

# THE MIDDLESEX CANAL RESTORATION Program Study

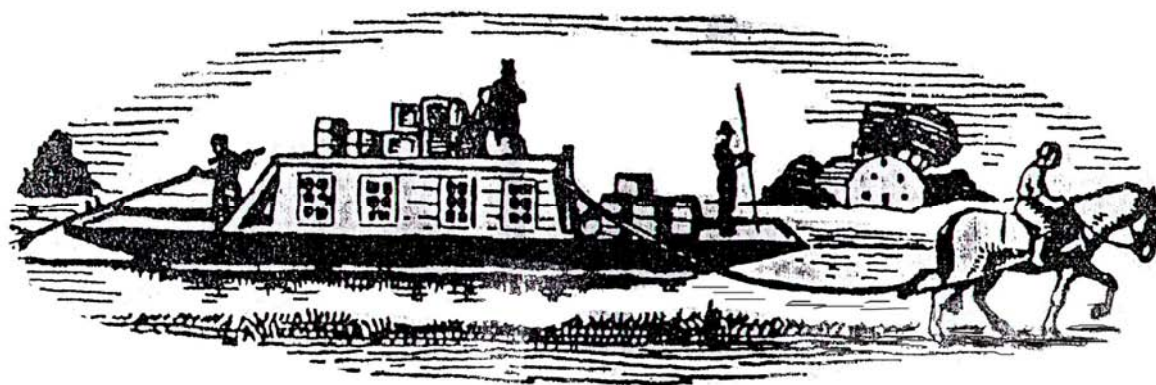


Winchester • Woburn • Wilmington • Billerica • Chelmsford • Lowell  
Massachusetts

*prepared for*  
The Middlesex Canal Commission

March 2008

*prepared by*  
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## Executive Summary

In the spring of 2007, The Waterfield Design Group, Inc. (WDG) conducted a physical inspection of the remaining segments of the Middlesex Canal between Winchester and Lowell, Massachusetts. From the time when commercial traffic ended on the canal in 1851, the structure has fallen into various levels of disrepair with many sections being built over and developed. The goal of the inspection was to identify existing segments of the canal and document the condition of each. The purpose of this report is to summarize WDG's findings and identify improvements necessary to return the canal to public use as an open space resource. In addition to a thorough visual inspection, research was performed on the ownership of all identified remaining canal segments.

As can be expected for a structure abandoned over 150 years ago, remaining segments of the canal are in poor condition. With the exception of a few areas which have received some attention in the recent past, the canal banks have lost a significant amount of their original shape. In most areas the original tow path, used by horses to guide the canal barges, is all but eroded into a path wide enough for individual foot traffic. In some areas the tow path has deteriorated completely.

Restoration of the remaining available canal segments will provide two functions. First, restoration will help to preserve this significant engineering accomplishment, which is listed on the National Register of Historic Sites. Second, it is proposed that along with restoration of the canal, the associated tow-path be reconstructed closely following the Massachusetts Highway Department's guidelines for Greenways. The result will be the creation of public open spaces, which will serve to honor the canal and encourage education of its rich history.

Within the limits of the Program Study nineteen (19) identifiable segments of the canal were identified. Review of each segment was performed with two goals in mind. First, physical elements were studied including condition, location, accessibility, and length. Second, restoration feasibility was evaluated. This evaluation was based not only upon physical elements, but also on existing ownership of the canal structure. A significant amount of the studied canal structure is located on private lands. Construction and maintenance of improvements in these instances will require property acquisition or access/maintenance easements.

As part of this Study, a rating system was devised to assist in planning and budgeting of the canal restoration program. This system was based upon the

following items:

- Ownership: Privately or publicly owned (or a combination)
- Condition: Level of disrepair
- Continuity: Will restoration provide for continuity of other restored segments
- Visibility: Segment visibility from public spaces
- Facilities Nearby: Proximity to public facility which will contribute to its use.

Conceptual cost estimates were prepared for each segment. A detailed breakdown of the estimate elements is included within the appendix of this Study. In general, the estimates included costs for restoration of the canal banks and towpath. In addition, costs for "Interpretive Elements" have also been included. These elements range from signs detailing the canal's history in a written and graphic form, to historically sensitive pedestrian bridge construction and landscaped park areas reminiscent of the canal's time in history. The estimated costs are for design and construction. Listed below are the nineteen segments and their associated estimates. Segments in bold received a score of "High" within the Study's restoration priority rating system.

Segment 1: <b>Sandy Beach—Winchester.....</b>	<b>\$351,750</b>
Segment 2: Wildwood Cemetery—Winchester.....	\$168,500
Segment 3: <b>Winn Street to Lowell Street—Woburn.....</b>	<b>\$628,950</b>
Segment 4: <b>Lowell Street to Middlesex Park—Woburn.....</b>	<b>\$643,350</b>
Segment 5: <b>Alfred Street to School Street—Woburn.....</b>	<b>\$1,134,500</b>
Segment 6: <b>Main Street to Burlington Avenue—Wilmington.....</b>	<b>\$1,646,050</b>
Segment 7: Shawsheen Avenue to Richmond Street—Wilmington.....	\$373,850
Segment 8: Richmond Street to Lake Street—Wilmington.....	\$743,150
Segment 9: Lake Street to Nichols Street—Wilmington.....	\$372,900
Segment 10: Grace Drive to Melody Lane—Wilmington.....	\$315,300
Segment 11: Shawsheen River Aqueduct—Wilmington/Billerica.....	\$140,200
Segment 12: George Brown Street to Dignon Road—Billerica.....	\$643,550
Segment 13: Kitchen Avenue to Staples Street—Billerica.....	\$378,700
Segment 14: Gray Street to Pond Street—Billerica.....	\$1,105,900
Segment 15: Pond Street to High Street—Billerica.....	\$594,300
Segment 16: High Street to Rogers Street—Billerica.....	\$1,092,200
Segment 17: Fire Station at Mill Pond to Brick Kiln Road—Billerica..	\$747,600
Segment 18: Brick Kiln Road to Riverneck Road—Chelmsford.....	\$1,241,800
Segment 19: Route 3 Crescent to Golf Course—Lowell.....	<u>\$463,250</u>
<b>TOTAL \$12,785,800</b>	

For the purpose of this study, easement and land acquisition costs were not included and will need to be evaluated on a case by case basis per segment.

## **History of the Middlesex Canal**

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.

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.

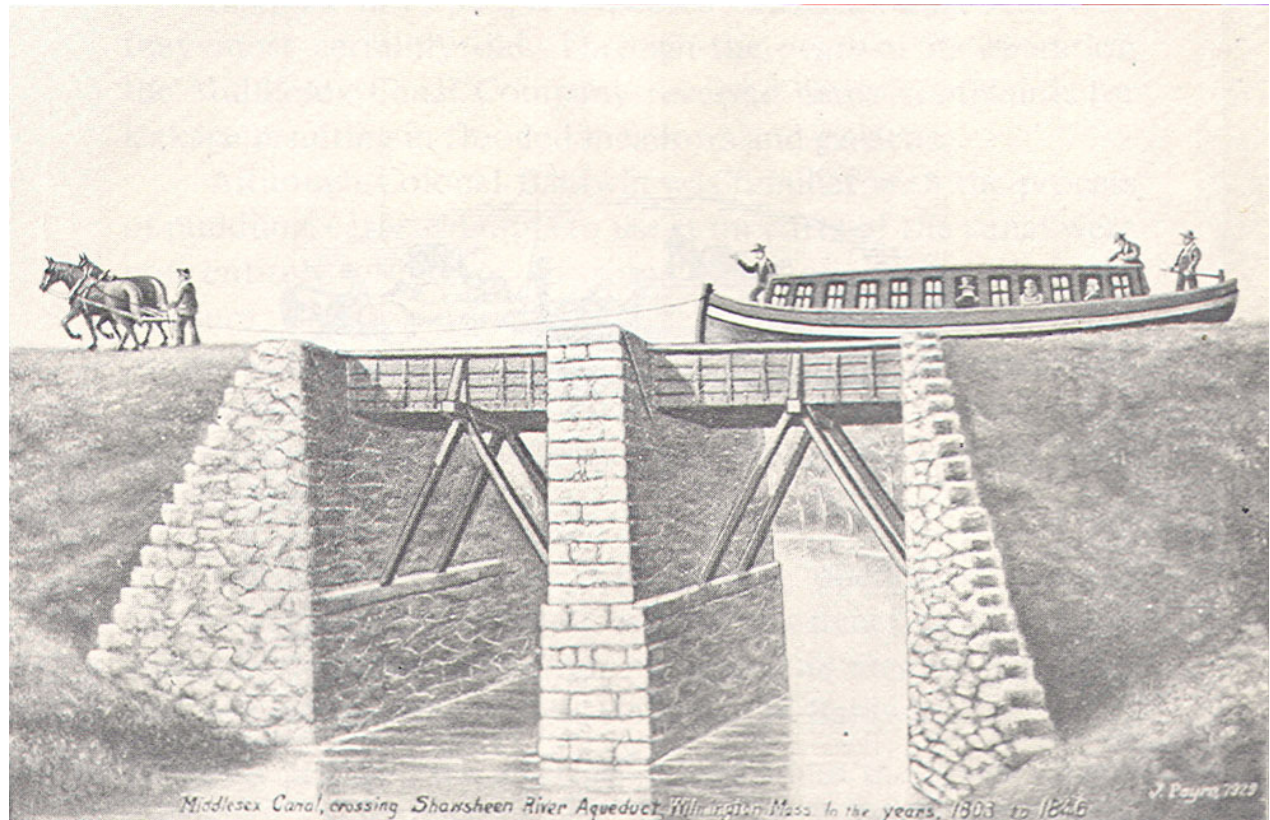
Dozens of canal boats, ranging from 45 to 75 feet in length and 9 to 9½ feet in width, were used. On the river, these boats were poled, rowed and sometimes sailed; on the canal, they were drawn by a horse or two, usually obtained from the company livery. To the north, the Middlesex Canal connected with 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. 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.

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 was frozen 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.

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.

*Source: Middlesex Canal Commission – [www.middlesexcanal.org](http://www.middlesexcanal.org)*



*Middlesex Canal, crossing Shawheen River Aqueduct, Wilmington, Mass. in the years, 1803 to 1846*



## **Project Description**

In line with the goals of the Middlesex Canal Commission and its effort to preserve and restore what remains of the Middlesex Canal, the purpose of this programming effort is to review and document the condition of extant portions of the Middlesex Canal and its accompanying Towpath. Included in the scope of this document are canal segments located in the towns of Winchester, Woburn, Wilmington, Billerica, Chelmsford and Lowell. The specific limits of the canal studied range from the Mystic Valley Parkway in Winchester, to the Route 3 Crescent in Lowell.

The integrity of what remains of the Canal and Towpath varies dramatically throughout the length of these limits. In many places, the Canal cross section (walls & bed) and Towpath can be easily seen. There are some wonderfully intact portions that still retain water either as a stormwater channel / collection point or through a vague or unintended connection to an adjacent water course. In others, the cross section of the Canal walls, bottom, and Towpath have been eroded or filled to be less discernable. Others have been obliterated altogether and replaced by new development. Some sections of the Canal are accessible and used (unofficially) by pedestrians and others are difficult to reach. Elements of major historical significance may be found in Woburn and Wilmington.

The goal of this project is to identify restoration opportunities along the canal corridor to achieve several goals. First, would be to find unique ways to preserve and present the Canal cross section to the general public at select locations. Second, create outdoor public spaces for enjoyment as pedestrian and cycling routes on the canal Towpath, and third, identify an overall network of canal segment interconnected via roadway segments which would allow for the travel from Charlestown to Lowell utilizing as much of the remaining canal as possible for the journey.

Included in the above stated goals will be the desire to create interpretive features into the landscape and through the use of Canal restoration,



monuments, or special signage. While enhancing public access to an outdoor wildlife area, the restoration of the Canal should be coupled with unique opportunities to highlight its historical significance wherever possible. The restoration should focus on both direct and indirect ways in which to exhibit the Canal's legacy.

## **Project Approach**

Based on the summary of project goals provided above, several elements have been completed and included within the development of this document. The focus of this effort was to visually review existing conditions and identify / rank extant sections based on a variety of factors important to the Commission. This effort is not a feasibility study nor is it a design exercise. The entire alignment within the limits previously identified has been evaluated to identify design programming or planning measures that will be needed to begin design.

### **Research Existing Conditions**

Existing data relating to the Middlesex Canal within the project boundaries has been researched and compiled. Information obtained includes assessor plans for determination of approximate available land areas, aerial photography, and any available topographic information that existed within the host municipalities.

### **Visual Inspection & Inventory**

A visual inspection of all relevant and accessible sections has been performed. The purpose of this inspection was to understand the type of land available for restoration and identify sections that have greater potential for restoration and re-use consistent with the goals of the Commission. Of the sections that have greatest potential for restoration potential, public access and parking options for re-use were identified as well as potential challenges that may be posed toward efforts of this project to restore the canal and to create publicly accessible walking trails.

## Planning & Programming

Using the information collected in each of the above tasks and through coordination with Canal Commission members, nineteen, (19) canal segments were identified for inclusion in this study. The identified segments are as follows:

- Segment 1: Sandy Beach—Winchester
- Segment 2: Wildwood Cemetery—Winchester
- Segment 3: Winn Street to Lowell Street—Woburn
- Segment 4: Lowell Street to Middlesex Park—Woburn
- Segment 5: Alfred Street to School Street—Woburn
- Segment 6: Main Street to Burlington Avenue—Wilmington
- Segment 7: Shawsheen Avenue to Richmond Street—Wilmington
- Segment 8: Richmond Street to Lake Street—Wilmington
- Segment 9: Lake Street to Nichol Street—Wilmington
- Segment 10: Grace Drive to Melody Lane—Wilmington
- Segment 11: Shawsheen River Aqueduct—Wilmington/Billerica
- Segment 12: George Brown Street to Dignon Road—Billerica
- Segment 13: Kitchen Avenue to Staples Street—Billerica
- Segment 14: Gray Street to Pond Street—Billerica
- Segment 15: Pond Street to High Street—Billerica
- Segment 16: High Street to Rogers Street—Billerica
- Segment 17: Fire Station at Mill Pond Park to Brick Kiln Road—Billerica
- Segment 18: Brick Kiln Road to Riverneck Road—Chelmsford
- Segment 19: Route 3 Crescent to Golf Course—Lowell

Canal Segment Summary Sheets have been created for these sections of the extant Canal which have been determined to most closely match the Commission's restoration and re-use goals. Site elements provided in each of these summary sheets include the following:

- Segment Identification  
Each segment is identified by its location in the vicinity of a particular landmark or the streets which define its limits.
- Segment Length
- Ownership  
The number of ownership parcels which the segment is located as well as the ownership type (public or private) is indicated.

- Nearby Public Facilities  
Parks, public schools, and other facilities available to the general public within the vicinity of the site are listed.
- Environmental Considerations  
The location of environmental elements warranting significant consideration, including, water bodies, streams, etc., are listed.
- Accessibility  
Available means of access to each site are listed including vehicular, pedestrian, and major public transit options.
- Observation Summary  
The existing conditions observed are summarized for each segment.
- Recommendation Summary  
Based upon review of the previously listed elements, recommendations for restoration of the segment are provided. Included with the summary is a bulleted list of priority elements that should be pursued during restoration. Each extant section may require different restoration approaches given their individual physical assets or constraints. The eventual end use of each section may also dictate how they are restored.
- Restoration Priority Rating  
A priority rating for restoration is included ranging from High to Low. Factors used to determine level of priority include (in no particular order) ownership (low=private ownership, high = public ownership), condition (low=canal form eroded, high=canal form intact), potential for continuity (low=no continuity, high=continuous), visibility (low=no visibility to a public way, high=visible to a public way), and proximity to significant public use facilities (low=no public facilities, high=public facilities in close proximity).
- Restoration Cost Estimate  
Order of magnitude cost estimates were developed based upon segment recommendations. For the purpose of this study, easement and land acquisition costs were not included and will need to be evaluated on a case by case basis per segment. In general, segments with a priority rating of "High" are publicly owned and more readily available for restoration.

## Estimate Elements

### Prism Restoration

#### *Wet Segments*

It is understood that one of the desired goals of restoring the canal would be to return available segments of the canal prism (cross section) to its original condition. While this is not a difficult task when dealing with dry segments of the canal, wet segments pose more challenges. Although the canal is a man made element, alteration, and or dredging operations within the wetted segments will likely be regulated by local Conservation Commissions and the Massachusetts Department of Environmental Protection. Also, dredging the canal bottom to return the shape to its original condition could quickly escalate costs of the restoration effort. For these reasons, the estimates created in this report do not include full restoration of wetted segments of the canal. Instead the following approach has been taken. The first 100' of any wet segment of the canal included in the study which terminates or abuts a public roadway was included in the estimate as a full restoration. The visual impact the canal will have on passing travelers will be vital to the education of the public regarding its past existence. For this reason it was determined that an "authentic" restoration should be undertaken at these areas where the canal will be most visible. The remaining sections of wet canal to be restored are proposed to have the banks built up and re-graded to resemble what the canal would have looked like from the waterline up. In these areas the canal may not have the depth of the original canal but the appearance will be very similar to the original.

#### *Dry Segments*

Although restoration of the canal prism at dry locations will be less complicated it will pose some challenges. The most significant will be the removal of large numbers of mature trees. While obviously not part of the original canal section, over the last 150 years, many trees have reclaimed the landscape. Removing these trees in order to provide an accurate historical restoration will most likely be met with resistance from the public. For the purpose of this report the removal of all trees in the canal cross section have been included in the individual estimates. As each segment is designed and community input is provided, it may be determined that tree removal is more selective.

### Towpath Construction

Although essentially part of the prism restoration, the towpath will get extra attention to allow for it to be used as a walking and/or biking path throughout. Criteria for development of the towpath will closely follow Massachusetts Highway Department's criteria for "Greenways" A "Greenway" is defined by MassHighway as an unpaved trail for walking, hiking, mountain biking, and other off-road activities. It should be noted that off road activities will not include motorized vehicles such as ATV's or snowmobiles. It is intended to include jogging, cross country skiing, snowshoeing, etc.

### Interpretive Elements

Each site to be restored should include some type of interpretive elements to showcase the canal's rich history. In some cases where options are limited these elements may consist of signage and graphic placards. In other cases where public use and visibility will be highest, and as space is available, a more significant impact can be made. For example, the segment of the canal studied in Winchester at the Sandy Beach public facility is situated next to a public beach, ample parking, can be easily seen from the roadway, and abuts a significant amount of public undeveloped land. The opportunity to create a canal themed element in the existing public space is great. In addition, one of the canal's more interesting features, an elevated aqueduct, once existed at this location. Incorporating details of that structure into the restoration of the segment would provide a unique element which visitors would easily remember and be compelled to share with others. This type of interest and word of mouth publicity will be an important part of educating the public about the canal and the role it played to help build an emerging nation.

Various other interpretive elements present themselves through the study. At some locations, pedestrian bridges may be necessary for connection to abutting access sites or for continuity of the towpath over streams. These bridges can be constructed to resemble period construction, or in some cases an old aqueduct.



## Segment 1: Sandy Beach—Winchester

**Length:**  
±900 LF (dry)

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

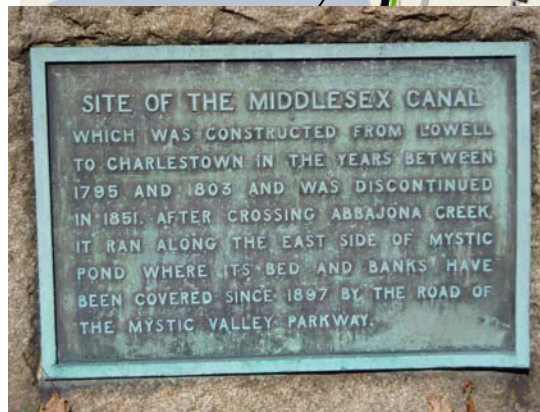
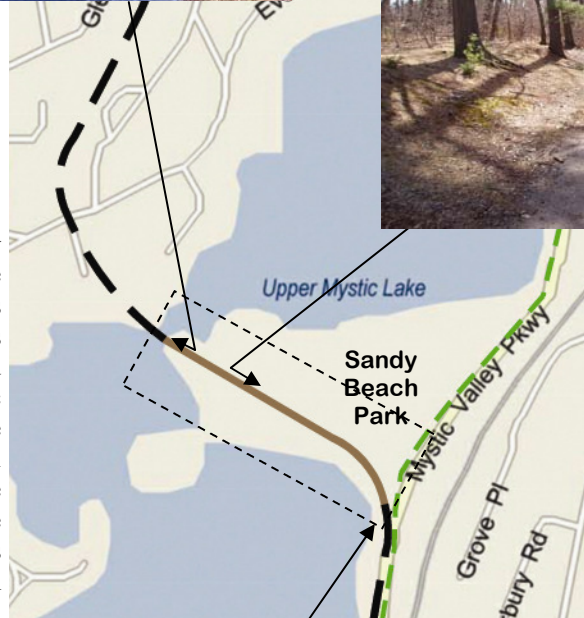
**Public Facilities Nearby:**  
Sandy Beach Park: Abutting

**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:	



## Segment 2: Wildwood Cemetery—Winchester

### Length:

±600LF (dry)

### Ownership:

Public: 1 owner - Town of Winchester

### Public Facilities Nearby:

Cemetery Grounds

### Environmental

#### Considerations:

In vicinity of potential Well Head Protection Area (validity to be determined)

### Accessibility:

Auto: Cemetery Roadside Parking

Commuter Rail: 3100 ft. (0.6 mi.) from Winchester Station

Pedestrian: Cemetery Main Entrance

### Observation Summary:

The segment begins on cemetery property at the entrance off of Palmer Street closest to Middlesex Street. The canal is difficult to locate because it has been either completely eroded or built over. According to historic documents it follows parallel with the paved cemetery road around the bend to where the houses on Middlesex Street begin. There is very little evidence of the canal's existence at this location. Definable features of the canal were not witnessed during visits to the site.



### Recommendations:

Ample space is available to recreate the canal prism although the exact location of the original route is not evident. Access to the site may be limited as the cemetery gates are locked during certain hours and days.

If this segment were restored, it is recommended that the canal cross section be recreated to its original condition. Signage should also be provided at various locations highlighting the canal remains.

### Recommendation Highlights

- Restore Canal Prism and Towpath
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** Low

**Restoration Cost Estimate:** \$168,500

**See Appendix B for breakdown of estimate**

### LEGEND:

- DRY CANAL PRISM: ————
- WET CANAL PRISM: ————
- BUILT OVER CANAL: - - - -
- BIKE TRAIL: - - - -
- POINT OF INTEREST: 🏠



### Segment 3: Winn Street to Lowell Street—Woburn

#### Length:

±1170 LF (wet)  
±700 LF (dry)  
±1380 LF (built over)

#### Ownership:

Public: 2 owners -  
Main St. to Kilby St.—City of Woburn  
Kilby St. to Lowell St.—Middlesex  
Canal Historical and Preservation  
Society of Woburn (Leonard Harmon)

#### Public Facilities Nearby:

Boys & Girls Club  
Wyman Elementary School

#### Environmental Considerations:

Wetlands Associated with Wet Canal Sections

#### Accessibility:

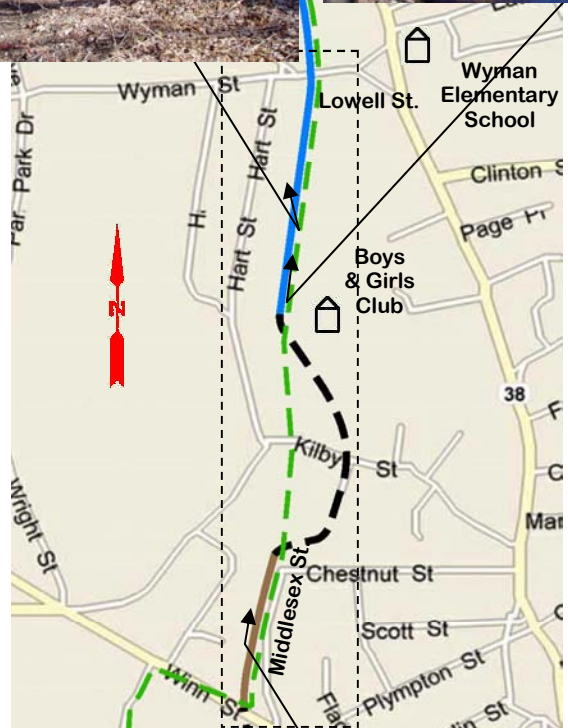
Auto: Small Parking Area at Lowell Street

Commuter Rail: None

Pedestrian: Winn Street, Lowell Street, Kilby Street and the  
Boys & Girls Club

#### Observation Summary:

The segment is split into two halves due to Kilby Street and development over portions of the canal prism. From the south, the segment begins at Winn Street and heads north for approximately 1000 feet toward Kilby Street. There is a clear, wide path down the middle of this section with some excessive tree growth along the sides. It is believed the current path is in the center of the canal bed which appears to have been filled in for the construction of a railroad (RR) bed. Approximately 400 feet south of Kilby, the canal's original route turned to the east, outside of the current RR right-of way (ROW). It then crossed over Kilby St. and shifted back west onto the RR ROW approximately 500' north. Currently where the RR ROW meets Kilby Street, there is a large elevation gap from the RR bed to the roadway. Beyond Kilby, the canal remnants pick up again just north the apartment complex parking lot. From there, the canal continues to Lowell Street. This section of the canal holds water and the banks and towpath are overgrown while the adjacent railroad right-of-way path remains clear. Two culverts were observed, one contributing to the canal from Hart Street and the other from Lowell Street.



#### Recommendations:

With close proximity to an elementary school and the Boys and Girls Club, a restored towpath/greenway would, among other benefits, provide a safe pedestrian route for children to these destinations.

It is recommended that the canal prism south of Kilby Street be fully restored. North of Kilby, it is recommended that the canal sides and towpath be restored. To provide a continuous path, the RR ROW between these sections should be filled and graded to provide a pathway which can cross Kilby St. at grade.

An opportunity to provide dedicated canal parking exists at this segment. Middlesex Street runs adjacent to the southern end of the segment for approximately 500 feet. Depending on the available space within the canal property at this area, 20 to 40 off street parking spaces could be created.

As with all other restored canal segments, significant signage should be provided at locations of access to illustrate the canals history

#### Recommendation Highlights

- Restore Canal Prism
- Restore Towpath as Greenway
- Create elevated path for Kilby Street connection
- Restore sides and towpath of wet section
- Create off street parking at Middlesex Street
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** High

**Restoration Cost Estimate:** \$628,950

**See Appendix B for breakdown of estimate**

#### LEGEND:

DRY CANAL PRISM: ————  
WET CANAL PRISM: ————  
BUILT OVER CANAL: - - - -  
BIKE TRAIL: - - - -  
POINT OF INTEREST: 🏠



## Segment 4: Lowell Street to Middlesex Park—Woburn

### Length:

±1700 LF (wet)

### Ownership:

Public: 1 owner - Middlesex Canal Historical and Preservation Society of Woburn

### Public Facilities Nearby:

Wyman Elementary School  
Hotel

### Environmental Considerations:

Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Small parking area at Lowell Street  
Hotel parking lot at Middlesex Park

Commuter Rail: None

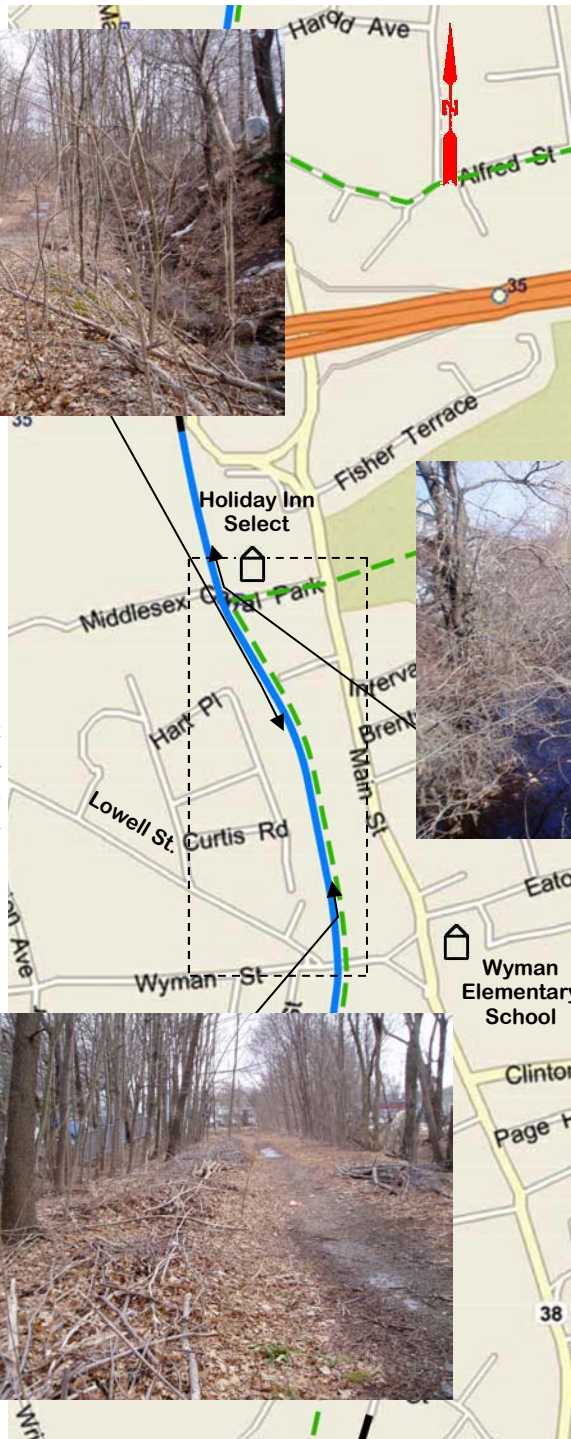
Pedestrian: Northern and Southern terminus

### Observation Summary:

Similar to the canal section south of Kilby St., this segment appears to have been partially filled for the construction of a RR bed. The existing path is located on an area wider than what would be expected for the canal towpath. And while a water channel exists throughout the entire segment, it is too narrow for the majority of its length to be the original canal prism. The canal on either side of Lowell Street has been reduced to a small drainage channel.

From the northern terminus at Middlesex Park, an existing path is visible down the east side of the canal. Debris was observed in the water such as tires and pieces of furniture. There were also fallen trees in the canal and on the path. Significant overgrowth has occurred with the majority concentrated on the canal sides. Two culverts were observed contributing to the waterway, one coming from Hart Street and the other from private property on the east side.

Continuing north of Middlesex Canal park, the canal, while overgrown on its banks, is a wide open clear waterway which ends at Route 95.



### Recommendations:

In addition to being publicly owned, this segment provides for excellent continuity with the previously described canal section. Also, with close proximity to an elementary school and hotel, this segment can improve awareness of the canal's history to local residents of all ages and to visitors from other areas.

It is recommended that the canal prism be fully restored. Although the existing channel is wet and may pose permitting difficulties, the original canal prism is unrecognizable. Work to widen the canal would not require any filling operations and therefore may be easier to permit with local authorities.

It is also recommended that the land adjacent to the east side of the canal north of Middlesex Park be developed into a public park. Ample space is available to create parking and incorporate park facilities (picnic tables, play structures) in order to take advantage of the wonderful existing wetted canal section at this location.

In addition the bridge rails at the Middlesex Canal Park intersection should be repaired.



### Recommendation Highlights

- Restore Canal Prism
- Reconstruct Towpath as Greenway
- Improve bridge aesthetics
- Create Public Park at Middlesex Canal Park
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** High

**Restoration Cost Estimate:** \$643,350

See Appendix B for breakdown of estimate

### LEGEND:

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



## Segment 5: Alfred Street to School Street—Woburn

### Length:

±2560 LF (wet)

### Ownership:

Public: 1 owner - City of Woburn

Private: 3 owners

### Public Facilities Nearby:

Ferullo Park

Linscott Elementary School

Kiwanis Park

### Environmental Impacts:

Wetlands Associated with Wet Canal Section

### Accessibility:

Auto: Parking lot at Ferullo Field

Small parking lot at 1790 House

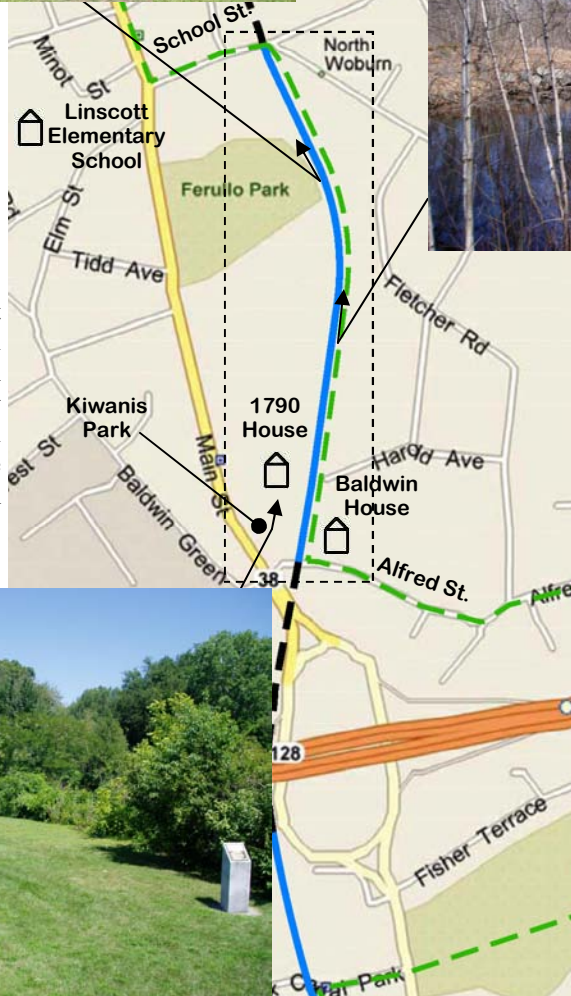
Commuter Rail: None

Pedestrian: Northern and Southern Terminus

### Observation Summary:

The southern terminus begins on the north side of Alfred Street with Kiwanis Park on the western bank and the “Sichuan Garden” Chinese restaurant (formerly the Baldwin Mansion) on the eastern bank. From this point, the canal winds its way approximately 2,560 feet to its northern terminus at School Street. The towpath is in good condition and exists the entire length along the easterly side of the canal. The abandoned RR bed exists parallel to the towpath at a slightly higher elevation

Along the western bank north of Kiwanis Park, the “1790 House” sits closely to the waterway. After the “1790 House”, the western bank is heavily wooded all the way to School Street. However, a narrow path exists through the woods which traverses through private property before opening up at Ferullo Field (City ball park).



### Recommendations:

This canal segment's high visibility location and proximity to several open space and historic landmark features, make it one of the most unique and exciting restoration sites along the route of the Old Middlesex Canal. In addition, its close proximity to two separate City parks will provide a connection between the two, essentially creating one large outdoor public space within a densely populated area.

It is recommended that the canal sides and embankments be fully restored. In addition, a paved bike path is recommended to loop around the canal segment utilizing the RR bed and the existing path location above the west bank. The existing towpath should be reconstructed as a Greenway.



Two pedestrian bridges would be needed to connect the bike path loop at both ends of the segment. The bridge near the southern terminus is recommended to be built to historical accuracy along with the English Garden that would be constructed to the west of the bridge.

Significant signage should also be provided to illustrate the canals history and how it appeared to the public during its existence.

### Recommendation Highlights

- Restore canal sides and embankments
- Restore towpath with gravel path
- Create a paved bike path loop
- Provide Canal Illustrative Signage
- Construction of two pedestrian bridges
- Creation of an English Garden at Kiwanis Park

**Restoration Priority Rating:** High

**Restoration Cost Estimate:** \$1,134,500

See Appendix B for breakdown of estimate

### LEGEND:

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



## Segment 6: Main Street to Burlington Avenue—Wilmington

### Length:

±2,240 LF (wet)  
±3,180 LF (dry)  
±600 LF (built over)

### Ownership:

Public: 2 owners  
- Town of Wilmington  
- Middlesex Canal Association

### Public Facilities Nearby:

Town Park

### Environmental Considerations:

Within Wellhead Protection Area (2 Wellheads within area)  
Wetlands associated with Wet Canal Sections

### Accessibility:

Auto: Parking lot at Town Park

Commuter Rail: Approx. 1000 ft. (0.2 mi.) from the  
Wilmington Train Station

Pedestrian: Southern Terminus, Butters Row, and Right-of-  
Way access from Towpath Drive and Patches Pond  
Lane at Northern Terminus

### Observation Summary:

Access to this segments southern terminus is at the Town Park parking lot. Heading northwest along the canal route, the path rounds the Ox Bow, Grooved Stone, and Quarry national sites before reaching into the remains of the aqueduct over Maple Meadow Brook. Crossing the brook, there is approximately 2000 feet of well defined, dry canal remnants. This is one of the most dramatic sections of the existing canal prism as it allows visitors to see the impressive size and shape of the canal over significant length. Throughout this dry section, both the towpath and the canal bed can be traversed to Butters Row.

North of Butters Row the canal is also well defined. Unlike the previous section, the canal bed is wet and only the towpath is traversable to Patches Pond. The vegetation throughout this section is more dense consisting of scrub type plantings rather than the towering pines located on the southern dry section. At Patches Pond, the towpath ends at the intersection of four paths. Continuing northwest leads to private property. The northeast path followed along an ATV trail, and a southwesterly path ended at Towpath Drive.



### Recommendations:

With a length of over one mile through wonderfully forested land, coupled with several unique canal features, this segment offers a great opportunity for the creation of a successful canal restoration/public recreation space. The close proximity to the Town Park provides a constant stream of visitors to the site. With proper education and signage, the canal is sure to be heavily traveled.

Restoration of the section between Main Street and Butters Row will require limited grading although a significant amount of mature trees are present. Full restoration would require removal of some of these although the impacts of such work would need to be addressed during the design process.

The wet section north of Butters Row is not as well defined and the banks will need considerable work. Significant clearing would be required although the existing vegetation is mostly scrub and weed trees. Full restoration of the wet canal is recommended at Butters Row for a length of 100' and bank reconstruction is recommended to Patches Pond.

At the Maple Meadow Aqueduct, a pedestrian bridge will be required for access. It is recommended that the bridge utilize the existing abutments and be constructed to replicate the original aqueduct.

Ample signage will be necessary for identification of the canal as well as notifying patrons that they are entering a protected aquifer district.

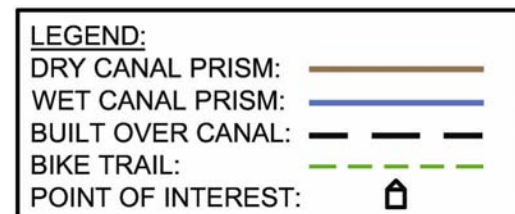
### Recommendation Highlights

- Restore Dry Canal Prism
- Reconstruct banks at Wet Canal Sections
- Restore Towpath as Greenway
- Aqueduct at Maple Meadow Brook
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** High

**Restoration Cost Estimate:** \$1,646,050

**See Appendix B for breakdown of estimate**





## Segment 7: Shawsheen Avenue to Richmond Street—Wilmington

### Length:

±710 LF (wet)  
±1420 LF (dry)  
±270 LF (built over)

### Ownership:

Public: 1 owner - Town of Wilmington

### Public Facilities Nearby:

None

### Environmental Considerations:

DEP BWP Major Facility  
Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Roadside parking at Bridge Lane

Commuter Rail: Approx. 2000 ft. (0.4 mi) from the  
Wilmington Train Station

Pedestrian: Bridge Lane and the stairway from the Fred F.  
Cain Bridge at Richmond Street

### Observation Summary:

The canal is accessible at its intersection with Bridge Lane and from the northern terminus at Richmond Street. Only the portion of the canal from Bridge Lane to Richmond Street is easily identifiable as canal remains. Most of the prism from Shawsheen Avenue to Bridge Lane has been built over or filled in. From Richmond Street to Bridge Lane the canal bed is wet and paths (both sides of canal in this section) are both overgrown with trees and vegetation.

The section of canal beneath Richmond Street (Rt. 129) has been fenced off. Access can only be gained through a break in the fence along the commuter rail ROW. Beginning at this point and heading north, an inaccurate restoration effort was undertaken by the Massachusetts Highway Department in the 1980's. Since that time, the section of this restoration beneath Rt. 129 has become heavily littered and covered with graffiti. The previously mentioned fencing was likely installed to keep out this type of activity.



### Recommendations:

Although located beneath Richmond Street (Rt. 129), a restored canal at this location with proper signage would be highly visible to many.

The section of canal from north of Shawsheen Avenue to Bridge Lane is dry and located on public land which would simplify its restoration although access at the south terminus is through private property. Without this access, restoration of this dry segment would not contribute to the continuity of the overall segment.

It is recommended that the canal prism from Bridge Lane to Richmond Street, be cleared of any debris and that the canal banks be fully restored.



The existing fences prohibiting access should be removed and, if feasible, reset along the commuter rail ROW. New fences should be installed if the existing cannot be reused.

It should be noted that the previous restoration fell into disrepair. "Lesson learned" meetings should be held with local authorities and the Massachusetts Highway Department to help prevent any new restoration from sharing the same fate.

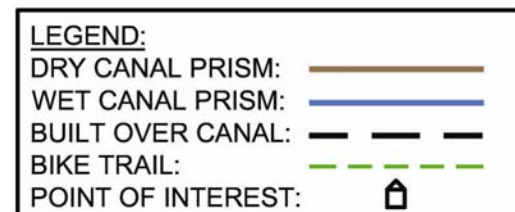
### Recommendation Highlights

- Restore canal banks from Bridge Lane to Richmond Street
- Restore prism south of Bridge Lane within publicly owned land
- Restoration of Towpath as Greenway
- Relocated existing fence
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** Medium-High

**Restoration Cost Estimate:** \$373,850

See Appendix B for breakdown of estimate





## Segment 8: Richmond Street to Lake Street—Wilmington

### Length:

±4800 LF (wet)

### Ownership:

Public: 2 owners

- Town of Wilmington

- Middlesex Canal Association

Private: 10 owners

### Public Facilities:

Shawsheen Elementary School

### Environmental Considerations:

Within Wellhead Protection Area

Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Parking at Shawsheen Elementary School

Roadside parking at Wedgewood Avenue

Commuter Rail: Approx. 1 mile from Wilmington Train Station

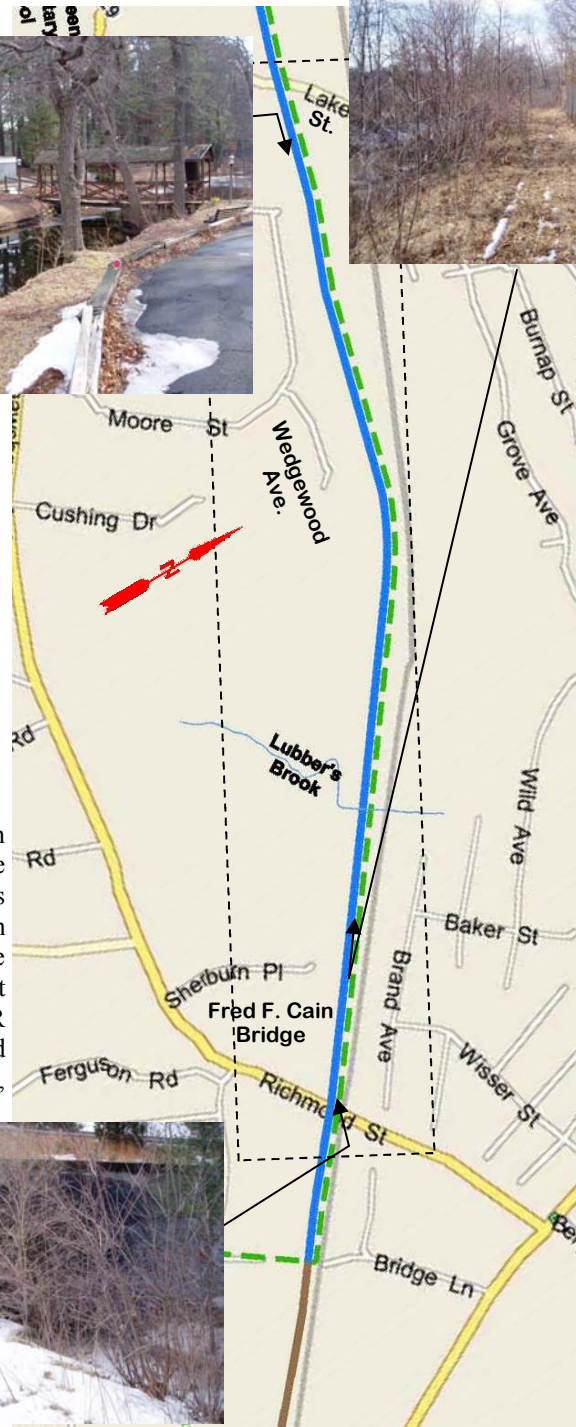
Pedestrian: Stairway from the Fred F. Cain Bridge at Richmond St.

Right-of-Way access from Wedgewood Avenue

### Observation Summary:

This segment is visible from the northern and southern terminus, as well as from the MBTA commuter rail. The canal bed is wet through the entire segment, although there is no contiguous path of travel. The towpath is reportedly on the west side, but the only adequate walking path is on the east side, which ends at Lubber's Brook. At this point crossing the brook is only possible via a culvert at the RR ROW approximately 200' east of the canal. Beyond Lubber's Brook, paths exist on both side of the canal, although both become heavily overgrown and not well defined roughly 1000' north of the brook. After another 1000'±, wire fencing across the canal prevents further travel. The canal in this vicinity is located on private lands.

From the northern terminus at Lake Street, there is a clear view of the canal cross section, although it is located on private properties.



### Recommendations:

This segment provides excellent continuity from the previous segment. In addition, its proximity to the commuter railroad will provide awareness of the canal to thousands commuters.

It is recommended that the canal prism be completely cleared of any debris. It is further recommended that the canal embankments be fully restored to the greatest extent possible with the understanding that rights to several private properties will be necessary for full length construction. Creation of a continuous path along the canal segment will require the construction of a crossing at Lubber's Brook.

In addition, it is recommended that views, visible from the RR ROW be included in the restoration to ensure that the large number of commuters passing the site are aware of its presence.

An area of concern that would need to be addressed in this segment is the condition of the culvert at Richmond Street. The graffiti and refuse in that location create a concern for safety. It is recommended that the area be completely cleared of any debris and graffiti, and security features be added such as lighting and/or cameras.

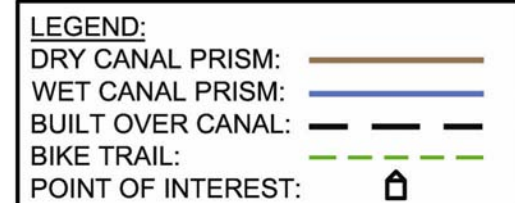
### Recommendation Highlights

- Clearing of Canal Debris
- Restoration of Canal Embankments
- Restoration of Towpath as Greenway
- Reconstruct Lubber's Brook Aqueduct
- Cleaning and securing culvert
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** Medium-Low

**Restoration Cost Estimate:** \$743,150

**See Appendix B for breakdown of estimate**





## Segment 9: Lake Street to Nichols Street— Wilmington

### Length:

±1200 LF (wet)

±70 LF (dry)

### Ownership:

Private: 3 owners

### Public Facilities Nearby:

Shawsheen Elementary School

### Environmental Considerations:

Wetlands Associated with Wet  
Canal Sections

### Accessibility:

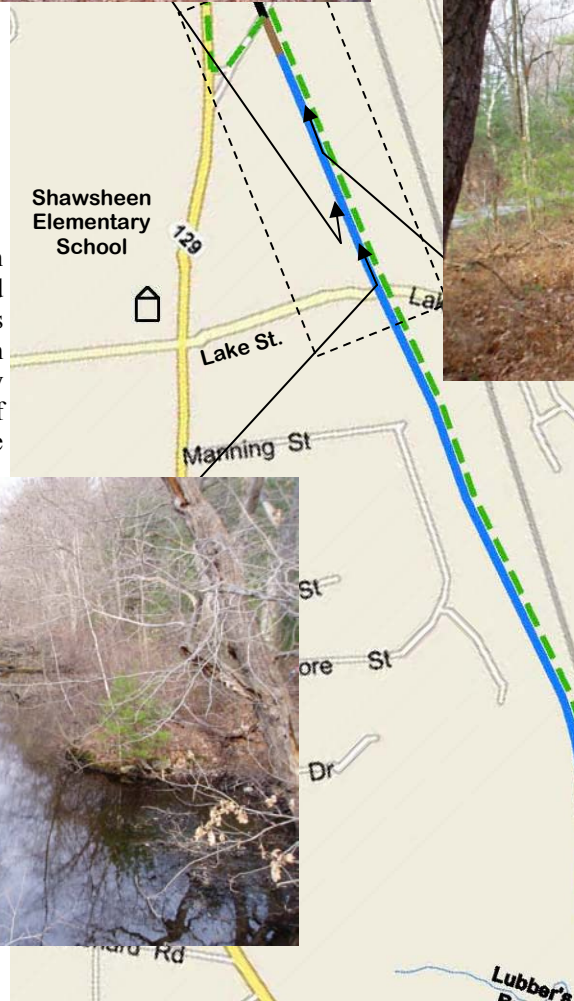
Auto: Parking at Shawsheen Elementary School

Commuter Rail: None

Pedestrian: Northern and Southern Terminus

### Observation Summary:

This segment is visible at both the northern and southern terminus. Fallen trees are littered along the pathways and over the waterway throughout this segment. The towpath is on the west side of the canal, but only the east side path can be traversed. Walking along the path, the topography becomes uneven at times and with heavy growth of vegetation. The canal bed is wet for the majority of the segment before gradually drying up and filled in as it approaches Nichols Street.



### Recommendations:

The whole of this segment is privately owned. While this would make acquisition of access easements difficult, a few factors are present which may make the process easier.

First, the landowner along Nichols Street has agreed to include in her property deed, public access to the canal upon her passing. Second, a subdivision development is currently proposed along the towpath side of the canal. The developer (at the time of this study) has agreed to work with the restoration effort to incorporate canal preservation into the proposed site plans.



It is recommended that the canal prism be cleared of any debris and overgrowth. Also, the canal sides and embankments should be fully restored. The towpath can be restored on the west side, but the main walking path may need to be constructed on the east side of the canal as this is where cooperation with private land owners is likely to occur.

Significant signage should also be provided to illustrate the canal's history.

### Recommendation Highlights

- Clearing Canal of Debris
- Restoration of Embankments
- Creation of a Greenway along the segment's entire length
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** Medium-Low

**Restoration Cost Estimate:** \$372,900

See Appendix B for breakdown of estimate

### LEGEND:

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



## Segment 10: Grace Drive to Melody Street—Wilmington

### Length:

±1080 LF (wet)

### Ownership:

Private: 9 owners

### Public Facilities

#### Nearby:

None

### Environmental

#### Considerations:

Wetlands

Associated with Wet Canal Sections

### Accessibility:

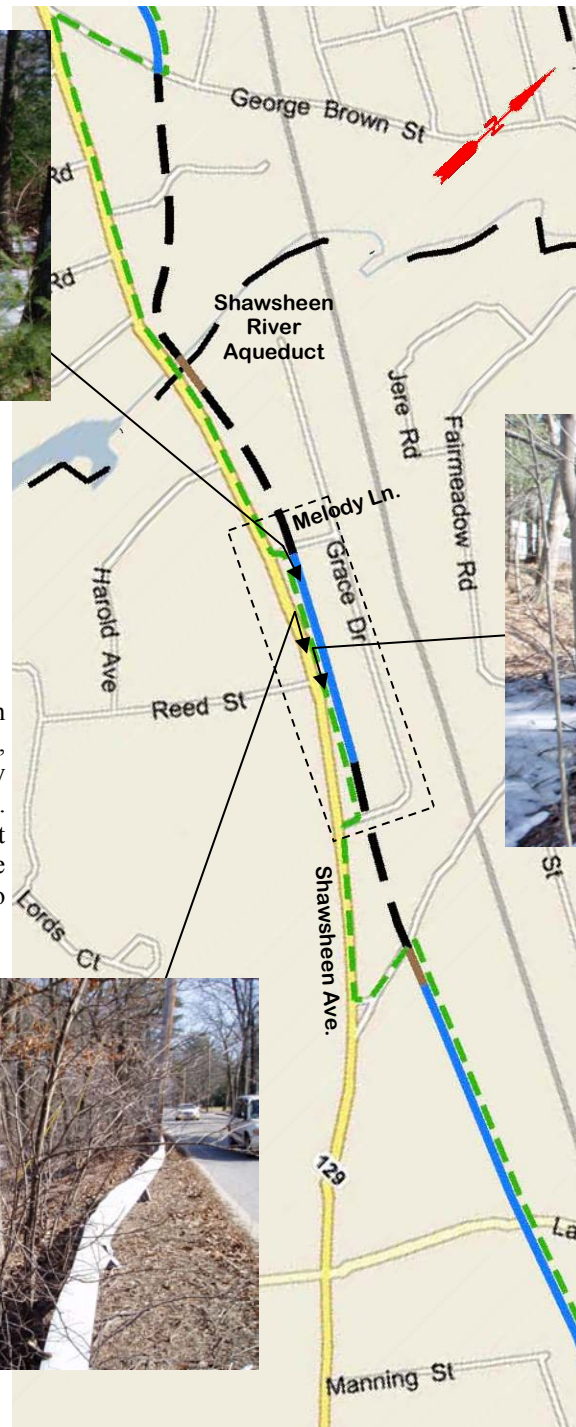
Auto: Roadside parking at Grace Drive or Melody Lane

Commuter Rail: None

Pedestrian: Either terminus

### Observation Summary:

The entire length of this segment is visible from Shawsheen Avenue. Due to the overgrowth along the sides of the canal, the visibility is more apparent at Grace Drive and Melody Lane where the cross section of the canal can be recognized. The canal is wet with not much overgrowth in the bed, but more along the sides. The overgrowth continues into the towpath, which is on the west side, making it difficult to traverse in some sections.



### Recommendations:

This segment could be highly visible from Shawsheen Avenue with selective tree clearing. A restored canal segment at this locating would serve to greatly enhance the impact of the neighboring Shawsheen Aqueduct remains by providing a visual perspective highlighting the continuation of the canal from the aqueduct.

