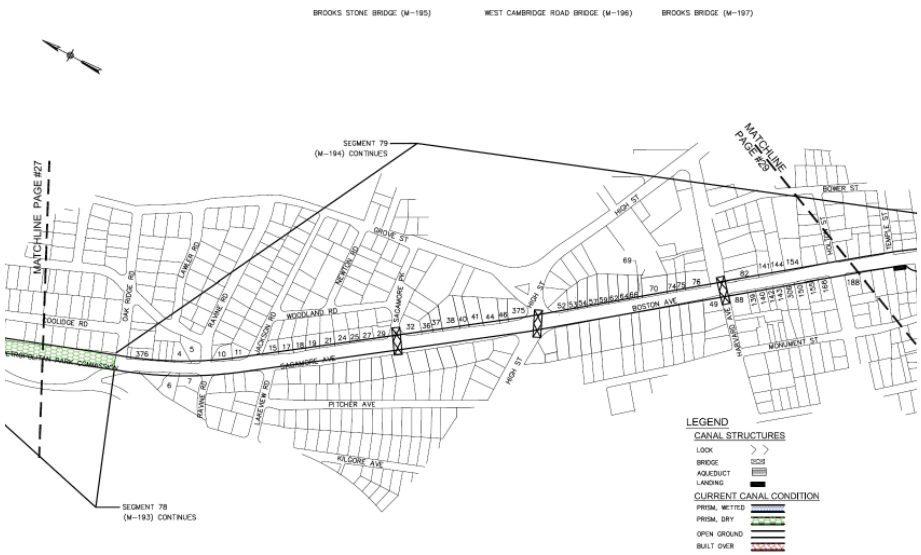


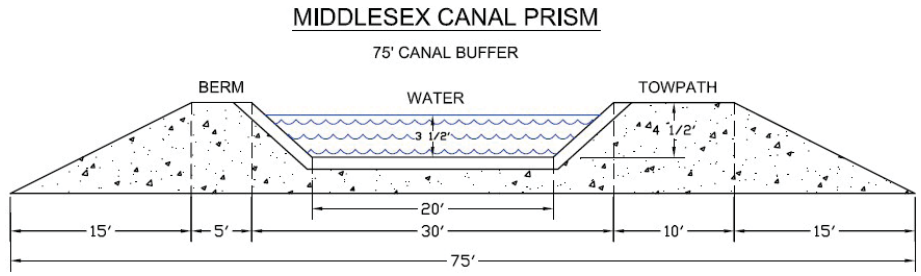
Map of the Brooks Bridge section of the Middlesex Canal

The Brooks Bridge (accommodation bridge) over the Middlesex Canal

If you would like to know more about the Middlesex Canal, why not becoming a Member ($10/year) or a Proprietor ($20/year) of the Middlesex Canal Association? You'll receive several issues of our newsletter ***Towpath Topics*** each year and receive invitations to all meetings and other Canal-related events. Most importantly, you'll be helping to preserve the historic remnants of the Middlesex Canal. Information about membership is available at our website **www.middlesexcanal.org** (or speak with walk leaders Roger Hagopian or Robert Winters).

Middlesex Canal Spring Walk - April 25, 2009

Walk Leaders: Roger Hagopian (781-861-7868), Robert Winters (617-661-9230, robert@middlesexcanal.org)



Middlesex Canal Facts (assembled by Bill Gerber, MCA Board)

Owner: Middlesex Canal Company, one of the nation's early stock companies. The company was incorporated in 1793 and dissolved in 1860.

Dates of full operation: 1804 to 1851; sections of the canal opened earlier, as construction of them was completed, and there was some residual use after the canal was closed.

Length: 27¼ miles

Northern terminus: on the Merrimack River at Middlesex Village in Chelmsford, Massachusetts (now part of the city of Lowell)

Southern terminus: Charlestown, Massachusetts, along the Charles River.

