B&P TUNNEL PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT & SECTION 4(f) EVALUATION

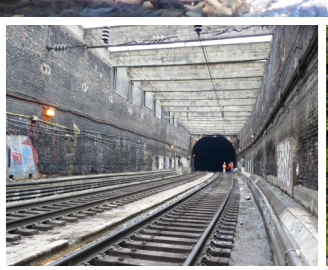
BALTIMORE & POTOMAC TUNNEL PROJECT

BALTIMORE, MARYLAND

DECEMBER 2015

U.S. Department of Transportation
Federal Railroad Administration

Maryland Department of Transportation



Baltimore and Potomac (B&P) Tunnel Project

Draft Environmental Impact Statement
&
Section 4(f) Evaluation

Prepared by:

Federal Railroad Administration

Cooperating Agency

Federal Transit Administration

Pursuant to:

National Environmental Policy Act (42 U.S.C § 4321 *et seq.*), and implementing regulations (40 C.F.R. Part 1500 *et seq.*), Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts (64 Federal Register [FR] 28545 [May 26, 1999] and 78 FR 2713 [January 14, 2013])., Section 4(f) of the U.S. Department of Transportation Act (49 USC § 303); National Historic Preservation Act (54 USC § 306101 et seq.) and implementing regulations (36 CFR Part 800); Clean Air Act as amended (42 USC § 7401 *et seq.*) and implementing regulations (40 CFR Parts 51 and 93); the Endangered Species Act of 1973 (16 USC § 1531 *et seq.*) and implementing regulations (50 CFR Part 402); the Clean Water Act (33 USC § 1251 *et seq.*) and implementing regulations (33 CFR Part 320 *et seq.* and 40 CFR Part 230); and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 USC § 4601 *et seq.*).

Dec. 8, 2015
Date of Approval

Sarah C. Feinberg
Sarah Feinberg, Administrator
Federal Railroad Administration

The following individual may be contacted for additional information concerning this document:

Michelle Fishburne, PE
Environmental Protection Specialist
Office of Railroad Policy and Development
USDOT Federal Railroad Administration
1200 New Jersey Avenue, SE
Washington, DC, 20590
info@bptunnel.com

The Baltimore and Potomac (B&P) Tunnel Project Draft Environmental Impact Statement (Draft EIS) and Section 4(f) Evaluation describes existing environmental conditions within the Study Area and provides an analysis of impacts on environmental resources of the Baltimore and Potomac (B&P) Tunnel Project. The primary purpose of the Project is to address the structural and operational deficiencies of the existing B&P Tunnel, improve passenger rail services, and support existing and future demands along the Northeast Corridor. FRA has evaluated four alternatives, including the No-Build Alternative (Alternative 1), Alternative 3A, Alternative 3B, and Alternative 3C. FRA retained these alternatives following a comprehensive alternatives development and evaluation process that incorporated input from the public as well as federal, state, and local government agencies.

FRA is making the B&P Tunnel Project Draft EIS and Section 4(f) Evaluation available for public review at the B&P Tunnel Project website (www.bptunnel.com).

Printed copies have been placed in the following locations:

Baltimore City Department of Transportation, Transit Bureau
Bentalou Recreation Center
Bon Secours Community Works
Enoch Pratt Library-Central Branch
Enoch Pratt Library-Edmondson Avenue Branch
Enoch Pratt Library-Pennsylvania Avenue Branch
Enoch Pratt Library-Walbrook Branch
John Eagar Howard Recreation Center
Maryland Department of Transportation
Maryland Transit Administration

Comments on this document are due by **February 5, 2016** and may be submitted via postal mail to 81 Mosher Street, Baltimore, MD 21217; through the online comment form (www.bptunnel.com); or by e-mail to info@bptunnel.com.

EXECUTIVE SUMMARY

The Baltimore and Potomac (B&P) Tunnel Project ("Project") considers the rehabilitation or replacement of a 1.4-mile long rail tunnel located along the Northeast Corridor (NEC) in Baltimore, Maryland. The B&P Tunnel is owned by the National Railroad Passenger Corporation (Amtrak) and used for Regional and Acela intercity rail passenger trains, Maryland Area Rail Commuter (MARC) passenger trains, and Norfolk Southern Railway (NS) freight trains.

This Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation analyzes impacts of the Project on the natural and human environment. The Federal Railroad Administration (FRA), as the lead federal agency, and the Maryland Department of Transportation (MDOT) prepared the document in accordance with the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq.* (NEPA) to assist readers in understanding the B&P Tunnel Project, the environmental review process, alternatives evaluated, potential environmental effects and consequences, and mitigation measures. The Federal Transit Administration (FTA) is involved with the development of the Project through the NEPA process as a cooperating agency in accordance CEQ regulation 40 CFR 1508.5.

A. Overview of the NEPA Process

The DEIS for the B&P Tunnel Project is a milestone within the NEPA process for the Project. The DEIS provides a description of the alternatives that are still under consideration and presents impacts at a level of detail appropriate to evaluate the alternatives. The DEIS also provides documentation of the project decisions, including the Purpose and Need for the Project, background information on the Project, a description of the affected environment in the Study Area, and information on the public involvement and agency coordination that has occurred throughout the DEIS phase of the Project. Technical Reports prepared for the Project were coordinated with the public throughout the development the project and are available on the project website at www.bptunnel.com.

Subsequent to this DEIS, a Public Hearing will be held to receive public input and comments on the DEIS. Comments on the DEIS will be received through February 5, 2016. Following the Public Hearing and comment period for the DEIS, FRA in coordination with MDOT and Amtrak will identify a Preferred Alternative for the B&P Tunnel Project. The Preferred Alternative could be Alternative 1: No Build, Alternative 3A, Alternative 3B, Alternative 3C, or some refinement of any of these alternatives. The identification of the Preferred Alternative will be based on an assessment of how the Preferred Alternative meets Purpose and Need; an assessment of rail operations, engineering, transportation, cost, construction; an assessment of all environmental impacts; and on public and agency comments received.

Two additional steps in the NEPA process include the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD). FRA in coordination with MDOT will prepare a FEIS to address comments received on the DEIS and document the identification of the Preferred Alternative. The ROD is the final step in the NEPA process. Following the receipt of comments on the FEIS, FRA will issue the ROD as the formal decision document for the selected alternative for the Project.

B. Project Background

The existing B&P Tunnel is located beneath the West Baltimore neighborhoods of Bolton Hill, Madison Park, Sandtown-Winchester, and Upton as shown in **Figure 1**. The existing tunnel is currently used by Amtrak, MARC, and NS. Built in 1873, the existing tunnel is one of the oldest structures on the NEC. It is approximately 7,500 feet (1.4 miles) long, and is comprised of three shorter tunnels and two daylighted sections. The double-track tunnel was originally constructed with brick and stone masonry; repairs have added additional building materials

over time. The existing B&P Tunnel was rehabilitated in the 1980s, and continuing repairs are required to maintain the structures.

The existing tunnel is a crucial link in the greater NEC, which runs through eight states and Washington, DC. The NEC is the nation's most congested rail corridor, and one of the highest volume corridors in the world. The NEC moves over 259 million passengers and 14 million car miles of freight cargo each year. The NEC and tunnel are owned and maintained by Amtrak, and are also used by eight commuter rail operators and four freight railroads.

C. Purpose and Need

The purpose of the Project is to address the structural and operational deficiencies of the existing B&P Tunnel and to accommodate future high-performance intercity passenger rail service goals for the NEC, including: to reduce travel time through the B&P Tunnel and along the NEC; to accommodate existing and projected travel demand for intercity and commuter passenger services; to eliminate impediments to existing and projected operations along the NEC; and to provide operational reliability, while accounting for the value of the existing tunnel as an important element of Baltimore's rail infrastructure.

The need for the project has been defined as follows:

- The existing B&P Tunnel is more than 140 years old and is approaching the end of its useful life with regard to its physical condition. While the tunnel currently remains safe for rail transportation, it requires substantial maintenance and repairs and it does not meet current design standards. The tunnel is considered to be structurally deficient due to its age, the original design, and wear and tear. The tunnel is also functionally obsolete and unable to meet current and future rail demands due to the combination of its vertical and horizontal track alignment, i.e. its grades and curves. The low-speed tunnel creates a bottleneck at a critical point in the NEC, affecting operations of the most heavily traveled rail line in the United States.
- The existing B&P Tunnel does not provide enough capacity to support existing and projected demands for regional and commuter passenger service along the NEC.
- The existing B&P Tunnel is not suited for modern high-speed usage due to the current horizontal and vertical track alignments, which limit passenger train speeds through the tunnel to 30 mph.
- The existing B&P Tunnel is a valuable resource. The disposition of the existing tunnel needs to be considered in the Project.

D. Alternatives

This DEIS includes a detailed evaluation of four Alternatives for the B&P Tunnel Project: Alternative 1: No-Build, Alternative 3A, Alternative 3B, and Alternative 3C. These alternatives were retained through a comprehensive alternatives development and evaluation process that incorporated input from the public as well as federal, state, and local government agencies. The alternatives development and evaluation process identified 16 Preliminary Alternatives as show in **Table 1**.


Liberty Square
Burleith Leighton
Hanlon Longwood
Gwynns Falls Pw
Mondawmin
Walbrook
W North Ave
Coppin Heights/Ash-Co-East
Rosemont
CSX
Winchester
Bridgeview/Greenlawn
Mosher
Edmondson Ave
Carroll-South Hilton
Druid Hill Park
Penn North
McCulloh St
Reservoir Hill
N Monroe St
N Fulton Ave
Druid Hill Ave
Sandtown-Winchester
Gilmor St Tunnel
Existing B & P Tunnel
Wilson St Tunnel
McMechen St
John St Tunnel
Charles Interlocking
Remington
CSX
Charles Village
Better Waverly
Barclay
East Baltimore Midway
Charles North
Penn Station
Amtrak Northeast Corridor
Bolton Hill
Eutaw Pl
Mid-Town Belvedere
Howard St Tunnel
St Paul St
Johnston Square
Upton
W Lafayette Ave
Pennsylvania Ave
Fremont Ave
Martin Luther King Jr. Blvd
Harlem Park
W Franklin St
W Mulberry St
Seton Hill
Mount Vernon
Downtown
Poppleton
Franklin Square
University
Bridge Interlocking
West Baltimore MARC
Amtrak Gwynns Falls Bridge
Amtrak Northeast Corridor
Existing B&P Tunnel
B & P Tunnel Openings
Light Rail Station
Metro Station
Metro Line
Light Rail Line
Railroad
Interstate
Parks
Charles and Bridge Interlockings
Figure 1: B&P Tunnel Project Study Area Overview
0 0.125 0.25 0.5 Miles
NORTH
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Table 1: B&P Tunnel Project Preliminary Alternatives

Alternative 1: No-Build	Alternative 2: Restore/Rehabilitate Existing B&P Tunnel
Alternative 3: Great Circle Passenger Tunnel	Alternative 4: Presstman Street
Alternative 5: Route 40	Alternative 6: Locust Point
Alternative 7: Sports Complex	Alternative 8: Wilson Street – Existing Tunnel
Alternative 9: Mosher Street North	Alternative 10: Mosher Street South
Alternative 11: Robert Street South	Alternative 12: Robert Street North
Alternative 13: Wilson Street – Under Existing Tunnel	Alternative 14: North Avenue Bridge
Alternative 15: Gilmor Street – Existing Tunnel	Alternative 16: North Avenue Tunnel

These 16 alternatives were evaluated in a Preliminary Screening Analysis that resulted in four Alternatives remaining (Alternatives 1, 2, 3, and 11) based on environmental impacts, public comments, and meeting Purpose and Need. This process is documented in the *Preliminary Alternatives Screening Report*.

Alternatives 1, 2, 3, and 11 were further refined to include options for Alternatives 3 and 11 for a total of seven Alternatives: 1, 2, 3A, 3B, 3C, 11A, and 11B. These seven Alternatives were compared and evaluated, and Alternatives 2, 11A, and 11B were eliminated. The documentation of this step in the process can be found in the B&P Tunnel *Alternatives Report*.

The alternatives retained for further review in this Draft Environmental Impact Statement and Section 4(f) Evaluation include Alternatives 1, 3A, 3B, and 3C.

1. Alternative 1: No-Build

Alternative 1: No-Build serves as the baseline for analysis of the Build Alternatives. It entails continued use of the existing B&P Tunnel with no significant improvements aside from routine maintenance. Alternative 1 would not meet the Purpose and Need for the project, but is retained as the baseline for comparison of the Build Alternatives.

2. Alternatives 3A, 3B, and 3C

Alternatives 3A, 3B, and 3C would provide a tunnel in a wide arc north of the existing B&P Tunnel. The wide, continuous arc allows trains to travel at higher speeds in comparison to the existing NEC alignment. Each of the three alternatives propose tracks in four separate tunnel bores extending between the north and south portals. The track alignments would remain below ground until exiting through the tunnel portals, where the tracks would transition back to the surface. Alternatives 3A, 3B, and 3C would each involve open cut and cut-and-cover sections to bring the tracks to the surface after exiting the portals. Tracks would pass through the portals then through a cut-and-cover section, followed by an open cut (trench) section prior to connecting with the existing NEC alignment.

From an engineering standpoint, Alternatives 3A, 3B, and 3C:

- Have identical maximum and minimum design speeds.
- Have similar tunnel depths and vertical grades.
- Provide universal interlocking to the NEC mainline.
- Avoid MTA's Metro Subway tunnel.

- Service the West Baltimore MARC Station and Baltimore Penn Station
- Include four tracks in four separate tunnel bores, and each includes "duck under" alignments to permit conflict-free operations.
- Require a ventilation plant at each portal and at an intermediate point along the tunnel.

Alternatives 3A, 3B, and 3C differ from one another primarily with regard to the location and impact of the south portal, and their impact to the existing West Baltimore MARC station. Alternative 3A allows the existing West Baltimore MARC station to remain in its current location. As a separate project, the MTA could and has been studying rebuilding the station to accommodate high level platforms several hundred feet south of the existing station and parking lots. Alternatives 3B and 3C would impact the Station and reconstruct a new West Baltimore MARC Station as part of the Project in the same location as the existing station.

Table 2 provides a detailed comparison of Operations, Engineering, Transportation, Cost, Construction, and Environmental criteria used to evaluate and compare Alternatives 1, 3A, 3B, and 3C.

E. Future of the Existing B&P Tunnel

The existing B&P Tunnel is a functioning railroad structure connecting Baltimore Penn Station with the NEC. If Alternative 1: No-Build is selected as the Preferred Alternative, the tunnel would continue use in its current configuration and condition, with maintenance limited to that necessary to maintain safe operation. If any of the Build Alternatives are selected as the Preferred Alternative, the existing tunnel would be replaced by new tunnels north of the existing location. Under each Build Alternative, the disposition of the existing B&P Tunnel will need to be evaluated. Three options for disposition of the existing B&P Tunnel include: close with no additional use ("abandonment"); modify train use (ie. single track); or convert for alternative use.

F. Affected Environment and Environmental Consequences

The B&P Tunnel Project would impact the human and natural environment. This section describes existing environmental conditions in the Study Area as well as the environmental consequences of the Project.

Because Alternative 1: No Build would involve no significant changes to the existing B&P Tunnel alignment aside from routine maintenance, no environmental impacts would occur under Alternative 1.

Generally, because the majority of the alignments are below ground, impacts occur at the tunnel portals, along the surface sections of new tracks (trackways), and at the intermediate ventilation plant location.

1. Socioeconomics

a. Land Use

The Study Area encompasses approximately five percent of the total land in Baltimore City. Most land use is residential. In 2013, there were 38,059 housing units within the Study Area representing 12.8 percent of the total housing units within Baltimore City. Approximately 69.3 percent of the housing units were occupied, which is lower than the proportion of occupied housing in Baltimore City (81.5 percent) and Maryland (89.9 percent). The Study Area currently contains six publicly-owned housing developments, with a total of 2,467 units, dispersed throughout the Study Area. There are also 22 affordable housing apartment developments with a total of 3,111 units.

Table 2: Summary of Potential Engineering-and Environmental Impacts

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Operations	**1. Travel Time Between Baltimore Penn Station and Gwynns Falls Bridge (southbound/northbound)**	Minutes: Seconds	Amtrak Acela 5:43/6:10 Amtrak Regional 5:50/6:19 MARC 5:50/6:14	Amtrak Acela 3:59/4:02 Amtrak Regional 4:19/4:19 MARC 4:56/4:17	Amtrak Acela 3:24/3:25 Amtrak Regional 3:43/3:34 MARC 4:22/3:56	Amtrak Acela 3:27/3:27 Amtrak Regional 3:46/3:37 MARC 4:33/4:04
	2. Travel Time Savings over Alternative 1 (southbound/northbound)	Minutes: Seconds	Not Applicable	Amtrak Acela 1:56 Amtrak Regional 1:46 MARC 1:26	Amtrak Acela 2:32 Amtrak Regional 2:26 MARC 1:53	Amtrak Acela 2:30 Amtrak Regional 2:23 MARC 1:44
	3. Value of Time Savings for All Passengers[1]	Dollars per year	Not Applicable	$32.5 Million per Year	$43.4 Million per Year	$42.3 Million per Year
	4. Lowest Design Speed within the Alignment	MPH	30 mph	50 mph	50 mph	50 mph
	5. Maximum Design Speed along the Alignment	MPH	75 mph	100 mph	100 mph	100 mph
	6. Average Operating Speed (southbound/northbound)	MPH	Amtrak Acela 35/34 mph Amtrak Regional 34/34 mph MARC 34/34 mph	Amtrak Acela 54/56 mph Amtrak Regional 50/52 mph MARC 44/52 mph	Amtrak Acela 63/66 mph Amtrak Regional 57/63 mph MARC 49/57 mph	Amtrak Acela 65/68 mph Amtrak Regional 59/65 mph MARC 49/57 mph
	7. Operational Flexibility and Reliability	High Medium Low	Low – only two tracks in common bore	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks

[1] 2040 Projected ridership, 2015 dollars

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	8. Meets Projected Year 2040 Level of Service for Amtrak/ MARC/ Freight	Yes/No	No – two tracks does not accommodate projected level of service; does not accommodate double-stack freight	Yes	Yes	Yes
Engineering	**9. Length of Alignment between Baltimore Penn Station and Gwynns Falls Bridge**	Miles	3.5 Miles	3.66 Miles	3.66 Miles	3.83 Miles
	10. Length of Tunnel	Miles	1.42 Miles	1.91 Miles	2.03 Miles	2.23 Miles
	11. Steepest Vertical Grade	% Grade	1.3%	2.0%	2.0%	2.0%
	12. Ability to Meet Current Project Design Criteria: Passenger (P) and Freight (F)	High Medium Low	Low (P) Low (F) Two tracks in a single bore; does not accommodate double-stack freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight
	13. Depth of Tunnel	Average Depth in Feet	15 foot average depth	130 foot average depth	130 foot average depth	140 foot average depth
	14. Extent of Major Utility Relocations	Minor Moderate Major Severe	None	Major – Relocations in the general vicinity of tunnel portals	Severe – Relocations extend significant distances outside of tunnel portal areas	Major - Relocations in the general vicinity of tunnel portals
Transportation	**15. Estimated Number of On-Street Parking Spaces Lost**	# Spaces	0	0	150	40
	16. Requires Reconstruction of West Baltimore MARC Station	Yes/No	No	No	Yes	Yes
	17. West Baltimore MARC Station in proximity to Existing MARC Parking	Yes/No	Yes	Yes	Yes	Yes

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	18. Allows for High-Level Platforms for West Baltimore MARC Station between Franklin and Mulberry Streets	Yes/No	No	No	Yes	Yes
Cost	**19. Capital Cost Estimate**	YOE $	$0	$ 3.7 Billion	$ 4.0 Billion	$ 4.2 Billion
Construction	**20. Impacts to Existing Amtrak Operations during Construction/ Rehabilitation**	Minor Moderate Major Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	21. Impacts to Existing MARC Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	22. Impacts to Existing LRT Operations During Construction/ Rehabilitation	Minor Moderate Severe	None – Construction would be contained within existing tunnel.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	23. Impacts to Existing NEC Freight Rail Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting freight operations; only final cutover would cause minor impacts.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.
	24. Temporary Community Impacts During Construction	High Medium Low	None	Low – The portal construction area is mostly located in either existing Amtrak ROW or industrial property.	Medium – Portal construction would impact residential and industrial areas east of the existing NEC.	Medium – Portal construction would impact residential and industrial areas west of the existing NEC.
Right-of-Way (ROW)	**25. Surface Right-of-Way Acreage Required, by land use type[2]**	Acres	Residential: 0 Acres Commercial: 0 Acres Industrial: 0 Acres Other: 0 Acres **Total: 0 Acres**	Residential: 0 Acres Commercial: < 0.1 Acres Industrial: 2.5 Acres Other: 5.3 Acres **Total: 7.8 Acres**	Residential: 1.9 Acres Commercial: 3.1 Acres Industrial: 5.1 Acres Other: 7.0 Acres **Total: 17.1 Acres**	Residential: 0.9 Acres Commercial: 1.7 Acres Industrial: 6.2 Acres Other: 7.1 Acres **Total: 15.9 Acres**
	26. Surface Acreage of Roadway LOD	Acres	0 Acres	1.4 Acres	4.0 Acres	5.4 Acres
	27. Estimated Surface Parcels Impacted	# of Parcels	0	10	100	40
	28. Area of Excavation (including open cut)	Acres	0 Acres	10.2 Acres	14.9 Acres	17.1 Acres
	29. Area of Permanent Open Cut	Acres	0 Acres	5.6 Acres	12.5 Acres	12.9 Acres

[2] Does not include existing Amtrak ROW. Includes temporary and permanent

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Community Resources	**30. Estimated Residential Building Displacements**	# Displaced	0	0	48	24
	31. Estimated Business Displacements	# Displaced	0	2	9	10
	32. Estimated Community Facility Displacements[3]	# Displaced	0	0	5	1
	33. Estimated Residential Properties Impacted, but Residence Not Displaced[4]	# of Parcels	0	< 5	15	< 5
	34. Estimated Non-Residential Properties Impacted with No Displacement[3]	# of Parcels	0	< 5	10	10
	35. Right-of-Way Impacts within Minority Population Areas	Acres	0 Acres	5.8 Acres	15.1 Acres	13.9 Acres
	36. Right-of-Way Impacts within Low Income Population Areas	Acres	0 Acres	0.9 Acres	2.4 Acres	5.0 Acres
	37. Impacts to Baltimore City's *West Baltimore MARC Station Master Plan*	Minor Moderate Severe	None – Compatible with West Baltimore MARC Station Master Plan	None – Compatible with West Baltimore MARC Station Master Plan	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.
	38. Parks Potentially Impacted	# of Parks	0	0	1 – Lafayette and Payson Park	0
	39. Estimated Area of Parkland Impacted	Acres	0 Acres	0 Acres	< 0.1 Acres	0 Acres

[3] Includes schools, churches, community centers, libraries, hospitals, police and fire stations
[4] Permanent or temporary impacts to property

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Cultural	**40. Adverse Effects for Historic Properties**	Number of Properties (Number of Contributing Elements)	0	6 (6 contributing historic elements impacted)	8 (87 contributing historic elements impacted)	10 (132 contributing historic elements impacted)
	41. Area of Surface disturbance within Historic District	Acres	0 Acres	12.0 Acres – Monroe-Riggs, Baltimore & Potomac Railroad, and Midtown-Edmondson Historic Districts	25.3 Acres – Edmondson Avenue, Baltimore & Potomac Railroad, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic District	20.3 Acres – Baltimore & Potomac Railroad, Edmondson Avenue, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic Districts
	42. Known Archaeological Resource Sites Impacted	# of Sites	0	0	0	0
Natural Resources	**43. Stream Impacts**	Linear Feet	0 Feet	0 Feet	0 Feet	0 Feet
	44. Wetland Impacts	Acres	0 Acres	0 Acres	0 Acres	0 Acres
	45. Estimated Street Trees Impacted	# of Trees	0	0	2	1
	46. Forested Land Impacted	Acres	0 Acres	1.5 Acres	2.5 Acres	3.7 Acres
	47. 100-Year Flood Plain Impact	Acres	0 Acres	3.5 Acres	3.5 Acres	3.5 Acres
Other Environmental	**48. Use of Section 4(f) Properties**	Number of Properties	0	5	11	10
	49. Hazardous Materials Sites Identified	# of Low, Medium, and High Priority Sites (and Total #)	N/A	57 Low, 29 Med, 6 High (92 Total)	71 Low, 37 Med, 6 High (114 Total)	92 Low, 52 Medium, 9 High (153 Total)
	50. Estimated Number of Buildings with Potential Noise Impacts	# of Buildings, Moderate or Severe	0 Severe 0 Moderate	0 Severe 254 Moderate	175 Severe 1,078 Moderate	111 Severe 979 Moderate

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	51. Estimated Number of Sites with Potential Vibration Impacts	# of Sites	24	69	138	92
	52. Permanent Negative Visual Impacts	Low Medium High	None	Medium – would construct new south tunnel portal and portal ventilation plant in primarily industrial area and construct an intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area

The majority of the Alternative 3A, 3B, and 3C alignments would be bored approximately 100 feet below the existing surface. As a result, surface land use impacts would be minimized and restricted to primarily portal and ventilation plant area locations. No housing displacements would occur under Alternative 3A. Alternative 3B would potentially displace 48 housing units as a result of south portal construction. These potentially displaced housing units are located in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods. Alternative 3C would potentially displace 24 housing units as a result of south portal construction. These potential housing unit displacements are located west of the existing tracks, clustered in the Rosemont Homeowners/Tenants neighborhood. Property acquisition activities, including relocations, would be performed in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) and all applicable state laws. Two business displacements would occur under Alternative 3A, nine under Alternative 3B, and 10 under Alternative 3C.

The location of the intermediate ventilation plant location is proposed at the south side of the intersection of Brookfield Avenue and Whitelock Street avoiding existing residences. The parcel is currently owned by the City of Baltimore and used by the Reservoir Hill neighborhood as a community garden. The parcel is currently zoned as Neighborhood Business District/Community Business District and would be converted to a transportation use under Alternatives 3A, 3B, and 3C.

b. Environmental Justice

In 2013, the total population of the Study Area by Census Block Group was 65,762 people. Eighty-seven (87.2) percent identified as minorities, which was higher than the Baltimore City average of 72.0 percent. Of the 26,358 households for which income was calculated in the Study Area, 8,812 households (33.4 percent) had income at or below the federal poverty level, which indicates low-income for the purposes of this study. The Study Area Census Block Groups contained a percentage of low-income households that was substantially higher (33.4 percent) than the Baltimore City average of 22.0 percent.

The U.S. Department of Transportation has defined a “disproportionately high and adverse effect” on minority and low-income populations as an adverse effect that:

- Is predominantly borne by a minority population and/or a low-income population; or
- Will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non- low-income population.

As a tool for evaluating the proportionality of impacts and benefits, this analysis identifies “EJ populations” within the Study Area. An “EJ population” is defined to include any Census Block Group in which the minority or low-income population meets either of the following thresholds:

- The minority or low-income population in the Census Block Group exceeds 50 percent, or
- The percentage of a low-income population in the affected area is “meaningfully greater” than the percentage of low-income people in the general population.

To determine whether impacts would be disproportionately high and adverse to identified EJ populations, the analysis identifies the potential for adverse effects on human health and safety and environmental resources in the Study Area described in this DEIS. Those impacts by alternative, geographic areas and type of impacts are identified and determined whether they occur to EJ populations. When impacts to EJ populations are identified, the impacts experienced by the affected population are compared to those experienced by others residing in the entire project boundary. A disproportionately high and adverse effect on minority and low-income population is defined as an impact that:

- Would be predominately borne by a minority and/or low-income populations in an EJ population, or
- Would be appreciably more severe or greater in magnitude than the adverse effect to the non-minority or non-low-income population in the affected area.

The DEIS compares the impacts of the Build Alternatives to the No Build and to each other. Alternative 3A has no high and adverse impacts, whereas Alternative 3B and Alternative 3C have high and adverse impacts in the following areas: property acquisition; housing displacement; land use/zoning; visual quality; community facilities; and noise.

Measures that would mitigate the severity of potential effects to less than high and adverse impacts would include efforts to relocate impacted residents and community facilities within the same community and provide fair compensation and relocation assistance.

c. Transportation

Transportation infrastructure in the Study Area includes the NEC, MARC commuter rail service, MTA Light Rail and Metro Subway services, a roadway network, and local bus service. While the Project could create short-term impacts to the operation of existing streets, long-term impacts are minimal.

Alternatives 3B and 3C would require reconstruction of the West Baltimore MARC Station in order to align with the new trackway. The reconstructed MARC Station would remain in the same location between Franklin and Mulberry Streets and adjacent to existing parking facilities. Rail services would be maintained during construction of any of the three Build Alternatives.

d. Neighborhoods and Community Facilities

The Study Area neighborhoods reflect the typical character of older, established urban areas, with historic architecture, highly trafficked pedestrian spaces, busy thoroughfares, and quieter residential roads. The neighborhoods are primarily residential, composed mainly of single-family attached rowhomes and several garden apartment complexes. The Study Area features a variety of commercial and industrial businesses, such as convenience stores, bar/restaurants, clothing retail, and automotive care, located along the main thoroughfares of North Avenue and Pennsylvania Avenue. The Study Area contains a wide range of community facilities and public services that are locally oriented and serve the region, including churches and other places of worship, cemeteries, schools, libraries, and parks.

Under Alternative 3A, no community facilities would be displaced. Under Alternative 3B, five churches would be displaced, one park would require a partial acquisition, and one school would experience temporary impacts due to construction. Alternative 3C in the south portal area would require displacing one community facility, the Charles R. Thomas Fire Station at 2249 Edmondson Avenue. The Alternative 3C displacements would be clustered near the intersection of Lauretta Avenue and North Bentalou Street in the Rosemont neighborhood.

2. Cultural Resources

Determination of impacts to cultural resources includes definition of an Area of Potential Effects (APE) which is the geographic area within which the project may directly or indirectly alter the character or use of historic properties.

a. Historic Architecture

Eighteen historic properties were identified within the APE. Project effects were determined by applying the Section 106 criteria of adverse effect (36 CFR 800.5). The effects assessment concluded that Alternatives 3A, 3B, and 3C would have adverse effects on historic properties. Alternative 3A would have an adverse effect on six historic properties; Alternative 3B would have an adverse effect on eight properties; and Alternative 3C would

have an adverse effect on 10 historic properties. FRA has received concurrence from the State Historic Preservation Officer (SHPO) on the effects determination on November 20, 2015

b. Archaeology

The archaeological assessment of the Study Area consisted of the background research on the history of the area, and on previously identified archaeological sites (within a one-mile radius). Given the severity and extent of past disturbance, most of the land within the study corridors is considered to have a low probability for containing any intact prehistoric archaeological resources. However, extensive areas of historic fill exist within the study corridors. Under certain circumstances, land filling has been instrumental in the protection of historic archaeological deposits. Therefore, the potential for both pre- and post-contact archaeological sites still exists. After the selection of a Preferred Alternative, more detailed archaeological impact studies will proceed in coordination with the SHPO and consulting parties.

3. Section 4(f) Properties

Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303(c)) is a federal law that protects publicly-owned parks, recreation areas, wildlife and/or waterfowl refuges, or any significant historic sites, whether privately or publicly owned. Fifteen historic properties and public parks eligible for Section 4(f) protection would be potentially impacted by one or more of the Build alternatives.

According to federal law, FRA may only approve use of a public park or historic property if there is no prudent and feasible alternative and the project includes all possible planning to minimize harm to the resource. FRA may determine that a project has a *de minimis* impact on a Section 4(f) property if the project will have no adverse impact on the resource and the agency with jurisdiction over the park or the State Historic Preservation Officer concurs after consulting with interested parties.

Alternative 3A would result in potential use of five Section 4(f) properties. Construction of the south portal approach for Alternative 3A would require demolition of three historic buildings that have been identified as contributing elements to the Midtown Edmondson historic district. The harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity, and thus meets the criteria of adverse effect per 36 CFR 800.5.

Alternative 3B would result in potential use of 11 properties qualifying for Section 4(f). Construction of the south portal approach for Alternative 3B would require demolition of 82 historic buildings or other contributing elements to the Midtown Edmondson Historic District. Construction of the south portal approach for Alternative 3B would require demolition of five historic buildings or other contributing elements to the Greater Rosemont Historic District.

Alternative 3C would result in potential use of 10 Section 4(f) properties. Alternative 3C would result in demolition of seven historic buildings or other contributing elements to the Midtown Edmondson Historic District, 31 historic buildings or other contributing elements to the Greater Rosemont Historic District, and 28 historic buildings or other elements contributing to the Edmondson Avenue Historic District.

4. Natural Resources

Natural resources in the Study Area were preliminarily identified based on a review of existing scientific literature, watershed reports, GIS databases, and mapping. Identified resources include soils; topography, geology, aquifers, and groundwater; water resources; floodplains and flood hazard areas; coastal zones; wildlife habitat; threatened and endangered species; and hazardous materials.

a. Streams and Wetlands

No streams of wetlands would be affected by the Alternatives 3A, 3B, or 3C.

b. Floodplains

Alternative 3A would impact approximately 3.5 acres of the Jones Falls floodplain, and Alternatives 3B and 3C would each impact approximately 3.5 acres. None of the alignments would impact the floodplain of the Gwynns Falls.

c. Wildlife

The project would have minor impacts on wildlife and their habitat, since most of the project will take place underground and ventilation plants will primarily impact urban areas with little habitat value.

d. Threatened and Endangered Species

No state or federally listed threatened or endangered species are known to exist within the Study Area.

e. Street Trees

Street trees within Alternatives 3A, 3B, and 3C, are only likely to be affected in areas where ventilation plants are proposed or due to cut-and-cover construction impacts near the tunnel portals. Street tree impacts are anticipated to be zero, two, and one for Alternatives 3A, 3B, and 3C, respectively.

5. Hazardous Materials

There are 92 hazardous material sites within the Study Area of Alternative 3A, including residences, dry cleaners/laundromats, schools, automotive maintenance facilities, fire stations, community resource centers, gas stations, industrial properties, and railway yards. Alternative 3B has 114 hazardous material sites, and Alternative 3C has 153 hazardous material sites.

6. Solid Waste

Alternative 3A, 3B, and 3C have the potential to generate large quantities of material from street and sidewalk demolition, building demolition, and excavated soil and rock. Between the re-use of some earthen material as fill and current land fill capacity, the disposal of generated solid waste by the project should be manageable. Thus, no substantial harmful impacts on the solid waste system would occur as a result of the solid waste created by any of the Build Alternatives.

7. Air Quality

The B&P Tunnel Project is located in Baltimore City, Maryland, which is presently designated by the Environmental Protection Agency (EPA) as a moderate nonattainment area for eight-hour ozone and a maintenance area for carbon monoxide (CO) and particulate matter (PM) equal to or less than 2.5 micrometers in diameter (fine particulates or $PM_{2.5}$).

As shown, the proposed Project would not have any effects on operational emissions due to no projected increase in diesel freight train operations and no significant air emissions generated by trains propelled by electric locomotives. For tunnel ventilation, the expected increases in emissions with the project are well within the prescribed values. For NO_2, the pollutant of most concern, the net change in emissions is also well within the applicable stationary source Prevention of Significant Deterioration threshold. Based upon these results, it is unlikely that emissions associated with the ventilation plants for the project will cause, nor substantially contribute to, a violation of air quality standards. Construction emissions stem from dust generated from earth moving activities and gaseous emissions generated from diesel-powered equipment at the project site. Emissions produced during construction activities will be temporary in nature and will not result in a long-term impacts to local air quality.

8. Noise

Project noise impacts are assessed based on land use categories and sensitivity to noise from transit sources under FTA's guidance manual, *Transit Noise and Vibration Impact Assessment*. The FTA noise criteria are delineated into two categories: moderate and severe impact. The moderate threshold defines areas where the change in noise is noticeable but may not be sufficient to cause a strong, adverse community reaction. The severe impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site is established by comparing the predicted future Project noise level at the site to the existing noise level at the site. Project noise impacts are expected from future operations and from construction.

In terms of operations, noise levels in the immediate vicinity of the ventilation plant buildings would be affected by operation of the ventilation fans. Fans would only operate when NO_2 levels in the tunnel exceed a set threshold or during emergencies when smoke is present. Because of the unpredictable nature of this activity, it is not possible to predict how many hours per day, on average, the fans would operate.

For Alternative 3A, for both the construction and operating phases, 254 buildings would be subject to a moderate impact, while none would have a severe impact. For Alternative 3B, 1,078 buildings would have moderate impacts and 175 would have severe impacts. For Alternative 3C, 979 buildings would have moderate impacts and 111 would have severe impacts.

Mitigation during construction would include noise barriers, relocation of noise generating activities, time of day work restrictions, and use of best available control technologies. Ventilation plants would be designed to meet noise limits established in the *Noise Regulations of the Health Code of Baltimore City* (Baltimore City Department of Legislative Reference, 2013).

