Bay Colony Rail Trail

May 2013

Bay Colony Rail Trail Conceptual Planning and Design Study

Needham, MA

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Executive Summary

Study Process

The Bay Colony Rail Trail Association (BCRTA) and Town of Needham have been evaluating the feasibility and legal aspects of creating a multi-use trail (or rail trail) along the MBTA-owned railroad right-of-way (ROW). The MBTA has committed to supporting the development of the BCRT along the unused sections of ROW and is willing to execute a 99-year lease agreement with the Town to allow for trail design, construction, and maintenance. To assist with their reconnaissance efforts, the BCRTA and the Town hired the engineering consulting firm Fay, Spofford & Thorndike (FST) to prepare a Conceptual and Planning Design Study for the "Southern Section" of ROW from the Charles River at the Needham/Dover Town Line to Needham Junction. The goal of this study was to address the major items of technical interest and concern along the corridor which include, but are not limited to, trail cross section, parking and access, at-grade crossing treatments, Charles River Bridge, and mitigation measures.

This study was prepared with a cross section of community input and direction. Members of the BCRTA and Park & Recreation Department directed the process. Two public information meetings were held in March and April 2013 to gather information and present the initial study results for public comment. An interdepartmental coordination meeting was held with the Park & Recreation, Public Works, Conservation, Police, and Fire Departments. As part of the study, FST also met with representatives from the MBTA Railroad Operations and Engineering sections. The preliminary conversations with the MBTA indicated that they intend to retain the section of ROW from High Rock Street to Needham Junction for railroad purposes. Therefore, coordination will need to continue with the MBTA and NSTAR in an effort to extend the multi-use trail through to Needham Junction in a future phase of the project.

Conceptual Design

This study focuses on the development of a 1.7 mile multi-use trail between the Charles River and the Town Forest entrance off High Rock Street with on-road connections heading west to High Rock School (0.4 miles) and east to Needham Junction (0.7 miles). This 1.7-mile trail corridor offers great in-Town utility as a recreational path and an additional way to access the open space parcels along the corridor.

The recommended design includes the following project components:

- Construct 10-foot wide multi-use trail from the Charles River north to the Town Forest (1.7 miles) using a compacted soft-surface material
- Consider paving the trail in the future pending additional funding and community support
- Establish on-road connections from Town Forest to High Rock School (0.4 miles) and to Needham Junction (0.7 miles)
- Provide scenic overlook at Charles River Bridge while future bridge rehabilitation or replacement options are further discussed
- Create southern trailhead and parking area between Fisher Street and Charles River Street
- Create northern trailhead and parking area at the Town Forest entrance off High Rock Street
- Implement safety improvements at proposed roadway crossings at Fisher Street, Charles River Street and High Rock Street
- Implement "*MassDEP's Best Management Practices for the Controlling Exposure to Soil during the Development of Rail Trails* "

Implementation Strategy

Completing the project in its entirety would prove difficult and cost prohibitive. There are coordination efforts, approvals, and additional funding required to advance certain portions of the project. For these reasons, it is recommended that the project follow a phased approach. The phased approach outlined in the table below has the potential to serve users in the near term while helping to advance the larger project over the long-term.

Recommended Project Phasing Strategy

Phase	Activity / Task	Estimated Construction Cost
1	Construct 10-foot wide multi-use BCRT between the Charles River and Town Forest using a compacted soft-surface material (1.7 miles)	$400,000
2	Construct trailhead parking areas and interpretive elements at Fisher Street and Charles River Street	$100,000
3	Construct trailhead at the Town Forest including improvements to the existing driveway, parking area, and trail connection to the BCRT	$85,000
4A	Create on-road bike route, directional signage and pavement markings from the Town Forest to High Rock School (0.4 miles)	$5,000
4B	Create on-road bike route with directional signage and pavement markings from the Town Forest to Needham Junction (0.7 miles)	$8,000
5	Explore multi-use trail alternatives between High Rock Street and Chestnut Street	Requires further study
6	Replace Charles River Bridge between Needham and Dover	$1.2 Million

The project goal is to secure construction funding through fundraising efforts and private donors rather than from public (federal, state) sources to offset some of the project development costs to the Town. The estimated construction costs listed in the table above include material and installation costs and assume the project will be publicly bid and constructed. The costs could be reduced if the labor was performed by volunteers or with the assistance of the Town's Public Works Department.

Next Steps

The major technical items addressed as part of this study and the due diligence efforts being conducted by the BCRTA will enable the Town to make an informed decision on how and when to proceed forward with the BCRT project. The next steps in the project development process include:

- Conduct additional outreach with abutters, residents, and departments/boards/commissions
- Resolve open issues with MBTA
- Determine whether to purchase environmental insurance or meet the indemnification provisions of the MBTA lease agreement on preexisting environmental contamination
- Gain approval at Town Meeting to allow the Board of Selectmen to enter into negotiations with the MBTA for a 99-year lease agreement
- Continue fundraising efforts

The BCRTA believes it is timely and appropriate for the Town to begin lease negotiations with the MBTA and work towards executing a lease allowing for multi-use trail construction to proceed in phases using a combination of funding sources.

PART I – The Vision

1 Introduction

The Bay Colony Rail Trail (BCRT) is a proposed 7-mile multi-use trail through the towns of Needham, Dover and Medfield. The goal of the BCRT project is to construct a multi-use trail (or rail trail) along the unused section of railroad Right-of-Way (ROW) owned by the Massachusetts Bay Transportation Authority (MBTA). An overview map of the regional BCRT corridor is shown in Figure 1.

This Conceptual and Planning Design Study assesses the section of project from the Needham/Dover Town Line at the Charles River north to Needham Junction ("the Southern Section"), a distance of approximately 2.2 miles. The future extension of the multi-use trail along the Northern Section in Needham and south into Dover and Medfield will be addressed as part of other study efforts.

In February 2013, the Bay Colony Rail Trail Association (BCRTA) and Town of Needham, through its Park and Recreation Department, partnered with the firm Fay, Spofford & Thorndike (FST) to prepare this conceptual and planning design study. Funding for the study was appropriated at the Fall 2012 Town Meeting. The study builds upon the prior efforts by the BCRTA and focuses on the major items of technical interest and concern along the Southern Section. A conceptual trail design was developed based on existing site conditions and key design and constructability issues. The study also identifies the key implementation activities and funding needed to advance the project forward in the near term using an organization such as the Iron Horse Preservation Society, independent contractor, and/or volunteers.

During the study process, preliminary conversations with the MBTA indicated that they intend to retain the section of ROW from High Rock Street to Needham Junction for railroad purposes. There is a potential to extend a multi-use trail through to Needham Junction in a future phase of the project, but this option requires further evaluation with many details yet to be resolved. Therefore, this study focuses on the development of a 1.7 mile multi-use trail between the Charles River and the Town Forest entrance off High Rock Street with on-road connections heading west to High Rock School (0.5 miles) and east to Needham Junction (0.7 miles). This 1.7-mile trail offers great in-Town utility as a recreational path and an additional way to access the open space parcels along the corridor.

Part I of this study illustrates the proposed conceptual design that resulted from this study. Part II of this study documents the existing conditions and site analysis of the MBTA ROW. Part III provides additional information on the Charles River Bridge visual assessment performed as part of this study.

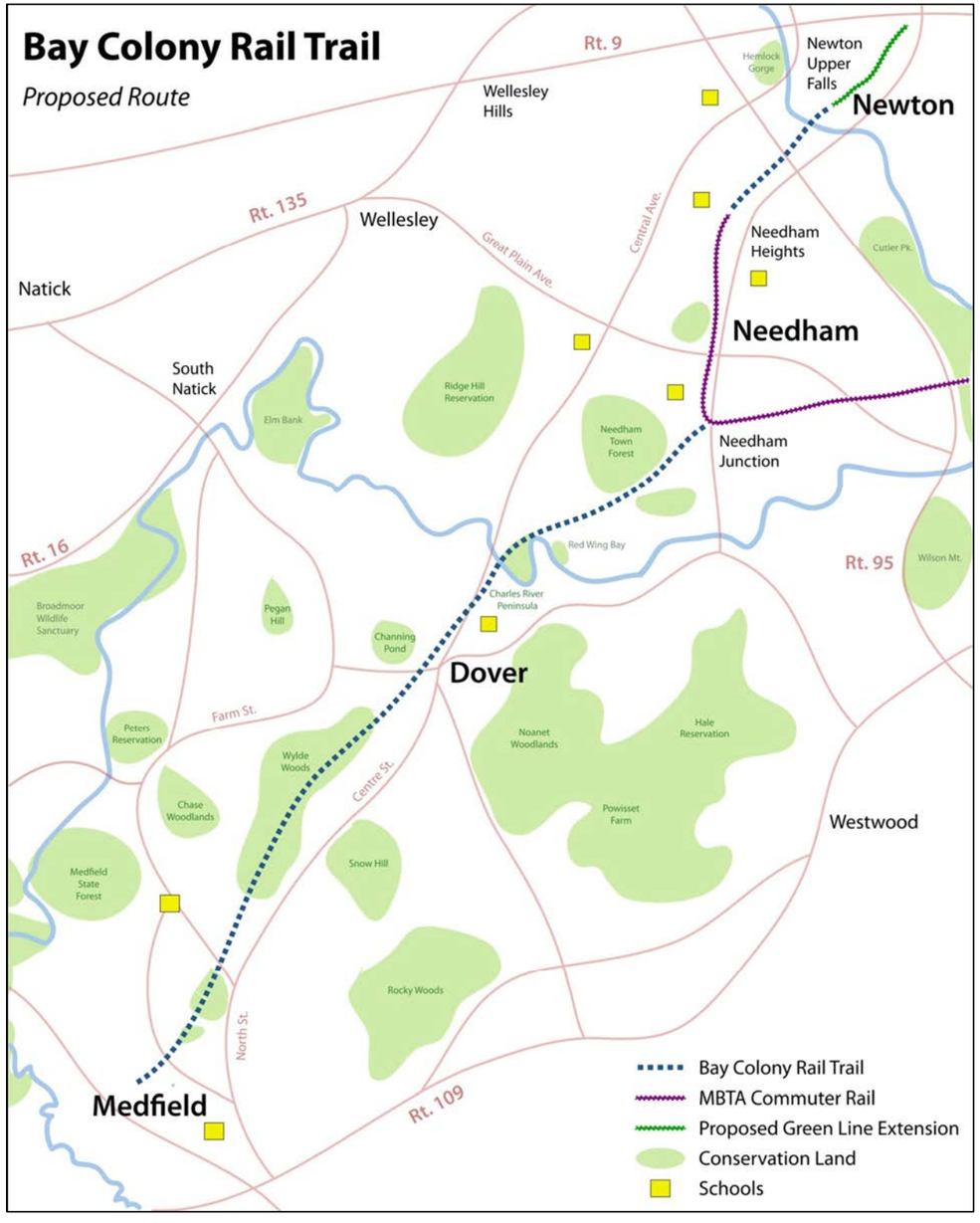

Figure 1: Proposed Bay Colony Rail Trail

2 Community Opportunity

The Southern Section of ROW forms a north to south spine from the natural areas along the Charles River to the Town Forest, with on-road connections and potential future multi-use trail extensions to the Needham Junction commercial area and commuter rail station. Reclaiming the unused section of ROW for a multi-use trail will enhance the overall quality of life and livability of the Town by promoting:

- **Increased health and wellness:** a trail gives residents of varying ages and physical abilities the chance to exercise and enjoy the outdoors.
- **Environmentally friendly transportation alternative**: a trail provides a viable, safe and green transportation route.
- **Enhanced open space protection:** trails preserve and maintain natural settings.
- **Stronger civic pride and community identity:** trails help to define "livable" towns and connect them to each other; help unite people with varying physical abilities; and aid in preservation of local history.

The need to acquire property rights to a corridor matched with efforts to develop community support and secure the necessary funds can often take several years. However, the Town of Needham has an opportunity to develop a community asset in the near term due to a confluence of positive factors.

First, the MBTA has committed to supporting the development of the BCRT along the unused section of ROW and is positioned to execute a lease agreement with the Town. Second, the current salvage value of the steel tracks and reuse options for railroad ties can help offset the cost of trail construction. Third, there is positive momentum in Town stemming from the two public information meetings conducted as part of this study. Lastly, this study presents a conceptual design that successfully meets the project objective and can be implemented in phases within a reasonable timeframe.

For these reasons, the BCRTA believes it is timely and appropriate for the Town to begin lease negotiations with the MBTA and work towards executing a lease allowing for multi-use trail construction to proceed using a combination of funding sources. With the support of local elected officials and town meeting members, departments, boards, commissions, and committees, the BCRT project will further the Town's efforts to continue to be a quality place to live, work and play.

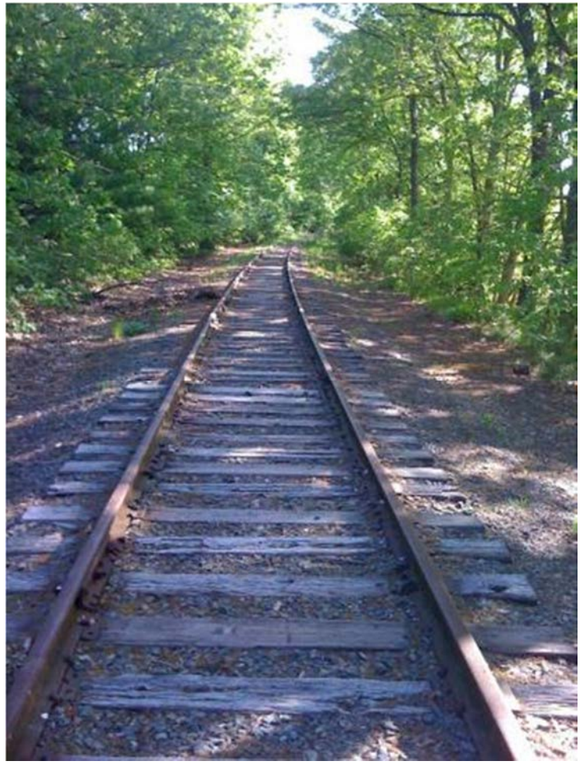

Figure 2: ROW Looking North Towards Fisher Street

Figure 3: ROW Connects to Town Forest Trail System

3 Conceptual Trail Design

This chapter addresses the following conceptual trail design elements:

- Facility type
- Trail cross section
- Trail profile
- Trail surface material
- At-grade trail/roadway crossing treatment

Facility Type

A project can be comprised of different facility types in order to connect users with various destinations in a community.

The proposed facility type proposed along the ROW is a multi-use trail. A multi-use trail (or rail trail) is a facility for non-motorized uses that is independently aligned and can be used for a variety of purposes including bicycling, walking, and running. This type of facility is attractive to users of varying ages and skill levels because of the separation from vehicular traffic.

Where the BCRT transitions to an on-road facility along local roadways, the proposed facility type is a bicycle route, shared roadway or sidewalk, depending upon the mode of travel and existing roadway cross section.

Trail Cross Section

Trail Width: It is recommended that the trail surface be a consistent 10–foot width along the entire corridor. Most of the locally known rail trails including the Nashua River Rail Trail and Cape Cod Rail Trail have a 10 foot wide trail surface.

As shown on Figures 44 and 45 in Part II of this study, sections of the ROW north of Charles River Street have a narrow rail bed width due to adjacent drainage swales, ledge outcrops, and/or eroding sideslopes. These conditions account for approximately 3,400 linear feet, which accounts for approximately 40% of the ROW. A 10-foot trail width will:

- Accommodate multiple user types with minimal conflict
- Minimize the amount of cut and fill operations required
- Avoid direct impacts to adjacent drainage swales and wetland resource areas
- Accommodate occasional access by emergency vehicles

Shoulder Width: A minimum 2-foot wide graded clear shoulder should be maintained adjacent to both sides of the 10 foot wide trail surface. The shoulder is typically graded to a slope of 1 vertical to 12 horizontal (1:12) to enhance proper drainage to prevent erosion and provide a recovery zone for trail users. Shoulder areas should be compacted and stabilized and designed to discourage their use as informal treadways.

Horizontal Clearance: A minimum 3-foot clearance should be maintained from the edge of the trail to existing obstructions such as signs, trees, fences, or other obstructions. A 5-foot separation from the edge of the trail surface to the top of slope is desirable in areas where the trail is located adjacent to steep slopes. If this offset cannot be achieved, then a physical barrier such as a wood rail fence or dense shrubbery should be installed along the top of slope to protect trail users. In general, the greater the height of the drop-off, the greater the need for protection.

Cross Slope: The trail will need to be raised slightly above the surrounding ground and have a 1.5% cross slope in one direction to ensure water drains off the trail surface. The direction of the cross slope should be established based on the natural drainage patterns at the site. A 1.5% cross slope (construction tolerance +/- 0.5%) is the same as a typical sidewalk and meets Americans with Disabilities Act (ADA) accessibility guidelines.

