and related water-quality issues limited the success of the West Haven Water Company.

The first significant supply source used by the West Haven Water Company was at a small mill privilege developed on the Cove River c1860 for gristmill and sawmill use, and used for winter ice harvesting. The company purchased 7 acres along the river including the mill privilege in 1884, and built a second dam some 400 feet above the mill dam to increase storage, as well as a pump house below the mill dam. Mains from the pump house ran west into the more densely-populated sections of the borough. Within a few years, the Cove River ponds totaling approximately 3.5 acres proved insufficient to meet local demand, and by 1889 the water company began plans for a larger reservoir on higher ground immediately southwest of its upper Cove River pond, in a rocky basin tributary to the river. Two small streams flowed under the railroad tracks into this area, some of which was marshy. The company acquired over 60 acres of land in early 1889, and between June 1889 and February 1890 appear to have secured funding for reservoir construction through sales of additional stock shares and a mortgage. Construction of the new reservoir, over 20 acres in area, was probably completed for under $20,000 in 1890, including two large and five smaller impoundments discussed below. From the principal outlet at the east end of the reservoir, a force main was built to the pump station on the Cove River.

All the West Haven Water Company reservoirs and ponds in the Cove River basin south of the railroad were originally referred to as Lake Phipps, after the company president. The company's commercial water supply were evidently not very successful even with the new reservoir, and by July 1891 the company was exploring a sale of its stock and assets to the New Haven Water Company and may have leased its facilities to the larger company. Despite the higher elevation of the c1890 reservoir, some 30 feet above the Cove River ponds, the use of the Cove River depended largely on the pump station which was at approximately the same elevation as the main West Haven service areas. There were also some undocumented water quality issues in one or more of the ponds. In 1900, as the New Haven Water Company completed a new Maltby Lakes dam which increased supply at an elevation approximately 100 feet higher than Lake Phipps, it acquired all stock of the West Haven Water Company and replaced the latter company's officers. The principal value of West Haven Water Company at that time may have been its distribution system and service area, into which the New Haven Water Company could feed water from the Maltby Lakes, although Phipps' patented pipe — used in West Haven — had to be replaced with cast-iron pipe.

The Lakes Phipps facilities were retained under the New Haven Water Company as a reserve supply in the event of any Maltby Lakes problems, and were evidently repaired as necessary. Available information suggests limited modifications to the structures at the c1890 reservoir c1900-1926, except for undocumented reinforcement of one of the two larger dams. By 1926, expansion of Maltby Lakes facilities precluded the need for Lake Phipps as a water supply source, and the New Haven Water Company was involved with very extensive projects elsewhere requiring large amounts of capital. In that year, all the Lake Phipps properties were sold to private real estate agents or developers, who established Lake Phipps Estates, Inc. to sell off residential lots located primarily around the 1890 reservoir. Some development at the west end of the latter pond included filling of former reservoir areas. Landowners around Lake Phipps organized the Lake Phipps Land Owners Corporation (LPLOC), and purchased the ponds and dams c1957. By this time, there were emerging dam safety issues at one or more of the dams impounding the ponds referred to as Lake Phipps, and by 1966 Connecticut's Water Resources Commission began urging repair work. The City of West Haven purchased the (Lower) Lake Phipps components on the Cove River c1970 and installed sewer lines along the river at the bottom of the outlet of the upper reservoir, which evidently led to a reconfiguration of upper reservoir outlet facilities and a new impoundment as discussed below. Probably about the time of the city's purchase, the c1890 reservoir was referred to as Upper Lake Phipps, and the two ponds on the Cove River were designated Lower Phipps Pond in some documents. Between 1972 and 1990, the State demanded that LPLOC repair the two Upper Lake Phipps dams, leading to limited repairs which did not satisfy State safety requirements. Court action beginning in 1982 led to the 1990 dissolution of LPLOC and the conveyance of Upper Lake Phipps to the Department of Environmental Protection (DEP). Following sufficient repair work by DEP in 1994 to lower the lake level by approximately 5 feet pending more permanent improvements, Macchi Engineers designed upgraded or rebuilt facilities at three impoundments which were installed in 2008. The Lake Phipps Special Taxing District, a new association of lakeside landowners, will take possession of the lake and dams in the future.

Upper Lake Phipps Engineering

The Cove River tributary impounded for Upper Lake Phipps has two principal channels with headwaters just north of the railroad. Prior to reservoir construction, these channels met near the center of the present lake in what appears to have been a low basin with schist bedrock close to the surface. Smaller flows into the basin from the west were enhanced after initial reservoir construction, with installation of one or more pipes under Allings Crossing Road. The east edge of the basin met the drainage divide with the main Cove River channel. At least some of the basin along the tributary was swampy, and there was evidently a small wetland — near the tracks and east of the drainage divide — which drained east into the Cove River. This latter wetland was at the extreme north and east edge of the present lake. It is not known if the channel from the wetland east into the Cove River, shown on a c1900 plan and today serving as the principal lake outlet, was modified for reservoir construction.

Unidentified engineers or contractors built at least seven structures to create Upper Lake Phipps in this relatively complex topography. The main impoundment of the Cove River tributary was a masonry dam across the stream channel just north of West Main Street, located between two low hills (now known as Dam No. 2) and built with a low-level spillway. Four of the other six structures walled off low edges around the tributary basin to create a reservoir surface approximately 60 feet above mean sea level, the largest of which was the long earthen dam at the lake outlet (now known as Dam No. 1), built with a low-level outlet as well as a force main leading to the pump station on the Cove River. The smaller structures around the reservoir perimeter, as well as two others which bridged peninsula or island areas in the impoundment, were small masonry dams or earthen causeways. Most of the smaller structures are no longer visible or have been enlarged as roads, and in some cases original flow patterns around or through these structures are not documented. The reservoir level appears to have flowed over the low drainage divide at the northeast end of the impoundment, and the northernmost causeway (today part of Phipps Drive) was probably built with undocumented original pipes to direct some flow into the remnant wetland on the divide. The pipes may have originally served to relieve pressure on this causeway, and were later rebuilt; they now direct flow towards the post-1970 lake outlet known as Dam No. 3.

Some of the engineering structures, notably at Dam No. 2, appear to reflect limited capital and attempts to cut costs. Dam No. 1, with a masonry core wall along the crest, has some very steep downstream earthen slopes with almost no retaining structures. Interpretation of Dam No. 1 is complicated by modifications to the slope below the outlet facilities by West Haven's sewer construction c1970. Dam No. 2 is an unusually narrow mortared-rubble masonry wall built with relatively small stones, and two generations of buttresses on the downstream face. The mortared-rubble buttresses described below were probably original to dam construction, and are a telling exception to dam engineer Edward Wegmann's remarks that he was not aware of dams at which buttresses were used to reduce original construction costs; in common practice, buttresses at gravity masonry dams represented repairs. The additional concrete buttresses and concrete facing between buttresses seen at Dam No. 2 were probably added after 1900, and were in place by 1934. While information available for this documentation did not indicate whether the New Haven Water Company added the concrete reinforcing structures, it is likely the company did so, perhaps to limit any liability from dam failure.