9. Vibration

Background levels refer to ambient ground vibrations not related to any specific transportation source (e.g. naturally occurring ground vibration). This background vibration level is assumed to be fairly constant from site to site. Background vibration levels in the vicinity of the project alternatives are dominated by local traffic, while background vibration levels in the vicinity of the existing B&P Tunnel are dominated by current rail operations.

Modeled impacts due to ground-borne vibration from train passbys are predicted to exceed the FTA frequent impact criterion for residential impacts are 69, 138, and 92 for Alternatives 3A, 3B, and 3C, respectively.

10. Construction Impacts

Construction of the tunnels for Alternative 3A, 3B, or 3C would primarily involve horizontal mining with a tunnel boring machine. The outside approaches, sloping down to the portals, would be built with a combination of trench cutting and cut-and-cover construction techniques.

Cut-and-cover construction requires removal of everything on the surface above the planned tunnel, excavating a deep and wide trench in which the tunnel structure is constructed, and restoring the ground cover. Horizontal excavation by mining involves boring at a portal where the alignment would transition from surface to underground and excavating horizontally; surface disturbance would only occur at the approaches to the portals on either end of the tunnel and for ancillary structures like emergency exits. Ancillary structures, such as ventilation shafts or emergency egress, could be mined in a combination of mechanical excavation and controlled blasting.

Construction impacts associated with construction of Alternative 3A, 3B, or 3C would include localized impacts at the mucking shaft and portal cut-and-cover locations; emissions and dust from construction vehicles; blasting noise and vibration near tunnel portal and ventilation shaft locations; temporary interruptions to vehicular and pedestrian traffic and temporary loss of on-street parking; and major utility relocations.

Measures that can be used to lessen construction noise fall into two general categories: design considerations and construction staging and/or sequencing of operations. Design considerations could potentially include erection of temporary walls or earth berms between the noise source and the sensitive receptor, the identification of haul routes that avoid sensitive receptors to the maximum extent possible, and location of stationary noise generating equipment at a distance from sensitive receptors. Construction activities can be planned to avoid prolonged noise generating activities and to minimize construction activities during the most sensitive time of day or night.

11. Indirect and Cumulative Impacts

Federal agencies are required to also consider the potential for indirect and cumulative effects (ICE) from a proposed project. The ICE analysis was completed using available information on past, present and foreseeable future development, as well as readily available data from published plans and studies. The ICE analysis geographic boundary was developed using the boundaries of environmental resources and socioeconomic units that would be directly and indirectly impacted by the Project. The temporal boundaries for the ICE analysis generally extend from approximately 1970 to 2040. Planned improvements and developments within the ICE analysis area are used to qualitatively analyze potential for indirect and cumulative effects.

a. Indirect Impacts

Alternatives 3A, 3B, and 3C, could potentially result in indirect effects. Each of the Build Alternatives could increase throughput capacity for freight traffic through the Study Area. Alternatives, 3A, 3B, and 3C, could indirectly result in changes in land use, population density, or growth rate in the city, but any effects would likely be relatively minor. Construction of a ventilation plant building in the Reservoir Hill neighborhood under Alternative 3A, 3B or 3C would permanently preclude future development at the proposed site. Alternative 3A would have minimal indirect community effects given that it would not result in any residential displacements. Alternative 3B and 3C could have indirect community impacts resulting from conversion of residential areas in the Midtown Edmondson and Bridgeview-Greenlawn neighborhoods to transportation use. Alternatives 3A, 3B and 3C would result in a beneficial indirect effect to transportation because each would result in downstream improvements to the efficiency of passenger rail service along sections of the NEC north and south of Baltimore as a result of the removed barrier. Indirect effects could also include changing travel behavior from automobile, air travel, and bus to passenger rail.

b. Cumulative Impacts

A review of master plans and planned development projects in the area does not indicate any projects or plans that would result in impacts or land use changes similar in nature to those resulting from the proposed Build Alternatives such as residential displacements, community facility and business displacements, historic building impacts, or conversion of land to transportation use. Therefore, no cumulative land-use impacts are anticipated from Alternatives 3A, 3B, and 3C.

Alternative 3A would not have any reasonably foreseeable cumulative socioeconomic or environmental justice impacts. Alternatives 3B and 3C would have community impacts such as displacements, noise, visual impacts, and loss of street connectivity that is similar in nature to the I-70 highway project.

Any reasonably foreseeable cumulative effects of the Build Alternatives along with planned projects along the NEC would be beneficial improvements to regional and high-speed rail service. Alternatives 3A, 3B, and 3C would improve travel times, improve reliability and safety, increase capacity, and allow for more high-speed travel.

G. Agency and Public Coordination

FRA and MDOT have provided opportunities for agencies and the public to stay informed of the B&P Tunnel Project and provide input into the study, including the alternatives. Agency and public input was received from

five Interagency Review Meetings, three Public Open Houses, ten community meetings, several individual community association meetings, the B&P Tunnel Project website, an online comment form, and via e-mail.

All comments received to date have been read, summarized, and responded to in previous deliverables and this DEIS. The comment period for this DEIS extends through February 5, 2016. Future Project activities providing additional opportunities for public comment prior to the completion of this project include a public hearing, public and community meetings, and updates to the project website. Comments received through future activities will be responded to in the Final Environmental Impact Statement prior to FRA issuing the final decision for the project in the Record of Decision.

This page intentionally left blank

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF IMAGES

LIST OF TABLES

I. INTRODUCTION

The Federal Railroad Administration (FRA) prepared this Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation in coordination with the Maryland Department of Transportation (MDOT) and in compliance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] Part 4321 et seq.), the Council of Environmental Quality (CEQ) NEPA Regulations (40 Code of Federal Regulations [CFR] Part 1500-1508), the FRA Procedures for Considering Environmental Impacts (64 Federal Register [FR] Part 28545 [May 26, 1999]), and FRA's Update to NEPA Implementing Procedures (78 FR Part 2713 [January 14, 2013]). The Federal Transit Administration (FTA) is involved with the development of the Project through the NEPA process as a cooperating agency in accordance CEQ regulation 40 CFR Part 1508.5.

The Baltimore and Potomac (B&P) Tunnel Project ("Project") considers the rehabilitation or replacement of a 1.4-mile long rail tunnel located along the Northeast Corridor (NEC) in Baltimore, Maryland. The B&P Tunnel is owned by Amtrak and used for Regional and Acela intercity passenger trains, Maryland Area Rail Commuter (MARC) passenger trains, and Norfolk Southern Railway (NS) freight trains.

Built in 1873, the B&P Tunnel is one of the oldest structures on the NEC. The narrow, single-bored, double-track, existing B&P Tunnel was constructed out of brick and stone masonry; additional materials were added over time. The Study Area surrounds the existing 1.4-mile B&P Tunnel in west-central Baltimore City. It includes Amtrak's NEC between Baltimore's Pennsylvania Station (Baltimore Penn Station) to the north and the Gwynns Falls Bridge to the south, as shown in **Figure 2**. The extent selected is intended to maximize capture of potential resources that could directly, or indirectly, be impacted by the B&P Tunnel Project. The Study Area for each alternative extends 500 feet on either side of the centerline and 500 feet to the northeast and southwest, past the termini.

NEPA requires the preparation of an Environmental Impact Statement (EIS) for all federal projects or actions that are likely to have a significant impact on the environment. This DEIS is a tool for FRA and MDOT to make informed decisions regarding the Project alternatives in accordance with NEPA. The DEIS includes a review of the alternatives, their ability to meet the needs of the study, and their likely impacts to the social, cultural, and natural environment. All technical reports and memoranda referenced in the DEIS are available for review on the Project website at www.bptunnel.com. The comment period for this DEIS ends February 5, 2016.

This page intentionally left blank

II. PURPOSE AND NEED

A. Project Background

The existing B&P Tunnel is a crucial link in the greater NEC Main Line, which runs through eight states and Washington, D.C. The NEC is the nation's most congested rail corridor and one of the highest volume corridors in the world (Amtrak, 2010a). The NEC came under the control of one owner, Penn Central, in 1969 and under Amtrak in 1971. Currently, the fully electrified NEC provides a direct connection between Washington, D.C., Baltimore, Philadelphia, New York, and Boston. The NEC moves over 259 million passengers and 14 million car miles of freight cargo each year (Amtrak, 2010a). It is a shared resource used by Amtrak, eight commuter rail operators, and four freight railroads.

As shown in **Figure 2**, the existing B&P Tunnel is located beneath several West Baltimore neighborhoods, including Bolton Hill, Madison Park, Sandtown-Winchester, and Upton. The tunnel is currently used by MARC, Amtrak, and NS. Built in 1873, the tunnel is one of the oldest structures on the NEC. It is approximately 7,500 feet (1.4 miles) long and is comprised of three shorter tunnels: the John Street Tunnel, the Wilson Street Tunnel, and the Gilmor Street Tunnel. The narrow-profile, single-bored, double-track tunnel was originally constructed out of brick and stone masonry, though repairs have added additional building materials over time. Electrification was added in the 1930s, and the tunnel was rehabilitated in the 1980s. Continual repairs are required to maintain the aging structures.

B. Prior Studies - Baltimore's Railroad Network

Following a July 18, 2001 fire from a CSX train derailment that occurred in the nearby Howard Street Tunnel, Congress mandated that FRA provide a comprehensive assessment of the region's complex rail system. In response to the Congressional mandate, FRA completed two studies, *Baltimore's Railroad Network: Challenges and Alternatives* (FRA, 2005) and *Baltimore's Railway Network: Analysis and Recommendations* (FRA and MDOT, 2011). The 2005 report characterized the state of the rail network and the demands placed on it. The study evaluated the existing B&P Tunnel, as well as other components of Baltimore's rail network, and underscored the importance of the B&P Tunnel to the NEC. The study also recommended potential actions that could improve passenger and freight railway capabilities in the Baltimore region, which included replacement of the existing B&P Tunnel. The 2011 report supplemented the findings of the 2005 report and evaluated passenger and freight alternative routes through Baltimore. The 2011 report states that "the physical condition of the [existing B&P Tunnel] requires that it be rebuilt or replaced within the next 10-20 years." In addition, "the conditions in the [existing] B&P Tunnel—as well as its criticality to the protection of a reliable passenger service—preclude its expanded use for most freight and constrain the flow of commerce to and through the Baltimore region" (FRA and MDOT, 2011).

C. National High-Speed Rail Program Investments

The Passenger Rail Investment and Improvement Act of 2008 (PRIIA) and the American Recovery and Reinvestment Act of 2009 (ARRA) established guidelines for the development of intercity and high-speed rail corridors. These two Acts called for a collaborative effort by the federal government, states, railroads, and other key stakeholders to help transform America's transportation system through the creation of a national network of high-speed rail corridors. To achieve this vision, FRA published the *High-Speed Rail Strategic Plan* in April 2009 (USDOT, 2009) and launched the *High Speed Intercity Passenger Rail (HSIPR) Program* in June 2009.

Figure 2: Existing B&P Tunnel Project Vicinity

The ARRA and annual appropriations have provided $10.1 billion to date to expand passenger rail access to new communities and provide Americans with faster and more energy-efficient travel options. This funding has helped transform travel in America through targeted investments in five key "megaregions" around the country (Seattle-Portland, San Francisco-Los Angeles, Charlotte-Raleigh-Washington, D.C., Midwest hub, and Northeast Corridor) that together hold roughly 65 percent of the population and are expected to contain the bulk of future population growth. Baltimore, Boston, New York, Philadelphia, and Washington, D.C. make up the Northeast megaregion, which is the densest and most economically productive megaregion in the country. This megaregion depends on its ability to accommodate frequent business travel among the cities, thus requiring efficient, reliable, and convenient transportation connections (Amtrak, 2010b).

The HSIPR program is improving the safety, reliability, and accessibility of rail infrastructure for passengers around the country through renewal of corridor infrastructure and stations. The national program is expected to:

- serve as a catalyst for growth in regional economic productivity and expansion by stimulating domestic manufacturing, promoting local tourism, and driving commercial and residential development;
- increase mobility by creating new choices for travelers in addition to flying or driving;
- reduce national dependence on oil; and
- foster livable urban and rural communities.

Through the HSIPR program, FRA is investing $950 million to upgrade some of the most heavily used sections of the NEC. The investments will increase speeds from 135 to 160 mph on critical segments, improve on-time performance, and add more seats for passengers, enabling one of the nation's busiest corridors to continue to set ridership and revenue records. As noted previously, the preliminary engineering and NEPA analysis for the existing B&P Tunnel is one of the NEC projects funded through the HSIPR program. The B&P Tunnel Project is critical to existing and future NEC operations because the current tunnel is a bottleneck in the rail corridor, does not have detour options in or near Baltimore, and is approaching the end of its useful life.

The Baltimore Metropolitan Council and MDOT amended the Fiscal Year 2011 State Transportation Improvement Program (TIP) list to add federal funds to the 2011-2014 Baltimore Regional Transportation Board's (BRTB) TIP for the existing B&P Tunnel Improvement Project (TIP # 92-1101-99). This project is funded through a High-Speed Intercity Passenger Rail (HSIPR) grant for preliminary engineering and NEPA analysis. The BRTB approved funding for the study on May 24, 2011 (Resolution #11-26).

D. Purpose of the Project

The purpose of the Project is to address the structural and operational deficiencies of the existing B&P Tunnel and to accommodate future high-performance intercity passenger rail service goals for the NEC, including:

- To reduce travel time through the B&P Tunnel and along the NEC,
- To accommodate existing and projected travel demand for intercity and commuter passenger services,
- To eliminate impediments to existing and projected operations along the NEC, and
- To provide operational reliability, while accounting for the value of the existing tunnel as an important element of Baltimore's rail infrastructure

E. Need for the Project

The need for the Project has been defined as follows:

- The existing B&P Tunnel is more than 140 years old and is approaching the end of its useful life with regard to its physical condition. While the tunnel currently remains safe for rail transportation, it requires substantial maintenance and repairs, and it does not meet current design standards. The tunnel

is considered to be structurally deficient due to its age, the original design, and wear and tear. The tunnel is also functionally obsolete and unable to meet current and future rail demands due to the combination of its vertical and horizontal track alignment, i.e. its grades and curves. The low-speed tunnel creates a bottleneck at a critical point in the NEC, affecting operations of the most heavily traveled rail line in the United States.

- The existing B&P Tunnel does not provide enough capacity to support existing and projected demands for regional and commuter passenger service along the NEC.
- The existing B&P Tunnel is not suited for modern high-speed usage due to the current horizontal and vertical track alignment, which limits passenger train speeds through the tunnel to 30 mph.
- The existing B&P Tunnel is a valuable resource. The disposition of the existing tunnel needs to be considered in the Project.

1. Physical Condition

The existing B&P Tunnel's two-track cross-section is horseshoe-shaped with an approximate spring line width of 27 feet and centerline height of about 21 feet. The majority of the existing B&P Tunnel is supported by a multiple course brick-lined arch and masonry sidewalls. One of the existing B&P Tunnel's tracks is typically designated for northbound traffic and the other for southbound traffic. Safety refuge areas (referred to as manholes) are located in the sidewalls of the tunnel. There is no physical separation of the tracks, which prohibits major improvements to the existing tunnel while in service due to safety and operational requirements. The existing track layout causes difficulties for maintenance and repair. Short working windows require multiple mobilizations for repairs, thus slowing progress and substantially increasing maintenance costs.

Saturated soil beneath the tunnels is causing its aging floor slabs to sink, forcing Amtrak to repeatedly make repairs (NEC Infrastructure and Operations Advisory Commission, 2013). Also, drainage through the tunnel's walls, leakage from existing utility lines, poor drainage of the tunnel's invert, and insufficient clearance were noted in a prior study of the tunnel (FRA and MDOT, 2011). Most recently, the *Existing B&P Tunnel Visual Inspection* prepared for the B&P Tunnel Project provides a review of the tunnel's structural integrity, water infiltration[5], drainage system function, railroad components, safety, and security. The inspection was performed from July 8, 2014 to July 18, 2014 and generally reviewed the NEC from Milepost 96 to Milepost 97.5. It covered the full lengths of the three tunnel sections, the north and south portals, and the two intermediate day-light sections between the three tunnels.

The Inspection Report is summarized by tunnel section in the outline below. The report identifies glistening surfaces and/or wet conditions for all three of the tunnel sections. Leaking water through the tunnel walls can lead to structural, electrical and mechanical problems. Leaking water could also carry fill material required for stability from behind the walls; this is a particular problem for horseshoe-shaped tunnels (such as the B&P Tunnel segments) that rely on fill material outside of the tunnel structure to provide resistance to the compressive forces transferred from above. These materials and the proper balance of force is necessary for the continued stability of the tunnel. Once a leak develops and water establishes a flow path, the problem of leaking may continue to develop over time as water flows through the path of least resistance. The water leakage in all three tunnels may have detrimental structural effects to the tunnel segments.

In addition, the Wilson Street Tunnel and the John Street Tunnel both have "multiple rows of missing brick", indicative of deterioration over time of the tunnels' masonry and concrete elements.

[5] Water infiltration in the existing B&P Tunnel relates to water leaking into the tunnel. This water can carry fine deposits and can leave voids behind the tunnel's liner and under slabs. The water infiltration also has the potential to prematurely age sump pumps and increase maintenance requirements and costs.

a. Gilmor Street Tunnel

Of the three tunnel sections, the Gilmor Street Tunnel is currently in the best physical condition. However, issues with this tunnel include sections of brick and mortar loss. Other problems include:

- transverse (crossways) cracks,
- spalls (chips/fragments) in the bench wall (elevated walkway used by maintenance personnel),
- shallow delaminations (divisions of thin layers) in the gunite (proprietary name of an early form of shotcrete that is a mix of Portland cement and sand) coating, and
- glistening surfaces due to moisture, which may indicate the possibility of water flow that could lead to structural, mechanical, or electrical problems in the tunnel.

b. Wilson Street Tunnel

Of the three tunnel sections, Wilson Street Tunnel is currently in the poorest physical condition. The majority of the tunnel is wet and actively leaking. Many of the leaks come from behind the tunnel's liner and produce efflorescence (crystalline deposits). Other problems include:

- spalls in the bench wall,
- shallow delaminations in the gunite coating,
- inflow of water from the invert (floor),
- large amount of debris in invert,
- brick debris on top of duct bench,
- deteriorating manholes, and
- multiple rows of missing brick over extended lengths.

c. John Street Tunnel

The leakage and moisture conditions in the Wilson Street Tunnel continue into the John Street Tunnel, but are not present over its entire length. Most of the leakage has pooled in the invert where the drainage system is clogged. Other problems include:

- spalls in the bench wall,
- deteriorating manholes,
- thick efflorescence,
- multiple rows of missing brick, and
- missing mortar.

2. Existing Track Alignment

The existing B&P Tunnel's grades and horizontal alignment limit train speeds, increase travel time, and impact the NEC's ability to support high-speed rail systems. A railroad's efficiency is dependent on its vertical and horizontal alignment, i.e. its grades and curves. Steep grades and the presence of curvature result in additional resistance by increasing friction between the wheels and the rail. The NEC's curvature, especially near Winchester Street (where the existing B&P Tunnel turns sharply at the entrance of the Gilmor Street Tunnel), prohibits high-speed service.

According to *Baltimore's Railroad Network: Challenges and Alternatives* (FRA, 2005), the NEC has "very difficult tunnel alignments" and "especially noteworthy are the restrictions imposed by the [existing] B&P Tunnel" for

the roughly two miles between Mileposts 95.9 and 97.7. **Table 3** shows the maximum allowable speeds on Amtrak's NEC through Baltimore in and adjacent to the existing B&P Tunnel.

Table 3: Maximum Allowable Speeds on Amtrak's NEC through Baltimore

Route Segment	Max Speed Passenger Service	Max Speed Freight Service
Union Tunnels, north of Baltimore Penn Station	45 mph	30 mph
Existing B&P Tunnel, south of Baltimore Penn Station	30 mph	20 mph
South of existing B&P Tunnel to Baltimore Washington International (BWI) Rail Station	110 mph	50 mph or less

Note: These maximum allowable speeds are general guidelines, always subject to site- and time-specific considerations.
Source: Baltimore's Railroad Network: Analysis and Recommendations, Table 2-7 (FRA and MDOT, 2011).

The table shows that the maximum allowable speed for Amtrak trains in the existing B&P Tunnel is 30 mph for passenger service and 20 mph for freight service. All trains must slow down in order to stop at Baltimore Penn Station. Trains traveling from the north must slow down to pass through the B&P Tunnel before gaining speed south of the B&P Tunnel (up to 110 mph for passenger services).

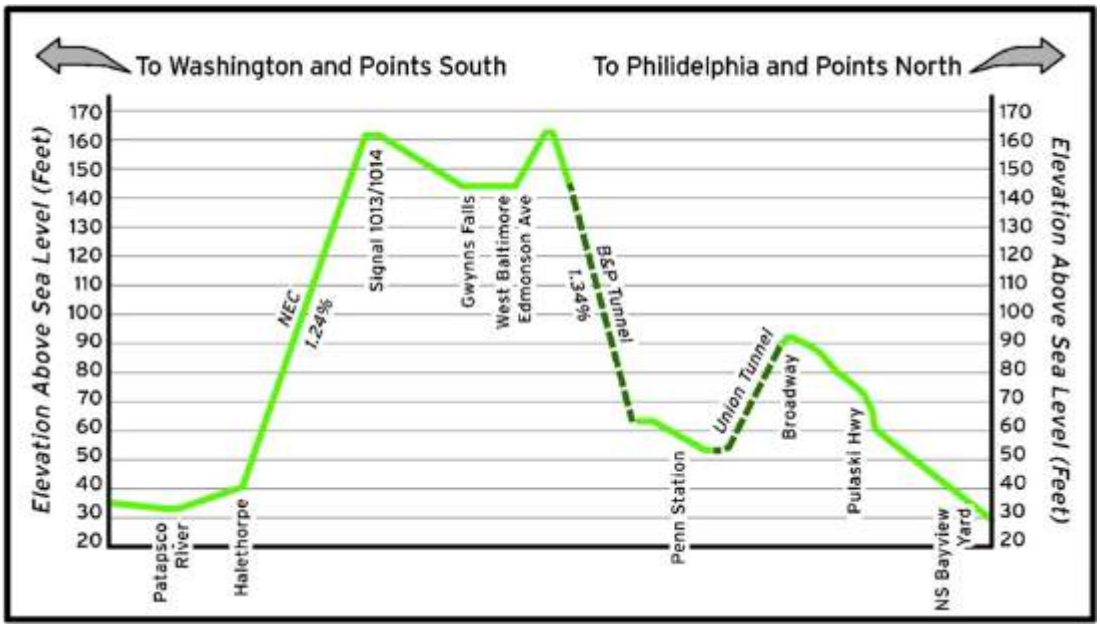
Southbound trains entering the existing B&P Tunnel slow for a sharp (8 degree) curve then ascend on a mile-long 1.34 percent grade, the steepest grade on the NEC between Philadelphia and Washington, D.C. **Figure 3** shows the elevation changes along the NEC. The elevation of the existing B&P Tunnel ranges from 150 feet above mean sea level to 70 feet above mean sea level. (FRA and MDOT, 2011).

Additionally, the approach section to the tunnel at the West Baltimore MARC Station is located on a curve (referred to as Curve 381) that limits train speeds to 55 mph. In addition to limiting the speed along the NEC at this location, Curve 381 also prohibits equal level alignment between the boarding platforms of the station and the MARC trains, resulting in a physical gap between the two. As such, the MARC Station is not accessible pursuant to the Americans with Disabilities Act (ADA) requirements. The need to provide ADA compliant facilities at the West Baltimore MARC Station has been the subject of previous planning studies conducted by MTA.

3. Bottleneck in NEC Operations

The NEC is the most heavily traveled rail corridor in the United States (NEC Master Plan Working Group, 2010). The NEC traverses eight northeast states and Washington, D.C. It is shared by eight commuter railroads and three freight railroads. It connects the five major metropolitan areas of Washington, D.C., Baltimore, Philadelphia, New York, and Boston. According to the *NEC Infrastructure Master Plan* (Amtrak, 2010a), this rail network is a centerpiece of the transportation infrastructure that contributes to the economic vitality of the Northeast region. By linking all the major northeastern cities, it moves more than 259 million passengers and 14 million car-miles of freight per year (Amtrak, 2010a).

Figure 3: Elevation Changes along the NEC



Source: Baltimore's Railroad Network: Analysis and Recommendations, Figure 2-20 (FRA and MDOT, 2011).

Due to the age of the existing B&P Tunnel and the technological advancement of the rail system in the more than 140 years since it was built, the existing B&P Tunnel limits the functionality of railroads through Baltimore and along the NEC. The existing B&P Tunnel is "a major chokepoint for intercity, commuter, and freight operations in the northeast" (Amtrak, 2010a). The tunnel creates a bottleneck in NEC operations due to its reduced travel speeds. The NEC, which has active use of three and four tracks elsewhere, has only two tracks through the existing B&P Tunnel, which must accommodate a mixture of regional and commuter passenger trains and freight service. The following sections review the existing travel times through the Study Area, the operational needs of the NEC, and the lack of rail connectivity/rerouting options.

a. Existing Travel Time

Travel times through the existing B&P Tunnel are listed in **Table 4**. Amtrak times are measured between a stop at Baltimore Penn Station and passing block signals 993/994 (at approximately Milepost 99.2, Gwynns Falls Bridge) while MARC times are measured between a stop at Baltimore Penn Station and a West Baltimore Station stop (Milepost 98.5). Trip times through the existing B&P Tunnel range from 5 minutes and 48 seconds to 7 minutes and 16 seconds. As indicated in the table, travel time is longer for northbound trains that stop at Baltimore Washington International (BWI) Rail Station because they must diverge at the Bridge Interlocking before entering the existing B&P Tunnel.

Table 4: Current Trip Times Through the Existing B&P Tunnel

Trip Direction	MARC Commuter[1]	Amtrak Regional/Intercity[2]	Acela[3]
Southbound	5 min, 48 sec	6 min, 20 sec	5 min, 52 sec
Northbound (No stop at BWI)	N/A	6 min, 5 sec	5 min, 56 sec
Northbound (Stop at BWI)	6 min, 18 sec	7 min, 16 sec	7 min, 1 sec

[1] *Trainset assumed for MARC Commuter trains: HHP-8 locomotive plus 7 MARC III cars*
[2] *Trainset assumed for Amtrak Regional/Intercity trains: AEM7 locomotive plus 8 Amfleet cars*
[3] *Trainset assumed for Acela trains: standard Acela trainset*
Source: General Orders Timetable (Amtrak, December 2012 and 2014)

4. Operational Needs of the NEC

Three major providers use the existing B&P Tunnel: Amtrak, MARC, and NS. The providers have documented the need for improvements along the NEC, particularly in Baltimore City and the area surrounding the existing B&P Tunnel. The following reports discuss the operational needs of the NEC, including the bottleneck created by the existing B&P Tunnel:

- *Baltimore's Railroad Network: Challenges and Alternatives* (FRA, 2005)
- *The Northeast Corridor Infrastructure Master Plan* (Amtrak, 2010a)
- *A Vision for High-Speed Rail in the Northeast Corridor* (Amtrak, 2010b)
- *Baltimore's Railway Network: Analysis and Recommendations* (FRA and MDOT, 2011)
- *The Amtrak Vision for the NEC* (Amtrak, 2012)
- *Critical Infrastructure Needs on the Northeast Corridor* (NEC IOAC, 2013)
- *MARC Growth and Investment Plan - Update 2013 to 2050* (MTA, 2013)
- *Washington Terminal Yard Future Operating Plans* (MARC/Amtrak 2020 and 2030 Plans) (LTK Engineering Services, 2014)
- *NEC FUTURE* (FRA, 2015)
- *Baltimore Penn Station Master Plan* (Amtrak, 2015)

a. Baltimore's Railroad Network: Challenges and Alternatives (2005)

FRA and MDOT developed *Baltimore's Railway Network: Challenges and Alternatives* (FRA and USDOT, 2005) in response to the November 2001 request from Congress. The study evaluates the condition and capabilities of the railroad network's fixed facilities and examines the benefits and costs of various alternatives for reducing congestion and improving safety and efficiency in the rail operations throughout the larger Baltimore region. Part 1 of the report characterizes the state of the network and demands placed on it. The study evaluates the existing B&P Tunnel, among other components of Baltimore's rail network, and emphasizes its importance to the overall NEC system. The study explains that "the conditions in the [existing] B&P Tunnel – as well as its criticality to the protection of a reliable passenger service – preclude its expanded use for most freight and constrain the flow of commerce to and through the Baltimore region." The study also describes the history of renovations made to the existing B&P Tunnel as well as its current car plate (i.e. height and width) clearance restrictions and "difficult geometry," noting that the "sharp curve at the south portal of the tunnel prevents southbound trains departing [Baltimore's Penn Station] from accelerating beyond 30 mph."

Part 1 of the 2005 study examines the horizontal and vertical track alignment of the existing B&P Tunnel, explaining that "grade, particularly in combination with curvature, has a major impact on the tractive effort and horsepower required to move a train of a given tonnage over a line. Collaterally, grades affect the speed, schedule, and on-time performance of a freight train, and to a lesser degree, a passenger train. Curves, in themselves, can severely limit train speeds because of the forces they create as trains pass over them, and the safety, ride quality, maintenance, and cost issues that these forces raise – issues that are worsened in mixed traffic conditions. For example, allowable superelevations (banking) on curves may differ for passenger and freight service. Where both services regularly share the same tracks, compromises must be made that may allow neither service to operate optimally."

The potential actions that could improve passenger and freight railway capabilities in the Baltimore region are detailed in Part 2 of the study. Replacement of the existing B&P Tunnel is a stated objective of the study. The study explains that "the tunnel's basic geometry was substandard when it was completed [in 1873]." Information from this study will be considered and incorporated into subsequent stages of the planning process during development of alternatives.

b. The Northeast Corridor Infrastructure Master Plan (2010)

The Northeast Corridor Infrastructure Master Plan (Amtrak, 2010a), prepared by Amtrak, provides a regional, corridor-wide perspective of the NEC Main Line and all its feeder lines. The Master Plan identifies an initial baseline of infrastructure investment needed to maintain the current NEC system in a state of good repair; integrates intercity, commuter and freight service plans; and moves the NEC forward to meet the expanded service, reliability, and trip-time improvements that are envisioned by the Northeast states and the District of Columbia. The plan identifies the existing B&P Tunnel as one of several major assets along the NEC that are approaching the ends of their useful lives, and which impede the overall speed, capacity, and reliability of the NEC Main Line. This plan states that the existing B&P Tunnel is "a major chokepoint for intercity, commuter, and freight operations in the northeast."

c. A Vision for High-Speed Rail in the Northeast Corridor (2010)

The need for high-speed rail in the NEC for present and future transportation networks is documented by Amtrak in *A Vision for High-Speed Rail in the Northeast Corridor* (Amtrak, 2010b). The report identifies general alignment constraints, such as dedicated tracks and curvature limits that would be required to implement next-generation high speed rail service along the NEC. This report includes a graphic from the 2010 NEC Master Plan, identifying the existing B&P Tunnel as a "previously identified chokepoint" and reiterates that the NEC through Baltimore exceeded 75 percent utilization capacity in 2008 and will exceed 100 percent by 2030. The report explains that "Amtrak services must play an expanded role in meeting the corridor's mobility and economic support needs. The NEC's daily use by major commuter rail operations and by numerous freight trains further underscores this importance. The benefits of the proposed Next-Gen High-Speed Rail system investment would extend beyond intercity rail passengers to air passengers, rail commuters, and highway drivers who will realize transportation network capacity gains."

d. Baltimore's Railroad Network: Analysis and Recommendations (2011)

Baltimore's Railway Network: Analysis and Recommendations (FRA and MDOT, 2011) is a feasibility study by FRA and MDOT that focused on large-scale, regional rail issues. The study supplements the findings of *Baltimore's Railroad Network: Challenges and Alternatives* (FRA and USDOT, 2005). It focuses on the principal elements of Baltimore's network of passenger and freight rail lines extending from Perryville—the junction of Amtrak's NEC with the NS principal route from Harrisburg and points west—to Halethorpe, where CSX Transportation and Amtrak lines from Washington, D.C. cross. Therefore, this 2011 study includes the existing B&P Tunnel, but covers a much larger area than the proposed B&P Tunnel Project. In Phase I of the report, a number of passenger and freight alternative routes through Baltimore are developed and evaluated. Phase II of the report further refines the engineering and cost aspects of two preferred alternatives.

The study states that "the conditions in the [existing] B&P Tunnel—as well as its criticality to the protection of a reliable passenger service—preclude its expanded use for most freight and constrain the flow of commerce to and through the Baltimore region." The study explains that "Amtrak's route through Baltimore is crucial to the viability of all intercity rail passenger service in the United States." Specifically, one-fifth of Amtrak's passenger-trips and one-third of its total revenues stem from trips making use of at least one of the NEC's Baltimore tunnels. Most of these trips depend on both the existing B&P Tunnel and the Union Tunnel (FRA and MDOT, 2011).

The study discusses the deteriorating condition of the existing B&P Tunnel and the tunnel's effects on NEC operations due to limited travel speeds, capacity, freight loading flexibility, and lack of detour route options. Track alignment through the existing B&P Tunnel and clearance are discussed in detail in the study. The study explains that "the physical condition of the tunnel requires that it be rebuilt or replaced within the next 10 to 20 years."

e. The Amtrak Vision for the NEC (2012)

The Amtrak Vision for the NEC report provides an update to the Vision for High-Speed Rail in the Northeast Corridor (Amtrak, 2010b), identifying recent developments in NEC planning and highlighting key findings related to how Amtrak can translate various strategies and concepts for growth and improvement of the NEC into reality. The report states that the entire network is often operating at or near capacity and is routinely hampered with congestion and delays. It recognizes that significant efforts are underway that address rehabilitation needs and reducing existing congestion. The NEC consists of aging infrastructure that will require extensive repair for safe and efficient operations at current traffic levels. Significant investments in the existing NEC will help eliminate key bottlenecks that limit service frequency and negatively affect reliability and performance. This report lists milestones over the next 30 years, with increases in tunnel and terminal capacity. Improvements to the existing B&P Tunnel are identified as a key project for trip-time and frequency improvements between Washington, D.C. and New York.

f. Critical Infrastructure Needs on the Northeast Corridor (2013)

Critical Infrastructure Needs on the Northeast Corridor (NEC IOAC, 2013) was prepared by the NEC Infrastructure and Operations Advisory Commission. The report was developed through a consensus-based process by the NEC Commission's members, which include representatives from the NEC States, USDOT, and Amtrak. This report recognizes that additional investment is necessary to renew and enhance the NEC as a world-class, high-performance rail corridor supporting the economic development and international competitiveness of the region and the nation with job creation, improved reliability of existing services, and a foundation for future mobility and economic growth. The report notes that the existing B&P Tunnel is one of the oldest structural assets on the NEC, it "severely" limits train speeds in Baltimore, and identifies it as "a major capacity bottleneck for both passenger and freight trains." "Development of the [existing] B&P Tunnel replacement project would mitigate a chokepoint, eliminate speed restrictions, and enhance freight access to the port of Baltimore" (NEC IOAC, 2013). The report identifies the B&P Tunnel Project as a necessary project on the NEC, and states that "while the alignment and design of any new tunnel is yet to be determined, planning will consider options for supporting higher speed train service and creating separate routes for passenger and freight trains through Baltimore." The report also explains that "new tunnels could free the existing tunnels for renewal, ultimately for additional capacity, and make Amtrak and MARC less susceptible to maintenance-related delays."

g. MARC Growth and Investment Plan - Update 2013 to 2050 (2013)

MARC Growth and Investment Plan - Update 2013 to 2050 (MTA, 2013) by MTA presents a summary of the commuter rail program whose service areas include Baltimore and Washington, D.C. and surrounding areas, with an average of 36,000 daily trips using the Penn, Camden, and Brunswick Lines. The plan identifies ridership and parking trends, re-aligns agency priorities, updates objectives for MARC service, and summarizes the growth of the Penn, Camden and Brunswick Lines. While the average annual growth from 2007 to 2012 in ridership for the Camden Line and Brunswick Lines were 0.5 percent and 1.7 percent, respectively, the Penn Line reported 3.5 percent growth. The Plan states that ridership demand is expected to continue to grow at historical rates. Challenges identified in the plan include insufficient track capacity on all three lines. In addition, the Plan notes that MARC's flexibility and ability to expand service is constrained by existing infrastructure and interactions with other rail operators.