The representative cross section locations along the ROW are shown on Figures 13 and 14 and include:

- Section A-A: Typical Section with Abutter Screening (Figure 19)
- Section B-B: Typical Section in Fill Section with Slope Stabilization (Figure 25)
- Section C-C: Typical Section in Cut Section with Drainage Swales (Figure 26)
- Section D-D: Typical Trail Cross Section in Fill Section (Figure 28)

Trail Profile

The profile of the rail corridor is relatively flat. The trail and any connections along the main alignment should have a 4.5% maximum slope or grade (construction tolerance +/- 0.5%) to meet ADA accessibility guidelines. For example, a trail connection through the Town Forest to High Rock Street should meet this maximum grade requirement.

Trail Surface Material

Following track and tie removal, the existing subbase material including the railroad ballast (stone) will be graded to fill any voids and then compacted and rolled. The next step is to install the base and top course materials, rolling and compacting between layers.

Any wet or organic subbase material should be removed to prevent uneven settlement of the base and top courses. Depending upon existing conditions, this may require installing additional depth of base course material to replace any unsuitable materials encountered during construction. The only way to confirm the suitability of the subbase material prior to the start of construction would be to conduct a geotechnical sampling program.

According to the "Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; Shared Use Paths" issued by the Architectural and Transportation Barriers Compliance Board (Access Board), a trail surface must be firm , stable, and slip resistant to meet current ADA guidelines. Per the Access Board definitions "a stable surface remains unchanged by applied force so that when the force is removed, the surface returns to its original condition. A firm surface resists deformation by indentations." Based on this definition, a soft surface trail will not fully meet current ADA guidelines under all conditions. A soft surface trail is flexible when dry and when it becomes wet, the entire surface softens and is susceptible to deformation (i.e. rutting). The trail would need to be constructed with a stabilized granular surface or hot mix asphalt (pavement) to meet current ADA guidelines under all weather conditions.

The following surface materials are commonly used in trail construction:

Granular Surface: A granular surface is constructed using natural materials. The Wachusett Greenways Trail system and Topsfield Linear Common have been constructed using granular materials. A variety of coarse (crushed stone) and fine (stone dust) stone size variations can be used. The performance of a granular surface is dependent upon drainage patterns, intensity and type of use, and seasonal maintenance. When dry, a stone dust surface is flexible and when it becomes wet, the entire surface softens, thereby comprising its firmness and stability and thus ADA accessibility. These surfaces can be installed using the same spreader and compacting roller equipment used for small roadways/driveways. Granular surface trails require maintenance at least twice a year to address grading and erosion issues.

- Stone Dust Surface: A stone dust surface constructed on the existing track ballast (stones) is not recommended as there is the potential for uneven settlement over time.
- Dense Graded Crushed Stone Surface**:** This surface consists of a 6" compacted (minimum) dense graded crushed stone base / top course. The riding surface of this option is rougher as there are some coarser (larger) stones Figure 4 shows an example of a weathered (1-3 year old) dense graded trail surface.
- Stone Dust Surface Over Dense Graded Crushed Stone: This surface consists of a 2" compacted (minimum) stone dust top course set on a 4" compacted (minimum) dense graded crushed stone base course. The smaller fines fill in the voids between the coarser stones which results in a smoother riding surface. Figure 6 shows an example of a stone dust trail surface.

Stabilized Granular Surface: A stabilized granular surface consists of a natural stone dust surface combined with a stabilizing agent. Stabilizing agents can be in the form of a spray application or a material admixture. This agent, when added or applied to native soils, granite or crushed aggregate screenings, binds the aggregate to provide a firm natural surface that meets ADA guidelines. As the water evaporates from the mixture, the surface becomes hard and will resemble an asphalt surface. When dry, a stabilized granular surface is firm and when it becomes wet, the top ¼" of the surface softens. Stabilized granular surfaces can provide increased durability and erosion resistance over conventional granular surfaces. Repairs can be accomplished with a small mixer. The color, texture and appearance of the finished surface depends on the selected aggregate (e.g. tan, gray, red). There are many different products available including, for example, Stabilizer Solutions, PolyPavement, DirtGlue and Road Oyl. The Minuteman National Park Battle Road Trail and DCR's Charles River Reservation trails were constructed using a stabilized granular surface. Figure 7 shows an example of a stabilized granular trail surface.

Paved Surface: Pavement or hot mix asphalt is the same surface material used on roadways and other rail trails such as the Nashua River Trail and Cape Cod Rail Trail. Asphalt is a durable material which, when properly constructed, requires minimal maintenance and has a long service life. For example, the Cape Cod Trail was recently resurfaced after more than 25 years of use. Surface and crack sealing can further expand its service life. By its nature, asphalt meets ADA requirements for firmness, stability and skid resistance. Asphalt accommodates the widest variety of users and is suitable for all levels and abilities. Figure 8 shows an example of a paved trail surface.

A representative photo of each trail surface type is included on the following page.

The BCRTA has indicated that their preference is to construct a soft surface trail in the near term to keep the construction cost reasonable, with the potential to upgrade to a hard trail surface in the future pending additional funding and community support. Based on this information, a granular surface constructed of 4" stone dust (2" compacted) over 4" dense graded crushed stone (minimum) is recommended in the near term. This recommendation is included in the conceptual cost estimates included as part of this study.

Figure 4: Example Dense Graded Crushed Stone Surface
(Representative Photograph)

Figure 5: Example Stone Trail Surface Over Dense Graded Crushed Stone During Construction (Topsfield Linear Common)

Figure 6: Example Stone Trail Surface Over Dense Graded Crushed Stone Following Construction (Topsfield Linear Common)

Figure 7: Example Stabilized Granular Surface
(Lizzy's Trail in DCR Bradley Palmer State Park)

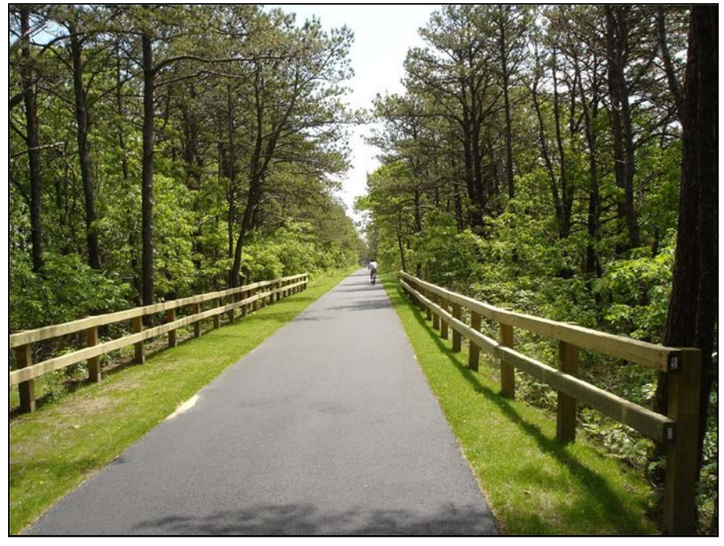

Figure 8: Example Paved Surface
(Cape Cod Rail Trail)

Cost Comparison:

Table 1 compares the complete-in-place construction cost of each granular surface material option. The unit prices include the cost of fine grading and compacting between layers.

Table 1: Granular Trail Surface Material Cost Comparison

Surface Material	Unit Price per Square Foot (Installed)	Design Notes
Dense Graded Crushed Stone	$2.00	6" Dense Graded Crushed Stone
Stone Dust Surface Over Dense Graded Crushed Stone	$2.50	4" Stone Dust (2" compacted) 4" Dense Graded Crushed Stone

If a granular surface is constructed in the near term, this surface could serve as a base course for a stabilized granular or paved surface in the future. Table 2 lists the upgrade costs for the improved surface material. This cost includes the cost of fine grading and compacting between layers, and a supplemental 1" of base course material to address any worn areas.

Table 2: Trail Surface Upgrade Costs

Surface Material	Unit Price per Square Foot (Installed)	Design Notes
Stabilized Granular Surface	+ $4.50	4" Stabilized Stone Dust (3" compacted)
Hot Mix Asphalt	+ $2.50	4" Asphalt

At-Grade Trail/Roadway Crossing Treatment

The BCRT ROW crosses Fisher Street and Charles River Street at-grade.

At each trail approach, the following safety improvements are recommended:

- Pave approximately 45 feet of the trail to allow for the installation of advance striping
- Construct trail median treatment with painted or textured median and removable steel bollard
- Install signs along the trail to warn trail users of the approaching intersection
- Install signs and pavement markings along the roadway to warn motorists of the approaching trail crossing
- Install "ladder" crosswalk consisting of two parallel horizontal white lines with spaced white vertical bars to improve crosswalk visibility by motorists.
- Mount street name signs above stop signs at each crossing for user orientation

For the benefit of vision-impaired trail users, the Town should also consider installing detectable warning surfaces (tactile warning strips) at each crossing. Detectable warning surfaces consist of small truncated domes that are integral to a walking surface and that are detectable underfoot. This surface panel extends 2 feet minimum in the direction of pedestrian travel and the full width of the shared use path.

The recommended intersection treatment is shown in section view in Figure 9 and plan view in Figure 10.

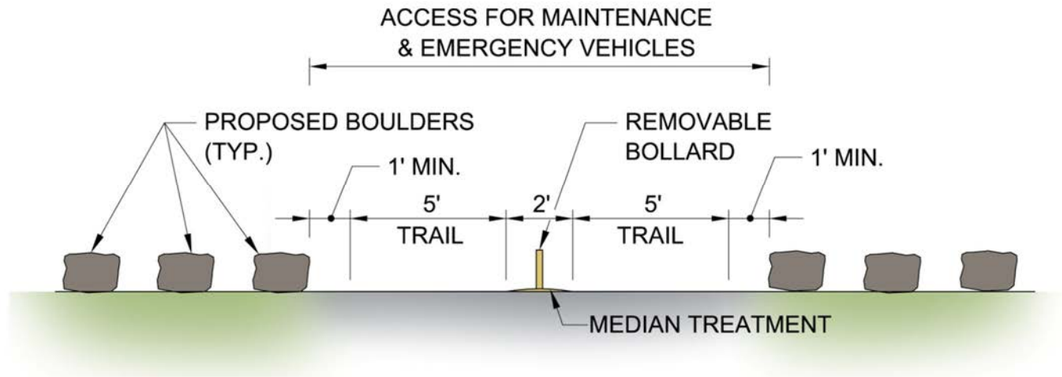

Figure 9: Recommended Intersection Treatment – Elevation View

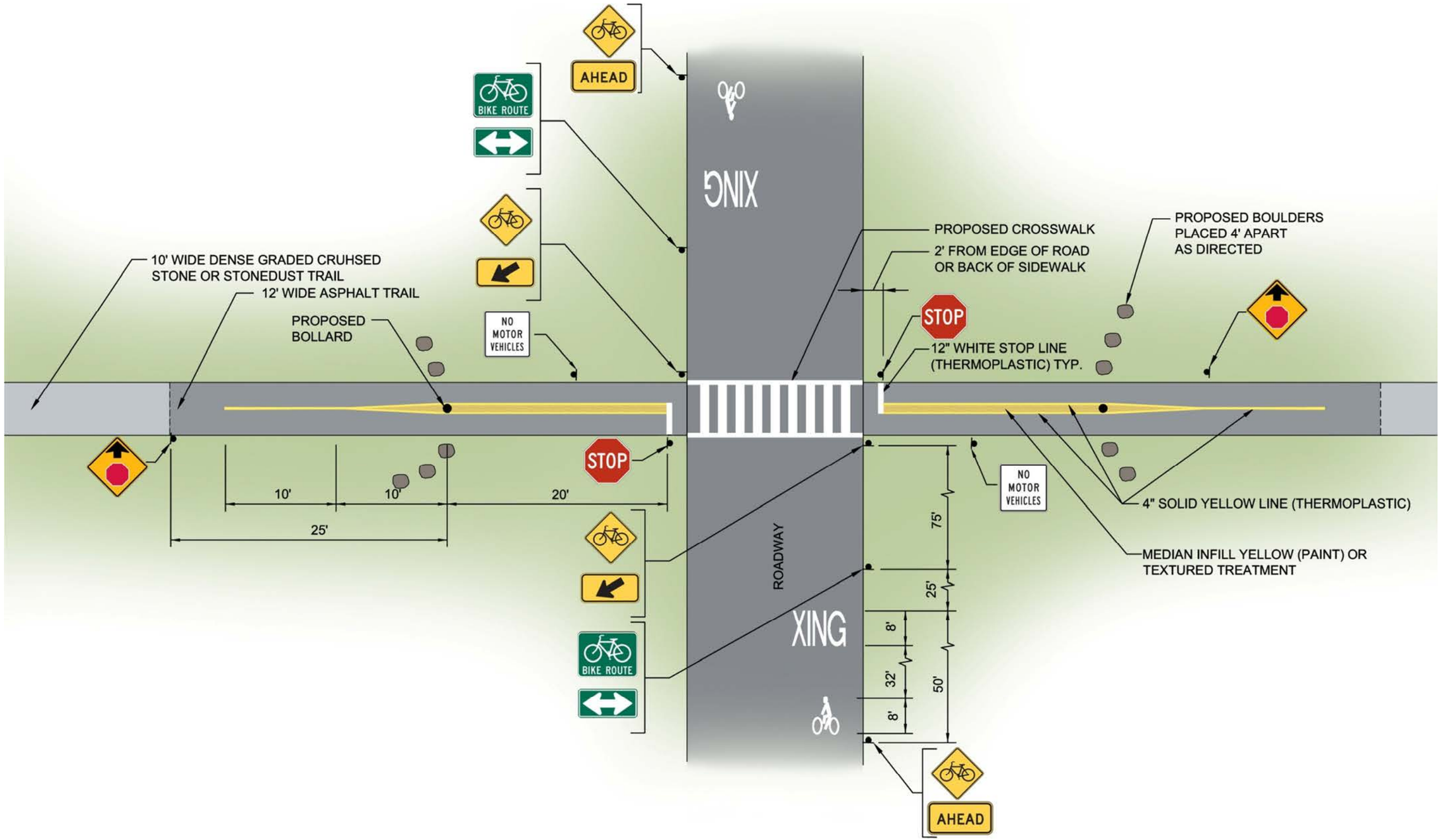

Figure 10: Recommended Intersection Treatment – Plan View

4 Conceptual Trail Alignment

The conceptual design alignment has been organized into three project sections for discussion purposes.

- Section 1 – Charles River Bridge to Charles River Street (0.5 miles)
- Section 2 – Charles River Street to Town Forest/High Rock Street (1.2 miles)
- Section 3 – Town Forest/High Rock Street to High Rock School and Needham Junction (0.4 – 0.7 miles)

Section 1 offers views of the Charles River and conservation and recreational areas on the east side of the corridor. Major project components along this section include a condition assessment of the existing railroad trestle over the Charles River and the development of a trailhead parking area at Fisher and Charles River Streets. The length of Section 1 is approximately 0.5 miles.

Section 2 parallels a mix of private residences and large tracts of Town-owned open space. The existing terrain varies significantly along this section of ROW. Major project components along this section include addressing abutter concerns and the development of a trailhead parking area at the Town Forest. The length of Section 2 is approximately 1.2 miles.

Section 3 extends from the Town Forest entrance off High Rock Street to High Rock School and Needham Junction. Preliminary conversations with the MBTA have indicated that they intend to retain the section of ROW from High Rock Street to Needham Junction for railroad purposes. Therefore, Section 3 includes on-road connections to High Rock School to the west and Needham Junction to the east. There is a potential to extend a multi-use trail through to Needham Junction in a future phase of the project, but this option requires further evaluation with many details yet to be resolved. The length of Section 3 is approximately 0.4 miles for the west on-road connection to High Rock School and 0.7 miles for the east on-road connection to Needham Junction.

Plans, representative cross sections, and renderings are included on the following pages to illustrate the conceptual design vision and major project components along each project section.

Figure 11: Multiple Conservation and Recreational Areas Open to the Public Along ROW

Figure 12: Potential Future Multi-Use Trail Extension North of High Rock Street Bridge

Figure 13: Conceptual Trail Alignment - Part 1

Figure 14: Conceptual Trail Alignment - Part 2

Section 1 – Charles River Bridge to Charles River Street

Section 1 extends from the Charles River at the Needham/Dover Town Line to Charles River Street, a distance of approximately 2,600 linear feet (0.5 miles).

Charles River Bridge Replacement and Scenic Overlook:

Figure 15: Existing Timber Railroad Trestle Over the Charles River

Figure 16: Scenic View of Charles River from Proposed Overlook

An existing timber railroad trestle spans the Charles River at the Needham / Dover town line. The existing trestle has an approximate span length of 135 feet between abutments and width of 9 feet. Diagonally braced, pile timber bents support the single railroad track across the Charles River. The trestle is approximately 18 feet above the Charles River.

A visual assessment of the existing bridge structure and abutments was performed as part of this study. The assessment identified extensive structural degradation from the rotting timber elements of the trestle superstructure, piles, abutments and wingwalls. Following review of various factors associated with a rehabilitation and replacement alternatives it was recommended that the existing trestle be removed and replaced with a new prefabricated steel bridge structure. More detailed information is included in Part III of this study.

According to the Massachusetts Cultural Resource Information System (MACRIS) on the Massachusetts Historical Commission's website, an inventory conducted in 1987 determined that the existing bridge is representative of a common type of twentieth century bridge construction and does not possess enough historic or engineering significance to be eligible for listing on the National Register of Historic Places. Despite this finding, the trestle is still of historic interest and should be documented in photographs and included in interpretive exhibits on the history of the railroad.

The decision to rehabilitate or replace the existing trestle to support trail use is contingent upon securing the necessary construction funds and more importantly, participation by the Town of Dover in the larger regional BCRT project. Therefore, while Dover is evaluating its section of corridor and gauging resident support, it is recommended that a wood rail fence be installed prior to the bridge to create a scenic overlook and discourage access across the bridge.

The Trustees of Reservations - Charles River Peninsula Connection: The MBTA ROW forms the northern boundary of the Charles River Peninsula along the entirety of Section 1. This 30-acre property was acquired by the Trustees of Reservations (TTOR) in 1960. There is a 20-acre open field and a walking loop trail that follows along the shoreline of the Charles River. According to the trail map (Figure 18), permitted activities include bird watching, dog walking, canoeing/kayaking, mountain biking, walking/hiking, picnicking and fishing. This property is an important local resource. The Trustees manage the existing circular parking area off Fisher Street in partnership with the DCR. This parking area provides adequate space for Peninsula and Red Wing Bay visitors. The Charles River Peninsula Management Plan specifically identifies an interest in exploring opportunities with the BCRT project as a potential way to increase visitation and exposure to the property.

DCR - Red Wing Bay and Village Falls Park: As previously noted, the existing parking area off Fisher Street is managed through a partnership of the DCR and the Trustees of Reservations. There is an existing cartop canoe launch at the Red Wing Bay recreation area.

Private Crossing: Between the Charles River Peninsula and the Walker School, there is an existing at-grade crossing of the ROW that is gated on either side. The Railroad Valuation Maps indicate that this crossing was a farm crossing when the Walker Gordon Farm existed on both sides of the ROW. The crossing should be retained as part of the project as it is used by the TTOR to access the Charles River Peninsula. It is also recommended that the Needham Police and Fire Departments coordinate with the Walker School and Trustees of Reservations about using this crossing for emergency response if an incident were to occur between the Charles River and Fisher Street.

Figure 17: Private Crossing from Walker School to Charles River Peninsula

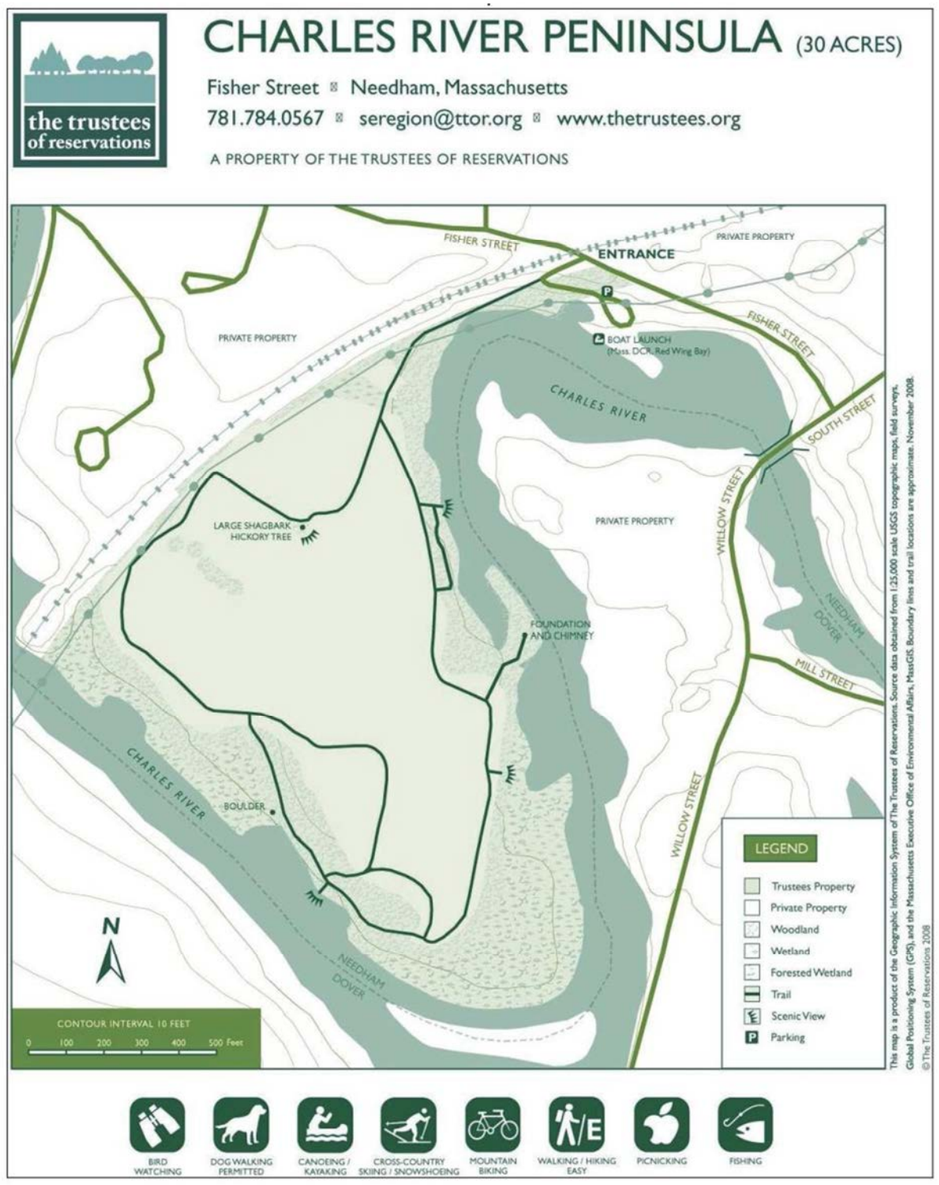

Figure 18: Charles River Peninsula Map

Walker School Fencing: The Walker School is a K-through-8th grade private school providing specialized education and mental health services. Based on the challenges faced by the students, it is critical that their learning environment be free of additional distractions and they remain on the school campus. Therefore, the School has the need to have a fence installed along the rear of their property to discourage students from viewing and accessing the BCRT. A typical section at this location is shown as Section A-A in Figure 19.

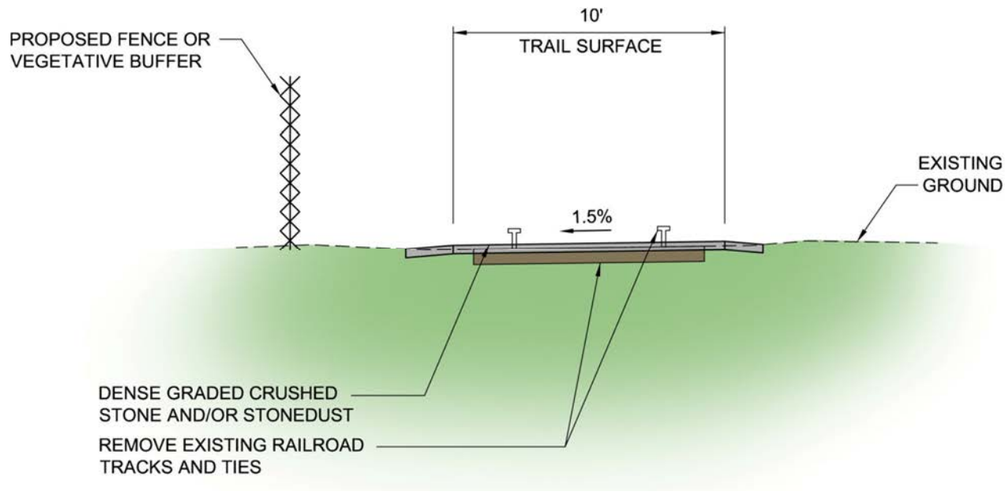

Figure 19: Section A-A
Typical Section with Abutter Screening

At-Grade Roadway Crossings: Within Section 1, the BCRT will cross two local roadways at-grade, Fisher Street and Charles River Street. These two crossings are separated by approximately 750 linear feet.

1. Fisher Street: Fisher Street is a low-volume, local roadway. The 2012 CTPS Study listed an average annual daily traffic (AADT) volume of 680 vehicles. There was no posted speed limit and speeding did not appear to be a problem during field visits. There is poor horizontal sight distance on the south side of the intersection that could be improved with roadside vegetative clearing.

Figure 20: Fisher Street Crossing

2. Charles River Street: Charles River Street is a designated Scenic Road that is heavily used by commuters. The 2012 CTPS Study listed an average annual daily traffic (AADT) volume of 2,600 vehicles. The Police Department confirmed that speeding is a problem along this stretch of roadway. There is poor vertical sight distance to the west and poor horizontal sight distance to the east at this crossing. Due to the poor sight distance and existing speeds, it is recommended that an advisory speed limit be posted in advance of the trail crossing.

Figure 21: Charles River Street Crossing

As discussed in Chapter 3 in Part I of this Study, signs and pavement markings should be installed along the trail and roadway at and in advance of each crossing to improve safety for trail users and motorists.

Southern Trailhead and Parking Area: The ROW between Fisher Street and Charles River Street presents an excellent opportunity to develop a trailhead parking area with user amenities such as benches, kiosks, and bike racks. This 100 foot wide section of ROW is the location of the former Charles River Station on the Charles River Railroad and the start of the railroad branch that led to the former Ridge Hill Farms / Baker Estate. Interpretive elements on the history of the railroad should be included at this trailhead. It is recommended that two small parking areas (approximately 5 spaces each) be developed in the near term, with expansion potential for the future based on demand.

The concept design shown on Figure 23 is intended to illustrate how these design elements can be included on the site. There are various alternative layouts that could be developed for this location.

Some of the locational items that need to be considered when evaluating alternative layouts include:

- Existing topography and vegetation
- Sight lines along intersecting roadways
- Privacy of abutting residences
- NSTAR access off Charles River Street
- Private abutter access off Charles River Street
- Interpretive exhibits relative to their historic location (i.e. station footprint, existing track)
- Future opportunities to expand parking areas

It is recommended that a topographic survey and design plans be prepared for this location. The design will also need to incorporate DEP's Best Management Practices (BMPs) related to residual soil contamination from the use of this section of ROW as a railroad depot as discussed further in Part II, Chapter 4 of this study.

Figure 22: Wide ROW Looking South from Charles River Street

Figure 23: Conceptual Layout of Southern Trailhead and Parking Area

Section 2 –Charles River Street to Town Forest/High Rock Street

Section 2 extends from Charles River Street to the Town Forest entrance off High Rock Street, a distance of approximately 6,300 linear feet (1.2 miles). The proposed multi-use trail alignment will extend west from the ROW and enter the Town Forest at a point south of where the ROW crosses beneath High Rock Street. The Town Forest will serve as the northernmost trailhead for the BCRT as preliminary conversations with the MBTA has indicated they intend to retain the section of ROW from High Rock Street to Needham Junction for railroad purposes.

The proposed improvements along this section of corridor include the following:

Slope Stabilization: Adjacent to the Boy Scout Camp, the corridor is located in a fill section with long and steep side slopes that are failing. To reduce and repair the erosion in this location, it is recommended that the following be installed:

- Wood rail fence on each side of the trail to control and block unwanted access
- Erosion control fabric, mat or cellular confinement system (such as geocell) to stabilize the slope.
- Fibrous plant species to re-vegetate and hold the steep slopes.

A typical section at this location is shown as Section B-B in Figure 25.

Private Crossing: Between Charles River Street and the Boy Scout Camp, there is an existing at-grade crossing of the ROW. The Railroad Valuation Maps indicate this as a farm crossing. The crossing should be retained as part of the project as it is used by the South Street property owner to access their land-locked property on the opposite side of the ROW. Also, the Needham Fire Department indicated that they have used this crossing to respond to brush fires. The Needham Police and Fire Departments should coordinate with the owner about continuing to use this crossing for emergency response along the BCRT if an incident were to occur between Charles River Street and the Town Forest.

Figure 24: Existing Private Crossing

Boy Scout Camp: The Boy Scout Camp abuts the ROW to the east and Town Forest to the north. This property is privately owned and therefore any potential trail connections to the Camp will need to be coordinated with the Boy Scouts of America, Boston Minuteman Council – Blue Hill District.

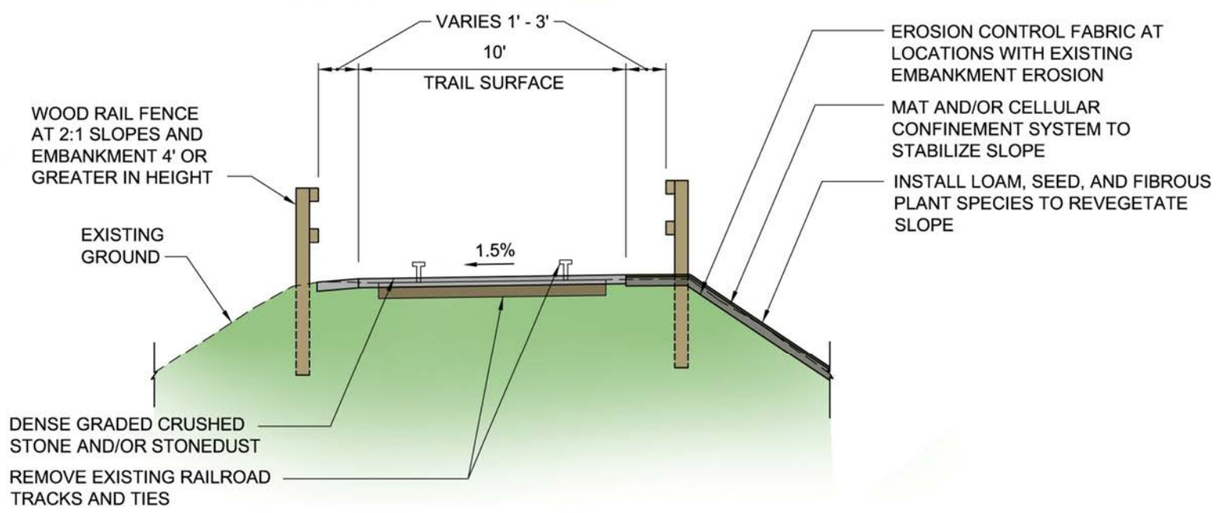

Figure 25: Section B-B
Typical Section in Fill Section with Slope Stabilization

Drainage Swale Maintenance: Along certain sections of the corridor, existing drainage swales line each side of the existing rail bed where the corridor is located in a cut section. Due to a lack of maintenance, sections of these swales retain standing water following precipitation events. Once these swales are cleaned as part of trail construction activities, the original drainage patterns of the site will be restored and these areas will outlet to the existing low points at the culvert crossings beneath the ROW. A typical section at this location is shown as Section C-C in Figure 26.

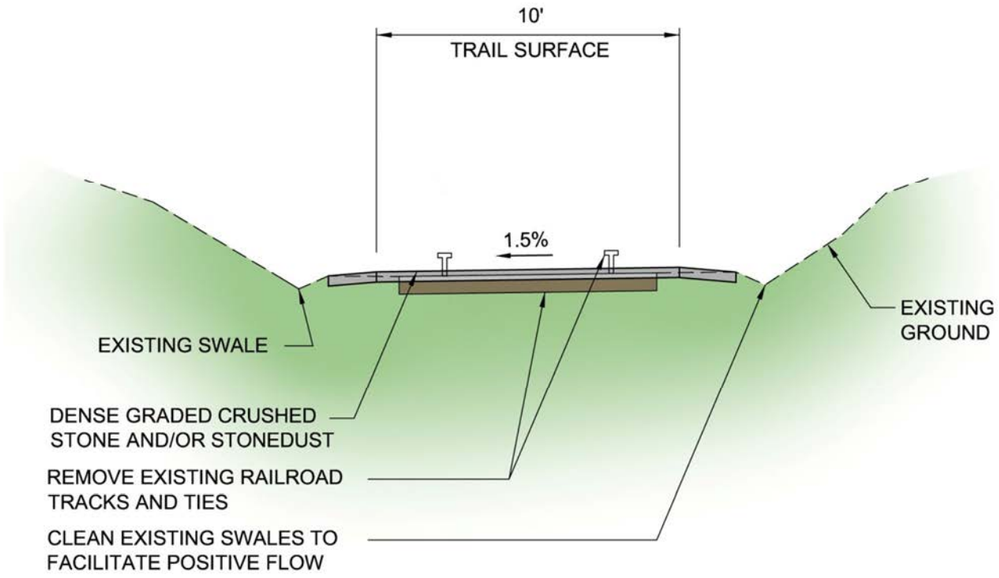

Figure 26: Section C-C
Typical Section in Cut Section with Drainage Swales

Abutter Screening: At the March 4, 2013 Public Information Meeting, residential abutters along this corridor section expressed concern over unwanted access and views from the trail to their property. One of the primary design goals is to maintain the natural vegetative buffer between the trail and abutting properties, where feasible. Additional measures such as fencing and vegetative screening can be installed to further retain the privacy of abutting properties.

- **Fencing:** Fencing can provide a physical barrier between the trail and adjacent property. Typical options include a 6-foot high chain link fence or a wood stockade fence. The cost is approximately $25 to $35 per linear foot installed.

- **Vegetative Screening:** in areas where there is limited vegetation and no NSTAR power lines nearby, evergreen trees can be planted to further retain the privacy of adjacent uses. Two evergreen tree species that are often used for screening include a White Pine and Norway Spruce (Figure 27). These species are fast growing species that require little to no maintenance. Both species are bushy and dense when young and they get more "natural" formed as they mature. For "instant" screening with no gaps, the trees would be planted in tightly spaced intervals (10 to 15-foot spacing). The better long term option would be plant them farther apart to allow for growth over time (20-foot spacing). The cost per 8 to 10 foot tall tree is approximately $500 installed. Shrubs could be used as an alternative to evergreen trees depending upon the existing topography. However, these shrubs are typically 3-4 feet tall and therefore they will only provide screening where the trail is already in a cut section (trail lower and residences higher).

Figure 27: Example Vegetative Screening
Norway Spruce and White Pine

Farley Pond Reservation Connection: The Farley Pond Reservation abuts the ROW to the east. This 25-acre reservation is under the jurisdiction of the Conservation Commission. The existing trail system is accessed from a trailhead on South Street or through the Town Forest. A typical section proximate to where the trail connects to the ROW is shown as Section D-D in Figure 28. With additional signage, the BCRT would improve and provide an alternative means to access to Farley Pond.

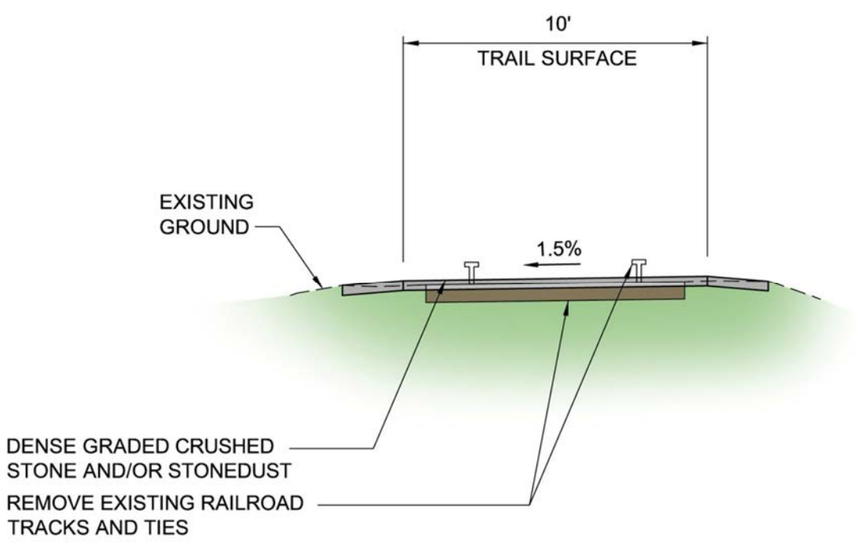

Figure 28: Section D-D
Typical Section in Fill

Signage Program: Section 2 extends a distance of approximately 1.2 miles between roadway crossings. Therefore, in addition to directional signage, it is recommended that a signage program be developed to assist users in identifying their current location along the trail for user safety and emergency response actions. This program should include:

- Post mile markers located consistently and correctly along one side of the trail
- One half-mile markers located along the trail surface between the mile markers

Town Forest Trailhead and Parking Area: The Town Forest provides an ideal location to create a trailhead parking area for the BCRT, which will also improve access to the existing Town Forest trail system. In order to minimize project impacts within the Town Forest and buffer zones/Riverfront Area of wetland resource areas, it is recommended that the improvements proposed as part of the BCRT project be located in the same general footprint as the existing facilities.

The existing entrance/access driveway to the Town Forest from High Rock Street is currently roped off to prevent vehicles from entering. The driveway is estimated to be at an approximate 5% grade based on field reconnaissance efforts. There is an existing cleared parking area at the bottom of the driveway. From the end of the parking area, a trail heads south along the edge of High Rock Pond, across a small stream channel, and through the Town Forest proximate to the ROW.

As shown on Figure 34, the concept design includes improvements to the existing driveway, parking area, and trail, and providing a new trail connection from the existing Town Forest trail system to the BCRT. The existing driveway entrance from High Rock Street will be widened to 20 feet. This width is based on the low volume of traffic anticipated and similar trailhead parking lot designs. The parking area includes five spaces, including one space that is ADA accessible. The size of the parking area could potentially be increased in the future beyond five spaces with approval from the Town of Needham Zoning Board. The selected driveway and parking area surface material should be ADA compliant and permeable, and allow for infiltration to avoid an increase in stormwater runoff. A removable bollard will be installed where the trail joins the parking area to prevent unwanted motor vehicle access to the trail.

The proposed trail from the parking area to the rail trail begins by following the existing Town Forest trail, crosses the stream channel leading from High Rock Pond via a proposed culvert, and gradually follows existing slope down to the BCRT. The trail connection to the BCRT follows the existing topography to minimize the required clearing and grading. Some areas may need to be graded to ensure the trail profile meets ADA accessibility requirements for maximum slope (4.5%). The point at which the trail connects to the BCRT from the Town Forest property was set based on the limits of the active ROW established by the MBTA. However, due to topographic constraints including ledge outcrops, a portion of the trail needs to be constructed within the active section of ROW which should be discussed with the MBTA and included in the lease agreement. Based on conversations with the Needham Fire Department, the trail will need to be 10 feet wide to accommodate emergency vehicle access. Therefore, the culvert used to span the stream channel should also be designed to accommodate occasional vehicle loading for emergency access.

Figure 29: Town Forest – Existing Driveway From High Rock Street

Figure 30: Town Forest – Existing Clearing and Location of Proposed Parking Area

Figure 31: Town Forest - Existing Trail Looking Towards Proposed Parking Area

Figure 32: Town Forest - Proposed Culvert Location

Figure 33: Town Forest – Proposed Trail Connection to ROW

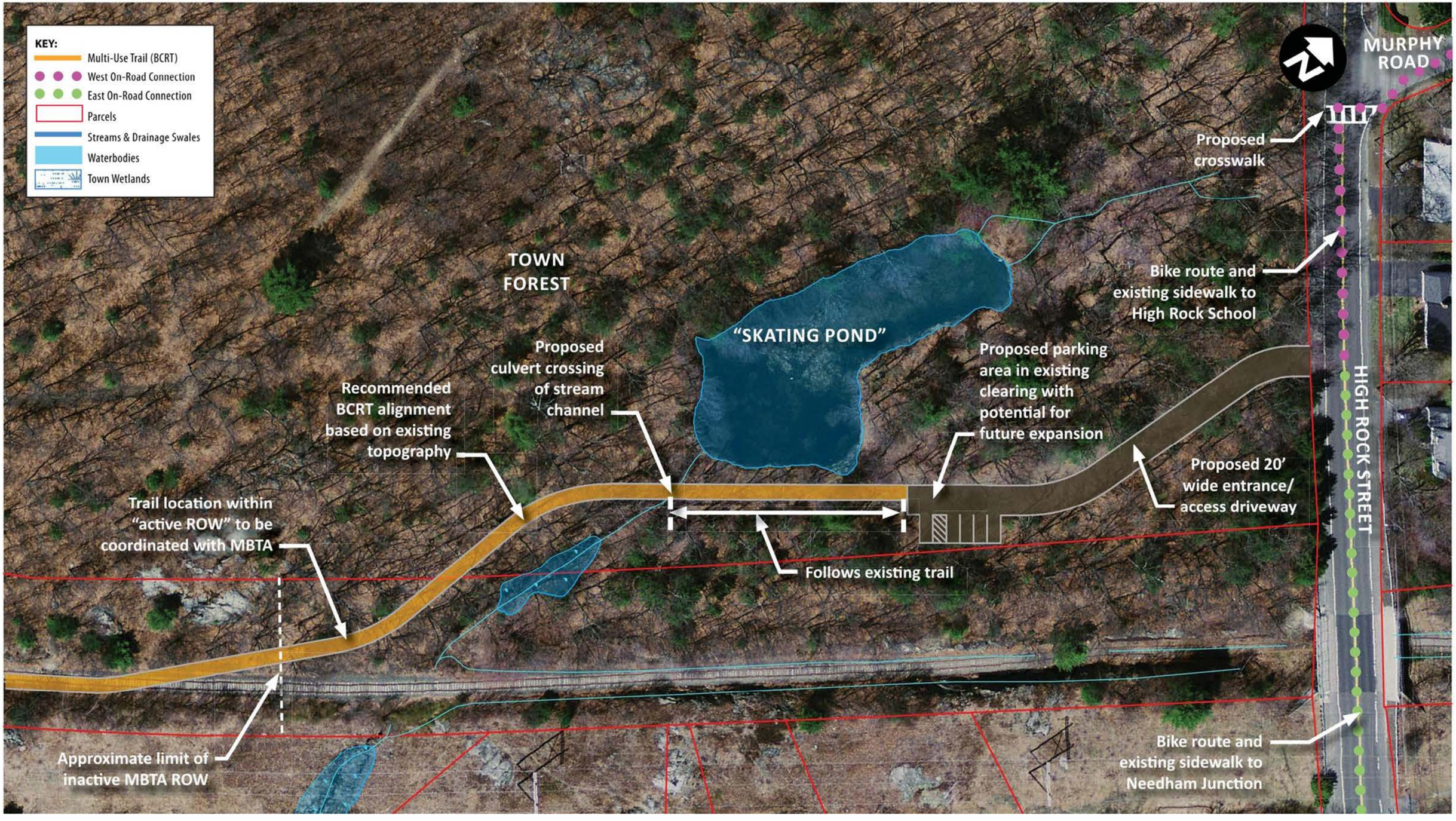

Figure 34: Conceptual Layout of Town Forest Trailhead and Parking Area

Section 3 –Town Forest/High Rock Street to Needham Junction

Section 3 extends from the Town Forest entrance off High Rock Street to High Rock School to the west and Needham Junction to the east. The original conceptual design goal was to continue the rail trail within the MBTA ROW between High Rock Street and Needham Junction. However, preliminary conversations with the MBTA have indicated they intend to retain the section of ROW from High Rock Street to Needham Junction for railroad purposes. Therefore, for the purposes of this study, this section of MBTA ROW was eliminated from further evaluation and on-road connections were identified. There is a potential to extend a multi-use trail through to Needham Junction in a future phase of the project, but this option requires further evaluation with many details yet to be resolved.

<u>On-Road Facility</u>: Each of the roadways between High Rock Street and Needham Junction were evaluated to determine their suitability to accommodate pedestrians and bicyclists. This evaluation included a field visit and review of available information including traffic volumes, MassDOT pedestrian and bicycle accident history, speeds, roadway width, presence of shoulders and sidewalks, and on-street parking. This evaluation also took into account the anticipated origin and destination points to the west and east.

Within the study area, sidewalks are located along the major roadways and school and commuter walking routes. Sidewalk width and condition vary along these roadways.

Based on a review of the existing roadway pavement widths within the study area, there is not enough available width to provide a dedicated 5-foot wide bike lane. Therefore, the recommended on-road facility type is a bike route. A bicycle route refers to use of normal roadway travel lanes by both motor vehicles and bicyclists. These facilities are also referred to as shared lanes or a shared roadway. "Share the Road" warning signs or "Bike Route" directional signage is typically installed along these facilities.

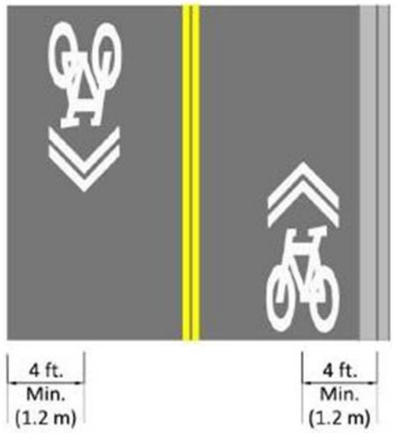

Figure 35: Shared Lane Marking

In addition, shared lane markings (sharrows) can also be provided to identify the route and to indicate how far from the roadway edge bicyclists should ride. A detail of a shared lane marking is shown in Figure 35. Bicyclists traveling along these local roadways follow the same rules of the road as vehicles.

Figure 36: West and East On-Road Connections

West On-Road Connection (Bike Route and Walking Route): Following the "West On-Road Connection", pedestrians would travel along the existing sidewalk on the south side of High Rock Street to a proposed mid-block crosswalk on the east side of Murphy Road. The crosswalk across High Rock Street would have similar warning signs and pavement markings on each roadway approach to those discussed for the at-grade trail / roadway crossing. If desired, a Rectangular Rapid Flashing Beacon (RRFB) could be installed at this location. A RRFB is a user-actuated warning system that supplements warning signs at unsignalized intersections or mid-block crosswalks. RRFBs use an irregular flash pattern that is similar to emergency flashers on police vehicles. The lights are typically post mounted on both sides of the roadway and face both directions for added visibility. The warning lights can be triggered actively using push buttons or passively using sensors located on the signal post or bollards. For this project, a push button actuation is recommended. The push button actuation will be easier for the Town to maintain, while also forcing bicyclists to stop to actuate the light before crossing the roadway.

After crossing High Rock Street, pedestrians would walk along the Murphy Road shoulder/edge of roadway as there are no sidewalks in this neighborhood. Murphy Road is a private road and its designation as part of the BCRT route would require approval from the Needham Housing Authority. Pedestrians would then follow existing sidewalks along Linden Street, Oak Street (existing at-grade railroad crossing) and Chestnut Street to connect to Needham Junction. Bicyclists would share the travel lane with vehicles as there are not designated shoulders along each of these local roadways. The West Connection brings users to the neighborhoods on the west side of the ROW, numerous Needham Housing Authority properties, and High Rock School (Grade 6). The length of this connection is approximately 2,000 linear feet (0.4 miles).

Figure 37: Example Rectangular Rapid Flashing Beacon Installation (FHWA)

Figure 38: Existing High Rock Street Sidewalk at Town Forest Driveway

Figure 39: Murphy Road Looking North From High Rock Street

East On-Road Connection (Bike Route and Walking Route): Following the "East On-Road Connection", pedestrians would travel along the existing sidewalk on the south side of High Rock Street to the existing signalized intersection at Chestnut Street. After crossing Chestnut Street, pedestrians would walk along the existing sidewalk on the east side of the Chestnut Street to Needham Junction.

Bicyclists travelling along High Rock Street would share the travel lane with vehicles as the existing curb to curb width is inconsistent and cannot accommodate a continuous widened shoulder. High Rock Street is 36 feet wide near the bridge over the ROW and narrows to 25 feet wide past Richardson Drive. Chestnut Street is a consistent 30 feet wide, with 12-foot lanes and 3-foot shoulders. Chestnut Street could be re-striped to provide an 11 –foot travel lane with 4-foot shoulder to provide bicyclists with a widened shoulder. If the travel lane is not restriped, it is recommended that shared lane markings (sharrows) be installed along Chestnut Street. It is also anticipated that bicyclists travelling north to south that are familiar with the area may choose to bike along Emerson Road to connect from Chestnut Street to High Rock Street. The East Connection brings users to neighborhoods on the east side of the ROW and the Needham Junction commercial area and train station. The length of this connection is approximately 3,700 linear feet (0.7 miles).

Figure 40: Looking North Along Chestnut Street

Figure 41: Existing Sidewalk Along East Side of Chestnut Street

5 Implementation Plan

Completing the project in its entirety would prove difficult and cost prohibitive. In addition, there are coordination efforts and subsequent agreements that need to be in place to allow certain portions of the project to be advanced. Therefore, it is recommended that the project follow a phased approach to allow time to obtain the necessary permits/approvals and secure project funding.

The three major factors influencing project implementation are as follows:

1. The Town needs to vote at Town Meeting to allow the Board of Selectmen to enter into negotiations with the MBTA for a 99-year lease agreement to allow for multi-use trail design, construction, and maintenance along a portion of the ROW.
2. The MBTA needs to grant the Town a long-term (99-year) lease for the BCRT corridor.

Phasing Strategy

The tasks under each phase have been organized based on their potential to serve users in the near term while helping to advance the larger project over the long-term. Many of these phases can be pursued concurrently depending upon available funding.

The recommended phasing strategy is outlined in Table 3.

Table 3: Project Phasing Strategy

Phase	Activity / Task	Requires MBTA Lease	Other Approvals*
1	Construct 10-foot wide multi-use BCRT between the Charles River and Town Forest using a compacted soft-surface material (8,000 feet)	Yes	MBTA NCC
2	Construct trailhead parking areas and interpretive elements at Fisher Street and Charles River Street	Yes	MBTA
3	Construct trailhead at the Town Forest including improvements to the existing driveway, parking area, and trail connection to the BCRT	Yes - Portion	NPRC NCC
4A	Create on-road bike route, directional signage and pavement markings from the Town Forest to High Rock School (2,000 feet)	No	NHA NPWD
4B	Create on-road bike route with directional signage and pavement markings from the Town Forest to Needham Junction (3,700 feet)	No	NPWD
5	Explore multi-use trail alternatives between High Rock Street and Chestnut Street	Yes-Portion	MBTA NSTAR NHA NCC
6	Replace Charles River Bridge between Needham and Dover	Yes	MBTA NCC Dover

* Legend:

- MBTA – Massachusetts Bay Transportation Authority
- NCC - Needham Conservation Commission
- NPWD – Needham Public Works Department
- NHA – Needham Housing Authority
- NSTAR – NSTAR Utility Company
- Dover – Town of Dover

6 Project Development Costs

A preliminary construction cost estimate was developed for each major project component based on the conceptual design presented in this study. In addition, project development costs also include the design costs for specific project elements, such as the Charles River Bridge or southern trailhead, environmental insurance costs (if purchased), and ongoing trail operation and maintenance costs.

Construction Cost Estimate

For the purposes of this study, the cost estimate for each phase does not include the cost of:

- Land acquisition (permanent or temporary easements or takings)
- Utility relocations (force accounts)
- Site amenities (benches, picnic tables, bike racks)
- Landscaping or fencing for abutter mitigation

As discussed in Chapter 4 in Part I of this study, fencing and vegetative screening can be installed to retain the privacy of abutting properties. The cost of chain link fencing is approximately $25 to $35 per linear foot installed. The cost per 8 to 10 foot tall White Pine or Norway Spruce is approximately $500 installed.

The unit costs associated with the major items of work are listed in Table 4 and the estimated construction costs by project phase are listed in Table 5. These costs include the material and installation costs assuming the project is publicly bid and constructed by an independent contractor. The costs could be reduced if the labor was performed by volunteers or with the assistance of the Town's Public Works Department.

Any estimated construction costs included in funding applications should be escalated using a flat inflation rate (4%) and compounded annually to estimate for expected increases in the cost of construction.

Table 4: Unit Costs for Major Work Items

Item Description	Unit Cost
Compost filter tubes for erosion/sedimentation control	$5 / linear foot
Clearing and grubbing	$12,000 / acre
2" compacted stone dust over 4" dense graded crushed stone (4") for trail surface	$2.50 / square foot
8" dense graded crushed stone for parking areas	$2.25 / square foot
4" loam borrow and seeding	$0.60 / square feet
At-grade trail / roadway crossing treatments	$12,500 / crossing
Wood rail fence	$25 / linear foot
Wood rail fence / guardrail	$35 / linear foot
Kiosk	$2,000 / each
Bike route sign on steel post	$250 / each
'Sharrow' pavement marking	$30 / each
Rectangular Rapid Flashing Beacon	$20,000 / crossing

Table 5: Estimated Construction Costs by Project Phase

Phase	Activity / Task	Estimated Construction Cost
1	Construct 10-foot wide multi-use trail between the Charles River Bridge and Town Forest (8,000 feet). Includes: • Compost filter tubes adjacent to wetland resource areas • Clearing and grubbing • 2" compacted stonedust surface over 4" dense graded crushed stone base course for trail surface • Wood rail fence • At-grade trail / roadway crossing treatments (2) Note: Track and tie removal and disposal are being offered at no cost to the Town under the Iron Horse Preservation model. Add approximately $120K for track and tie removal and tie disposal ($15 / linear foot) if a different procurement method and/or contractor is selected.	$400,000
2	Construct trailhead parking areas and interpretive elements at Fisher Street and Charles River Street. Includes: • Clearing and grubbing • Excavation • 8" dense graded crushed stone parking areas and driveways • 8" dense graded crushed stone private driveway with gate • 2" compacted stonedust surface over 4" dense graded crushed stone base course walkway areas • 4" Loam borrow and seeding • Wood rail fence / guardrail to separate trail from parking areas • Landscaping • Interpretive elements • Kiosks Note: Add approximately $100K for potential excavation and disposal of 6" contaminated soil and installation of 8" clean fill under 4" loam borrow and seeding to provide 12" cover per DEP BMP for former station area. Soil testing required to confirm absence/presence of elevated levels of soil contamination. See Part II, Chapter 4 of this Study for further discussion.	$100,000
3	Construct trailhead at the Town Forest including improvements to the existing driveway, parking area, and trail connection to the ROW Includes: • Compost filter tubes adjacent to wetland resource areas • Clearing and grubbing • 8" dense graded crushed stone parking area and driveway • Kiosk • Culvert crossing of stream channel	$85,000
4A	Create on-road bike route, directional signage and pavement markings from the Town Forest to High Rock School (2,000 feet). Includes: • Bike route signs • 'Sharrow' pavement markings Note: Add $20K to install Rectangular Rapid Flashing Beacon at High Rock Street / Murphy Road crossing	$5,000
4B	Create on-road bike route with directional signage and pavement markings from the Town Forest to Needham Junction (3,700 feet). Includes: • Bike route signs • 'Sharrow' pavement markings • Re-striping lanes on Chestnut Street	$8,000
5	Explore multi-use trail alternatives between High Rock Street and Chestnut Street	Requires further study
6	Replace Charles River Bridge pending coordination with Dover	$1.2 Million

Note: All costs listed in Table 5 include a 25% contingency to account for details yet to be determined including, for example, enhancements such as user and site amenities.

Design Cost Estimate

The design cost is typically between 10% and 20% of the construction cost, with the variation being attributed to the complexity of the design and extent of required permitting. The major project elements for which a topographic survey with preliminary and final design is recommended include the following:

- Trailhead parking area between Fisher and Charles River Streets
- Trailhead parking area and trail connection through Town Forest
- Charles River Bridge replacement structure

Environmental Insurance

As part of the 99-year lease agreement, the MBTA requires that the municipality hold the MBTA harmless for any pre-existing environmental contamination, but it will not allow testing to take place before the lease is signed. To address the MBTA indemnification clause and third party liability issues, Senator Resor introduced an amendment to the 2006 Economic Stimulus bill, which became law in July 2006. This amendment allows towns to purchase insurance to cover the cost of cleaning up rail trail corridors found to be severely contaminated. A five-year environmental insurance policy is estimated at $50,000, with the state covering one half of this cost. It is up to the Town whether they elect to purchase this insurance. A preliminary screening of the corridor was conducted as part of this study and is included in Section II, Chapter 4 of this study. The BCRTA and Town are reviewing the terms of the lease and available insurance coverage and consulting with other municipalities who have entered into 99-year lease agreements with the MBTA to determine whether or not to purchase the environmental insurance policy. The cost of this insurance policy needs to be considered as part of the overall project development costs.

Operation and Maintenance Costs

As the BCRT will be a public facility, the Town or another party will be responsible for maintenance to keep the trail in a safe, usable condition. There may be an opportunity to engage local volunteers in the maintenance and oversight of the path. The use of volunteer labor and/or resources will help reduce the costs to the Town.

Many publicly owned and managed trails incur trail maintenance costs as part of their annual public works or park & recreation operation budgets. These entities typically do not keep a separate cost and activity record of the maintenance and management of trails. Therefore, it is difficult to identify the costs related to as-needed, seasonal, and long-term maintenance activities.

The Rails-to-Trails Conservancy (RTC) Northeast Regional Office completed a study of various path/trail maintenance and operations issues for more than 100 open rail-trails in the northeast region of the United States. Their findings have been compiled in a publication entitled *"Rail-Trail Maintenance & Operation: Ensuring the Future of Your Trail - A Survey of 100 Rail-Trails*." This publication is available on RTC's website [http://www.railtrails.org/]. The Town can consult this publication for valuable information on budgetary issues, staffing, equipment, and various other needs related to the operation and maintenance of a multi-use trail.

7 Project Funding

The project goal is to secure construction funding through fundraising efforts and private donors rather than from public (federal, state) sources. This approach will help offset some of the project development costs to the Town.

There are a number of potential private and non-profit funding sources that could help advance the project from the study phase through construction. However, the Town and BCRTA should not preclude the option of funding certain aspects of the project with state funding, such as the Recreational Trails Program (RTP) or Parkland Acquisitions and Renovations for Communities (PARC)

Potential funding sources include, but are not limited to, those listed in Table 6. Each of these potential funding programs is highly competitive.

Table 6: Potential Funding Sources

	Funding Program	Administering Agency	Funding Range
1	Bikes Belong Coalition	Bikes Belong	Up to $10,000
2	WalkBoston	WalkBoston	Varies
3	Healthy Aging Initiative	Metrowest Health Foundation	Up to $50,000
3	Fields Pond Foundation	Fields Pond Foundation	$2,000 to $10,000
4	New England Grassroots Environment Fund (NEGEF)	NEGEF	$500 to $10,000
5	Kodak American Pathways Grant Program	Kodak	$500 to $1,000
6	Recreational Trails Program (RTP)	DCR (State)	$2,000 to $50,000
7	Parkland Acquisitions and Renovations for Communities (PARC)	EOEEA (State)	$50,000 to $400,000
8	Private Sources	Varies	Varies

If the BCRTA and Town were to pursue state and/or federal project funding, the most commonly used funding programs are the Transportation Enhancement (TE) Program, Congestion Mitigation and Air Quality (CMAQ), and MassWorks Infrastructure Program. These three programs are administered by MassDOT and fund infrastructure projects of varying scope.

The following three programs – Bikes Belong Coalition, WalkBoston, and the Metrowest Health Foundation's Healthy Aging Initiative – support planning and small scale infrastructure improvement projects. These programs are typically used for installing bike route signage and pavement markings, conducting bikeability or walkability audits, performing any necessary ADA upgrades, and outreach and educational programs to encourage biking and walking in the community.

1. Bikes Belong Coalition

Bikes Belong Coalition is a nonprofit organization sponsored by members of the American Bicycle Industry. Bikes Belong provides competitive national grants for projects that will "put more people on bicycles more often." They will not consider projects in which Bikes Belong is the sole funder but will consider proposals where they are the initial funder and the project sponsor is looking to leverage the money for other funding programs. In 2011, Bikes Belong Coalition also launched a Community Partnership Grant which will primarily fund the construction or expansion of bicycle facilities such as bike lanes, trails, and paths. The grants committee will also consider advocacy projects that promote bicycling as a safe and accessible mode of transportation. Eligible applicants for this program include nonprofit organizations or a local government entity. Grants range from $5,000 to $10,000. More information is available at: http://www.bikesbelong.org

2. WalkBoston

WalkBoston is a nonprofit membership organization dedicated to improving walking conditions in cities and towns across Massachusetts. The organization's mission is to create and preserve safe walking environments that build vital communities. They promote walking for transportation, health, and recreation through education and advocacy. More information is available at: http://www.walkboston.org/

3. Healthy Aging Initiative

The Metrowest Healthy Foundation supports programs that directly benefit the health of those who live or work in one of the 25 communities in the Metrowest area, which includes Needham. The Healthy Aging Initiative program is aimed at improving the quality of life and care among the elderly. In 2011, the Town of Natick received $65,000 to make the town more walkable through a Safe Steps program which will help pay for a walking conditions audit, surveys, programs, and some basic engineering costs. Eligible applicants include 501(c) (3) organizations or organizations that are recognized as instrumentalities of state or local government. Organizations interested in applying for a grant must submit a concept paper prior to a full proposal. The maximum funding amount during this grant round is $50,000. More information is available at: http://www.mwhealth.org/

The following three programs – Fields Pond Foundation, New England Grassroots Environmental Fund, and Kodak American Pathway Grant Awards Program – are smaller grant programs which focus on enhancing partnerships and building project support in the community. These programs are typically used for newsletters, visioning workshops, and educational programs to encourage biking and walking in the community.

4. Fields Pond Foundation

The primary mission of the Fields Pond Foundation is to provide financial assistance to nature and land conservation organizations that are community-based and that serve to increase environmental awareness by involving local residents in conservation issues. Proposals from municipal government agencies are encouraged. The foundation accepts project grants for trail-making and other enhancement of public access to conservation lands, rivers, coastlines and other natural resources. They look for opportunities where a modest investment of grant funds can help in a significant way to improve public access to, and enjoyment of, natural areas, while maintaining the health and integrity of the environment. Projects in which volunteerism is a significant component are more likely to be funded. The expected range of grants is $500 to $25,000, with most falling within the range of $2,000 to $10,000. The Foundation is willing to consider multiple-year grants. Proposals may be submitted at any time since the Directors meet regularly throughout the year. It is recommended that applicants contact them informally before proceeding to prepare a formal application. More information is available at: http://www.fieldspond.org/

5. New England Grassroots Environment Fund (NEGEF)

The New England Grassroots Environment Fund (NEGEF) supports volunteer-driven groups that are doing community-based environmental work in the New England region. They offer "Seed" grants to support community groups launching new project and/or evolving the scale of an existing project. As examples, a prior grant was awarded to the Great Barrington Trails and Greenways Project to develop a public outreach program that included a monthly e-newsletter, a vision map, community walks, and meetings with community groups to promote broader participation. In addition, the Squannacook River Trail Committee in Townsend received a grant to mail informational flyers to share news about the committee's progress and urging townspeople to continue their support. Grants range from $500 to $10,000. More information is available at: http://www.grassrootsfund.org/

6. Kodak American Pathways Grant Awards Program

The Kodak American Pathways Grant Awards Program is a partnership project of the Eastman Kodak Company, the Conservation Fund, and the National Geographic Society. The program provides small grants to stimulate the planning and design of pathways in communities throughout America. Grants may be used for activities such as: mapping, ecological studies, surveying, conferences, and design activities; developing brochures, interpretative displays, audio-visual productions or public opinion surveys; hiring consultants, incorporating land trusts, building a foot bridge, planning a bike trail, or other creative projects. In general, grants can be used for all appropriate expenses required to complete a pathway project including planning, technical assistance, legal and other costs. Letters of support from associated agencies, public officials, citizen groups, or nonprofit organizations must be included with the application. Eligible applicants include local, regional, or Statewide nonprofit organizations. Although public agencies may also apply, community organizations will receive preference. The maximum grant is $2,500, however most grants range from $500 to $1,000. More information is available at: http://www.conservationfund.org/

The following two programs – Recreational Trails Program and Parkland Acquisitions and Renovations for Communities –are competitive programs administered by agencies under the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) that fund infrastructure projects of varying scope. These programs would be ideal funding sources for multi-use trail construction along the ROW and the proposed access and trail improvements at the Town Forest.

7. Recreational Trails Program (RTP)

The Recreational Trails Program (RTP) provides Federal funding support for a variety of trail development and maintenance projects and is administered on a reimbursement basis by the Massachusetts Department of Conservation and Recreation.

The RTP funds up to 80% of each trail project, with at least 20% of the total project cost funded by other sources. The match can consist of money from other sources such as non-Federal grants, donations, or municipal funds. A "soft match" in the form of materials, labor, and in-kind services is also permitted. "Soft match" contributions include paid labor, volunteer/donated labor, purchased materials and services, and donated labor and materials. Grant amounts, not including the match, may range from $2,000 to $50,000, with requests greater than $50,000 being considered for regional or Statewide projects.

Unlike the projects programmed for inclusion on the TIP or through TE or CMAQ, the RTP requires that projects be primarily recreational in nature, rather than transportation oriented. Priority will be given to projects that create or facilitate physical improvements that seek to protect or enhance the site's natural and cultural resource values while also satisfying a recreational demand. Historically, grant applications seeking funds for trail planning and design activities have not been looked at favorably. More information is available at: http://www.mass.gov/dcr/stewardship/greenway/regionalGrants.htm

8. Parkland Acquisitions and Renovations for Communities (PARC)

The Parkland Acquisitions and Renovations for Communities (PARC) Program is administered by the EEA. The PARC program provides grant assistance to cities and towns to acquire parkland, develop new parks, or renovate existing outdoor public recreation facilities (formerly the Urban Self-Help Program). Municipalities must have a current open space and recreation plan to apply. In addition, all properties for which grant assistance is provided must be open to the general public for appropriate active recreational use. Also, as the property will become protected open space under Article 97 of the Amendments to the Constitution of the Commonwealth of Massachusetts, the applicant must own the property in fee. Grants range from $50,000 to $400,000. More information is available at http://www.mass.gov/eea/dcs-grants

The BCRTA and Town could reach out to a number of potential private donors both locally and Statewide to seek project support and funding. Such donors could include local corporations, developers, or public health service providers (hospitals) as well as other nonprofit organizations such as the Trustees of Reservations or Trust for Public Land.

9. Private Sources

Many private companies and nonprofits have financial resources that that they contribute as part of a community outreach program. For example, Intel Corporation of Hudson, Massachusetts donated funds and assistance, in the form of volunteers, to the Assabet River Trail project through their "Intel in the Community" program. In Salisbury, the Timberland Company, local contractors, town workers and volunteers sponsored a cooperative Earth Day work event to help construct an extension of the Salisbury Point Ghost Trail.

1 Railroad Right-of-Way

History of Rail Service

The Charles River Branch Railroad was chartered on May 1, 1849 to build a line from the Boston and Worcester Railroad's Brookline Branch at Brookline Village to Dover, a distance of 16 miles. The railroad reached Needham in June 1853, just before the railroad ran out of money and merged with the New York and Boston (NY&B) Railroad Company. Between 1858 and 1863, the line was primarily used by independent contractors to haul material from a gravel pit in Needham to the Back Bay. By November 1861 the Charles River Railroad was extended to Medway and by October 1863 the line reached Woonsocket, Rhode Island. The Boston, Hartford and Erie Railroad acquired the New York and Boston in 1865 and the New York and New England became the owner in 1875. The New York and New England was acquired by the New England Railroad, a subsidiary of the New York, New Haven and Hartford Railroad. In November 1906, the New Haven Railroad built a four-mile connection from Needham Junction to West Roxbury. Passenger service on the Charles River declined in the 1920's and by 1967, passenger service was only provided between Needham Junction and Needham Heights. Following a merger of the Pennsylvania Railroad and the New York Central Railroad in 1968, the new Penn Central Transportation Company took over the freight and passenger operations of the New York, New Haven and Hartford Railroad. The Massachusetts Bay Transportation Authority (MBTA) purchased the Newton Highlands to Millis section of the line from Penn Central in 1973. In 1982 , the Bay Colony Railroad began operating freight service along the line under a 25-year contract with the MBTA. In 2008, the Bay Colony Railroad ceased operations on the Medfield to Newton section of line.

There was one branch railroad along the Charles River. A two mile branch was built from the Charles River Station (Figure 42) to a small station at Ridge Hill Farms in 1879. Ridge Hill Farms was created by William Emerson Baker and featured a hotel and large recreational area which was open to the public for a small fee (Figure 43). Passenger service ran during the summers until 1885 and the branch was subsequently abandoned in 1889. The tracks were torn up during the 1920s and '30s.

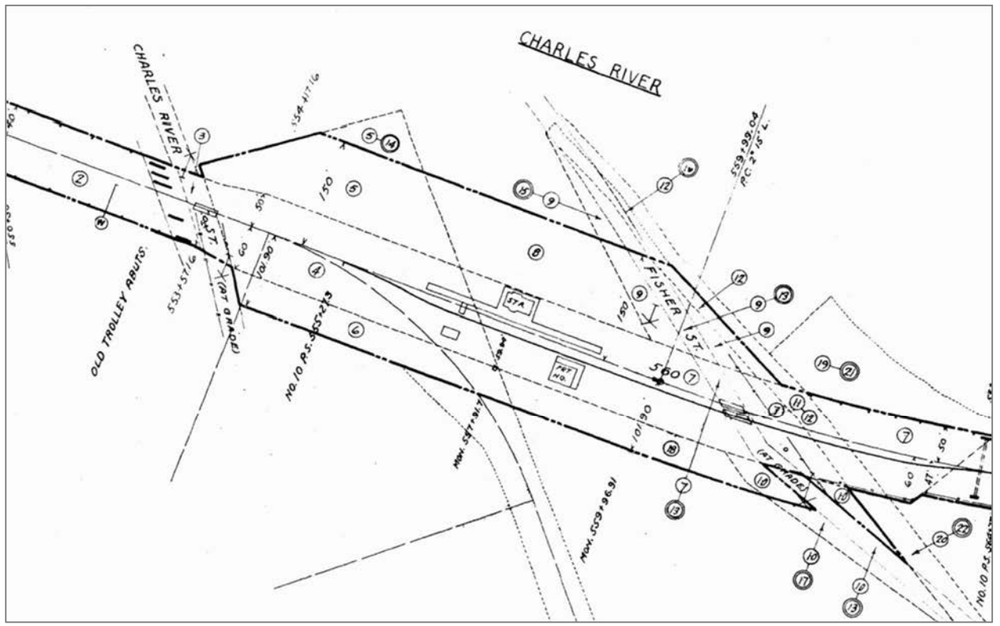

Figure 42: Railroad Valuation Map Showing Site of Former Charles River Railroad Station

Figure 43: Former 2-mile Railroad Branch to Ridge Hill Farms / Baker Estate

Title Conveyance

The deed and taking documents transferring ownership of the corridor from Penn Central to the MBTA were filed at the Registry of Deeds in January 1973. The MBTA acquired a fee simple title to the corridor after a confirmatory taking in June 1975. Under the fee simple title, the MBTA retains exclusive control of the property even after deciding not to operate a train along the corridor. Conversely, under an easement, a railroad possesses a right to operate a train on land owned by others. Therefore, under the current fee simple ownership, the MBTA can choose to develop the property itself or to sell or lease it for any number of uses.

Conrail abandoned its freight rights on the line through the Surface Transportation Board (a federal agency). Bay Colony Railroad was operating freight on the line through a modified certificate. Bay Colony Railroad also has a trackage rights agreement with the MBTA that allows them to operate freight on the Dover Secondary and Needham Secondary Branches that are owned by the MBTA. The trackage rights agreement is being amended by the parties (MBTA and Bay Colony Railroad) that will remove the Dover Secondary and Needham Secondary from the agreement thereby allowing the MBTA to execute 99-year lease agreements with Medfield, Dover, Needham and Newton. Bay Colony Railroad will also send a notice to the Surface Transportation Board informing them that they will no longer be operating freight on those branches.

ROW Width

Based on a review of the Railroad Valuation Maps (Val Maps), the existing ROW is approximately 70 to 90 feet wide along the majority of the corridor. The ROW widens where the corridor is in a fill section and steep slopes lead down to wetland resource areas and culvert crossings. The ROW between Fisher Street and Charles River Street was the former location of the Charles River Station and the "Branch Railroad." The approximate ROW widths are listed in Table 7.

Table 7: Approximate ROW Widths

Corridor Section	Approximate ROW Width (Feet)
Charles River Bridge to Fisher Street	70 - 110
Fisher Street to Charles River Street	110
Charles River Street to High Rock Street	60 – 130

Active ROW

At an April 3, 2013 meeting, the MBTA Railroad Operations - Engineering & Maintenance Section confirmed that they need to retain exclusive use of the ROW from 1,000 feet south of the switch to the active Commuter Rail track (the entire "Y") for track maintenance and emergency access. The 1,000 feet south of the switch extends approximately 700 feet south of the High Rock Street bridge. The MBTA acknowledged that although they do not actively use this section of ROW, it is an important piece of ROW for maintenance and emergency purposes and the track infrastructure needs to remain intact.

Property Agreements

The MBTA's Real Estate Consultant, Transit Realty Associates (TRA), reviewed their files to determine if the MBTA executed any agreements with outside parties for use of the inactive section of ROW between the Charles River Bridge and High Rock Street in Needham. TRA's review identified a few occupancy agreements for existing utilities. TRA did not locate any occupancy agreements with private parties.

Site reconnaissance activities identified the uses and/or crossings of the ROW between the Charles River Bridge and High Rock Street listed in Table 8.

Table 8: Existing Uses and/or Crossings Along ROW

	Approximate RR Val Map Station	Location Description	Current Use	Notes
1	572+75	North of Charles River	Access from Walker School to Charles River Peninsula	Shown as farm crossing on RR Val Maps
2	561+80	At Fisher Street	Driveway to Charles River Peninsula/Red Wing Bay	
3	556+50	At Charles River Street	Access to greenhouse	
4	553+60	At Charles River Street	Access to NSTAR ROW	
5	526+40	Off South Street	Access to landlocked property	Shown as farm crossing on RR Val Maps
6	525+20	Adjacent to farm crossing	Potential access to Boy Scout Property	Shown as private crossing on RR Val Maps

Some of these crossings are shown on the Railroad Valuation (Val) Maps as farm and private crossings and were likely negotiated with the railroad at the time the ROW was acquired from the abutting property owners. Pending a review of the terms of the crossing agreement, such crossings sometimes "go with the land" and provide these parties with a grandfathered right to cross the corridor if the use is consistent with the original terms of the agreement (i.e. farm crossing is still used for farm purposes).

If there is no existing occupancy agreement and/or it is not a "grandfathered" use, then the person/business occupying the ROW will either need to execute an occupancy agreement with the MBTA for their use of the ROW or vacate the property (remove the encroachment).

The Town should work with the MBTA and impacted residents/agencies with existing private crossings during the lease agreement process.

Rail to Trail Conversion

In order for the Towns to pursue plans to convert the railroad right-of-way to a rail trail, they must submit a formal application to the MBTA stating their desired use, and plans for the railroad corridor. The MBTA can supply the Towns with access to the land but does not financially contribute to the project. Pending approval from the MBTA, the Towns would be granted a 99-year lease for the design, construction and maintenance of the rail trail. As part of the 99-year lease agreement, the MBTA requires that the municipality hold the MBTA harmless for any pre-existing environmental contamination.

2 Site Analysis

Existing site conditions along the ROW were evaluated to identify potential constraints to converting the former railroad corridor into a multi-use trail. The evaluation of existing conditions was completed utilizing existing reports/studies and mapping, aerial orthophotographic mapping, Town and State geographic information system (GIS) data, and field investigation. An existing conditions and site analysis plan showing the location of these features is shown in Figures 45 and 46.

Abutting Land Use and Development

Between the Charles River and Fisher Street, the ROW abuts open space areas to the east and academic and residential areas to the west. Heading north from Fisher Street, the ROW abuts a combination of residential and undeveloped open space and conservation properties. North of High Rock Street, the ROW abuts Needham Housing Authority property to west and NSTAR property to the east. Existing NSTAR power lines parallel the entire ROW from the Charles River to the electronic substation off Chestnut Street in Needham Junction.

Topography

The profile of the corridor is relatively flat from the Charles River to Needham Junction. However, the adjacent cut and fill slopes vary over the length of the corridor. There are only a few select locations where the corridor is relatively level across the width of the ROW. The majority of the corridor is located in either a cut or fill section ranging from an elevation difference of 2 feet to over 20 feet.

At the Charles River Bridge, the corridor is elevated above the adjacent land. Heading north from the river, the corridor transitions from being level with the adjacent Walker School and Charles River Peninsula to a fill section on the approach to Fisher Street. Between Fisher Street and Charles River Street, the corridor is relatively flat as this is the location of the former Charles River Railroad Station. North of Charles River Street, the corridor continues to transition from a cut section with ledge outcrops to a steep fill section. Adjacent to the Town Forest at High Rock Street, the corridor is a cut section before transitioning to a fill section on either leg of the "y" on the approach to Needham Junction.

Railbed

As shown on Figure 45, sections of the ROW north of Charles River Street currently have a narrow rail bed width and/or eroding sideslopes. Where the trail is located in a cut section, the narrow railbed width is due to abutting ledge outcrops and/or parallel drainage swales. In fill sections, the narrow railbed width is due to the eroding sideslopes and wetland resource areas at the toe of slope. These existing conditions limit the proposed width of the trail surface to 10 feet along the corridor.

Vegetation

The ROW has varying levels of vegetation, from thick grasses to mature woodland vegetation, that has established since the last trains operated. The existing vegetation on adjacent cut slopes provides some screening between adjacent properties and the corridor, particularly during the spring and summer months. Conversely, the section between Fisher Street and Charles River Street and north of High Rock Street is relatively devoid of vegetation due to intermittent use in previous years.

Drainage

Along the ROW, several existing culverts convey natural waterways and drainage to either side of the rail bed embankment. The Railroad Valuation Maps were used as a guide for identifying the culverts along the corridor. In addition, the Town and MBTA indicated that Culvert #7 was replaced in YEAR. Field reconnaissance efforts indicate that each of these culverts appear to be functioning properly.

Table 9: Existing Culverts Along ROW

#	Val Map Station	Size/Material	Location Description
1	569+00 ±	2.0' x 2.0' Stone Box	South of Fisher Street
2	564+45 ±	2.0' x 2.0' Stone Box	South of Fisher Street
3	527+70 ±	1.5' x 2.0' Stone Box	North of Charles River Street proximate to Boy Scout proeprty
4	517+25 ±	2.5' x 3.5' Stone Box	Between Town Forest and Farley Pond Reservation property
5	497+30 ±	2.0' x 2.0' Stone Box	South of High Rock Street at Town Forest
6	481+45 ±	2.0' x 2.0' Stone Box	West spur at Needham Junction
7	474+20 ±	Replacement Structure	West spur at Needham Junction
8	484+65±	3.0' x 4.0' Concrete Arch	East Spur at Needham Junction
9	213+75±	3.0' x 4.0' Concrete Arch	East Spur at Needham Junction

Working in conjunction with the culverts, existing swales along the ROW capture runoff from the rail bed and adjacent upland areas. Many of these swales have not been maintained over time and have become clogged with vegetative debris. Once cleaned, the swales will restore existing drainage patterns along the ROW. This effort should be coordinated with the Needham Conservation Commission to determine if any of these swales are jurisdictional wetland resource areas.

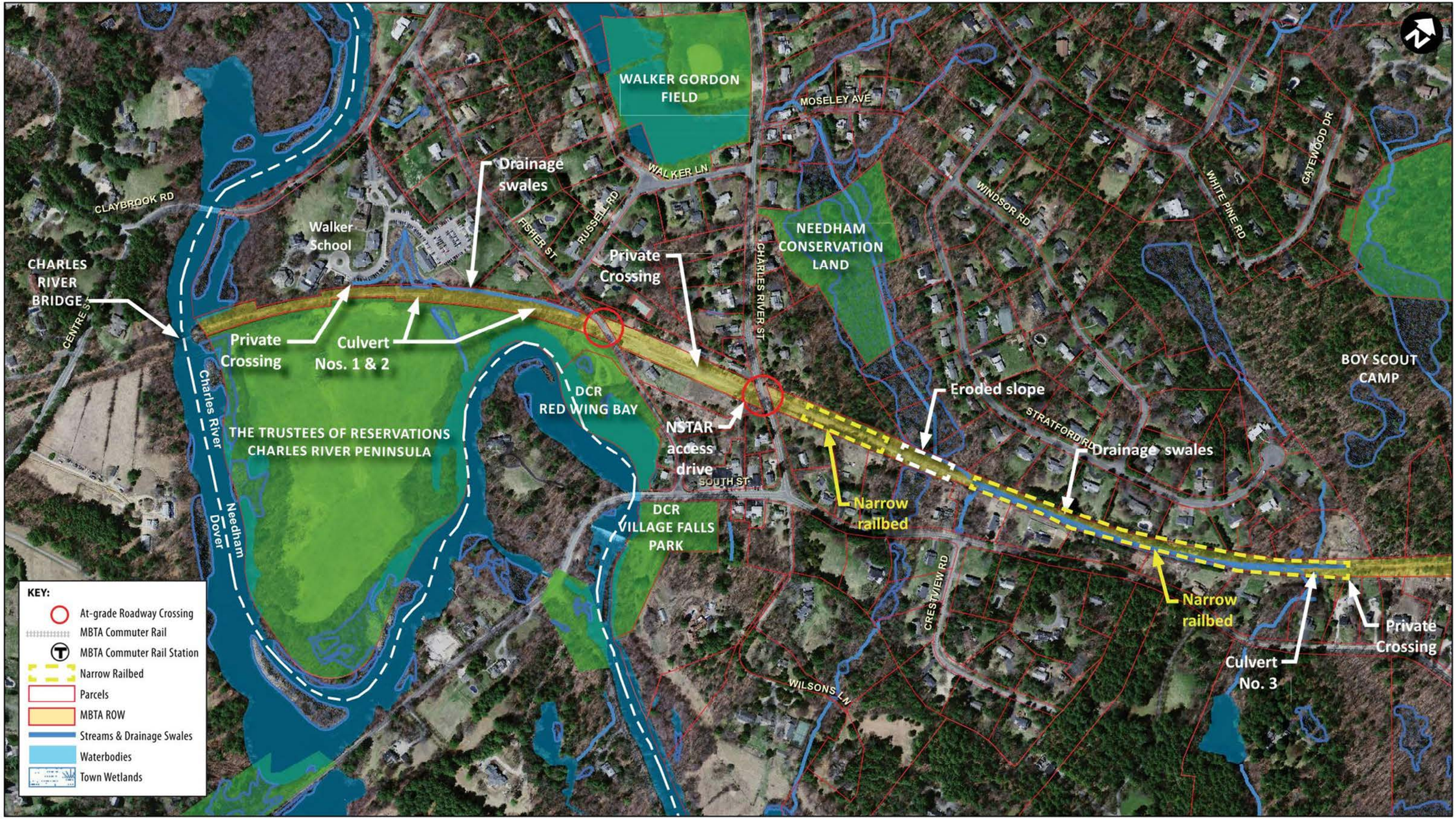

Figure 44: Existing Conditions and Site Analysis - Part 1

Figure 45: Existing Conditions and Site Analysis - Part 2

3 Environmental Resources and Anticipated Permits

It is important to identify environmental resources and permitting requirements early in the project development process. In doing so, site-specific measures to avoid and minimize impacts to environmental resources can be incorporated into the project. This approach respects the concerns of the regulatory agencies and helps streamline the permitting process.

Environmental Resources

The Town's Wetlands and Waterbodies/Stream GIS datalayers (based on the 2009 Townwide Vector Data) were compared to the USGS topographic quadrangle images and then overlaid on the base plan to document the presence/absence and general location of wetland resource areas within, adjacent and proximate to the ROW.

The following provides a general overview of the types of wetland resources that occur along the trail corridor:

Bordering Vegetated Wetlands: BVWs are defined as freshwater wet meadows, marshes, swamps, and bogs that border on rivers, streams, ponds, and lakes. There are numerous BVW areas along the project corridor.

Figure 46: Bordering Vegetated Wetlands

Rivers, Streams, and Ponds: An existing timber trestle supports the railroad over the Charles River and existing culverts convey unnamed intermittent or perennial streams beneath the ROW. There are also some ponds located on the properties abutting the ROW. The resource areas associated with these waterbodies include:

- **Bank** abuts and typically confines water bodies such as intermittent and perennial streams, ponds, and lakes. Bank along the project corridor is primarily associated with the Charles River and the intermittent and perennial streams. The Charles River and any other streams meeting the 'perennial stream' criteria outlined in the Wetlands Protection Act (WPA)Regulations are also afforded Riverfront Area protection.
- **Land Under Waterbodies and Waterways (LUW)** is the land beneath rivers, streams, ponds or lakes. LUW extends from the lower boundary of Bank.
- **Riverfront Area** is the area of land that extends 200 feet laterally from a river's (and perennial stream's) mean annual high water line. According to the WPA, Rivers and streams shown as perennial on the USGS map are presumed to be perennial. The USGS map depicts the Charles River as perennial. The classifications of the other streams along the corridor need to be determined using the criteria outlined in the WPA.

Figure 47: Charles River At Existing Timber Trestle

Figure 48: Existing Stream Crossing Via Culvert Under ROW

Bordering Land Subject to Flooding: BLSF is defined as the portion of the 100-year floodplain that extends beyond the limits a Bordering Vegetated Wetland. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for the Town of Needham, BLSF (Zone A as it is depicted on the FEMA Maps) occurs in association with the Charles River. The elevation on the downstream side of the railroad bridge over the Charles River is 106 feet (NAVD88)

Potential Vernal Pools: According to the MassGIS Vernal Pools datalayer [provided by the Natural Heritage and Endangered Species Program (NHESP)], two Potential Vernal Pools (PVP) are located along the trail corridor. Both PVPs are located on the west side of the corridor within the Town Forest. One is located opposite from the end of Richardson Drive and the other appears to be the location of the "Skating Pond." Additional field work will be required to determine the exact location of the PVPs and whether they meet the criteria for certification by NHESP.

In addition, other datalayers as mapped by MassGIS were reviewed to determine the presence/absence and general location of other protectable environmental resources within, adjacent, and proximate to the project corridor.

Rare Species: Based on the Massachusetts Natural Heritage Atlas [MA NHESP; 13th Edition, Effective October 1, 2008] and related MassGIS datalayers, there are no Priority Habitat of Rare Species (PH) or Estimated Habitats of Rare Wildlife (EH) within the project corridor. Therefore, no further review by NHESP relative to rare species will be required as part of this project.

Stormwater Critical Areas: Stormwater critical areas include Outstanding Resource Waters, Special Resource Waters recharge areas for public water supplies, bathing beaches, coldwater fisheries, and shellfish growing areas. Based on a review of MassGIS datalayers, there are no stormwater critical areas within the project corridor.

Anticipated Permits

The project corridor parallels and traverses several wetland resource areas. Accordingly, environmental permit applications will need to be prepared and filed for agency review and approval before the start of construction.

The following is a list of the anticipated environmental permits.

- Request for Determination of Applicability (RDA) or Notice of Intent (NOI) under the Massachusetts Wetlands Protection Act (MGL. c. 131 s 40), its implementing Regulations (310 CMR 10.00), and Needham Wetlands Protection Bylaw (Section 6) and Needham Wetlands Protection Regulations
- NPDES General Permit for Discharges from Construction Activities

If federal funding was used, then a Programmatic Categorical Exclusions (CE) Determination under the National Environmental Policy Act (NEPA) would be required. CEs are actions which individually or cumulatively do not involve significant social, economic or environmental impacts, and are therefore, categorically excluded from the requirement to prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS). At the state level, it is not anticipated that the project will exceed any review thresholds under the Massachusetts Environmental Policy Act (MEPA) requiring the preparation of an Environmental Notification Form (ENF) or Environmental Impact Report (EIR).

Request for Determination of Applicability (RDA) or Notice of Intent (NOI): A RDA or NOI application will need to be filed with the Needham Conservation Commission for trail construction activities occurring within the following regulated areas:

- Wetland resource areas
- 25-foot No-Build Zone to a Vegetated Wetland or Bank.
- 50-foot No Disturb Zone to a Vegetated Wetland or Bank
- 100 foot No-Build Zone to a Vernal Pool
- 100 foot Buffer Zone of wetland resource areas (i.e. vegetated wetlands, rivers/streams, banks, vernal pools)
- 200 foot Riverfront Area of perennial rivers and streams

Much of the proposed trail construction will occur within these areas and zones. When reviewing the permit application, the Conservation Commission will need to take into account the previously-altered nature of the majority of the project area (i.e. railroad ROW, existing trail system and cleared area in Town Forest) and the lack of alternatives to re-locate the trail.

The Needham Conservation Commission will also need to determine the jurisdiction of the existing drainage swales along the corridor. These swales were constructed by the railroad in order to capture stormwater runoff from the rail bed and adjacent upland areas. Many of these swales have not been maintained over time and have become clogged with vegetative debris which results in standing water following precipitation events. Once cleaned, the swales will restore existing drainage patterns along the ROW. It is anticipated that a 10-foot-wide trail could be constructed without impacting these swale areas.

Figure 49: Existing Drainage Swales Along ROW

It is recommended that the Town/BCRTA consult with the Director of Conservation and Conservation Commission to determine the appropriate filing mechanism (RDA or NOI) based on the scope of proposed construction activities included in each phase of the project relative to regulated wetland resource areas. For example, per the Regulations, a RDA may be the appropriate filing for "constructing an unpaved walkway for pedestrian use" within the Buffer Zone provided it is unlikely to alter the ability of the resource area to protect the interests of the Bylaw.

With respect to stormwater management, in accordance with Volume 1 of the Stormwater Handbook and 310 CMR 10.05 6 (m), "footpaths, bike paths, and other paths for pedestrian and/or non-motorized vehicle access" need to comply with the Stormwater Management Standards "to the maximum extent practicable". The goal of stormwater design will be to maintain existing swales and drainage patterns, allow rainwater to percolate into the soil, and avoid point source discharges. A summary of the 10 Standards as they relate to the project should be included with the RDA or NOI application.

NPDES General Permit: The proposed project involves more than one acre of earth disturbance. Therefore, a Stormwater Construction General Permit in accordance with the Environmental Protection Agency's (EPA) Phase II of the National Pollutant Discharge Elimination System (NPDES) Stormwater program will be required. The need for a NPDES Permit also will necessitate the preparation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP details construction activities, erosion control measures, and inspection schedules to be implemented during construction to ensure that the construction activities do not have an adverse impact on wetlands and waterways. In order to apply for NPDES permit coverage the operator (Town or contractor) will need to submit a NOI, Stormwater Pollution Prevention Plan (SWPPP), and documentation of eligibility to the EPA.

These two permits need to be prepared and filed between the preliminary design phase and the start of construction.

4 Contamination Issues

Potential Sources

Contamination along a former rail corridor is typically the result of either residual contamination from railroad operations or contamination associated with adjacent uses. Rail trail construction would not introduce any hazardous waste or contaminated materials to the project area.

The most common contamination found along a rail corridor is residual contamination from railroad operations. In addition, certain components of the rail and bridge infrastructure need to be handled and disposed of in accordance with local, State, and Federal hazardous waste disposal requirements.

Current and historic uses of adjacent properties may also have resulted in contamination along the corridor. Such uses could include improper disposal actions along the rail corridor or a release of oil or hazardous material that occurred on an adjacent property and extended into the rail corridor.

Findings

A preliminary hazardous waste and contaminated materials screening was conducted for the BCRT ROW. The preliminary screening is a general review to identify properties in close proximity to the project area that could either contain, or be a source of hazardous wastes or contaminated materials. The screening was limited to a visual observation of the corridor and a review of searchable databases and the Railroad Valuation Maps. Sites of known contamination are a greater concern than sites with potential contamination.

Abutting Sites: Sites directly abutting the BCRT ROW were reviewed and documented as part of this screening. The approximate location of each site was determined using the Town's assessor database. Each site was evaluated for potential project impacts based on the information provided in the databases including use histories, the type of site and proximity to the project.

The Massachusetts Department of Environmental Protection (DEP) Bureau of Waste Site Cleanup (BWSC) database lists 3 properties with a documented release of oil and/or hazardous material directing abutting the ROW between the Charles River and Needham Junction. One site is a private Fisher Street residence located on the western side of the corridor where a release of fuel oil was reported in 1994. The second site is located off Chestnut Street where the track splits into a "Y" at the approach to Needham Junction. There was a reported chemical release in 1995 which subsequently led to an Activity and Use Limitation (AUL) being placed on the property. The third site is located at the NSTAR Substation off Chestnut Street where a release of transformer oil without Polychlorinated Biphenyls (PCBs) was reported in 2005. All three sites are closed sites with varying levels of residual contamination on-site. A closed designation indicates that the site has been cleaned up to the appropriate applicable standards and presents no significant risk for current site use. None of the three releases are expected to impact the project based on the proposed trail alignment.

There were no records in the DEP BWSC database indicating any level of hazardous materials evaluation within the ROW.

Residual Contamination: The majority of the corridor lines historically residential, undeveloped, and rural (farm) properties and is likely to have been only affected by the normal operation of the line with a residual level of contamination, as documented in the DEP's "Best Management Practices for Controlling Exposure to Soil during the Development of Rail Trails,". Commonly reported contaminants in former rail corridors include arsenic, which was used as an herbicide to control weeds, metals, and constituents of oil or fuel (petroleum products), which likely dripped from the rail cars as they travelled along the corridor. Coal ash is also considered residual contamination.

The Massachusetts Contingency Plan (MCP) (310 CMR 40.0000) is the set of regulations that governs the reporting, assessment and cleanup of oil and hazardous material spills in Massachusetts. While, it is acceptable to both leave and re-use soil containing residual contamination for trail base or shoulder material along the corridor, the DEP's anti-degradation policy under the MCP restricts off-site reuse to a similar setting. If soil needed to be taken off-site, the soil would have to be tested at an approved laboratory to ensure selection of a proper disposal option and then be transported to a proper disposal facility. This is an additional cost to the Contractor, which ultimately increases the overall cost of the rail trail project to the Town. It is therefore important for the rail trail design to balance cut and fill volumes to minimize any transportation of material off-site.

The anti-degradation policy does not apply to contamination "hot spots" where contamination other than residual contamination is present. For example, if an oil or hazardous material spill has contaminated the soil along a portion of the corridor, this soil cannot be left or place or re-used and must instead be cleaned up under the MCP. There is no record of such contamination "hot spots" within the ROW.

Former Charles River Railroad Station: The section of ROW between Fisher Street and Charles River Street is the site of the former Charles River Railroad Station. According to the DEP's BMP document, these relatively small stretches along a ROW are expected to have contamination elevated over the residual levels, due to more frequent/intense use of pesticides to improve sight lines and greater frequency/intensity of human activities. Although there is no evidence of a specific release at this location, this area poses a concern based on the history and operations occurring at this site when it was in use as a railroad depot. This concern can be evaluated by testing the shallow soils or implementing DEP's BMPs which include either removing the top foot of soil or placing one foot of clean soil in lawn areas (i.e. areas not covered by parking or trail surfaces).

Figure 50: Site of Former Charles River Railroad Station

Charles River Junction: It is possible that the section of ROW proximate to Needham Junction may have elevated levels of contamination given its previous and intended continued use for railroad operation and maintenance activities. Should the MBTA allow potential rail trail development south of High Rock Street, further investigation into the nature of railroad activities and a site investigation with soil testing would be needed to select BMPs appropriate to this section of ROW.

Rail Infrastructure: The contractor will be responsible for providing all labor, equipment, materials and protection necessary to remove the steel track, tie plates, spikes, pins, rail anchors, timber cross ties, timber switch ties, signs, junction boxes, wire, signal crossings and other rail infrastructure and hardware. All materials removed will become the property of the Contractor and shall be disposed of in accordance with all local, State and Federal regulations. No rail materials shall be left within the ROW unless specifically requested by the Town for historic interpretation purposes, for example.

The existing timber railroad ties for the track and Charles River trestle are suspected to be treated with creosote, pentachlorophenol and/or Copper-Chromium-Arsenic (CCA). The contractor will be responsible for testing, loading, transporting, and disposing of the treated wood to either a waste-to-energy (biomass) facility that is licensed to burn treated wood or to a potential re-use site depending upon the condition of the ties. All aspects of the tie removal and disposal process must be completed in accordance with state and federal regulations. Ties should never be left behind or dumped along the corridor. Generally, the salvaging of the track and ties can be a profitable operation depending upon current economic conditions.

Also, there is existing railroad equipment at the Charles River Road crossing as shown in the following photo. Testing was not performed on the equipment contained in the cabinet to determine the presence of PCBs or transformer oil. The contractor will be responsible for testing the cabinet contents and properly handling and disposing of the equipment.

Figure 51: Charles River Street Crossing Rail Infrastructure

Recommendations

Trail design and construction should follow MassDEP's "*Best Management Practices for Controlling Exposure to Soil during the Development of Rail Trails*" to protect public health and provide a practical alternative to extensively testing for and possibly removing common residual contamination left in the soil from railroad operations.

Along the trail and in other small seating or similar areas along the corridor, a layer of compacted stone dust or pavement should be placed over existing potentially contaminated soil to limit public exposure. Shoulder areas should be compacted and stabilized and designed to discourage their use as informal treadways.

The creation of a trailhead and gathering area at the site of the former Charles River Station increases the potential for contact with existing soils and the intensity of that contact when compared to walking/biking along the linear multi-use trail. Consequently, additional efforts to limit public exposure to soil more likely to have remnant contamination concentrations are recommended in this location. While a trailhead is feasible, it is recommended that additional BMP measures be implemented given the anticipated higher residual contamination concentrations. In this location, it is recommended that either the top foot of soil be removed and replaced with clean material or a foot of clean fill be placed over existing soil in proposed lawn areas (i.e. areas not covered by parking or trail surfaces), separated by a geosynthetic liner. An estimated cost for the excavation and disposal of the existing soil and placement of additional clean fill material is included in Table X in Part I, Chapter X of this study. It is recommended that further soil evaluations be performed in this area during the preliminary design phase to confirm the absence/presence of elevated levels of soil contamination. Soil testing along the corridor is not allowed prior to the execution of a lease agreement with the MBTA.

In addition, provisions should be included in the construction contract to ensure proper handling and disposal of hazardous waste and contaminated materials during trail construction.

PART III – Supplemental Material

1 Charles River Bridge Visual Assessment

Existing Bridge

A visual assessment of the existing bridge structure and abutments was conducted by FST personnel on March 6, 2013. The superstructure currently consists of two steel rails, two 7¼"x4¼"± timber curbs, 8"x8"± timber ties spaced at 13"-14"± on center, and a set of (3)-8"x15½"± timber stringers under each rail. This superstructure is supported by 14 timber pile bents roughly spaced at 10'-0"± on center. Each pile bent consists of a 15"x14"± timber pile cap supported by timber piles. The number and size of timber piles varies per bent. The two abutments and four wingwalls are constructed of timber cribbing. The total length of the bridge between abutments is approximately 135 feet.

The existing timber curbs have sections missing due to severe deterioration. Approximately 90% of the existing timber ties are severely deteriorated. The timber stringers also exhibit signs of severe deterioration and localized areas of fire damage. Some of the stringers have sections that are rotted completely through the depth of the member at the support locations. Moss and vegetation are extensive throughout the top of the timber superstructure. Some rotting can be seen at the tops of some of the timber piles and at the bottom of some of the timber piles. Some of the bottoms of the timber piles are completely rotted through and would not provide any support for the superstructure. The existing timber abutments and wingwalls have significant deterioration. A small tree is growing out of the west face of the south abutment. There is extensive soil erosion at the northeast corner of the north abutment.

Given the observed extensiveness of structural degradation from the rotting timber elements of the trestle, it might not be cost effective to salvage the existing structure by repairs and rehabilitation. A replacement structure might be more cost effective.

Design Criteria

A new pedestrian bridge structure should be designed in accordance with the Guide Specifications for the Design of Pedestrian Bridges and the Standard Specifications for Highway Bridges, both published by the American Association of State Highway and Transportation Officials (AASHTO).

Pedestrian bridges in Massachusetts are often designed for an H10 vehicular load. An H10 vehicle is representative of a light truck, such as a standard maintenance, patrol or emergency vehicle, with a total weight of 10 tons (20,000 pounds). For an H10 maintenance or emergency vehicle, the minimum bridge clear width is 10 feet.

Figure 52: Missing Timber Piles

Figure 53: Deteriorated Timber Ties

Figure 54: Deteriorated Northwest Abutment

Figure 55: Deteriorated Timber Pile and Soil Erosion at Abutment

Structure Alternatives

Many factors are considered when evaluating structure alternatives, such as aesthetics, restoration, rehabilitation, replacement, life cycle cost, and life expectancy. Aesthetics may influence the choice of materials and configuration of the structure. Costs are important not only from the standpoint of construction, but also from the standpoint of annual maintenance and repair, and the expected life of the structure needs to be taken into consideration.

Two alternatives are considered for this bridge:

- Alternative 1 – Rehabilitation of the Existing Bridge Structure
- Alternative 2 – Replacement with a Prefabricated Steel Bridge Structure

Alternative 1 – Rehabilitation of the Existing Bridge Structure: Due to the poor condition of the existing timber superstructure and timber abutments, Alternative 1 includes a replacement timber superstructure and new concrete abutments and wingwalls. New timber stringers will support a new timber deck and timber railing. The existing timber pile bents are assumed to be salvaged for reuse with appropriate repairs. Based on photographic evidence, three existing timber piles are assumed to be replaced with new timber piles at each pile bent. This assumption is dependent upon results of further structural investigation and testing.

Due to the steep embankments at the bridge approaches, sections of timber rail fence are proposed for both sides of each approach. This fence would tie in with the timber railing on the proposed bridge.

Demolition would include three timber piles per bent and all of the abutments and wingwalls. The demolition and construction would include in-water construction activities which would require environmental permitting from the applicable agencies for an additional cost.

The reuse of the existing timber bents is presented with several cautions. A structural evaluation, with underwater divers, is needed to determine which of the existing timber piles are able to be reused to support the new superstructure. An evaluation from Wood Advisory Services on the species of the existing timber piles and pile cap would be required to determine the allowable loads on these structural components. Additionally, reuse of the existing timber pile bents would result in a shorter structure life expectancy than for a replacement substructure.

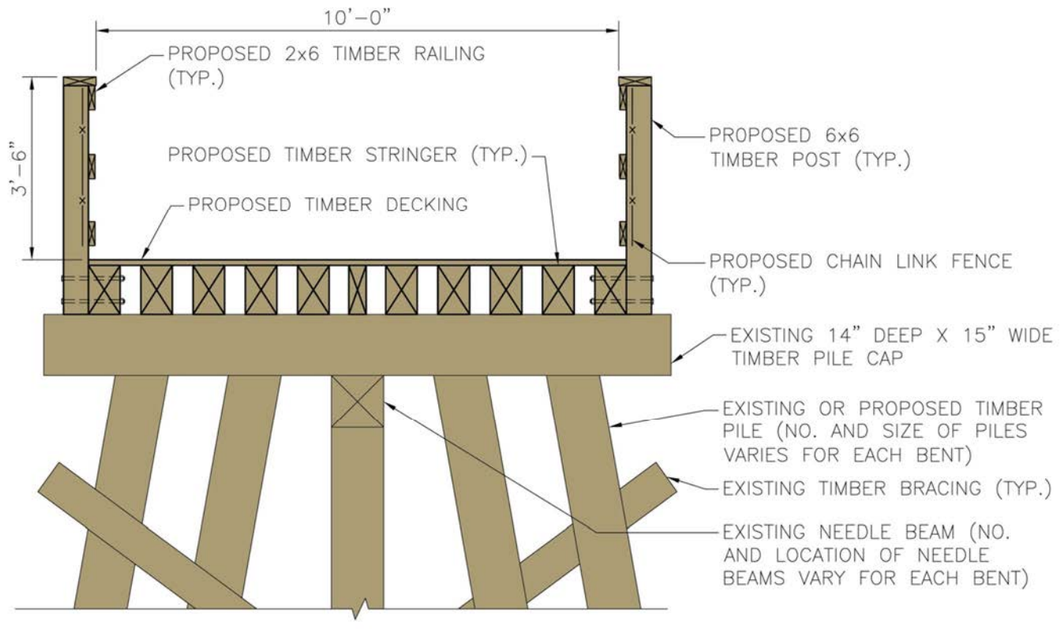

Figure 56: Alternative 1 – Rehabilitation of Existing Bridge Structure Cross Section

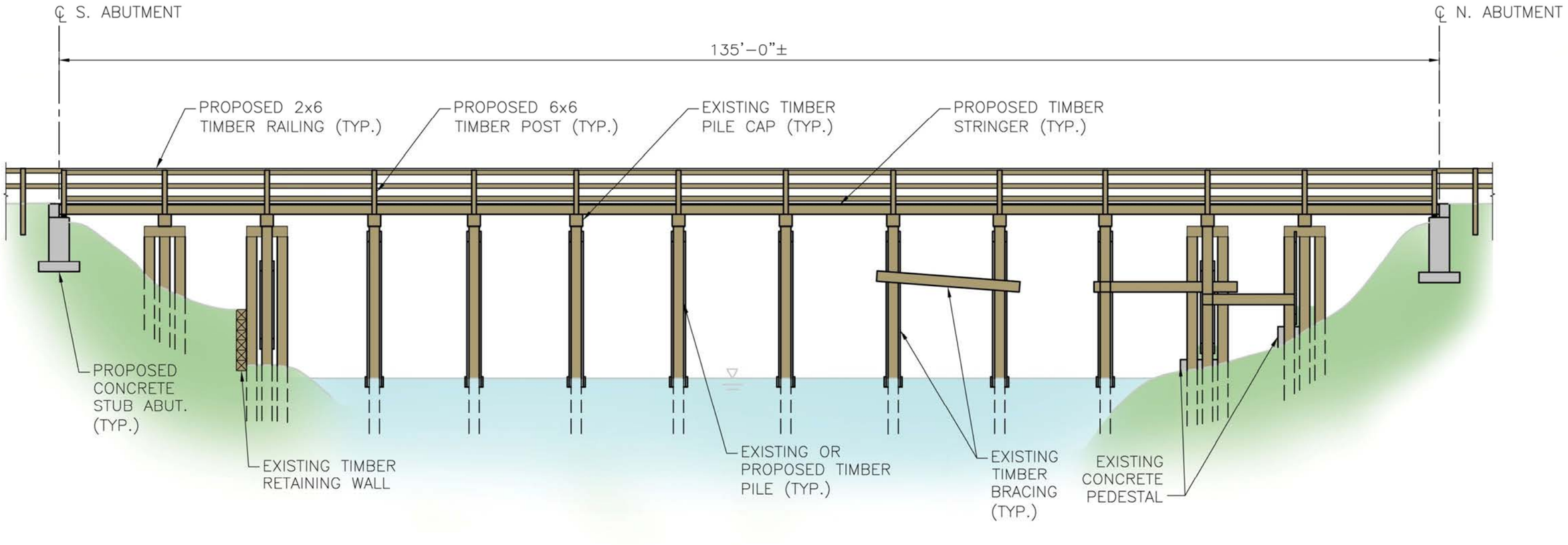

Figure 57: Alternative 1 – Rehabilitation of Existing Bridge Structure Elevation View

<u>Alternative 2 – Replacement with a Prefabricated Steel Bridge Structure:</u> Alternative 2 consists of a prefabricated truss-type steel bridge with a timber deck. Timber railings will be mounted onto the steel truss. There are a variety of truss types available. This structure would be a single-span bridge, spanning from concrete abutment to concrete abutment. Concrete wingwalls would replace the existing timber wingwalls. Similar to Alternative 1, sections of timber rail fence are proposed for both sides of each approach.

Demolition would include the entire existing timber superstructure and substructure. The existing timber abutments and wingwalls would be demolished in their entirety. The existing timber retaining wall on the south embankment would also be removed. The demolition would include in-water construction activities which would require environmental permitting from the applicable agencies for an additional cost.

A prefabricated steel bridge would have shorter construction duration than constructing a timber superstructure. The fabrication would take place in the shop which would provide for quick and easy installation on site. Periodic repainting of the steel members will be required unless weathering steel is used, which doesn't require painting.

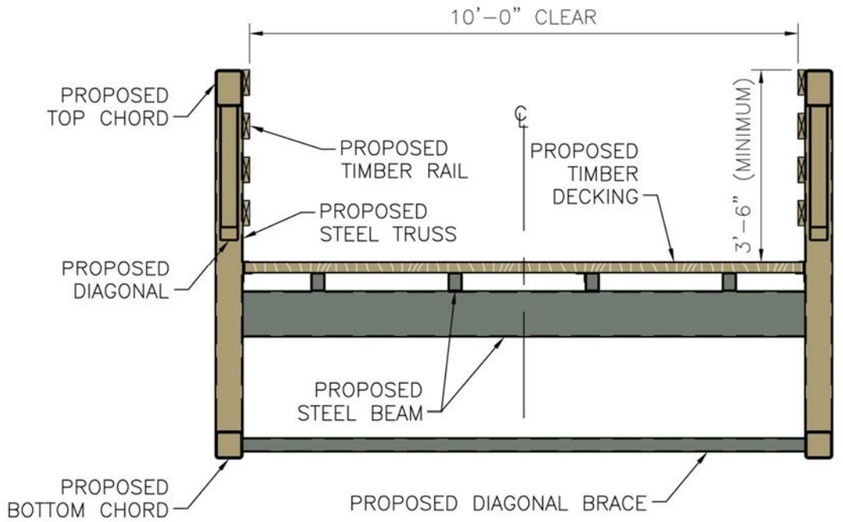

Figure 58: Alternative 2 - Replacement with Prefabricated Steel Bridge Structure Cross Section

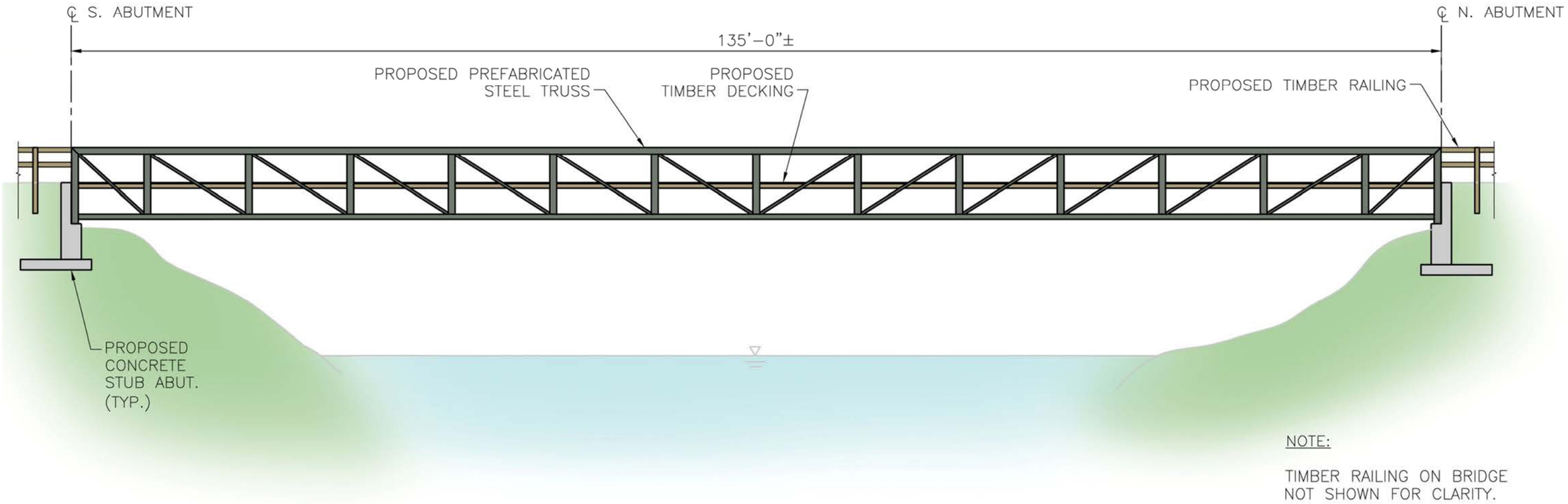

Figure 59: Alternative 2 – Replacement with Prefabricated Steel Bridge Structure Elevation View

Cost Comparison of Alternatives

The rehabilitation alternative includes additional costs associated with evaluation and testing of the existing substructure, and costs for new timber piles, which makes this estimated construction cost almost the same as for a prefabricated steel bridge replacement. A more precise number and length of new timber piles will be dependent upon results from structural investigation and analysis. A conservative estimate is provided for this study.

The replacement alternative cost assumes a straight steel truss, constructed of weathering steel, Ipe timber decking and railings, and a live load design for pedestrian and H10 vehicles. Weathering steel and Ipe timber would require very little maintenance. An alternative to weathering steel is using painted steel. This option would cost between 8% and 45% more than weathering steel; therefore, it's not recommended due to cost and future maintenance. An alternative to Ipe timber decking is using Douglas Fir decking. Douglas Fir decking will deteriorate faster than Ipe decking but is approximately 10% less expensive. A third alternative to consider is the live load design requirements. If the bridge is designed for pedestrian live load only, the bridge cost would be reduced by approximately 8-10%.

Recommendation

Alternative 1 has several unknowns associated with the reuse of the existing timber substructure. Even if some of the existing timber substructure components can be reused, they would not be expected to last nearly as long as a replacement substructure would. The minor potential cost savings of reusing the existing substructure must be weighed against the construction and maintenance costs of the bridge structure. Alternative 1 would only prolong the inevitable substructure replacement.

It is recommended that the existing railroad bridge over the Charles River be removed in its entirety and replaced with a prefabricated steel bridge (Alternative 2). Alternative 2 would provide for an aesthetically pleasing, economical bridge structure with a design life of 75 years. This bridge alternative would also minimize environmental impacts since there would be no intermediate supports in the Charles River.

Table 10: Bridge Alternatives Cost Comparison

ALTERNATIVE 1: Rehabilitation				
Work Description	**Unit**	**Quantity**	**Unit Price**	**Cost**
Demolition of Portions of Railroad Bridge	Lump Sum	1	$342,800	$342,800
Timber Superstructure & Railings	Lump Sum	1	$79,800	$79,800
Timber Piles	Foot	2600	$85	$221,000
Concrete Abutments/Wingwalls	Lump Sum	1	$98,600	$98,600
Inspection & Testing	Lump Sum	1	$10,500	$10,500
Mobilization/Demobilization	Lump Sum	1	$50,000	$50,000
		Subtotal		$802,700
		Contingencies (25%)		$200,700
		Total		$1,003,400
		Budget		$1,000,000

ALTERNATIVE 2: Replacement				
Work Description	**Unit**	**Quantity**	**Unit Price**	**Cost**
Demolition of Entire Railroad Bridge	Lump Sum	1	$500,300	$500,300
Prefabricated Steel Bridge & Railings	Lump Sum	1	$229,900	$229,900
Concrete Abutments/Wingwalls	Lump Sum	1	$109,200	$109,200
Mobilization/Demobilization	Lump Sum	1	$75,000	$75,000
		Subtotal		$914,400
		Contingencies (25%)		$228,600
		Total		$1,143,000
		SAY		$1,200,000