Description of the Upper Lake Phipps Dams

In 2008, there were three main built components associated with the 24.5-acre pond at Upper Lake Phipps, impoundments currently as Dam No. 1, Dam No. 2, and Dam No. 3. In an 0.4-square-mile watershed above the lake within a small Cove River tributary drainage, stormwater runoff feeds the former reservoir through piping at four points: two from the west and south across Allings Crossing Road, and two passing under the railroad tracks approximately 400 feet from the intersection of Allings Crossing Road and at Phipps Lane west of Shady Lane. Since the early 20th century, the lake has evidently had a normal water elevation of approximately 59.5 feet above mean sea level.

After c1970, the lake discharged through two pairs of 1.25-foot-diameter corrugated metal pipe culverts associated with Dam No. 3: one pair running through the causeway on Phipps Drive at normal lake level to discharge into a small cove, and the second pair at elevation 59.2 within Dam No. 3 which discharge into a 12-foot-wide, approximately 400-foot-long channel leading to the Cove River and Lower Phipps Pond. At higher lake levels, the Dam No. 2 overflow spillway at approximately elevation 60 feet drains excess water into a storm water drainage system. The two dams associated with Lower Phipps Pond also survive, but were not part of the present documentation

Dam No. 1

Located at the east end of Lake Phipps with a crest more than 30 feet above the Cove River, Dam No. 1 is an approximately 345-foot-long, 20-to-65-foot-wide earthen embankment up to 33 feet high, with a 2.5-foot-wide mortared-rubble core wall probably founded on bedrock. The dam has an angled plan, hinged on a rocky knoll which divides the structure into a 185-foot-long section at the extreme east end of the lake, and the remaining 160 feet running towards the west. The downstream slopes are extremely steep in places, but are unreinforced except for a 45-foot-long, 1.5-to-2.5-foot-high rubble wall at the toe of the central section of the north-facing slope. On the 12-to-15-foot-wide dam crest, the highest elevation of 63.3 feet is at the top of the core wall which runs the length of the dam.

When first constructed c1890, the dam was approximately 60 linear feet from the Cove River, and originally included the low-level outlet for Lake Phipps as well as the head of a force main which ran over 1500 feet to the pump station near the outlet of Lower Phipps Pond. Engineering features associated with these features are poorly documented, and to some extent can only be inferred from one historic plan and from piping observed by contractors during 2008 dam repairs. Outlet controls included a 10-by-15-foot mortared-rubble intake structure in the lake 35 feet from the dam crest, with 2.5-foot-thick walls, from which a pipe approximately 3 feet in diameter led to a 5-by-6-foot mortared-rubble gate chamber below and just east of the dam crest. The latter structure, capped in 2008 with a concrete slab, is reported to have contained a gate valve approximately 25 feet below the dam crest. From the gate valve, there was an undocumented low-level outlet pipe into the Cove River, and a force main perhaps 8 inches in diameter running under and along the river to the pump station. No information on the precise locations of these pipes was found during this documentation. Several plans suggest that West Haven sewer construction along the Cove River in the early 1970s included some filling of Cove River streambanks, and other unconfirmed data indicate that one or both outlet pipes were partially removed and/or fitted with valves during the sewer project. An area near the toe of the eastern downstream slope at the probable original low-level outlet invert elevation, adjacent to the river in possible filled streambank, has had observed seepage since sewer construction. Interruption of the c1890 outlet infrastructure almost certainly led to modification of the Dam No. 3 area for lake discharge.

Dam No. 2

Dam #2 is a 190-foot-long masonry structure, founded largely or entirely on schist bedrock, with a rubble-covered earthen upstream face approximately 15 feet wide in most sections and 3 feet below the dam crest elevation of 63 feet. Built in a shallow depression close to bedrock, the masonry dike is typically 9-13 feet high and tapers to heights of approximately 1 foot at the ends. The west end meets a rock slope, and the east end extends into an earthen abutment faced upstream with a 30-foot-long mortared rubble wall approximately 18 feet from the dam face. The dike wall has a slightly tapered cross section 2.8-3 feet wide at the top in most places, narrowing to 1.8-1.9 feet wide at the east and west ends. The wall has a core of mortared rubble and brick fragments, faced with .3-foot-wide sides of mortared, horizontally-set pieces of small-to-medium-size rubble. This unusually thin structure was first reinforced — probably during original construction — with three 7-to-10-foot-high, 6-foot-wide, 9-to-12-foot-long mortared rubble buttresses, spaced at approximately 30-foot-center intervals with sloping downstream faces. Later reinforcement was added between the rubble buttresses, consisting of two similarly-shaped, 7-to-9-foot-high, 6-foot-square unreinforced-concrete buttresses and 1.3-to-2.5-foot-thick, approximately 8-foot-high concrete facing. Near the west end of the dam, the overflow

View North of Dam No. 2 Downstream Face, with Spillway (Left) and Buttresses

Detail to Northeast of Dam No. 2 Masonry Cross Section Near East End of Dam. The approximately 2-foot-wide wall has a core of mortared rubble and brick fragments, faced with 4-inch-wide sides of mortared, horizontally-set pieces of small-to-medium-size rubble.

spillway is 19.5 feet wide, with an original mortared-rubble section built integral with the rest of the dike to a crest elevation of approximately 58.2 feet. A narrower, 1.8-foot-high concrete cap was added to the spillway in 1979.

Below the spillway, a channel cut into bedrock runs east approximately 50 feet towards West Main Street, narrowing to 10 feet at its lower elevation of 42.3 feet. To minimize erosion of the western rubble-masonry buttress, a low unmortared-rubble wall runs from the toe of the buttress to the channel. The principal outlet for spillway flow is a 3-foot-diameter, 100-foot-long reinforced-concrete storm drain with a concrete headwall. A secondary outlet consists of a 2-foot-diameter, 55-foot-long section of reinforced-concrete storm drain running southeast from the spillway bottom under West Main Street. A recent, poorly-documented low-level outlet also feeds into the spillway through an approximately 50-foot-long pipe of unknown size. The outlet control, built 35 feet upstream of the dam center, has an 11-foot-long gate chamber of two parallel, 2.3-foot-wide, approximately 9.5-foot-high mortared rubble walls, set 2.3 feet apart with 3-inch-wide slots cut to support a wooden weir or drop gate which controls flow into the outlet pipe. The top of the chamber is at an elevation of approximately 55.6 feet. The low-level outlet facilities appear to post-date 1980, as they do not appear on a plan of the dam made that year. One map made shortly after reservoir construction appears to show an outlet control in this area, but it does not appear on later images including 1934 and 1965 aerial photographs.

Dam No. 3

Dam No. 3, located at what was probably an original natural outlet to the Cove River from a marshy area at the north edge of Lake Phipps, is a 12-foot-long, 7-foot-high earthen dam with an 8-foot-wide crest at an elevation of 61.7 feet, and the two 1.25-foot-diameter corrugated metal pipe culverts noted above which drain into the outlet channel. The downstream slope is extremely steep. There was no documentation of this structure during the federal inspection conducted in 1980, and it appears likely that Dam No. 3 represents work done to create a new lake outlet following the sewer project below Dam No. 1 mentioned above. At the southeast corner of the cove east of Phipps Drive, undocumented landscape modifications since the early-mid 20th century have evidently created a second outlet, near the head of which a homeowner constructed a 10-foot-long earthen berm with a 3-foot-wide crest at approximately elevation 60.5 feet, and an 0.8-foot-diameter low-flow pipe to limit the depth of the water in this offshoot.