It is recommended that the banks and towpath of the entire segment be restored. As this segment is located at the back of private property, acquiring access/maintenance easements may be challenging.



### Recommendations Highlights

- Restore canal embankments
- Restore Towpath
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** Medium-Low

**Restoration Cost Estimate:** \$315,300

See Appendix B for breakdown of estimate

### LEGEND:

DRY CANAL PRISM: ————

WET CANAL PRISM: ————

BUILT OVER CANAL: - - - - -

BIKE TRAIL: - - - - -

POINT OF INTEREST:



## Segment 11: Shawsheen River Aqueduct—Wilmington/Billerica

### Length:

450 LF (dry)

### Ownership:

Public: 2 owners  
- Town of Wilmington  
- Billerica Historical Society

### Public Facilities Nearby:

None

### Environmental Considerations:

Shawsheen River

### Accessibility:

Auto: Roadside parking at Grace Drive Cul-de-Sac

Commuter Rail: None

Pedestrian: Property at Grace Drive Cul-de-Sac  
Shawsheen Avenue

### Observation Summary:

While the aqueduct is highly visible from Shawsheen Avenue the adjacent canal section is not. While access to view the aqueduct is available directly off of Shawsheen Avenue, access to the canal prism is not as simple. To reach the canal there is a path located on Town owned land at the end of Grace Drive. At this location the path leads south along the Shawsheen River and into a steep slope at the historic structure with the aqueduct and canal remains sitting about 10 to 15 feet higher than the pathway. There is some overgrowth in the canal segment with large diameter trees growing in the canal and on the towpath.



### Recommendations:

This segment presents an opportunity to make one of the most popular features of the Middlesex Canal more accessible. Its high visibility on a major roadway adds to the importance of this location as a key site on the canal trail for education of the public and awareness of the canal's history.

It is recommended that the canal prism and towpath be restored to its original geometry. In addition a great opportunity exists to create a public recreation space at the site. The existing pathway to the canal off of Grace Drive is owned by the Town of Wilmington. Through coordination with the Town, a public space could be planned at the site with the canal as the focal point. As several kayakers were observed using the site for access to Shawsheen River at this location, incorporating a canoe/kayak launch in to the site could become a very popular feature.

With or without the above mentioned park, a more stable gravel path on the Grace Drive property should be constructed with an ramp and/or staircase for better accessibility to the canal segment. The stone abutments and piers should

remain undisturbed, although lighting directed toward the structure would create a dramatic nighttime feature.

### Recommendations Highlights

- Restore canal prism and towpath
- Creation of public space at Grace Drive property.
- Path construction from Grace Drive Cul-de-Sac to Canal Segment
- Provide Canal Illustrative Signage and Lighting

**Restoration Priority Rating:** Medium-High

**Restoration Cost Estimate:** \$140,200

See Appendix B for breakdown of estimate

### LEGEND:

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



## Segment 12: George Brown Street to Dignon Road—Billerica

### Length:

±1800 LF (wet)

### Ownership:

Public: 1 owner - Middlesex Canal Association

### Public Facilities Nearby:

None

### Environmental

#### Considerations:

Wetlands Associated with Wet Canal Sections

### Accessibility:

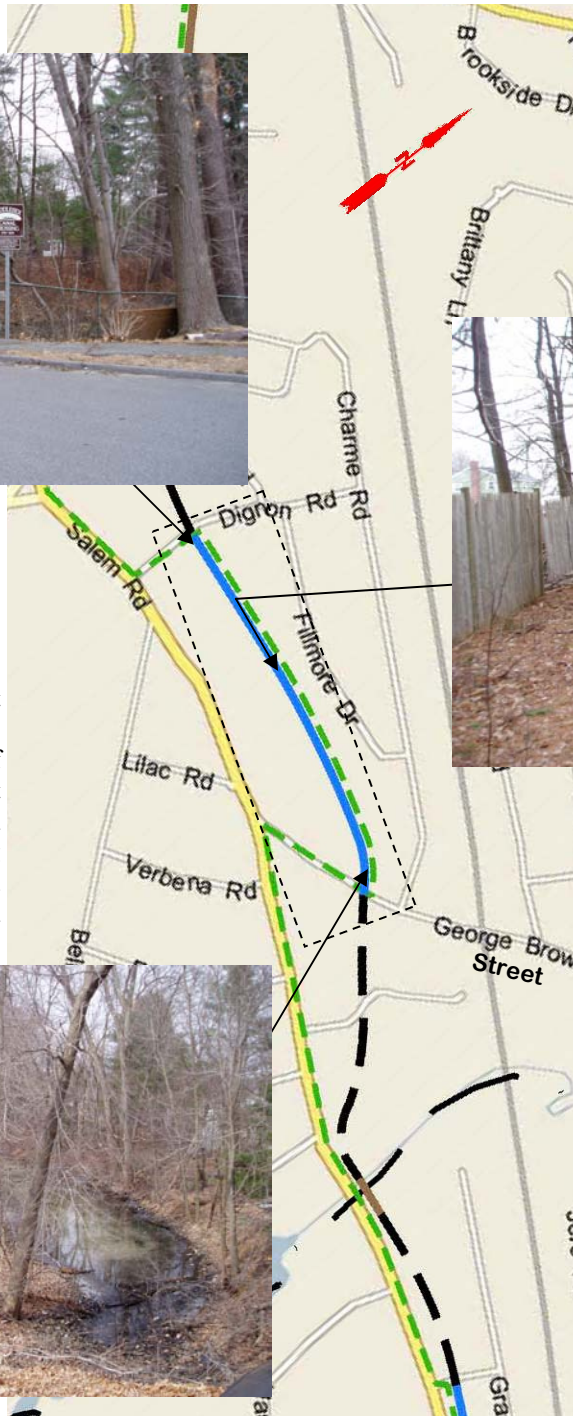
Auto: Roadside parking at George Brown Street or Dignon Road

Commuter Rail: None

Pedestrian: Southern and Northern Terminus

### Observation Summary:

The canal segment is visible from both George Brown Street and Dignon Road. Tucked in a residential neighborhood, abutters' properties seem to be very close to the pathways of the canal. A bridge and culvert are located at Dignon Street and appear to be in good condition. The canal bed is wet and the embankments and towpath are overgrown. The existing paths are difficult to traverse due to the vegetation and uneven topography. At George Brown Street, there seemed to be little or no water flow and no culverts were observed.



### Recommendations:

It is recommended that the canal embankments be completely restored. The original cross section of the canal can be recreated without significant disruption. A Greenway should be constructed at the location of the existing towpath, which is on the west side of the canal. The canal at this location appears to be used as a drainage channel although positive flow could not be determined. An inspection of local culverts and their condition should be performed.

### Recommendation Highlights

- Restoration of the canal embankments
- Reconstruction of the towpath as a Greenway
- Culvert and water flow inspection
- Installation of Canal Illustrative Signage

**Restoration Priority Rating:** Medium-High

**Restoration Cost Estimate:** \$643,550

See Appendix B for breakdown of estimate

### LEGEND:

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



### Segment 13: Kitchen Avenue to Staples Street—Billerica

**Length:**

±1060 LF (dry)

**Ownership:**

Public: 1 owner - Town of Billerica

Private: 2 owners

**Public Facilities****Nearby:**

None

**Environmental****Considerations:**

Wetlands Associated with Wet Canal Sections

**Accessibility:**

Auto: Roadside Parking at Kitchen Ave

Commuter Rail: None

Pedestrian: Access from either terminus

**Observation Summary:**

This segment of the canal is not visible from a major roadway. After a short walk into the woods from Kitchen Ave, the canal cross section becomes evident. The canal is a mixture of dry and wet areas with uneven topography throughout the segment. The sides of the canal retain some form, but are overgrown with trees and other vegetation. The growth continues into the towpath, which is on the west side of the canal. The segment ends at Staples Street, which was built over the canal prism. At this location the canal way is well below the elevation of the roadway.

**Recommendations:**

With low visibility to a major roadway, this segment would be more of an opportunity for local residents to enjoy a public common area and to create more awareness of the history of the Middlesex Canal.

It is recommended that the canal prism be fully restored. The original cross section of the canal can be recreated without significant disruption. A Greenway should be constructed for easier access through the canal segment and to highlight the

location of the towpath. Access at the north end of the segment is through private property. Access/maintenance easements will be required for continuity of the segment.

Significant signage should also be provided to illustrate the canals history and how it appeared to the public during its existence.

**Recommendation Highlights**

- Restore Canal Prism
- Reconstruct towpath as Greenway
- Provide Canal Illustration Signage

**Restoration Priority Rating:** Medium-Low

**Restoration Cost Estimate:** \$378,700

See Appendix B for breakdown of estimate

**LEGEND:**

DRY CANAL PRISM: ————

WET CANAL PRISM: ————

BUILT OVER CANAL: - - - - -

BIKE TRAIL: - - - - -

POINT OF INTEREST:



## Segment 14: Gray Street to Pond Street—Billerica

### Length:

±4690 LF (wet)

±1000 LF (dry)

### Ownership:

Private: 14 owners

### Public Facilities Nearby:

None

### Environmental

#### Considerations:

Abutting Former Landfill

Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Roadside Parking at Gray Street and Pond Street

Commuter Rail: None

Pedestrian: Southern and Northern Terminus

### Observation Summary:

The segment begins in the wooded area behind the properties of Kara Lane and to the west of overhead power lines. The canal bed to the south is dry and a walking path exists on the east side. Before the canal becomes wet, approximately 800' into the segment, the path crosses to the west which is the location of the towpath. The elevation of the path soon dips, exposing numerous tree roots. In addition overgrown conditions exist along the canal sides including trees and other vegetation. Approximately one half of the way through the segment the towpath drops below the water level making it impossible to traverse.

From Pond Street, there is a clear view of the canal cross section. A path can be traversed for a short length along the east side of the canal before it drops below the water again. No continuous pathway exists along the entire length of this segment.



### Recommendations:

This would be a great opportunity to restore one of the longest remaining segments of the Middlesex Canal.

It is recommended that the canal prism be fully restored along the dry section of the canal segment. For the wet section, the embankments and towpath should be restored. The towpath would need to be built up to cover the tree roots for a safer passage. The towpath would also need to be raised to provide a continuous Greenway although the environmental impacts of filling a wet area may be limiting.

At a minimum a pathway could be constructed leading to Tomahawk Drive to avoid the sunken towpath. This will create a more direct route for pedestrians to travel to the northern terminus of the segment rather than backtracking to the main roads. Due to the high visibility at the northern terminus, a 100 foot full restoration of the historic canal should be constructed.

### Recommendations Highlights

- Restoration of dry canal prism
- Reconstruction of embankments along wet canal section
- Restoration of towpath as Greenway (raise grade at low areas)
- Construction of pathway to Tomahawk Drive
- 100' wet canal restoration at north terminus
- Installation of Canal Illustrative Signage

**Restoration Priority Rating:** Medium-Low

**Restoration Cost Estimate:** \$1,105,900

**See Appendix B for breakdown of estimate**



### LEGEND:

DRY CANAL PRISM: ————

WET CANAL PRISM: ————

BUILT OVER CANAL: - - - - -

BIKE TRAIL: - - - - -

POINT OF INTEREST:

## Segment 15: Pond Street to High Street—Billerica

### Length:

±2800 LF (wet)  
±1700 LF (built over)

### Ownership:

Public: 1 owner - MBTA (Massachusetts Bay Transit Authority)  
Private: 4 owners

### Public Facilities Nearby:

None

### Environmental Considerations:

Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Roadside Parking at Pond Street  
Parking at High Street

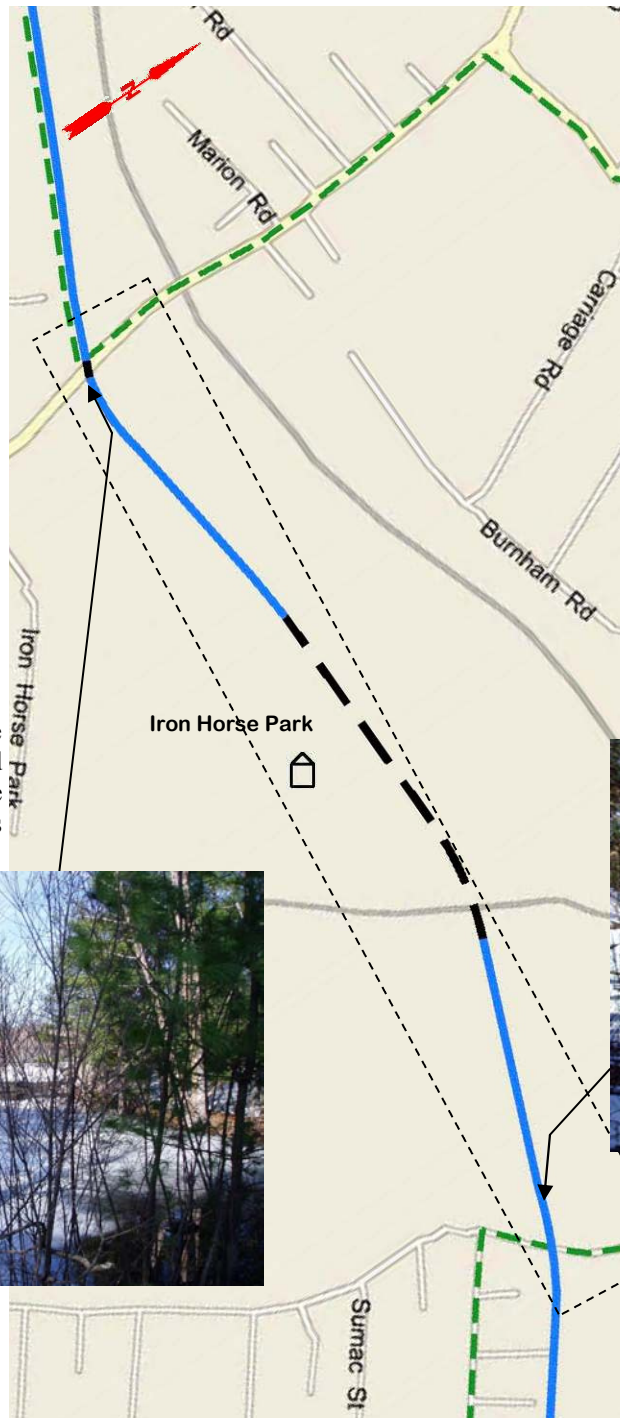
Commuter Rail: None

Pedestrian: Southern and Northern Terminus

### Observation Summary:

This segment is visible from the roadways at both the northern and southern terminus. From the south at Pond Street, only 200 feet of pathway can be traveled before the water level rises above the towpath. Accessibility is difficult due to the elevation drop from the street level down to the canal

From the northern terminus at High Street, the path can be traveled to the railroad yard which is approximately 1500 feet in. The path is fairly clear with plant overgrowth in a few areas and uneven topography. The canal sides had an overgrowth of trees and other vegetation.



### Recommendations:

Due to the presence of the railroad yard, full continuity of this segment is highly unlikely. Therefore, recommendations for restoration are limited in this segment. However, with the high visibility at the northern terminus and southern terminus from the roadways, it is recommended that a 100 foot full restoration of the Middlesex Canal be constructed at both areas.

There is also potential to create a Greenway 1500 feet in length from the northern terminus at High Street to the railroad yard. It would highlight the towpath, and create more accessibility to the canal's secluded location.

### Recommendation Highlights

- 100 foot full canal restoration at segment ends
- Reconstruction of the towpath as a Greenway
- Installation of Canal Illustrative Signage

**Restoration Priority Rating:** Low

**Restoration Cost Estimate:** \$594,300

**See Appendix B for breakdown of estimate**



### LEGEND:

DRY CANAL PRISM: ———  
WET CANAL PRISM: ———  
BUILT OVER CANAL: - - - -  
BIKE TRAIL: - - - -  
POINT OF INTEREST: 🏠



## Segment 16: High Street to Rogers Street—Billerica

### Length:

±2650 LF (wet)

±60 LF (built over)

### Ownership:

Private: 2 owners

### Public Facilities Nearby:

Approx. 1500 ft. (0.3 mi.) from the Middlesex Canal Museum and Mill Pond Heritage Park. Mill Pond Heritage Park connects Segments 16-17 (see next page)

Approx. 1300 ft. (0.25 mi.) from North Billerica Train Station

### Environmental Considerations:

Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Roadside Parking at Rogers Street

Parking at High Street down the road from entry point

Commuter Rail: Approx. 1400 ft. (0.25 mi.) from North Billerica Train Station

Pedestrian: Northern and Southern Terminus

### Observation Summary:

This segment is visible from both the northern and southern terminus. From the north at Rogers Street, there is a steep slope on the west side of the canal leading down to the towpath. The towpath and canal are bisected by an RR track approximately 700 feet to the south before continuing on to High Street.

The canal way is at a consistent water level for the entire segment and the towpaths are intact with just some uneven topography. Some overgrown conditions occur in the towpath and canal way which include trees and other vegetation. From the southern terminus at High Street, there is an access way for pedestrians with a stone marker on display indicating the presence of the canal.



### Recommendations:

It is recommended that the canal embankments be fully restored and the towpath be reconstructed as a Greenway. Providing a continuous path throughout this segment will be dependent upon providing an acceptable crossing at the observed RR track.

### Recommendation Highlights

- Restoration of canal embankments
- Reconstruction of the towpath as a Greenway
- Construction of railroad crossing
- Installation of canal illustrative signage

**Restoration Priority Rating:** Medium-High

**Restoration Cost Estimate:** \$1,092,200

**See Appendix B for breakdown of estimate**

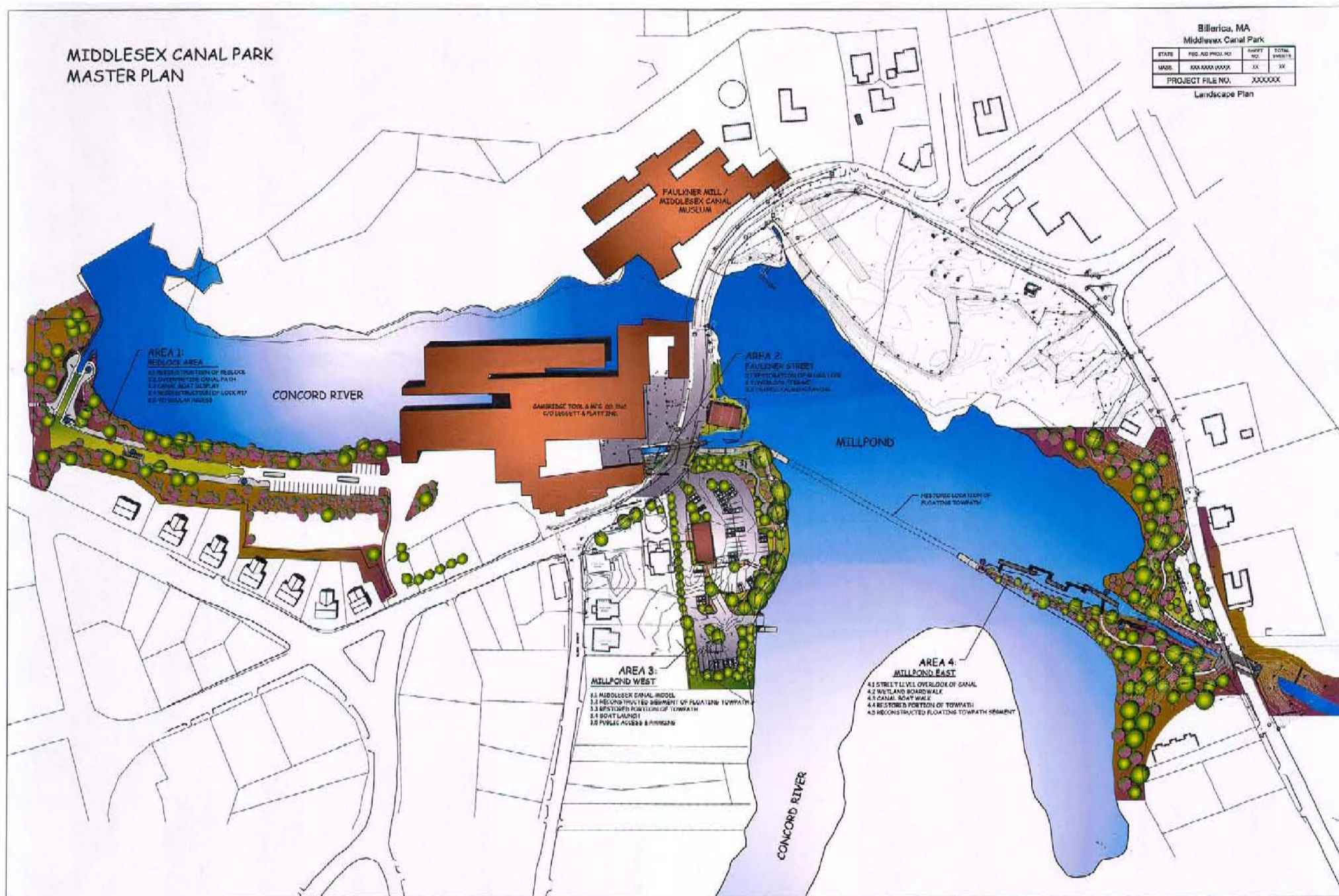


### LEGEND:

DRY CANAL PRISM: ————  
WET CANAL PRISM: ————  
BUILT OVER CANAL: - - - - -  
BIKE TRAIL: - - - - -  
POINT OF INTEREST: 🏠



# Mill Pond Heritage Park Phase I: Approved and Proceeding (See Figure 8)





## Segment 17: Fire Station at Mill Pond to Brick Kiln Road—Billerica

### Length:

±3980 LF (wet)  
±400 LF (dry)  
±260 LF (built over)

### Ownership:

Public: 2 owners  
- Town of Billerica  
- Middlesex Canal Association  
Private: 19 owners

### Public Facilities Nearby:

Approx. 2000 ft. (0.4 mi.) from the Middlesex Canal Museum and Mill Pond Heritage Park. Mill Pond Heritage Park connects Segments 16-17 (see previous page)

### Environmental Considerations:

Wetlands Associated with Wet Canal Sections (See attached next page)

### Accessibility:

Auto: Roadside Parking at Lowell Street and Brick Kiln Rd.  
Parking in Plaza at intersection of Lowell Street and Boston Rd.

Commuter Rail: Approx. 2600 ft. (0.5 mi.) from North Billerica Train Station

Pedestrian: Southern and Northern terminus & Boston Road

### Observation Summary:

This segment consists of two sections with varying conditions. The southern section, traverses from the fire station to Boston Road and is fully visible from Lowell Street. The western bank of this section has been recently cleared of brush and trees, but the east side still overgrown. Four culverts were observed with water flowing in the entire section. Approximately half of this section is wet.

The northern section spans from Boston Road to Brick Kiln Road and is not as visible from the roadway. Here, most of the canal has wet with standing water. The canal prism was difficult to identify at several areas throughout this section.



### Recommendations:

This segment presents ample opportunity to restore the canal and provide public interest. The high visibility from Lowell Street adds to the importance of this location as a key site on the canal trail for education of the public and awareness of the canal's history.

It is recommended that the canal prism be fully restored from the fire station to Boston Road. It is also recommended that the canal embankments be restored from Boston Road to Brick Kiln Road. It is noted that the restoration effort at several area of this section will require significant filling of wetland in order to construct a proper canal bank.



In order to take advantage of this segment's high visibility, significant signage should also be provided to create awareness of the canal's existence and rich history.

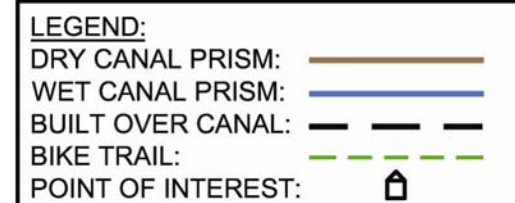
### Recommendation Highlights:

- Restoration of the canal prism (southern section)
- Construction of improved canal embankments (northern section)
- Reconstruction of the towpath as a Greenway
- Provide Canal Illustrative Signage

**Restoration Priority Rating:** Medium-High

**Restoration Cost Estimate:** \$747,600

See Appendix B for breakdown of estimate





## Segment 18: Brick Kiln Road to Riverneck Road—Chelmsford

### Length:

±4750 LF (wet)  
±1350 LF (dry)  
±170 LF (built over)

### Ownership:

Public: 1 owner  
- Town of Chelmsford  
Private: 5 owners

### Public Facilities Nearby:

None

### Environmental Considerations:

Within Wellhead  
Protection Area (5 Wellheads within area)  
Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Roadside Parking at Brick Kiln Road  
Office building parking lot at Riverneck Road

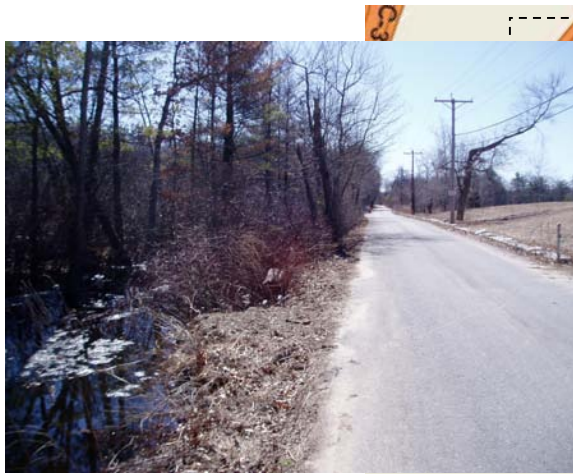
Commuter Rail: None

Pedestrian: Canal Street

### Observation Summary:

Beginning at the northern end of this segment at Riverneck Road and traveling south, the towpath for this entire canal segment has transformed into a 20 foot wide road. Heading south along Canal Street the water way is visible on the left and continues is wet for approximately 1,000 feet to the site of an abandoned house. The water level is high with not much of an embankment showing on either side. After an abandoned house, the canal bed continues dry for about 1,500 feet and then becomes wet again. Approximately 800' north of Brick Kiln Road, the canal banks spill over onto Canal Road and floods the area. It is here where a large water body exists with hydraulic continuity to the canal. During wet seasons it is assumed that this flooding condition regularly exists. From this point south, the area has been developed with commercial buildings and the canal prism is unrecognizable.

There is an overgrowth of trees and other vegetation for the entire length of the segment in the canal bed and along the sides.



### Recommendations:

This is a great opportunity to restore another one of the longest remaining segments of the Middlesex Canal.

It is recommended that the canal embankments be fully restored in all the wet areas of the segment and the entire canal prism be restored at dry locations. Construction of a Greenway at the towpath location will be a challenge as the towpath has been consumed by Canal Street. It is recommended that the shoulder of the street be widened to create a roadside path wide enough for safe passage of pedestrians and cyclists.

A raise in the road grade will be necessary at the southern end of the segment to prevent the canal from flooding Canal Street.



### Recommendation Highlights

- Restoration of embankments along wet canal sections
- Reconstruction of canal prism at dry locations
- Adjustment to grade of Canal Street to prevent flooding
- Installation of illustrative signage



**Restoration Priority Rating:** Medium  
**Restoration Cost Estimate:** \$1,241,800  
See Appendix B for breakdown of estimate

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



## Segment 19: Route 3 to Mt. Pleasant Golf Club—Lowell

### Length:

±4650 LF (wet)

### Owners:

Public: 1 owner - City of Lowell

Private: 3 owners

### Public Facilities Nearby:

None

### Environmental Considerations:

Wetlands Associated with Wet Canal Sections

### Accessibility:

Auto: Parking at Mount Pleasant Golf Club

Commuter Rail: None

Pedestrian: Northern Terminus through golf course

### Observation Summary:

Access could not be gained from the southern terminus due to the thick brush and wetlands. Entering from the golf course was much more feasible. The canal through the golf course is well defined and maintained. Heading south at the limit of the golf course property, the canal could be traveled along for approximately 500 feet before wetlands obstructed the path. The canal bed and towpath had overgrowth conditions with trees, vegetation and some uneven topography. The water was at a consistent level.



### Recommendations:

This segment could be a good opportunity to extend the canal which is already in great condition on the Mt. Pleasant Golf Course. Access will likely be an issue as it is only feasible through the golf course.

### Recommendation Highlights

- Restoration of the embankments along wet canals sections
- Reconstruction of the towpath as a Greenway
- Installation of illustrative signage

**Restoration Priority Rating:** Low

**Restoration Cost Estimate:** \$463,250

See Appendix B for breakdown of estimate

### LEGEND:

DRY CANAL PRISM: ————

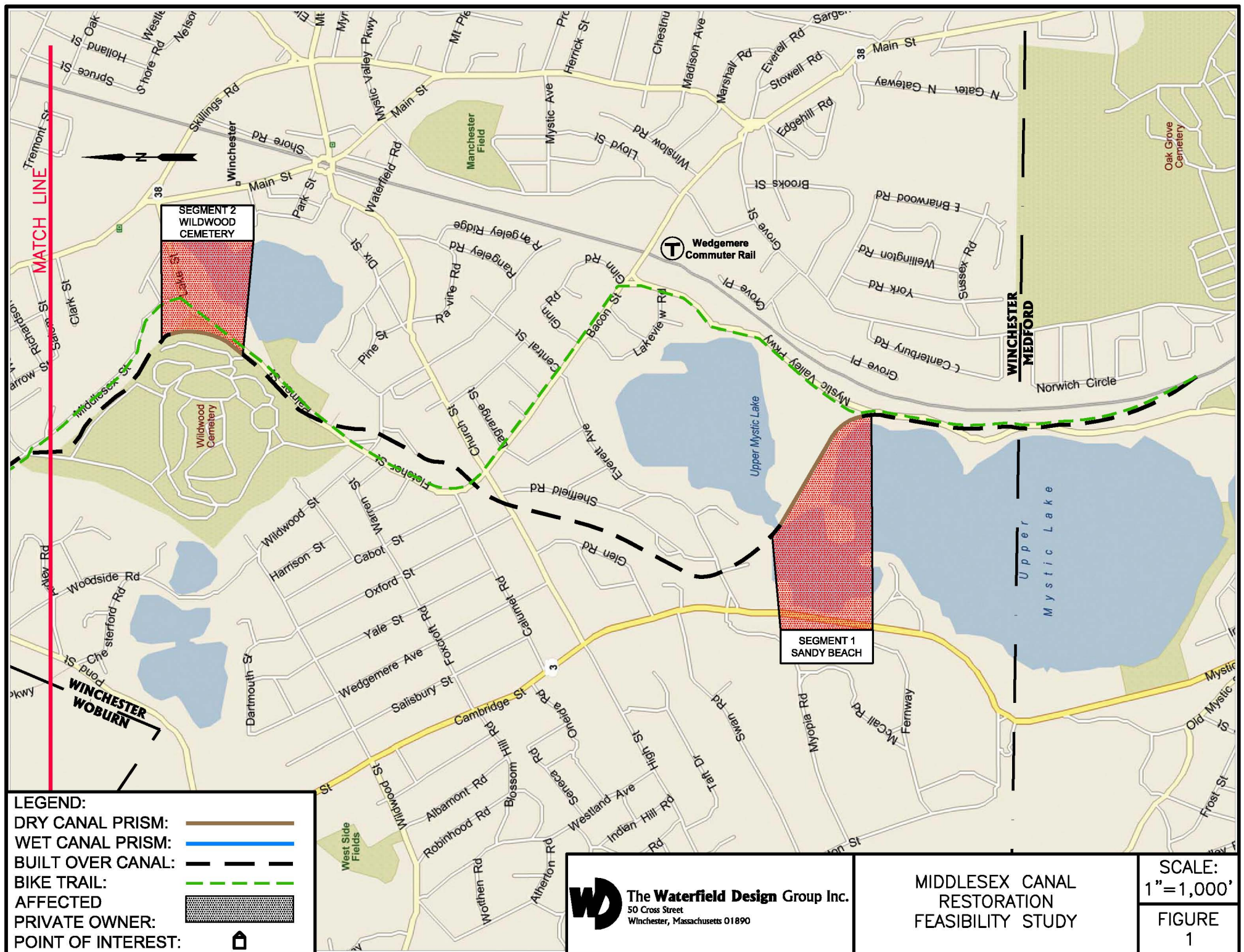
WET CANAL PRISM: ————

BUILT OVER CANAL: - - - - -

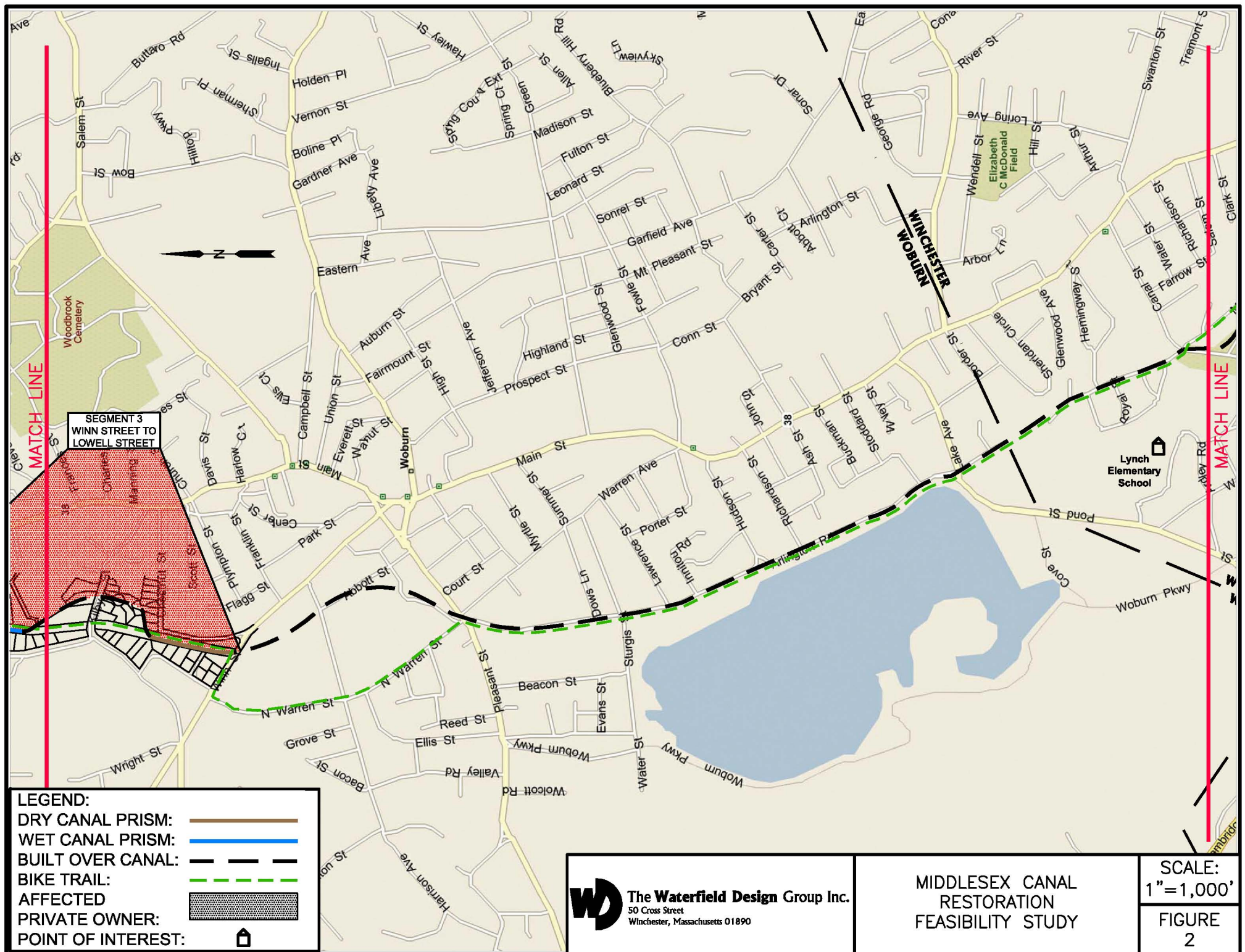
BIKE TRAIL: - - - - -

POINT OF INTEREST: 





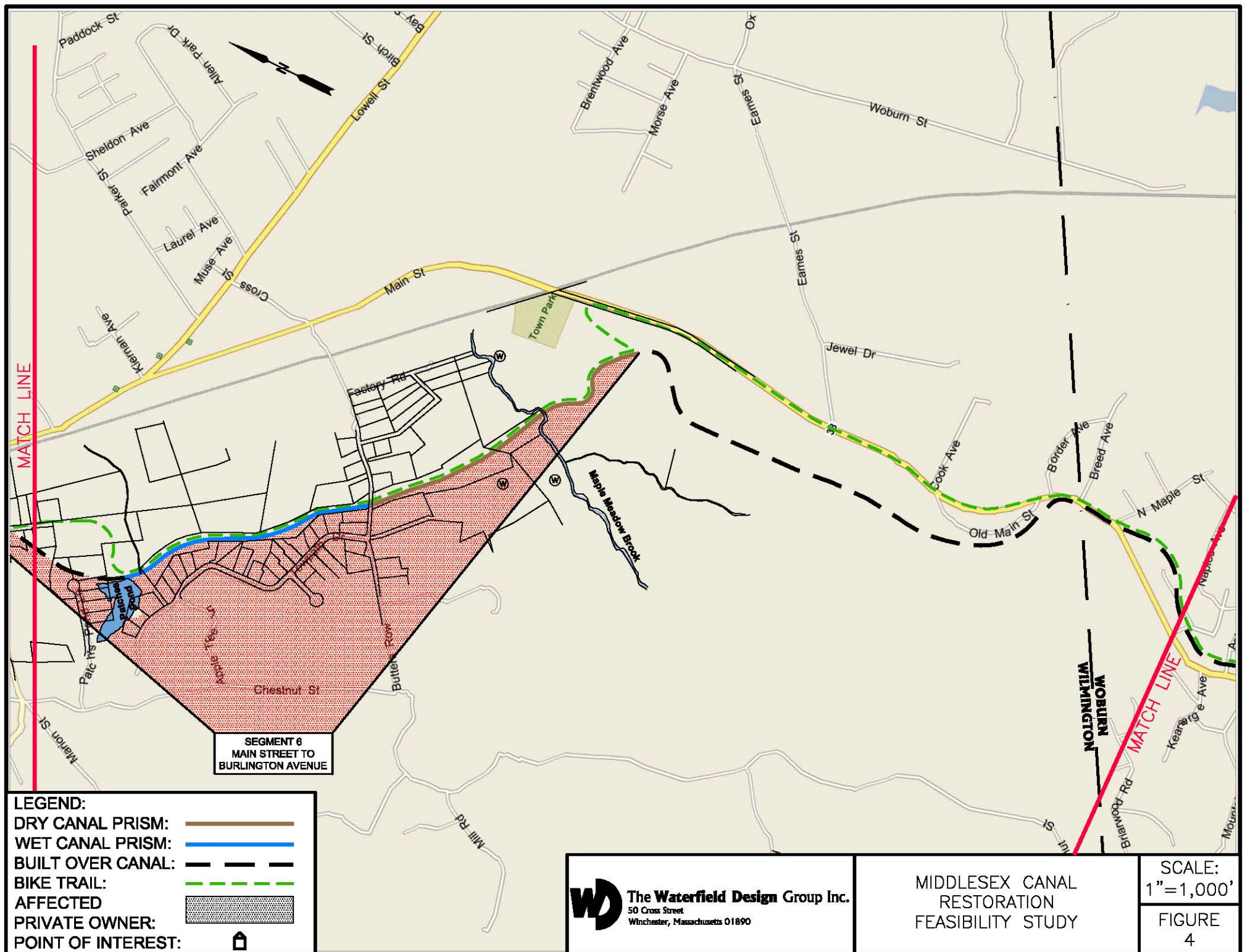




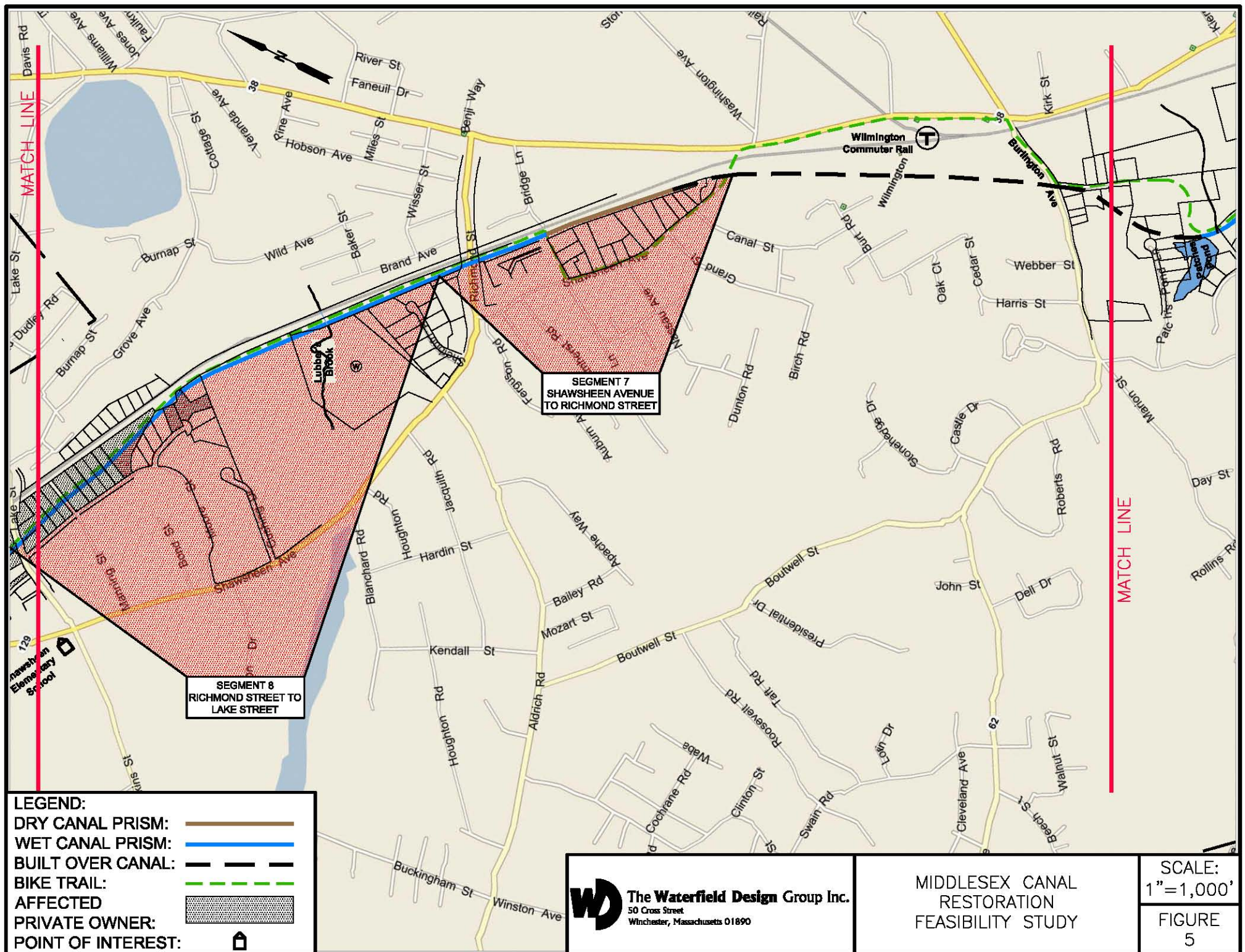








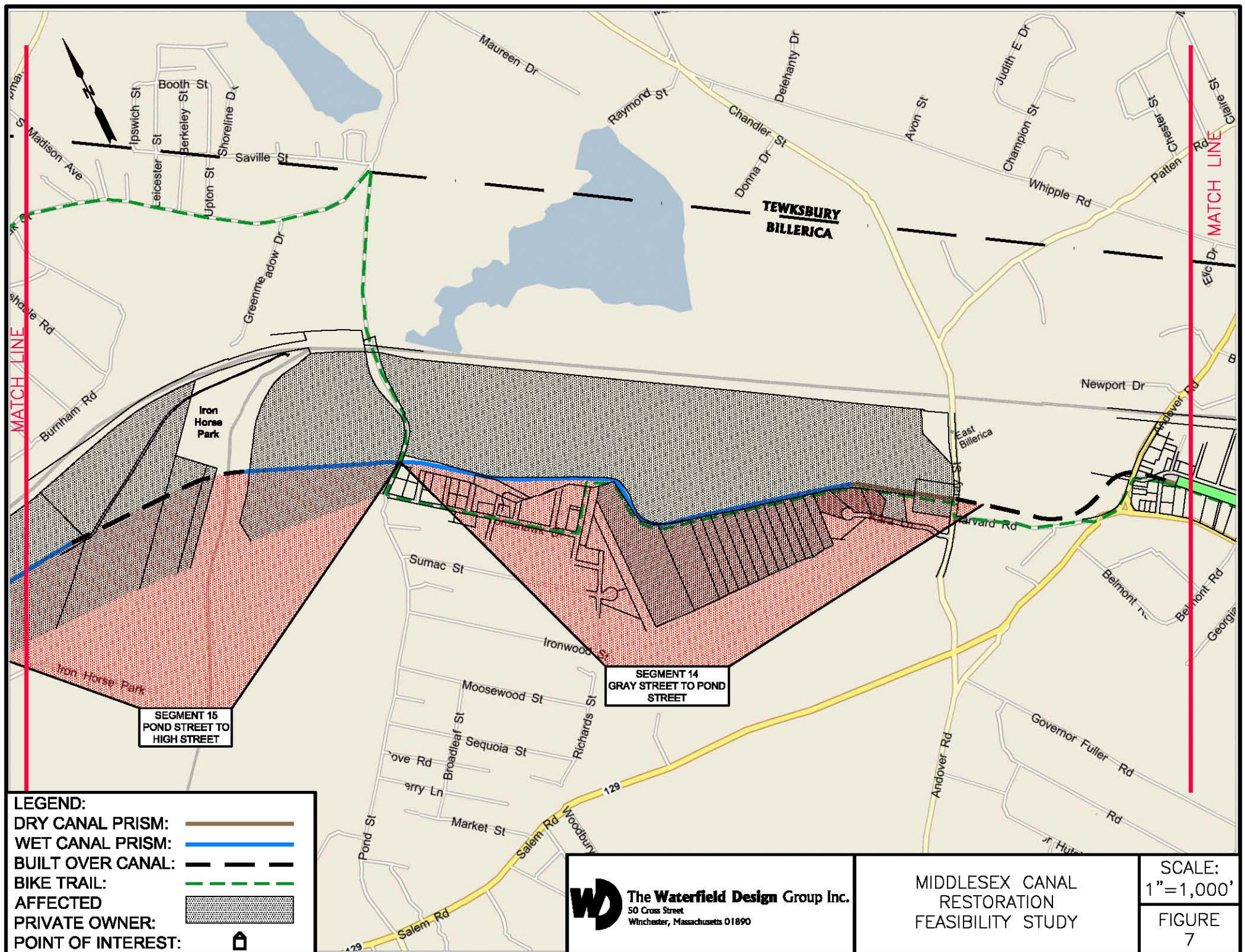




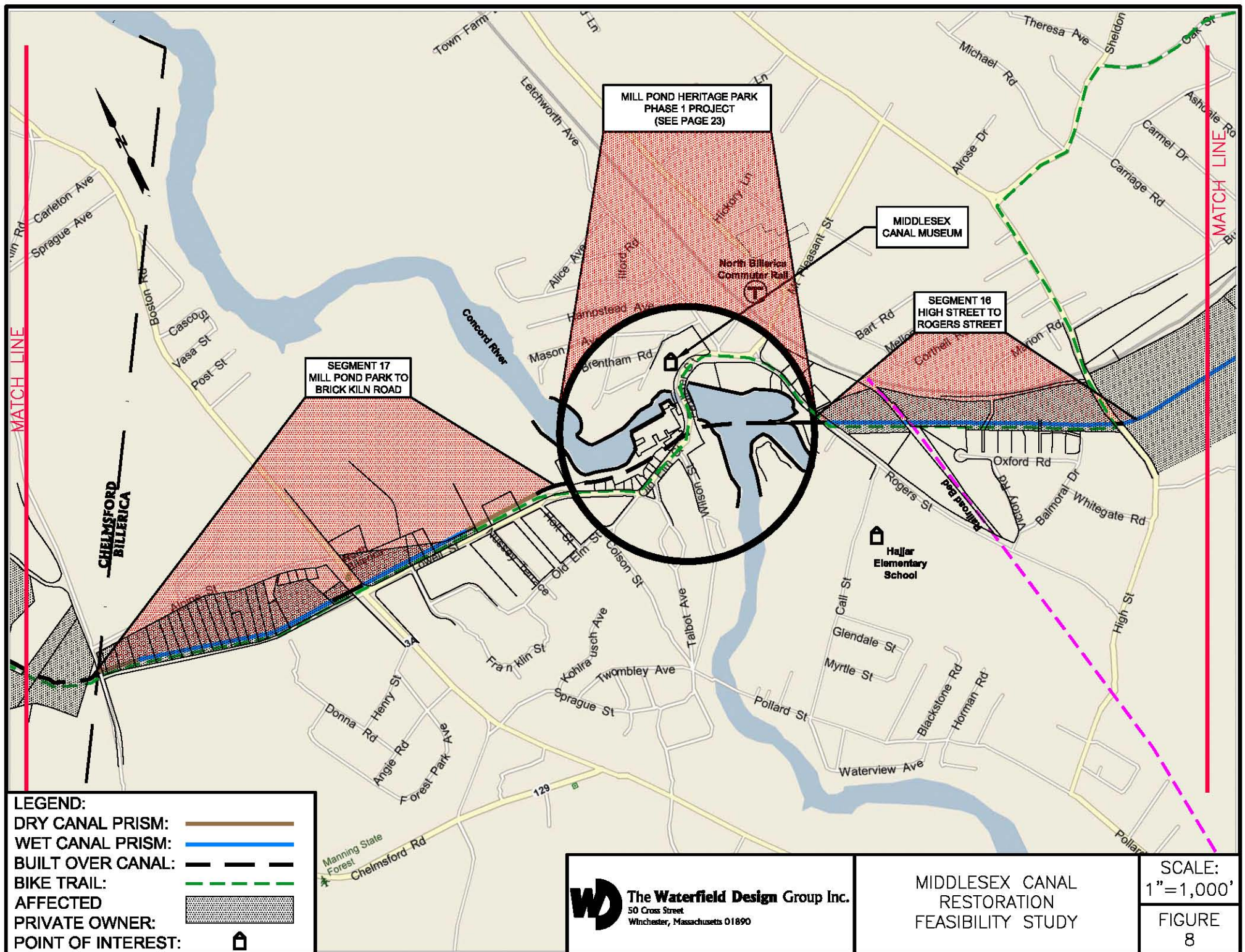




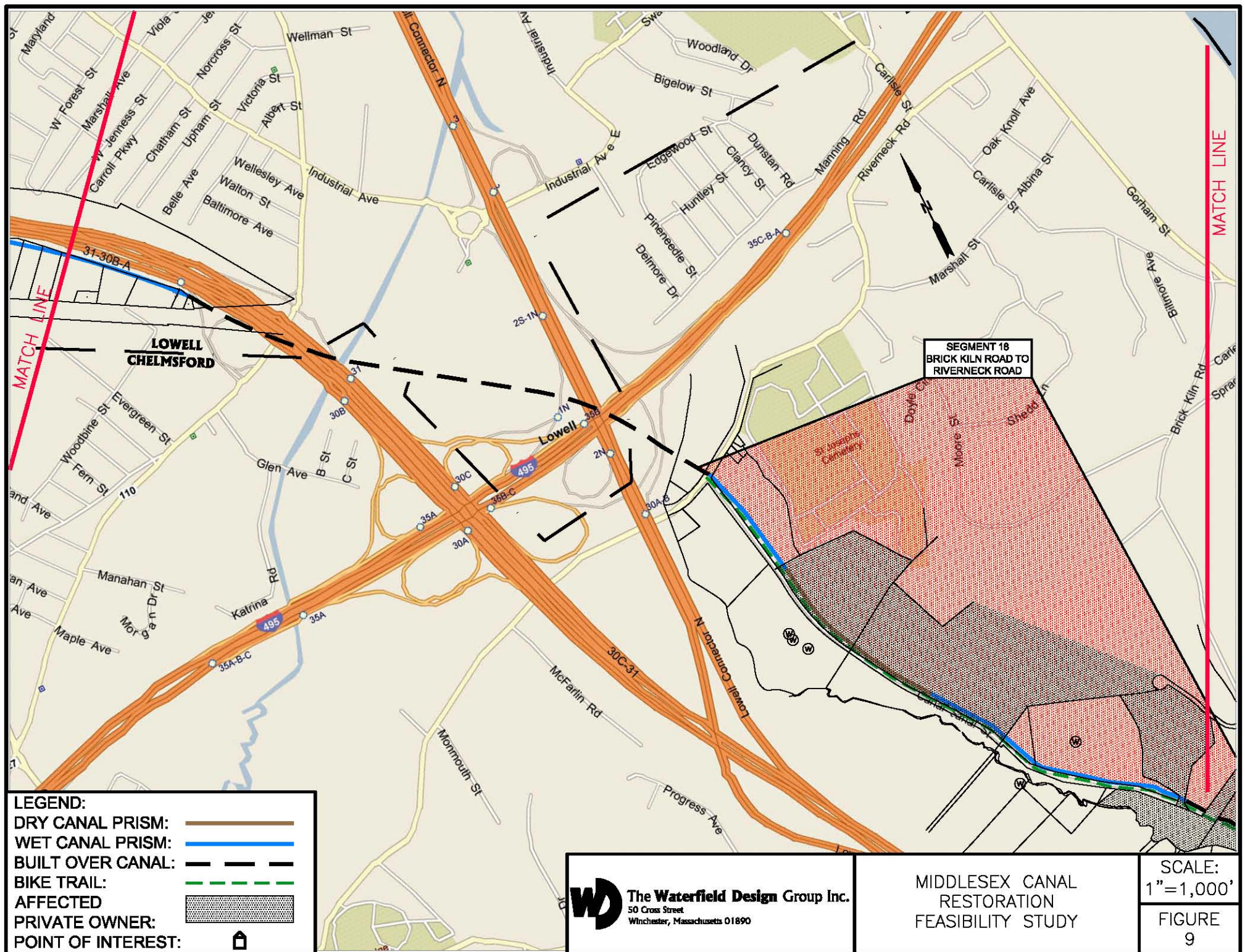


















# Appendix B

## Cost Estimates



# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 1 Sandy Beach

### Segment 2 Wildwood Cemetery

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total
<b>Site Preparation</b>								
Clearing and Grubbing	A	0.95	\$5,000.00	<b>\$4,750.00</b>	A	0.32	\$5,000.00	<b>\$1,600.00</b>
Tree Trimming	LF	0	\$7.50	<b>\$0.00</b>	LF	900	\$7.50	<b>\$6,750.00</b>
Tree Removed - Dia. Under 24 Inches	EA	30	\$750.00	<b>\$22,500.00</b>	EA	0	\$750.00	<b>\$0.00</b>
Tree Removed - Dia. 24 Inches and Over	EA	20	\$1,500.00	<b>\$30,000.00</b>	EA	0	\$1,500.00	<b>\$0.00</b>
Chain Link Fence Removed and Stacked	LF	180	\$4.50	<b>\$810.00</b>	LF	130	\$4.50	<b>\$585.00</b>
Chain Link Fence Gate Removed & Reset	EA	0	\$988.00	<b>\$0.00</b>	EA	1	\$988.00	<b>\$988.00</b>
Sedimentation Fence	LF	0	\$7.50	<b>\$0.00</b>	LF	1,800	\$7.50	<b>\$13,500.00</b>
Mobilization	LS	1	\$5,000.00	<b>\$5,000.00</b>	LS	1	\$5,000.00	<b>\$5,000.00</b>
Bales of Hay for Erosion Control	EA	620	\$13.00	<b>\$8,060.00</b>	EA	500	\$13.00	<b>\$6,500.00</b>
			<b>Subtotal</b>	<b>\$71,120.00</b>			<b>Subtotal</b>	<b>\$34,923.00</b>
<b>Embankment &amp; Path Construction</b>								
Earth Excavation	CY	857	\$26.00	<b>\$22,282.00</b>	CY	0	\$26.00	<b>\$0.00</b>
Earth Excavation Rehandled and Reused	CY	325	\$15.00	<b>\$4,875.00</b>	CY	0	\$15.00	<b>\$0.00</b>
Ordinary Borrow	CY	0	\$25.00	<b>\$0.00</b>	CY	2,535	\$25.00	<b>\$63,375.00</b>
Fine Grading , Compacting and Finishing	SY	4,500	\$5.00	<b>\$22,500.00</b>	SY	3,000	\$5.00	<b>\$15,000.00</b>
Dense Graded Crushed Stone (Towpath)	CY	170	\$44.00	<b>\$7,480.00</b>	CY	115	\$44.00	<b>\$5,060.00</b>
			<b>Subtotal</b>	<b>\$57,137.00</b>			<b>Subtotal</b>	<b>\$83,435.00</b>
<b>Drainage and Utilities</b>								
			<b>Subtotal</b>	<b>\$0.00</b>			<b>Subtotal</b>	<b>\$0.00</b>
<b>Interpretive Elements</b>								
Aqueduct Abutment	EA	1	\$20,000.00	<b>\$20,000.00</b>	EA	0	\$20,000.00	<b>\$0.00</b>
Park Features	LS	1	\$100,000.00	<b>\$100,000.00</b>	LS	0	\$100,000.00	<b>\$0.00</b>
Illustrative Signage	EA	3	\$1,000.00	<b>\$3,000.00</b>	EA	2	\$1,000.00	<b>\$2,000.00</b>
			<b>Subtotal</b>	<b>\$123,000.00</b>			<b>Subtotal</b>	<b>\$2,000.00</b>
			<b>Construction Subtotal</b>	<b>\$251,257.00</b>			<b>Construction Subtotal</b>	<b>\$120,358.00</b>
			25% Construction Contingency	<b>\$62,814.25</b>			25% Construction Contingency	<b>\$30,089.50</b>
			<b>Subtotal</b>	<b>\$314,071.25</b>			<b>Subtotal</b>	<b>\$150,447.50</b>
			Survey and Design	<b>\$37,688.55</b>			Survey and Design	<b>\$18,053.70</b>
<b>Design and Construction Total</b>					<b>Design and Construction Total</b>			
				<b>\$351,760</b>				<b>\$168,501</b>

\* This estimate for budgeting purposes only

A = Acre, EA = Each, CY = Cubic Yard, LF = Linear Feet, LS = Lump Sum, SY = Square Yard, TON = Ton



# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

Segment 3					Segment 4			
Winn Street to Lowell Street					Lowell Street to Middlesex Park			
Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total
<b>Site Preparation</b>								
Clearing and Grubbing	A	1.77	\$5,000.00	<b>\$8,850.00</b>	A	1.77	\$5,000.00	<b>\$8,850.00</b>
Removal of Canal Debris (Wet Segment)	LF	386	\$50.00	<b>\$19,300.00</b>	LF	572	\$50.00	<b>\$28,600.00</b>
Tree Removed - Dia. Under 24 Inches	EA	150	\$750.00	<b>\$112,500.00</b>	EA	100	\$750.00	<b>\$75,000.00</b>
Tree Removed - Dia. 24 Inches and Over	EA	75	\$1,500.00	<b>\$112,500.00</b>	EA	40	\$1,500.00	<b>\$60,000.00</b>
Mobilization	LS	1	\$10,000.00	<b>\$10,000.00</b>	LS	1	\$10,000.00	<b>\$10,000.00</b>
Bales of Hay for Erosion Control	EA	1,100	\$13.00	<b>\$14,300.00</b>	EA	1,150	\$13.00	<b>\$14,950.00</b>
			<b>Subtotal</b>	<b>\$277,450.00</b>			<b>Subtotal</b>	<b>\$197,400.00</b>
<b>Embankment &amp; Path Construction</b>								
Earth Excavation	CY	2386	\$26.00	<b>\$62,036.00</b>	CY	4,475	\$26.00	<b>\$116,350.00</b>
Earth Excavation Rehandled and Reused	CY	975	\$15.00	<b>\$14,625.00</b>	CY	0	\$15.00	<b>\$0.00</b>
Ordinary Borrow	CY	0	\$25.00	<b>\$0.00</b>	CY	0	\$25.00	<b>\$0.00</b>
Fine Grading , Compacting and Finishing	SY	5,450	\$5.00	<b>\$27,250.00</b>	SY	2,835	\$5.00	<b>\$14,175.00</b>
Gravel Borrow for Sub-base	CY	225	\$35.00	<b>\$7,875.00</b>	CY	0	\$35.00	<b>\$0.00</b>
Dense Graded Crushed Stone (Towpath)	CY	350	\$44.00	<b>\$15,400.00</b>	CY	315	\$44.00	<b>\$13,860.00</b>
Hot Mix Asphalt (Parking Area)	TON	170	\$130.00	<b>\$22,100.00</b>	TON	0	\$130.00	<b>\$0.00</b>
			<b>Subtotal</b>	<b>\$149,286.00</b>			<b>Subtotal</b>	<b>\$144,385.00</b>
<b>Drainage and Utilities</b>								
Cleaning Drainage Structures	EA	2	\$250.00	<b>\$500.00</b>	EA	3	\$250.00	<b>\$750.00</b>
			<b>Subtotal</b>	<b>\$500.00</b>			<b>Subtotal</b>	<b>\$750.00</b>
<b>Interpretive Elements</b>								
100' Wet Canal Restoration	EA	1	\$20,000.00	<b>\$20,000.00</b>	EA	2	\$20,000.00	<b>\$40,000.00</b>
Park Features	LS	0	\$70,000.00	<b>\$0.00</b>	LS	1	\$70,000.00	<b>\$70,000.00</b>
Bridge Rehabilitation	LS	0	\$5,000.00	<b>\$0.00</b>	LS	1	\$5,000.00	<b>\$5,000.00</b>
Illustrative Signage	EA	2	\$1,000.00	<b>\$2,000.00</b>	EA	2	\$1,000.00	<b>\$2,000.00</b>
			<b>Subtotal</b>	<b>\$22,000.00</b>			<b>Subtotal</b>	<b>\$117,000.00</b>
			<b>Construction Subtotal</b>	<b>\$449,236.00</b>			<b>Construction Subtotal</b>	<b>\$459,535.00</b>
			25% Construction Contingency	<b>\$112,309.00</b>			25% Construction Contingency	<b>\$114,883.75</b>
			<b>Subtotal</b>	<b>\$561,545.00</b>			<b>Subtotal</b>	<b>\$574,418.75</b>
			Survey and Design	<b>\$67,385.40</b>			Survey and Design	<b>\$68,930.25</b>
<b>Design and Construction Total</b>					<b>Design and Construction Total</b>			
<b>\$628,930</b>					<b>\$643,349</b>			

\* This estimate for budgeting purposes only

A = Acre, EA = Each, CY = Cubic Yard, LF = Linear Feet, LS = Lump Sum, SY = Square Yard, TON = Ton

# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 5 Alfred St. to School St.

### Segment 6 Main St. to Burlington Ave.

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total
<b>Site Preparation</b>								
Clearing and Grubbing	A	1.29	\$5,000.00	<b>\$6,450.00</b>	A	7.20	\$5,000.00	<b>\$36,000.00</b>
Removal of Canal Debris (Wet Segment)	LF	844	\$50.00	<b>\$42,200.00</b>	LF	739	\$50.00	<b>\$36,950.00</b>
Tree Removed - Dia. Under 24 Inches	EA	94	\$750.00	<b>\$70,500.00</b>	EA	672	\$750.00	<b>\$504,000.00</b>
Tree Removed - Dia. 24 Inches and Over	EA	4	\$1,500.00	<b>\$6,000.00</b>	EA	50	\$1,500.00	<b>\$75,000.00</b>
Mobilization	LS	1	\$10,000.00	<b>\$10,000.00</b>	LS	1	\$10,000.00	<b>\$10,000.00</b>
Bales of Hay for Erosion Control	EA	1,710	\$13.00	<b>\$22,230.00</b>	EA	3,700	\$13.00	<b>\$48,100.00</b>
			<b>Subtotal</b>	<b>\$157,380.00</b>			<b>Subtotal</b>	<b>\$710,050.00</b>
<b>Embankment &amp; Path Construction</b>								
Earth Excavation	CY	0	\$26.00	<b>\$0.00</b>	CY	3,027	\$26.00	<b>\$78,702.00</b>
Earth Excavation Rehandled and Reused	CY	0	\$15.00	<b>\$0.00</b>	CY	3,002	\$15.00	<b>\$45,030.00</b>
Ordinary Borrow	CY	2,125	\$26.25	<b>\$55,781.25</b>	CY	0	\$26.25	<b>\$0.00</b>
Fine Grading , Compacting and Finishing	SY	4,270	\$5.00	<b>\$21,350.00</b>	SY	19,650	\$5.00	<b>\$98,250.00</b>
Gravel Borrow for Sub-base	CY	1,495	\$35.00	<b>\$52,325.00</b>	CY	0	\$35.00	<b>\$0.00</b>
Dense Graded Crushed Stone (Towpath)	CY	475	\$44.00	<b>\$20,900.00</b>	CY	1,005	\$44.00	<b>\$44,220.00</b>
Hot Mix Asphalt (Bike Path)	TON	1,120	\$130.00	<b>\$145,600.00</b>	TON	0	\$130.00	<b>\$0.00</b>
Wooden Boardwalk (Bike Path)	LF	325	\$100.00	<b>\$32,500.00</b>	LF	425	\$100.00	<b>\$42,500.00</b>
			<b>Subtotal</b>	<b>\$328,456.25</b>			<b>Subtotal</b>	<b>\$308,702.00</b>
<b>Drainage and Utilities</b>								
Cleaning Drainage Structures	EA	2	\$250.00	<b>\$500.00</b>	EA	0	\$250.00	<b>\$0.00</b>
			<b>Subtotal</b>	<b>\$500.00</b>			<b>Subtotal</b>	<b>\$0.00</b>
<b>Interpretive Elements</b>								
100' Wet Canal Restoration	EA	2	\$20,000.00	<b>\$40,000.00</b>	EA	1	\$20,000.00	<b>\$20,000.00</b>
Pedestrian Bridges	EA	2	\$130,000.00	<b>\$260,000.00</b>	EA	1	\$130,000.00	<b>\$130,000.00</b>
English Garden Landscaping	LS	1	\$20,000.00	<b>\$20,000.00</b>	LS	0	\$20,000.00	<b>\$0.00</b>
Illustrative Signage	EA	4	\$1,000.00	<b>\$4,000.00</b>	EA	7	\$1,000.00	<b>\$7,000.00</b>
			<b>Subtotal</b>	<b>\$324,000.00</b>			<b>Subtotal</b>	<b>\$157,000.00</b>
			<b>Construction Subtotal</b>	<b>\$810,336.25</b>			<b>Construction Subtotal</b>	<b>\$1,175,752.00</b>
			25% Construction Contingency	<b>\$202,584.06</b>			25% Construction Contingency	<b>\$293,938.00</b>
			<b>Subtotal</b>	<b>\$1,012,920.31</b>			<b>Subtotal</b>	<b>\$1,469,690.00</b>
			Survey and Design	<b>\$121,550.44</b>			Survey and Design	<b>\$176,362.80</b>
				<b>Design and Construction Total</b>				
				<b>\$1,134,471</b>				
				<b>Design and Construction Total</b>				
				<b>\$1,646,053</b>				

\* This estimate for budgeting purposes only

A = Acre, EA = Each, CY = Cubic Yard, LF = Linear Feet, LS = Lump Sum, SY = Square Yard, TON = Ton



# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 7 Shawsheen Ave. to Richmond St.

### Segment 8 Richmond Street to Lake Street

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total	
Site Preparation									
Clearing and Grubbing	A	0.82	\$5,000.00	\$4,100.00	A	2.70	\$5,000.00	\$13,500.00	
Removal of Canal Debris (Wet Segment)	LF	234	\$50.00	\$11,700.00	LF	954	\$50.00	\$47,700.00	
Tree Removed - Dia. Under 24 Inches	EA	50	\$750.00	\$37,500.00	EA	30	\$750.00	\$22,500.00	
Tree Removed - Dia. 24 Inches and Over	EA	30	\$1,500.00	\$45,000.00	EA	50	\$1,500.00	\$75,000.00	
Fence Removed and Reset	LF	300	\$22.00	\$6,600.00	LF	0	\$22.00	\$0.00	
Mobilization	LS	1	\$10,000.00	\$10,000.00	LS	1	\$10,000.00	\$10,000.00	
Bales of Hay for Erosion Control	EA	475	\$13.00	\$6,175.00	EA	1,930	\$13.00	\$25,090.00	
			Subtotal	\$121,075.00			Subtotal	\$193,790.00	
Embankment & Path Construction									
Earth Excavation	CY	1,355	\$26.00	\$35,230.00	CY	0	\$26.00	\$0.00	
Earth Excavation Rehandled and Reused	CY	1,100	\$15.00	\$16,500.00	CY	0	\$15.00	\$0.00	
Ordinary Borrow	CY	0	\$25.00	\$0.00	CY	3,985	\$25.00	\$99,625.00	
Fine Grading , Compacting and Finishing	SY	8285	\$5.00	\$41,425.00	SY	8,000	\$5.00	\$40,000.00	
Dense Graded Crushed Stone (Towpath)	CY	400	\$44.00	\$17,600.00	CY	890	\$44.00	\$39,160.00	
72 Inch Chain Link Fence (STW)	LF	450	\$31.00	\$13,950.00	LF	0	\$31.00	\$0.00	
			Subtotal	\$124,705.00			Subtotal	\$178,785.00	
Drainage and Utilities									
Cleaning Drainage Structures	EA	1	\$250.00	\$250.00	EA	1	\$250.00	\$250.00	
			Subtotal	\$250.00			Subtotal	\$250.00	
Interpretive Elements									
100' Wet Canal Restoration	EA	1	\$20,000.00	\$20,000.00	EA	1	\$20,000.00	\$20,000.00	
Pedestrian Bridge	EA	0	\$130,000.00	\$0.00	EA	1	\$130,000.00	\$130,000.00	
Illustrative Signage	EA	1	\$1,000.00	\$1,000.00	EA	2	\$4,000.00	\$8,000.00	
			Subtotal	\$21,000.00			Subtotal	\$158,000.00	
			Construction Subtotal	\$267,030.00			Construction Subtotal	\$530,825.00	
			25% Construction Contingency	\$66,757.50			25% Construction Contingency	\$132,706.25	
			Subtotal	\$333,787.50			Subtotal	\$663,531.25	
			Survey and Design	\$40,054.50			Survey and Design	\$79,623.75	
Design and Construction Total				\$373,842	Design and Construction Total				\$743,155
* This estimate for budgeting purposes only									

\* This estimate for budgeting purposes only

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# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 9 Lake Street to Nichols Street

### Segment 10 Grace Drive to Melody Lane

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total
<b>Site Preparation</b>								
Clearing and Grubbing	A	1.47	\$5,000.00	<b>\$7,350.00</b>	A	1.12	\$5,000.00	<b>\$5,600.00</b>
Removal of Canal Debris (Wet Segment)	LF	420	\$50.00	<b>\$21,000.00</b>	LF	356	\$50.00	<b>\$17,800.00</b>
Tree Removed - Dia. Under 24 Inches	EA	50	\$750.00	<b>\$37,500.00</b>	EA	60	\$750.00	<b>\$45,000.00</b>
Tree Removed - Dia. 24 Inches and Over	EA	60	\$1,500.00	<b>\$90,000.00</b>	EA	40	\$1,500.00	<b>\$60,000.00</b>
Mobilization	LS	1	\$10,000.00	<b>\$10,000.00</b>	LS	1	\$5,000.00	<b>\$5,000.00</b>
Bales of Hay for Erosion Control	EA	850	\$13.00	<b>\$11,050.00</b>	EA	720	\$13.00	<b>\$9,360.00</b>
			<i>Subtotal</i>	<b>\$176,900.00</b>			<i>Subtotal</i>	<b>\$142,760.00</b>
<b>Embankment &amp; Path Construction</b>								
Ordinary Borrow	CY	996	\$25.00	<b>\$24,900.00</b>	CY	896	\$25.00	<b>\$22,400.00</b>
Fine Grading , Compacting and Finishing	SY	2,350	\$5.00	<b>\$11,750.00</b>	SY	1,800	\$5.00	<b>\$9,000.00</b>
Dense Graded Crushed Stone (Towpath)	CY	240	\$44.00	<b>\$10,560.00</b>	CY	200	\$44.00	<b>\$8,800.00</b>
			<i>Subtotal</i>	<b>\$47,210.00</b>			<i>Subtotal</i>	<b>\$40,200.00</b>
<b>Drainage and Utilities</b>								
Cleaning Drainage Structures	EA	1	\$250.00	<b>\$250.00</b>	EA	1	\$250.00	<b>\$250.00</b>
			<i>Subtotal</i>	<b>\$250.00</b>			<i>Subtotal</i>	<b>\$250.00</b>
<b>Interpretive Elements</b>								
100' Wet Canal Restoration	EA	2	\$20,000.00	<b>\$40,000.00</b>	EA	2	\$20,000.00	<b>\$40,000.00</b>
Illustrative Signage	EA	2	\$1,000.00	<b>\$2,000.00</b>	EA	2	\$1,000.00	<b>\$2,000.00</b>
			<i>Subtotal</i>	<b>\$42,000.00</b>			<i>Subtotal</i>	<b>\$42,000.00</b>
			<i>Construction Subtotal</i>	<b>\$266,360.00</b>			<i>Construction Subtotal</i>	<b>\$225,210.00</b>
			25% Construction Contingency	<b>\$66,590.00</b>			25% Construction Contingency	<b>\$56,302.50</b>
			<i>Subtotal</i>	<b>\$332,950.00</b>			<i>Subtotal</i>	<b>\$281,512.50</b>
			Survey and Design	<b>\$39,954.00</b>			Survey and Design	<b>\$33,781.50</b>
<b>Design and Construction Total</b>					<b>Design and Construction Total</b>			
				<b>\$372,904</b>				<b>\$315,294</b>

\* This estimate for budgeting purposes only

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# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 11 Shawsheen River Aqueduct

### Segment 12 George Brown Street to Digon Road

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total	
Site Preparation									
Clearing and Grubbing	A	0.13	\$5,000.00	\$650.00	A	2.04	\$5,000.00	\$10,200.00	
Removal of Canal Debris (Wet Segment)	LF	0	\$50.00	\$0.00	LF	590	\$50.00	\$29,500.00	
Tree Removed - Dia. Under 24 Inches	EA	30	\$750.00	\$22,500.00	EA	100	\$750.00	\$75,000.00	
Tree Removed - Dia. 24 Inches and Over	EA	15	\$1,500.00	\$22,500.00	EA	140	\$1,500.00	\$210,000.00	
Mobilization	LS	1	\$5,000.00	\$5,000.00	LS	1	\$10,000.00	\$10,000.00	
Bales of Hay for Erosion Control	EA	260	\$13.00	\$3,380.00	EA	1,200	\$13.00	\$15,600.00	
			Subtotal	\$54,030.00			Subtotal	\$350,300.00	
Embankment & Path Construction									
Earth Excavation	CY	430	\$26.00	\$11,180.00	CY	0	\$26.00	\$0.00	
Earth Excavation Rehandled and Reused	CY	165	\$15.00	\$2,475.00	CY	0	\$15.00	\$0.00	
Ordinary Borrow	CY	0	\$25.00	\$0.00	CY	1,495	\$25.00	\$37,375.00	
Fine Grading , Compacting and Finishing	SY	2,250	\$5.00	\$11,250.00	SY	3,000	\$5.00	\$15,000.00	
Dense Graded Crushed Stone (Towpath)	CY	84	\$44.00	\$3,696.00	CY	335	\$44.00	\$14,740.00	
			Subtotal	\$28,601.00			Subtotal	\$67,115.00	
Drainage and Utilities									
Cleaning Drainage Structures	EA	0	\$250.00	\$0.00	EA	1	\$250.00	\$250.00	
			Subtotal	\$0.00			Subtotal	\$250.00	
Interpretive Elements									
100' Wet Canal Restoration	EA	0	\$20,000.00	\$0.00	EA	2	\$20,000.00	\$40,000.00	
Public Recreation Space	LS	1	\$13,000.00	\$13,000.00	LS	0	\$6,500.00	\$0.00	
Lighting	LS	1	\$2,500.00	\$2,500.00	LS	0	\$2,500.00	\$0.00	
Illustrative Signage	EA	2	\$1,000.00	\$2,000.00	EA	2	\$1,000.00	\$2,000.00	
			Subtotal	\$17,500.00			Subtotal	\$42,000.00	
			Construction Subtotal	\$100,131.00			Construction Subtotal	\$459,665.00	
			25% Construction Contingency	\$25,032.75			25% Construction Contingency	\$114,916.25	
			Subtotal	\$125,163.75			Subtotal	\$574,581.25	
			Survey and Design	\$15,019.65			Survey and Design	\$68,949.75	
Design and Construction Total				\$140,183	Design and Construction Total				\$643,531
* This estimate for budgeting purposes only									

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# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 13 Kitchen Avenue to Staples Street

### Segment 14 Gray Street to Pond Street

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total	
Site Preparation									
Clearing and Grubbing	A	0.83	\$5,000.00	\$4,150.00	A	2.60	\$5,000.00	\$13,000.00	
Removal of Canal Debris (Wet Segment)	LF	0	\$50.00	\$0.00	LF	752	\$50.00	\$37,600.00	
Tree Removed - Dia. Under 24 Inches	EA	70	\$750.00	\$52,500.00	EA	200	\$750.00	\$150,000.00	
Tree Removed - Dia. 24 Inches and Over	EA	70	\$1,500.00	\$105,000.00	EA	200	\$1,500.00	\$300,000.00	
Mobilization	LS	1	\$10,000.00	\$10,000.00	LS	1	\$10,000.00	\$10,000.00	
Bales of Hay for Erosion Control	EA	480	\$13.00	\$6,240.00	EA	1,900	\$13.00	\$24,700.00	
			Subtotal	\$177,890.00			Subtotal	\$535,300.00	
Embankment & Path Construction									
Earth Excavation	CY	1,905	\$26.00	\$49,530.00	CY	955	\$26.00	\$24,830.00	
Earth Excavation Rehandled and Reused	CY	385	\$15.00	\$5,775.00	CY	955	\$15.00	\$14,325.00	
Ordinary Borrow	CY	0	\$25.00	\$0.00	CY	3,300	\$25.00	\$82,500.00	
Fine Grading , Compacting and Finishing	SY	5,300	\$5.00	\$26,500.00	SY	12,817	\$5.00	\$64,085.00	
Dense Graded Crushed Stone (Towpath)	CY	200	\$44.00	\$8,800.00	CY	1,054	\$44.00	\$46,376.00	
			Subtotal	\$90,605.00			Subtotal	\$232,116.00	
Drainage and Utilities									
Cleaning Drainage Structures	EA	0	\$250.00	\$0.00	EA	2	\$250.00	\$500.00	
			Subtotal	\$0.00			Subtotal	\$500.00	
Interpretive Elements									
100' Wet Canal Restoration	EA	0	\$20,000.00	\$0.00	EA	1	\$20,000.00	\$20,000.00	
Illustrative Signage	EA	2	\$1,000.00	\$2,000.00	EA	2	\$1,000.00	\$2,000.00	
			Subtotal	\$2,000.00			Subtotal	\$22,000.00	
			Construction Subtotal	\$270,495.00			Construction Subtotal	\$789,916.00	
			25% Construction Contingency	\$67,623.75			25% Construction Contingency	\$197,479.00	
			Subtotal	\$338,118.75			Subtotal	\$987,395.00	
			Survey and Design	\$40,574.25			Survey and Design	\$118,487.40	
Design and Construction Total				\$378,693	Design and Construction Total				\$1,105,882
* This estimate for budgeting purposes only									

\* This estimate for budgeting purposes only

A = Acre, EA = Each, CY = Cubic Yard, LF = Linear Feet, LS = Lump Sum, SY = Square Yard, TON = Ton



# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 15 Pond Street to High Street

### Segment 16 High Street to Rogers Street

Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total	
Site Preparation									
Clearing and Grubbing	A	1.30	\$5,000.00	\$6,500.00	A	3.63	\$5,000.00	\$18,150.00	
Removal of Canal Debris (Wet Segment)	LF	471	\$50.00	\$23,550.00	LF	838	\$50.00	\$41,900.00	
Tree Removed - Dia. Under 24 Inches	EA	100	\$750.00	\$75,000.00	EA	135	\$750.00	\$101,250.00	
Tree Removed - Dia. 24 Inches and Over	EA	100	\$1,500.00	\$150,000.00	EA	150	\$1,500.00	\$225,000.00	
Mobilization	LS	1	\$10,000.00	\$10,000.00	LS	1	\$10,000.00	\$10,000.00	
Bales of Hay for Erosion Control	EA	950	\$13.00	\$12,350.00	EA	1,690	\$13.00	\$21,970.00	
			Subtotal	\$277,400.00			Subtotal	\$418,270.00	
Embankment & Path Construction									
Ordinary Borrow	CY	2,325	\$25.00	\$58,125.00	CY	2,200	\$25.00	\$55,000.00	
Fine Grading , Compacting and Finishing	SY	4,670	\$5.00	\$23,350.00	SY	4,420	\$5.00	\$22,100.00	
Dense Graded Crushed Stone (Towpath)	CY	520	\$44.00	\$22,880.00	CY	495	\$44.00	\$21,780.00	
			Subtotal	\$104,355.00			Subtotal	\$98,880.00	
Drainage and Utilities									
Cleaning Drainage Structures	EA	3	\$250.00	\$750.00	EA	4	\$250.00	\$1,000.00	
			Subtotal	\$750.00			Subtotal	\$1,000.00	
Interpretive Elements									
100' Wet Canal Restoration	EA	2	\$20,000.00	\$40,000.00	EA	3	\$20,000.00	\$60,000.00	
Illustrative Signage	EA	2	\$1,000.00	\$2,000.00	EA	2	\$1,000.00	\$2,000.00	
Railroad Crossing					LS	1	\$200,000.00	\$200,000.00	
			Subtotal	\$42,000.00			Subtotal	\$262,000.00	
			Construction Subtotal	\$424,505.00			Construction Subtotal	\$780,150.00	
			25% Construction Contingency	\$106,126.25			25% Construction Contingency	\$195,037.50	
			Subtotal	\$530,631.25			Subtotal	\$975,187.50	
			Survey and Design	\$63,675.75			Survey and Design	\$117,022.50	
* This estimate for budgeting purposes only									
Design and Construction Total				\$594,307	Design and Construction Total				\$1,092,210

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# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

Segment 17 Mill Pond Park to Brick Kiln Rd.					Segment 18 Brick Kiln Road to Riverneck Rd.			
Item	Unit	Quantity	Unit price	Total	Unit	Quantity	Unit price	Total
<b>Site Preparation</b>								
Clearing and Grubbing	A	4.08	\$5,000.00	<b>\$20,400.00</b>	A	3.10	\$5,000.00	<b>\$15,500.00</b>
Removal of Canal Debris (Wet Segment)	LF	866	\$50.00	<b>\$43,300.00</b>	LF	1,394	\$50.00	<b>\$69,700.00</b>
Tree Removed - Dia. Under 24 Inches	EA	80	\$750.00	<b>\$60,000.00</b>	EA	265	\$750.00	<b>\$198,750.00</b>
Tree Removed - Dia. 24 Inches and Over	EA	100	\$1,500.00	<b>\$150,000.00</b>	EA	170	\$1,500.00	<b>\$255,000.00</b>
Mobilization	LS	1	\$10,000.00	<b>\$10,000.00</b>	LS	1	\$10,000.00	<b>\$10,000.00</b>
Bales of Hay for Erosion Control	EA	2,680	\$13.00	<b>\$34,840.00</b>	EA	3,070	\$13.00	<b>\$39,910.00</b>
			<b>Subtotal</b>	<b>\$318,540.00</b>			<b>Subtotal</b>	<b>\$588,860.00</b>
<b>Embankment &amp; Path Construction</b>								
Earth Excavation	CY	385	\$26.00	<b>\$10,010.00</b>	CY	1,285	\$26.00	<b>\$33,410.00</b>
Earth Excavation Rehandled and Reused	CY	385	\$15.00	<b>\$5,775.00</b>	CY	1,285	\$15.00	<b>\$19,275.00</b>
Ordinary Borrow	CY	3,065	\$25.00	<b>\$76,625.00</b>	CY	3,145	\$25.00	<b>\$78,625.00</b>
Fine Grading , Compacting and Finishing	SY	8,635	\$5.00	<b>\$43,175.00</b>	SY	14,670	\$5.00	<b>\$73,350.00</b>
Dense Graded Crushed Stone (Towpath)	CY	815	\$44.00	<b>\$35,860.00</b>	CY	1,130	\$44.00	<b>\$49,720.00</b>
			<b>Subtotal</b>	<b>\$171,445.00</b>			<b>Subtotal</b>	<b>\$254,380.00</b>
<b>Drainage and Utilities</b>								
Cleaning Drainage Structures	EA	4	\$250.00	<b>\$1,000.00</b>	EA	3	\$250.00	<b>\$750.00</b>
			<b>Subtotal</b>	<b>\$1,000.00</b>			<b>Subtotal</b>	<b>\$750.00</b>
<b>Interpretive Elements</b>								
100' Wet Canal Restoration	EA	2	\$20,000.00	<b>\$40,000.00</b>	EA	2	\$20,000.00	<b>\$40,000.00</b>
Illustrative Signage	EA	3	\$1,000.00	<b>\$3,000.00</b>	EA	3	\$1,000.00	<b>\$3,000.00</b>
			<b>Subtotal</b>	<b>\$43,000.00</b>			<b>Subtotal</b>	<b>\$43,000.00</b>
			<b>Construction Subtotal</b>	<b>\$533,985.00</b>			<b>Construction Subtotal</b>	<b>\$886,990.00</b>
			25% Construction Contingency	<b>\$133,496.25</b>			25% Construction Contingency	<b>\$221,747.50</b>
			<b>Subtotal</b>	<b>\$667,481.25</b>			<b>Subtotal</b>	<b>\$1,108,737.50</b>
			Survey and Design	<b>\$80,097.75</b>			Survey and Design	<b>\$133,048.50</b>
<b>Design and Construction Total</b>					<b>Design and Construction Total</b>			
<b>\$747,579</b>					<b>\$1,241,786</b>			

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# The Middlesex Canal Restoration

## Program Study: Conceptual Cost Estimates

August 15, 2007

### Segment 19

#### Rt. 3 to Mt. Pleasant Golf Course

Item	Unit	Quantity	Unit price	Total
<b>Site Preparation</b>				
Clearing and Grubbing	A	0.55	\$5,000.00	<b>\$2,750.00</b>
Removal of Canal Debris (Wet Segment)	LF	175	\$50.00	<b>\$8,750.00</b>
Tree Removed - Dia. Under 24 Inches	EA	54	\$750.00	<b>\$40,500.00</b>
Tree Removed - Dia. 24 Inches and Over	EA	50	\$1,500.00	<b>\$75,000.00</b>
Mobilization	LS	1	\$5,000.00	<b>\$5,000.00</b>
Bales of Hay for Erosion Control	EA	353	\$13.00	<b>\$4,589.00</b>
			<b>Subtotal</b>	<b>\$136,589.00</b>
<b>Embankment &amp; Path Construction</b>				
Ordinary Borrow	CY	3,860	\$25.00	<b>\$96,500.00</b>
Fine Grading , Compacting and Finishing	SY	7,750	\$5.00	<b>\$38,750.00</b>
Dense Graded Crushed Stone (Towpath)	CY	865	\$44.00	<b>\$38,060.00</b>
			<b>Subtotal</b>	<b>\$173,310.00</b>
<b>Interpretive Elements</b>				
100' Wet Canal Restoration	EA	1	\$20,000.00	<b>\$20,000.00</b>
Illustrative Signage	EA	1	\$1,000.00	<b>\$1,000.00</b>
			<b>Subtotal</b>	<b>\$21,000.00</b>
			<b>Construction Subtotal</b>	<b>\$330,899.00</b>
			25% Construction Contingency	<b>\$82,724.75</b>
			<b>Subtotal</b>	<b>\$413,623.75</b>
			Survey and Design	<b>\$49,634.85</b>
<i>* This estimate for budgeting purposes only</i>				
<b>Design and Construction Total</b>				<b>\$463,259</b>

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# Appendix C

## Restoration Priority Matrix



# The Middlesex Canal Restoration

## Program Study: Restoration Priority Matrix

August 15, 2007

	Segment 1 - Sandy Beach	Segment 2 - Wildwood Cemetery	Segment 3 - Winn St to Lowell St	Segment 4 - Lowell St to Middlesex Park	Segment 5 - Alfred St to School St	Segment 6 - Main St to Burlington Ave	Segment 7 - Shawsheen Ave to Richmond St	Segment 8 - Richmond St to Lake St	Segment 9 - Lake St to Nichol St	Segment 10 - Grace Dr to Melody Ln	Segment 11 - Shawsheen River Aqueduct	Segment 12 - George Brown St to Dignon Rd	Segment 13 - Kitchen Ave to Staples St	Segment 14 - Gray St to Pond St	Segment 15 - Pond St to High St	Segment 16 - High St to Rogers St	Segment 17 - Fire Station to Brick Kiln Rd	Segment 18 - Brick Kiln Rd to Riverneck	Segment 19 - Rte 3 to Golf Course
Ownership	5	5	5	5	4	5	5	4	1	1	5	5	3	1	3	2	3	3	1
Condition	5	1	3	4	5	4	3	3	3	4	5	3	2	3	2	4	3	3	1
Continuity	1	1	5	5	5	5	3	3	4	1	1	4	4	3	1	5	5	5	1
Visibility	5	1	5	4	5	3	5	3	5	5	5	4	1	3	2	4	5	3	1
Facilities Nearby	5	1	3	3	5	4	1	1	1	1	3	1	1	1	1	1	3	1	1
Average	4.2	1.8	4.2	4.2	4.8	4.2	3.4	2.8	2.8	2.4	3.8	3.4	2.2	2.2	1.8	3.2	3.8	3	1
Priority Level	H	L	H	H	H	H	MH	ML	ML	ML	MH	MH	ML	ML	L	MH	MH	M	L