Type: towpath, with lift, guard and tidal locks

Width/depth: 30 feet/3.5 feet

Locks: eventually, 18 lift locks, 2 extendable-length guard locks, and 2 tidal locks - each 80 feet long by 10 feet wide.

Special Features: Floating Towpaths, Extendable-length Guard Locks and early use of the law of Eminent Domain.

The Middlesex Canal employed two floating towpaths. Following its enlargement in 1809, one 150 foot long floating towpath enabled draft animals to pull canal boats across the Concord River millpond, at North Billerica, Massachusetts (now the site of the Middlesex Canal Museum and Visitors Center). This towpath could be "opened" to allow debris to be cleared from the upstream side and to enable boats, logs and rafts transiting the Concord River to enter and leave the canal. Another floating towpath was used for a short time in the millpond at the southern terminus in Charlestown. (It was not adequate to support tow animals and was soon replaced by a bank side towpath.)

In about 1809, at each of the Concord River guard locks, a second set of

lower lock gates were built to extend the usable lock-length by several hundred feet. When employed, in place of the normal lower gates, these extended-length guard locks enabled complete “bands” of log rafts (as many as ten rafts attached one to another, end to end, to make a long “train”) to be taken across the river without requiring disassembly and reassembly.

The Middlesex Canal Company made use of the law of Eminent Domain to acquire a small portion of the land needed to build the canal. This was a very early use of this law by a private corporation. Before then it had been used to build turnpikes in Massachusetts, but prior to independence this was exclusively the King’s prerogative.

Other features: 8 aqueducts; 48 bridges serving significant roads, plus other accommodation bridges; and taverns, stables, landings (controlled cargo transfer points), mills and other facilities to support and maintain life and commercial operations on the canal.

During the construction phase, special carts were designed to facilitate removal of earth from the dig sites. These could run on wooden rails to reduce the manpower required to use them.

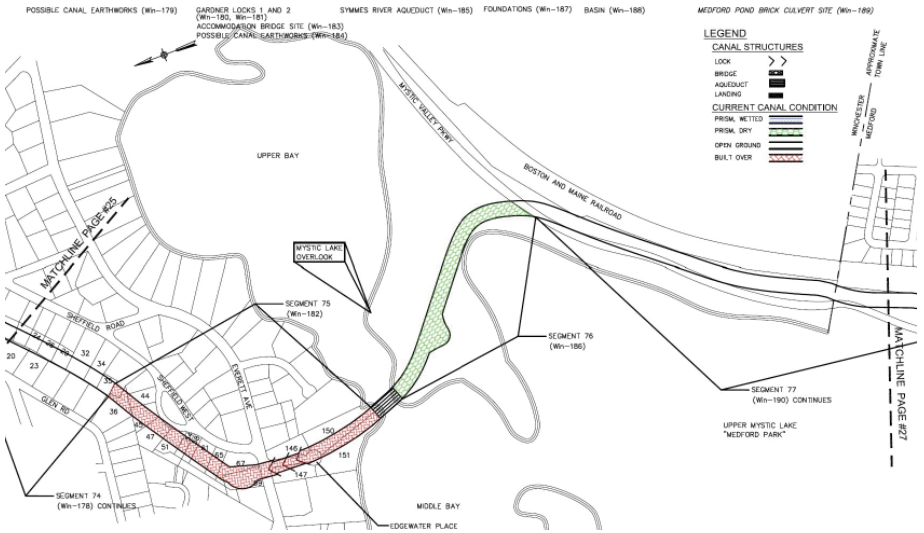
Cargo transported: included stone, iron ore, staves, timber, boards, plank, wood, and shingles, in large quantities, that came through the canal to Boston, as well as ashes, butter, cheese, beef, pork, cider, and grains. English goods, groceries, codfish, mackerel, salt, lime, plaster and many other articles were transported up the canal to the Merrimack River Valley.

