

**Society for Industrial Archaeology  
and  
Middlesex Canal Association**

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**Joint Tour  
of the  
Middlesex Canal**

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**May 3, 2014**

## **AGENDA**

### **0930 - Assemble at the M'sex Canal Museum**

Growth of the Canal System

Video - Journey Along the Middlesex Canal

Presentation - Canal Landings

### **1100 - Board Bus**

Quick visit - West side of Concord River

Summary of activities conducted here

### **1200 - Lunch - Sichuan Garden**

Short walk along "restored" section of canal

### **1315 - Board Bus**

Debarb - Symmes River Aqueduct

Passby - Tay's Tavern site

Debarb - Maple Meadow Brook Aqueduct

& rope scoured rock @ Oxbow

Passby - Shawsheen Aqueduct

Passby - Allen's Tavern

Passby - Lock Keeper's House, Gillis Lock

Debarb - Walk through, McLannan Way to Brick Kiln Road (time permitting)

Debarb - Middlesex Village

### **1600 - Return to Museum**

## HISTORY OF THE MIDDLESEX CANAL

During the 1790s, soon after the end of the Revolutionary War, American economic and political leaders became aware of the commercial and industrial advantages that man-made waterways brought to England and France, and wished to emulate their success in the United States. Such developments were also intended to bind the new republic more closely together, as championed by Alexander Hamilton.

In Massachusetts, General Henry Knox, a Revolutionary War hero and America's first Secretary of War, was among the early canal enthusiasts. In 1791, he headed a company, incorporated by the Massachusetts legislature, to build a 100-mile-long canal between the Connecticut and Charles Rivers. Although this canal never advanced beyond the planning stage, it, nevertheless, prepared the citizens of Massachusetts for other more economical and technically feasible canal projects. (Among these projects was the Pawtucket Canal, built to by-pass the dangerous Pawtucket Falls on the Merrimack River. Its opening predated the Middlesex Canal by about six years.)

The Middlesex Canal, which linked Charlestown, on the Charles River, to the Merrimack River at Chelmsford, was the result of efforts by merchants and other wealthy men of Boston, Medford, and surrounding towns to develop a more efficient way to tap the natural resources and reach the markets of the Merrimack River Valley in northeastern Massachusetts and New Hampshire. Incorporated on June 22, 1793, the enterprise was given ten years to complete its task. The first meeting of the Proprietors was held at the Blanchard Tavern in Medford.

James Sullivan, a highly successful lawyer who became attorney general and later Governor of Massachusetts, was an early advocate for and an investor in the Middlesex Canal. He, Loammi Baldwin and other investors joined together to form the Middlesex Canal Company and to serve on its Board of Directors, with Sullivan as president.

As Superintendent of Construction, Baldwin received early technical assistance from William Weston, an English canal engineer who was in America supervising the construction of several canals in Pennsylvania. In the summer of 1794, during a three-week visit to Massachusetts, Weston and Baldwin surveyed two proposed routes for the Middlesex Canal using a "wye-level", an instrument first brought to America by Weston. Thereafter, Weston never returned to the canal site; but he contributed lock plans and sections adapted to the intended size of

the Middlesex, provided patterns to be used to cast selected lock parts, and sometimes consulted with Baldwin by letter.

A precursor of the modern transit, the “we-level”, together with a graduated “station staff”, i.e., a vertical measuring rod, enabled accurate elevation measurements to be made, repeatedly and continuously, along the route of survey. The results of the Weston-Baldwin survey pointed out significant elevation errors in earlier surveys made by Samuel Thompson and others. James Sullivan subsequently purchased two of these instruments, from Weston’s source in London, for the Middlesex Canal Company.

Baldwin was familiar with the technique of “puddling” - literally the sealing of a canal against leaks by packing the channel with layers of hard-packed clay. This was done at selected sections, however this technique was determined to be too expensive to be used throughout and Baldwin developed alternative means to seal the bed of the Middlesex. Generally this involved packing the earth bottom and sides, once roots and stones had been removed, and “seasoning and consolidating” the banks by flooding, draining and repacking them; and repeating this procedure until a sufficient seal was achieved. Though not as effective as puddling, and more susceptible to leakage and damage, this solution was acceptable and more affordable.

