



# Light Rail Corridor Shared-Use Path Study

Prepared for:



Prepared by:



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**Glossary**

**Ballast Curb** – A concrete curb installed outside of the light rail track to confine the ballast and allow other features to be constructed outside of the tracks.

**Best Management Practices** – Measures taken to retain stormwater and provide pollutant removal prior to the runoff being discharged into a natural waterway.

**Bio Retention** - The process in which contaminants and sedimentation are removed from stormwater runoff. Stormwater is collected into a treatment area which usually consists of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants.

**Bus Rapid Transit** – A mode of mass transit that uses rubber-tired vehicles. These vehicles run on pavement.

**Light Rail** – A mode of mass transit that uses a train car to carry passengers. It runs on a rail system and is confined to the rail corridor.

**Permeable Pavement** – Pavement that is porous and allows stormwater to infiltrate through the pavement, removing pollutants in the process.

**Right-of-Way** – Property owned by an entity that is generally used for transportation or infrastructure owned by that entity.

**Shared-Use path** – A facility that is designed to adequately accommodate more than one type of user (i.e. pedestrians and bicycles).

**Strategic Growth Areas** – Areas within the City of Virginia Beach that have been designated as areas of preferred redevelopment. Specific area plans have been adopted by the City for these Strategic growth Areas.

**Transit Oriented Development** – Development that is specifically designed to take advantage of transit systems. They are generally close to the transit system to allow people to access the system via walking or bicycling.

**Transit Station** – Locations where the transit system stops to allow passengers to get on or off of the system.

**Abbreviations**

**AASHTO** –American Association of State Highway and Transportation Officials

**Ac** – Acre

**BMP** – Best Management Practice

**BRT** – Bus Rapid Transit

**CY** – Cubic Yard

**DEIS** – Draft Environmental Impact Statement

**DVP** – Dominion Virginia Power

**Ea** – Each

**FEIS** – Final Environmental Impact Statement

**GPIN** – Geographical Parcel Identification Number

**HRSD** – Hampton Roads Sanitation District

**HRT** – Hampton Roads Transit

**kV** – Kilovolt

**LF** – Linear Feet

**LRT** – Light Rail

**LS** – Lump Sum

**LYNX** – Light rail system in Charlotte, NC

**Mo** –Month

**MUTCD** – Manual on Uniform Traffic Control Devices

**NSRR** – Norfolk Southern Railway

**OCS** – Overhead Contact System

**SY** – Square Yard

**TOD** – Transit Oriented Development

**VDOT** – Virginia Department of Transportation



## Introduction

With the plans to extend transit from Newtown Road to the oceanfront in the City of Virginia Beach progressing, there is an opportunity to enhance pedestrian and bicycle mobility in an east/west direction along the corridor. The development of this multi-modal transportation corridor could include a system of shared-use paths to allow pedestrian and bicycle connectivity to proposed transit stations and provide a significant pedestrian and bicycle facility either along the corridor or in close parallel proximity. This shared-use path system would function as station access paths, supplementing the transit design and connecting the public to proposed transit stations. In addition to providing an east-west shared-use path through the City of Virginia Beach, transit station connectivity, and connecting existing neighborhoods and employment centers, this shared-use path system would likely be a catalyst for development and redevelopment along the transit corridor and become a heavily used amenity for the residents and visitors of the City. Six of the City's eight Strategic Growth Areas (SGAs) will be connected by this shared-use path; it will encourage interaction between the various SGAs as they continue to develop.

This project provides a study of the viability of a shared-use path between the light rail station at Newtown Road and the Norfolk Avenue Trail. The study area includes the former Norfolk Southern Railway (NSRR) right-of-way and/or parallel road rights-of-way. This east/west shared-use path has been identified as a top priority infrastructure project by the City Council-adopted Bikeways and Trails Plan.

At the time of this study, Hampton Roads Transit (HRT) has completed the development of the Draft Environmental Impact Statement (DEIS) for transit options between Newtown Road and the oceanfront. The DEIS includes light rail and bus rapid transit as two options for the mode of transit. The DEIS end-of-line options include Town Center, Rosemont Road, the oceanfront via the former NSRR, and the oceanfront via the Hilltop area. On March 12, 2015, the Virginia Beach City Council selected a Locally Preferred Alternative (LPA) that includes extending light rail from Newtown Road to Town Center. No mode of transit, or route, was selected east of Constitution Drive at this time. In response to the City Council's decision on the LPA, the Hampton Roads Transportation Planning Organization Board amended the 2034 Long Range Transportation Plan to make the Newtown to Town Center corridor a transit construction project and the remainder of the former NSRR right-of-way east to the Oceanfront a future transit corridor. For the purposes of this study, it is assumed that the mode of transit selected east of Town Center will be light rail, and the shared-use path will remain in the former NSRR right-of-way between London Bridge Road and the Norfolk Avenue Trail.

This study is highly dependent on the cooperation of HRT and their development of the light rail transit (LRT) plans. HRT is a

key stakeholder. With the LRT plans at a very preliminary stage, a collaborative effort is critical for the continued planning of this shared-use path and the transit system expansion. During the development of this study, HRT has been engaged for input and feedback, which will continue as this study and design advances.

This study will be complimented by a supplemental study that will investigate opportunities to enhance pedestrian and bicycle connectivity at the specific transit stations and within the SGAs.

## Study Area

The study area for the Light Rail Corridor Shared-Use Path, commonly referred to herein as the "path", generally follows the former Norfolk Southern Railway right-of-way. The path will start from the LRT station at Newtown Road and extend toward the oceanfront, terminating at the Norfolk Avenue Trail where Birdneck Road and Norfolk Avenue intersect. This study does not include a shared-use path through, or connecting to, the Hilltop area. If that alignment option is selected as the locally preferred alternative (LPA) by the City, a supplemental study will be needed to incorporate that area.

For purposes of this study, the corridor was divided into three sections: Newtown Road to Town Center, Town Center to London Bridge Road, and London Bridge Road to Norfolk Avenue. These sections are based on manageable study areas and are not intended to suggest, or follow any construction phasing of the transit extension.

## Plan Objective

A shared-use path operates as an off-road transportation facility that complements a roadway and transit network. The Light Rail Corridor Shared-Use Path will utilize the existing former NSRR right-of-way to transform an abandoned railroad track site into a usable, community asset, and ultimately an enhancement to surrounding development. This will create a more inviting environment for pedestrians, bicyclists, and transit users to support a flourishing transportation system along the corridor as well as provide an additional amenity for future transit oriented development (TOD). The objective of this study is to determine if a shared-use path is a feasible and implementable option within the constraints of existing conditions and proposed developments.