Chief engineer: Colonel Loammi Baldwin, Sr., was the Supervisor of Construction. In this capacity, functionally, he was chief engineer for the Middlesex Canal from its inception through to completion, and for a short time thereafter. His son, Loammi II, assisted and later became known as the father of civil engineering in the US.

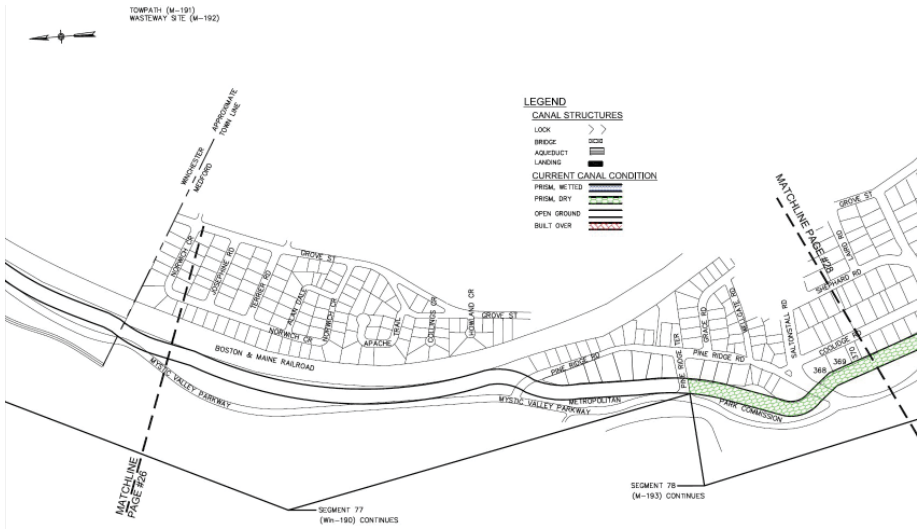
History of the Middlesex Canal

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, neverthe-



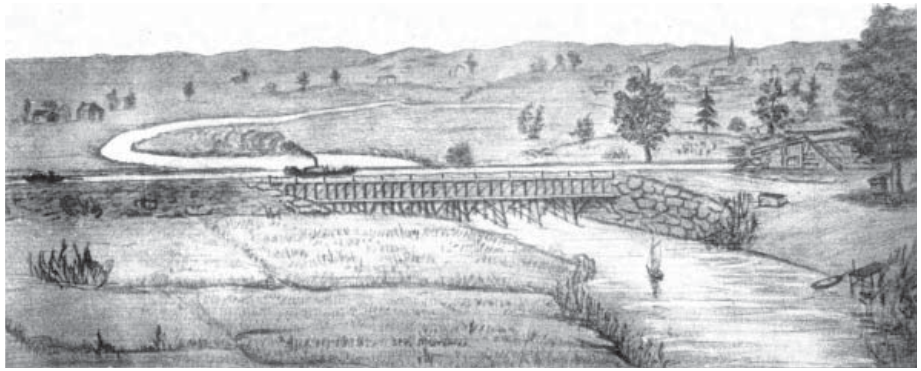
Map of the Aberjona River section of the Middlesex Canal