Baldwin was responsible for still other technical innovations. Among these was adapting hydraulic cement for use on the Middlesex Canal. Known since ancient times, this special cement, which hardens or “sets” underwater, was initially used to build the three locks between the northern canal terminus and the Merrimack River. Baldwin manufactured this material by grinding “trass” very fine, and mixing it with lime and sand.

“Trass” is a volcanic stone that the Middlesex Canal Company imported from the Dutch West Indies. Finding a source of volcanic stone in the western world, importing it, developing a good working process, constructing the canal locks and recording the formula was a definite contribution. Years later his formula appeared in civil engineering books, thus this may have been the first use of hydraulic cement in the USA.

Baldwin created other notable engineering structures. Particularly impressive was the aqueduct that carried the canal across the Shawsheen River. One of eight aqueducts along the canal, the trough was 188 feet long and stood 35 feet above the river. It was built of wood, like a boat-hull turned inside out, and suspended on two abutments and three central stone piers, all of which were constructed without the use of mortar.

Completed on December 31, 1803, the Middlesex Canal became an immediate success. In his 1808 survey of internal improvements, Albert Gallatin called it “the greatest work of its kind to date in the United States”. Another assessment claimed that it increased the value of New Hampshire timber, alone, by five million dollars.

Timber and masts from the forests of New Hampshire were very important items of canal commerce. These were bound into rafts at the points of origin and floated on river and canal to Boston and Medford, or by the river to Newburyport.

Dozens of canal boats, ranging from 45 to 75 feet in length and 9 to 9½ feet in width, were used. On the river, these boats were poled, rowed and sometimes sailed; on the canal, they were drawn by a horse or two, usually obtained from the company livery. Unlike other canals, families did not live aboard these boats, hence the need for taverns, boarding houses and other land based facilities to support the crews and others who traveled on the canal.

In about 1804, a tidal lock was constructed to provide access from the Charlestown mill pond (the southern terminus of the canal) into the Charles River. A fixed line, which was weighted so that it normally sank to the bottom (so as not to interfere with boats traveling on the river), was extended across the river to the Boston shore. Boatmen used this line to warp their boats across the river. Initially, the Boston end of this line terminated at Barton’s Point, where a warehouse was constructed to facilitate the transshipment of goods.

In 1805, a branch canal, incorporating two lift locks (one being a tidal lock), was constructed in Medford to access the Mystic River. This enabled the canal to better serve the many ship-building firms situated along that river. Medford was originally conceived as the southern terminus for the canal but had been bypassed, initially, for a more direct connection to Boston.

In 1808, John Langdon Sullivan, a son of James Sullivan, became the Agent for the Middlesex Canal. Among his earliest contributions was to devise and promulgate procedures for operating and using the canal, and for collecting fares, all of which were essential to the sustainment and fiscal health of the canal. He claimed to be a businessman; however Sullivan also served in an engineering capacity for the construction of several of the Merrimack River Canals and the maintenance of almost the entire system thereafter.

In 1809, a bridge was constructed across the Charles River, from Leverett Street in Boston to Lechmere Point. This was a joint effort of the Middlesex Canal Company, the Lechmere Point Company (established by Andrew Cragie and

several other proprietors of the Middlesex Canal Company, and other investors), and the Newburyport Turnpike proprietors. Apparently the bridge was to include towing paths “by the sides of such bridge” for conducting boats, rafts, etc., but no record has been found to indicate that this feature was ever added; and so the fixed line, described above, continued to be used by boats crossing the river.

In about 1810, an independent firm, the Boston Mill Pond Company (MPC) constructed a canal into Haymarket Square (unofficially called the Mill Creek Canal), along the route of Boston’s present day “Canal Street”. Further on, Boston’s harbor was reached through “Mill Creek”, a natural waterway that the MPC had earlier enlarged to provide small boat access between their mill site (by Haymarket Square) and the harbor.

At about the same time, the Lechmere Point Corporation laid out a land development plan that included the construction of docks and canals in East Cambridge (across the Charles River from Boston). Named the Broad, Lechmere, South and Portland (or North) Canals, this network was intended to link all of East Cambridge and Cambridgeport, through the Middlesex Canal, to the commerce of the Merrimack Valley. The Broad Canal extended from the Charles River more than half a mile parallel to and just north of Broadway. The North Canal connected the Broad Canal to the Miller’s River, running between what is now Portland and Fulkerson streets and meeting the channel of the Miller’s River at a landing near what is now the intersection of Lambert and Gore Streets. The South Canal ran between Broadway and Canal Streets (later named Harvard Street), running parallel to the Broad Canal for about a quarter mile. The middle of the Broad Canal was connected to the east end of the South Canal via the Cross Canal near what is now Ames Street. This provided an alternate access to the Charles River. It is not clear whether the North Canal ever saw much use. The Broad Canal remained in use into the 20th Century, and its eastern end remains intact today.

In the book *East Cambridge* (by Susan E. Maycock and the Cambridge Historical Commission), we find the following: “The construction of the North Canal between the Miller’s River and the Broad Canal after 1811 may have been intended to provide a protected route to the canals in the Lower Port. Although one traveler tells of going to East Cambridge to board the packet boat *General Sullivan* for Chelmsford, there is only circumstantial evidence linking commercial traffic on the Middlesex Canal to the Cambridgeport canal system.”

To the north, the Middlesex Canal connected with the Merrimack River at Middlesex Village. By 1815 this river had been made navigable upstream to Concord, New Hampshire, by eleven relatively short canals constructed around

discrete falls and rapids, (and possibly on to Plymouth, through yet an additional canal). The river downstream was navigable, made so by about 1796 by the Proprietors of Locks and Canals on Merrimack River. All together, the upstream canals, the Middlesex and Pawtucket Canals, and improvements made to nine other rapids, extended commercial transportation between Concord and Boston, and to tidewater and beyond. Additional tributary canals soon provided access to several growing villages and industrial sites along the Merrimack. At its peak, the total river and canal complex considerably exceeded 100 miles in length.

Soon after being made agent for the Middlesex Canal, John Langdon Sullivan became head of the Merrimack Boating Company (MBC), his own private company, which became the principal long-haul shipper on the canal. Also, as head of the Boston Steamboat Company, Sullivan developed several generations of steam tow boats that were used by the MBC, for more than a decade (perhaps for more than two decades), to expedite shipping on the Merrimack River. From this latter endeavor, Sullivan was awarded a total of 16 patents of his own; and he employed the rights of another eight patents held by Samuel Morey and Michael Morrison, and possibly one by Robert Fulton.

The Middlesex Canal's period of greatest prosperity occurred between 1819 and 1833. However, in 1830, the state of Massachusetts chartered the Boston and Lowell Railroad. Ironically, the railroad, which became the canal's greatest rival and the mechanism of its demise, used the canal over the next two years to transport rail line construction materials and its first engine. Unlike the canal, which froze in the winter, the railroad could operate throughout the year; it was also faster and more flexible. As successive rail lines extended northward, first to Lowell in 1835, then to Nashua in 1838, and finally Concord in 1842, they progressively took away the canal's customers. Commercial traffic on the Middlesex Canal ended on November 23, 1851, though independent boaters apparently made some use of it for a year or so longer. Nine years later the Middlesex Canal Company was dissolved and the waterway abandoned. Although it ultimately succumbed to them, the complex of the Middlesex and Merrimack River Canals competed with the railroads for a decade and a half.

The early success of the Middlesex Canal helped to inspire the construction of canals in other parts of the United States, particularly the Erie Canal. States such as New York sent official delegations to inspect the successful Middlesex. The Middlesex Canal also served as a school of practical experience for early engineers, and is considered by many to be the birthplace of American Civil Engineering.

Suggestions for further Reading

Samuel P. Hadley, Boyhood Reminiscences of Middlesex Village (with Map), Contributions of the Lowell Historical Society, Volume 1, April 1913; pp. 180 to 286

Christopher Roberts, The Middlesex Canal. Cambridge, Mass: Harvard University Press, 1938.

Lewis M. Lawrence, The Middlesex Canal. Boston Mass. 1942. Manuscript reprinted in 1997 by the Middlesex Canal Association.

Mary Stetson Clark, The Old Middlesex Canal. Easton, Pa: Canal History and Technology Press, 1986.

Bert VerPlanck, Middlesex Canal Guide and Maps, Billerica Mass: The Middlesex Canal Association, 1996

Carl and Alan Seaburg and Thomas Dahill, The Incredible Ditch: A Bicentennial History of the Middlesex Canal. Medford, Mass: Anne Miniver Press, Medford Historical Society, 1997

East Cambridge, Volume I of the 5-volume Survey of Architectural History in Cambridge; Cambridge Historical Commission, Revised Edition by Susan E. Maycock. Cambridge, MA: MIT Press, 1988

Many of the records of the Proprietors of the Middlesex Canal can be found at the Mogan Center in Lowell, the Massachusetts Historical Society in Boston, and Baker Library at Harvard University in Cambridge, all in Massachusetts.

Exhibits, and some of the same records, can be seen at the Middlesex Canal Museum in North Billerica, Mass.

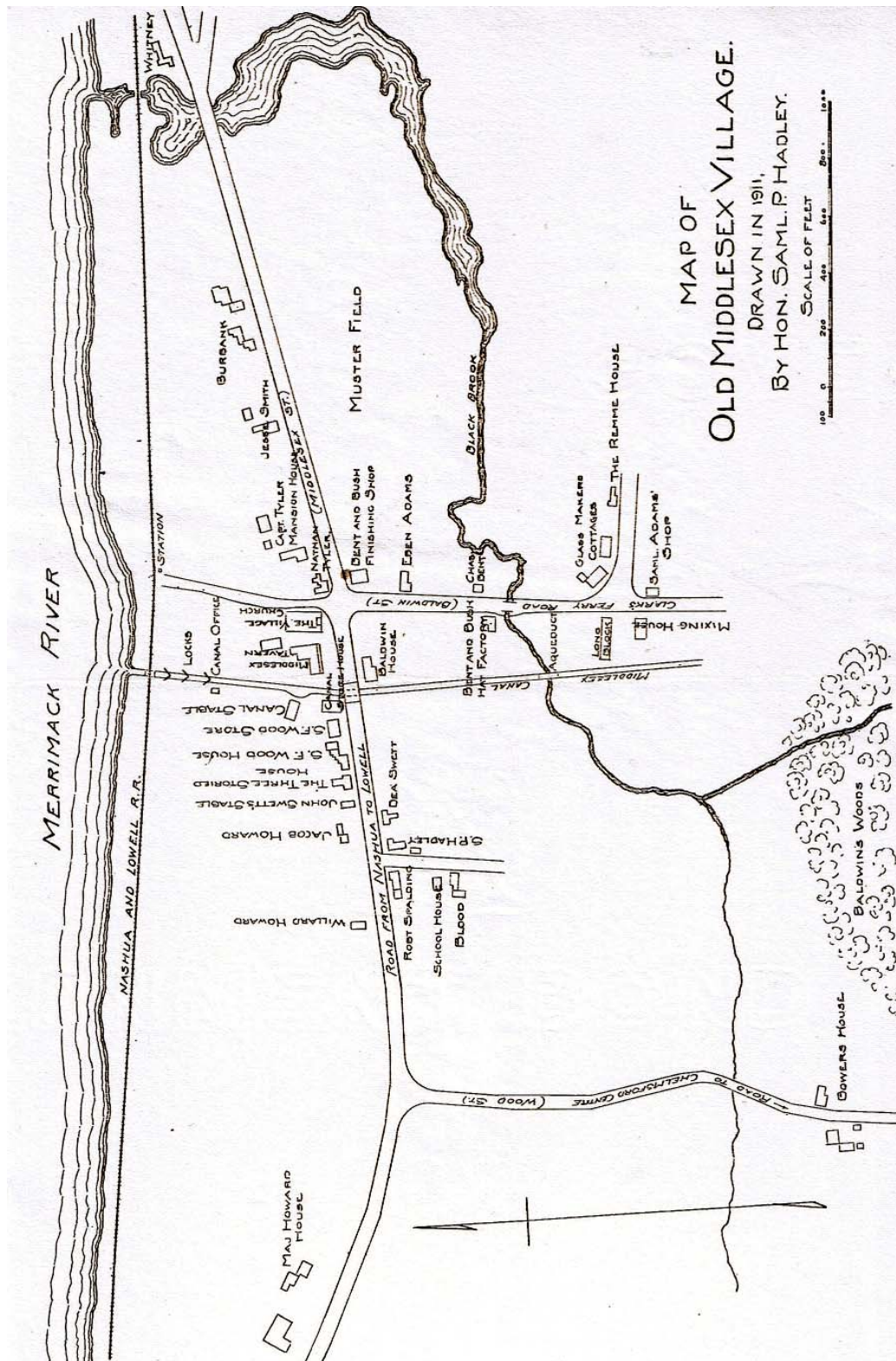
Links: Middlesex Canal Association: [www.middlesexcanal.org](http://www.middlesexcanal.org) and Lowell National Historic Park: [www.nps.gov/lowe](http://www.nps.gov/lowe)

### **A DESCRIPTION OF THE MIDDLESEX CANAL** by Charles Frederic Morey

See <[middlesexcanal.org/towpath/canalnewsJan1964.htm](http://middlesexcanal.org/towpath/canalnewsJan1964.htm)> for text and graphics



**PLOT PLAN OF MIDDLESEX VILLAGE**  
 by Judge Samuel P. Hadley  
 from: Boyhood Reminiscences of Middlesex Village





## BLACK BROOK AQUEDUCT

by Bill Gerber

See <<http://middlesexcanal.org/towpath/towpathtopicsApr2014.htm>> for text and graphics.

## THE SHAWSHEEN AQUEDUCT RESTORED

by Robert E. Valyou

In 1969 the Greater Lowell Area Planning Commission issued a report which documented the natural resources and historical sites located in this area. In their report the Commission concluded that the most significant area-wide historical resource was the Middlesex Canal. They further recommend that each town take steps to preserve those remnants located within its borders. Thus was born what was probably the first area-wide restoration project in the State and perhaps the most important.

Area towns, including Chelmsford, Wilmington and Woburn initiated action on this project with notable success. Perhaps the most spectacular structure associated with the Middlesex Canal was, and still is, the Shawsheen Aqueduct, the point at which the canal crossed the Shawsheen River. It has been designated a



photo by Kathy Norton

**Shawsheen Aqueduct, October 2013**

National Historic Civil Engineering Landmark and represents the most ambitious project in the entire length of the canal. Over the years, but at an ever increasing pace, erosion, both natural and man-made, have taken their toll. Restoration of this historical monument was undertaken by the Town of Billerica.

Early in 1975 the Billerica Planning Board applied for Federal assistance to restore it. Under the auspices of the Area Planning Commission, application was made through the Community Block Grant Program.

On April 3, 1975, the Billerica Planning Board held a pre-application hearing and on April 5 approval was given by the Town Meeting for the Selectmen to file an application. A public informational hearing on the project was held by the Planning Board on April 8, 1975, and on August 29, 1975, the application was filed.

Coordination was handled by Mark Hall, Secretary of the Planning Board, with substantial assistance from Col. Wilbar M. Hoxie, President of the MCA.

Approval of the project was received on November 26, 1975, and the Billerica Historical Commission was designated by the Board of Selectmen as the administrative unit. On March 25, 1976, the Board of Selectmen received a letter of credit notifying them that, subject to an environmental review, \$25,000 was available for the project.

For the next year Archaeological, Historical and Ecological surveys were conducted to satisfy the requirements of the Environmental Review. Final release was received on April 26, 1977. During that same period, the Historical Commission, with help of the Selectmen's office and Public Works Engineers compiled and received approval of a set of detailed specifications in preparation for competitive bidding.

The job was advertised, and on August 11, 1977, the bids were received. Prices ranged from \$14,500 to \$22,900. The low bidder was E. C. Blanchard Co., Inc. of Lynn. A contract was signed on October 4, 1977. Work started the next day and was completed on October 27. Every effort was made by the contractor to keep the work moving to avoid conflict with the sewer project which passes through the same area. The effort was successful.

Except for a few rainy days, work proceeded smoothly. Expandable aluminum joints were suspended from the granite ledges and a staging was erected between the West abutment. Stones were lifted from the river banks and laid out on the canal banks, west of the aqueduct, for measuring and selection. Every

effort was made to identify stones and place them in their original position. Only original stones were used with the exception of the long ashler on the South end of center pier. This stone could not be found and the Committee felt that it was of sufficient importance to the overall effect to warrant buying a replacement.

Stones to finish the top of the pier were dredged from the river bed. I am told that some of the workers had a chilly swim. Finally several yards of concrete were poured into the center of the structure in the hope that it will last for another 200 years.

This has truly been a cooperative project. In addition to the many Town Boards and Committees who took part in one way or another, much interest and assistance was given by neighboring residents and people from out of town. Perhaps with this as a start, other portions of the Canal can be saved.

### **GILLIS LOCK TENDER'S HOUSE & TAVERN**

Over the years I've read 'snippets' about, and thought about, the lock keepers' houses (and taverns) that once served boatmen and other canal travelers. This article is an attempt to cluster the disparate snippets, and my thoughts about them, in one place. Please be aware that the article includes considerable speculation.

Given that we have no evidence that anyone lived aboard our freight boats, or that there were even provisions aboard for them to do so, it seems likely that the 'board and room' needs of travelers on the Middlesex Canal and the 'Merrimack River Navigation' were met by an "exoskeleton" of canal side taverns, lock keepers houses, and rooming houses (the latter more for boatmen who wintered over).

A photo of the Keeper's House at Gillis Lock is shown below, and the content of this article should pertain to it, as well as others.

With this in mind, it seems reasonable to expect that the taverns and lock keepers houses would have been laid out, internally, so that there would have been semi- private living space for the keeper's family, and a "common room" of sorts, where family members and hired help would have fed and 'entertained' the boatmen and travelers.





Occasional references to strong libations suggest that this latter area would likely have included a 'bar' of sorts. (E.g., see Folklore and Music in the October '09 issue of Towpath Topics at [middlesexcanal.org/towpath/towpath](http://middlesexcanal.org/towpath/towpath).) By the way, the canal song that begins - "Oh The Middlesex Was Rising" - and includes the line - "I scarcely think that I'll get a drink 'till I get to Butter's Row", might possibly refer to Tay's Tavern, but more likely refers to the keeper's house at Gillis Lock, the facility nearest to Butter's Row.

Above the common room, likely there would have been sleeping facilities - perhaps bunk rooms to accommodate men and women separately, or possibly the second floor was divided into individual rooms. There may also have been separate stairs between the floors to serve the family independently of the boatmen and others, a desirable feature from both convenience and safety points of view.

Likely there would have been a small office area in the house, where the lock keeper could keep his ledgers and receipts secure. Company regulations called for the keeper to issue and collect on passports, from time to time, for the shipment of goods that might not travel the full length of the canal. Fresh blanks would have been delivered by the Packet, as needed, and would also have been kept in the office. Likely any receipts would also be sent to the Corporate office on the downward-bound Packet.

Recall that the primary purpose of the packet boat was to maintain communications up and down the canal, so this was the way that company

business was conveyed between the corporate offices and all of the lock and landing sites. (Of course, to defray the cost of operating this essential function the packets also carried paying passengers and light freight.)

Outside, nearby, there would have been a 'privy' (no doubt a "multi- holer"), a stable, and perhaps a shed or workhouse of some sort where the boatmen's horses would have been sheltered and cared for. It wasn't intended for the Lock Keeper's sites to be horse-changing stations. For the Packets, the horse changing function appears to have been accomplished mid-canal, at Tay's Tavern (on the Woburn/Wilmington line). Spare horses, to replace a sick, injured or lame horse may have been kept here but more likely were available at the Concord River Crossing in North Billerica and at Horn Pond, i.e., at the "quarter-distance" points.

According to the owner of one of the few surviving Lock Keeper's houses, the total area of his original property was about 6.5 acres. This would not have been enough land to farm on any reasonable scale, but would have been adequate for a good size garden that might have provided fresh vegetables seasonally, and perhaps a small orchard; in fact, there are a few scrawney apple trees on the Wilmington property. (Baldwin Apples, perhaps?)

An exchange of messages with an owner may have resolved a long standing mystery about his house. The 'oral tradition' was that his house is now laid out asymmetrically because part of the house was detached, moved across the street and used as the basic structure for a new house. No doubt, houses are sometimes moved, but almost never are sections of them removed unless they are semi-autonomous additions. At one point I sent the owner a clip of Louis Linscott's painting of the Horn Pond House. This was an important clue, the owner realized that what was removed from his house was the attached carriage shelter; thus the structure of the nearby house 'fit the picture'; mystery solved!

### **THE OLD MIDDLESEX CANAL - 1898,**

[The following article was contributed by Andrea Houser a member of the Association. Daniel Gowing, her great grandfather, was lock tender at the Gillis Lock. He was featured in a newspaper article found in Mary Gowing Swain's, Wilmington scrapbook (Wilmington Public Library, call no. W 974.444 Wil).]

See <[middlesexcanal.org/towpath/towpathtopicsOct2008.htm](http://middlesexcanal.org/towpath/towpathtopicsOct2008.htm)> for text and graphics.

See also: excerpts from the Wilmington Patch -- <<http://wilmington.patch.com/articles/then-and-now-gillis-lock-house#photo-7917994>

And see excerpts from MIDDLESEX CANAL ARCHAEOLOGICAL RECONNAISSANCE SURVEY, submitted by PAL (<<http://www.middlesexcanal.org/Report.html>>)





# MIDDLESEX CANAL SYMMES RIVER AQUEDUCT

by Tom Raphael

See <<http://middlesexcanal.org/towpath/TowpathTopics-Sept2011color.pdf>> for text and graphics.

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## RECENT DISCOVERY -- BY J. JEREMIAH BREEN

[About] the dynamiting of the Symmes aqueduct in 1865 to allow an ice jam that was causing flooding of Winchester basements to flow downriver. In 1828, the aqueduct was replaced with a massive granite, multi-box culvert as illustrated by Dahill 1998, <http://tinyurl.com/Dahill-Symmes>.

The assumption seems to be that the dynamite was placed in the culvert from downstream with the explosion scattering the culvert's granite blocks. More likely to me is that the dynamite was used to open a channel through the embankment of the canal. Once the water began to flow, the river would finish the job of cutting the channel to what we see today. The dynamiters would choose the part of the embankment away from the culvert as then the cutting of a channel by the river would not be limited by the massive granite culvert.

The Google Earth photo, opposite, has plotted on it the culvert as located using George Baldwin's 1829 survey. The change in vegetation over the culvert from that southeast of it [suggests] that the culvert wasn't destroyed.



So the dynamiting was [probably] not of the aqueduct but at the location of the former aqueduct.

Dynamite was not patented by Nobel in the United States until 1867 but presumably nitroglycerine, which had been invented in 1846, and is easily made, [may have been used].