## Goals

The primary goals driving this study are to:

- Determine how the addition of a shared-use path along the proposed light rail track alignment can be feasible
- Create a continuous east/west pedestrian and bicycle shared-use path between Newtown Road (the western City of Virginia Beach limits) and the oceanfront



Figure 1: Section 1 - Newtown Road to Town Center



Figure 2: Section 2 - Town Center to London Bridge Road



Figure 3: Section 3 - London Bridge Road to Norfolk Avenue Trail

- Plan a pedestrian and bicycle friendly connection between proposed transit stations
- Identify a conceptual planning-level opinion of probable costs
- Conceptualize a facility to connect Strategic Growth Areas
- Supplement urban development with modes of transportation that serve pedestrian traffic
- Allow the shared-use path to serve as maintenance access to the transit system and other utility organizations that may have easement rights within the corridor

## Confines

The study area includes the existing former NSRR right-of-way and approximately a 1/2-mile width on either side of the right-of-way. The Laskin Road/Hilltop alignment alternative was not considered. For the purpose of this study, the transit mode is assumed to be light rail. This is a conservative approach, as other modes of transit would generally have the same, or a smaller footprint than light rail. The safety setbacks and clear zone dimensions were developed based on the light rail design guidelines prepared by HRT.

## Existing Conditions

### Opportunities

The City of Virginia Beach purchased the right-of-way previously owned by NSRR in anticipation of the extension of transit from the Norfolk/Virginia Beach city line at Newtown Road to the oceanfront. The former NSRR right-of-way extends from Newtown Road (where the existing Norfolk LRT system ends), to Birdneck Road at Norfolk Avenue. There is an existing shared-use path that has been constructed adjacent to Norfolk Avenue that continues eastward to Pacific Avenue at the oceanfront. This right-of-way is generally 66 feet wide. In addition to the former NSRR right-of-way, the City of Virginia Beach has also purchased an additional parcel adjacent to the transit corridor at Independence Boulevard. This parcel is referred to as the old Circuit City parcel and currently is being leased by a car dealership.

There were multiple funding sources used for the purchase of the former NSRR right-of-way and the old Circuit City parcel. In addition to those parcels, the City has acquired several parcels in the vicinity of Witchduck Road that were necessary for the construction of



Witchduck Road, Phase 2. Because of the various funding sources used to acquire all of these properties, various constraints exist on the uses of these properties. For example, the agreement for the purchase of the former NSRR right-of-way states that the corridor must be used for a transit system.

This transit corridor provides a straight swath of land through the entire city from west to east. The corridor, and the transit system within it, are critical pieces of the City's future redevelopment plans. Six of the eight SGAs are along this corridor; TOD is an element of each of those six plans. An east/west path that supports bicycle and pedestrian traffic while connecting to six SGAs supports the City's vision. A significant opportunity provided by the former NSRR right-of-way is the safe environment it creates for users of the path, being removed from the mix of vehicular traffic and managed roadway crossings.

In areas where right-of-way constraints in the former NSRR corridor do not provide adequate space for a shared-use path, there is an opportunity to take advantage of other parallel east/west right-of-ways. Temporarily diverting the shared-use path to run along streets such as Southern Boulevard, Virginia Beach Boulevard, or Bonney Road could provide additional space needed to maintain a shared-use-path. On a case by case basis, use of a parallel right-of-way would be evaluated to ensure continuity of the path. This would include factors such as distance from and sight line to the proposed transit corridor.

Funding for the extension of the light rail from Newtown Road to Town Center has been committed by the Commonwealth of Virginia towards the extension of light rail that will connect downtown Norfolk with Virginia Beach's downtown. The City of Virginia Beach will complete the funding. The current schedule projects revenue collection to begin in 2019. If it is determined that a shared-use path is feasible, the portion between Newtown Road and Town Center will be constructed as part of the light rail extension construction.

### Constraints

The most restrictive features controlling the placement of the shared-use-path are the Dominion Virginia Power (DVP) transmission lines and poles located along the corridor and within the former NSRR right-of-way. The cost of moving these transmission structures is prohibitive, forcing the alignment of the transit rail to be designed with sufficient clearance from the lines and poles both horizontally and vertically. Therefore, the transit alignment is not centered in the existing right-of-way, but offset to avoid conflicts with the transmission lines and poles. This, in turn, drives the location and cross sectional dimensions of any shared-use path options within the existing right-of-way.

Other utilities exist within the transit corridor. In addition to the Dominion Virginia Power transmission poles, there are Dominion

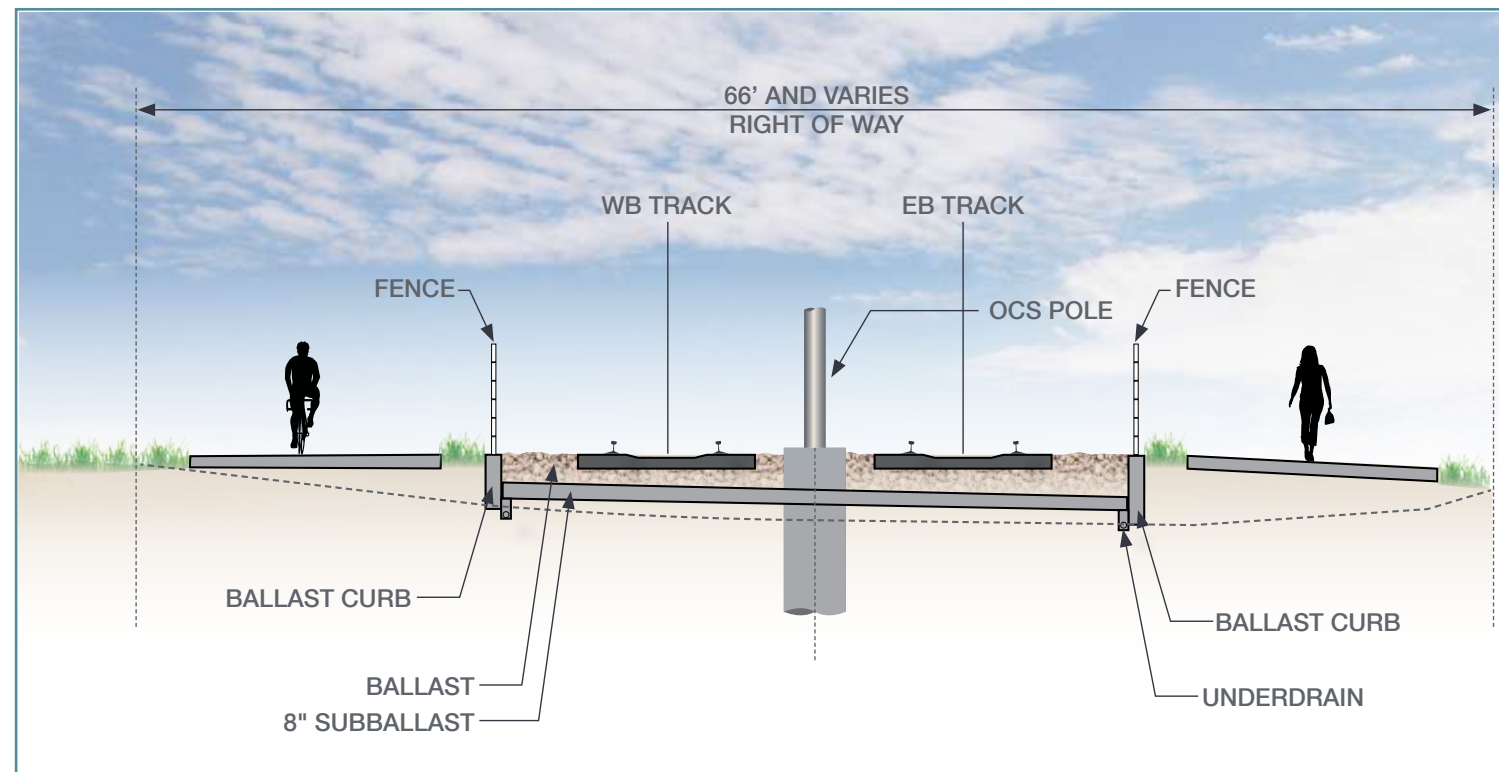


Figure 4: Ballast Curb

Virginia Power distribution poles and lines paralleling the right-of-way between Newtown Road and London Bridge Road. In addition, major underground utilities exist. A City of Virginia Beach 48"/42" water main, and Hampton Roads Sanitary District (HRSD) 36" force main are obstacles to proposed rail structural elements and underground storm drainage necessary for the transit line and the shared-use path.

Stormwater management will be a constraint since the conceptual LRT plans developed by HRT are utilizing linear ditches to provide pollutant removal. A closed-drainage system will be required to allow the shared-use path to fit within the right-of-way. Therefore, linear stormwater treatment is less viable and other treatment measures may be required. It is anticipated that additional property will need to be acquired adjacent to the former NSRR right-of-way to accommodate stormwater management.

### Dominion Virginia Power Offset Requirements

Generally, the clearances required by Dominion Virginia Power transmission lines are as outlined in (Table 1). The clearances are based upon maximum sag of transmission conductors, which changes based on operating and ambient temperatures as well as wind loading. The transmission lines along the shared-use path corridor are 230 kV. Through discussions with DVP, they have offered to review the conceptual design developed by HRT, and provide comments on horizontal and vertical offsets to their facilities.

Table 1

	Radial Clearances in Feet*		
	115kV	230 kV	500 kV
Railroads	31.5	33.5	39
Lights	17	20	26

\*Radial Clearances are measured from the conductors based on 60 degrees F ambient temperature and 48-49 mph wind load.

## Gathering Information

### Constructed Example

To develop an understanding of light rail track and shared-use path systems that have been implemented successfully, the LYNX project in Charlotte, NC was visited and studied. In the LYNX system, right-of-way and space constraints led to the use of ballast curb, and in some instances, non-standard practices were acceptable.

Ballast curb, as detailed in Figure 4, is a standard practice when right-of-way is limited. Although there is added construction cost, ballast curb allows the reduction or elimination of slopes that occupy valuable right-of-way.

To accommodate drainage, the LYNX system utilizes underdrains to transport water to appropriate outfalls. This closed drainage system model is an attractive solution for constrained spaces, but has a higher construction cost than an open conveyance system using ditches.



Figure 5: Charlotte LYNX System - Ballast Curb



Figure 6: Charlotte LYNX System - Ballast Curb



Figure 7: Charlotte LYNX System - Asset to Development



Figure 8: Charlotte LYNX System - Asset to Development



The LYNX system initially viewed their multi-use path as a means to provide connectivity to stations. However, the multi-use path has proven to be a tremendous amenity for the community. The multi-use path has helped to spur development, provided a means for connecting development, and created a passive recreational asset. The way the development community has embraced the path as a value-added amenity demonstrates the success of the LYNX pathway system.

The initial construction of the LYNX system included narrower asphalt paths to provide connectivity. When development occurred, the developers improved the path by making it wider, and reconstructing their segments out of concrete. In some cases, the developers connected their improvements to the path to enhance both the path, and their development.

### Collecting Existing Data

Base mapping used for this study is a compilation of accessible GIS information, and the conceptual LRT survey and design plans being developed for the DEIS provided by HRT. Both the horizontal and vertical LRT alignments were used in the development of the shared-use path's typical sections, alignment, and profiles.

## Alternatives Development

### Typical Section Alternatives

Meetings with City staff were held to define the design parameters and gain an understanding of the City staff's desires and objectives. As a starting point, the team began using the following parameters to develop initial concepts:

- 10-foot minimum path width for maintenance vehicle access
- 12-foot path width is desirable
- Paths on both sides of LRT guideway
- Path constructed of asphalt to minimize cost
- Closed drainage system likely necessary to accommodate the transit and shared-use paths
- Conform to VDOT guidelines

In addition to those guidelines, AASHTO guidelines for shared-use paths are as follows:

- 10-foot minimum path width
  - 11-foot minimum for bicyclists and pedestrian use with option to pass
- 2-foot minimum graded buffer
  - 3- to 5-foot desired
  - Maximum cross slope 6-foot horizontal per 1-foot vertical distance

- 2 percent maximum path cross slope
  - 1 percent cross slope desired
  - Minimum 5-foot transition length per each 1 percent change in cross slope
- 5 percent maximum grade or match adjacent roadway grade

Throughout the majority of the corridor, the former NSRR right-of-way is 66 feet wide. Early concepts that were developed revealed that in order to achieve the desirable 12-foot path widths, without realigning HRT's conceptual LRT horizontal alignment, the 12-foot path would be outside of the right-of-way on one side (See **Figure 9**).

The DVP transmission poles and line locations drive the location of the transit guideway due to clearance requirements. HRT has used a minimum 12-foot offset from the transmission poles to locate the closest rail. Due to the location of the transmission poles and subsequent rail locations, the rail is not centered in the 66-foot right-of-way. From the centerline of the rail to the ballast curb, 8.5 feet of space are required. From the ballast curb to the edge of the shared-use-path, 2 feet are required. These constrained dimensions caused a portion of one of the 12-foot paths on the north side of the proposed tracks to be outside of the existing right-of-way in the first potential typical section in **Figure 9**.

Other options were investigated and resulted in an option with a 14-foot-wide shared-use path on one side only (south side of the rail line). Reducing the facility to one 14-foot path allowed for the inclusion of open ditches on either side of the path to accommodate drainage. This typical section is shown in **Figure 10**.

One of the desires is to have connectivity between transit stations on both sides of the transit tracks. Another option was developed as a hybrid between the first two options. This typical section is pictured in **Figure 11**. Based on right-of-way restrictions, a 12-foot path was not feasible on the north side of the LRT alignment. However, along most of the corridor, a 5-foot sidewalk could be accommodated. The restricted width constrains the north side to use as a sidewalk; however, the value this adds in accessibility for pedestrian traffic coming from the north side is important. On the south side, the right-of-way allowed for a 14-foot path to run along the majority of the corridor. Having one, consistent shared-use path on one side of the LRT alignment would provide for connectivity between the transit stations and SGAs and provide continuity throughout the City. This typical section was the most desirable of the developed alternatives. If necessary, the 5-foot sidewalk could be constructed in the future, separate from the construction of the 14-foot shared-use path. Further, after the 5-foot sidewalk is constructed, agreements can be forged with future developers to require the widening of the 5-foot sidewalk to a shared-use path. This gives flexibility in the implementation of this alternative.

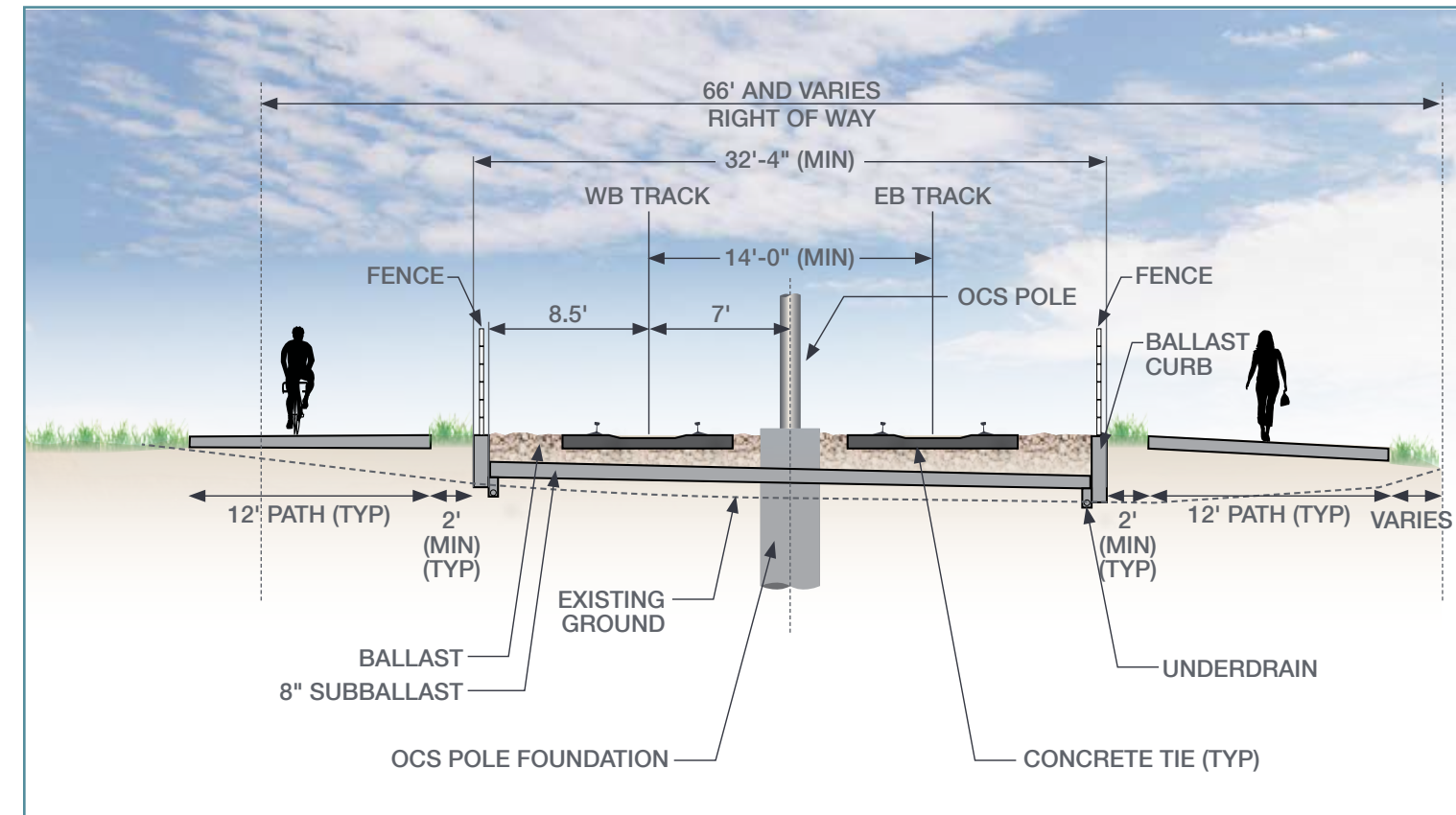


Figure 9: Typical Section - two 12-foot-wide shared-use paths

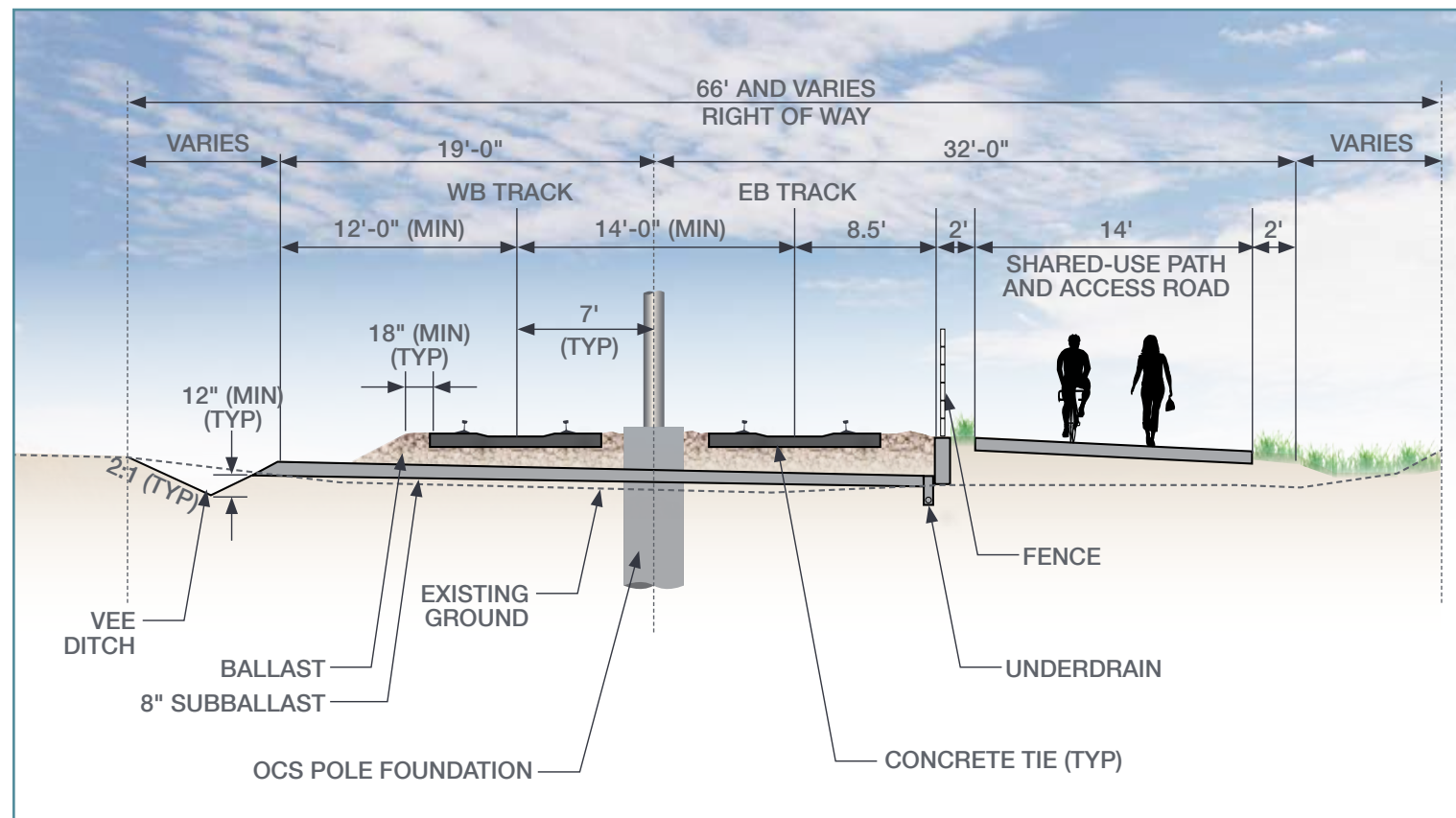


Figure 10: Typical Section - one 14-foot-wide shared-use path

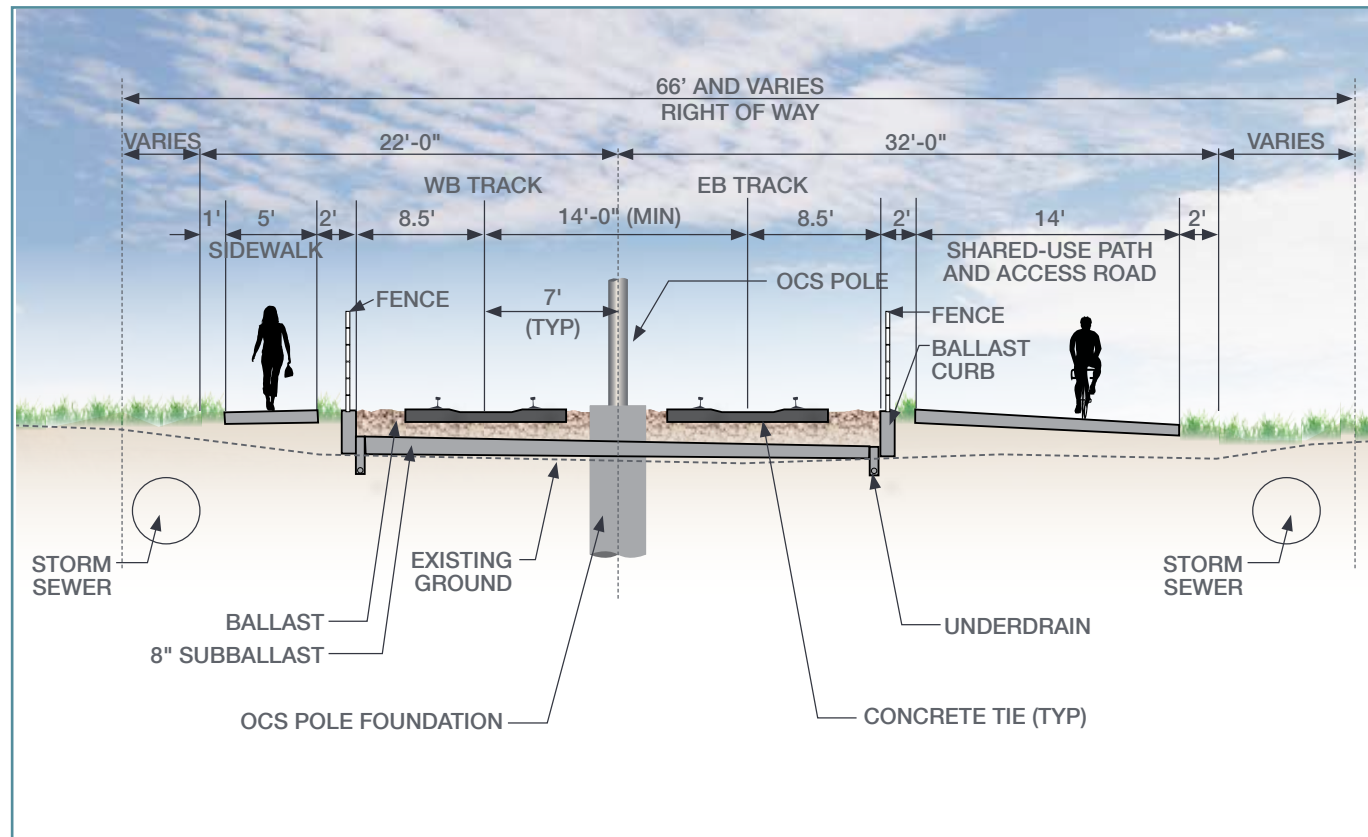


Figure 11: Typical Section – one 5-foot sidewalk and one 14-foot shared-use path

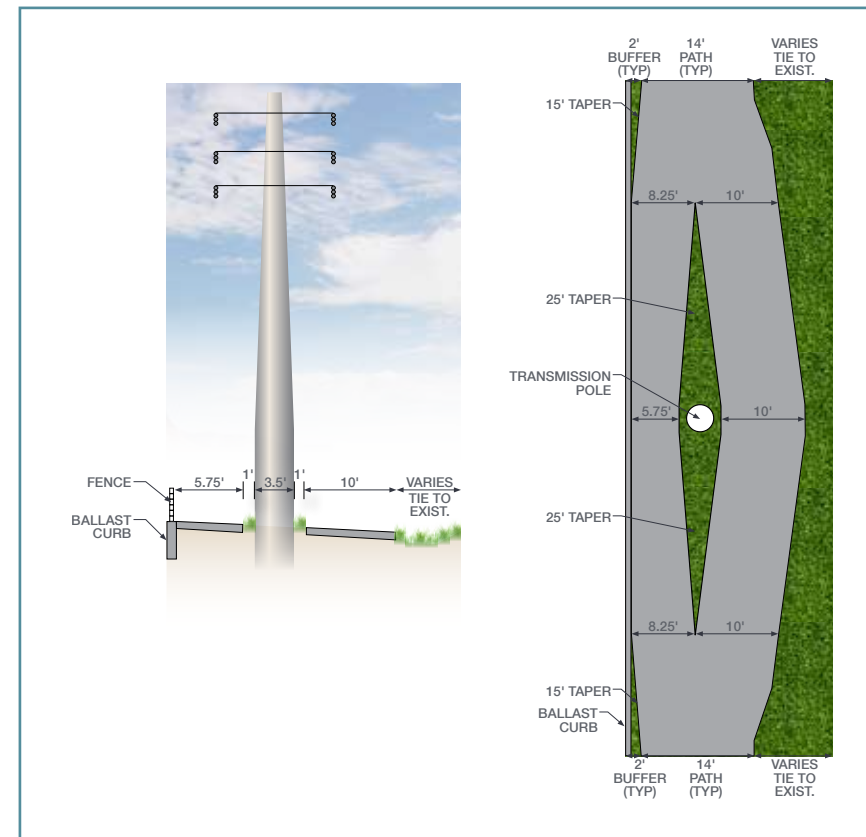


Figure 12: Pole between Newton and Princess Anne (Cross sectional view and plan view)

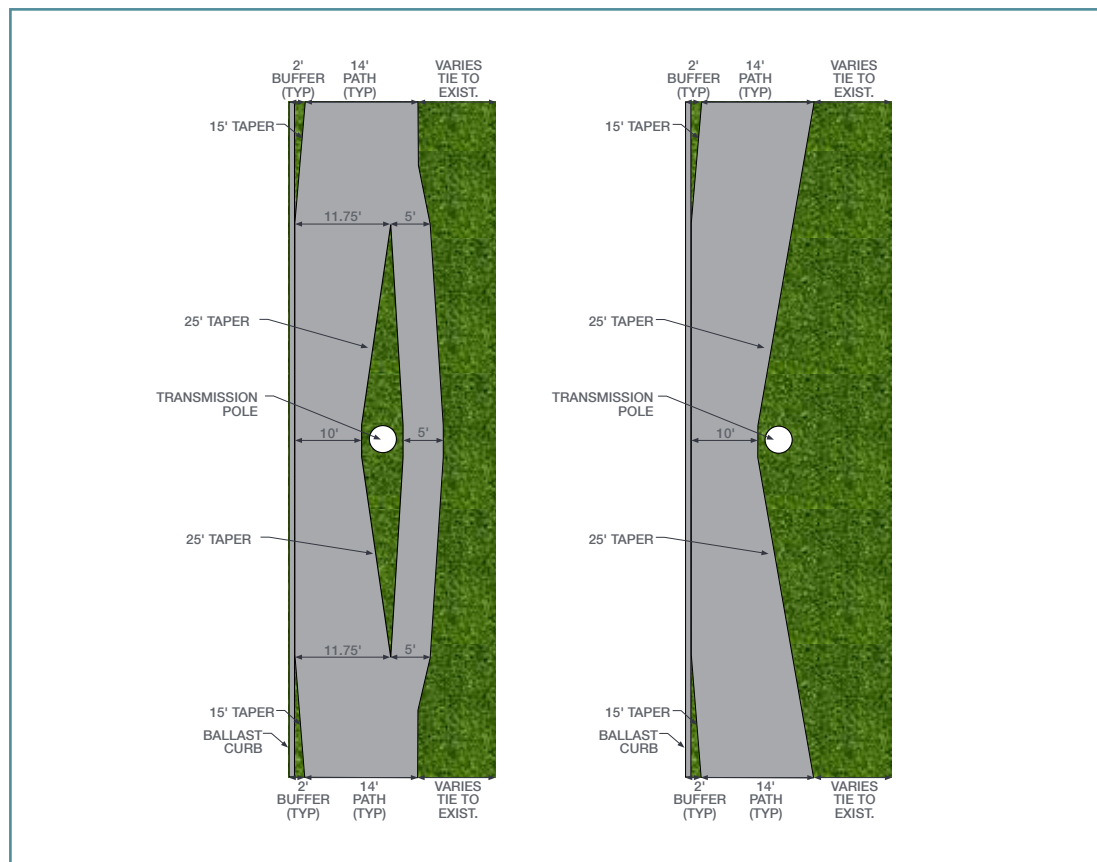


Figure 13: Pole between Princess Anne and Lowther Drive (Plan view)

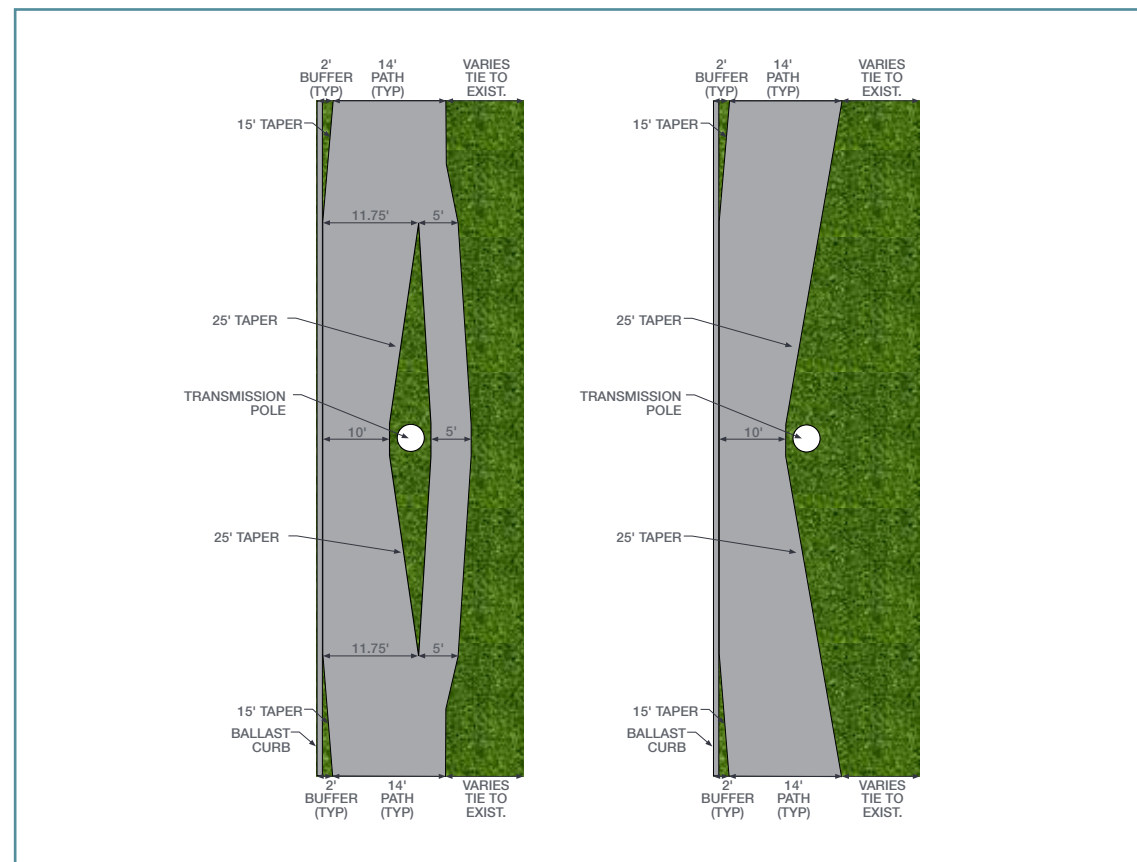


Figure 14: Pole between S. Kentucky Avenue and Lynn Shores Drive (Plan view)

In future phases of design, it will need to be determined whether the path be constructed of asphalt or concrete. A cost benefit analysis weighing cost, aesthetics, ride-ability, durability, and life cycle maintenance factors of the two materials should be completed prior to making a decision.

### Accommodating Transmission Lines and Poles in Pathway

Although the light rail track was set at a minimum horizontal clearance from the transmission poles, the poles are within the right-of-way. In many cases, the preferred placement of the 14-foot shared-use path coincides with the existing transmission pole placement. Options were developed that split the path around existing poles. It was determined that a minimum paved width of the shared-use path would be 10 feet. In situations where the shared-use path would “split” around a transmission pole, a minimum walkway width of 4 feet will be provided along with certain DVP approved physical barriers being installed around the transmission poles. Figures 12 through 14 show various treatment options of the shared-use path “splitting” around a transmission pole. These options allow for a minimum of 10 feet of pavement to accommodate a City or HRT maintenance or emergency vehicle. Based on the geometrics at any specific transmission pole location, some amount of buffer or path-side ditch will need to be paved. Taper lengths for the “split” transitions were determined according to the VDOT Road Design Manual under the assumption of a 15 mile-per-hour speed.



Existing shared-use paths across the country utilize this same design method, often termed a “splitter island” or “choker”, as a form of pedestrian traffic calming. (See **Figure 15**). In some states, standard details are available that depict the requirements for striping, colored concrete, or other material that guides pedestrians around obstacles within a shared-use pathway.



Figure 15: Washington and Old Dominion Trail

### Stormwater Management Opportunities

It was recognized early that stormwater management will be a major concern of this project since the conceptual HRT plans show intentions of using track-side open ditches for linear stormwater treatment. Since the typical section proposed with this shared-use path study reduces the amount of track-side open ditches, other stormwater treatment methods must be considered.

This project will not be grandfathered under Part IIC of the VSMP Technical Criteria for Regulated Land-Disturbing Activities: (9VAC25-870-93), and will need to follow the current regulations commonly referred to as Runoff Reduction, Part IIB (9VAC25-870-62). The current regulations favor water treatment at the source by means of infiltration; therefore the preferred best management practices (BMPs) will likely incorporate some form of infiltration. It is likely that one type of BMP will not adequately treat the required

amount of runoff. Therefore, a combination of these types may be used. Some opportunities for BMPs include:

- **Permeable pavement**

If the 5-foot sidewalk and 14-foot path were to be constructed with permeable pavement, the entire sidewalk and path could be infiltrated. This allows the stormwater runoff to begin being treated at the source. This is a viable engineering solution but would require routine maintenance by the City and may cause the construction costs to exceed the current estimates.

- **Infiltration strip under a landscaped buffer**

Along the corridor, a 2-foot landscaped buffer will run between the LRT track and the path. By placing a stone infiltration strip beneath the landscaped buffer, water will be allowed to infiltrate along the strip. This design would need to allow the water to reach existing underground sand layers for infiltration to occur. Infiltration also requires that two forms of pretreatment be used; a grass filter strip and upper sand layer would likely be chosen. More analysis will need to be done to determine the depth of the stone layer, as well the depth of the existing sand layers.

- **Linear dry/wet swales**

In areas where right-of-way is not restrictive, linear swales can be designed to treat and transport water to outfall locations.

- **Linear bioretention**

There is the possibility of including a linear bioretention system when the right-of-way does not restrict the minimum required surface area. The system would fit between the outside edge of the path and the right-of-way limit. This design will only be appropriate in areas where there is a minimum of two feet of separation between the bottom of the bioretention media, or underdrain, and the seasonally high groundwater table elevation. An underdrain will be necessary in areas where the soil does not have adequate infiltration rates.

- **Land acquisition for BMPs at outfalls**

Although not preferred under the runoff reduction methodology, retention basins or other BMPs that require land area could be constructed near identified outfalls. This would require the acquisition of land or permanent drainage easements to construct and maintain the facilities. To transport the stormwater runoff to the outfalls, ditches would be required. In cases where right-of-way is restrictive, this may require permanent easements to be acquired.

During the stormwater design phase of this project, it may be concluded that one of the options listed above does not meet the requirements as a stand-alone solution. Therefore, a combination of

these methods may be required. It is typical to use multiple BMPs to design a “treatment train” in order to meet the runoff reduction requirements. When selecting the BMP that best fits the project site, it will be important to understand the design requirements of each respective BMP and how each would integrate with the proposed improvements within the project area. A cost analysis will need to be conducted to understand the best solution.

Throughout the development of the recommended drainage design, the shared-use path should be planned so that it can be implemented as a stand-alone project. Because of this, the cross-slope of the pathway will need to drain away from the proposed transit alignment to prevent standing water. This requirement leads to the recommendation in most cases to be the use of linear dry or wet swales. The addition of permeable pavement is recommended as a supplemental option if dry or wet swales are not sufficient.

### Safety Features

In order to create a shared-use path that enhances the transit corridor, it is of high importance to all stakeholders and users of the path that safety features are incorporated. In future stages of proposed design, the shared-use path will include proper lighting, fencing between the LRT track and pedestrian and bicycle facilities, signage, pavement markings, and channelizing. There will also be emergency “blue lights” located at appropriate places along the rail and shared-use path.

## Horizontal Alignment

As stated previously, the length of the study was divided into three sections to make it more manageable. The sections include:

- **Newtown Road to Town Center** – Extension of LRT from its current terminus at the Newtown Road Station in Norfolk to Constitution Drive in the Town Center area of Virginia Beach. In March 2015, the City Council of Virginia Beach chose an LPA to extend LRT from Newtown Road to Town Center, a 3.5-mile section. This segment was one of the alternatives being considered by HRT as part of the DEIS for extending transit into Virginia Beach (see **Figure 1**).
- **Town Center to London Bridge Road** – This section begins at Constitution Drive and extends to London Bridge Road where one of the HRT alternatives for the extension of transit splits to the north to the Hilltop area. The section spans approximately 4.7 miles (see **Figure 2**).
- **London Bridge Road to Norfolk Avenue** – The study continues along the former NSRR right-of-way and terminates at the Birdneck Road/ Norfolk Avenue intersection where the path will connect with the existing Virginia Beach Trail. If the Hilltop Alternative is selected as the LPA, it is anticipated that a shared-use path would continue in the former NSRR right-of-way between London Bridge Road and Birdneck Road. Along this anticipated alignment, the path stretches about 2.8 miles (see **Figure 3**).

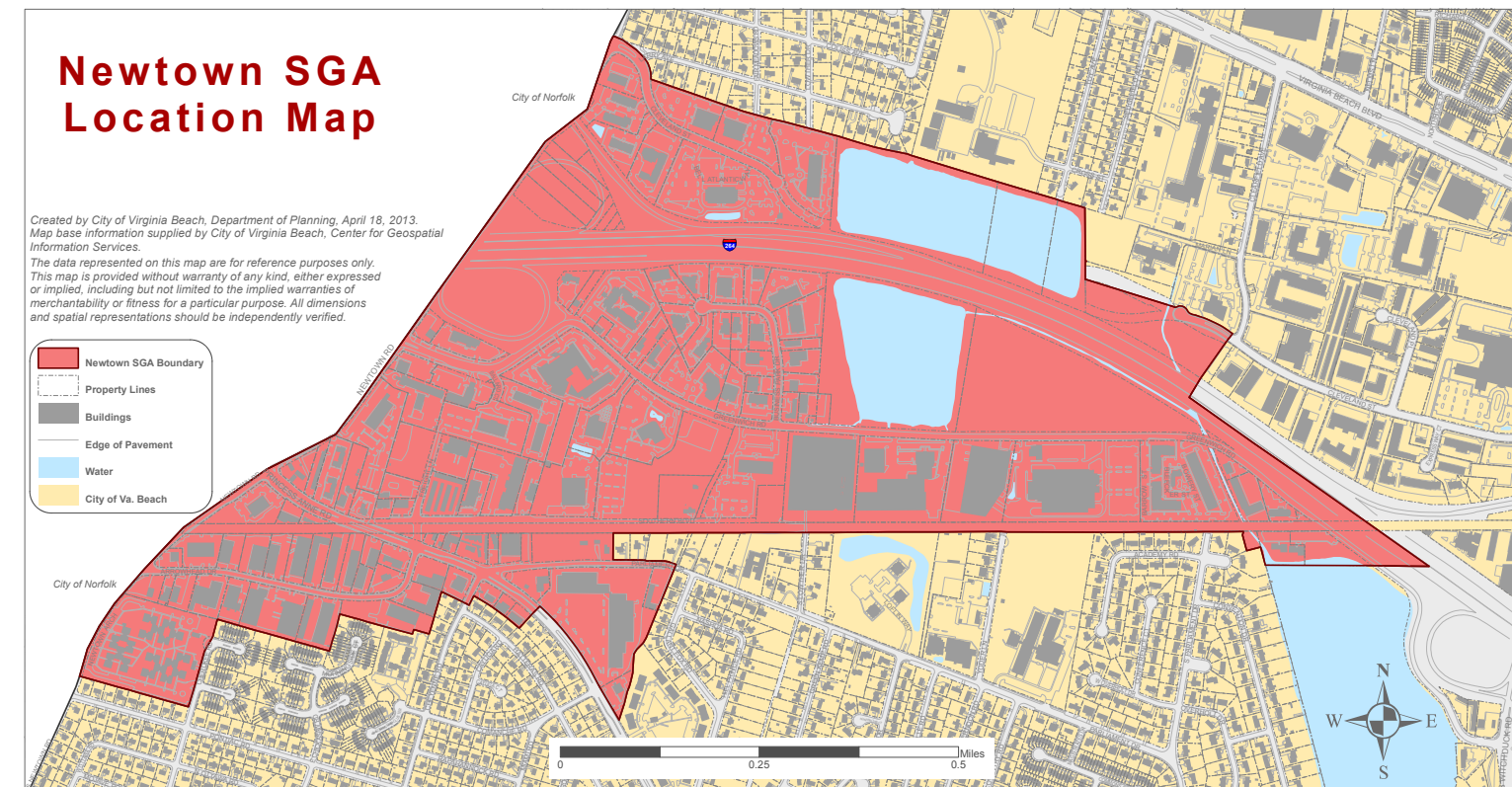


Figure 16: Newtown SGA Location Map