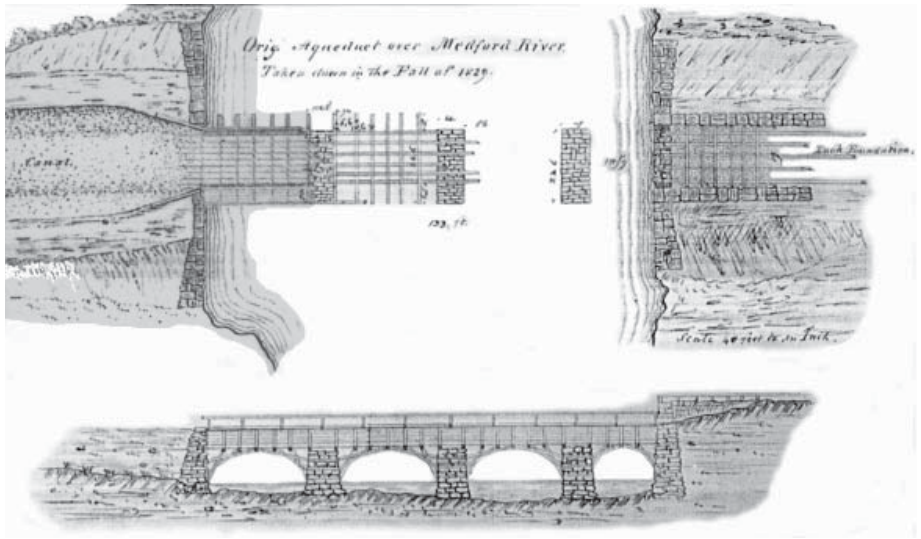
Map of the Mystic Lakes section of the Middlesex Canal

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 and Lowell National Historic Park: www.nps.gov/lowe



Middlesex Canal Aqueduct over the Symmes (Aberjona) River



Detail of the Aberjona River Aqueduct

less, 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 “wye-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

est 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.

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 great-

(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

Segment 1: Sandy Beach—Winchester

Length:
±900 LF (dry)

Ownership:
Public: 1 owner - DCR (Department of Conservation and Recreation)

Public Facilities Nearby:
Sandy Beach Park: Abutting

Environmental Considerations:
Mystic Lake: Abutting

Accessibility:
Auto: Parking Lot On Site
Commuter Rail: Approx. 1/3 mile from Wedgemere Train Station
Pedestrian: Southern Terminus Only

Observation Summary:
This segment of the canal is visible from the Mystic Valley Parkway. A stone marker has been placed at the entrance to the site describing the past presence of the canal. At this point the beginnings of a recognizable cross section turns in from the sidewalk along the Mystic Valley Parkway and continues along Sandy Beach Park on toward the Mystic Lake. The canal bed is dry and the bottom is paved for use as an access way by the DCR. Midway along the canal segment is the remains of a holding pond which was once used by canal boats waiting to cross an aqueduct over the Mystic Lakes. Currently the DCR keeps a dumpster at this location. Several sewer manholes were witnessed within the canal bed. Research at Town offices indicated that a sewer line runs beneath the canal toward the lake where a siphon structure is used to cross beneath the water. The sides of the canal still have some form, but are overgrown with trees and other vegetation. The overgrown condition continues into the towpath, which is located on the east side of the canal. Reaching the end of the segment there exists the remains of the old aqueduct abutment. It appears that a restoration effort had taken place at one time which may not have paid close attention to historical accuracy.

Recommendations:
This segment presents ample opportunity to restore the canal and provide public interest. Its high visibility on a major roadway adds to the importance of this location as a key site on the canal trail for public education and awareness of the canal's history.

It is recommended that the canal prism be fully restored. The original cross section of the canal can be recreated without significant disruption to the current use. In addition, the area of the old holding pond provides a place in which some type of interpretive play feature could be included. An example would be a climbing structure designed to look like a canal boat. Crafted to be "play friendly", a skeletal type climbing structure would serve both enjoyment of younger visitors as well as provide a glimpse into the past when boats were held up at this location waiting to cross the nearby aqueduct.

Ample space is also available at the site to provide other park features such as picnic tables, play facilities etc. Significant signage should also be provided to illustrate the canals history and how it appeared to the public during its existence.

It is also recommended that the aqueduct abutment be resorted with historical accuracy.

Recommendation Highlights
- Restore canal prism and towpath
- Restoration of aqueduct remains
- Construct Park Features
- Provide Canal Illustrative Signage

Restoration Priority Rating: High
Restoration Cost Estimate: $351,750
See Appendix B for breakdown of estimate

LEGEND:
DRY CANAL PRISM:
WET CANAL PRISM:
BUILT OVER CANAL:
BIKE TRAIL:
POINT OF INTEREST: