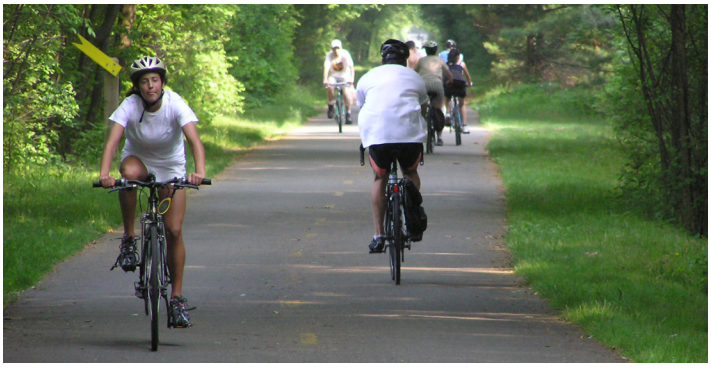
Shared Use Path Planning and Design Guide

Cost Estimating Tool

Guidance Document



Minuteman Bikeway, MA. Credit: Terry Gleason, Bedford Bicycle Advisory Committee Chairman

October 2018

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Background and Overview

Shared use paths are facilities meant to accommodate non-motorized users in a variety of settings. In Massachusetts, shared use paths may be found along active or abandoned railroads, adjacent to roadway corridors (sidepaths), along waterfronts, and more. Shared use paths have become a widely utilized form of transportation and recreation for pedestrians and bicyclists that encourage mode shift towards active transportation and healthy lifestyles. These paths provide links in growing, comprehensive pedestrian and bicycling networks.

To support planners and designers hoping to design and build shared use paths, MassTrails is developing the Shared Use Path Planning and Design Guide (SUPPDG). The Shared Use Path Cost Estimating Tool is intended to supplement this guide; however, it will be released in advance of the guide in order to assist with one of the first steps of these projects – understanding a magnitude of cost.

This guidance document is meant to help planners and designers use the Shared Use Path Cost Estimating Tool and should be used in conjunction with the SUPPDG.

Purpose of the Tool

The Estimating Tool allows planners and designers to assess and develop a preliminary cost of a shared use path project. This tool can help planners and path proponents plan, program, and allocate funds with a higher level of accuracy than the current practice of estimating based on a cost per linear foot or mile, and a lower level of effort than detailed estimates per standard details and unit costs.

EXISTING METHODS

Shared use path planners and designers often choose from one of the following methods in estimating costs:

- "Per foot or Per Mile" Method; or
- Unit Cost Method.

PER FOOT/PER MILE METHOD

The "Per Foot or Per Mile" approach to cost estimating can be valuable during planning level discussions. This approach uses experiential data to give planners and designers a basic estimate of costs associated with shared use facilities for a given length. However, this antiquated practice of estimating is not very accurate and often does not account for some complexities that arise with more current projects. Low-hanging fruit projects are few and far between and have been replaced with more multifaceted projects that require complex design solutions, frequently utilizing structures, lighting and security, and more.

UNIT COST METHOD

The Unit Cost Method allows the planners to determine quantities for parts of a project and apply a unit cost to these elements in order to calculate a total project cost estimate. This approach is more detailed than a per foot or per mile cost and is generally utilized after the planning level assessment. An engineering background is helpful and may be required to appropriately execute this method.

The unit cost approach allows the construction inspector/supervisor to carefully manage the expenses of the project as it related to completeness of construction but is time-consuming and may not be appropriate at the planning stage.

Shared Use Path Cost Estimating Tool Approach

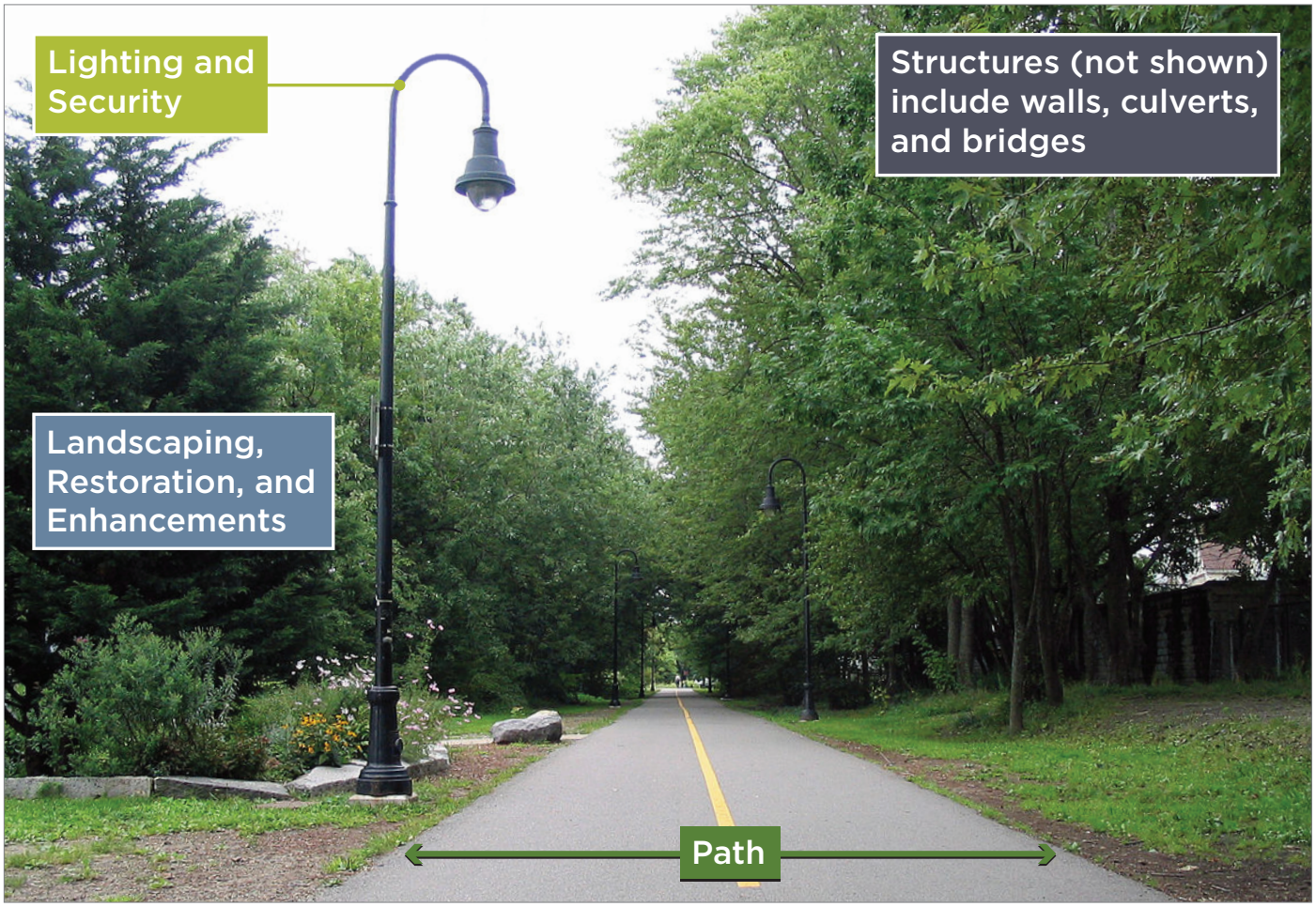
The Estimating Tool is meant to find the middle ground between the two aforementioned cost estimating methods. While the Per Foot or Per Mile method is overly simplistic, calculating quantities for each item involved in a shared use path and finding appropriate unit costs is time consuming and requires considerable effort. Additionally, it can be difficult to determine design elements and right of way impacts ahead of survey.

The Estimating Tool allows the planner or designer to input the overall length of a path and answer basic questions about it. It makes certain assumptions for the shared use paths based on those inputs and calculates a project cost. Prices are developed using bid tabulations from other shared use paths, as the Weighted Bid Prices tend to be driven higher by roadway projects.

The estimate is broken down by category so that the user can see how much each project component costs and adjust features to achieve an overall price that is suitable. In this way, the project development becomes an iterative process. The cost categories are included below:

- Path;
- Structures;
- Landscaping Restoration and Enhancements; and
- Lighting and Security.

Survey, design, and traffic control are also estimated as a percentage of the construction cost.



Methodology

After downloading the Excel spreadsheet, there are three tabs that can be toggled between, shown below.

The three tabs will be described in detail in the pages that follow. The user only needs to input information into the green boxes on the User Interface tab. The other two tabs are informational only: the Assumptions tab outlines the price and quantity rules followed during creation of the tool; the Summary tab provides a total cost for the project, as well as costs broken down by category.

User Interface

The planner or designer must have a basic idea of what will be required to build a path; however, they can easily fill in the blanks on the Project Summary page before a preliminary survey is completed. The Estimating Tool collects the necessary information by asking questions such that the user can answer all questions using only basic tools such as Google Maps and MassDOT's new "MaPIT" GIS website. A site visit to review existing conditions is also recommended.

Inputs are either numerical or chosen from a drop-down list so that the spreadsheet equations will be triggered appropriately. As seen in **Figure 1**, the inputs are meant to provide enough detail that the estimate can be more customized than a "Per Foot or Per Mile" method. The input questions are grouped to identify which cost category each input affects.

Figure 1. Project Inputs – Page 1 of 2

Shared Used Path Design Guide
Cost Estimator

PROJECT INPUTS - PAGE 1 OF 2

	PROJECT DESCRIPTION				INPUT	CLICK INFO	
1	What year is the project expected to begin construction?				2020		
2	Should the estimate include cost of engineering design and/or traffic control?				Design		
3	How many distinct segments of path are there? (differing exist. or prop. conditons)				3		PATH
	Input a number between 1 and 4.	Segment 1	Segment 2	Segment 3			
4	What is the length of the segment of path? *(in feet)*	400 ft	800 ft	3,000 ft			
5	What are the existing conditions of the area?	Roadway	Clear, flat	Clear, flat			
6	What type of path is being proposed?	Roadway Sidepath	Rail Trail (w/ exist. rail)	Rail with Trail			
7	What material will the shared used path be?	Concrete	Asphalt	Asphalt			
8	What material will the shoulders be?	Concrete	Grass	Unpaved			
9	What is the width of the path? *(Typ. range: 10 ft to 14 ft)*	8 ft	10 ft	12 ft			
10	Will a separate equestrian path be provided?	No	Yes, unpaved	No			
	Clear out any extra data shown in red						
11	What length of the path requires boardwalk due to unavoidable wetlands?				100 ft		STRUCTURES AND INTERSECTIONS
	Please see the Guidance Document and consult the MassGIS website to locate wetlands:				OLIVER		
12	Are there steep separations or resource areas that may require retaining walls?				Yes		
13	Is the ROW constrained in any locations?				Some of the length		
14	How many crossings with roadways are there?				3		
	Please fill in the information in the chart on the next page.						
15	How many crossings are there over bodies of water?				1		
	Please fill in the information in the chart on the next page.						
16	How many crossings are there with a active railroads?				0		
	Please fill in the information in the chart on the next page.						
17	What is the extent of landscape restoration and enhancements?				Moderate		LANDSCAPING AND AMENITIES
18	How many parking spaces will be provided?				25		
18a	*What will be the material of the parking lot?*				Typical Asphalt		
19	Will the path require lighting along its length?				Yes		LIGHTING AND SECURITY
19a	*If not along the entire length, what length requires lighting?*				200 ft		
19b	*If there is lighting, should security be included?*				No		

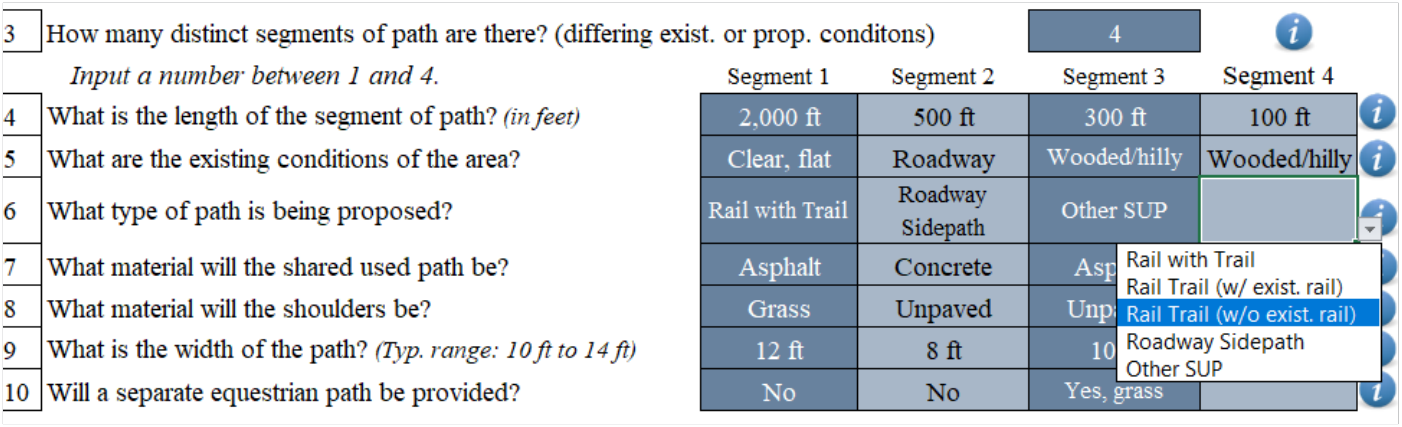
CHECK FOR ERRORS ← *Click Button before proceeding*

Due to variability along a path, the Estimating Tool allows the user to input separate segments with different values for the following categories:

- Length and width of path segment;
- Existing conditions;
- Proposed path type;
- Material of shared use path and shoulders; and
- Inclusion of a separate equestrian trail.

This function allows the user to input data for up to four unique sections of path. This could be useful in situations where a proposed path type transitions from one to another. For example, a roadway sidepath used to connect a proposed shared use path to on-road facilities. This can also be used if only certain lengths of the path include separate equestrian accommodations, or have different materials, existing conditions, or dimensions.

An image of the Estimating Tool with sample data for a path with four segments is included below.

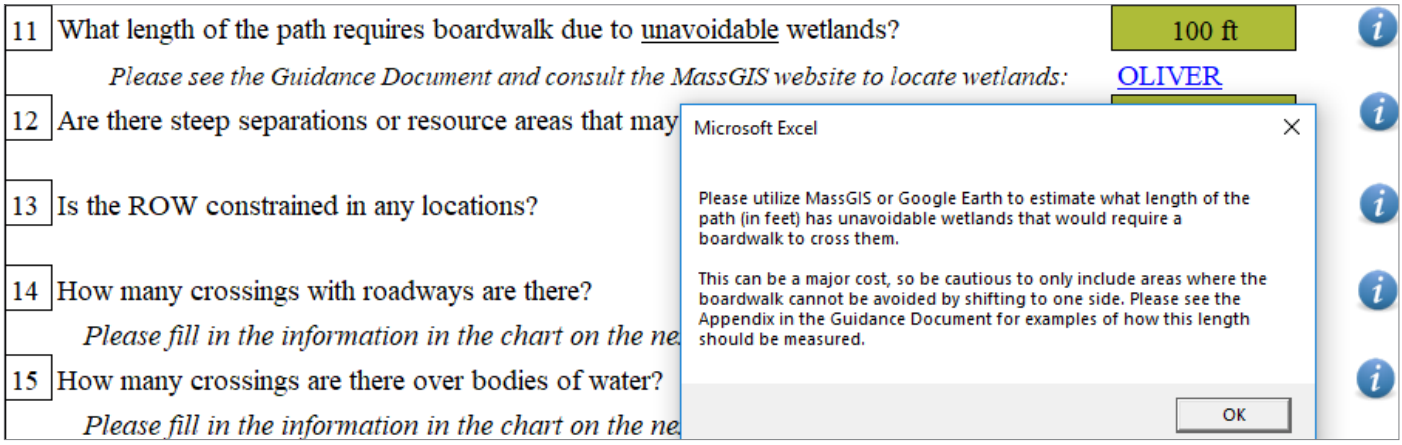


3	How many distinct segments of path are there? (differing exist. or prop. conditons)		4		
	Input a number between 1 and 4.	Segment 1	Segment 2	Segment 3	Segment 4
4	What is the length of the segment of path? *(in feet)*	2,000 ft	500 ft	300 ft	100 ft
5	What are the existing conditions of the area?	Clear, flat	Roadway	Wooded/hilly	Wooded/hilly
6	What type of path is being proposed?	Rail with Trail	Roadway Sidepath	Other SUP	
7	What material will the shared used path be?	Asphalt	Concrete	Asp	
8	What material will the shoulders be?	Grass	Unpaved	Unp	
9	What is the width of the path? *(Typ. range: 10 ft to 14 ft)*	12 ft	8 ft	10	
10	Will a separate equestrian path be provided?	No	No	Yes, grass	

Example of a drop-down menu used on the User Interface of the Project Summary Page

The planner or designer must also decide to what extent landscaping, lighting, and security will be incorporated. More detail on the various categories will be provided in the sections that follow. It should be noted that the inputs can be changed to reflect an iterative process when trying to operate within a construction cost budget.

After filling out the Project Inputs page, the user can click the "Check for Errors" button at the bottom of the page to ensure that no contradictory information has been entered. There are also buttons to the right of each question that the user can click for additional information to the specific question.



Example of an information box that pops up if the "i" number box is clicked next to Question #11.

Assumptions

A list of assumptions is included on the second page of the Estimating Tool so that planners and designers have perspective on the project cost that is computed. For example, a two-foot shoulder is assumed on each side of the path, but no other edge treatment or grading is calculated. If the topography of the user's path is such that extensive grading will be required, the cost of earthwork should be considered.

These assumptions should be reviewed thoroughly before using the tool. Although it is customizable, the Estimating Tool does estimate a cost for a generic project and the user's unique proposed project should be compared to that.

Unit Costs

Two types of prices are used in the Estimating Tool to calculate a total project cost. **Weighted Bid Prices** are used in estimate calculations according to MassDOT standard details and dimensions entered by the user. **Proportional Costs** are also used for design elements that are more difficult to precisely calculate at this stage; for example, design, survey, and retaining walls are calculated as a percentage of the total project cost. Both of these types of prices were researched and validated using bid tabulations from past shared use path projects in the Commonwealth. This process allowed us to eliminate outliers that influence the Weighted Bid Prices on the MassDOT website.

Bid tabulations were also used to measure how much the proportional costs should be. Projects with similar characteristics (clear, flat vs. hilly vs. roadway) were used to develop the input descriptions on the User Interface tab and were compared so that appropriate percentages of applicable design elements could be applied.

Calculations

All calculations performed in order to determine an estimated Project Total cost are performed in the background of the Estimating Tool. The following sub-categories are included in the calculation of the four main Project Categories:

- Path:
  - Path and shoulder cross section (asphalt, porous pavement, unpaved, concrete, or stabilized aggregate, and all necessary subgrades and excavation);
    - Curbing for roadway sidepaths; and
    - Equestrian paths, either grass or unpaved;
  - Drainage;
  - Clearing and grubbing where appropriate;
  - Wooden rail fencing;
  - Intersection treatments; and
  - Environmental contamination costs.
- Structures:
  - Retaining walls;
  - Culverts;
  - Boardwalks; and
  - Bridges.
- Landscaping Restoration and Enhancements:
  - Plantings and vegetation management;
  - Slope stabilization;
  - Amenities; and
  - Parking lots, including drainage for proposed paved lots.
- Lighting and Security:
  - Lighting and equipment; and
  - Surveillance cameras.

Path

The Path cost is comprised of the user-input surface for the path and shoulders, as well as any other materials and activities required to construct the path itself.

TYPE AND MATERIAL

There are four options for Question #6 – "What type of path is being proposed?"

- Rail with Trail – a shared use path that runs adjacent to an active rail line.
- Rail Trail with existing ties – a shared use path that is built on abandoned rail beds.
- Roadway Sidepath – a shared use path that is built adjacent to a roadway, often connecting other sections of a path. Curbing is estimated for this type of path.
- Other Shared Use Path – any shared use path that does not fall under the prior three categories. This includes, but is not limited to, waterfront trails, linear parks, and utility corridors.

There are several options for path material, but it should be noted that some surfaces are not appropriate in certain situations. While a porous asphalt path is beneficial for stormwater drainage, it may not be suited for a path along a former rail bed due to known soil contaminants that likely exist. Unpaved paths, except for stabilized aggregate, are not ADA-accessible and may not be eligible for some funding sources. Caution should be used when designing concrete paths due to the presumed indication that a concrete surface is a pedestrian zone rather than a shared space.

The calculations that are used to compute path, shoulder, and sidewalk costs are based on standard items and dimensions as shown in the MassDOT standard details. Some assumptions are made for thicknesses, but they are within reason and should not vary substantially between projects.

DRAINAGE

Although drainage is difficult to estimate without knowing the details of a project, the Estimating Tool attempts to make assumptions based on the type of path to be built. If "Roadway Sidepath" is chosen from the proposed path type drop-down list, then a closed drainage system is estimated. Otherwise, an open system is assumed with a linear foot cost calculated for country drainage. For closed drainage systems, the Estimating Tool assumes a catch basin and manhole every 250 feet. The estimate uses MassDOT Weighted Bid Prices and standard details to calculate costs for associated equipment and piping.

CLEARING AND GRUBBING

Clearing and grubbing is calculated for the area of paths that are identified as being built on an existing wooded, hilly area, and proposed rails with trails and rail trails. Clearing and grubbing is also calculated along equestrian trails to accommodate the width of the trail and the buffer zone.

FENCING

Wooden fencing is assumed along 50% of the path on both sides if the existing conditions are identified as hilly or the proposed path is along a waterfront. Otherwise, fencing is assumed along 25% of the path. Fencing is also assumed on both sides of boardwalks for their entire length.

INTERSECTIONS

Intersection costs are estimated based on various assumptions. The user must input the total number of roadway crossings; from this information, an empty table populates on Page 2 of the Project Summary input pages based on the number of rows entered. It is important to note that driveway crossings are not considered in this cost estimate and should not be included.

In the example table that follows, data is inputted for a shared use path that crosses three roadways. The user must indicate the location of the intersection (controlled intersection, uncontrolled intersection, or mid-block); the number of lanes being crossed; the speed on the road; whether traffic is light, moderate, or heavy; and whether the crossing is at-grade, an underpass, or an overpass. Underpass and overpass choices generate the calculations discussed in culverts and bridges, respectively. However, structural engineers should be consulted for accurate evaluations of these costs.

Roadway Crossing Information Table

	Location Info	Speed Info	Lane Info	Traffic Info	Type Info	Lighting Info	
#	Location	Speed (mph)	Total # Lanes	Traffic	Type	Lighting Needs	**Treatment**
1	Mid-Block	30-40	2	Moderate	At-Grade	Yes, new lighting	**Traffic Device**
2	Intersection (Uncontrolled)	30-40	2	Light	At-Grade	No lighting required	**Traffic Device**
3	Intersection (Uncontrolled)	>40	5	Moderate	Overpass	Yes, new lighting	**Bridge**
4	Intersection (Stop/Signals)	30-40	2	Light	At-Grade	se existing lighting	**None**
5	Intersection (Stop/Signals)	<30	2	Light	At-G	ghting	**None**
6	Intersection (Stop/Signals)	<30	2	Light	At-G	uired	**None**
7	Mid-Block	<30	1	Light	At-G	uired	**Traffic Device**

Structural
If an overpass or underpass is required, please consult a structural engineer. Cost estimated by the tool is subject to change based on conditions.

Example user-inputted data in green for a path that crosses seven roadways.

For at-grade roadway crossings, two curb ramps and street signs are assumed. MassDOT standard details are used to determine an average area for wheelchair ramps. It is assumed that a crosswalk will need to be striped for all roadway crossings. Crossings occurring at existing controlled (stop or signalized) intersections are assumed to contain sufficient traffic control devices. Since cyclists will cross during pedestrian phases, it is not recommended that any Rectangular Rapid Flashing Beacons (RRFBs) or High-Intensity Activated Crosswalk Beacons (HAWKs) be added.

Additional crossing treatments for mid-block crossings and uncontrolled crossings are determined based on the other user inputs according to the table on the next page. At a minimum, every mid-block crossing is assumed to include a RRFB. This assumption is conservative as many low-volume, low-speed roads with two lanes or less will not require any traffic control device.

The full design guide discusses other potential treatments at intersections, such as raised tables and medians. These components are not included in the Estimating Tool as the cost implications are not substantial but should still be considered during design.

Mid-Block Crossings										
		One Lane			Two Lanes			3 + Lanes		
Speed		>30	30-40	<40	>30	30-40	<40	>30	30-40	<40
Traffic	Light: 0 – 5,999 veh/day	RRFB	RRFB	RRFB	RRFB	RRFB	HAWK	HAWK	HAWK	HAWK
	Moderate: 6,000 – 11,999 veh/day	RRFB	RRFB	RRFB	HAWK	HAWK	Signals/ HAWK	HAWK	Signals/ HAWK	Signals/ HAWK
	Heavy Traffic: 12,000 + veh/day	HAWK	HAWK	HAWK	HAWK	Signals/ HAWK	Signals/ HAWK	Signals/ HAWK	Signals/ HAWK	Signals/ HAWK

**The use of a HAWK or signalization will require the designer to assess traffic warrants. Signalization may only be warranted if projected volumes are significant (>100/hr for multiple hours) according to MUTCD Chapter 4.*

ENVIRONMENTAL

For paths that are proposed on or along railroads, certain environmental contingencies are included in the cost in case contaminated soils are encountered. However, consistent with the assumption that the topography is relatively flat, this contingency will not cover situations where substantial contaminated soil must be removed. The removal of soil along railroads for cut and fill operations is typically avoided during design. For rail trails on existing rail beds, additional costs are estimated for track excavation, transporting rail, and disposal of treated wood.

Structures

BOARDWALK

Boardwalk construction may be required in order to avoid disturbing wetlands. When these areas are present, a shared use path should attempt to avoid impacts by selecting an alignment that shifts away as much as possible. However, in areas where space is limited due to Right of Way or other factors, a project may encroach on environmental resource areas.

The first step in addressing these concerns is to identify these areas. The Estimating Tool provides a link to the MassGIS's Online Mapping Tool (OLIVER). An appendix at the end of this guidance document provides instructions on how to use OLIVER to locate and measure wetlands, as well as strategies to limit effects. It is important to note that the Estimating Tool does not include costs associated with environmental permitting required to work in and

around wetlands. Mitigation from other environmental resource areas such as floodplains and riverbanks are not considered.

RETAINING WALL

Several questions on the User Interface tab are incorporated into the retaining wall cost, which is estimated as a percentage of the total project estimate.

- **Existing Conditions:** The percentage is highest if the existing conditions are identified as "woody/hilly."
- **Wetlands:** Retaining walls are often built to avoid impacts to wetlands, so a multiplier is added in intervals for each 10% of wetlands identified.
- **Steep Separations:** If the user identifies steep separations that may necessitate retaining walls, a multiplier is added to the estimate.
- **Right of Way:** The cost of retaining walls increases as Right of Way becomes more constrained.

Retaining walls associated with culverts and bridges are also estimated.

CULVERT

The Culvert cost assumes a 10-foot height based on the minimum vertical clearance for underpasses in the American Association of State Highway and Transportation Officials (AASHTO)*Bike Guide*. A 10'x16' precast concrete box culvert with support of excavation and excavation costs make up the total estimated cost for this category. Culverts are appropriate for short distances under roads with heavy traffic volumes and high speeds.

The user must fill in a table for each type of roadway crossing. For any crossing that is identified as an "underpass," a culvert is estimated. The length of the shared use path culvert is calculated by multiplying the user-input number of roadway lanes being crossed by a standard 12-foot lane width, plus shoulders and grading down under the roadway.

An example of a bike path through a box culvert.

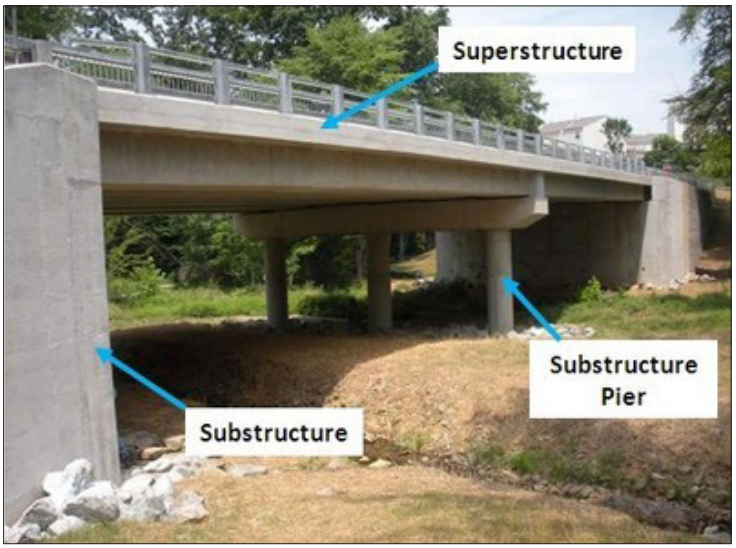
Culverts may also be specified for railroad crossings when underpasses are selected. The railroad clearance under a path can range from 17 to 23 feet according to the MassDOT *Project Development and Design Guide* (PPDG), so an underpass can require half as much transition length as an overpass. The retaining walls required to meet this transition are calculated within the Estimating Tool. Only the length of the railroad crossing itself should be input by the user.

BRIDGES

The number of bridges is determined by the user's response to the number of river crossings and the number of roadway and railroad crossings that are overpasses.

From the intersection table, the crossing distance of the shared use path bridge over a roadway can be calculated by multiplying the user-input number of roadway lanes by a standard 12-foot lane width, plus shoulders and grading up above the roadway.

For river and railroad crossings, the user is asked whether or not there is an existing bridge that crosses the river. A unit cost is assumed per fabricated steel bridge if there is no existing bridge, and a unit cost is assumed per bridge superstructure if there is an existing substructure that can be utilized. There is also an option for bridge replacement, which adds a cost for demolition. Existing bridges are assumed to require cleaning and minor rehabilitation. The image to the right shows the two major components of a bridge: substructure and superstructure.



A substructure consists of the piers, abutments, and foundations. A superstructure consists of beams and deck.

As for culverts, transition lengths are calculated within the tool and retaining wall costs will be carried as necessary. Assuming that a path is designed with a maximum of a five percent running slope, transitions for an overpass over a railroad can be as much as 500 feet in each direction, according to the MassDOT PDDG.

Lighting and Security

LIGHTING

Lighting needs can be customized for full or partial lengths along the path, as well as at each crossing. For general path lighting, the user should answer "Yes" to question 19 on the User Interface Page 1, which asks if the path requires lighting along its length. This question refers to lighting along the actual path, excluding crossings. If this lighting is only required for some of the path's length, the user can enter a partial length in the box for 19a. This may be helpful for paths that utilize existing spillover lighting from nearby areas such as streets or parking lots but require lighting along other lengths. If no partial length is filled in for 19a but lighting is identified as a requirement, it will be estimated along the entire length of the path.

The Estimating Tool assumes that a light will be required every 50 feet along the entire length of the path or along a user-input length. Standard MassDOT items are used to estimate the costs of fixtures, conduits, pull boxes, and all other associated equipment. Most projects that implement new lighting use LED lights, which are reflected in the tool.

For crossings, the user has the option to select lighting needs from three options:

- Yes, need new lighting;
- Use existing lighting; and
- No lighting required.

Lighting will be calculated along the length of the bridges and culverts for overpasses and underpasses, and at intersections for at-grade crossings.

SECURITY

The planner or designer has the ability to include security as a cost towards the shared use path. Surveillance cameras should only be included in areas where the path is lit, and the "Check for Errors" button confirms this. Like lighting, this input can be customized in the case that security is required at certain locations rather than along the entire path. The options are as follows:

- Yes, full length;
- Yes, partial length;
- Only at crossings; and
- Partial length and crossings.

Surveillance cameras are assumed to be spaced every 500 feet along lengths that are specified, as well as one per crossing. Call boxes were not calculated but may be considered.

Landscaping Restoration and Enhancements

Landscaping can be used for screening and blocking, or for aesthetics and the enjoyment of users. The landscaping cost is estimated as a percentage of the total project cost – excluding structural costs – ranging from 2-10% percent based on the level of landscaping specified by the user: minimal, moderate, or advanced. Most shared use path projects fall under the "Moderate" category. A more detailed breakdown of the three options follows.

A custom granite post on the Charles River bike path in Watertown, MA, an example of "advanced" landscaping.

"Minimum" includes basic site work and furnishings such as:

- Vegetation management for invasive plant species;
- Clearing and grubbing;
- Tree protection, trimming, and removal;
- A small number of benches to meet accessibility needs for resting; and
- Basic wayfinding and orientation.

"Moderate" includes items under "Minimum" with opportunities to increase amenities, such as adding more benches, tables, and bike racks. Additional work may be included such as:

- Planting vegetation buffers and limited shade tree planting;
- Basic trail head treatments such as boulders or fencing to provide barrier on each side of path;

- More advanced wayfinding and orientation such as park signs, mile markers, and town line markers; and
- Pull-off areas at road crossings.

"Advanced" includes items listed above with opportunities for upgrades in materials, such as granite benches rather than wood benches or integral color pavement. Additional work may include:

- Picnic areas with picnic shelters, scenic overlooks, and play structures;
- Additional site furnishings and trailhead features such as kiosks, bicycle repair stations, and water bubblers;
- Additional wayfinding such as trail maps, interpretive signage, and $\frac{1}{10}^{th}$ mile markers;
- Stone engraving, ornamental or screening fence, and textured pavements; and
- Portable toilets or concrete pads for portable toilets.

Non-Construction Costs

SURVEY

The cost for survey is estimated as a base per mile cost with a multiplier determined by the conditions that the planner uses to describe the topography and environment. The base cost and multipliers were developed using quoted survey costs for various types of shared use path projects in Massachusetts. A typical scope of work for survey will include prepared plans in AutoCAD Civil 3D, a base plan with Right of Way and property lines computed, and property ownership identified. All bounds within the project limits are located and a model of the existing surface is prepared. Survey is typically used to identify surface and subsurface utilities as well.

TRAFFIC CONTROL AND DESIGN

The user has the option to include Temporary Traffic Control Plans (TTCP) and design in the Estimating Tool. These costs are simpler to assume as percentages of the total construction cost based on experience and past projects. These are escalated for the project year, if included.

Temporary traffic control aims to move road users safely through or around work zones.

The design fee is calculated as a percentage of the total construction cost and has an inverse correlation to that cost. Experience has demonstrated that the design fee is a more significant percentage of smaller projects because many of the same contract documents are required as for larger projects amounting to a greater percentage of the project. Therefore, the ratio of design to construction is impacted by length and duration of the project. There is also a multiplier based on how much structures (culverts, bridges, and retaining walls) cost within the project, as consulting a structural engineering firm would increase the design fee.

The traffic control fee ranges depending on the proposed type of path. TTCP costs for different segments are proportionally weighed and applied to the overall TTCP cost of the path; rail trail segments are assumed to require no traffic control while roadway sidepaths require the highest effort.

Summary of Project Costs

The Project Cost page of the Estimating Tool summarizes the cost of each of the four design categories described in the previous sections. There is a standard 15% contingency applied to the construction subtotal. Nothing on this page can be edited.

After contingency is added, design and traffic control are added to the project cost, if the user has chosen to include them, to be escalated for the construction year. Survey is also included on this page as a requirement for the project. These costs are provided separately from the construction costs in the case that different funding sources are being applied to various stages of the project.

For MassDOT projects, it is important to note that the estimated cost to be included on the Project Need Form (PNF) and Project Initiation Form (PIF) forms should not include cost escalation. The MaPIT software that supports these forms will automatically calculate escalation. Cost escalation is only incorporated in the SUPPDG Cost Estimating Tool for planners who are seeking a cost estimate for future projects that are not ready to go through the MassDOT PNF process.

A cost per mile is also calculated to indicate the magnitude of cost for the path, i.e. whether or not it is an “expensive” or “inexpensive” path relative to others.

Lastly, there is a button that reads “Click to Generate Error/Information Warning Report.” This will list error and warning messages on the bottom portion of the summary page. Messages may include warnings that extensive environmental permitting may be required but is not estimated, or that unpaved parts of the path may not be ADA-accessible or eligible for federal funding.

Figure 2. Project Cost Summary

Shared Used Path Design Guide
Cost Estimator

PROJECT COST SUMMARY

Project Name: Please enter Project Name here
Project Location: Please enter Project Town here

PROJECT CATEGORY			ESTIMATED PRICE
Path	Length: 4,200 ft # Segments: 3	Width: 8 ft to 12 ft # Intersections: 3	$540,100.00
Structures			$1,350,400.00
Landscaping Restoration & Enhancements			$353,200.00
Lighting & Security			$81,600.00

CONSTRUCTION COST

Traffic Control	*Traffic cost not included*	TTCP COST	$0.00
		SUBTOTAL	$2,325,300.00
		Contingency (assume 15%)	*$348,795.00*
		CONSTRUCTION COST	$2,674,095.00 **
Cost Escalation	Construction Year: 2020	**CONSTRUCTION TOTAL**	**$2,918,500.00**
Assumed 4.47% increase in costs per year		**COST PER MILE**	**$3,668,970.00**

***Use this estimated cost on PIF forms - escalation is already included on the MassDOT Website*

NON-CONSTRUCTION COSTS (NOT ESCALATED)

Survey	*Based on existing conditons*	SURVEY COST	$54,300.00
Design	*Assume 13% of construction cost*	DESIGN COST	$359,195.00
		PROJECT TOTAL	**$3,331,995.00**

Click to Generate Error/Informational Warning Report

-Costs for ROW and permitting are not included in this estimate.
-Environmental mitigation from paving a parking lot may be required. Cost not included.
-Your project includes culverts and/or bridges. Please consult a structural engineer for more accurate costs.

CONSTRUCTION COST

NON-CONSTRUCTION COST

PROJECTED COST WITH ESCALATION

Tool Assessment

Contract documents and bid tabulations for four shared use path projects in Massachusetts were evaluated and run through the SUPPDG Cost Estimating Tool in order to test and refine it. When entered into the tool, all of the projects were estimated within 20% of the actual project cost.

The major cost discrepancies that tool users should be cautious about are as follows:

- Some estimate items that are only required by MassDOT (field office, mobilization, etc.) were substantial costs due to the magnitude of the project but are not included in the SUPPDG Cost Estimating Tool.
- The work limits of projects sometimes extend on to side streets and include sidewalk and roadway improvements, which are not covered within the scope of the Estimating Tool.
- Retaining walls proved difficult to estimate because their necessity is very situational:
  - Retaining walls will always be included into the Estimating Tool, but it is possible that a project will not require any.
  - Retaining walls required for minor streams and canals may not be captured by any user inputs.
- The Estimating Tool's estimate may be higher for intersection costs because an RRFB is the minimum treatment estimated for a path crossing a road at mid-block. However, for some projects intersections with two-lane, low volume, low speed roads may not require any traffic control device.

Conclusion

The SUPPDG Cost Estimating Tool provides a much more accurate estimate for shared use paths than the old “million a mile” rule of thumb, with a fraction of the effort required to do a full MassDOT cost estimate. While the user should be cautious of costs such as retaining walls that can be very situational, the Estimating Tool provides an order-of-magnitude cost estimate that can be used for planning purposes.

Shared Use Path Planning and Design Guide

Cost Estimating Tool

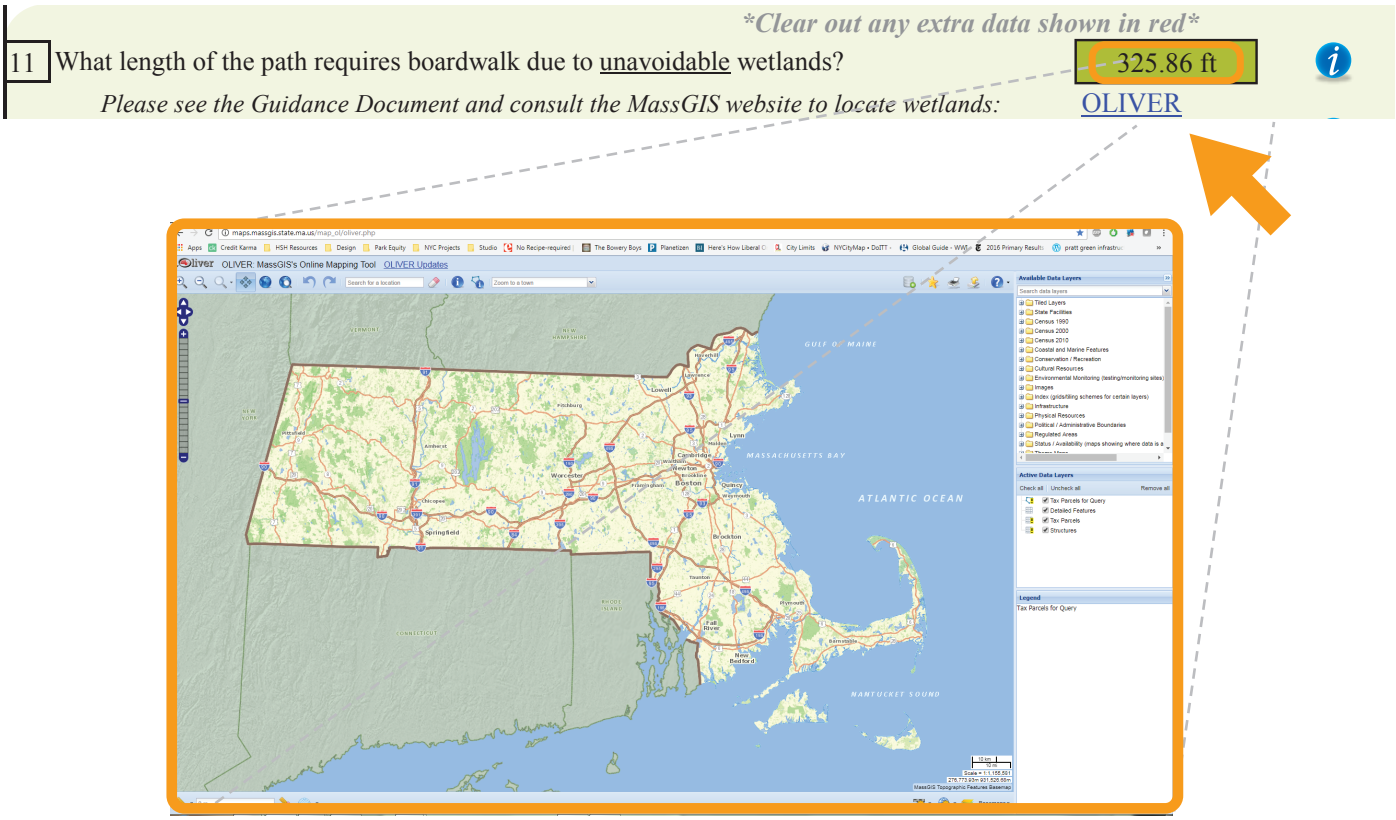
Appendix A. Wetlands Document

Appendix

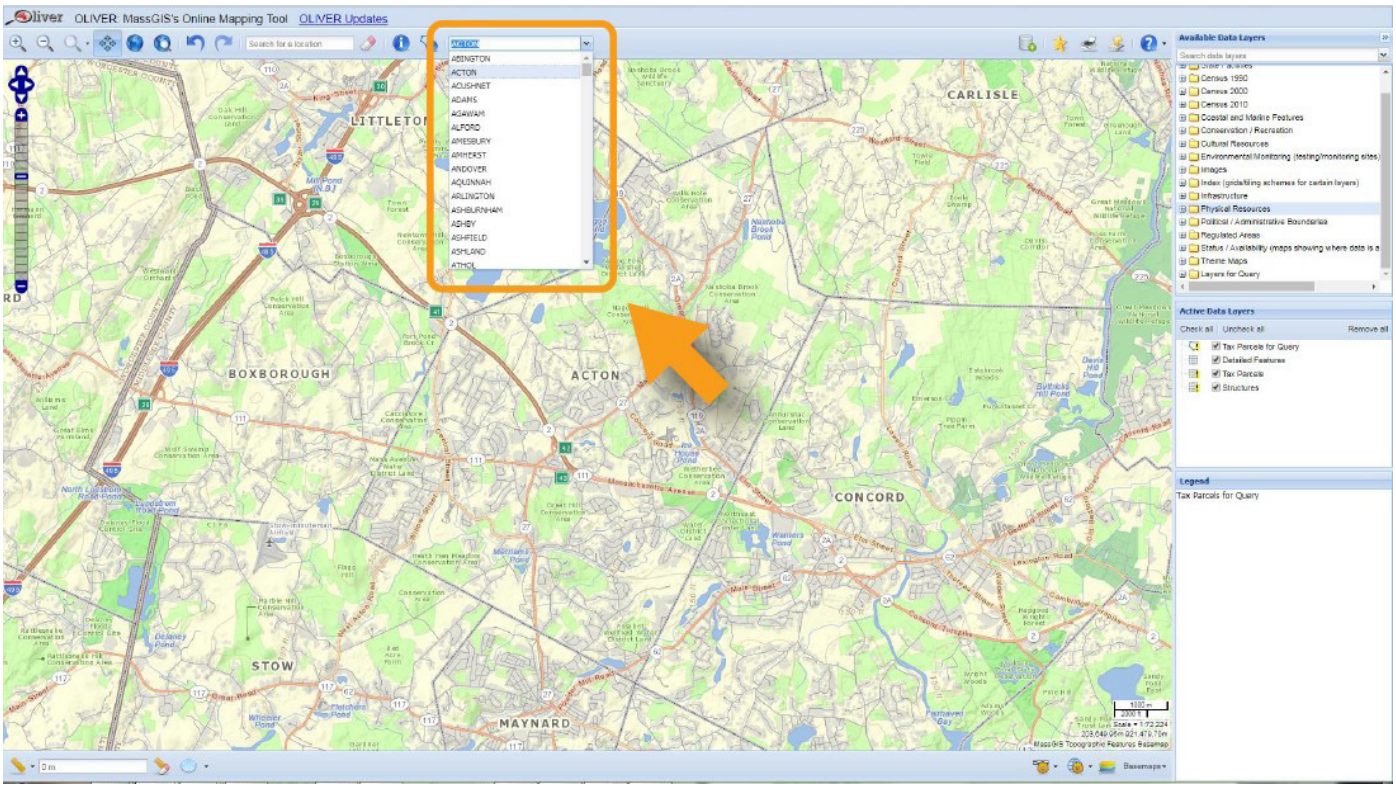
User Interface (Question 11) Wetlands Instruction

Within the User Interface worksheet of the Cost Estimating Tool, click on OLIVER to access MassGIS's Online Mapping Tool (OLIVER) under Question 11.

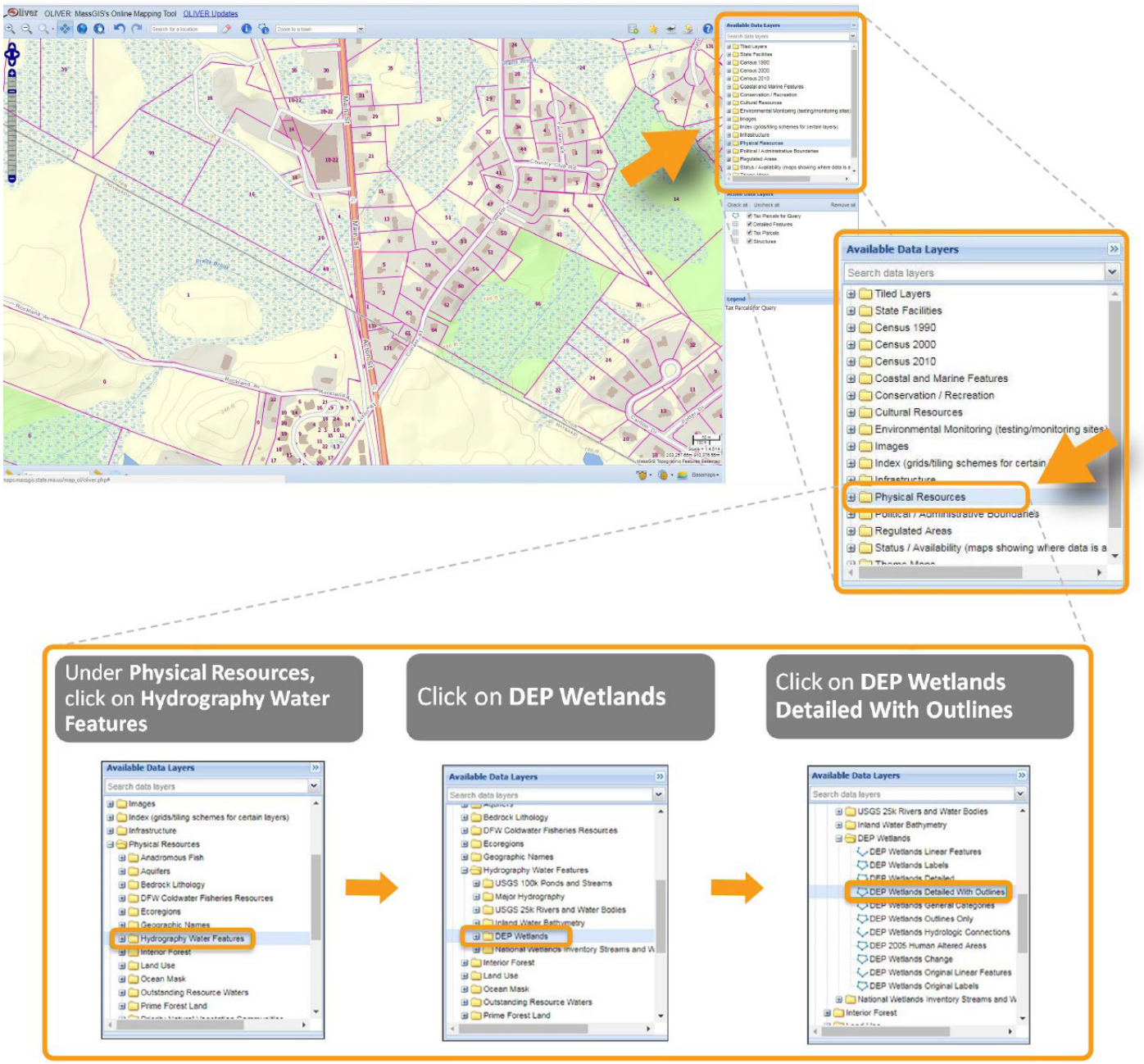
You can also access the website by entering the following link into your web browser: ***http://maps.massgis.state.ma.us/map_ol/oliver.php***



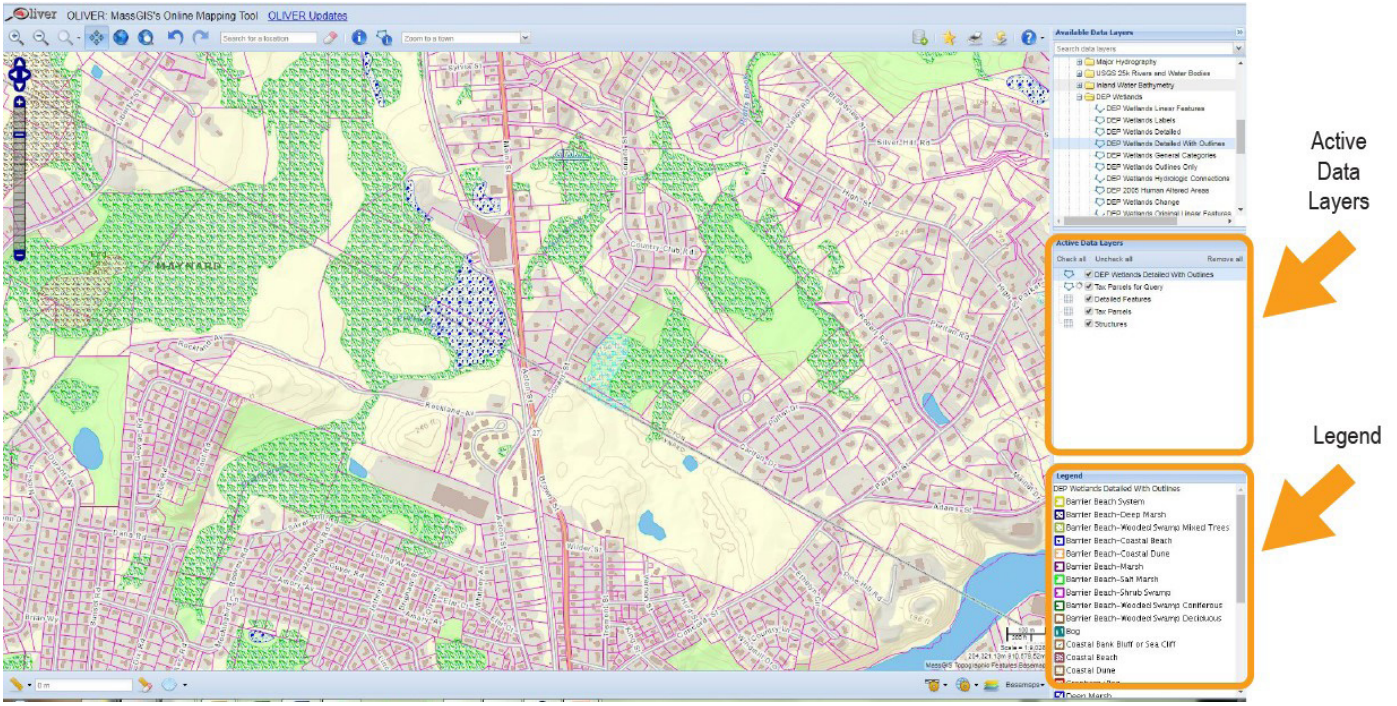
Click on the drop-down menu labeled **Zoom to a town** (located next to the **Identify Features** icon) and select the municipality in which the project is located and zoom to the project area.



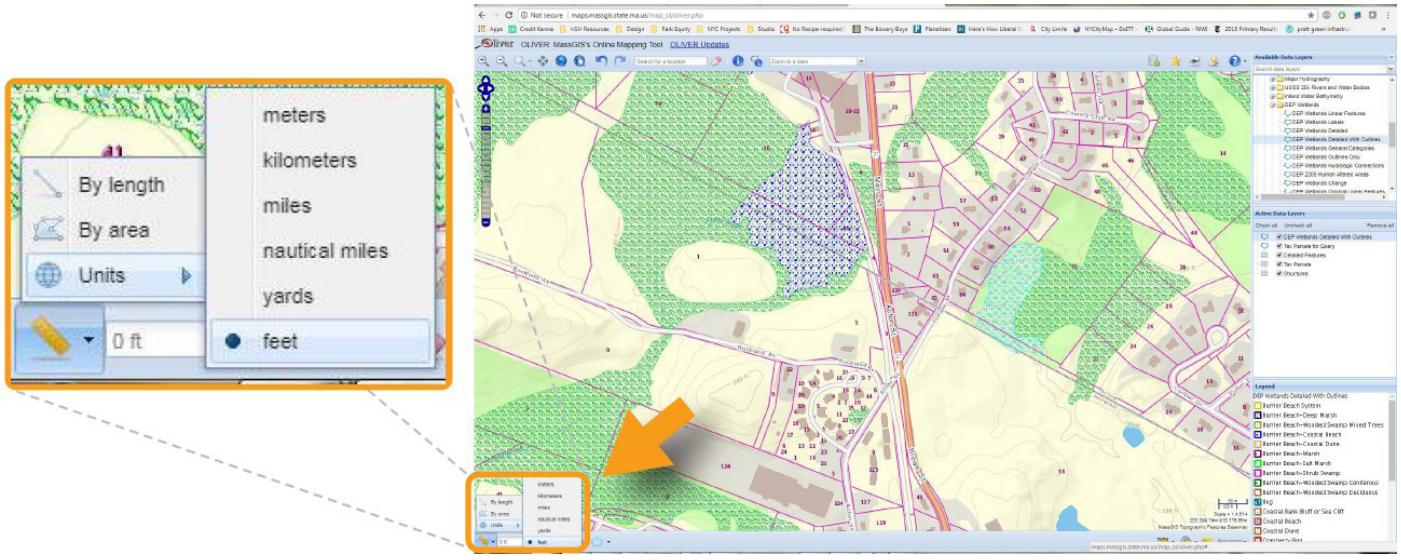
Navigate to **Physical Resources** under **Available Data Layers** to find the Wetlands layer.



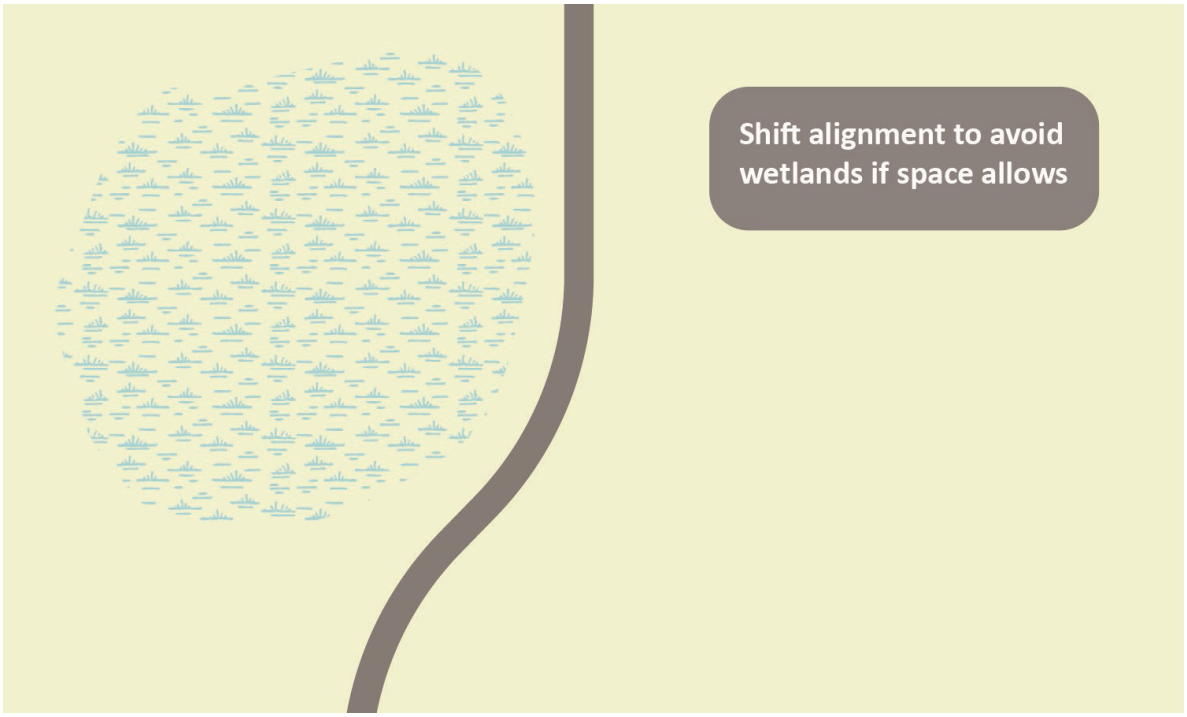
Bring in **DEP Wetlands Detailed With Outlines** into the **Active Data Layers** box by double-clicking on the selected layer. Make sure the layer is checked so you can see it on the Map View window. The legend for the Wetlands layer will be located below the **Active Data Layers** box.

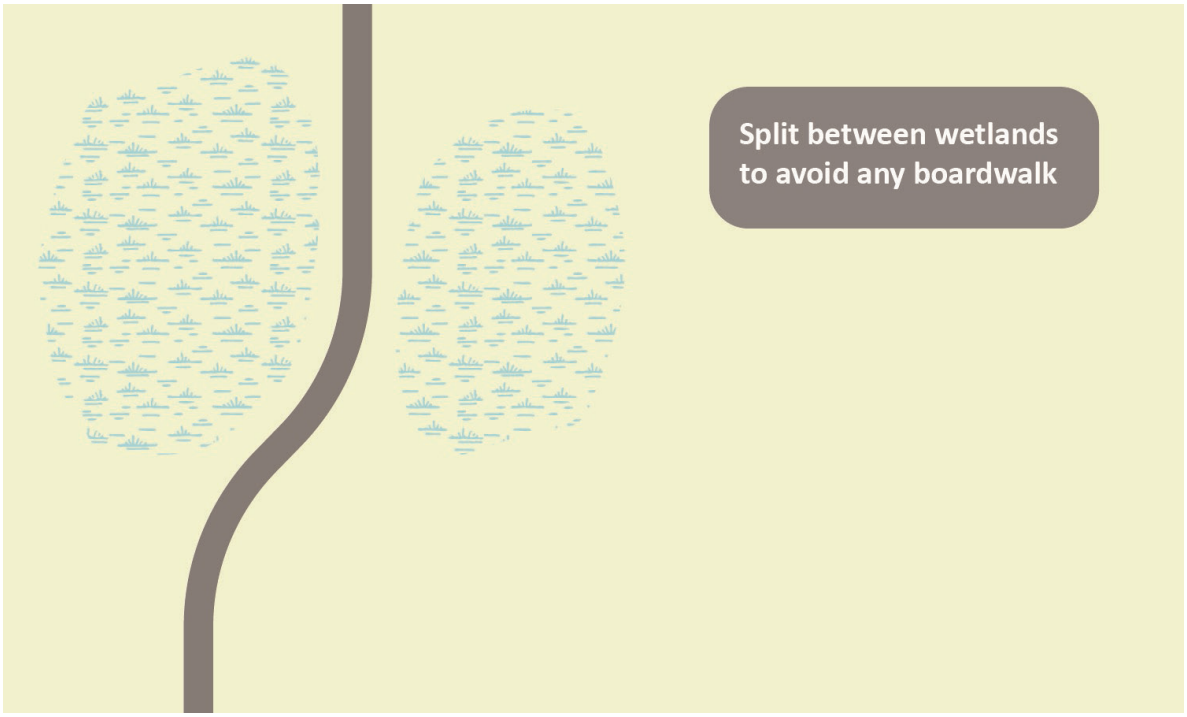


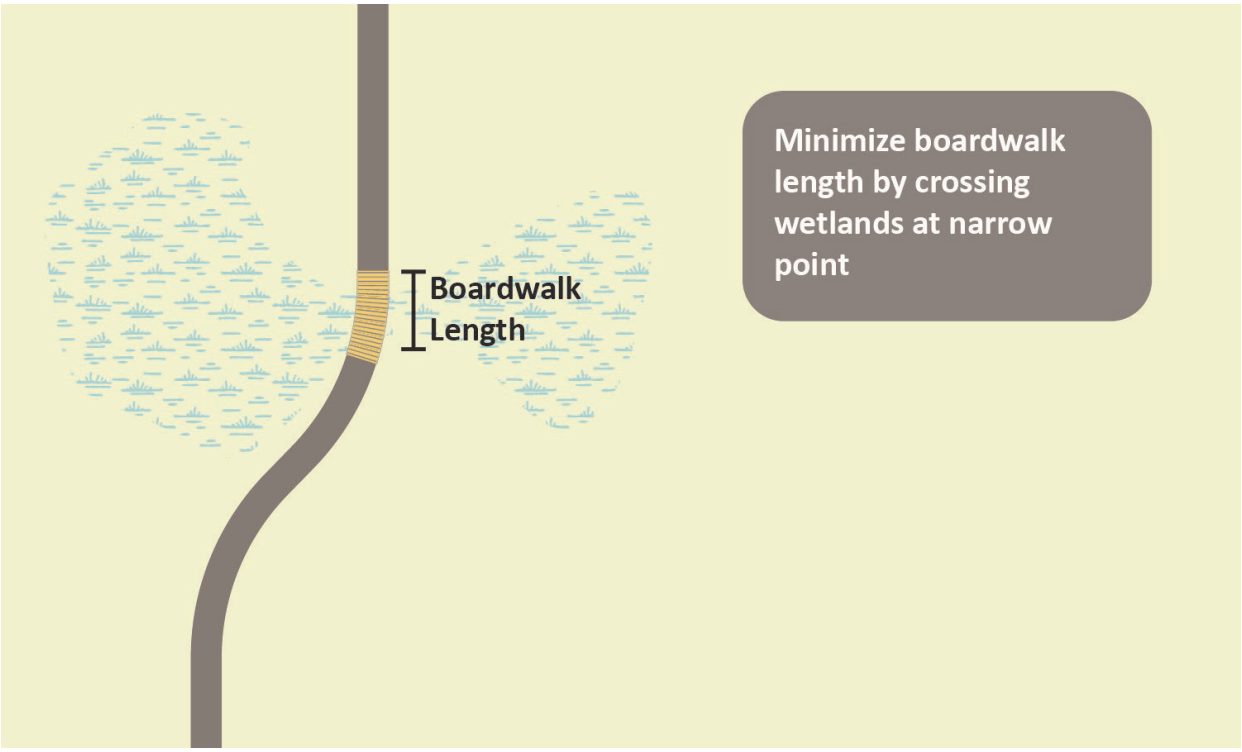
Use the **Ruler** application located in the lower left corner of the page to measure the length of the boardwalk. To make sure you are measuring in feet, click the **Ruler icon**, click on **Units**, and choose **feet**.

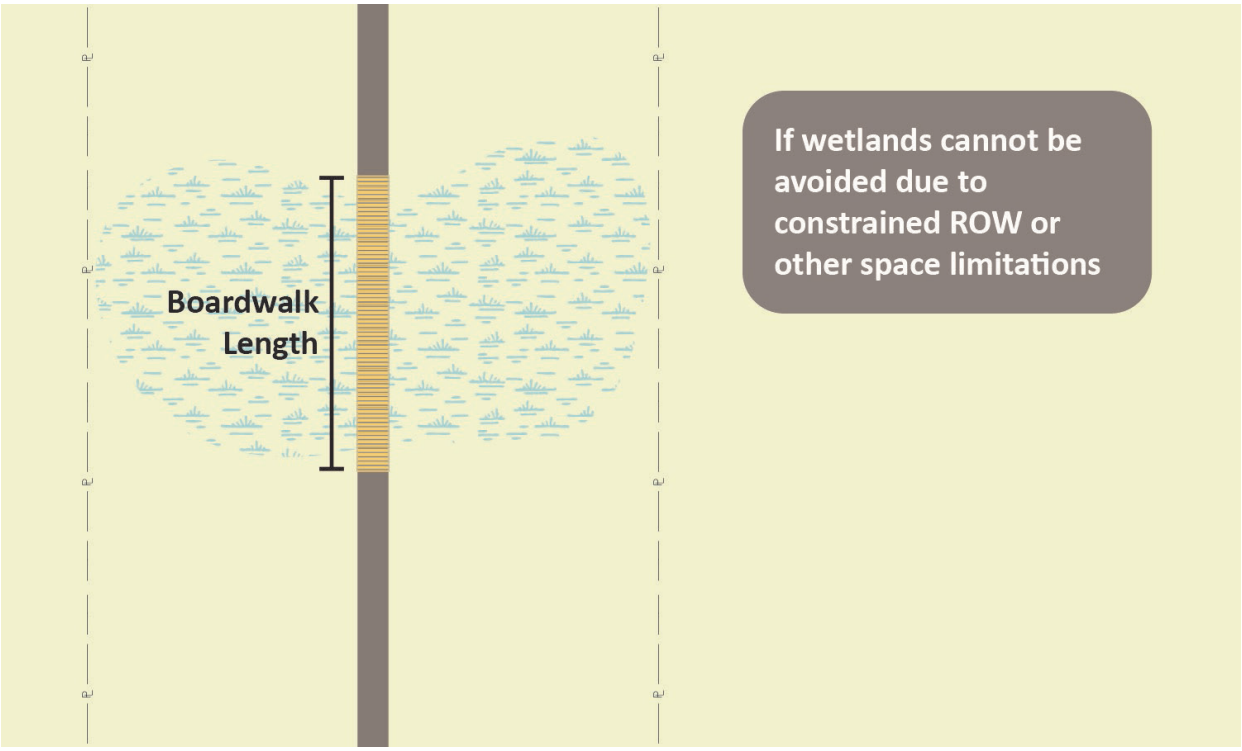


Before measuring, you should ensure that the path alignment limits disruption to wetlands as much as possible. Here are (4) scenarios of wetland layouts and how you can attempt to shift your path to limit boardwalk construction:

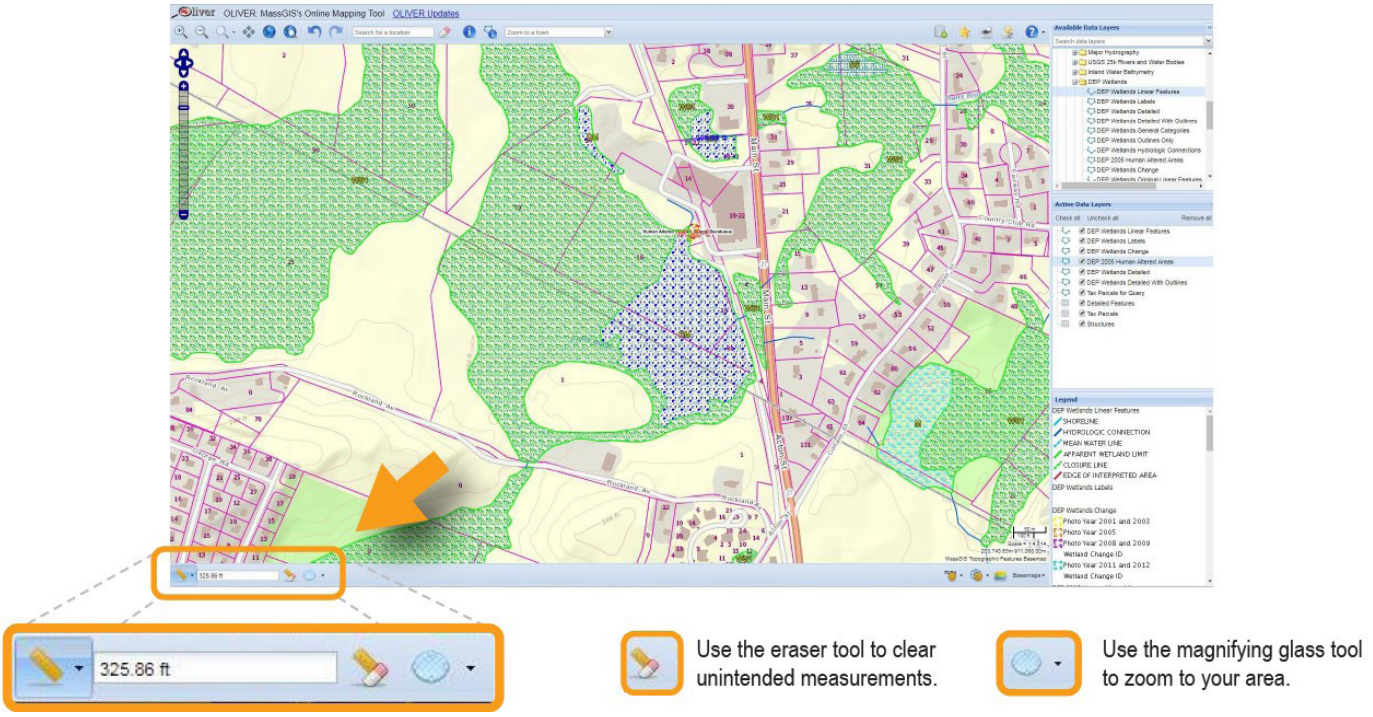





Boardwalk
Length
Minimize boardwalk length by crossing wetlands at narrow point


Boardwalk
Length
If wetlands cannot be avoided due to constrained ROW or other space limitations

Once you've determined a path, you can use OLIVER's ruler application to measure the length. To measure, make sure the **Ruler icon** is selected and bolded. Click on your starting point and continue to click along the map until you've reached your endpoint. Once you've reached the end of your measurement, double click on the map and the total value will show on the lower right corner of the page (next to the **Ruler icon**).



Input the linear feet of boardwalk into Question 11 of the User Interface worksheet (Page 1).

Clear out any extra data shown in red

11	What length of the path requires boardwalk due to unavoidable wetlands?	100 ft	
	Please see the Guidance Document and consult the MassGIS website to locate wetlands:	OLIVER	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