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Concrete Water Tanks:
An Example from Stamford, Connecticut

Introduction

America's urban sprawl and rise of suburbs during the first half of the 20th century created a set of issues related to water redistribution. Potable water had not only to be brought to a central location but then needed to be channeled back outside the cities to the suburban communities. Supply problems related to the lack of facilities for the storing, pumping, and transporting of water to areas of greatest demand. Distribution costs became alarmingly high and resulted in the uneven allocation of water resources to varying socioeconomic neighborhoods with the placement of undersized pipes and overextension of water lines in poorer communities. The "Water Crisis," as it came to be known after World War II, led to the recognition of a potential large scale water shortage. The proposed solutions for this problem yielded a variety of responses including restrictions on water usage and focusing on more efficient water capturing systems. Dam projects, mostly throughout the western part of the United States, were commissioned to create large reservoirs that would supply potable water to the metropolitan and suburban areas of states such as Arizona, Nevada, Utah, and California.

Though large reservoirs were feasible in the West because of the availability of open space, such reservoirs were difficult to envision in overcrowded areas of the Northeast where space was at a premium. Smaller municipalities had to rely on small reservoirs or water tanks for distribution to the surrounding residents. Water tanks and water towers were particularly useful since they were restricted spatially and could provide continuous storage for varying lengths of time. Starting in the 1880s, most of the elevated water tanks in this country were made out of steel with riveted plates; steel remained a material of choice for the construction of water towers. The majority of at-grade water tanks were also constructed with riveted steel plates but starting in the 1930s welded steel plates were replacing the riveted plates. By the 1950s much of the newer steel tanks had abandoned the use of rivets (Walski

Photograph 1. *Location of water tank at 77 Blachley Road, Stamford,CT. View towards the south-southwest.*

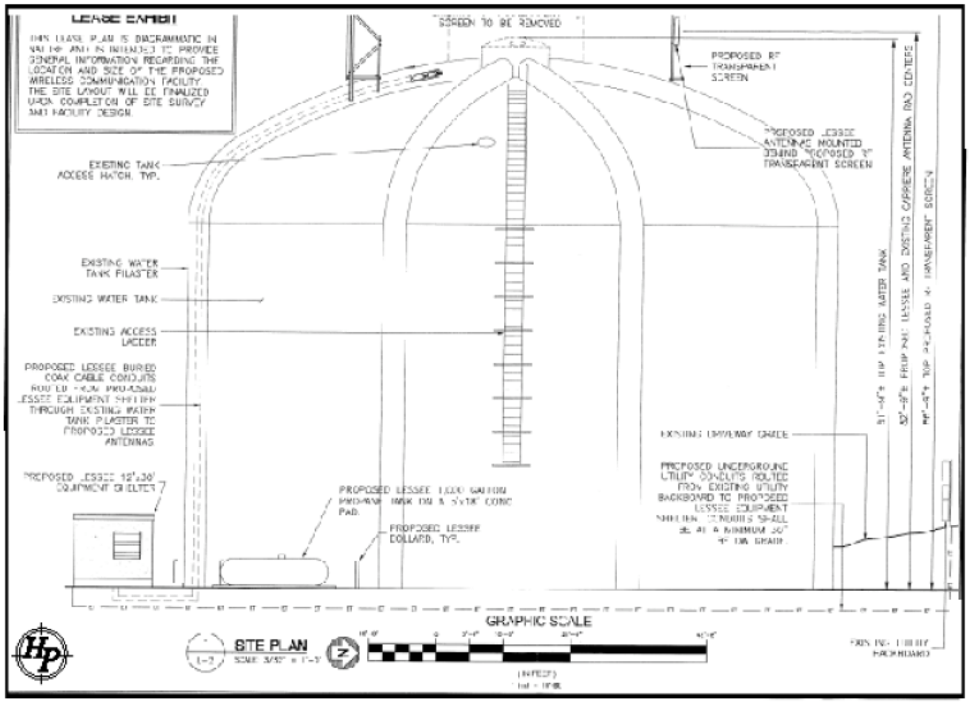

Figure 1. *Schematic profile of water tank. Illustration of pilasters conjoining on top with screen cover. (Drawn 11/15/06)*

2006:116). Starting in the 1970s, bolted tanks with factory coatings of chemically treated paints, including the use of zinc or oxide, became common, particularly for smaller containers.

Though the first reinforced concrete structure was a water tower built in Victoria, Canada in 1903, reinforced concrete because of its overall weight was mostly used for underground tanks and tanks at grade (Kemprey 1910). In 1942, J.M. Crom, who founded the Crom Corporation, one of the most important water tank contractors in the country, developed the first prestressed concrete water tank.

The American Water Works Association (1995) has defined four distinct corewall construction techniques (see also American Concrete Institute 2003):

Type I – cast-in-place concrete with prestressed reinforcement which was introduced in the 1930s;

Type II – shotcrete with a steel diaphragm first built in 1952;

Type III – precast concrete with a steel diaphragm which was first used in 1966; and,

Type IV – cast-in-place concrete with steel diaphragm.

Typically, the concrete tank wall stood on a strip concrete footing that was set as one cast with the floor slab, which was reinforced concrete poured on grade. Isolated or strip footings were sometimes placed in the concrete to support columns or interior walls. Tank roofs were either set with a flat-profile concrete slab that was held by columns or consisted of a pre-stressed dome ring. From 1950 to 1970, tanks measuring up to 125 ft. in diameter were built with dry-mix shotcrete domes while larger tanks were built using cast-in-place concrete domes. Most concrete tanks today are constructed either using this technique or either precast concrete panels. Concrete columns are often used, depending on the roof type, as structural reinforcement inside the tank wall.

Because these tanks are in some cases older than fifty years, deterioration and distress is often noted on these structures due to exposure to the elements. Signs of deterioration include cracks, leaking, flaking, spalling and delamination caused by corrosion and thaw/freeze resistance. Regular maintenance of these tanks is necessary to alleviate the effects of time on these structures. Rehabilitation might be considered when the integrity of the structure is compromised and replacement is the final option when costs for rehabilitation measures become too exorbitant.

77 Blachley Road Tank Description

The water tank at 77 Blachley Road, Stamford, CT is a dome-shaped structure dating to 1954 which measures 81ft. 9in. in height (24.9m) and has an estimated diameter of 50ft. 8in. (15.44m). Its total circumference is measured at 160ft. 5in. (48.9m). It is constructed of prestressed concrete panels, with reinforcement by eight pilasters (each 3ft. 9in. [1.14m] wide) surrounding the outside of the structure (Figure 1). The eight pilasters conjoin at the top of the structure below a circular semi-transparent screen cover. The base of the water tank is composed of a concrete ring that lies directly on top of a circular concrete slab that was directly laid at grade. Each of the pilasters is also sealed at their base by a cement lining set into the concrete slab

The development of wireless communications in the last twenty years has required the construction of wireless towers throughout the country. For cost purposes, wireless carriers have looked at existing structures that can be used to install their antennas (Gabin 2003). The water tank located at 77 Blachley Road is currently being used by a number of wireless communication providers; each has installed antennas and various ancillary equipment either on the tank itself or in proximity to the structure. These additions to the water tank do not however appear to have compromised the integrity of the structure and consequently have not adversely affected its potential historical significance.

Conclusions

The water tank located at 77 Blachley Road represents a fine example of prestressed concrete structures that were commonly built starting in the 1940s in the United States. Though the techniques used in the construction of this water tank were common at that time, the shape of the structure is not of the most standard design. Most early prestressed concrete water tanks were cylindrical or circular in shape and are still manufactured today to these form specifications. Dome shaped water tanks, as the one located on Blachley Road, were much less common, the design being abandoned in the 1960s to be replaced by more conventional and probably less costly forms. In that sense, the water tank can be included in a narrow timeline of engineering changes occurring in the 20th century construction of municipal water tanks lasting less than a few decades.

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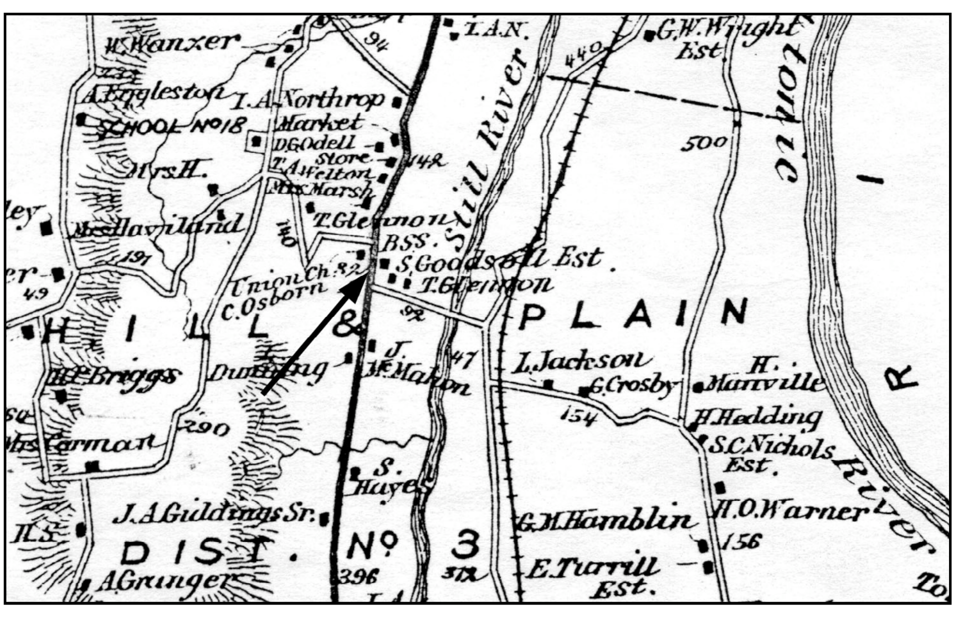

Figure 1. *The 1874* Beers County Atlas of Litchfield, Connecticut *showing the house and blacksmith shop (BSS) of the S(turges) Goodsell Est(ate).* (See article, *Archeology at Yankee Blacksmith Shops in Connecticut* by Ross J. Harper, page 18.)

Archeology at Yankee Blacksmith Shops in Connecticut

Archaeological and Historical Services, Inc. (AHS) of Storrs, Connecticut, recently discovered the remains of early blacksmith shops during cultural resource management surveys for the Connecticut Department of Transportation. The remains of the blacksmith shops were adjacent to busy roads but entirely buried and hidden from view. The Dayton-Leach-Goodsell blacksmith shop is located in New Milford, in the southwest corner of the state. It was occupied by several owners, and was in operation from about 1801 to 1869. A comparative blacksmith site was found at the Daniels Homestead Site in Waterford, in the southeast corner of the state; this smithy dates to the third quarter of the 18th century. Both sites contribute to the understanding of early family-owned and operated Yankee forges.

The Dayton-Leach-Goodsell Blacksmith Shop, New Milford, CT

In 1801 James Clark Dayton purchased a small empty corner lot for $35 in the town of New Milford and soon after built a house and a blacksmith shop. The shop was located on Danbury Road (now Route 7), which was an 18-mile turnpike built in 1795 connecting the coastal town of Norwalk with Danbury to the north. In 1813 Dayton sold the shop and house to his father-in-law, Daniel Leach. The next year Dayton died, and his probate inventory listed "1 pr blacksmith's bellows" and "1 pr nailing do," suggesting the shop engaged in general smithing and in making nails. To pay off Dayton's debts, the contents of his forge were sold at a public auction, but most were purchased by his father-in-law, for the sum of $236, his anvil the most valuable of his forging equipment, at $20. Other tools included hammers, tongs, chisels, punches and a screw plate for threading hand-made bolts and screws. Daniel Leach owned the house and blacksmith shop until 1834 when he sold his property to another blacksmith, Sturges Goodsell.

Although Goodsell was the third owner of the property, he held it for the longest time. Goodsell appears on the 1850 census at age 56 as a blacksmith with real estate modestly valued at $500. Goodsell's house and shop appears in the 1859 Hopkins County map. In the 1860 census Goodsell's blacksmith shop and house were valued at $520. Goodsell died on May 2, 1869, at the age of 76 and his widow died a few years after that. The house and shop appear on the 1874 Beers Atlas as the Est(ate) of S(turges) Goodsell. Goodsell's estate papers indicate that his tools and equipment were sold off and the blacksmith shop seems to have ceased operation at that time. Goodsell's probate papers list his household furniture, wearing apparel, land holdings and the contents of his blacksmith shop. The smithy items include wheel and wagon components such as tires and wagon springs, horse shoes, ox shoes, a set of ox slings, lengths of chain, and various old and broken iron tools kept for scrap or for being repaired. Tools and

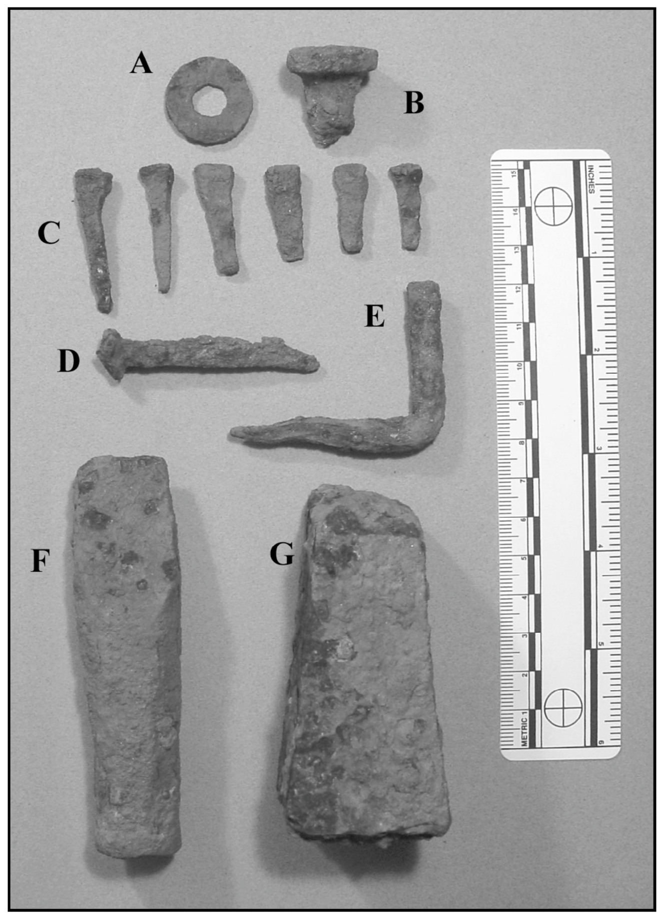

Figure 2. *Forge related artifacts from the Clayton-Leach-Goodsell Forge: A) washer, B) bolt head, C) six shoeing nails, D) a rose head nail, E) a pintle, F) a chisel, and G) scrap iron.*

*Figure 3. Interior of a rural Connecticut blacksmith shop. The c. 1900 photograph shows tools, vise, anvil, forge and quenching bucket. Carriage wheels are visible in the back - ground (*People at Work Collection*, Quinebaug Valley Community College Library, Danielson, Connecticut).*

equipment included bellows, two anvils, and various hammers, chisels, punches, tongs and rasps.

Remains of the blacksmith shop were initially discovered buried in a residential yard 16' from the edge of Route 7. From nine shovel-test pits, 16 slag, two coal, 41 nails and an axe head were found in an area that measured 197' x 33' in size. A large assemblage of domestic artifacts were also recovered, including sherds of late 18th- to mid-19th-century ceramics, glass bottles, window glass, and bone and shell remains. An additional 31 test pits were excavated in a five-meter interval grid across the site, and intensified historic background research was done by AHS's historian Bruce Clouette.

The additional excavations found many artifacts associated with the blacksmith shop and house. A total of 3,193 artifacts were recovered. Forge-related artifacts include 78 hand-wrought nails of the L-head, T-head and rose head variety, and two nail rods. A total of 470 shoeing nails and a horseshoe were found. Although machine-cut nails were being made in New England by the 1790s, hand-wrought shoeing nails continued to be important as they had the elasticity and tensile strength needed to clench horseshoes to hooves. Other artifacts include an iron pintle, eight fragments of scrap iron, two bolts, two washers, a chisel, and fragments of a knife and scythe. A total of 183 slag and five scale fragments, 150 coal and 129 coal ash fragments were also recovered. The transition from wood charcoal to mined coal likely occurred with Sturges Goodsell after 1840 when the Housatonic Railroad reached New Milford and first brought coal as an available and affordable commodity to the town. No in situ structural remains were found, but the archaeological testing was limited to a linear roadside strip. The majority of the site, including the blacksmith shop, is still likely buried to the east.

The Daniels Site Forge/Nailery, Waterford, CT

Around 1712 Thomas Daniels purchased a small plot of land from his future father-in-law. The construction date of the house is recorded in the diary of Daniels's neighbor Joshua Hempstead, who wrote on May 12, 1712 that "I was att work att ye meeting house & Tho Daniels all day: Boarding it." Daniels was a farmer. By the time he died in 1735, had accumulated a respectable homestead comprised of 67 acres of land, livestock, a house and an orchard. Thomas's widow Hannah remained in the house until her death in 1744, at which time the property and house were acquired by local land speculator and merchant Matthew Stewart, who incorporated the Daniels property into his large 300-acre land holdings. Stewart, however, underwent a period of bad luck in the 1750s; he lost several vessels to French privateers and went into bankruptcy. Stewart's land holdings, including the Daniels homestead, were then sold off in a grand "Scheme of Lottery" in 1759 to raise money to pay his debts.

The Daniels site was found in an archaeological survey of a new interchange off of I-95. Large-scale data recovery excavations indicate that the house was occupied until about the 1770s when it was abandoned, the house was dismantled, and the home lot was con-

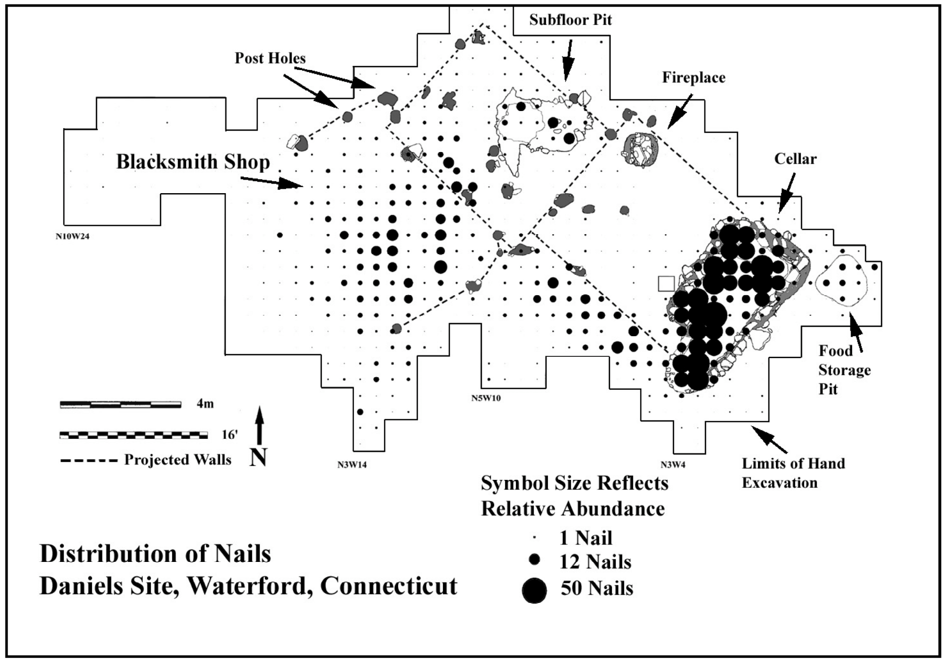

Figure 4. *Site plan of Daniels Site showing distribution nails in the post-in-ground smithy and along the outer south wall of the house.*

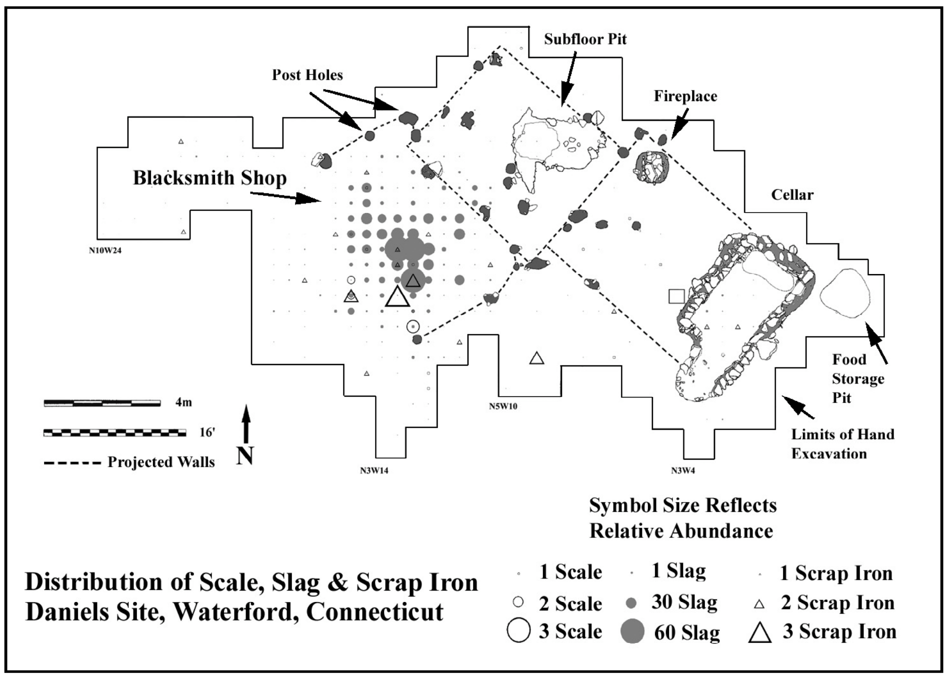

Figure 5. *Site plan of Daniels Site showing distribution of slag, scale and scrap iron in the post-in-ground blacksmith area.*

verted into an agricultural field. It remained a field until discovered by archaeologists 225 years later. It's uncertain who lived in the house after the Daniels family; it may have been someone who won the house in the lottery, a tenant who leased the land, or even a squatter. The excavations determined that the house began as a small timber-framed one-room end-chimney type. The house sills had been laid on a stone foundation that rested directly on the ground. The foundation stones and most of the stones from the fireplace were removed when the house was abandoned and the site readied for plowing. The excavations found a filled-in stone-lined cellar with a bulkhead entrance and several food-storage pits outside of the house, such as for keeping root vegetables.

The post-Daniels unidentified occupants built a post-in-ground or earthfast addition off the west end of the house, creating a sort of hall-parlor plan. There was a subfloor storage pit in the addition and the earthfast posts seem to have been of the "puncheon" variety, whereby the outside of the upright posts were planed flat and the clapboards were simply nailed to the outside of the posts. Puncheon-post construction was the most primitive of the ancient English earthfast tradi-

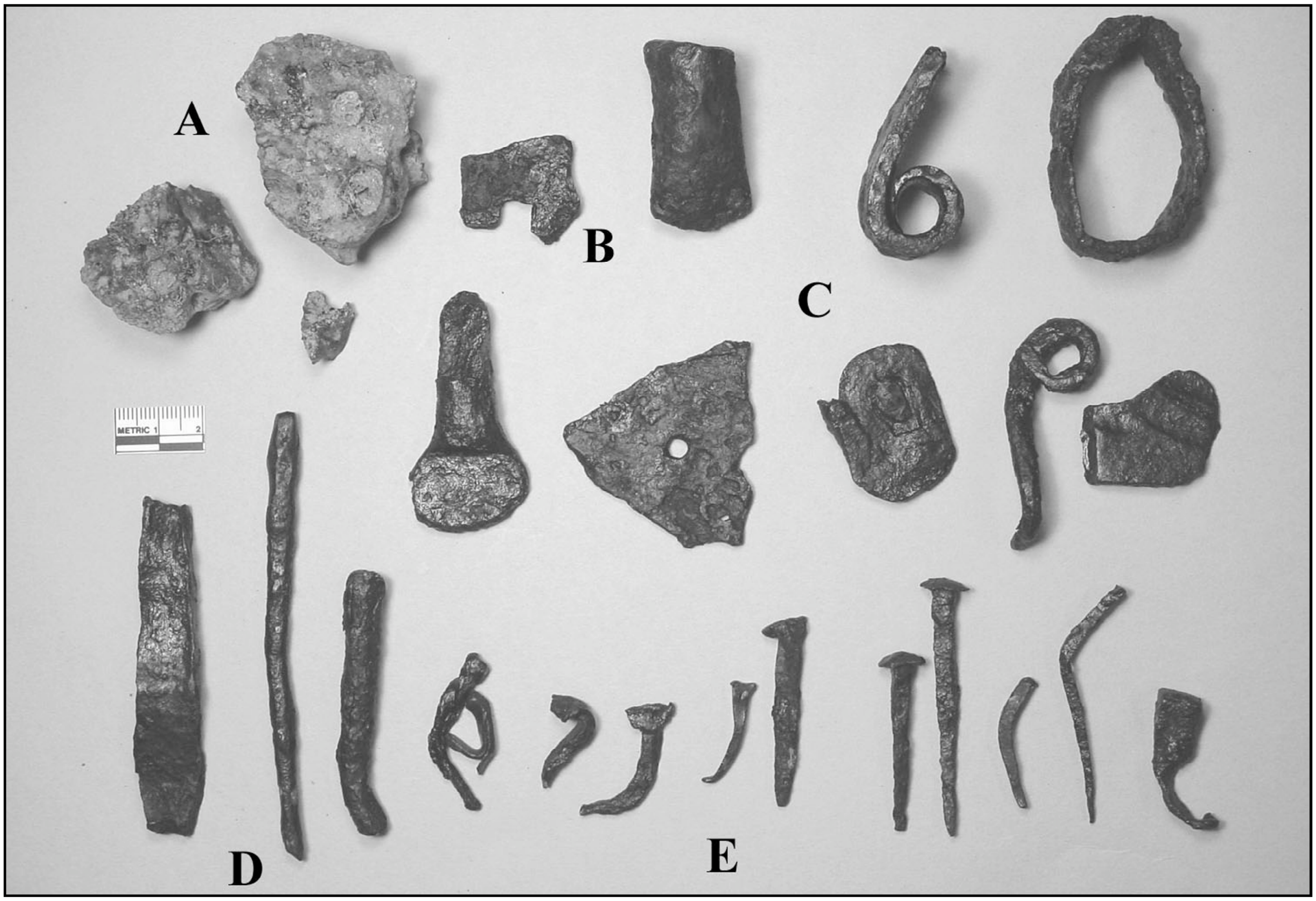

Figure 6. *Forge related artifacts from the Daniels Site: A) three slag, B) a fragment of a nail header, C) eight scrap iron, D) three nail rod and a rejected nail, E) pairs of nail types including T-head, L-head, rose head, and headless and a shoeing nail.*

tions and by its very nature was impermanent. At this time an earthfast blacksmith shop lean-to was also built off the back of the house, with an open end that faced the south yard. The forge structure was approximately 14' x 20' in size and had a gravel floor to create a raised and drier work area. A concentration of clay mortar in the shop area may be remnants from a stone forge base.

Nail production was the most important activity at the forge. Hand-wrought nails were found in various stages of production, including nail rod, nail blanks, finished nails and rejected nails. There were 59 L-head, 104 T-head, 72 headless and 2,694 of the rose head variety, along with 105 shoeing nails. The 1,358 slag, 21 scrap iron and 29 scale fragments were concentrated in the middle and open end of the forge, whereas the nails were primarily in the middle and opening of the forge and along the south wall of the house. Many nails were also recovered from within the cellar, probably buried with house structural debris (likely rotten and decayed) when the cellar was filled in and buried. A chisel and a fragment of a nail-header were the only iron-working tools found. European flint strike-a-lights for fire-making were also found in the forge area; these were made by breaking up cobbles that had likely been ship ballast dumped on the shore.

Once commonplace, Early American, family-owned Yankee blacksmith shops have vanished. Nails and hardware, the manufacturing and repair of tools and implements, and shoeing horses and oxen were necessities of everyday life. Blacksmith shops could be found on every main road throughout New England but virtually none are standing and very few shops have been archaeologically excavated. Archaeological data can shed new light on how such shops were run, what they manufactured, how they were organized, how the families lived, and how they evolved over time.

For more information on the Daniels Site visit the website: http://www.ahs-inc.biz/Daniels/

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History of the Engine House and Water Tower at the Shore Line East Guilford Train Station

Town of Guilford, New Haven County, Connecticut

Introduction

The Engine House and Water Tower are circa (ca.) 1875 brick industrial buildings located on the north side of the railroad right-of-way (ROW) at the Guilford Train Station at 325 Old Whitfield Street in the Town of Guilford, New Haven County, Connecticut (Photos 1 and 2). The buildings and the three-track railroad ROW are owned by the National Railroad Passenger Corporation (Amtrak), and the Connecticut Department of Transportation (CTDOT) operates its Shore Line East trains along the ROW. The Engine House and Water Tower are rare surviving examples of 19th-century railroad buildings that facilitated steam engine maintenance and operations, and are classified as contributing resources to the Guilford Town Center Historic District which was listed in the National Register of Historic Places (NRHP) in 1976 for its historic and architectural significance (NRHP, no date). They are in a highly deteriorated condition.

CTDOT intends to erect a 100-vehicle parking lot on the north side of the Guilford Train Station, north of the Engine House and Water Tower, and lengthen the eastbound platform. In compliance with Section 106 of the National Historic Preservation Act (NHPA), CTDOT and the Connecticut State Historic Preservation Office (CTSHPO) have concurred that the action will not constitute an adverse effect provided that CTDOT: 1) prepare a State-Level Historical and Architectural Character Documentation Report which is available at the CTSHPO in Hartford, and 2) protect the historic buildings during construction.

Historic Context

The first railroads were established in Connecticut in the 1830s. By 1852, the New Haven & New London Railway opened a railroad along the Long Island Sound from New Haven, across the Connecticut River to New London via Guilford. It completed a physical junction with the New London, Willimantic & Palmer Railroad at New London, and offered connections to Boston (Withington, 1935). Two Guilford residents were officers of the New Haven & New London Railway, President Frederick R. Griffing (1799-1852) and Treasurer R.D. Smyth (1804-1874). Because of the involvement of Griffing and Smyth, much of the railroad's stock was taken in Guilford (Steiner, 1975).

Soon after the opening of the New Haven & New London Railway, the New London & Stonington Railroad was incorporated in 1852 to operate between Groton and Stonington along the Long Island Sound, with a ferry connection across the Thames River in New London. In 1856, the New Haven & New London Railway merged with the New London & Stonington Railroad to form the New Haven, New London & Stonington Railroad Company (Steiner, 1975). The new railroad opened in 1858, and despite the ferry crossings at the Connecticut and Thames rivers, a predominantly all-rail route was made available between New York City and Boston, operated by multiple railroad companies (Public Archeology Survey Team, Inc. [PAST], March 2001; Withington, 1935).

The New Haven, New London & Stonington Railroad Company failed to make a profit (Steiner, 1975). In 1864, it was reorganized with the portion from Groton to Stonington sold to the Stonington Railroad, and the portion from New Haven to Groton, via Guilford, reorganized as the Shore Line Railroad Company, commonly known as the Shore Line Railroad (PAST, March 2001).

The Shore Line Railroad was more financially successful than the preceding rail companies, and in 1870 the line was leased to the New York & New Haven Railroad for $100,000 per year (Steiner, 1975). That same year, a bridge was completed over the Connecticut River, eliminating the need for a ferry crossing at that location (Karr, no date). Lease of the Shore Line Railroad proved to be a strategic move because it provided the New York & New Haven

Railroad with a valuable connection along the Long Island Sound via Guilford. Two years later in 1872, the New York & New Haven Railroad merged with the Hartford & New Haven Railroad to form the New York, New Haven & Hartford Railroad Company, commonly known as the New Haven Railroad. The Shore Line Railroad Company lease via Guilford was incorporated into the new consolidated company. The New Haven Railroad operated freight and passenger trains in New York, Connecticut, Massachusetts, and Rhode Island, including its well-used main line between New York City and Boston (New Haven Railroad Historical and Technical Association, 1998).

In 1874, the New Haven Railroad purchased property in Guilford to construct maintenance facilities on the north side of the railroad tracks, east of the grade crossing at Whitfield Street (present-day Old Whitfield Street). It is likely that one year later in 1875, the one-and-a-half-story, rectangular-plan, brick Engine House and associated non-extant turntable, and the two-story, octagonal-plan, brick Water Tower and associated non-extant well were built. At the time of their construction, the Engine House and Water Tower became part of a growing railroad depot which included the Passenger Station and platform built on the north side of the railroad tracks between 1852 to 1864.

As built, the six-bay-by-two-bay Engine House measured 62 ft long and 37 ft wide, and was capped by a side-gable roof pierced by two brick chimneys and a central ventilator. The north and south, or side, facades were pierced by six nine-over-six double-hung sash set within arched brick surrounds with stone sills. Each window was set within a recessed panel, flanked by brick pilasters which extended to a simple brick cornice. The east façade had two arched openings on the first story, and two oculus windows in the top half-story. The two arched openings faced the turntable located east of the Engine House, and two sets of tracks led from the openings to the turntable, while one track led from the turntable to the railroad ROW (Sanborn Map Company, 1889). Based on this evidence, it appears that the Engine House provided space for the maintenance of up to two steam locomotives.

As built, the octagonal-plan Water Tower measured 26 feet (ft) in diameter and 22 ft high, and was capped by a tent-shaped roof with a central ventilator topped by a finial. Opposite the railroad ROW, the first story of the Water Tower had a door set within a segmental brick-arch surround, and six-over-six double-hung sash set within segmental brick-arch surrounds with stone sills. Oculus windows pierced the second story. The corners of each facade were embellished with two-story pilasters. The upper portion of the pilasters featured corbelled brick with stone caps. A brick dentil course extended between the pilasters on each façade. Within the Water Tower, a steam pump and boiler occupied the first story, and a water tank occupied the second story. The tank was constructed of redwood with an iron plate at its base which was heated by steam from below (Roth, 1980). The water tank was supplied by a well located east of the building, and an underground water pipe carried water westward from the Water Tower to a vertical swiveling pipe that could be swung over the northernmost railroad tracks to fill locomotive tenders. A wheel-operated valve at the base of the northernmost tracks controlled the water flow (PAST, March 2001).

In general, water towers, such as the building at the Guilford Train Station, were crucial to the successful operation of steam railroads during the 19th century. Steam engines consumed large amounts of water and had to stop repeatedly to refill their supply because they were not designed to recapture steam. Availability of water and fuel, such as coal or wood, determined the range of a steam locomotive. Therefore, water towers regularly spaced along a railroad ROW facilitated smooth operations. The towers were most often placed at stations, such as Guilford, where the delay associated with obtaining water could coincide with scheduled station stops (PAST, March 2001).

In 1889, the New Haven Railroad constructed a bridge over the Thames River in New London which replaced the ferry crossing (Withington, 1935). Completion of the bridge resulted in an all-rail journey along the Shore Line Railroad in Connecticut, speeding travel between New York City and Boston, and facilitating the ability of the New Haven Railroad to become the most expedient route between the two cities during the late-19th and early-to-mid-20th centuries. Many improvements were made to the Shore Line Railroad during the 1890s. Between 1890 to 1891, it was double-tracked via Guilford. In 1897, the Shore Line Railroad was finally consolidated into the New Haven Railroad, became its Shore Line Division, and was poised for further growth in the 20th century (Steiner, 1975).

By 1909, the New Haven to Boston section of the New Haven Railroad had obtained numerous railroad maintenance and service facilities through its acquisition of regional railroads. These included:

- 42 Roundhouses;
- 180 Water Stations, including the Water Tower in Guilford;

- 74 Coaling Stations; and
- 109 Turntables, including the Turntable in Guilford.

As locomotive technology improved during the first half of the 20th century, the number of maintenance and service facilities slowly decreased along the New Haven to Boston section in favor of fewer centralized locations in New Haven, Providence, and Boston. This consolidation set the stage for the demise of the Guilford Engine House and Water Tower (Public Archeology Lab [PAL], 2001).

During the early 1920s, the Engine House and Water Tower remained in active use at the Guilford Train Station as Shore Line Division trains still relied upon steam locomotives for motive power. By 1922, however, the well which supplied groundwater to the Water Tower may have been defunct. Newspaper accounts indicated that "[e]ngines were first supplied with water from a well near the tank house which was pumped into tanks conveniently placed by the track. Now city water is used" (Shore Line Times, July 6, 1922). Based on historic maps and photographs, by 1925, the Engine House was converted into a storage facility and no longer appeared to be used for engine repair based on the large number of maintenance and service facilities along the New Haven to Boston section of the New Haven Railroad during this period (Sanborn Map Company, 1925) (Photo Plate 1). During this period, a single-story, wood frame addition was appended to the northern portion of the west façade of the Engine House, and was most likely constructed to provide additional work space for buildings users.

Beginning in the 1930s, the New Haven Railroad began to switch from steam to the more efficient diesel electric locomotives along the non-electrified portions of its railroad ROW, including the Shore Line Division via Guilford. By the end of World War II, the New Haven Railroad had 60 diesel electric locomotives, many of which were used along the Shore Line Division via Guilford. By 1950, the switch from steam to diesel electric locomotives along the Shore Line Division was complete for both passenger and freight trains, and the Engine House and Water Tower were rendered obsolete (Swanberg, pers. comm., October 8, 2009).

Plate 1. *View looking east toward the Water Tower and Engine House on the north side of the railroad right-of-way (ROW) at the Guilford Train Station. Both buildings retain their historic form and massing despite their deteriorated condition.(Robert Stewart, 2009)*

During the 1950s, the New Haven Railroad began to decline as the federal government invested in highway construction. In 1958, the Connecticut Turnpike (Interstate [I] 95) was built largely adjacent to the Long Island Sound, US Route 1, and the New Haven Railroad between Greenwich and East Lyme, via Guilford. Completion of the turnpike greatly facilitated inter-city and long distance travel by automobile, rather than railroad. Furthermore, the long-haul trucking industry gained in popularity as it became more economical to ship goods via truck rather than freight trains (PAL, 2001; "Connecticut Turnpike," no date). In 1969, the New Haven Railroad was purchased by Penn Central Corporation which eventually declared bankruptcy. Bankrupt passenger lines were incorporated into the federally subsidized, quasi-public agency, Amtrak, in 1971, and bankrupt freight lines were incorporated into the Consolidated Rail Corporation (Conrail) in 1976 (Adams, 1996).

Following the creation of Amtrak, the agency was charged with the responsibility to preserve inter-city passenger service in the northeast between Washington, DC and Boston, among other duties. Dubbed the Northeast Corridor route by Amtrak, it utilized a portion of the former New Haven Railroad ROW between New York City and Boston, via Guilford (PAL, 2001). While trains passed through Guilford, they no longer stopped there, and the station entered a dormant period.

Documents and historic photographs of the Guilford Train Station from the 1970s indicate that the Engine House was occupied by a manufacturer who slightly altered the building. In addition, the Water Tower remained standing in decrepit condition. Despite their condition, the significant role that the Engine House and Water Tower played in Guilford history was officially recognized in 1976 when the Guilford Town Center Historic District was listed in the NRHP. Both buildings were designated as contributing resources to the district (Raiche, 1975; NRHP, no date).

In 1977, Amtrak surveyed the Guilford Train Station as part of its plan to refurbish the Northeast Corridor ROW through the installation of new rails and concrete ties. The new rail system would facilitate the introduction of high-speed trains (Berman, 1979).

By the 1980s, increasing traffic on the Connecticut Turnpike (I-95) sparked interest in reviving local train service in Guilford. In 1988, CTDOT

Plate 2. *View looking northwest toward the Engine House and Water Tower.*
(Robert Stewart, 2009)

Plate 3. *Looking northeast toward the Engine House and Water Tower in 1928. (Source: New Haven Railroad Photograph Collection, University of Connecticut, Thomas J. Dodd Research Center, Storrs, Connecticut)*

allocated funds to establish the Shore Line East Commuter Railroad between New Haven and Old Saybrook, via Guilford. The trains would run along the former Shore Line Division ROW, and stop in Guilford. To operate the railroad, CTDOT entered into a contract with Amtrak for use of a portion of the Northeast Corridor ROW. The Shore Line East Commuter Railroad began service in Guilford in 1989. As a result, improvements were made at the Guilford Train Station that consisted of a platform and parking lot on the south side of Whitfield Street, and installation of Plexiglas shelters, telephones, and lights (Seo, September 16, 1989; Tardiff, December 8, 1989; Tardiff, February 17, 1990).

By 1990, ridership on the Shore Line East Commuter Railroad exceeded CTDOT's projections, and by 1996, service was extended eastward to New London ("Shore Line East," no date; Altimari, October 21, 1990). Photographs from the 1990s indicate that the Engine House and Water Tower were vacant and in poor condition.

During the early 1990s, Amtrak embarked on a project to electrify the Northeast Corridor between New Haven and Boston to facilitate introduction of its high-speed Acela train. By 2000, electrification via steel catenary bridges was complete, and Acela commenced service between Washington, DC and Boston, via Guilford (Guilford Courier, November 30, 2000). In 1999, the Town of Guilford formed a Train Station Oversight Committee (TSOC) when CTDOT announced plans to upgrade stations along the Shore Line East Commuter Railroad to help ease traffic congestion. The plans called for new eastbound and westbound platforms on the north and south sides of the railroad tracks, respectively; a pedestrian overpass above the tracks; and parking expansion. CTDOT's plans also proposed removal of the 19th-century Passenger Station on the north side of the railroad tracks, but preservation of the vacant Engine House and Water Tower would be explored (Ezold, May 26, 1999).

Simultaneous with the electrification of the New Haven to Boston portion of the Northeast Corridor in 2000, Amtrak removed the 19th-century Passenger Station located on the north side of the railroad tracks in Guilford (Fredricksen, February 25, 2000). Amtrak claimed that they took such action because the station's deteriorated condition posed a hazard to rail operations (Harvey, February 26, 2000). Removal of the building galvanized the historic preservation community in Guilford who claimed they had been engaged in a study to examine methods of rehabilitating it prior to its removal (Fredricksen, February 25, 2000). In response to the concerns expressed by the historic preservation community, Amtrak offered to sell the Town of Guilford the Engine House and Water Tower for $1 per building (Crompton, June 20, 2000). The town opted to explore methods of building rehabilitation prior to accepting the offer.

In the early 2000s, Guilford elected officials, TSOC, and the Guilford Preservation Alliance (GPA), encouraged CTDOT to design a new train station complex that would incorporate the Engine House and Water Tower (PAL, 2001; PAST, March 2001). In 2004, GPA committed funding to support stabilization and rehabilitation of the buildings, and assembled a team to explore alternatives (Connecticut Preservation News, March/April 2005). In 2005, GPA published a proposal which included a rendering of a new train station connected to the rehabilitated Engine House and Water Tower. The proposal also indicated that GPA would solicit development schemes for the property (GPA, 2005). Discussions between GPA and Amtrak continue concerning acquisition of rights to both buildings (Weeden, pers. comm., December 8, 2009).

On November 28, 2005, the new Guilford Train Station opened to the public ("Shore Line East", no date). Although the Engine House and Water Tower have not yet been rehabilitated or incorporated into the new station, CTDOT has required that when the new parking lot is built, precautions be taken to ensure that they remain stable during construction. The retention of both historic buildings will allow for further coordination between the interested parties in determining an appropriate treatment for them.

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