The MARC Growth and Investment Plan also identifies a new station at West Baltimore under the State of Good Repair long-term plan (2020-2029). The November 2008 West Baltimore Master Plan noted opportunities and plans for economic growth in the area. The USDOT Ladders of Opportunity Program identified the West Baltimore MARC Station as one of seven national locations where the USDOT will help foster sustainable economic development related to planned transportation projects.

h. Washington Terminal Yard Future Operating Plans (MARC/Amtrak 2020 and 2030 Plans) (2014)

Amtrak and MARC developed the *Washington Terminal Yard Future Operating Plans* as draft conceptual Amtrak/MARC operating plans for the 2020 and 2030 time horizons for use in conjunction with the Washington Union Station (WUS) and Washington Terminal Yard (WTY) Master Plans. Based on this ongoing study, MARC expects a 3 percent ridership increase per year on the Penn Line, which is the equivalent of an approximately 60 percent ridership increase through 2030 when compounded annually.

i. NEC FUTURE (2015)

NEC FUTURE (FRA, 2015) is a comprehensive planning effort to define, evaluate, and prioritize long-term future investments in the Northeast Corridor (NEC), from Washington, D.C. to Boston. The Federal Railroad Administration (FRA) launched NEC FUTURE in February 2012 to consider the role of rail passenger service in the context of current and future transportation demands. Through the NEC FUTURE program, FRA will determine a long-term vision and investment program for the NEC. The Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) for NEC FUTURE was completed in December 2015 and assesses the broad impacts of investment programs to improve passenger rail service within the NEC FUTURE Study Area. A Service Development Plan (SDP) will be prepared based on the selection of the investment program identified through the NEC FUTURE Tier 1 EIS Process. The SDP will provide the platform for implementation of the program by the federal government, states, the NEC Infrastructure and Operations Advisory Commission (NEC Commission), and the NEC railroads.

FRA developed projections for the future passenger train volume through the B&P Tunnel for the year 2040 as part of the NEC FUTURE program. These projections identified the need for a minimum of four tracks through Baltimore to serve the future passenger demand along the NEC.

j. Baltimore Penn Station Master Plan (2015)

Amtrak is in the early planning stages of developing a master plan for the future needs at Baltimore Penn Station (Amtrak, 2015). The plan will outline a series of incremental and phased improvements to the station facility and select land assets to guide the station into the future. The master plan will build off three studies: the Operations and Facilities Study, which will assess the long-term operational and facility requirements for Baltimore Penn Station to meet the growing capacity demands; the State of Good Repair Study; and the Commercial Development Study. Early coordination between the B&P Tunnel Project team and Baltimore Penn Station representatives indicate that neither project would impact the other. Planned high level platforms at Baltimore Penn Station would not have any material effect to the alternatives considered for replacing the B&P Tunnel.

5. System Linkage and Rerouting

There are no practical detours available to route rail traffic around the existing B&P Tunnel for maintenance or in case of emergencies without rail services experiencing extensive delays. In an emergency or bottleneck situation, there is no way to route NEC traffic over the CSX, or vice versa. This lack of inoperability came to the forefront during the Howard Street Tunnel fire, when CSX had to route trains via Cleveland, Ohio (FRA and MDOT, 2011). Another constraint associated with system linkage is related to the close proximity of the Union Street Tunnel and its passenger and freight restrictions with substantial elevation changes.

With no practical detour route options for the existing B&P Tunnel, a major maintenance problem in the tunnel could have a substantial impact to rail operations, since the NEC does not have inherent redundancy at this location. The existing B&P Tunnel's two tracks are in the same structural envelope, which means that incidents that affect service on one track, most likely affect the other track as well, reducing the possibility of single-tracking around an issue. Single-tracking can be accomplished in some cases if a train can safely pass on the other track, but since there is no physical separation between the tracks, tunnel repairs typically impact service

on both tracks. Currently, if the existing B&P Tunnel were closed for major renovations/repairs or an emergency, passenger train service along the NEC through Baltimore would be stopped.

A three-hour delay and an additional 111.6 miles are added to Norfolk Southern freight trains' travel time and route when they must bypass the existing B&P Tunnel (Plate C Clearance) by leaving the main line at Manassas Junction and traveling to Front Royal in Virginia where they connect to Roanoke, Virginia; Hagerstown, Maryland; and Harrisburg, Pennsylvania. Use of the Hagerstown route eliminates the expensive and time-consuming need to exchange high dimension cars in order for a train to be routed through Baltimore.

6. Capacity to Support Existing and Projected Demands

Roughly 50 million people, or one out of every six Americans, live in the NEC region (NEC IOAC, 2013). "It is the country's economic powerhouse, generating $1 out of every $5 in gross domestic product....The density that supports this immense productivity, however, also creates congestion challenges for [the] transportation network….Every day, over 700,000 people, nearly half of all railroad commuters nationally, travel over portions of the NEC….Overall, ridership on Amtrak's NEC services has grown 37 percent since 2000" and the demand for rail service along the NEC is at record levels (NEC IOAC, 2013). "Contributing factors to this growth include a relative rebound in population and employment growth in its major urban markets, increasing delays affecting other major transportation options including highways and air travel, and the reliability and convenience of rail in serving core-city markets for both intercity and local travel. The NEC, however, cannot continue to accommodate this rising demand due to infrastructure that is highly constrained and in need of repair" (NEC IOAC, 2013).

As population increases and dependency on rail transportation grows, the demand for more efficient, better rail service within the Northeast megaregion is expected to rise. This will increase the service demands for the number of passenger trains for Amtrak and MARC along the NEC and require additional capacity and improved operations throughout the Project limits.

a. Existing Use

i. *Commuter and Passenger Rail*

As shown in **Table 5**, 57 MARC trains currently use the existing B&P Tunnel each day. Of those, 17 trains travel through the tunnel during the four-hour evening peak period. MARC has approximately 4,600 passenger trips that use the tunnel per day with 1,900 passenger trips using the tunnel during the four-hour evening peak period.

Amtrak has a total of 88 trains that currently use the existing B&P Tunnel per day, made up of 33 Acela Express trains, 43 Northeast Regional service trains, and 12 long-distance trains. Of those, 18 trains travel through the tunnel during the four-hour evening peak period. Amtrak has approximately 17,000 passenger trips that use the tunnel per day, with 3,400 passenger trips using the tunnel during the four-hour evening peak period.

i. *Freight Rail*

Approximately 50 Class 1 and regional freight trains use the NEC each day to serve industries, power plants and ports in the Northeast and Midwest. This heavy volume of freight traffic reinforces the NEC's role as a vital link in the national freight network. However, due to capacity, speed, and loading constraints, all rail freight movements between the northeast and southwest parts of the Port of Baltimore are difficult and costly to accomplish. Due to clearance limitations in the B&P Tunnel, NS cannot route many types of shipments to the southwest part of the Port and CSX cannot route many shipments to the northeast part of the Port. This lack of connectivity and routing flexibility diminishes the Port's efficiency and attractiveness. The Port is a major economic player in the Baltimore region and generates $1.5 billion in business revenue annually (Amtrak, 2010a).

Table 5: NEC Trips through the Existing B&P Tunnel Corridor

	Number of Trains (2014)		Number of Passengers (2014)	
Types of Service	Daily	4-Hour PM Peak Period	Daily	4-Hour PM Peak Period
Intercity	88	18	17,000	3,400
MARC Commuter Rail Service	57	17	4,600	1,900
NS Freight	2	0	N/A	N/A
TOTAL	**145**	**35**	**21,600**	**5,300**

Source: (Amtrak, December 2012 and 2014)

Amtrak has statutory and contractual obligations to permit the continued operation of freight trains. Currently, NS operates two trains through the existing B&P Tunnel daily for freight purposes, none of which travel through the tunnel during the four-hour peak evening period, as shown previously in **Table 5**. Due to the tunnel clearances, freight usage is limited and most freight on the NEC is routed around the existing B&P Tunnel.

Vertical clearance is a limiting characteristic of the existing B&P Tunnel. The existing vertical clearance of the B&P Tunnel ("Plate C") is unable to support passage of larger, newer freight cars ("Plate H"). **Table 6** shows the critical dimensions and examples of associated car types. "Plate" refers to a standard-sized opening of the tunnel, giving vertical and horizontal clearance of the train.

Table 6: Critical Dimensions and Associated Car Types

Plate	Maximum Height Above the Top of Rail	Width at Maximum Height Above Top of Rail	Typical Car Types Satisfying Plate
C	15'6"	7'0"	Conventional box cars, flats (depending on load), gondolas, coal hopper cars
H	20'2"	8'6⅜"	Double-stack container cars, tri-level auto rack cars, high-cube box cars

The existing B&P Tunnel's Plate C clearances do not allow sufficient clearance for modern, efficient Plate H double-stack container cars, tri-level auto carriers, and high-cube box cars (FRA and MDOT, 2011). For clearance plate C, the maximum height above the top of rail is 15'6" and width at maximum height above top of rail is 7'0". Typical car types used with clearance plate C are conventional box cars, flats, gondolas, and coal hopper cars. None of the north-south traffic lanes through Baltimore can currently accommodate Plate H double stack container cars and tri-level auto carriers. Therefore, NS cannot service any local shippers south of Baltimore with the most modern cars. In Washington, D.C., the District Department of Transportation (DDOT) and CSX are studying the Virginia Avenue Tunnel in order to accommodate Plate H clearances and address another major bottleneck in the eastern seaboard freight network. Completion of the Virginia Avenue Tunnel project[6] would

[6] Please refer to "www.virginiaavenuetunnel.com" for additional information regarding the Virginia Avenue Tunnel project.

shift greater focus on the existing B&P Tunnel as a freight clearance impediment, and further emphasize the need to improve the freight clearance at the existing B&P Tunnel.

b. Future Needs

"The aging and congested multimodal transportation network of the Northeast region is facing a crisis. An expected increase in population, estimated to grow by 30 percent from roughly 50 million residents today to 65 million in 2050, will create additional travel demand and strain an already stressed network that routinely operates near or at capacity along key segments" (Amtrak, 2012). According to the *Baltimore Railroad Network: Analysis and Recommendations* (FRA and MDOT, 2011), the demand for train movements of all types is expected to increase by 40 percent northeast of Baltimore and 37 percent southwest of Baltimore between 2008 and 2050. By mid-century, a heightened pressure for rail transport would place a huge incremental load on an antiquated rail network that, if left unchanged, would continue to detract from the speedy, efficient, and economical movement of passengers and goods along the East Coast (FRA and MDOT, 2011).

i. *Commuter and Passenger Rail*

Future needs for Amtrak in the NEC are identified in the series of reports and plans covered under **Section II.E.4.,** Operational Needs of the NEC.

The average annual growth from 2007 to 2012 for the MARC Penn Line was 3.5 percent, and ridership demand is expected to continue to grow at historical rates. MARC service is expected to increase substantially both north and south of Baltimore, with possible extensions to Elkton, Maryland, or Newark, Delaware, in the longer term. The *MARC Growth and Investment Plan Update - 2013 to 2050* identifies challenges related to trains being crowded at rush hour and states that adding flexibility and expanding service is constrained by infrastructure (MTA, 2013). MARC expects a three percent future ridership increase per year on the Penn Line, which is the equivalent of approximately 60 percent ridership increase through 2030 when compounded annually (LTK Engineering Services, 2014).

The *West Baltimore MARC Station Master Plan (Transit-Centered Community Development Strategy)* identifies improvements to the Penn Line and West Baltimore MARC Station that would reduce the amount of time between trains (Baltimore City and MDOT, 2008). The proposed improvements would allow a decrease from 25-minute to 15-minute headways during rush hour, from once an hour to once every 30 minutes in non-rush hour times, and providing late evening and weekend service.

The MTA has been considering the potential to create accessibility, in compliance with the Americans with Disabilities Act (ADA), to the West Baltimore MARC Station. One method to accomplish this is to relocate the existing MARC platforms several hundred feet south of the existing West Baltimore MARC Station.

ii. *Freight Rail*

According to the *Baltimore's Railroad Network - Challenges and Alternatives* report, the freight capacity of the Baltimore network is not enough to handle the expected freight volumes forecasted for 2050 (FRA, 2005). A 44 percent national increase in freight traffic is projected by 2030 (Amtrak, 2010a).

F. Summary

The Project purpose and need is to address the structural and operational deficiencies of the existing B&P Tunnel and support future high-speed rail services along the NEC. The Project would improve operations along the NEC, improve passenger rail services, and support existing and future demands along the NEC. The physical condition of the existing B&P Tunnel requires that it be rebuilt or replaced within the next 10-20 years (FRA and MDOT, 2011). Not only is the structure over 140 years old, the design of the railway is unable to support higher speed trains or more passenger and freight capacity. The structural and operational deficiencies result in a transit bottleneck along the NEC in Baltimore.

According to the *Northeast Corridor Infrastructure Master Plan*, the existing B&P Tunnel is important not only for Baltimore, but also the entire NEC (Amtrak, 2010a). The NEC traverses eight northeast states and Washington, D.C. It is shared by eight commuter railroads and three freight railroads. It connects the five major metropolitan areas of Washington, D.C., Baltimore, Philadelphia, New York, and Boston. The existing B&P Tunnel is a centerpiece of the Baltimore rail network that contributes to the economic vitality of the Northeast region. The Master Plan identifies the need to maintain the current NEC system in a state of good repair; integrate intercity, commuter, and freight service plans; and move the NEC forward to meet the expanded service, reliability, frequency, and trip-time improvements that are envisioned by the Northeast states and the District.

This page intentionally left blank

III. ALTERNATIVES DEVELOPMENT

This DEIS includes a detailed evaluation of the four remaining alternatives for the B&P Tunnel Project: Alternative 1: No-Build, Alternative 3A, Alternative 3B, and Alternative 3C. These four alternatives were retained through a comprehensive alternatives development and evaluation process that incorporated input from the public as well as federal, state, and local government agencies.

The alternative development and evaluation process identified 16 Preliminary Alternatives. These 16 alternatives were evaluated in a Preliminary Screening Analysis and resulted in the elimination of 12 preliminary alternatives. Alternatives 1, 2, 3, and 11 remained for further studies based on the evaluation of environmental impacts, public comments, and ability to meet Purpose and Need. This process is documented in the *Preliminary Alternatives Screening Report*.

Alternatives 1, 2, 3 and 11 were further refined to address rail service demands and minimize impacts, leading to the development of three options (A, B, and C) for Alternative 3 and two options (A and B) for Alternative 11. Alternatives were compared and evaluated, and Alternatives 2 and 11 were eliminated and Alternatives 1, 3A, 3B, and 3C were retained. The evaluation of all the alternatives is documented in the B&P Tunnel *Alternatives Report*.

The following sections in this chapter summarizes the alternatives development process from the initial identification of preliminary alternatives through the elimination of alternatives for details studies. The Alternatives retained for further study in this DEIS are described in detail in following Chapter IV.

A. Preliminary Alternatives Development and Screening

The initial range of alternatives was identified based on previous studies, including *Baltimore's Railroad Network Study* (FRA, 2005; FRA and MDOT, 2011) and during the preliminary alternatives development phase of the Project. A total of 16 preliminary alternatives were identified, including Alternative 1: No-Build, Alternative 2: Restore/Rehabilitate Existing B&P Tunnel, and fourteen new location alternatives. The 14 new location alternatives included five alternatives based on previous studies (Alternatives 3 through 7), and nine additional alternatives identified by this Project (Alternatives 8 through 16). Alternative 16 was based on public comments received at the October 29, 2014 public open house.

FRA considered the following preliminary alternatives:

- Alternative 1: No-Build
- Alternative 2: Restore/Rehabilitate Existing B&P Tunnel
- Alternative 3: Great Circle Passenger Tunnel
- Alternative 4: Presstman Street
- Alternative 5: Route 40
- Alternative 6: Locust Point
- Alternative 7: Sports Complex
- Alternative 8: Wilson Street—Existing Tunnel
- Alternative 9: Mosher Street North
- Alternative 10: Mosher Street South
- Alternative 11: Robert Street South
- Alternative 12: Robert Street North
- Alternative 13: Wilson Street—Under Existing Tunnel
- Alternative 14: North Avenue Bridge
- Alternative 15: Gilmor Street—Existing Tunnel
- Alternative 16: North Avenue Tunnel (Alternative from Public Input)

The preliminary alternatives screening process was applied to all of the 16 preliminary alternatives with the exception of Alternative 1: No-Build and Alternative 2: Restore/Rehabilitate Existing B&P Tunnel. In accordance with Council on Environmental Quality guidance (40 CFR Part 1502.14(d)), Alternative 1: No-Build was not screened, as it is the baseline against which the impacts of the Build Alternatives are assessed. Alternative 2 was not fully evaluated because there was insufficient information at the time on the most appropriate manner of tunnel restoration and rehabilitation, future uses of the existing tunnel, and whether re-construction of the tunnel could reasonably accommodate train operations.

Alternatives 3 through 16 were first screened for fatal flaws that clearly rendered the alternative not feasible or unreasonable. An alternative was considered to have a fatal flaw if it did not meet Purpose and Need, did not utilize existing infrastructure at Baltimore Penn Station and the Gwynns Falls Bridge, or would result in an unacceptable engineering issue that could not be reasonably avoided or solved during the early stages of alternatives development. Alternative 5: Route 40, Alternative 6: Locust Point, Alternative 7: Sports Complex, Alternative 14: North Avenue Bridge, Alternative 15: Gilmor Street, Alternative 16: North Avenue Tunnel, were all found to have a fatal flaw.

The eight remaining preliminary alternatives that did not have a fatal flaw were then evaluated using criteria derived from the Project Purpose and Need, as well as functional needs identified by FRA, MDOT, and Amtrak. A total of 24 screening criteria within these categories were identified: Engineering, Operational, and Environmental. These criteria are summarized below.

1. Engineering

- Tunnel Separation: the minimum separation between existing underground structures (especially the MTA Metro tunnel) and the proposed tunnel should be 30 to 40 feet.
- Tunnel Clearance: alternatives should be able to accommodate Plate H (double stack) clearance for either twin single-track tunnels or a single double-track tunnel.
- Horizontal Curvature: alternatives should allow for design speed of 40 miles per hour or greater.
- Vertical Grade: the maximum vertical compensated grade should not exceed two percent.
- West Baltimore MARC Station Service: the alternative should be capable of serving the West Baltimore MARC commuter rail station.
- Track Grade at Baltimore Penn Station: alternatives should not alter existing track alignments at Baltimore Penn Station.
- Physical Constraints: the alternatives should not impact physical constraints, including MTA Light Rail, the CSX track under Howard Street, the Jones Falls Bridge, the Jones Falls Expressway and the Howard Street Bridge.
- Separated Right-of-Way: tunnels should be on physically separate right-of-way (ROW) within a well-protected perimeter.

2. Operational

- Amtrak and MARC Operations: Amtrak and MARC should be able to maintain the volume and frequency of trains through Baltimore Penn Station with no significant interruptions.
- Number of Tracks and Throughput Capacity: tunnels should include at least two tracks and a practical throughput capacity of at least 24 trains per hour per direction during and after construction. This is equivalent to a theoretical throughput capacity of 30 trains per hour or two-minute headways between trains.

- Travel Time: tunnels should reduce travel time between the northern and southern project limits.
- NEC Operational Reliability: each track should be bi-directional and the tunnel should have universal interlocking with the NEC mainline (the ability for a train on any track to reach any other track within the limits of the interlocking).
- Movement of Freight: alternative should accommodate movement of freight at current (2015) levels.

3. Environmental

- Primary Construction Method: tunnels should be primarily bored, and should require limited cut-and-cover construction.
- Parks: impacts to parks located within the surface disturbance footprint should be avoided or minimized.
- Residential Land Uses: impacts to residential land use areas within the surface footprint should be avoided or minimized.
- Existing Bridge over Jones Falls: alternatives should utilize the existing bridge over Jones Falls.
- Minority and Low-income Communities: alternatives should avoid or minimize impacts to low-income and minority populations.
- Historic Districts and Structures: effects to historic districts and structures within the surface footprint should be avoided or minimized.

As a result of this initial screening process, twelve alternatives were eliminated from further study, and four alternatives, including Alternative 1 and Alternative 2, were retained for further engineering development and environmental evaluation. This information was presented to the public in December 2014 in the *Preliminary Alternatives Screening Report*. The results of this evaluation are shown in **Table 7.**

Table 7: Preliminary Alternatives Screening Results

	Alternative	Basis for Elimination or Retention
Eliminated from Study	Alternative 4: Presstman Street	• Does not meet tunnel separation requirement. • Amount of cut-and-cover construction would likely result in more severe environmental impacts relative to the other alternatives.
	Alternative 5: Route 40	• Fatal flaw: Does not utilize existing infrastructure at Baltimore Penn Station.
	Alternative 6: Locust Point	• Fatal flaw: Does not utilize existing infrastructure at Baltimore Penn Station.
	Alternative 7: Sports Complex	• Fatal flaw: Does not utilize existing infrastructure at Baltimore Penn Station.
	Alternative 8: Wilson Street-Existing Tunnel	• Requires closing the existing tunnel during construction. • Fails to avoid a key physical constraint (CSX mainline). • Likely to have substantial environmental impacts.
	Alternative 9: Mosher Street North	• Conflicts with multiple rail lines at Baltimore Penn Station. • Fails to meet NEC reliability criterion that requires two-track operation and universal interlocking with the existing NEC mainline.

	Alternative 10: Mosher Street South	• Conflicts with multiple rail lines at Baltimore Penn Station. • Fails to meet NEC reliability criterion that requires two-track operation and universal interlocking with the existing NEC mainline. • Fails to avoid a key physical constraint (CSX mainline). • Likely to have substantial environmental impacts.
	Alternative 12: Robert Street North	• Fails to avoid a key physical constraint (MTA Metro rail line). • Fails to maintain existing passenger operations during construction. • May have substantial environmental impacts.
	Alternative 13: Wilson Street-Under Existing Tunnel	• Fails to avoid a key physical constraint (CSX mainline). • Fails to maintain existing passenger operations during construction. • May have substantial environmental impacts.
	Alternative 14: North Avenue Bridge	• Fails to meet profile grade requirements. • May have substantial environmental impacts.
	Alternative 15: Gilmor Street-Existing Tunnel	• Proposed geometry impossible to design or construct.
	Alternative 16: North Avenue Tunnel	• Fails to meet profile grade requirements.
Retained for Further Study	Alternative 1: No-Build	• Serves as baseline for comparison to other alternatives
	Alternative 2: Restore/Rehabilitate Existing Tunnel	• Additional information needed to determine the viability of alternative; in particular, the most appropriate method of tunnel restoration or rehabilitation and whether construction could reasonably accommodate train operations.
	Alternative 3: Great Circle Passenger Tunnel	• Does not contain a fatal flaw and meets engineering and operational criteria.
	Alternative 11: Robert Street South	• Does not contain a fatal flaw and meets engineering and operational criteria.

Based on the *Preliminary Alternatives Screening Report* (PASR) screening criteria, Alternatives 3 and 11 met tunnel separation goals, had less conflict with physical constraints, maintained existing Amtrak operations, maintained at least two tracks and throughput capacity of at least 24 trains per hour in each direction, supported NEC reliability, and required a potentially less-invasive primary construction method (boring instead of cut-and-cover). The remaining four alternatives (Alternative 1: No-Build, Alternative 2: Restore/Rehabilitate Existing B&P Tunnel, Alternative 3: Great Circle Passenger Tunnel, and Alternative 11: Robert Street South) were retained for further design development and environmental evaluation.

B. Development of Alternatives 1, 2, 3, and 11

Alternatives 1, 2, 3, and 11 carried forward from the *Preliminary Alternatives Screening Report* underwent additional, more detailed, preliminary engineering review based on refined design goals, criteria, future rail

demands, required operational services and safety. Construction methods and potential community impacts were also taken into consideration during the development of the alternatives and included public and agency input, as described in **Section VII.**

1. Alternatives Design Goals

Design development and environmental evaluation were based on refined design goals that considered existing and future NEC operations, the Baltimore Penn Station Master Plan, and input from agencies and the public.

a. NEC Operations

In the Project Area, NEC operations consist of shared rail service through the B&P Tunnel by Amtrak Northeast Regional and Acela Express passenger trains; the MARC commuter train between the West Baltimore MARC Station and Baltimore's Penn Station; and NS freight. Amtrak NEC service and some MARC Penn Line trains are powered by overhead electric wires (catenary), while other MARC and freight trains are powered by diesel-electric locomotives. MTA plans to increase the number of MARC diesel locomotives by 2019.

A total of 145 daily trains traverse the B&P Tunnel with a maximum of 35 trains during the four-hour afternoon peak period. The majority of trains using the B&P Tunnel are Amtrak trains (61 percent), 38 percent are MARC trains, and less than 1 percent are NS freight trains. In 2014, an estimated 21,600 people passed through the tunnel daily, of which 79 percent are Amtrak passengers and 21 percent MARC passengers.

The NEC is included in multiple national efforts including the HSIPR Program (implemented by the 2009 *High Speed Rail Strategic Plan* (USDOT, 2009)), 2008 Congressional Mandate for Amtrak to Reduce Travel Time along the NEC (Public Law 110-432), *Amtrak NEC Master Plan* (Amtrak, 2010a), and the NEC FUTURE Program (USDOT, Accessed September 8, 2014). Those efforts are described as follows:

- HSIPR Program
  - Strategic investments in the nation's transportation network of passenger rail corridors to connect communities across the country.
  - *High Speed Rail Strategic Plan* (USDOT, 2009).
- 2008 Congressional Mandate for Amtrak to Reduce Travel Time along the NEC
  - Section 212(d) of the PRIIA Public Law 110-432.
  - Goals are reduced travel time along the NEC, improved train operations, increased service capacity, maintenance of rail services, and cost benefits.
- *Amtrak NEC Master Plan* (Amtrak, 2010a).
  - Provides the baseline for infrastructure investments needed to maintain the current NEC system in a state of good repair (SOGR)[7].
  - Integrates intercity commuter and freight service plans and moves the NEC forward to meet the expanded service, reliability, frequency, and trip-time improvements envisioned by the Northeast states and Washington, D.C.
- NEC FUTURE Program
  - FRA comprehensive planning effort to define, evaluate, and prioritize future investments in the NEC, from Washington, D.C. to Boston, Massachusetts.
  - Improve the reliability, capacity, connectivity, performance, and resiliency of passenger rail service on the NEC for both intercity and regional trips.

[7] SOGR is defined by the USDOT as a condition in which the existing physical assets, both individually and as a system, (a) are functioning within their "useful lives" and (b) are sustained through regular maintenance and replacement programs.

As described in the NEC FUTURE *Tier 1 EIS Alternatives Report* (FRA, 2015), the NEC FUTURE Program considers the B&P Tunnel Project an element of the Program. The Project will continue to be coordinated with the NEC FUTURE Program to ensure compatibility with future design and construction of the NEC FUTURE alternatives.

b. Baltimore Penn Station Master Plan

The Baltimore Penn Station Master Plan is in its early planning stages that include consideration of both short- and long-term improvements. In the short term, general station improvements would include modifying existing low-level platforms to high-level platforms on certain tracks with level boarding. None of these changes would affect where B&P Tunnel tracks would tie into station tracks. Long-term improvements, such as a streetscape, bike lanes, etc., would not affect or need to be incorporated into the B&P Tunnel Project.

c. West Baltimore MARC Station Improvements

Over the last several years, MTA in coordination with FTA has been making incremental improvements to the existing West Baltimore MARC Station. These improvements include upgrades to the facilities including addressing some of the ADA compliant needs. It is not feasible to construct a fully accessible station with high level platforms and level boarding that is in compliance with ADA at the current station because it is is located along a curved portion of the track. Since the existing Station cannot be completely upgraded to be ADA compliant, MTA has been reviewing options to relocate the Station to the south along a straight portion of the track; however, there has been concern from the public and MTA regarding the distance of the potential new station in relation to the existing parking lots. Amtrak and MTA have been coordinating the need to maintain service and operations for MARC passengers and the potential to straighten the curve and provide a fully accessible Station at the existing location.

d. Overall Design Goals

Several goals for the B&P Tunnel Project guide the design process. The overall design for the B&P Tunnel Project will provide:

- Optimal safety
- Minimum travel times (maximum speeds)
- Maximum passenger comfort
- Optimum constructability
- Minimum long-term maintenance costs

The Alternative design must meet the purpose and need for the Project as well as preserve as much existing infrastructure as possible. The Alternatives should:

- Include four tracks optimized for Amtrak and MARC commuter services, with freight able to provide service on either set of tracks.
- Provide reduced trip times by enabling higher speeds.
- Offer greater capacity by increasing the number of tracks and supporting double stack container freight cars.
- Provide universal interlockings with the NEC mainline.
- Minimize substantial track modifications south of, and over, Gwynns Falls Bridge and through, or north of, Baltimore Penn Station.
- Serve the West Baltimore MARC Station and Baltimore Penn Station.
- Have no impact on the MTA Metro tunnels and underground Penn-North or Upton Avenue/Market stations.
- Preserve the CSX track under Howard Street, Amtrak Jones Falls Bridge, Jones Falls Expressway and the Howard Street Bridge.

- Enable freight movement at current levels.
- Continue operation of the two tracks through the existing tunnel during construction, with temporary outages taken as permitted by rail schedules weekday nights and on weekends during construction.

The B&P Tunnel design should not preclude implementing the alternatives of the NEC FUTURE Tier 1 EIS (USDOT and FRA, 2015). The following describes applicable NEC FUTURE constraints:

- Build alternatives include four tracks through the B&P Tunnel.
- Provide for a minimum of 70 mph speeds where possible for passenger trains throughout the project limits.
- Ensure that conflicts do not occur between express through-rail traffic at Baltimore's Penn Station and MARC commuter trains turning at the station. NEC FUTURE assumes NEC intercity operations would typically be on the railroad's west side of Baltimore's Penn Station (geographical north) with MARC operations on the railroad's east side (geographical south). Two mainline tracks would feed each line on either side of the station, which is consistent with the current operating pattern. To provide operational redundancy and resiliency, either service should be able to use alternate station tracks when conditions warrant.

2. Alternative Design Criteria

Design criteria establish the standards and guidance needed to complete the engineering and design work for the proposed B&P Tunnel modernization or replacement. These criteria, standards and guidance are described in the B&P Tunnel Project *Draft Final Design Criteria Report* and form the basis for design updates during the Preliminary Engineering phase of the Project.

Table 8 summarizes the design criteria and assumptions most relevant to the development and evaluation of B&P Tunnel alternatives. Many design criteria stipulate the components, size, clearance, and placement of design features. These criteria originate from regulations, oversight agency guidance, and knowledge of safety standards, constructability, operational parameters, and maintenance needs.

Table 8: Design Criteria and Assumptions

Design Criterion/Assumption	Description
Design Speed	Intercity Passenger Trains: Maximum 110 mph or greater Commuter Passenger Trains: Maximum 70 mph Freight Trains: Maximum 50 mph
Horizontal Geometry	Curvature should support desired maximum speeds. When a horizontal curve is located on the grade, the maximum allowed grade on the curve is reduced by 0.04 percent for each degree of horizontal curve.
Slope/Grade	Grades measured as the change in elevation in feet per 100 feet of horizontal distance shall not exceed 2 feet (or 2.000 percent grade). Avoid frequent changes in gradient.
Geotechnical	Maximize tunnel placement in bedrock to minimize the amount of soft ground and mixed-face mining required.
Mining Tunnel Portal	Minimum 50 feet depth from ground surface to top of rail for underground construction.
Tunnel Clearance	One set of tracks per bore. Design to Plate H clearances suitable for double stack container freight operations with an operating envelope, generally, of 10 feet 8 inches wide by 20 feet 3 inches tall.
Internal Tunnel Dimensions	Approximately 30 feet diameter to allow safe passage of trains, operation and maintenance of tunnel, and meet applicable regulatory code[1].

Design Criterion/Assumption	Description
Fire Life/Safety	Ensure emergency ventilation and exits. Emergency ventilation provided by jet fans in the tunnel and/or ventilation plants housing fans and other equipment. With multiple tunnels, place cross passageways for separate track tunnels at no more than 800 foot intervals between adjacent tunnels or use fire-resistant enclosed stairways/passageways with maximum distance to surface of 2,500 feet, separate from ventilation shafts. The maximum distance between emergency exits cannot exceed 2,500 feet. Evacuation Walkways: 30 foot clearance between composite clearance template and any continuous obstruction alongside the track in a designated passenger emergency evacuation path.
Signals	Design based on fixed interlockings at the "Charles" Interlocking on the north and the "Bridge" Interlocking on the south.
Utilities	Consider railroad alignment changes to avoid or minimize difficult or costly utility relocations.
Right-of-Way (ROW)	Safety and security of the public, as well as the neighborhoods that house the railroad, require a physically separate ROW with a well-protected perimeter. The Project must, by location and design, prevent unauthorized intrusion into or upon the operating railroad environment, discourage vandalism, loitering, or dumping on the ROW or adjacent to facilities.

3. Alternative Options and Track Alignments

During further engineering development and environmental evaluation, three options were developed for Alternative 3, and two options were developed for Alternative 11. The options follow similar alignments as their respective alternatives and were developed in order to address issues such as minimizing environmental impacts, flattening curves to increase speeds, and/or minimizing impacts to large underground utilities such as sanitary sewers or storm drains. Additionally, as the alternatives underwent continued development, Alternative 2 was modified to involve reconstruction and modernization of the existing tunnel. The *Alternatives Report* evaluated Alternative 1: No-Build, Alternative 2: Reconstruct and Modernize Existing Tunnel, Alternative 3 Option A, Alternative 3 Option B, Alternative 3 Option C, Alternative 11 Option A, and Alternative 11 Option B. A full description of the alternatives and evaluation is presented in the *Alternatives Report*.

Additional information on how tunnels are built and the basis for the number of tunnels developed for Alternative 3 and Alternative 11, is included below.

Railroad tunnels may be constructed in several ways, including:

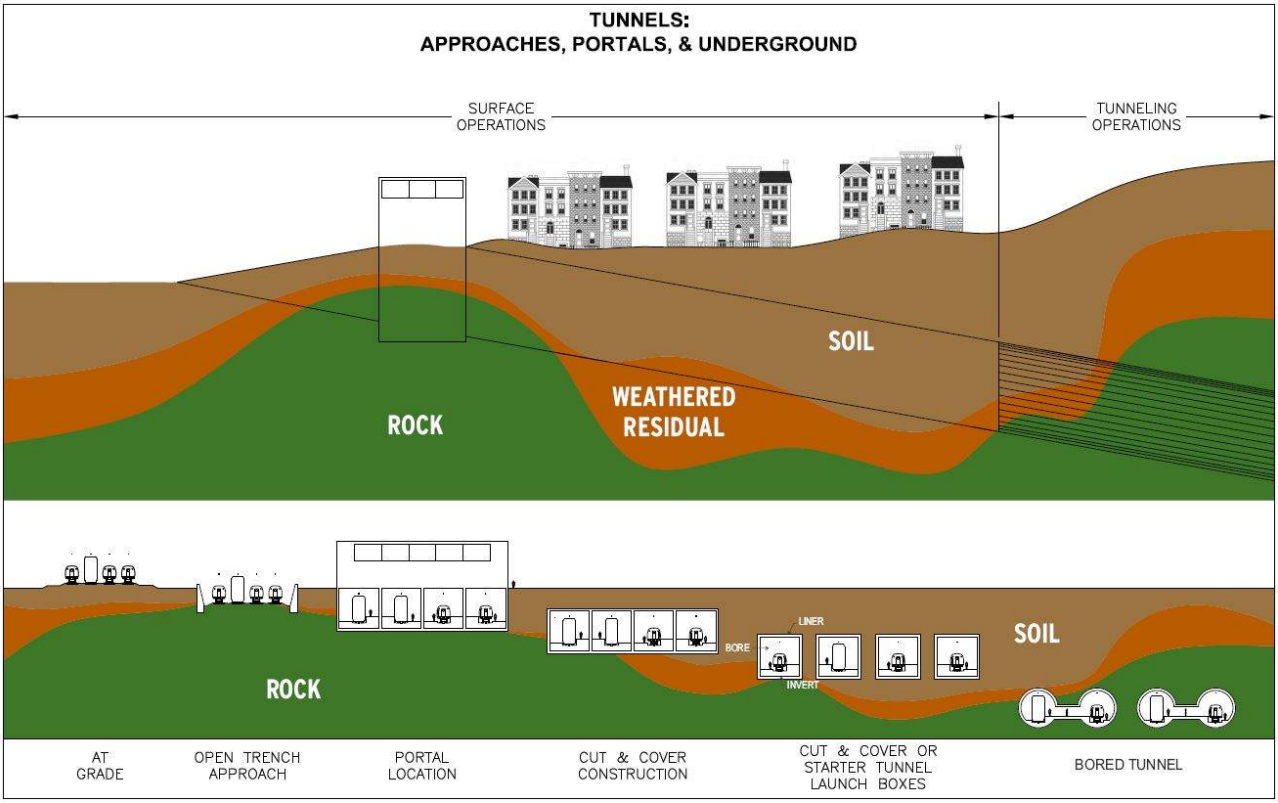
- Cut-and-cover construction where an open trench is excavated, the tunnel built, and then covered.
- Horizontal excavation by mining, which includes boring with a tunnel boring machine, drill and blast, or sequential excavation.

Cut-and-cover construction requires removal of everything on the surface, above the planned tunnel, and excavating a deep and wide trench; in which the tunnel structure is constructed and then covered, restoring the ground cover. After excavation, the trench would be covered with fill material. Where cut-and-cover construction would occur, the covered portion would likely exist as grass-covered open space. Any land use aside from open space would need to be planned and coordinated with B&P Tunnel Project engineers.

Horizontal excavation by mining involves boring at a portal where the alignment would transition from surface to underground and excavating horizontally; surface disturbance would only occur at the approaches to the portals on either end of the tunnel and for ancillary structures like emergency exits. Depending upon

topography, depth of the tunnel, and other factors; tunnels may have sections that are mined and other sections that are cut-and-cover. When both cut-and-cover and mining operations are employed, the portals would occur between the mined and cut-and-cover sections and would not be visible from the surface. In these cases, the permanent, visible entrances to the finished tunnel would occur at the exposed end of the cut-and-cover section. See **Figure 4** for a schematic diagram.

Figure 4: Tunnel Terminology Diagram



The tunnels proposed as options under Alternatives 3 and 11 would all predominantly use tunnel boring techniques to minimize surface impacts. A combination pressurized face/rock tunnel boring machine would be used to maintain stability of the excavation face in soil, bedrock, and weathered bedrock while advancing the tunnel excavation. The outside approaches, sloping down to the portals, would be built with a combination of trench cutting and cut-and-cover construction techniques. Ancillary structures, such as ventilation shafts or emergency egress, could be mined in a combination of mechanical excavation and controlled blasting.

4. Four Tracks

Consistent with NEC long-range planning needs identified in the NEC FUTURE Program, the B&P Tunnel Alternatives 3 and 11 propose a total of four tracks through Baltimore. The increased number of tracks will eliminate a chokepoint and expand capacity to accommodate future high-frequency, high-speed passenger train service anticipated on the NEC by 2040. Four tracks provide the resiliency/redundancy needed to maintain rail traffic between the West Baltimore MARC Station and Baltimore Penn Station and NEC connectivity in the event of interruptions to service on any of the tracks. Four tracks also provides the ability for conflict-free operation and separation of traffic types (intercity vs. commuter) which further improves operations, reduces travel time, and accommodates over-takes of slower trains by faster trains.

Alternatives 3 and 11 would have tunnel clearances to accommodate double stack container freight cars, known as AAR Plate H. Alternative 2 would increase the height of the rehabilitated tunnel to accommodate double stack

container freight cars. Neither Alternative 1: No-Build nor Alternative 2: Restore/Rehabilitate Existing B&P Tunnel would include four tracks. The current tunnel does not accommodate Plate H equipment and cannot be made so without reconstruction, therefore Alternative 1 would not accommodate Plate H.

5. Four Separate Tunnel Bores

For Alternatives 3 and 11, single sets of tracks in four separate, equally-sized tunnel bores are proposed. The single track design instead of two double-track tunnels is based on several criteria: conflict-free operations, physical constraints, and constructability. It has been determined that four tunnel bores, as opposed to two bores with two tracks each, would achieve the project's operational and safety needs. The design for four separate bores is driven by engineering issues related to conflict-free operations, physical constraints, and constructability as described below.

a. Conflict-free Operations

Alternatives were designed with the goal of conflict-free operations and service flexibility, so that the number of conflicting moves at railroad interlockings and places where two or more sets of tracks would cross (junctions) are minimized. These movements can be controlled by at-grade signaling or grade-separated crossings. A subterranean grade-separated track crossing or "duck under" is proposed as the most efficient method for preventing conflicts, and maintaining operational goals, for the new four-track B&P Tunnel. This could not be achieved if two sets of tracks were together in a single tunnel.

b. Physical Constraints

The separation of four sets of tracks into individual tunnel bores is driven by physical constraints that include passing beneath the existing Metro tunnel and its Penn-North or Upton/Avenue Market stations. The depth of the subway and geotechnical ground conditions require approximately one-half tunnel diameter of separation, which would result in a railroad grade just under the design criterion of 2.000 percent. Two percent is the maximum design grade allowable to connect to the existing NEC near the West Baltimore MARC Station. A single bore with two sets of tracks would be wider, resulting in an increased vertical separation between the new tunnel and the Metro subway. Lowering the tunnel to provide the additional clearance would increase the steepness of the grade and exceed the maximum for connection to the NEC at the West Baltimore MARC Station. To avoid an increase in profile grade, the connection between a new B&P Tunnel with double tracks and the existing NEC would have to be made further south of the West Baltimore MARC Station. This would increase surface impacts by requiring a longer trench excavation for the approach to the new tunnel, require modifications to the West Baltimore MARC Station, and cause more extensive impacts to adjacent communities.

c. Constructability

Another issue in the decision to construct four sets of tracks in four separate tunnel bores is constructability of the tunnel portal, where the surface transitions to the underground tunnel bore. A conservative criterion used to select the location of a tunnel portal is where ground cover above the tunnel is a minimum of 75 percent of the proposed tunnel diameter. Single tracks in a single bore would be a minimum of 50 feet below the overlying ground surface to the top of rail elevation. Two tracks per bore would be a minimum of 62 feet from top of rail elevation to the overlying ground surface. The latter would not work at the north portal because the grade would be too steep for connecting to the existing "Charles" Interlocking, which is a relatively short distance to the railroad north (geographical southeast).

The available space for the "Charles" Interlocking between the north portal and Baltimore Penn Station is a limiting factor. The limited space would also incur more surface impacts at the south portal from a longer trenched approach, which would connect to the existing NEC alignment further south. The north and south portals could be shifted further away from the existing alignment, but this would encroach further into neighborhoods and greatly increase environmental impacts to communities.

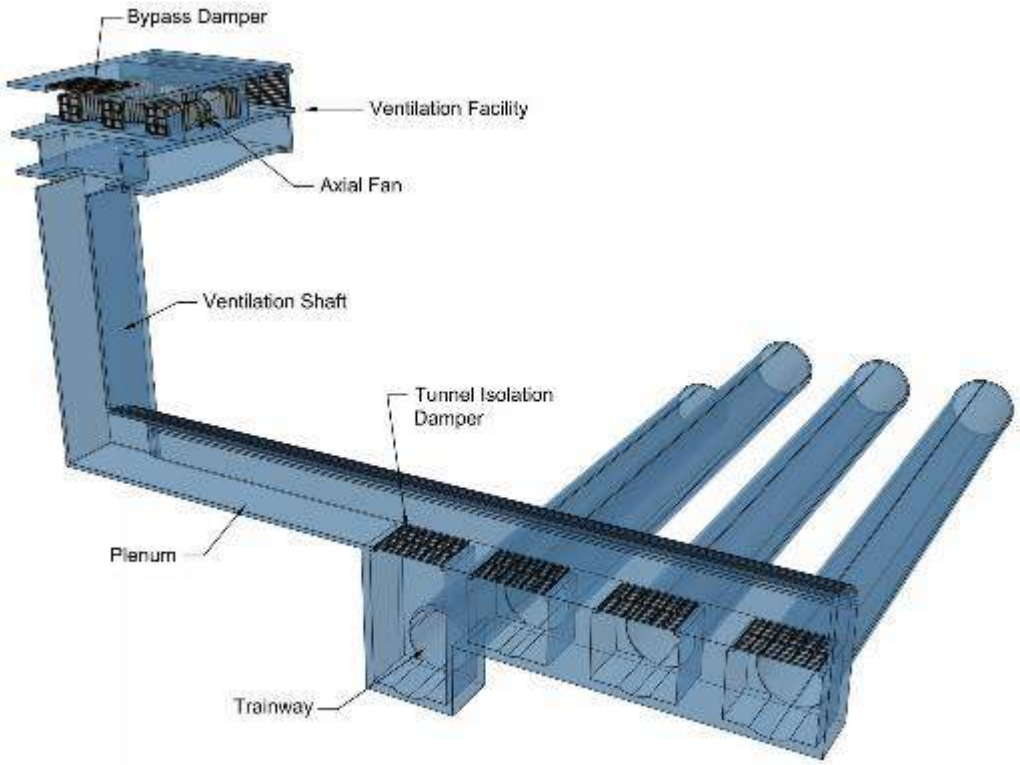
6. Ventilation Plants

Each Build Alternative proposed for the B&P Tunnel Project would require a ventilation system with three above-ground ventilation plants in order to meet current safety industry standards (NFPA 130) for projected NEC FUTURE train demand and headway.

Ventilation plants, are an essential Life/Safety component of the B&P Tunnel Project. As shown in **Figure 5**, they are an above-ground structure housing facilities essential to safely and securely performing necessary tunnel ventilation, including fans, operation and control equipment, fire protection equipment, and emergency exits. The purpose of the ventilation plant is to pull fresh air into the tunnel and ventilate the tunnel air to the outside; this is done through both passive (from train movement) and active (from fans) ventilation. Passive or active ventilation occurs depending on the following tunnel operations:

- Normal operation: trains run at their scheduled speed, providing sufficient ventilation through the piston effect, or "push-pull" movement.
- Congested operation: trains run at slower speeds and do not provide sufficient passive ventilation, necessitating active mechanical ventilation.
- Maintenance operation: while work is being performed in the tunnel, trains would not provide sufficient passive ventilation, requiring active mechanical ventilation to provide a safe atmosphere for workers. Ventilation plants maintain safe air quality by automatically turning on fans when sensors indicate air is nearing air quality standards for nitrogen dioxides, an indicator pollutant, regulated by the Occupational

Figure 5: Ventilation Plant Schematic



Safety and Health Administration (OSHA). The diesel emissions discharged from the fan plants will meet national ambient air quality standards (NAAQS). The ventilation plants will also reduce heat generated by train operations.

- Emergency operation: in a potential emergency situation, active mechanical ventilation is necessitated to control heat and smoke to provide a tenable environment for first responders and emergency egress

The number and placement of ventilation plants is determined by tunnel length and the necessary number of ventilation zones. Three ventilation plants— one at the north portal, one at an intermediate location along the tunnel alignment, and one at the south portal— are needed to divide each alternative into two ventilation zones. Current industry safety standards dictate that only one train can be permitted in a ventilation zone at a time. The tunnels proposed under each Build Alternative would be approximately two miles long, and projected NEC FUTURE train demand and headway could not be met with a single ventilation zone tunnel. Train performance models show that the NEC FUTURE demand and headway requirements can be met with two ventilation zones for this Project. The interface between the two ventilation zones must be located at the point that balances travel time in each ventilation zone (considering both directions). Due to asymmetrical curvature and grades, differing speeds trains enter the tunnel depending on their direction of travel, and braking distances; the ventilation zone interface is not in the geographic middle of the tunnel for each option under Alternative 3.

The ventilation zones are created by installing tunnel isolation dampers in the tunnel ceiling at the interface location (**Figure 3**). The dampers are connected to the intermediate ventilation plant at the surface by a horizontal connecting tunnel and vertical shaft. In order to meet practical air velocities and pressures, this conduit must have a cross-sectional area larger than 30 feet in diameter.

Preliminary engineering determined that a site sized approximately 100’ x 200’ and 55 feet tall would be needed. In order to function properly there needs to be at least 3,000 square feet of louvers and the bottom of the louvers must be at least 12 feet above ground. The facility is sized to address emergency ventilation requirements in one tunnel at a time; this emergency capacity provides sufficient capability for normal, congested, and maintenance operations in all four tunnel simultaneously

a. Intermediate Ventilation Plant Site Identification

The size of the ventilation plants are determined by the equipment that is located within them, which is largely dictated by the size of fire that is to be controlled by the ventilation plant. The ventilation plant footprint is estimated to be up to 200 feet by 100 feet and approximately 55 feet high. The ventilation plants must be large enough to house the required number of fans and ancillary equipment, such as silencers and dampers, as well as associated ductwork to connect to the tunnel. The ventilation plants contain electrical equipment such as transformers and motor starters and provide emergency and maintenance access to the tunnels. The ventilation plants would, to the greatest extent practical, conform to local building codes and complement/blend in with the built environment. **Image 1** and **Image 2** show examples of existing and proposed ventilation plant designs for similar (but smaller) projects in New York.

C. Elimination of Alternatives from Further Study

The Alternatives and Options summarized above were evaluated using the 52 criteria shown in **Table 2.** These criteria include design criteria, design goals, and environmental impacts. The overall categories are Operations, Engineering, Transportation, Cost, Construction, ROW, Community Resources, Cultural Resources, Natural Resources, and Other Environmental.

The *Alternatives Repor*t documented the conclusion that Alternative 1: No-Build, Alternative 3 Option A (Alternative 3A), Alternative 3 Option B (Alternative 3B), and Alternative 3 Option C (Alternative 3C) were still under consideration. Alternative 2, Alternative 11 Option A, and Alternative 11 Option B were eliminated from further consideration. The reasons for elimination are described below.

Image 1: Existing Ventilation Plant, 58 Joralemon Street, Brooklyn, NY

Image 2: Proposed Ventilation Plant Example in NY

1. Alternative 2: Reconstruct/Modernize Existing Tunnel

Alternative 2 would reconstruct and modernize the existing tunnel, but would not meet the project's Purpose and Need.

Specific reasons for the elimination of Alternative 2:

- Construction would require the complete cessation of rail service along the NEC corridor, including all Amtrak service, MARC service north of the West Baltimore MARC Station, and freight service using the B&P Tunnel during construction. Service would be interrupted for an extended period of time, as long as several years.
- Design speeds would be the same as the current tunnel; horizontal geometry would remain effectively unchanged. Design speed would be as low as 30 mph, significantly lower than the other Build Alternatives.
- No travel time savings over existing conditions.
- Can only accommodate two tracks, which does not allow for future growth in rail service along the NEC.
- An option to build four new tracks could be accommodated by more significant widening of the existing alignment. This option was not analyzed because there is no available ROW and widening would require significant residential takes for the entire length of the alignment. An option to build four new tracks under the existing tunnel (in a two-by-two arrangement) is not feasible due to the clearance needed from the MTA Metro Subway line and geometry needed to bring the tracks together in a four track arrangement transitioning from the tunnel portals.
- Due to the shallow depth of the existing tunnel, the only viable construction approach is open excavation along the entire tunnel length. This excavation would have significant impacts on the community, including the following:

- Full or partial closure of Wilson Street, Winchester Street, and numerous cross streets throughout construction.
- No parking along Wilson Street or Winchester Street during construction.
- Limitations for residential and commercial access along Wilson Street and Winchester Street during construction.
- Minor impacts to four parks—Eutaw Place Median Park, Park Avenue Median Park, Mount Royal Median Park, and Fitzgerald Park.
- Substantial residential property impacts.
- Severe impacts to North Avenue, central Light Rail line, and CSX Main Line operations due to open cut construction through North Avenue, light rail, and CSX track beds.

2. Alternative 11 Option A

Alternative 11 Option A would meet the project Purpose and Need. However, the overall impacts would not result in commensurate benefits compared to the alternatives still under consideration.

Specific reasons for the elimination of Alternative 11 Option A:

- Extensive excavation in a residential area, with the following resulting impacts:
  - 140 historic buildings impacted, more than any other Build Alternative.
  - 160 parcels impacted, more than any other Build Alternative.
  - 140 residential displacements, more than any other Build Alternative.
  - 20 business displacements, more than any other Build Alternative.
  - Loss of 120 on-street parking spaces.
  - High level of community impacts during construction.
  - Potential environmental justice considerations—impacts within minority communities and partially within low income communities.
  - 210 buildings with potential noise impacts, more than any other Build Alternative.
  - Permanent closure of some sections of local streets.
- West Baltimore MARC Station shifted further south, which is a less desirable location for the station and access to parking lots and bus lines.
- Demolition of the American Ice Company building, a locally-important, community historic resource.
- Potentially severe impact to redevelopment efforts envisioned in the West Baltimore MARC Station Master Plan due to relocation of the station away from planned redevelopment properties and demolition of the American Ice Company building, a centerpiece of the plan.
- Impacts to Winterling Elementary School.

3. Alternative 11 Option B

Alternative 11 Option B would meet the project Purpose and Need. However, the overall impacts, less operational flexibility, and high construction cost would not result in commensurate benefits compared to the alternatives still under consideration.

Specific reasons for the elimination of Alternative 11 Option B:

- Requires demolition of the entire block bounded by Edmondson Avenue, Franklin Street, Pulaski Street, and the Amtrak NEC. Due to the construction, the entire block is lost to excavation and the needs of the B&P Project. There is no opportunity to use cut-and-cover construction and gain back any of the property for other uses.
- Potential environmental justice considerations: all residences and businesses taken are within minority and low income communities.

- Potentially severe impacts to the redevelopment efforts envisioned in the West Baltimore MARC Station Master Plan, including demolition of nearby properties proposed for redevelopment.
- Historic resources: demolition of the American Ice Company building and other historic resources in the Midtown Edmondson Historic District.
- Minor impacts to Winterling Elementary School recreational facilities.
- Reconstruction of Franklin and Mulberry Streets at a higher elevation to accommodate Alternative 11 Option B passing underneath. The higher elevation would raise Franklin and Mulberry Streets to between 10 and 20 feet, with resultant impacts including visual effects.
- Highest capital cost among Build Alternatives, estimated at $4.2 billion.
- Requires a MARC Station to be constructed below surface grade, in a cut section.
- Requires taking of a portion of the existing West Baltimore MARC Station parking lots.
- Less operational flexibility compared with other build options:
    - During construction, most work would be performed without affecting NEC operations once temporary runaround tracks are in place. However, the runaround tracks require a lower operating speed, thereby affecting train movement during the project.
    - Alternative does not accommodate a new “Fulton” (partial) Interlocking. If one of the two tracks that serve the side platforms at West Baltimore MARC was out-of-service, one MARC platform would not be accessible.
    - Requires construction of a temporary viaduct west of the existing tracks between Franklintown Road and Edmondson Avenue to maintain NEC service throughout the duration of construction.

This page intentionally left blank

IV. ALTERNATIVES STILL UNDER CONSIDERATION

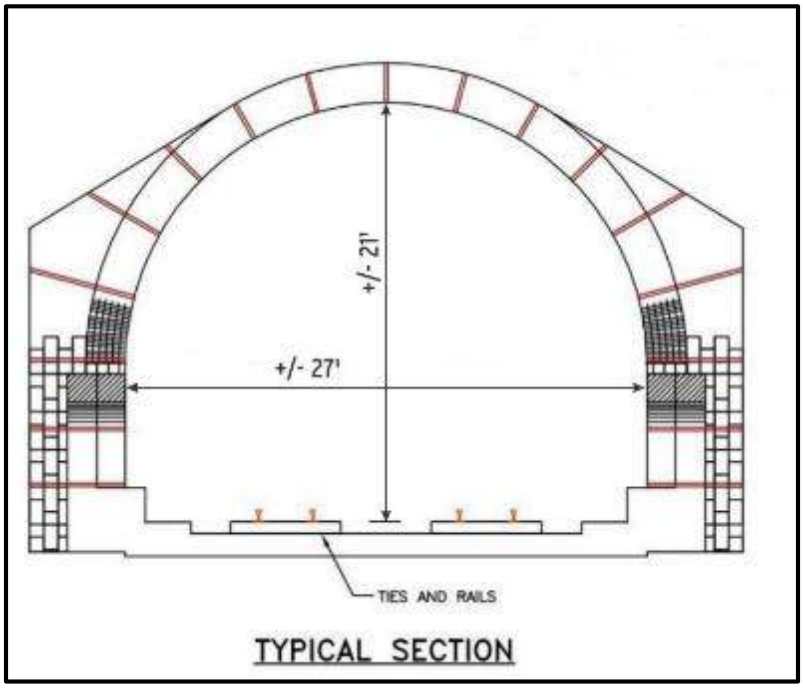
Alternatives 1, 3A, 3B, and 3C are the alternatives still being considered for the B&P Tunnels. The specific descriptions of these alternatives including the ventilation plants are provided in this section. Potential impacts associated with these four alternatives are located in **Section VI**.

A. Alternative 1: No-Build

Alternative 1: No-Build; serves as the baseline for analysis of the Build Alternatives. It entails continued use of the existing B&P Tunnel with no significant improvements aside from routine maintenance. Maintenance would include the following:

- Injection of waterproofing material behind the tunnel liner.
- Repair of brick and mortar defects in the tunnel liner.
- Repair of leaking utility lines above the tunnel.
- Rebuilding of deteriorated safety niches (also known as “manholes”).
- Repair of the Gilmor Street Tunnel portal.
- Replacement of invert slab where deteriorated.
- Removal of debris.
- Demolition of remaining portions of the Pennsylvania Avenue depot, which is no longer in use.
- Scale and removal of delaminated gunite/shotcrete.
- Cleaning of sidewall drains.
- Replacement of lighting and utility mounts.
- Replacement of catenary supports.

Figure 6: Alternative 1: No-Build Typical Section



The tunnel’s basic geometry and structure would not be improved as shown above in **Figure 6**; the existing tunnel and tracks would be left in place as shown below in **Figure 7**. This alternative would be more intensive than the maintenance currently performed, but would not modernize the tunnel and fall short of a SOGR; it

would maintain existing service and ongoing maintenance, with minimal disruption. This alternative would not meet Purpose and Need for the Project.

Repairs completed in the early 1980s included replacement and lowering of the tunnel invert, repair of the tunnel lining, drainage improvements, and installation of an improved track system. Since these repairs, evaluations concluded the B&P Tunnel should be replaced within 20 years due to the increasingly difficult and expensive maintenance exacerbated by increased train traffic and a short work window during which maintenance can be performed without adversely affecting on-time performance.

B. Alternatives 3A, 3B, and 3C

Alternatives 3A, 3B, and 3C were developed, in part, as a way to bypass the tight curves that slow train traffic through the existing B&P Tunnel while still maintaining platforms at Baltimore Penn Station. Alternatives 3A, 3B, and 3C would extend on new location along a wide arc north of the existing B&P Tunnel. The wide, continuous arc of each proposed alignment allows trains to travel at higher speeds.

Tracks in four separate tunnel bores extend between the north and south portals. The alignments would remain below ground until exiting through the tunnel portals, where the tracks would transition back to the surface. Alternatives 3A, 3B, and 3C would each involve open cut and cut-and-cover sections to bring the tracks to the surface after exiting the tunnel portals on each end. Tracks would pass through the portals, through a cut-and-cover section, followed by an open cut (trench) section prior to connecting with the existing NEC alignment.

There are several design elements that would apply to each of the Alternatives, as described below:

- All three Alternatives include a four-track alignment in four individual tunnel bores.
- Each Alternative would provide universal interlocking to the NEC mainline and would avoid the Metro Subway while servicing the West Baltimore MARC Station.
- Each includes “duck under” alignments to facilitate conflict-free operations. To properly align the tracks, the southbound MARC commuter train track would duck under the two Amtrak tracks to align as the west track on the southbound platform of the West Baltimore MARC Station.
- All three Alternatives would relocate a pier of CSX (formerly B&O) Bridge Number 3.
- NEC service would continue through the existing tunnel during construction of a new alignment.
- Each Alternative would involve surface track work between the existing Baltimore Penn Station platforms and an existing retaining wall adjacent to the MTA North Avenue LRT station. Each alignment would pierce the retaining wall to pass below the LRT tracks and station before entering into bored tunnels at the north portal.

Three ventilation plants for Alternatives 3A, 3B, and 3C would be required to ensure proper ventilation of the proposed tunnels. Two of these ventilation plants would be located near the tunnel portals, one near the north portal and one near the south. A third intermediate tunnel ventilation plant would be connected to the bored portion of the tunnels (see **Section IV.F** for more detail). Emergency egresses would also be required; locations for each alignment option have yet to be determined.

C. Alternative 3A

Alternative 3A is nearly identical to the Great Circle Passenger Tunnel concepts originally envisioned through previous studies and the PASR. As Alternative 3 underwent additional design and study, it was determined the overall travel time between Gwynns Falls Bridge and Baltimore Penn Station would be governed by the tight curve where the West Baltimore MARC Station is currently located (referred to as Curve 381). It was determined that Alternative 3A would effectively preclude measures to alleviate the tight curve for the life of the new tunnel (approximately 100-150 years).

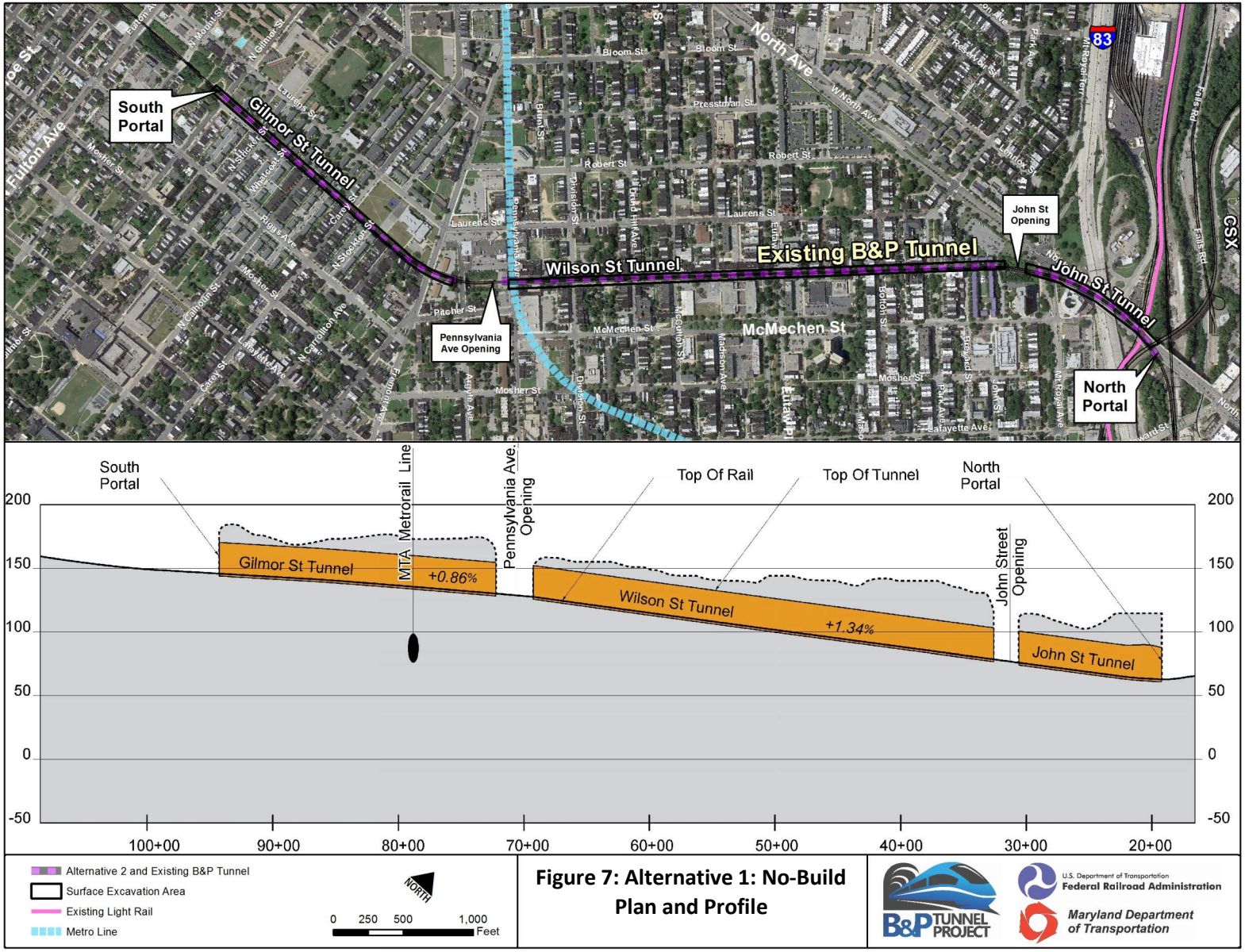


Figure 7: Alternative 1: No-Build Plan and Profile

Alternative 3A would result in a total travel distance of 3.66 miles between Baltimore Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 1.91 miles of the total length. Alternative 3A, including the horizontal alignment and vertical profile, is shown in **Figure 8**.

1. North Portal

Alternative 3A follows the existing mainline tracks in the Jones Falls valley under the Howard Street Bridge to just before North Avenue, where the alternative diverges from the existing track alignment. The alignment continues aboveground until the north portal located at the retaining wall next to the MTA North Avenue LRT Station. The alignment would travel through an existing retaining wall, adjacent to the LRT station, to begin its descent below ground. The north portal would require specialized tunnel construction techniques, such as ground improvement, in advance of tunneling to allow the four tracks to pass below the LRT facilities. The north portal would include a ventilation plant. A map of the north portal is shown in **Figure 9** and a rendering of the north portal is shown in **Image 3**.

2. Tunnel Segment

Alternative 3A continues below ground in a gradual arc for 1.91 miles, traversing below primarily residential city blocks in the neighborhoods of Reservoir Hill, Penn North, Sandtown-Winchester, Bridgeview/Greenlawn, Midtown-Edmondson, and Penrose/Fayette. From the north portal, the alignment crosses under I-83 (Jones Falls Expressway) north of the intersection of Reservoir Street and Mount Royal Terrace. The alignment continues in a gradual curve north of Reservoir Street and Ducatel Street, and south of the east-west portion of Whitelock Street. The alignment continues to curve southwest, crossing Whitelock Street and the intersection of North Avenue and Pennsylvania Avenue. The alignment begins to curve to the south, as the western side of the alignment runs near the east side of the Carver Vocational-Technical High School athletic field boundary. Through the tunnel segment, the depth of the alignment would reach 185 feet, with an average depth of 130 feet (from ground level to top of tunnel).

3. South Portal

Alternative 3A would include a south portal located within the existing P. Flanigan and Sons Asphalt plant, roughly a third of a mile west of the existing B&P Tunnel south portal. The cut-and-cover and open cut sections would be located between the P. Flanigan and Sons property and Lafayette Avenue, with some additional at-grade track work located between Lafayette Avenue and Edmondson Avenue. Further at-grade track work within Amtrak ROW would be located between Mulberry Street and the Amtrak Gwynns Falls Bridge. A new "Fulton" Interlocking would be constructed south of the south portal. No modifications to the West Baltimore MARC Station would be required; consequently, no high-level platform for level boarding at the Station would be provided. A map of the south portal is shown in **Figure 10** and a rendering of the south portal is shown in **Image 4**.

D. Alternative 3B

Alternative 3B was developed to retain the basic conceptual alignment of Alternative 3, while eliminating speed restrictions imposed by Curve 381. This is achieved by shifting the alignment east to modify/improve the curve. Alternative 3B would result in a total travel distance of 3.66 miles between Baltimore Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 2.03 miles of the total length. An overview of Alternative 3B, including the horizontal alignment and vertical profile, is shown in **Figure 11**.

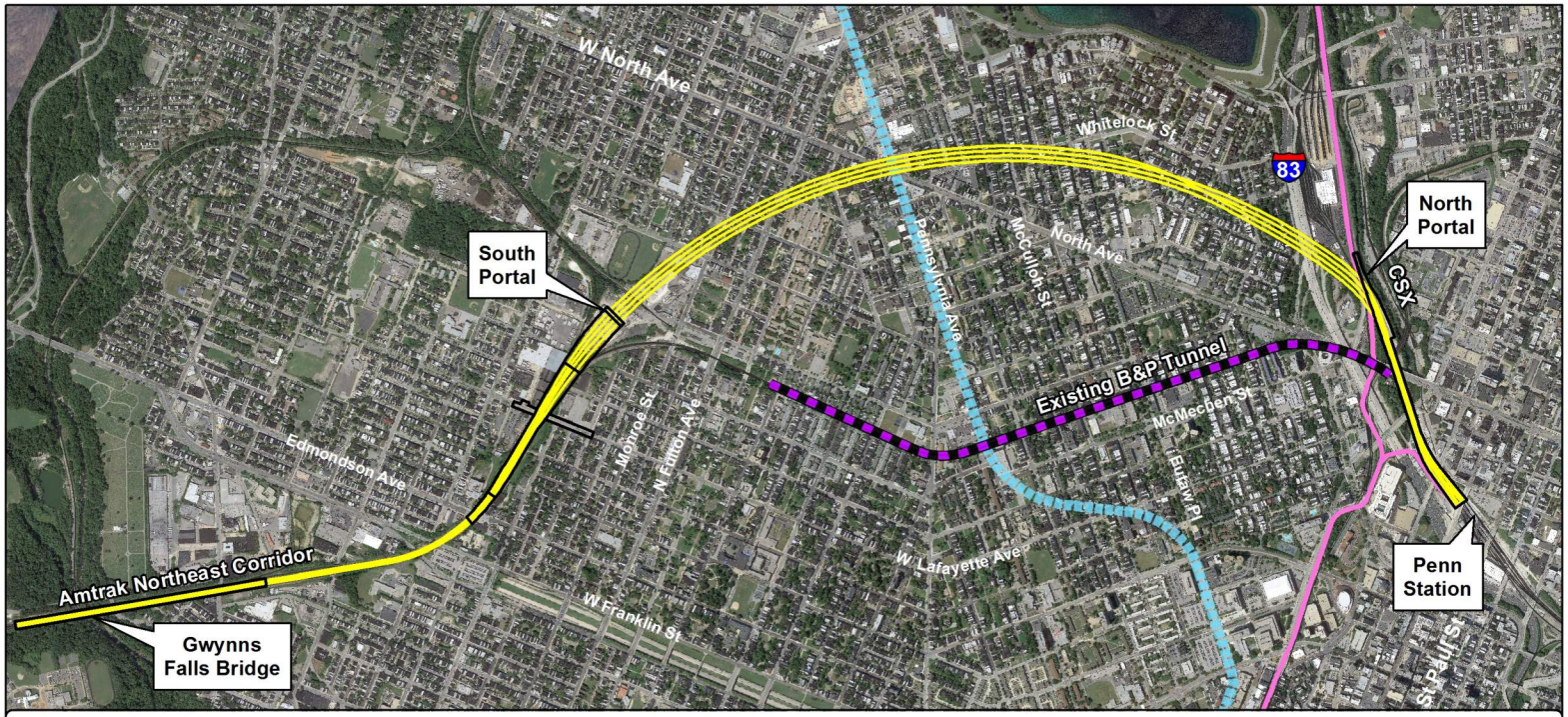


Figure 8: Alternative 3A Plan and Profile

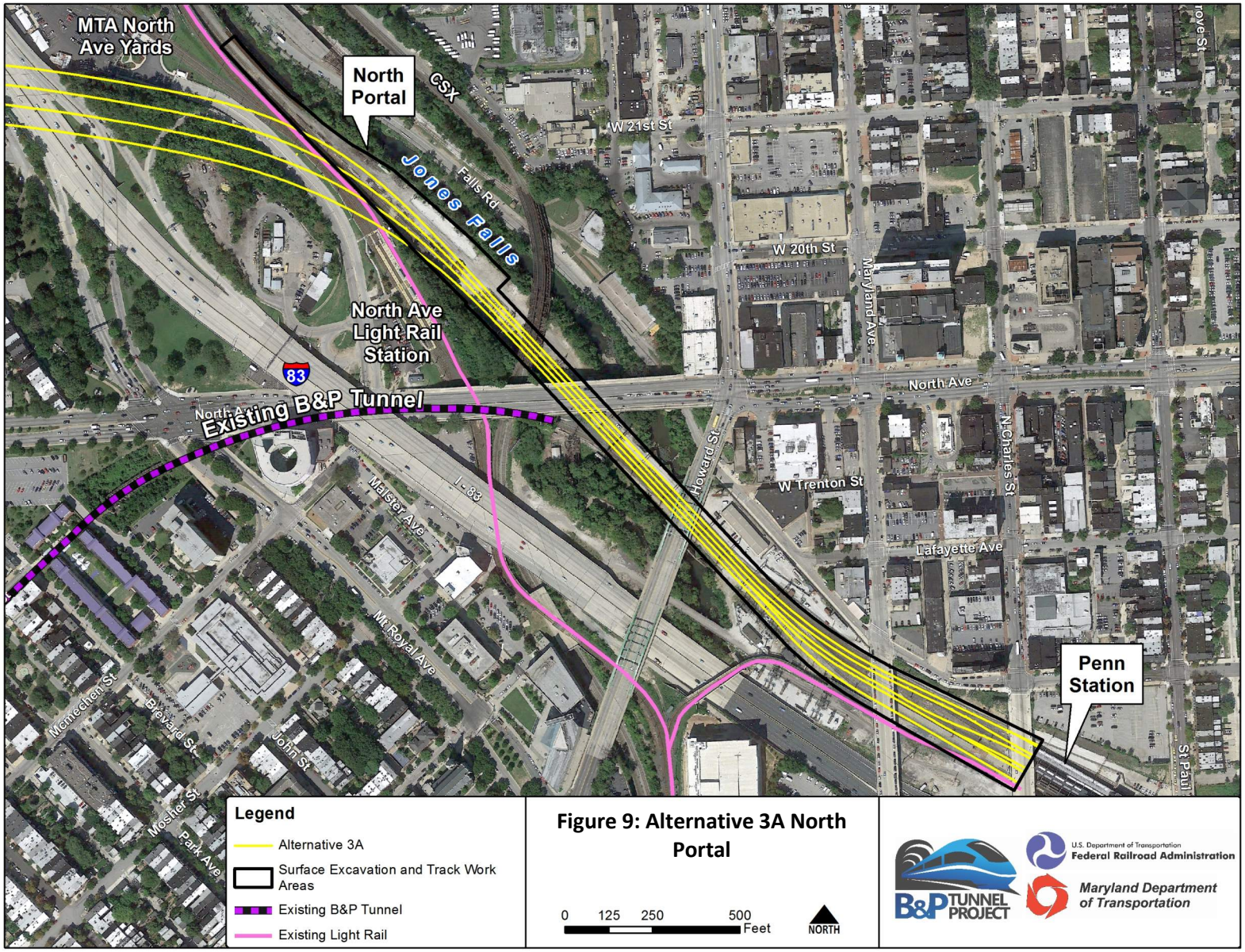
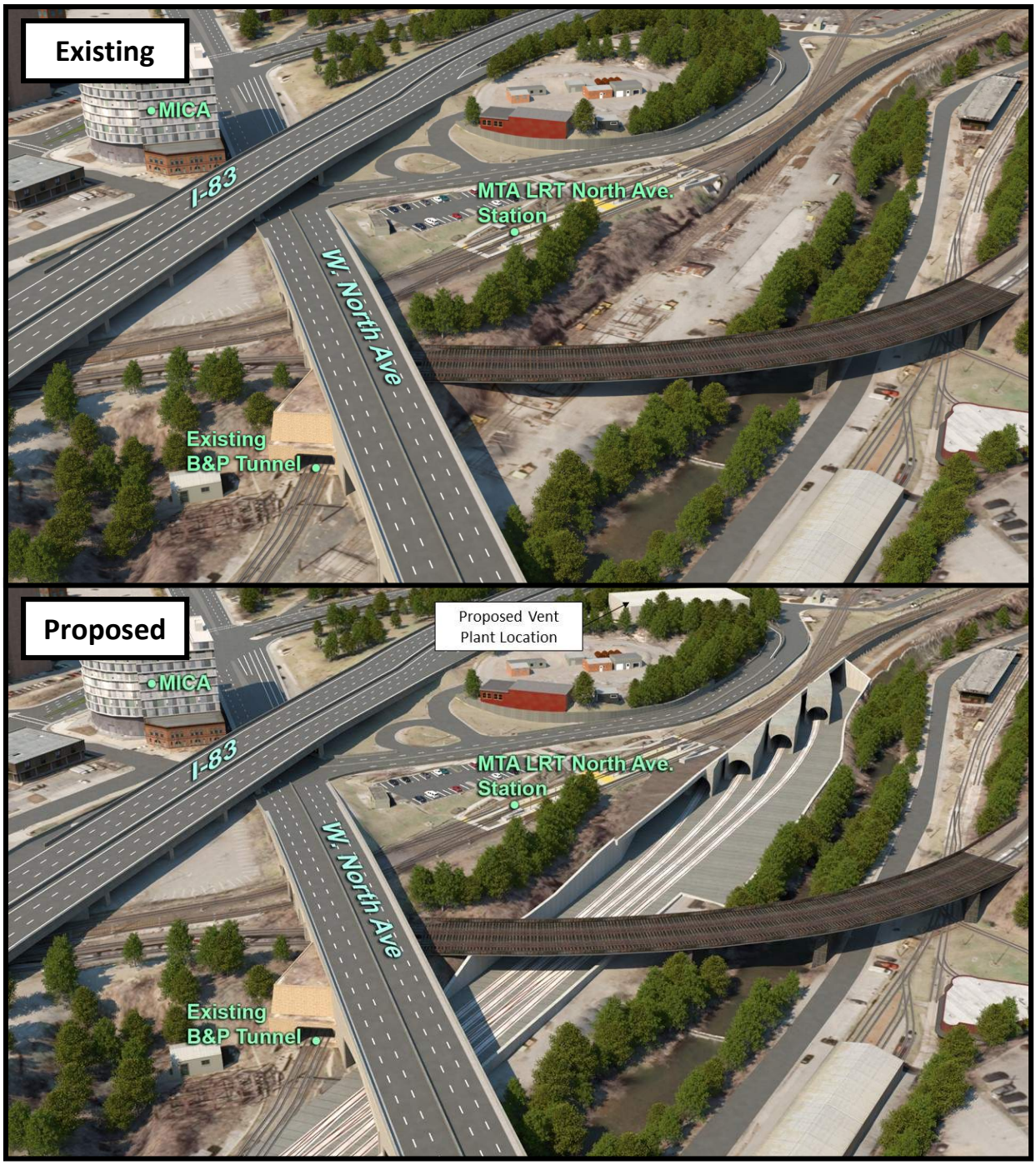


Figure 9: Alternative 3A North Portal

Image 3: Rendering of Alternative 3A North Portal



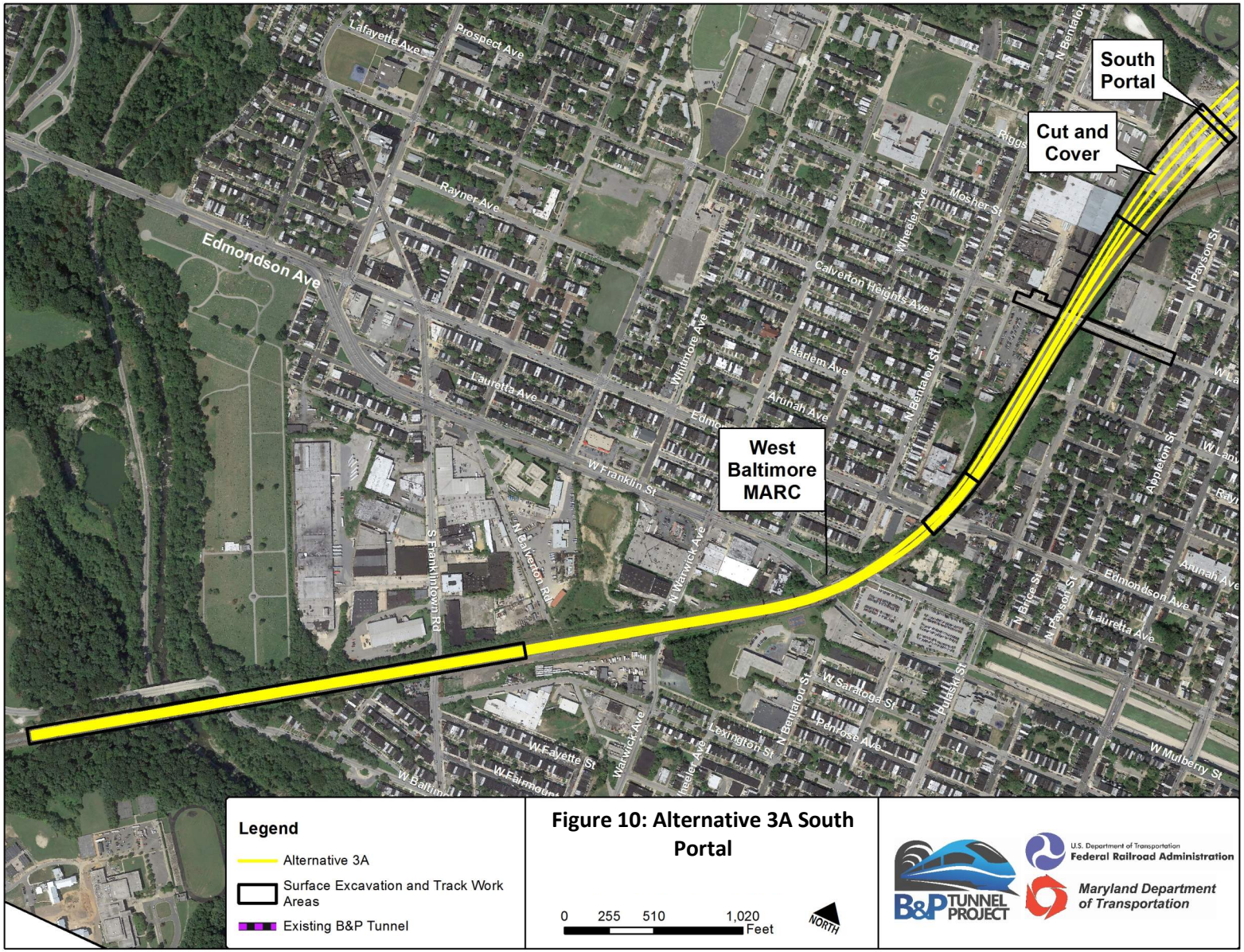
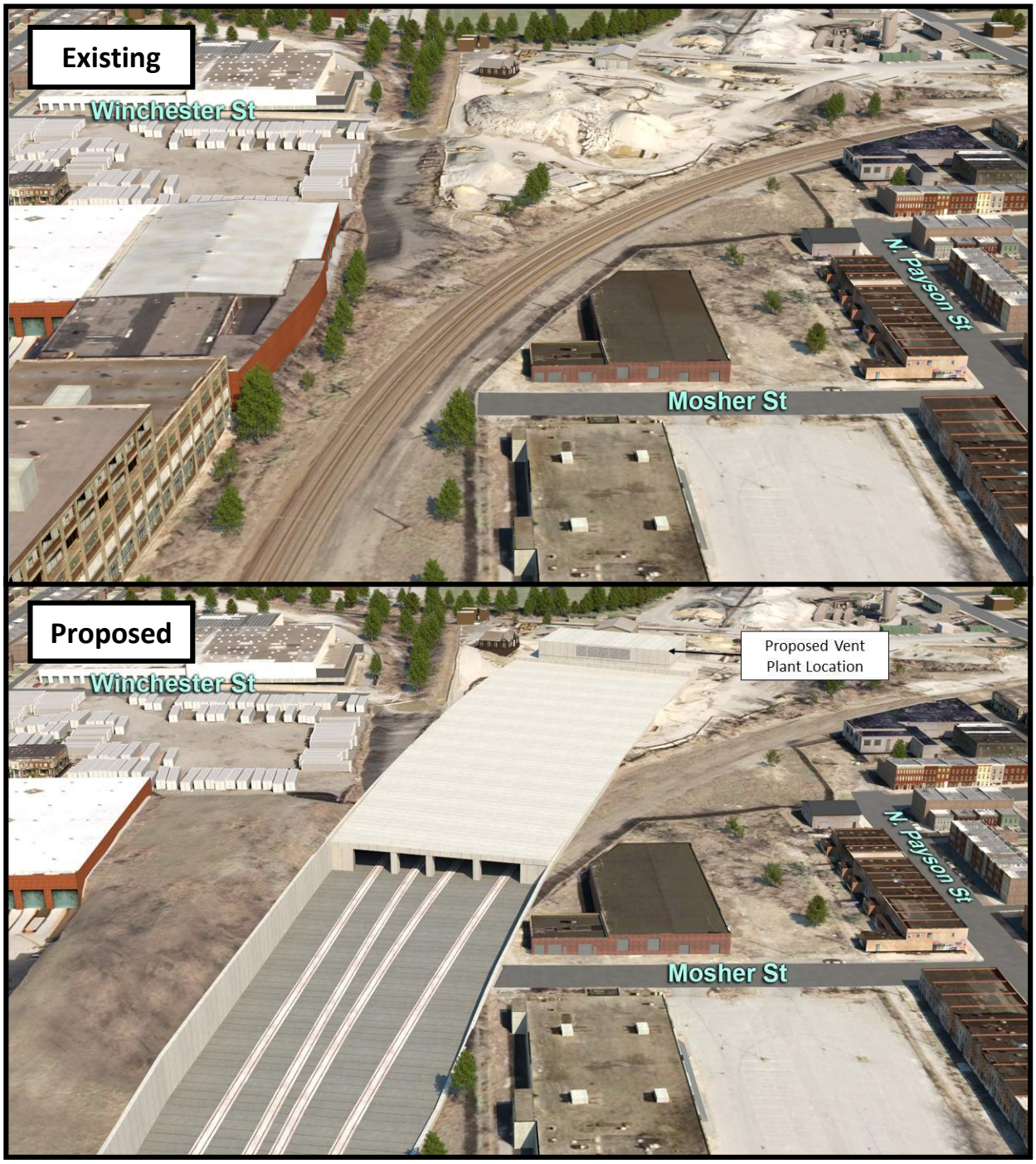


Figure 10: Alternative 3A South Portal

Image 4: Rendering of Alternative 3A South Portal



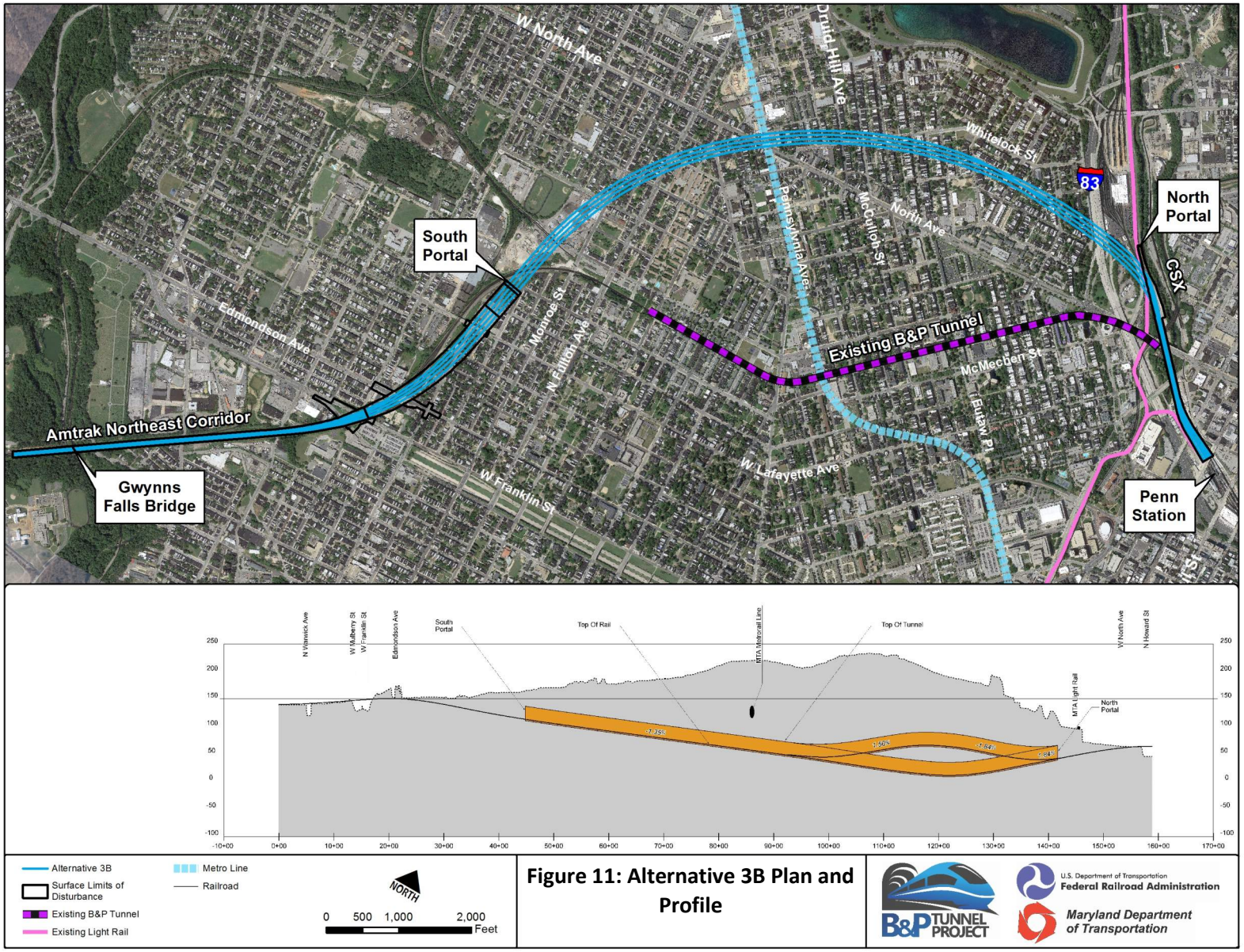


Figure 11: Alternative 3B Plan and Profile

Alternative 3B differs from 3A primarily in the location of the southern portal and the southern tie-in with existing tracks. The existing speed-limiting curve (referred to as Curve 381), located at the West Baltimore MARC Station, is improved to eliminate the speed restriction. The alignment shifts the existing NEC corridor east between Edmondson and Riggs Avenues near Pulaski and Payson Streets and slightly west near Franklin and Mulberry Streets.

1. North Portal

Alternative 3B follows the existing railroad mainline track in the Jones Falls valley under the Howard Street Bridge to just before North Avenue, where the alternative leaves the existing track alignment to begin its gradual arc. The alignment continues aboveground until it reaches its north portal located at the retaining wall next to the MTA North Avenue LRT Station. The alignment would travel through an existing retaining wall adjacent to the LRT rail station to begin its descent below ground. The north portal would require specialized tunnel construction techniques, such as ground improvement, in advance of tunneling to allow the four tracks to pass below the LRT facilities. A map of the north portal is shown in **Figure 12** and a rendering of the north portal is shown in **Image 5**.

2. Tunnel Segment

Alternative 3B continues below ground in a gradual arc for 2.03 miles, traversing below primarily residential city blocks in the neighborhoods of Reservoir Hill, Penn North, Sandtown-Winchester, Bridgeview/Greenlawn, Midtown-Edmondson, and Penrose/Fayette. From the north portal, the alignment crosses under I-83 (Jones Falls Expressway) north of the intersection of Reservoir Street and Mount Royal Terrace. The alignment continues in a gradual curve north of Reservoir Street and Ducatel Street, and south of the east-west portion of Whitelock Street. The alignment continues to curve southwest, crossing the northeast-southwest portion of Whitelock Street and the intersection of North Avenue and Pennsylvania Avenue. The alignment continues to curve southwest, under the center of an industrial property at 1320 North Monroe Street. In comparison to Option A, the Option B alignment is shifted further east, away from the depth south, crossing under the Amtrak NEC railroad curve at North Payson Street. Through the bored tunnel segment, depth of the alignment reaches 185 feet, with an average depth of 130 feet (from ground level to top of tunnel).

3. South Portal

Alternative 3B would include a south portal located southeast of the P. Flanigan and Sons Asphalt plant, and southeast of the existing NEC tracks, approximately 200 feet east of the 3A south portal. The cut-and-cover and open cut sections would be located adjacent to the existing NEC between the proposed south portal and Lafayette Avenue. The alignment would continue on a new aerial structure over Franklin and Mulberry Streets, then return to the existing NEC ROW near Warwick Avenue. At-grade track work within Amtrak ROW would occur from near Edmondson Avenue to just south of the Gwynns Falls Bridge. A new “Fulton” Interlocking would be constructed south of the permanent south portal. The West Baltimore MARC Station would be relocated slightly east of its current location to align with the new tracks. Some neighborhood streets near the new portal would be closed at the new rail ROW and others re-established after construction. A map of the south portal is shown in **Figure 13** and a rendering of the south portal is shown in **Image 6**.

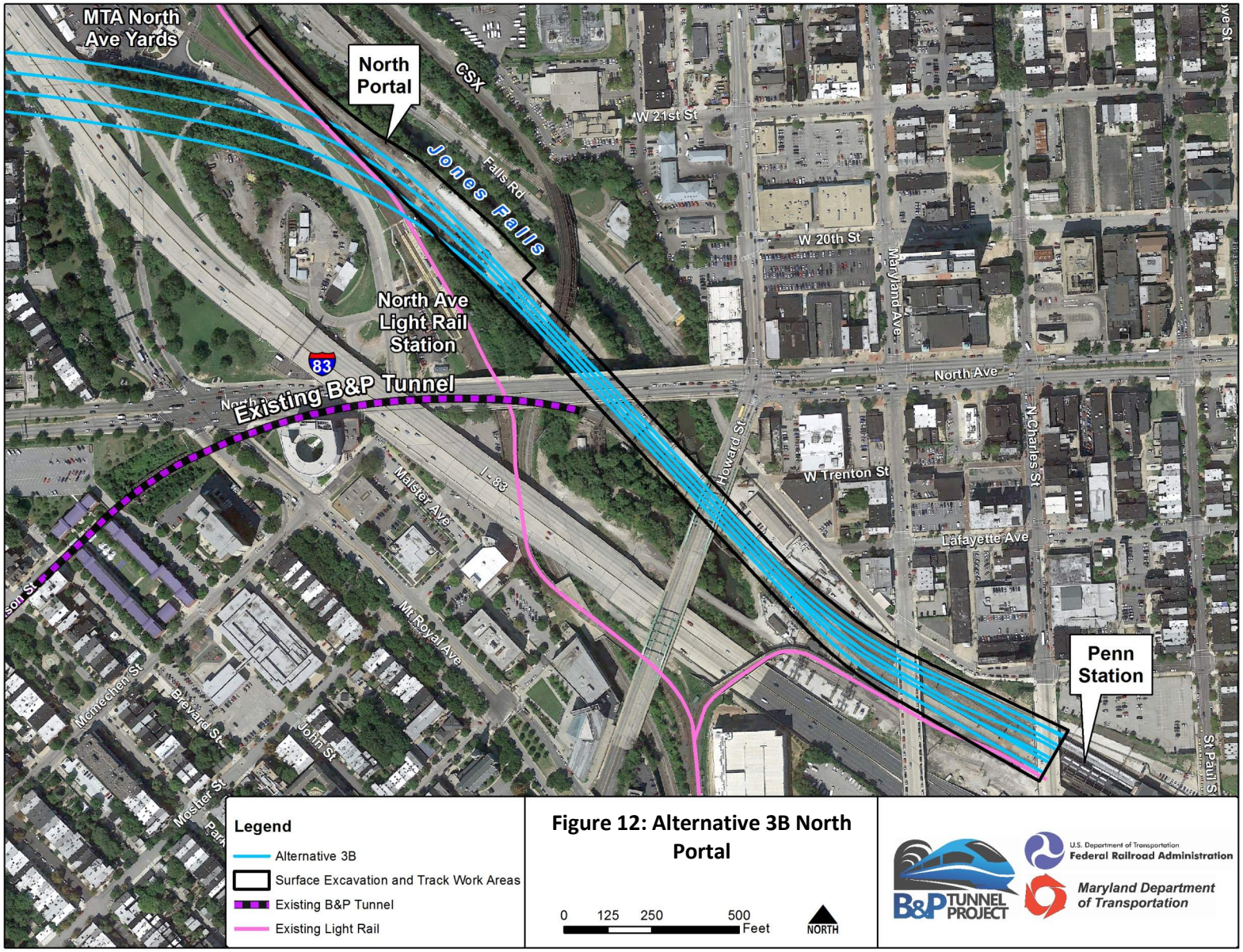
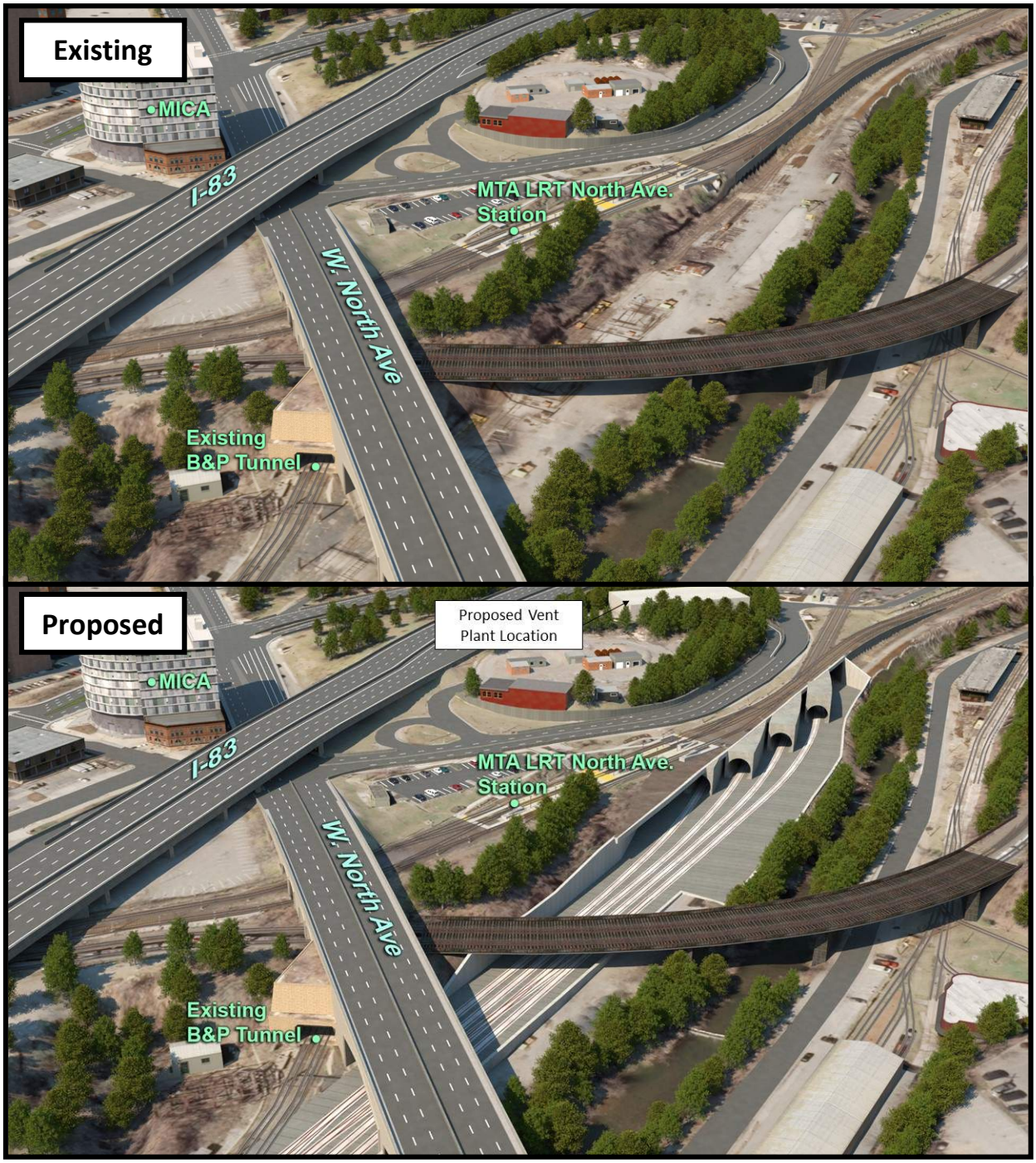


Figure 12: Alternative 3B North Portal

Image 5: Rendering of Alternative 3B North Portal



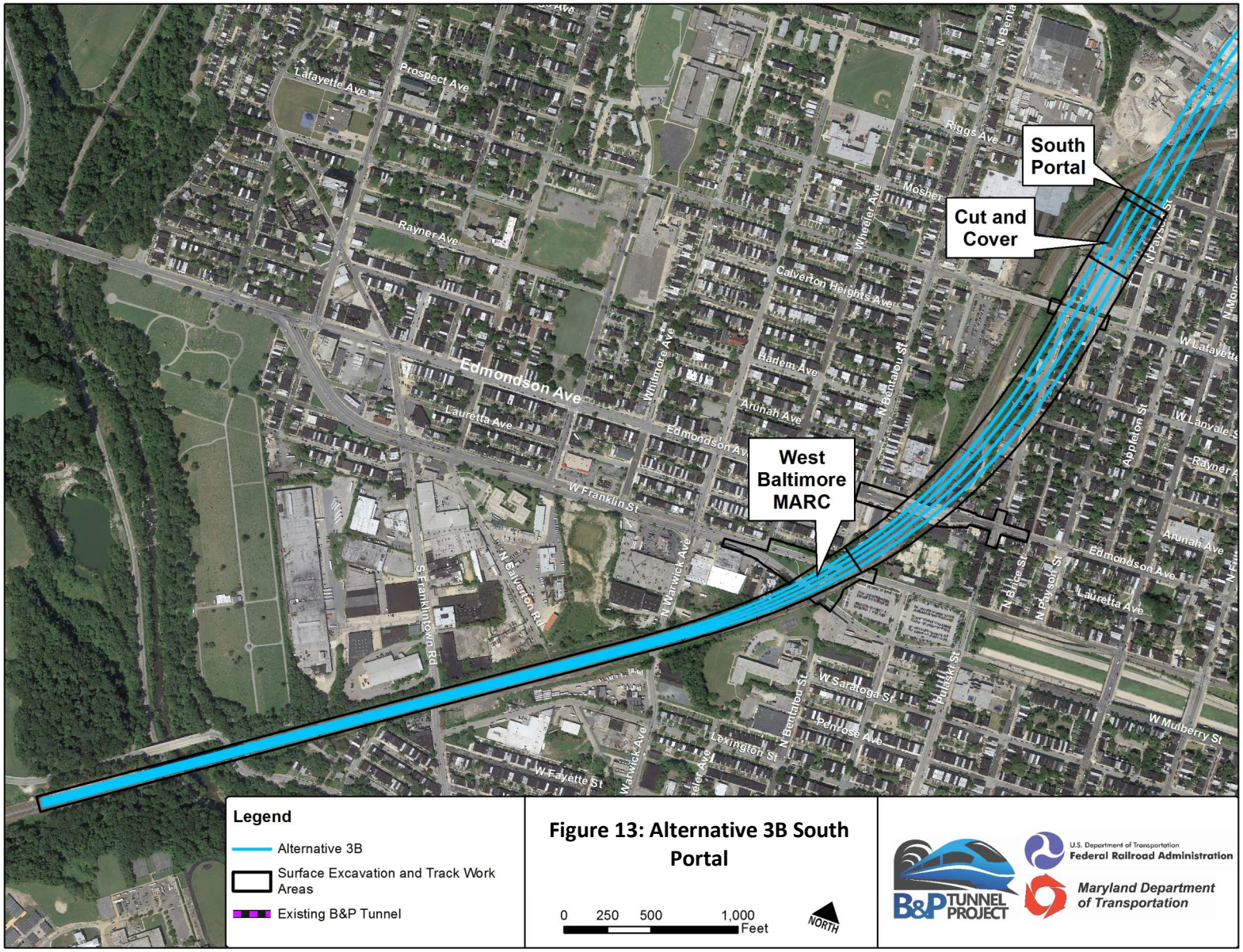
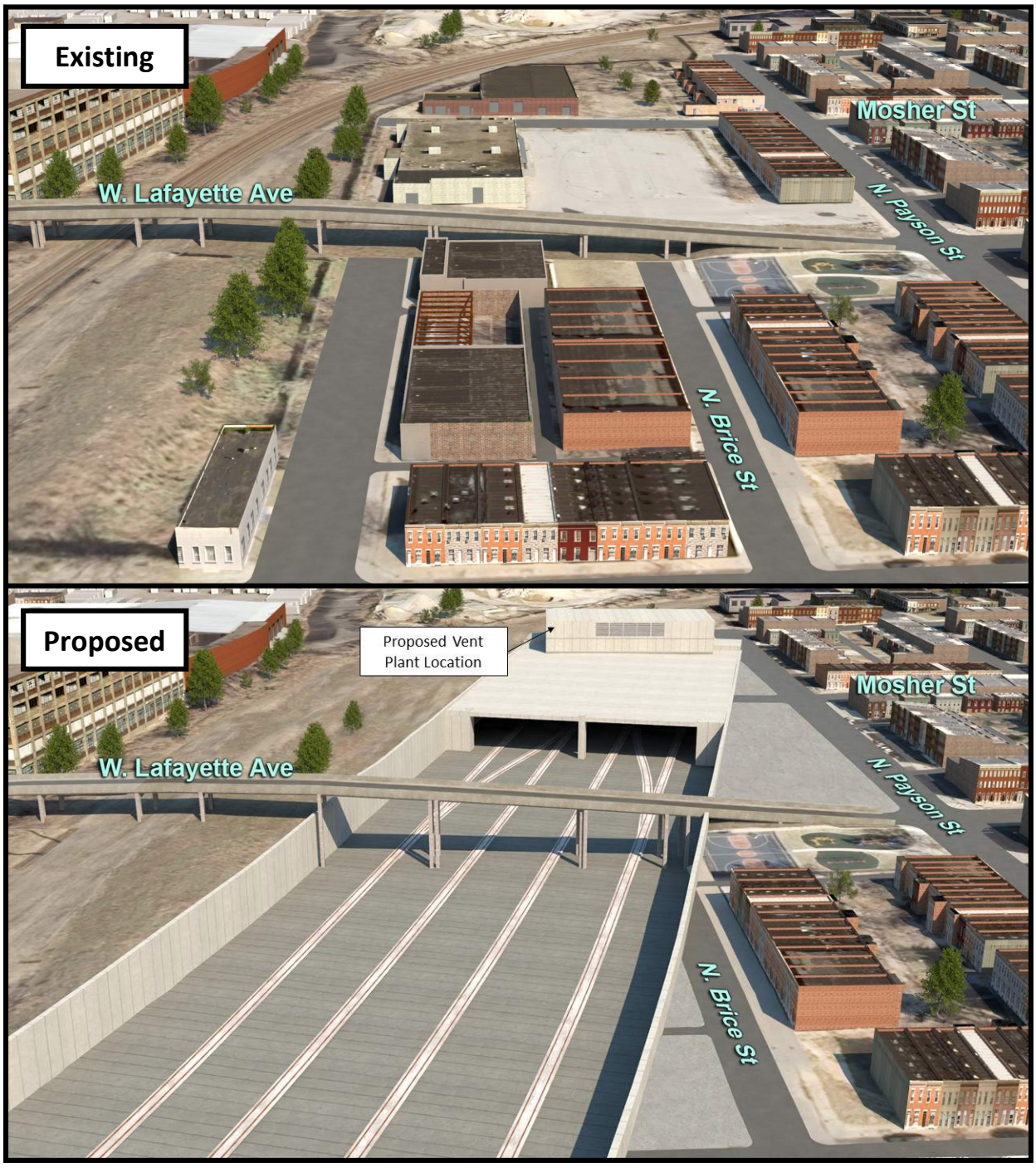

South Portal
Cut and Cover
West Baltimore MARC
Edmondson Ave
Lafayette Ave
Prospect Ave
Rayner Ave
Riggs Ave
Mosher
Wheeler Ave
Calverton Heights Ave
Whitmore Ave
Bidem Ave
Arunah Ave
Lauretta Ave
W Franklin St
N Bentalou St
N Warwick Ave
S Franklintown Rd
N Calverton Rd
Appleton St
N Brice St
N Payson St
W Saratoga St
Pulaski St
Penrose Ave
Lexington St
W Fayette St
W Mulberry St
Legend
Alternative 3B
Surface Excavation and Track Work Areas
Existing B&P Tunnel
Figure 13: Alternative 3B South Portal
0 250 500 1,000 Feet
NORTH
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Image 6: Rendering of Alternative 3B South Portal



E. Alternative 3C

Alternative 3C was also developed to retain the basic conceptual alignment of Alternative 3, while eliminating speed restrictions imposed by Curve 381. This is achieved by shifting the alignment west to modify/improve the curve. Alternative 3C would result in a total travel distance of 3.83 miles between Baltimore Penn Station and the Amtrak Gwynns Falls Bridge (average of the four tracks). The tunnel segment of the alignment comprises

2.23 miles of the total length. An overview of Alternative 3C, including the horizontal alignment and vertical profile, is shown in **Figure 14**.

Alternative 3C differs from 3A and 3B in the location of the southern portal and tie-in and alignment of the underground tunnels. Alternative 3C would modify the existing speed-limiting curve (referred to as Curve 381) located at the West Baltimore MARC Station. This would be achieved by shifting the alignment up to approximately 100 feet west of the existing NEC corridor between Lafayette Avenue and Warwick Avenue; the alignment is further west of Alternative 3A and 3B.

1. North Portal

Alternative 3C follows the existing railroad mainline tracks in the Jones Falls valley under the Howard Street Bridge to just before North Avenue, where the alternative diverges from the existing alignment. The alignment continues aboveground until it reaches its north portal located at the retaining wall next to the MTA North Avenue LRT Station. The alignment would travel through an existing retaining wall adjacent to the LRT station and begin its descent below ground. The north portal would include tunnel construction techniques that allow the four tracks to pass below the LRT facilities. The segment of the alignment below the MTA North Avenue LRT Station would require specialized construction, such as ground improvement, in advance of tunneling. A map of the north portal is shown in **Figure 15** and a rendering of the north portal is shown in **Image 7**.

2. Tunnel Segment

Alternative 3C continues below ground in a gradual arc for 2.23 miles. The alignment traverses below primarily residential city blocks in the neighborhoods of Reservoir Hill, Penn North, Easterwood, Bridgeview/Greenlawn, Midtown-Edmondson, and Penrose/Fayette. From the north portal, the alignment crosses under I-83 (Jones Falls Expressway) north of the intersection of Reservoir Street and Mount Royal Terrace. The alignment crosses under I-83 farther north than either 3A or 3B. The alignment continues in a gradual curve south of Chauncey Avenue and north of Newington Avenue and Whitelock Street. At the intersection of Madison Avenue and Brooks Lane, the alignment begins to arc to the southwest, running roughly in between Clifton Avenue and Retreat Street. The alignment curves to the south, traveling below the intersection of Payson Street and Baker Street. Before entering the south portal, Alternative 3C runs fully under the center of the Carver Vocational-Technical High School athletic field. Through the tunnel segment, the depth of the alignment reaches 170 feet, with an average depth of 140 feet.

3. South Portal

Alternative 3C would include a south portal located within the P. Flanigan and Sons Asphalt plant, just south of the athletic fields at Carver Vocational-Technical High School and, roughly a third of a mile west of the existing B&P Tunnel south portal. The cut-and-cover and open cut sections would be located along the western edge of the P. Flanigan and Sons property, and travel south in a cut-and-cover section, parallel to the existing Amtrak ROW near Lafayette Avenue. The alignment would continue in an open-cut section shifted west of the NEC, south of Lafayette Avenue. The alignment would continue on a new aerial structure over Franklin and Mulberry Streets, then return to the existing NEC ROW near Warwick Avenue. At-grade track work within Amtrak ROW would occur from near Edmondson Avenue to just south of the Gwynns Falls Bridge. A new “Fulton” Interlocking would be constructed south of the permanent south portal. The West Baltimore MARC Station platforms would be relocated west to align with the new tracks. Some neighborhood streets near the new portal would be closed at the new rail ROW and others re-established after construction. A map of the south portal is shown in **Figure 16** and a rendering of the south portal is shown in **Image 8**.

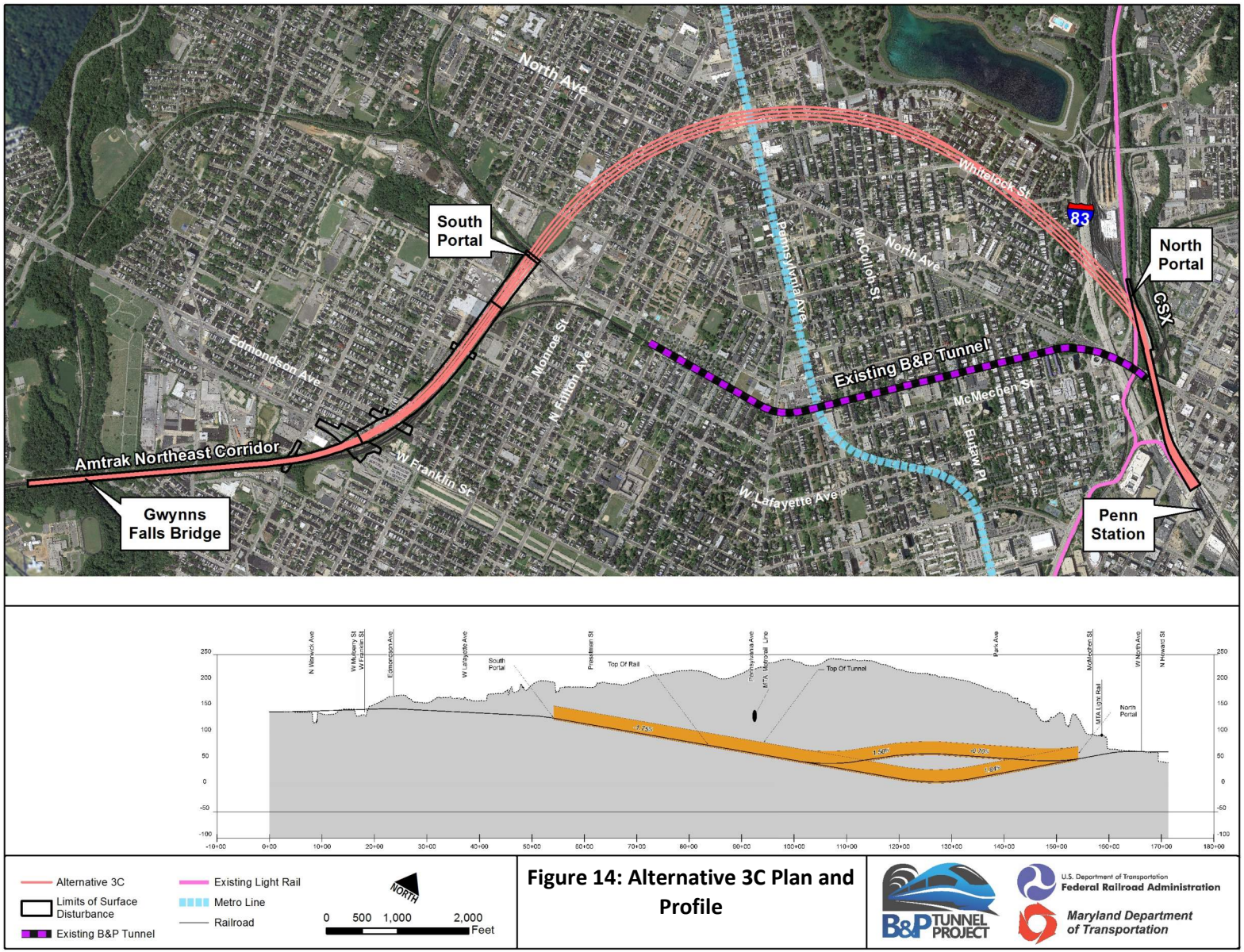
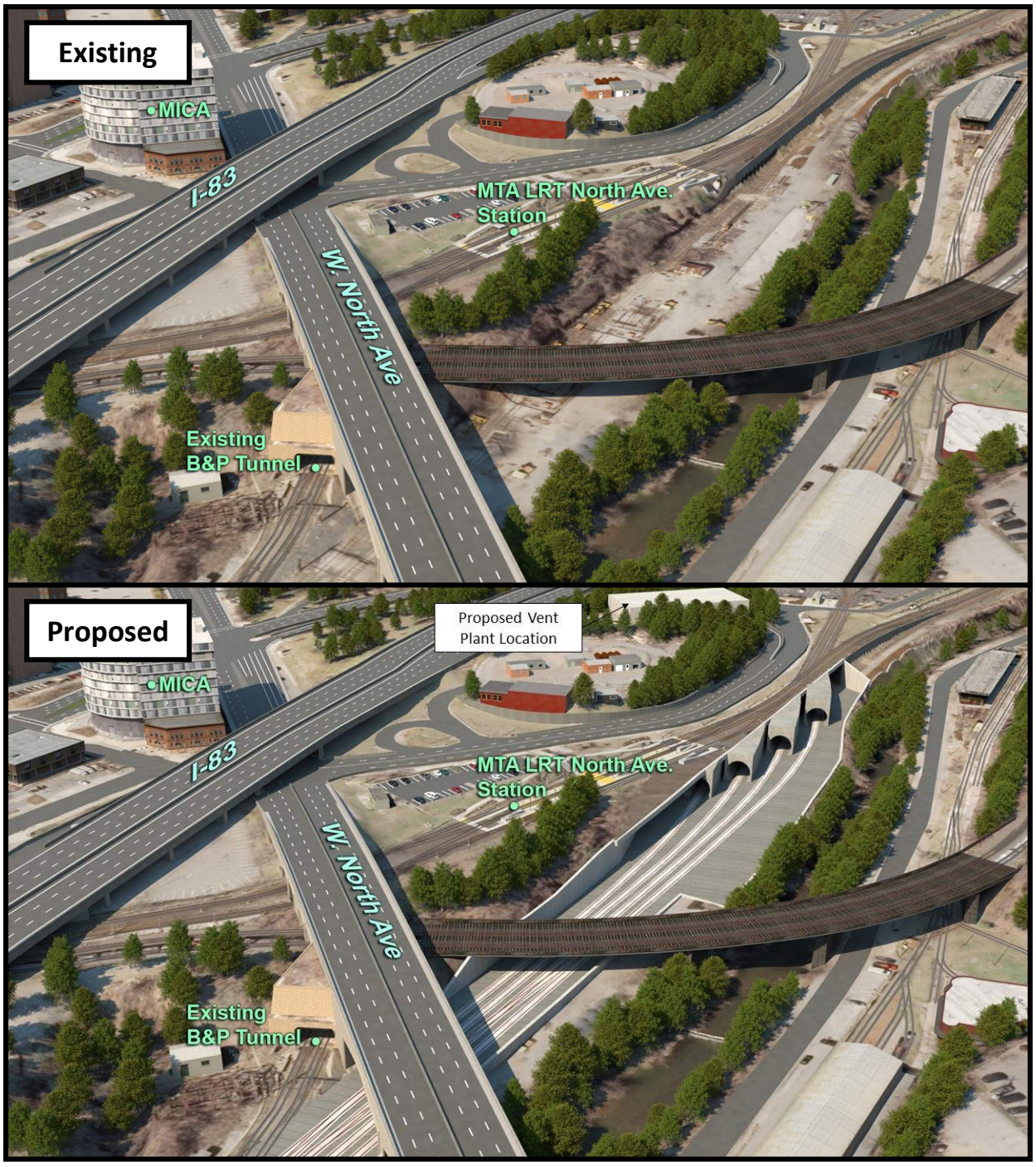


Figure 14: Alternative 3C Plan and Profile

Figure 15: Alternative 3C North Portal

Image 7: Rendering of Alternative 3C North Portal



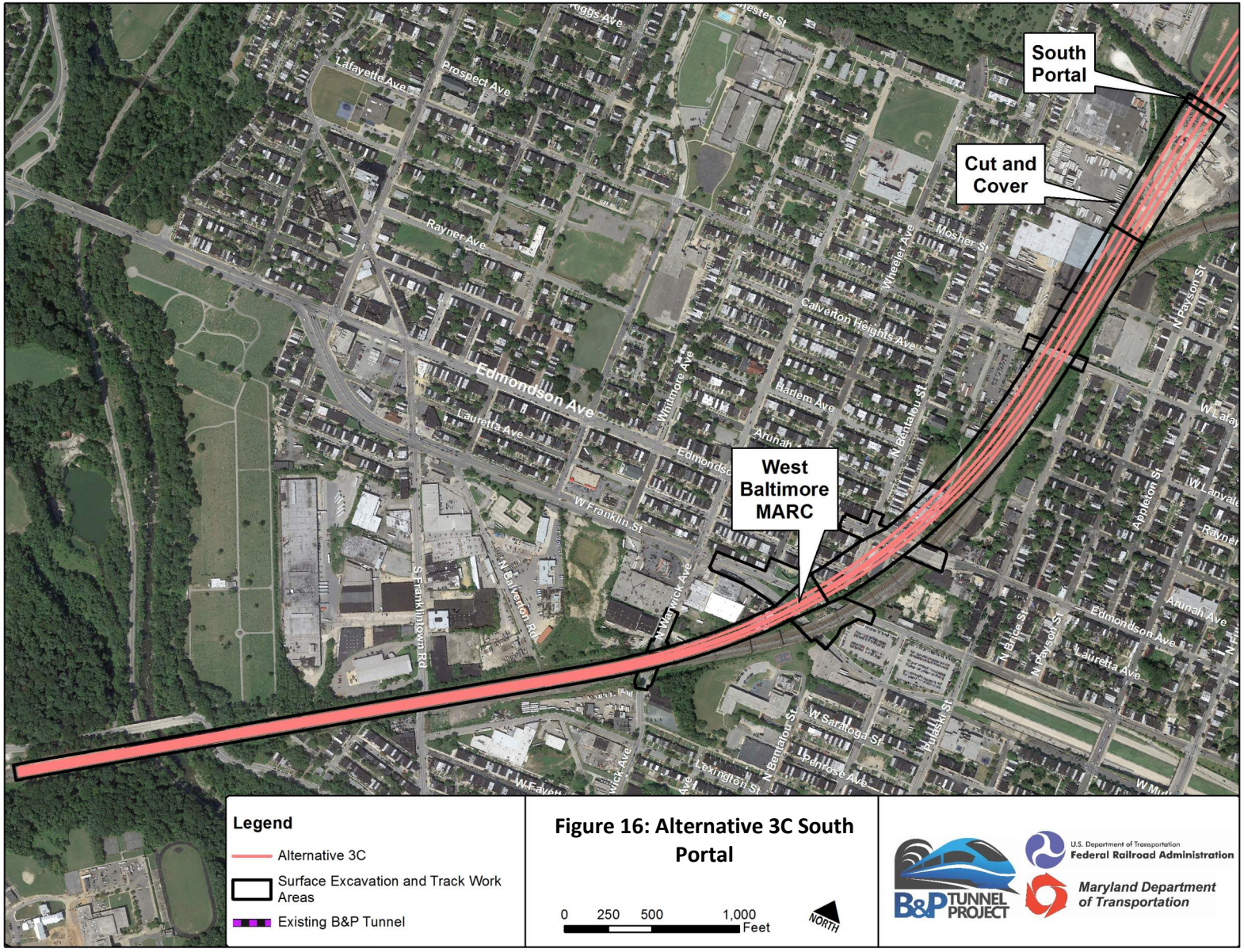


Figure 16: Alternative 3C South Portal

Image 8: Rendering of Alternative 3C South Portal

F. Intermediate Ventilation Plant

As described previously in **Section III.B.6**, each of the Build Alternatives would require three ventilation plants to ensure proper ventilation of the proposed tunnels. Two of the ventilation plants would each be located at the north and south portals. A third intermediate ventilation plant would be located at street level, connected to the bored portion of the tunnels by a vertical shaft and connecting tunnel (plenum), splitting the proposed tunnel into two unequal lengths. The ventilation plant would consist of a building, approximately 100 feet by 200 feet in plan with a maximum height of 55 feet.

1. Area of Consideration

An Area of Consideration for the intermediate tunnel ventilation plant of each Build Alternative has been identified as part of the preliminary engineering, based on considerations described above. The three overlapping Areas of Consideration (corresponding with Alternatives 3A, 3B, and 3C) are located in the Reservoir Hill neighborhood and shown in **Figure 17** and **Image 9**. The area is roughly bounded by Whitelock Street to the north, Ducatel Street to the south, Brookfield Avenue to the east, and Morris Street to the west. This area was developed to assist with identifying the ideal ventilation plant location, from an engineering standpoint, while allowing for flexibility in the specific site proposed to minimize community impacts.

Open properties with no buildings within the Area of Consideration were initially considered for the intermediate ventilation plant site. A proposed suitable site, located at the corner of Whitelock Street and Brookfield Avenue was identified within the Area of Consideration.

2. Identification of Alternate Sites

Public comments regarding the proposed ventilation plant location on Whitelock Street have prompted further consideration of other potential intermediate ventilation plant locations. These sites are located inside and outside of the original Area of Consideration. The following sites are being considered (see **Figure 18** for site locations):

- Druid Park Lake Drive between Brookfield Avenue and Linden Avenue
- Druid Park Lake Drive between Brookfield Ave and Lakeview Ave
- Whitelock Street at Linden Avenue
- North Avenue between Linden Avenue and Park Avenue
- North Avenue between Linden Avenue and Eutaw Place
- North Avenue between Morris Street and Madison Avenue
- North Avenue between Madison Avenue and McCulloh Street
- Druid Hill Avenue between Whitelock Street and Clendenin Street
- Druid Hill Avenue between Cloverdale Road and Retreat Street.

In general, these sites are much further from the ventilation zone interface. A longer connection could result in changes to the ventilation system such as increased ventilation duct cross-section size, increased ventilation fan horsepower and associated electrical power, and reduced effectiveness of piston action ventilation requiring the fans to run in normal operations more frequently. Furthermore, a greater amount of drill-and-blast construction leading to more severe construction-related impacts would result from a site with a longer connecting shaft. It is estimated that, as the connection between the ventilation zone interface (described above) and the intermediate ventilation plant become longer, the cost increases by approximately $50,000 per foot of extension due to additional drilling of the lateral shaft.

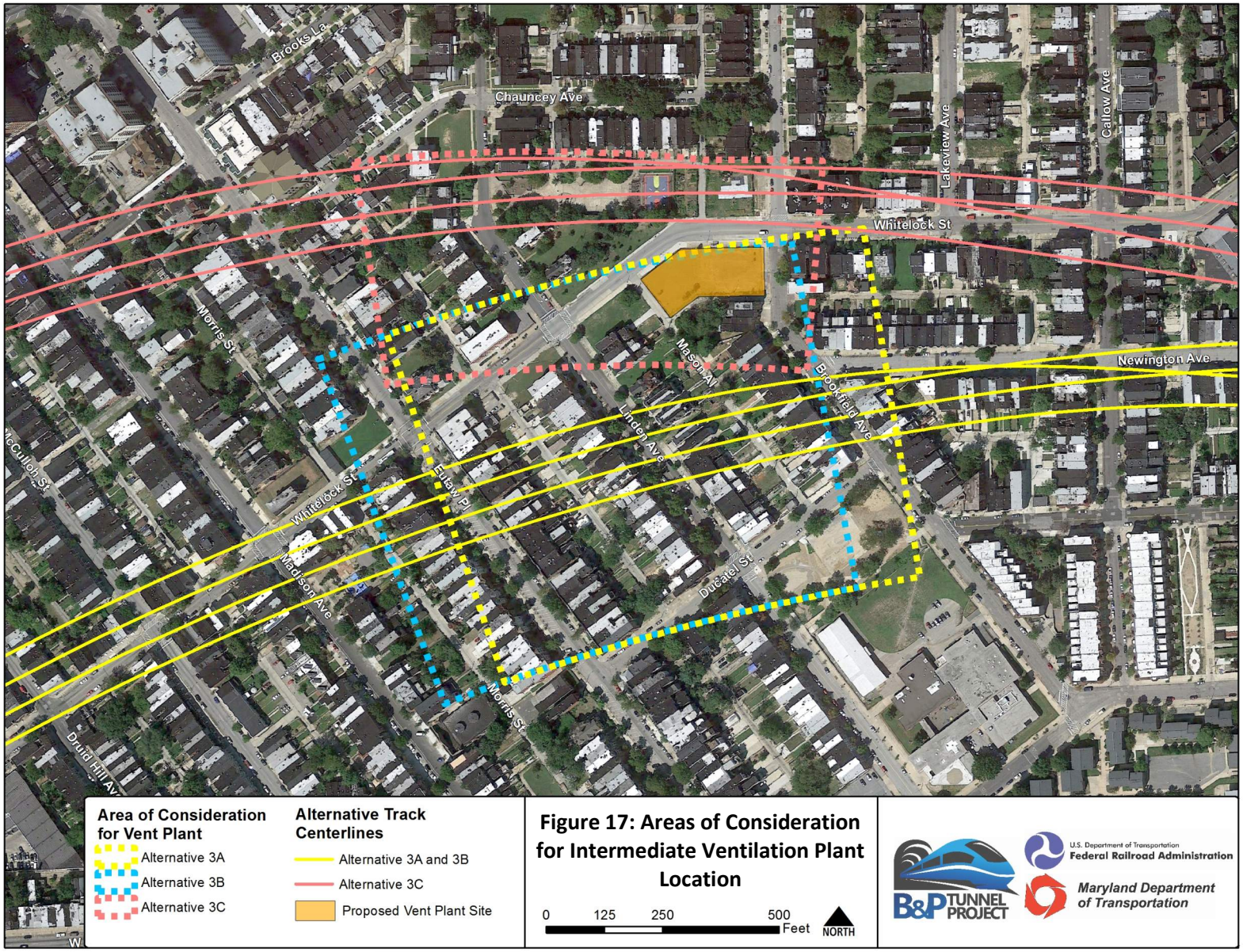
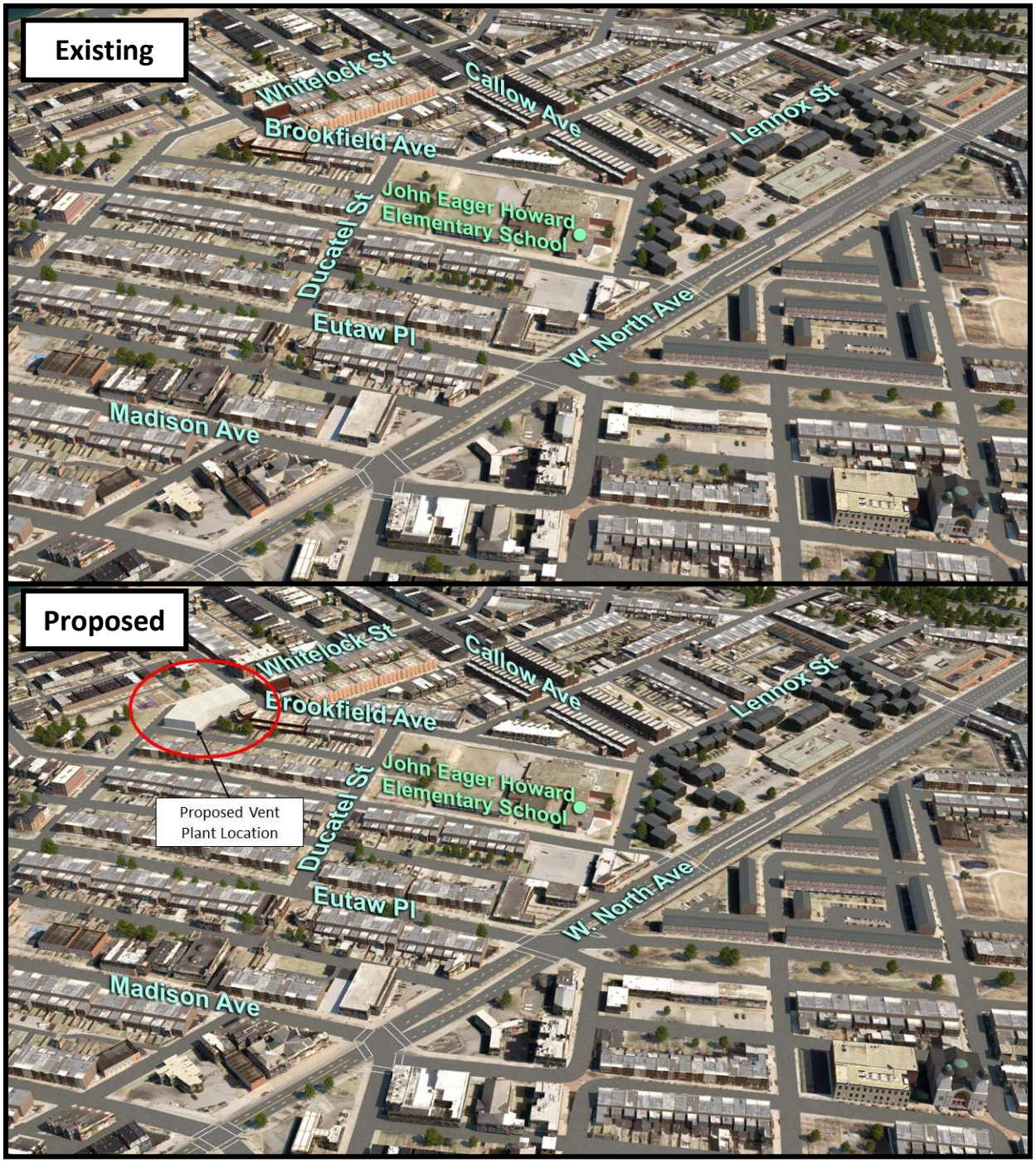


Figure 17: Areas of Consideration for Intermediate Ventilation Plant Location

Image 9: Rendering of Alternatives 3A, 3B, and 3C Intermediate Ventilation Plant Location




Druid Park Lake Dr
Chauncey Ave
Whitelock St
Newington Ave
Reservoir St
W North Ave
Clendenin St
Gloverdale Rd
Flora St
Francis St
Salem St
Traction St
Cumberland St
N Stockton St
Brooks Ln
Lakeview Ave
Callow Ave
Mt Royal Ter
Morris St
McCulloh St
Madison Ave
Mason Pl
Eutaw Pl
Brookfield Ave
Ducatel St
Linden Ave
Park Ave
Druid Hill Ave
Proposed Vent Plant Site
Alternate Vent Plant Sites
Alt 3A/B Track Centerlines
Alt 3C Track Centerlines
Vent Plant Area of Consideration 3A
Vent Plant Area of Consideration 3B
Vent Plant Area of Consideration 3C
NORTH
0 125 250 500 Feet
Figure 18: Alternate Intermediate Ventilation Plant Locations
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Additional ventilation zones would allow reducing the headway below the two-minute mark, which is not warranted for the project. This would not reduce the size of the ventilation facilities, which are governed by the design fire and size of trains in the tunnel. More ventilation zones would require more ventilation plants of the same minimum size and capacity, one at each zone interface. Each ventilation plant would cost an estimated $150 million.

G. Future of the Existing B&P Tunnel

The existing B&P Tunnel is a functioning railroad structure connecting Baltimore Penn Station with the NEC. If Alternative 1: No-Build is selected, the tunnel would continue use in its current configuration and condition, with maintenance limited to that necessary to maintain safe operation. If any of the Build Alternatives are selected as the Preferred Alternative, the tunnel would be replaced by new tunnels in a different location and disposition of the existing tunnel determined. Under each Build Alternative, the disposition of the existing B&P Tunnel will need to be evaluated.

Three options for disposition of the existing B&P Tunnel include:

(1) Close with no additional use ("abandonment");
(2) Modify train use (single track); or
(3) Convert for alternative use.

The following briefly describes characteristics of the existing B&P Tunnel and proposed options for disposition.

The existing B&P Tunnel was built in 1873. It is comprised of three tunnel sections separated by two daylight sections with a total length of approximately 7,500 linear feet (1.4 miles). **Section II.E.1** includes a detailed description of the existing tunnel. The three tunnel sections are approximately 21 feet in height at the centerline and 27 feet wide, where the walls of the tunnel meet the top arch (i.e., the springline). The tunnels are primarily supported by a multiple course brick-lined arch and brick walls, with some stone masonry. Later improvements included the installation of a concrete slab invert (floor) and spraying the walls with gunite as a liner. Repairs to the tunnel in the early 1980s included repair of the lining, drainage improvements, replacement of the invert, and installation of an improved track system.

The present-day condition of the B&P Tunnel is documented by a visual inspection conducted in July of 2014 and reported in the *Existing B&P Tunnel Inspection Report*. The visual inspection and prior studies of the B&P Tunnel identified water leaks caused by groundwater seepage and leaking water pipes. The drainage system below the tracks is not fully functioning as it is clogged with efflorescence (water soluble salts). Saturated soil beneath the tunnel segments is causing the aging floor slabs to settle under train loading and require periodic repair. The tunnel lining is deteriorating with cracked and spalled gunite, loss of bricks, and degraded mortar in some areas of the brick-lined arch, especially in the Gilmor Street and Wilson Street Tunnel sections. Utilities throughout the tunnels would require repairs and maintenance.

1. Abandon the Existing B&P Tunnel

Abandonment can be temporary or permanent; either must provide for long-term stability of tunnel openings. The two methods of abandonment considered include:

- Permanent abandonment by backfilling the tunnel
- Temporary abandonment by securing the portals and conducting limited repairs

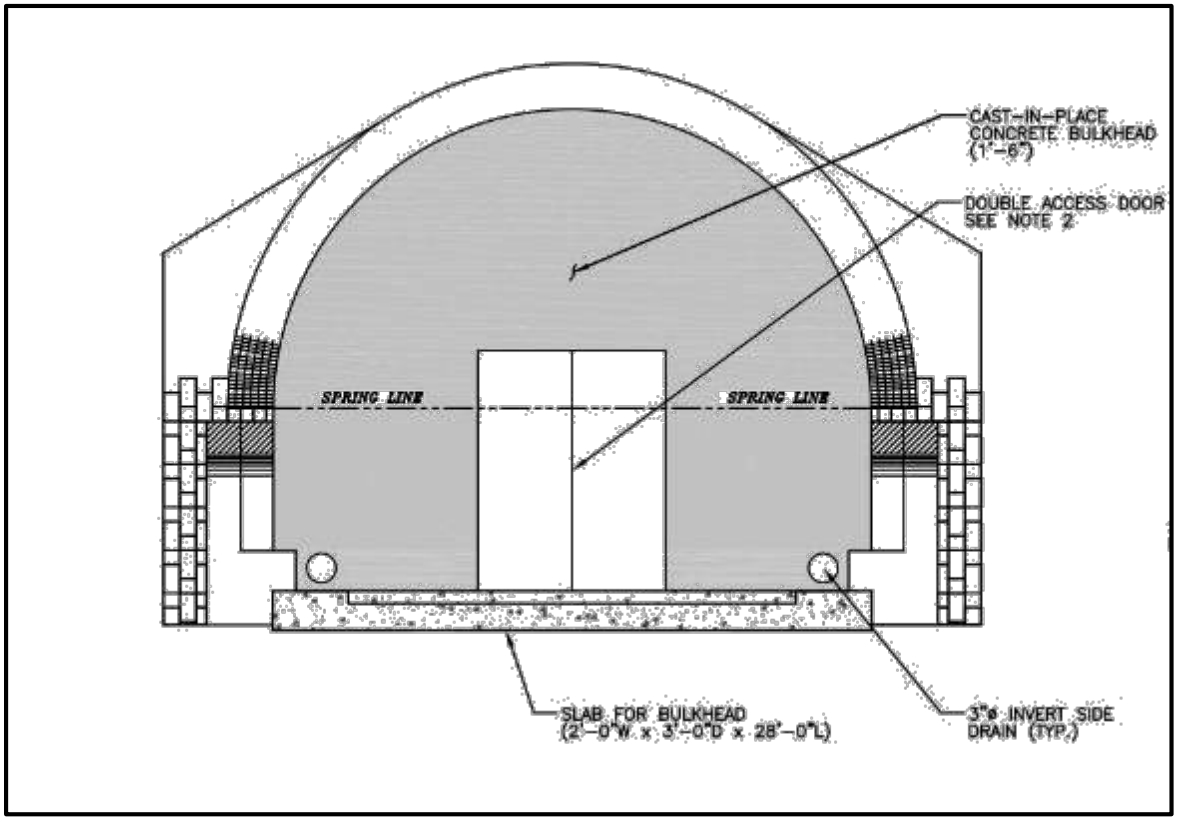
Backfilling would provide a walk-away solution with no future maintenance. Backfill materials could include concrete, crushed stone or aggregate filled with grout, or excavation materials from construction of the replacement tunnel (temporarily stockpiled until the existing tunnel was ready to be abandoned).

Methods of backfilling:

- Drilling holes from grade at specific intervals and inserting backfill through the holes; temporary storage of backfill would have short-term surface impacts to surrounding communities.
- Horizontal placement of fill, in stages, using temporary bulkheads.
- Backfill, grade, and cover with top soil the two daylight sections of the tunnel at Pennsylvania Avenue and John Street; these areas could be reclaimed for other surface uses. Backfilling would eliminate the risk of collapse and subsidence, but would preclude subsequent re-use of the tunnel.

Temporary abandonment would require securing the portals, conducting regular inspections of the tunnel, and long-term maintenance. This option would preserve the tunnel for either transportation or other uses in the future. A concrete bulkhead would fill the portal, with a locked door for authorized access (**Figure 19**). At the two daylight sections, an enclosed stairwell would provide access at the tunnel level to access doors, with the adjacent open trench filled, graded, and covered with topsoil, making it suitable for other surface uses. The tunnel liner could require some strengthening and/or mitigation for water leakage to maintain tunnel stability. Fire and Life/Safety facilities, much less substantial than the ventilation plants required for new tunnels, would be required to protect maintenance crews, but not the public as the tunnel would be closed. Ongoing ventilation of the tunnels must occur to prevent accumulation of unsafe gases and allow maintenance personnel to work. Disadvantages of temporary closure include long-term maintenance and risk of tunnel collapse, or subsidence, if maintenance does not occur.

Figure 19: Temporary Abandonment Concept

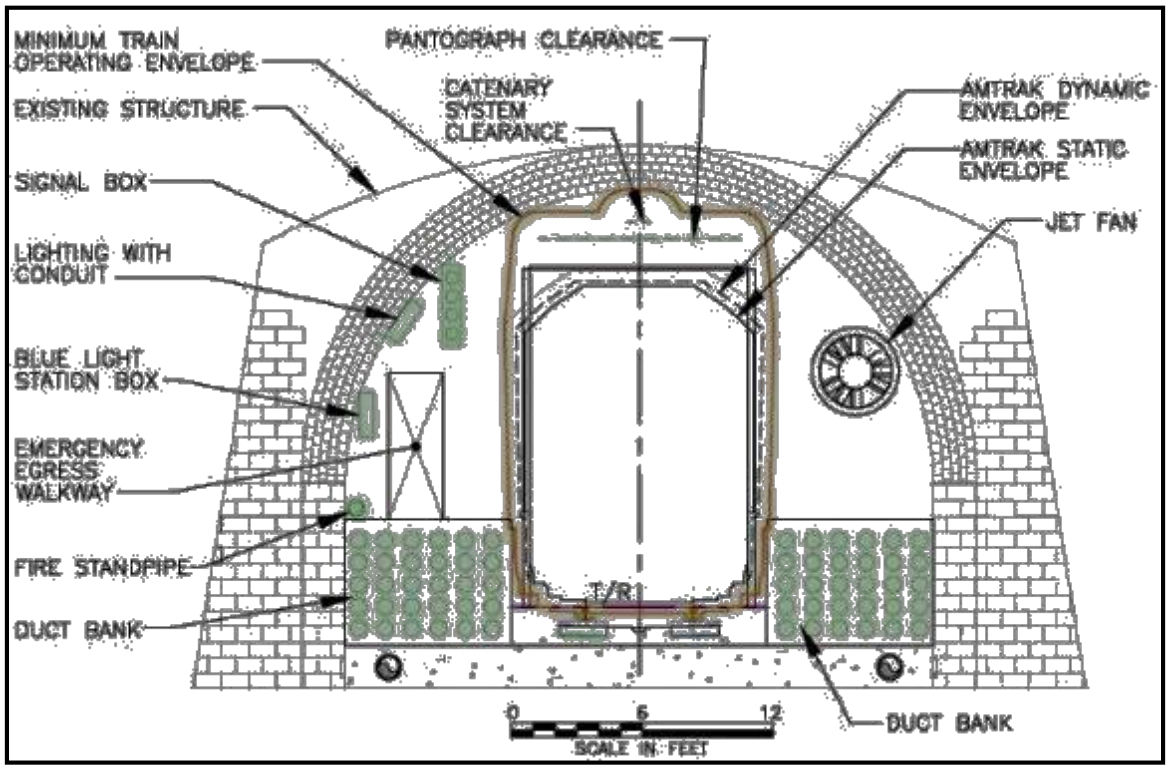


2. Modified Train Use (Single Track)

The existing B&P Tunnel may be a valuable transportation resource in the future. For example, the tunnel could be used with one track to move Amtrak, MARC, or freight trains (**Figure 20**). Future use would require modifications such as increased vertical clearance to accommodate double-stack rail cars as an independent

freight route (profile issues prevent a connection back into the NEC). Vertical clearance could be attained by either lowering the tracks or raising the tunnel roof (raising the roof would require open-cut construction). Modifications for a single track may not involve increasing the width of the existing tunnel and would not require extensive cut-and-cover construction along the majority of the existing alignment. Restoration and modernization of the tunnel could potentially involve repair of the liner, replacement of the invert, and upgrading fire suppression, ventilation and emergency egress to meet current safety standards. Drainage problems would also need to be addressed. The track could be used by MARC to store out-of-service trains on nights and weekends, and during non-rush hour periods (which would not require improved clearance). The storage would free up platform space at Baltimore Penn Station and limit non-revenue movements to and from MARC's facility near Martins Airport. Since these should be non-revenue trains, the full rehabilitation to current safety standards would not be required.

Figure 20: Single Track Concept



3. Adaptive Re-Use of the Existing B&P Tunnel

A range of alternative uses have been considered, some of which are being evaluated for other tunnels in the country. Adaptive re-use could involve other parties besides, or in addition to, Amtrak. Re-use concepts evaluated include:

- Recreation space
- Underground businesses (e.g. mushroom farm, storage)
- Community facility
- Public exhibit
- Utility corridor/stormwater control
- Linear park/rail "trail"

While there are potential economic and community building opportunities from adaptive re-use, there would be challenges that must be taken into consideration. Challenges relate to feasibility of implementation due to

the need for infrastructure upgrades, depth, and proximity to ground surface. A combination of uses would be feasible, for example a utility corridor (**Figure 21**) and public space, such as a recreational park (**Figure 22**). Public use, as a park or community facility, would initially require repairs to stabilize the tunnel lining and floor and modifications to accommodate new utilities, including stormwater lines. Once the new utilities were in place, the tunnels could be modified for adaptive re-use. It would be about a 30-35 minute walk from the north portal to the south portal.

Some improvements would be necessary to ensure functionality and occupant safety. For example, the tunnel liner would need to be repaired and grouted, throughout or in specific locations, depending on the desired use. New stairways and elevators may need to be installed at the existing portals, including the Pennsylvania Avenue and John Street open cuts, to allow for improved ingress and egress as required by code. Additional Fire Life/Safety elements, such as low-velocity fan ventilation and construction of emergency vehicle access roadways, may be required as under local, state, and federal codes and ordinances. Adaptive re-use would also need to meet Americans with Disabilities Act accessibility regulations.

Figure 21: Utility Corridor Concept

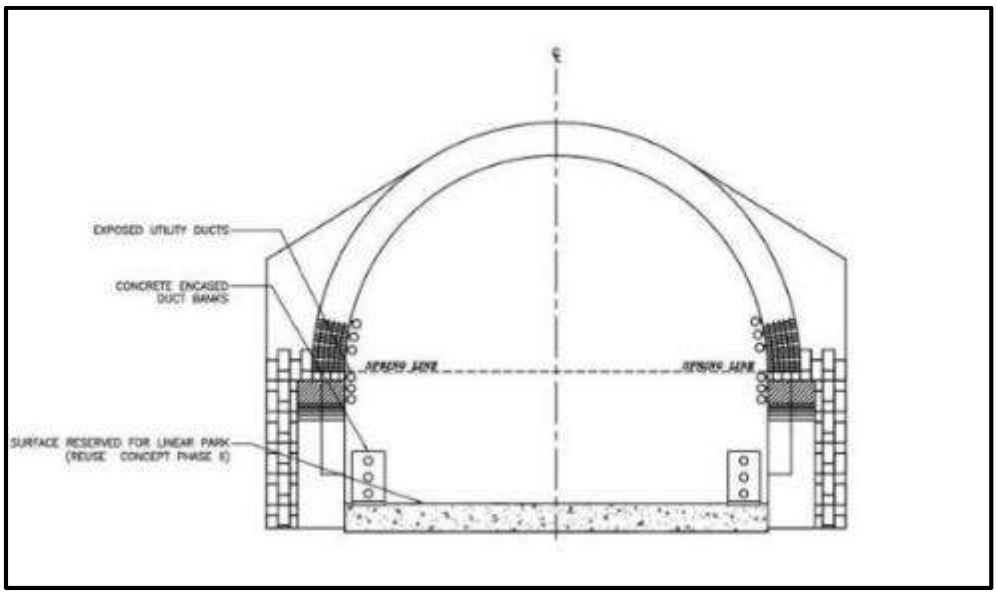
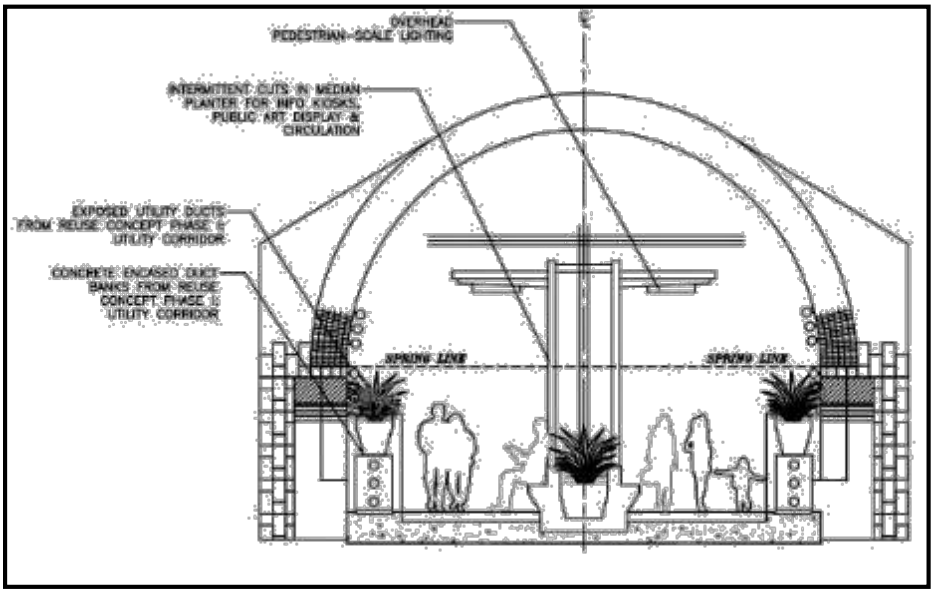


Figure 22: Linear Park Concept



H. Evaluation and Identification of Preferred Alternative

Table 9 provides a comparison of the four alternatives based on 52 engineering and environmental evaluation criteria developed for this project. Subsequent to this DEIS, the Public Hearing, and end of the comment period for this DEIS, FRA in coordination with MDOT and Amtrak will identify a Preferred Alternative for the B&P Tunnel Project.

The Preferred Alternative could be Alternative 1: No Build, Alternative 3A, Alternative 3B, Alternative 3C, or some refinement of any of these alternatives. The identification of the Preferred Alternative will be based on an assessment of how the Preferred Alternative meets Purpose and Need, an assessment of rail operations, engineering, transportation, cost, construction, an assessment of all environmental impacts, and on public and agency comments received. The evaluation and identification of the preferred alternative will be included in the Final EIS.

Table 9: Summary of Potential Engineering and Environmental Impacts

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Operations	**1. Travel Time Between Baltimore Penn Station and Gwynns Falls Bridge (southbound/northbound)**	Minutes: Seconds	Amtrak Acela 5:43/6:10 Amtrak Regional 5:50/6:19 MARC 5:50/6:14	Amtrak Acela 3:59/4:02 Amtrak Regional 4:19/4:19 MARC 4:56/4:17	Amtrak Acela 3:24/3:25 Amtrak Regional 3:43/3:34 MARC 4:22/3:56	Amtrak Acela 3:27/3:27 Amtrak Regional 3:46/3:37 MARC 4:33/4:04
	2. Travel Time Savings over Alternative 1 (southbound/northbound)	Minutes: Seconds	Not Applicable	Amtrak Acela 1:56 Amtrak Regional 1:46 MARC 1:26	Amtrak Acela 2:32 Amtrak Regional 2:26 MARC 1:53	Amtrak Acela 2:30 Amtrak Regional 2:23 MARC 1:44
	3. Value of Time Savings for All Passengers[8]	Dollars per year	Not Applicable	$32.5 Million per Year	$43.4 Million per Year	$42.3 Million per Year
	4. Lowest Design Speed within the Alignment	MPH	30 mph	50 mph	50 mph	50 mph
	5. Maximum Design Speed along the Alignment	MPH	75 mph	100 mph	100 mph	100 mph
	6. Average Operating Speed (southbound/northbound)	MPH	Amtrak Acela 35/34 mph Amtrak Regional 34/34 mph MARC 34/34 mph	Amtrak Acela 54/56 mph Amtrak Regional 50/52 mph MARC 44/52 mph	Amtrak Acela 63/66 mph Amtrak Regional 57/63 mph MARC 49/57 mph	Amtrak Acela 65/68 mph Amtrak Regional 59/65 mph MARC 49/57 mph
	7. Operational Flexibility and Reliability	High Medium Low	Low – only two tracks in common bore	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks

[8] 2040 Projected ridership, 2015 dollars

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	8. Meets Projected Year 2040 Level of Service for Amtrak/ MARC/ Freight	Yes/No	No – two tracks does not accommodate projected level of service; does not accommodate double-stack freight	Yes	Yes	Yes
Engineering	**9. Length of Alignment between Baltimore Penn Station and Gwynns Falls Bridge**	Miles	3.5 Miles	3.66 Miles	3.66 Miles	3.83 Miles
	10. Length of Tunnel	Miles	1.42 Miles	1.91 Miles	2.03 Miles	2.23 Miles
	11. Steepest Vertical Grade	% Grade	1.3%	2.0%	2.0%	2.0%
	12. Ability to Meet Current Project Design Criteria: Passenger (P) and Freight (F)	High Medium Low	Low (P) Low (F) Two tracks in a single bore; does not accommodate double-stack freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight
	13. Depth of Tunnel	Average Depth in Feet	15 foot average depth	130 foot average depth	130 foot average depth	140 foot average depth
	14. Extent of Major Utility Relocations	Minor Moderate Major Severe	None	Major – Relocations in the general vicinity of tunnel portals	Severe – Relocations extend significant distances outside of tunnel portal areas	Major - Relocations in the general vicinity of tunnel portals
Transportation	**15. Estimated Number of On-Street Parking Spaces Lost**	# Spaces	0	0	150	40
	16. Requires Reconstruction of West Baltimore MARC Station	Yes/No	No	No	Yes	Yes
	17. West Baltimore MARC Station in proximity to Existing MARC Parking	Yes/No	Yes	Yes	Yes	Yes

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	18. Allows for High-Level Platforms for West Baltimore MARC Station between Franklin and Mulberry Streets	Yes/No	No	No	Yes	Yes
Cost	**19. Capital Cost Estimate**	YOE $	$0	$ 3.7 Billion	$ 4.0 Billion	$ 4.2 Billion
Construction	**20. Impacts to Existing Amtrak Operations during Construction/ Rehabilitation**	Minor Moderate Major Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	21. Impacts to Existing MARC Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	22. Impacts to Existing LRT Operations During Construction/ Rehabilitation	Minor Moderate Severe	None – Construction would be contained within existing tunnel.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.
	23. Impacts to Existing NEC Freight Rail Operations	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off	Minor – Most work would be performed without affecting	Minor – Most work would be performed without affecting	Minor – Most work would be performed without affecting

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	During Construction/ Rehabilitation		peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	freight operations; only final cutover would cause minor impacts.	freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.
	24. Temporary Community Impacts During Construction	High Medium Low	None	Low – The portal construction area is mostly located in either existing Amtrak ROW or industrial property.	Medium – Portal construction would impact residential and industrial areas east of the existing NEC.	Medium – Portal construction would impact residential and industrial areas west of the existing NEC.
Right-of-Way (ROW)	**25. Surface Right-of-Way Acreage Required, by land use type[9]**	Acres	Residential: 0 Acres Commercial: 0 Acres Industrial: 0 Acres Other: 0 Acres **Total: 0 Acres**	Residential: 0 Acres Commercial: < 0.1 Acres Industrial: 2.5 Acres Other: 5.3 Acres **Total: 7.8 Acres**	Residential: 1.9 Acres Commercial: 3.1 Acres Industrial: 5.1 Acres Other: 7.0 Acres **Total: 17.1 Acres**	Residential: 0.9 Acres Commercial: 1.7 Acres Industrial: 6.2 Acres Other: 7.1 Acres **Total: 15.9 Acres**
	26. Surface Acreage of Roadway LOD	Acres	0 Acres	1.4 Acres	4.0 Acres	5.4 Acres
	27. Estimated Surface Parcels Impacted	# of Parcels	0	10	100	40
	28. Area of Excavation (including open cut)	Acres	0 Acres	10.2 Acres	14.9 Acres	17.1 Acres
	29. Area of Permanent Open Cut	Acres	0 Acres	5.6 Acres	12.5 Acres	12.9 Acres

[9] Does not include existing Amtrak ROW. Includes temporary and permanent

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Community Resources	**30. Estimated Residential Building Displacements**	# Displaced	0	0	48	24
	31. Estimated Business Displacements	# Displaced	0	2	9	10
	32. Estimated Community Facility Displacements[10]	# Displaced	0	0	5	1
	33. Estimated Residential Properties Impacted, but Residence Not Displaced[11]	# of Parcels	0	< 5	15	< 5
	34. Estimated Non-Residential Properties Impacted with No Displacement[3]	# of Parcels	0	< 5	10	10
	35. Right-of-Way Impacts within Minority Population Areas	Acres	0 Acres	5.8 Acres	15.1 Acres	13.9 Acres
	36. Right-of-Way Impacts within Low Income Population Areas	Acres	0 Acres	0.9 Acres	2.4 Acres	5.0 Acres
	37. Impacts to Baltimore City's *West Baltimore MARC Station Master Plan*	Minor Moderate Severe	None – Compatible with West Baltimore MARC Station Master Plan	None – Compatible with West Baltimore MARC Station Master Plan	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.
	38. Parks Potentially Impacted	# of Parks	0	0	1 – Lafayette and Payson Park	0
	39. Estimated Area of Parkland Impacted	Acres	0 Acres	0 Acres	< 0.1 Acres	0 Acres

[10] Includes schools, churches, community centers, libraries, hospitals, police and fire stations
[11] Permanent or temporary impacts to property

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Cultural Resources	**40. Adverse Effects for Historic Properties**	Number of Properties (Number of Contributing Elements)	0	6 (6 contributing historic elements impacted)	8 (87 contributing historic elements impacted)	10 (132 contributing historic elements impacted)
	41. Area of Surface disturbance within Historic District	Acres	0 Acres	12.0 Acres – Monroe-Riggs, Baltimore & Potomac Railroad, and Midtown-Edmondson Historic Districts	25.3 Acres – Edmondson Avenue, Baltimore & Potomac Railroad, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic District	20.3 Acres – Baltimore & Potomac Railroad, Edmondson Avenue, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic Districts
	42. Known Archaeological Resource Sites Impacted	# of Sites	0	0	0	0
Natural Resources	**43. Stream Impacts**	Linear Feet	0 Feet	0 Feet	0 Feet	0 Feet
	44. Wetland Impacts	Acres	0 Acres	0 Acres	0 Acres	0 Acres
	45. Estimated Street Trees Impacted	# of Trees	0	0	2	1
	46. Forested Land Impacted	Acres	0 Acres	1.5 Acres	2.5 Acres	3.7 Acres
	47. 100-Year Flood Plain Impact	Acres	0 Acres	3.5 Acres	3.5 Acres	3.5 Acres
Other Environmental	**48. Use of Section 4(f) Properties**	Number of Properties	0	5	11	10
	49. Hazardous Materials Sites Identified	# of Low, Medium, and High Priority Sites (and Total #)	N/A	57 Low, 29 Med, 6 High (92 Total)	71 Low, 37 Med, 6 High (114 Total)	92 Low, 52 Medium, 9 High (153 Total)
	50. Estimated Number of Buildings with Potential Noise Impacts	# of Buildings, Moderate or Severe	0 Severe 0 Moderate	0 Severe 254 Moderate	175 Severe 1,078 Moderate	111 Severe 979 Moderate

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	51. Estimated Number of Sites with Potential Vibration Impacts	# of Sites	24	69	138	92
	52. Permanent Negative Visual Impacts	Low Medium High	None	Medium – would construct new south tunnel portal and portal ventilation plant in primarily industrial area and construct an intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area

This page intentionally left blank

V. AFFECTED ENVIRONMENT

This section presents the existing environmental conditions of resources in the Study Area. The human and natural environmental resources within the Project Area and associated areas were first identified to analyze how the project could potentially affect the environment. Potential environmental impacts to these resources are discussed in **Section VI**.

The resources considered in the environmental analysis include: air quality; water quality; noise and vibration; solid waste disposal; natural ecological systems; wetlands; endangered species; flood hazard evaluation and floodplain management; coastal zone management; production and consumption of energy; use of natural resources other than energy; aesthetic environment; transportation; elderly and handicapped; land use; socioeconomic environment; public health; public safety; recreation areas and opportunities; minority race and ethnicity and low-income populations; sites of historical, archaeological, architectural or cultural significance; and construction impacts. Each resource is discussed in proportion to its applicability to the B&P Tunnel Project. Since there are no regulated coastal zones within or near the B&P Tunnel Project, regulated coastal zones are dismissed from further discussion.

A. Socioeconomics

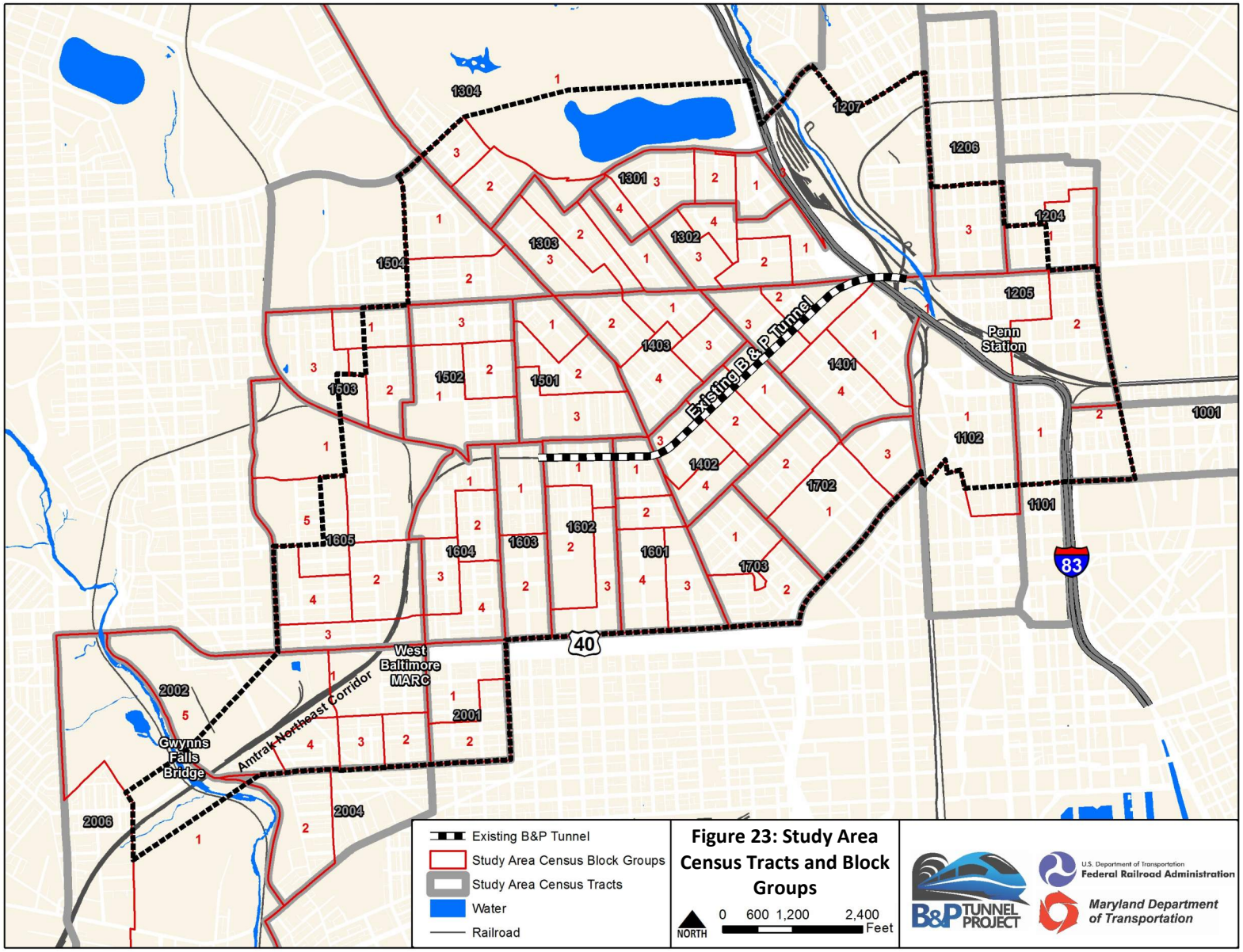
Existing socioeconomic and demographic conditions within the Study Area include population, land use and zoning, transportation, economy, housing, neighborhood and community facilities, and minority ethnicity and low-income populations. The data used for the analysis are from American Factfinder (US Census Bureau, 2013b) and the American Community Survey (ACS) 2009-2013 (US Census Bureau, 2013a), developed by the U.S. Census Bureau, U.S. Bureau of Labor Statistics (BLS), U.S. Department of Housing and Urban Development (HUD), Maryland Department of Business Economic Development, Baltimore Development Corporation, Baltimore Department of Housing and Community Development, and Baltimore County Department of Economic and Work Force Development. See **Appendix E** for socioeconomic data tables.

The Study Area boundary for socioeconomic evaluation was defined using a combination of Census block group and Census tract boundaries. The area was developed to approximately include block groups and tracts within 500 feet of the alternative centerlines of the alternatives considered in the *Alternatives Report*. The Study Area boundary for socioeconomic evaluation is shown in **Figure 23**.

1. Population

Data helps describe the population and demographic character of the Study Area, local region, and state. Population data also help identify communities of concern or environmental justice (EJ) communities. For this assessment, block group data was used to provide the highest level of comparable data. Where block group data was unavailable, Census tract level data was used.

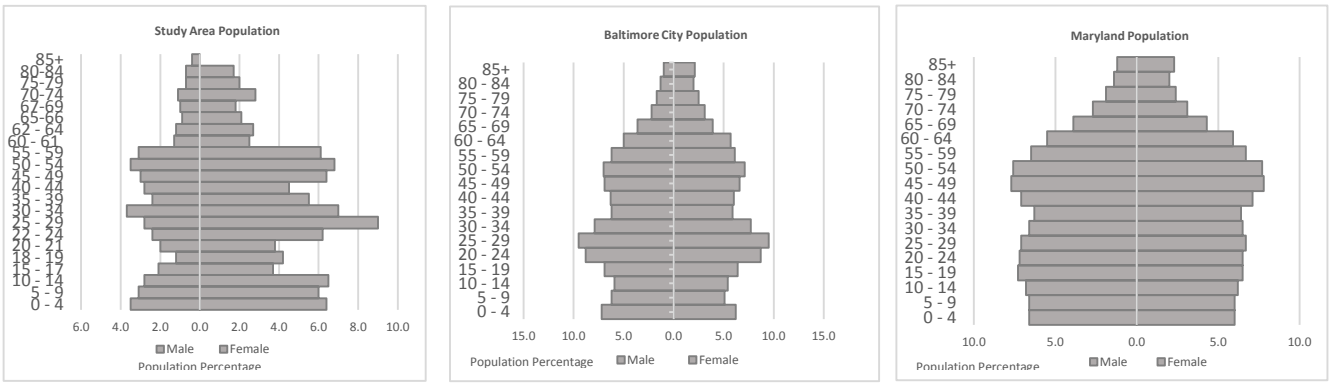
Based on Census block group data, the total population of the Study Area was approximately 65,762 in 2013 (US Census Bureau, 2013a), which represents 10.5 percent of Baltimore City's population and 1.1 percent of the state population. The residents are distributed across 77 individual Census block groups. Census block group 1101-1 is the most populous block group with a population of 2,612 residents, located in the Mid-Town Belvedere neighborhood, in the northeast portion of the Study Area. Census block group 2002-2 is the least populous block group with a population of 249 residents, located in the Penrose/Fayette Street neighborhood in the southwest portion of the Study Area. The average number of residents per block group was 854 people.


1304
1207
1206
1301
1204
1303
1302
1504
1205
Penn Station
Existing B & P Tunnel
1403
1401
1503
1502
1501
1001
1102
1402
1702
1101
1605
1604
1603
1602
1601
1703
83
40
West Baltimore MARC
2002
2001
Amtrak Northeast Corridor
Gwynns Falls Bridge
2004
2006
Existing B&P Tunnel
Study Area Census Block Groups
Study Area Census Tracts
Water
Railroad
Figure 23: Study Area Census Tracts and Block Groups
NORTH
0 600 1,200 2,400 Feet
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

a. Age

Figure 24 shows the age distribution of male and female populations in the Study Area, with Baltimore City and Maryland provided for comparison. The most populous age cohort in the Study Area is age 25-29 for females, and age 30-34 for males. In Baltimore City, the most prevalent age cohort is aged 25-29 for both males and females; in Maryland it is age 45-49 for both males and females. The Study Area population pyramid skews noticeably towards female; males are generally underrepresented relative to the city or state, particularly in the 15-17, 18-19, and 20-21 age cohorts.

Figure 24: Age Distribution of the Study Area



Source: U.S. Census Bureau, American Community Survey, 2009 – 2013, Five year estimates (US Census Bureau, 2013a).

b. Racial Composition

Table 10 presents a summary of the racial composition of the Study Area, Baltimore City and Maryland. This data is detailed by Census block group in **Appendix E**. In 2013, majority of the Study Area population was African American or Black Alone (81.2 percent), which is higher than that of Baltimore City (63.0 percent) and significantly higher than Maryland (29.4 percent). Nearly thirteen percent (12.8 percent) of the Study Area population is classified as White Alone, a lower representation than that of Baltimore City, and Maryland (28.3 percent and 58.4 percent respectively). The remaining populations include Asian Alone, Other Alone and Two or More Races Alone, each representing below three percent of the Study Area population, compared to Baltimore City and Maryland. The total Hispanic or Latino population within the Study Area was 1.3 percent, a lower representation than that of Baltimore City (4.0 percent) and Maryland (8.5 percent).

Table 10: Racial Composition of the Study Area

Category	Maryland	Baltimore City	Study Area
Total Population	5,834,299	621,445	65,762
White Alone	3,406,243 (58.4%)	174,590 (28.0%)	8,400 (12.8%)
African American or Black Alone	1,717,582 (29.4%)	389,758 (63.0%)	53,407 (81.2)%
Asian Alone	332,620 (5.7%)	14,822 (2.0%)	1,515 (2.3%)
Other[1] Alone	215,749 (3.7%)	1,362 (0.0%)	163 (0.2%)

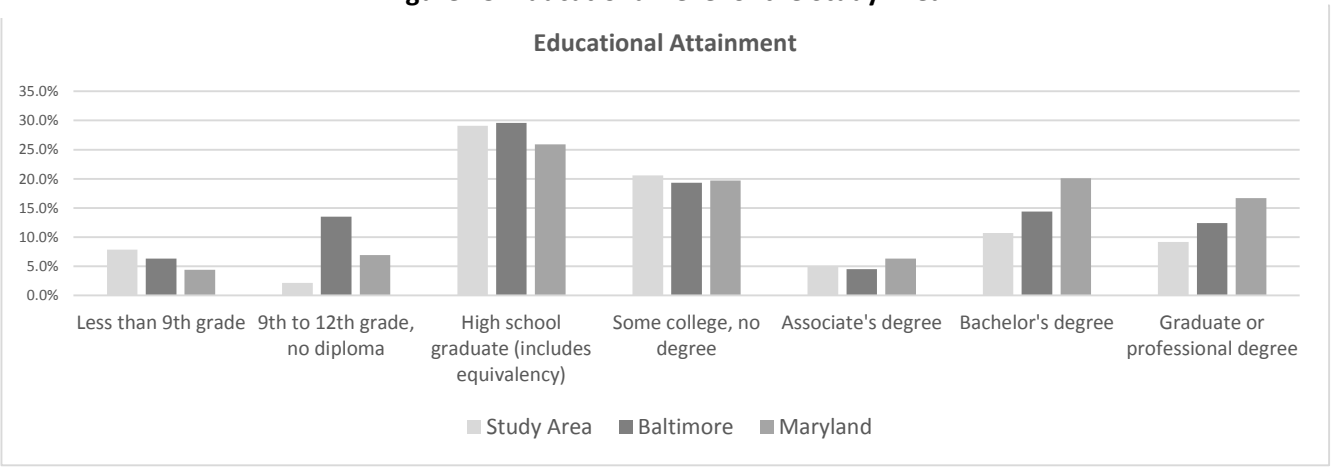
Category	Maryland	Baltimore City	Study Area
Two or More Races Alone	162,105 (2.8%)	12,400 (2.0%)	1,317 (2.0%)
Total Hispanic or Latino	493,310 (8.5%)	26,772 (4.0%)	844 (1.3%)

Source: U.S. Census Bureau, American Community Survey, 2009 – 2013, Five year estimates (US Census Bureau, 2013a).
[1] Other includes American Indian and Alaska Native alone, Native Hawaiian and Other Pacific Islander alone and some other race alone.

c. Educational Level

Figure 25 below shows the highest level of educational attainment of the Study Area, Baltimore City and Maryland for the population 25 years and over. Approximately 30.0 percent of the Study Area have a high school degree as their highest educational attainment, similar to Baltimore City, whereas 25.9 percent of the population statewide have a high school degree as their highest educational level. The percentage of people who have a Bachelor's degree as the highest level of education is lower within the Study Area (10.7 percent), than in Baltimore City (14.4 percent) and approximately half that of Maryland (20.1 percent). Graduate or professional degree attainment as the highest level of education is generally lower within the Study Area, relative to Baltimore City and Maryland (9.2 percent, 12.4 percent and 16.7 percent respectively).

Figure 25: Educational Level of the Study Area



Source: *U.S. Census Bureau, American Community Survey, 2009 – 2013, Five year estimates* **(US Census Bureau, 2013a).**

d. Poverty

The U.S. Census Bureau Poverty Thresholds for 2013 was an annual median household income of $23,834 for a family of four. In 2013, the percent of the Study Area population for whom poverty status was determined with income in the past 12 months below the poverty level was 30.6, compared to 23.8 percent in Baltimore City and 9.8 percent for Maryland. Census Tract 1402 Block Group 4, located in the Upton neighborhood and Census Tract 1702 Block Group 1, which spans the Upton and Madison Park neighborhoods had the most households below poverty level (216 and 217 respectively). Poverty status is further assessed in **Section V.A.8**.

e. Linguistic Isolation

According to the U.S. Census 2013 ACS data, there are approximately 422 limited English speaking households in the Study Area block groups, or 1.6 percent of the total households. This is proportionately somewhat lower than Baltimore City (2.2 percent) or statewide (3.1 percent).

A "limited English speaking household" is defined by the U.S. Census Bureau as: "…one in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English 'very well'. In other words, all members 14 years old and over have at least some difficulty with English".

Block Groups in the Study Area range from zero limited English speaking households up to approximately 15 percent (Block group 1206.003). **Figure 23** above depicts the Study Area block groups analyzed. **Appendix E** provides the information on individual block groups along with Baltimore City and Maryland.

f. Commute (Journey to Work)

According to the U.S. Census Bureau, Commute (or Journey to Work) refers to a worker's travel from home to work. Place of work refers to the geographic location of the worker's job. **Appendix E** depicts the commute time and mode of residents in the Study Area, Baltimore City and statewide. Most people within the Study Area use an automobile (car, truck or van) to get to work (59 percent), although it is a lower percentage than the population that takes an automobile within Baltimore (73 percent) and significantly lower in Maryland (87 percent). Census block groups 1101.001 and 1102.001, located in the Mount Vernon and Midtown Belvedere neighborhoods have the largest number of people who use an automobile to commute to work (829). Census block group 1101.001 also has the largest number of people who commute via public transportation (377). Eight percent within the Study Area walk to work and two percent use other modes (includes taxi cab, motorcycle or bicycle). 18 percent have a commute that is less than 15 minutes to work, similar to Baltimore City and Maryland.

2. Land Use and Zoning

a. Land Use

This section describes existing land use within the Study Area, Baltimore City, and Maryland. Land use data are from Baltimore City (Baltimore City, 2008) and the Maryland Department of Planning (MDP, 2010).

Land uses in the Study Area are mostly residential and dispersed fairly evenly throughout the Study Area. Other land uses in the Study Area include institutional, primarily west of Baltimore Penn Station; transportation-related; open space, scattered throughout the Study Area as small neighborhood parks, playgrounds, and athletic courts, with the largest block being Druid Hill Park in the northeast; commercial, located primarily along the major roads North Avenue, Pennsylvania Avenue, and West Lafayette Avenue; industrial, concentrated along the NEC in the southwest and near the MTA North Avenue Light Rail Yard in the northeast; and mixed-use. **Figure 26** displays the existing land use within the Study Area.

Table 11 summarizes land use in the Study Area, Baltimore City, and Maryland. Because of different classifications, the latest state land use data (MDP, 2010) are not broadly comparable to Baltimore City data (2008), except for residential, commercial, and industrial land uses.

The Study Area encompasses approximately five percent of the total land in Baltimore City. Most land use is residential, both in the Study Area and city. Institutional use represents the next greatest percentage (14.2 percent) in the Study Area, whereas in Baltimore City, it represents 12.7 percent. In the Study Area, transportation is the next most prevalent land use at 11.2 percent; this percentage is nearly twice that of Baltimore City (6.3 percent). Less of the Study Area is open space (9.6 percent) and industrial (6.9 percent) compared to Baltimore City at 14.2 percent and 15.7 percent, respectively. More land is commercial (7.7 percent) and mixed-use (1.1 percent) in the Study Area than in Baltimore City (6.2 percent and 0.7 percent, respectively).

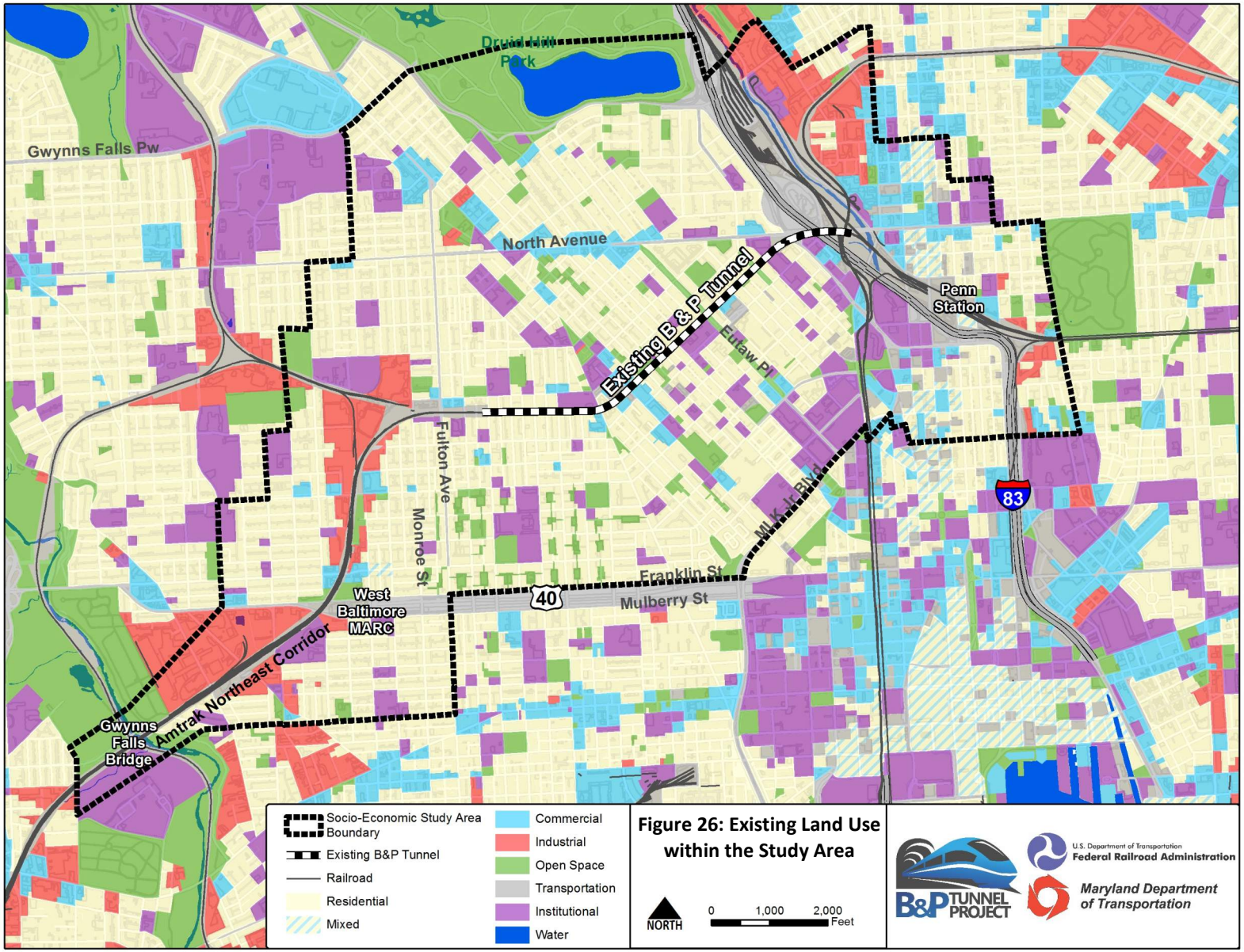


Figure 26: Existing Land Use within the Study Area

Table 11: Land Use Summary

Land Use Type	Study Area (Acres)	Study Area (Percent)	Baltimore City (Acres)	Baltimore City (Percent)
Residential	1,327.9	49.3	23,915.8	44.2
Institutional	382.0	14.2	6,899.8	12.7
Transportation	301.3	11.2	3,390.5	6.3
Open Space	259.9	9.6	7,699.7	14.2
Commercial	208.1	7.7	3,339.6	6.2
Industrial	185.6	6.9	8,509.7	15.7
Mixed	28.8	1.1	390.1	0.7
Total	2,693.6	100.0	54,145.2	100.0

Source: State of Maryland Land Use and Shapefile (MDP, 2010; Baltimore City, 2008)

b. Zoning

Zoning in the Study Area is generally consistent with citywide land use (**Table 12** and **Figure 27**). Open space constitutes nearly 10 percent of land use in the Study Area, however, no land is actually zoned as open space. Study Area zoning is comparable to citywide zoning in most categories, except proportionately more properties are zoned as Community Businesses, Central Commercial, Community Commercial, and Office-Residences. Substantially less acreage is zoned industrial in the Study Area compared to citywide. The ROW for the existing B&P Tunnel and approach tracks are zoned industrial and/or "approved conditional use" through other zoning such as residential and commercial. According to current zoning, no railroad yards or shops are approved outside industrial zoning.

3. Transportation

a. Northeast Corridor (NEC)

The NEC runs from South Station in Boston through Pennsylvania Station in New York City and terminates at Union Station in Washington, D.C. The NEC in the Study Area is shared by intercity, commuter, and freight operations, and moves 365 million passengers and 14 million car-miles of freight per year. A total of 145 daily trains, with a peak of 35 trains during the four-hour afternoon peak period, traverse the existing B&P Tunnel, including 11.6 million passengers on Amtrak's Northeast Regional and Acela Express Services (FRA, 2015). The NEC accommodates Amtrak; Northeast Regional and Acela Express passenger trains; MARC commuter rail service; and NS freight service.

Table 12: Zoning Districts

Zoning District	District Description	Study Area (Acres)	Study Area (Percent)	Baltimore City (Acres)	Baltimore City (Percent)
Residential	Includes both single-family and general residential districts	1,667.6	64.1	34,976.7	65.4
Office-Residence	Primarily accommodates office and residential use in appropriate areas and locations	102.9	4.0	582.8	1.1
Neighborhood Business	Shopping convenience for people residing in nearby areas.	22.1	0.8	42.8	0.1
Community Business	Designed to accommodate the needs of a large consumer population served by a neighborhood business district.	205.6	7.9	2,245.9	4.2
Central Business	Provides for a great variety of large retail stores, offices, and related activities characteristic of major business streets of the downtown area and that serve the metropolitan region.	24.7	0.9	290.2	0.5
Central Commercial	Provides for uses and activities in the central business district of the City.	124.4	4.8	538.5	1.0
Community Commercial	Designed primarily to accommodate business, service, and commercial uses of a highway-oriented nature	116.3	4.5	1,354.6	2.5
Industrial	Intended to permit light manufacturing, warehousing and service uses, suitable for industrial and related activities.	338.6	13.0	13,436.5	25.1
Total		**2,602.2**	**100.0**	**53,499.9**	**100.0**

Source: Land Use Shapefile (Baltimore City, 2008)

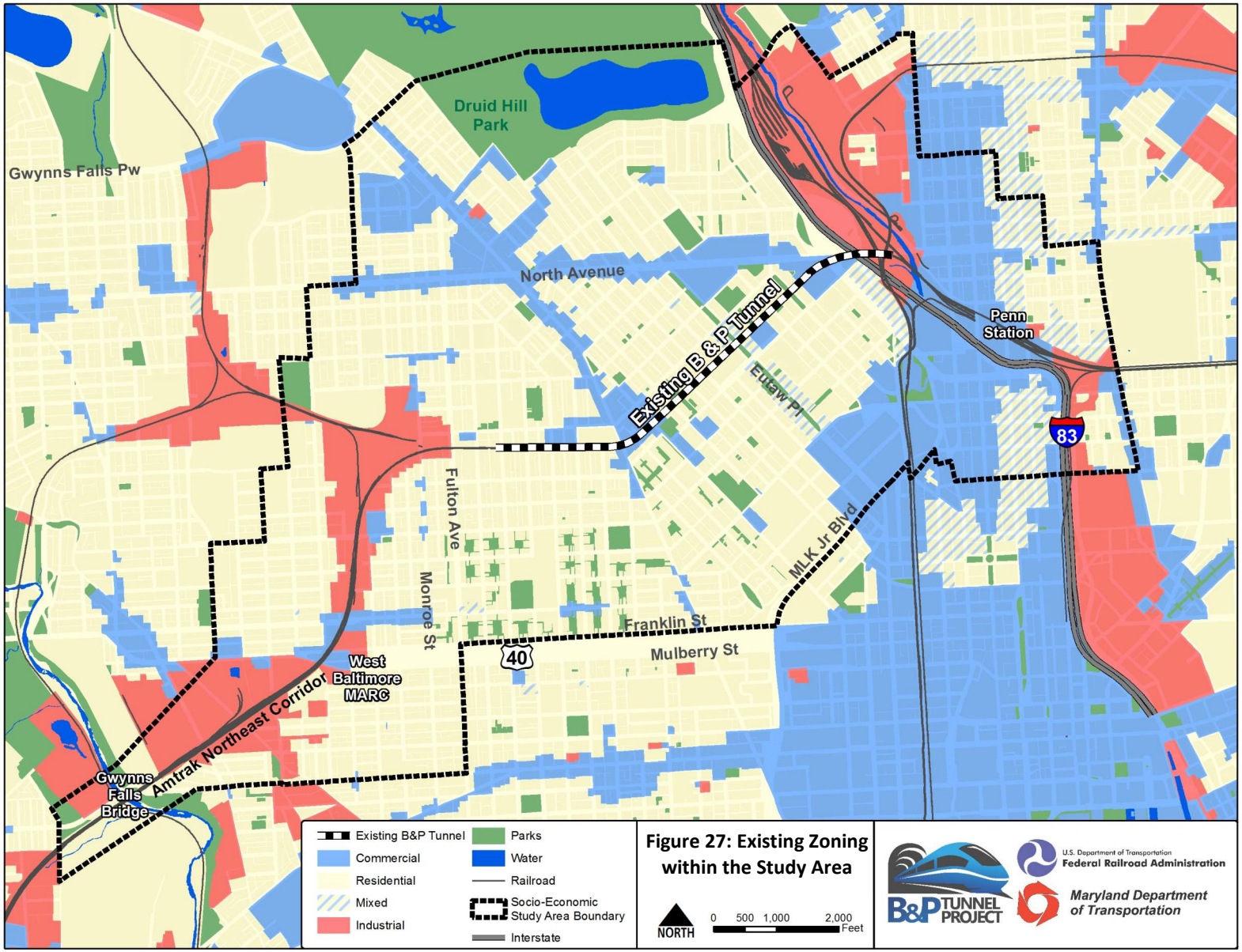


Figure 27: Existing Zoning within the Study Area

b. MARC Commuter Rail Service

MARC is a commuter rail system providing service between Baltimore City and Washington, D.C. MARC Train service has two stations in the Study Area: Baltimore Penn Station and West Baltimore station. MARC Train service has a 20 minute headway during peak hours and a one-hour headway during non-peak hours. In 2012, the two stations served over 28,400 passenger trips daily (MTA, 2013). In December 2013, the MARC Penn Line began providing weekend service to Washington, D.C.

c. Light Rail

Light Rail is a 30-mile alignment with 32 stations. In 2014, it carried over 8.1 million passengers (Maryland Department of Transportation, 2015).The Light Rail follows a north-south alignment from Hunt Valley in Baltimore County to Baltimore/Washington International Thurgood Marshall Airport (BWI) and Glen Burnie in Anne Arundel County. Light Rail connects to Amtrak, MARC, and local bus service, operated by MTA.

d. Metro Subway

Metro Subway is a 15.5 mile heavy rail system serving Baltimore City and Baltimore County, from Johns Hopkins Hospital in the southeast to Owings Mills in the northwest. Metro has a headway of 8 to 10 minutes and end-to-end travel time of approximately 30 minutes. Metro provides connections to the local bus service and Light Rail. In fiscal year (FY) 2016, the Metro transported 14.6 million passengers (Maryland Department of Transportation, 2015).

e. Roadway Network

The major arterials that pass through the Study Area include: North Avenue, West Franklin, and West Mulberry Street, which run east to west; and, Pennsylvania Avenue, which runs northwest to southeast. These arterials provide connections throughout Baltimore City and facilitate short intra-city trips between residential, commercial, and employment destinations. The regional connectors in the Study Area include Martin Luther King Junior Boulevard, which provides connections to Interstate 95 (I-95) and Interstate 295 (I-295); Interstate 83 (I-83), which runs from the northern suburbs of Baltimore to downtown; and U.S. Route 40, which connects to points west.

f. Bus Service

The Study Area is served by MTA's local bus service and Baltimore City's Charm City Circulator (CCC). MTA buses provide transit service along 57 local, limited stop and express bus routes throughout the region. It has an average daily ridership of 242,000 and an average headway of approximately 20 minutes during peak hours and 30 minutes during non-peak hours. Within the Study Area, MTA local bus service provides connections to Amtrak, MARC, Light Rail, Metro, and the CCC.

The CCC is a free shuttle service provided by the Baltimore City Department of Transportation (DOT), with one route that passes through the Study Area. The Purple Route travels north-south through the Study Area from Baltimore Penn Station in Mount Vernon to Federal Hill in south Baltimore. The service has a fifteen minute headway and operates during peak and off-peak hours on weekdays and weekends, connecting with other transit services. In FY 2014, the Purple Route transported approximately 150,000 riders per month (Baltimore City, 2014).

g. Freight

Currently, cargos to/from specific railroad customers of the freight trains that pass through the B&P Tunnel include vegetable oil; plastic pellets; paper; lumber; and produce. There are no regulations or restrictions,

however, which would preclude other forms of freight cargo on these trains, providing the material is moved in accordance with federal transportation rules.

Norfolk Southern Corporation and CSX Corporation have rights to operate on the Northeast Corridor per "trackage-rights agreements" that date back to Amtrak's acquisition of the Northeast Corridor on April 1, 1976 as part of the Railroad Revitalization and Regulatory Reform Act of 1976 (see end note for more discussion regarding dates). Per these agreements, Amtrak must make reasonable efforts to accommodate freight rail operations on the Northeast Corridor, and freight rail companies must be equally accommodating in accepting off-hour track assignments for the movement of goods (nights, weekends), when passenger trains operate less frequently and the insertion of freight trains will not delay them. While these agreements guarantee private rail freight companies access to the Northeast Corridor, these rail freight companies have other route options around Baltimore that make it unlikely that the B&P Tunnel route would be more attractive as a major through route across or around the city.

Because of these alternate route options, there are currently no "through" freight trains operating through Baltimore on the Northeast Corridor. For the past several years, only one local Norfolk-Southern Corporation ("NS") freight train has been operating through the B&P Tunnel daily, serving customers south of the B&P Tunnel between Baltimore and Washington, D.C. The train originates at Bayview Yard in Eastern Baltimore (north of Baltimore Penn Station), travels through the Station and the Tunnel, and delivers and/or picks up cars at various sidings, and then returns to Bayview Yard.

NS has no plans to increase or change its B&P Tunnel freight operation in the near future. NS has, however, restated its contractual right to increase freight operations in the future should it see value in doing so. In addition, the agreements provide that Amtrak cannot take any action that may restrict future growth in freight traffic through the B&P Tunnel.

Amtrak's first priority is to its passenger services. Therefore, although Amtrak must accommodate requests from NS or other freight operators with trackage rights agreements for additional train moves on the Northeast Corridor, Amtrak need only schedule such moves as space between passenger trains can be made available. Where the freight operator and Amtrak have a dispute about scheduling of freight moves, the Surface Transportation Board (STB) adjudicates trackage rights agreements.

4. Economy

a. Employment

The labor force includes the civilian and U.S. Armed Forces population over 16 years of age working as paid employees, people who are self-employed (including farmers), or who worked 15 hours or more as unpaid workers for a family farm/business. Excluded from the labor force are those over 16 years of age who are students, homemakers, unpaid volunteers, retirees, institutionalized, or worked less than 15 hours a week as unpaid workers for a family farm/business.

The unemployed are defined as those over 16 years of age and not currently working, but actively looking for work and generally available to work. As shown in **Table 13**, in 2013, the unemployed population of the Study Area was 20.4 percent, which was about 6.5 percent higher than Baltimore City and about 12.2 percent higher than the statewide rate (US Census Bureau, 2013a).

Table 13: Labor Force Characteristics

Geographic Area	Population	
	Residents in Labor Force	Unemployed Residents in Labor Force (Percent)
Study Area	36,055	20.4
Maryland	3,214,633	8.2
Baltimore City	312,986	13.9

Source: U.S. Census Bureau (US Census Bureau, 2013a).

The percent of residents employed in each occupation category of the ACS in 2013, detailed in **Appendix E,** is similar for the Study Area Block Groups, Baltimore City, and Maryland (see **Table 14**). Most workers residing in the Study Area (about 33.2 percent) work in management, business, science, and arts. Approximately a quarter (25.1 percent) work in a service capacity, and 25.2 percent are sales and office staff. The remaining workers are in natural resources, construction, and maintenance sectors (4.4 percent) or laborers in production, transportation, or material-moving jobs (12.0 percent).

The highest percent of Study Area workers in the management, business, science, and art professions (82.2 percent) reside in the Bolton Hill neighborhood (Block Group 1401.004). For the other analyzed occupation types in the Study Area, the majority (67.4 percent) work in sales and office occupations and reside in the Midtown-Edmondson neighborhood (Block group 1605.002); majority of Study Area residents working in services (53.7 percent) reside in the Sandtown-Winchester neighborhood (Block Group 1501.003); the highest percentage of people whose occupations are in natural resources, construction, and maintenance (28.6 percent) reside in the Mondawmin neighborhood (Block Group 1504.001); and the highest proportion of working residents in production, transport, and material moving jobs (44.1. percent) reside in in the Penrose/Fayette neighborhood (Block Group 2002.002). Major employers in the Study Area include Bon Secours Hospital and the University of Baltimore (US Census Bureau, 2013e).

Table 14: Summary of Resident Occupations

Geographic Area/Census Block Group	Management, Business, Science, and Arts (Percent)	Service (Percent)	Sales and Office (Percent)	Natural Resources, Construction, and Maintenance (Percent)	Production, Transportation, and Material-Moving (Percent)
Maryland	44.2	16.9	23.2	7.9	7.7
Baltimore City	38.4	21.6	23.5	6.1	10.5
Study Area Total Block Groups	33.2	25.1	25.2	54.4	12.0

Source: U.S. Census Bureau (US Census Bureau, 2013a).

b. Business

The U.S. Census Bureau's 2013 Annual Economic Survey provides certain business characteristics data by North American Industry Classification System (NAICS) code and zip code (US Census Bureau, 2013c), which is the smallest available analysis unit for businesses in the Study Area. The zip code boundaries encompassed in all, or part of the Study Area include: 21201, 21202, 21216, 21217, 21223, and 21229 (**Figure 28**).

Table 15 shows a total of 4,185 businesses are located in the Study Area zip codes with the majority in the easternmost portion that extends south (21202), encompassing Baltimore Harbor (US Census Bureau, 2013c). The top five sectors in the Study Area zip codes are professional, scientific, and technical services (17.3 percent); retail trade (15.0 percent); accommodation and food services (13.0 percent); health care and social assistance (12.0 percent); and other services (11.1 percent). A total of 2,137 establishments (51.1 percent) have one to four employees with the largest 12 establishments having 1,000 or more employees (0.3 percent). In comparison, in 2013, Baltimore City had 12,280 establishments of which 386 had 100 or more employees (3.1 percent) and statewide 135,421 establishments had 3,375 had 100 or more employees (2.5 percent). (US Census Bureau, 2013f). In 2013, annual payroll was distributed in the following zip codes (US Census Bureau, 2013d):

- 21201: $2.2 billion
- 21202: $3.8 billion
- 21216: $0.3 billion
- 21217: $0.1 billion
- 21223: $0.2 billion
- 21229: $0.3 billion

Annual 2013 payroll in Baltimore City was approximately $16 billion (US Census Bureau, 2013c) and $108 billion statewide (US Census Bureau, 2013e).

The largest business in the immediate vicinity of the south portal, P. Flanigan & Sons (F&S) Inc., is located at 1300 North Monroe Street, intersecting zip codes 21216 and 21217 within the Study Area. It is the only Maryland State Highway Administration approved recycled concrete aggregate base manufacturer in Maryland and has been in operation since 1885. It has an advantageous location for material transportation, which utilizes the CSX freight line spur to transport stockpiles of aggregate, as much as three times per week and it is in close proximity to several major highways and facilities, including I-95, I-695, I-70, U.S. Route 1, U.S. Route 40, MD-295, the Port of Baltimore and BWI Airport. This location employs approximately 50 people, some of whom reside in adjacent communities, making this business one of the economic drivers of the community. Potential impacts to this business are discussed in **Section VI**.

c. Property Taxes

Both Baltimore City and Maryland real property tax rates have remained constant since 2008, at $2.268 and $0.112 per $100 assessed value, respectively (Baltimore City, 2013). Based on parcel tax data, 2014 Baltimore City real property taxes in the Study Area totaled approximately $34.8 million, compared to $763 million levied citywide in 2013 (Baltimore City, 2013; Baltimore City, 2014). The State collected approximately $738 million in real property taxes in 2013 (Maryland State Archives, 2015).

d. Income and Wages

Table 16 summarizes 2013 inflation-adjusted median household income of people residing in the Study Area, Baltimore City, and Maryland. The median household income of the 77 Study Area Blocks Groups ranged from $8,643 to $78,365. The average median household income of the Study Area Block Groups was $29,474 — approximately $12,000 (29 percent) less than that of Baltimore City and $44,000 (60 percent) less than the statewide average.

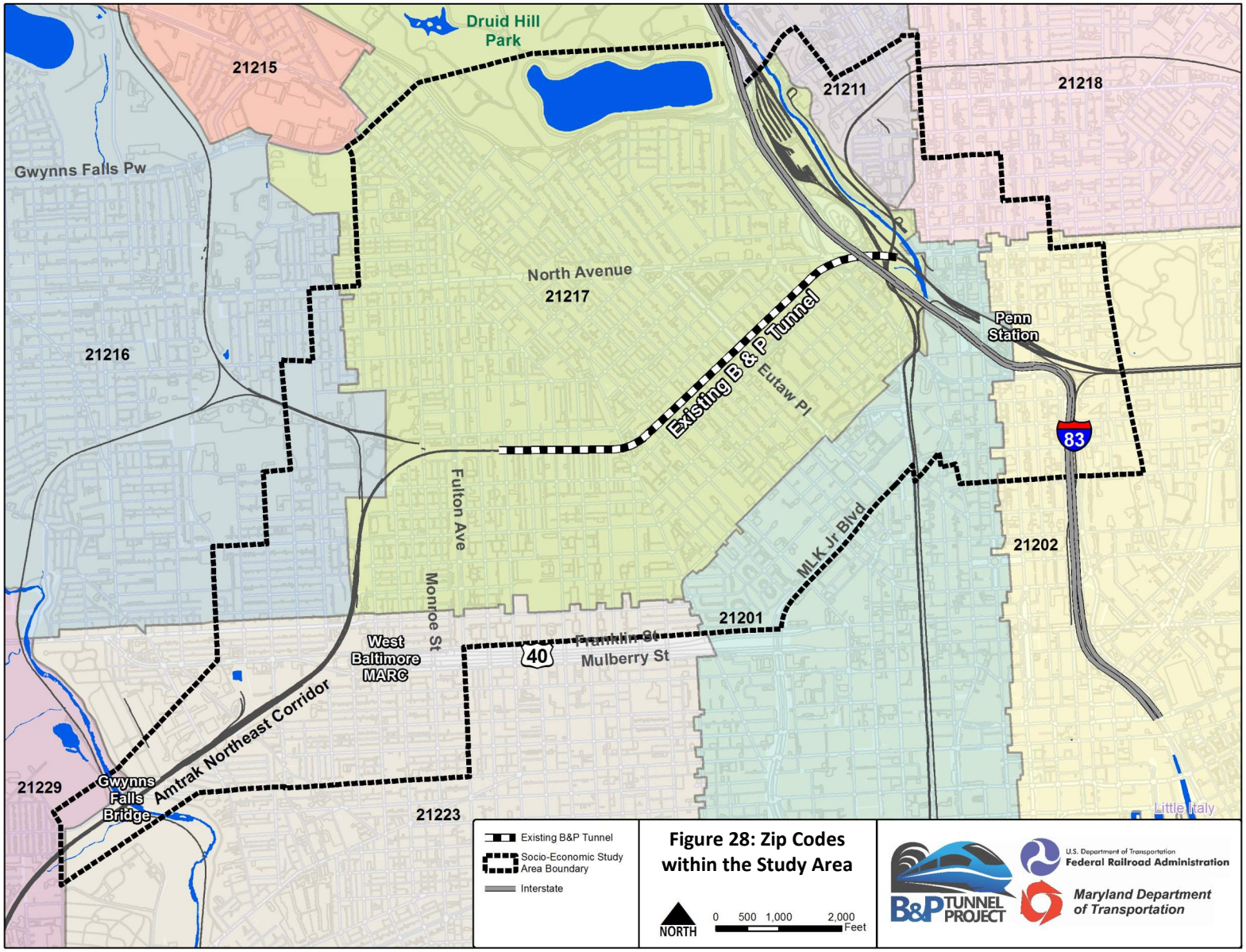

Druid Hill Park
21215
21211
21218
Gwynns Falls Pw
North Avenue
21217
21216
Existing B & P Tunnel
Eutaw Pl
Penn Station
83
Fulton Ave
Monroe St
MLK Jr Blvd
21202
21201
West Baltimore MARC
40
Franklin St
Mulberry St
Amtrak Northeast Corridor
21229
Gwynns Falls Bridge
21223
Little Italy
Existing B&P Tunnel
Socio-Economic Study Area Boundary
Interstate
NORTH
0 500 1,000 2,000 Feet
Figure 28: Zip Codes within the Study Area
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Table 15: Number of Business Establishments per NAICS Business Sector by Zip Code

NAICS Business Sector[1]	Zip Code						Total Number by Business Sector
	21201	21202	21216	21217	21223	21229	
Accommodation and Food Services	195	202	17	36	50	44	**544**
Administrative, Support, Waste Management and Remediation Services	59	97	4	10	12	15	**197**
Arts, Entertainment, and Recreation	19	27	0	9	4	2	**61**
Construction	23	22	7	12	17	29	**110**
Educational Services	17	26	3	5	5	8	**64**
Finance and Insurance	86	166	4	6	7	13	**282**
Health Care and Social Assistance	146	117	53	57	29	101	**503**
Information	35	46	0	2	3	3	**89**
Management of Companies and Enterprises	17	19	0	0	0	0	**36**
Manufacturing	7	14	2	5	32	6	**66**
Other Services (Except Public Administration)	126	142	29	69	49	51	**466**
Professional, Scientific, and Technical Services	316	359	1	19	14	16	**725**
Real Estate and Rental and Leasing	59	78	10	23	29	13	**212**
Retail Trade	141	143	56	91	114	81	**626**
Transportation and Warehousing	8	12	10	5	11	10	**56**
Utilities	2	8	0	0	0	0	**10**
Wholesale Trade	25	44	4	8	32	22	**135**
Industries Not Classified	0	0	0	2	0	1	**3**
Zip Code Total Number of Establishments	**1,281**	**1,522**	**200**	**359**	**408**	**415**	**4,185**

Source: U.S. Census Bureau Economic Survey (US Census Bureau, 2012).

[1]*North American Industry Classification System*

Table 16: Median Household Income

Geographic Area	Median Household Income (U.S. Dollars)[1]
Study Area	$29,474
Maryland	$73,538
Baltimore City	$41,385

Source: U.S. Census Bureau (US Census Bureau, 2013a).
[1]2013 inflation-adjusted dollars

5. Housing

Housing types, tenure, vacancy, and ownership rates are useful in understanding the availability of suitable housing in areas where residential property displacements could occur as a result of the Project.

The number of housing units and occupancy within the Study Area is summarized in **Table 17**. In 2013, there were 38,059 housing units within the Study Area, representing 12.8 percent of the total housing units within Baltimore City and 1.6 percent of statewide housing units (US Census Bureau, 2013a). Approximately 69.3 percent of these housing units were occupied, which is lower than the proportion of occupied housing in Baltimore City (81.5 percent) and Maryland (89.9 percent). Based on field-verified data, rowhouses are the most common residential buildings in the Study Area.

Table 17: 2013 Housing Units and Occupancy Characteristics

Geographic Area	Total Housing Units	Occupied Housing Units	Owner Occupied Housing Units (Percent)	Average People/Occupied Housing Unit
Maryland	2,387,285	2,146,240	67.6	2.8
Baltimore City	296,256	241,455	48.3	2.6
Study Area Total	**38,059**	**26,358**	**30.9**	**2.8**

Source: U.S. Census Bureau (US Census Bureau, 2013a).

According to the ACS, about 30.9 percent of the occupied housing units within the Study Area Block Groups were owner-occupied in 2013. Comparatively, the percentage of owner-occupied housing units within Baltimore City and Maryland was 48.3 and 67.6 percent, respectively. The average number of people per occupied housing unit for the Study Area Block Groups was 2.5, similar to the Baltimore City average of 2.6, and Maryland at 2.8 people.

The Study Area currently contains six publicly owned housing developments, with a total of 2,467 units, dispersed throughout the Study Area. There are also 22 affordable housing apartment developments with a total of 3,111 units. Seven of these developments provide family housing, 12 serve the elderly, and two provide disabled housing. One development is not classified (HABC, Accessed 2014).

6. Neighborhoods and Community Facilities

Neighborhoods and facilities were identified based on site visits and a review of Geographic Information Systems (GIS) data. Thirty residential neighborhoods were identified within, and/or intersecting with, the Study Area.

Community facilities within the Study Area include educational, religious, law enforcement, fire and rescue, parks and recreation facilities, and cemeteries.

a. Neighborhoods

The proposed intermediate ventilation plant and South Portal locations for Alternatives 3A, 3B, and 3C are within three Study Area neighborhoods. These are Reservoir Hill, Bridgeview/Greenlawn, and Midtown-Edmondson. The Jones Falls Area neighborhood surrounds the proposed North Portal location; however, this neighborhood is the least residential due to heavy transportation land use with I-83, MTA North Avenue Light Rail Yard, and Baltimore Penn Station. These neighborhoods are shown in **Figure 29** and listed in **Table 18**.

The Study Area neighborhoods are typical of older, established urban areas, with historic architecture, highly trafficked pedestrian spaces, busy thoroughfares, and quieter residential roads. The neighborhoods are primarily residential, composed mainly of single-family attached rowhomes and several garden apartment complexes. The Study Area features a variety of commercial and industrial businesses, such as convenience stores, bar/restaurants, clothing retail, and automotive care, located along the main thoroughfares of North Avenue and Pennsylvania Avenue. Residential and commercial areas alike are characterized by a near-constant hum of pedestrian activity.

In some neighborhoods, the residential character/cohesion has been impacted by previous construction of substantial linear infrastructure. The existing B&P Tunnel rail alignment traverses from Gwynn's Falls as surface tracks (i.e., daylighted) through the Carroll-South Hilton, Penrose/Fayette Street Outreach, Rosemont Homeowners/Tenants, Evergreen Lawn, Midtown-Edmondson, and Bridgeview/Greenlawn neighborhoods. Since it was constructed in 1873, the railroad has been a physical barrier to the neighborhoods, except in nine locations where it is crossed by local roads or there is an overpass. Land adjacent to the rail corridor is primarily commercial and industrial, which act as a buffer between the railway and residential land uses.

The residential character of neighborhoods has also been impacted by wide multilane roads such as U.S. 40, which bisects neighborhoods to the southwest of the Study Area; North Avenue, a major east-west thoroughfare in the north of the Study Area; Martin Luther King Junior Boulevard, which leads to I-95 and I-295 in the southeast of the Study Area; and I-83 to the east. The Jones Falls Area neighborhood is the least residential as it has heavy transportation land use where I-83, the MTA North Avenue Light Rail Yard and Baltimore Penn Station are located. Neighborhoods in the Study Area east of the Jones Falls Area connect to the neighborhoods west or south via 11 overpasses at nearly all major intersecting streets, ensuring neighborhood access.

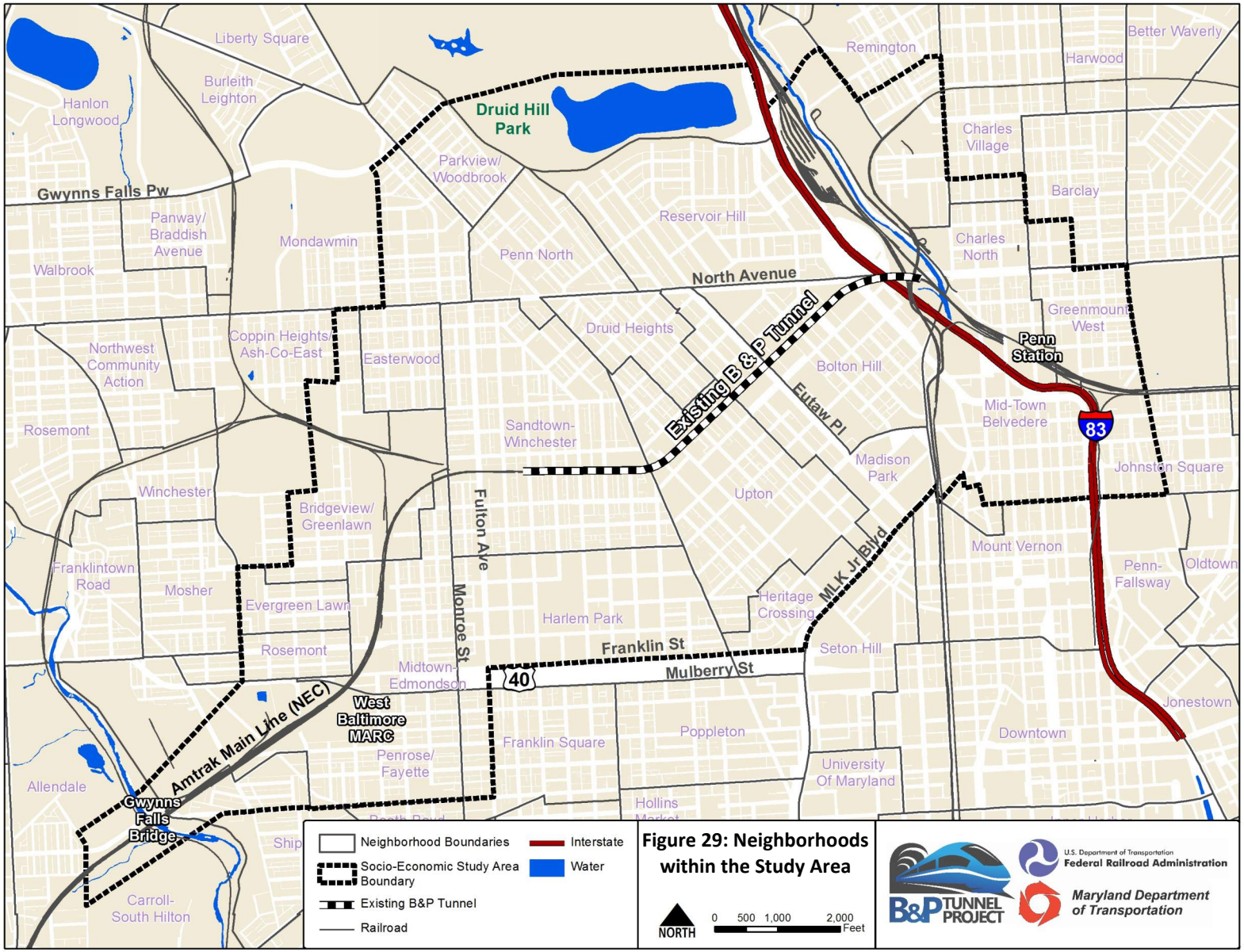


Figure 29: Neighborhoods within the Study Area

Table 18: Neighborhoods within the Study Area

Neighborhood	Location within Study Area
Barclay	East
Bolton Hill	Central
Bridgeview/Greenlawn	West
Coppin Heights/Ash-Co-East	North
Druid Heights	North
Easterwood	West
Evergreen Lawn	Southwest
Franklin Square	South west
Greenmount West	East
Harlem Park	South
Heritage Crossing	South
Johnston Square	East
Madison Park	Central
Mid-Town Belvedere	East
Midtown-Edmondson	Southwest
Penrose/Fayette Street Outreach	Southwest
Rosemont Homeowners/Tenants	Southwest
Sandtown-Winchester	Central
Upton	Central
Carroll-South Hilton	Southwest
Shipley Hill	Southwest
Mondawmin	Northwest
Parkview/Woodbrook	Northwest
Penn North	North
Reservoir Hill	North
Jones Falls Area	Northeast
Charles North	Northeast
Charles Village	Northeast
Druid Hill Park Area	North
Remington	Northeast

b. Community Facilities

The Study Area contains a wide range of community facilities and public services that are locally oriented and serve the region, including churches and other places of worship, recreation centers, cemeteries, schools, libraries, and parks. **Figure 30** shows the community facilities within the Study Area. These facilities are an integral part of the communities in which they serve, as resident participation contributes to community cohesion.

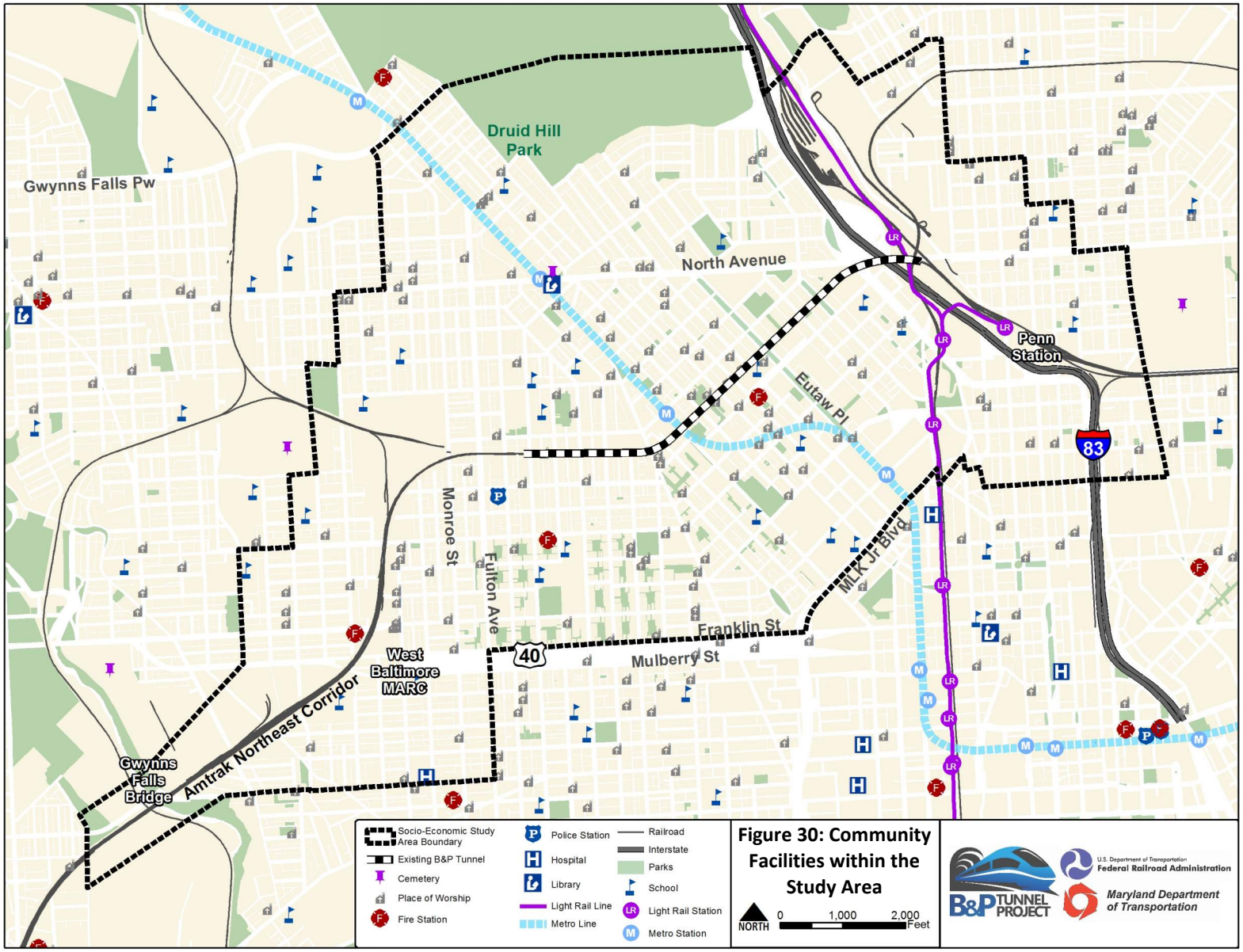


Figure 30: Community Facilities within the Study Area

i. *Educational Facilities*

There are 25 educational institutions within the Study Area. There are four elementary/middle schools, two middle schools, and three high schools. Carver Vocational Technical High School is the only vocational school within the Study Area. The University of Baltimore is the only higher education institution in the Study Area. **Table 19**.

Table 19: Schools within the Study Area

Name	Location
Eutaw-Mashburn Elementary School	1624 Eutaw Place
Westside Elementary School	2235 N Fulton Avenue
Matthew A. Henson Elementary School	1600 N Payson Street
Harlem Park Elementary/Middle School	1401 W Lafayette Street
Dallas F. Nicholas Sr. Elementary School	201 E 21st Street
John Eager Howard Elementary School	2011 Linden Avenue
Mount Royal Elementary Middle School	121 McMechen Street
Gilmor Elementary School	1311 N Gilmor Street
Samuel Coleridge-Taylor Elementary School	507 W Preston Street
Furman L. Templeton Elementary School	1200 N Pennsylvania Avenue
Booker T. Washington Middle School	1301 McCulloh Street
James Mosher Elementary School	2400 W Mosher Street
Mary Ann Winterling Elementary School	220 N Bentalou Street
Lockerman Bundy Elementary School	301 N Pulaski Street
Empowerment Academy Elementary/Middle School	851 Braddish Avenue
Midtown Academy	1398 Mount Royal Avenue
New Song Academy Elementary/Middle School	1530 Presstman Street
Baltimore Montessori Public Charter School	1600 Guilford Avenue
New Hope Academy middle/high school	900 Druid Hill Avenue
Augusta Fells Savage Institute of Visual Arts	1500 Harlem Avenue
Baltimore Talent Development High School	1500 Harlem Avenue
Baltimore Renaissance Academy HS	1301 McCulloh Street
Carver Vocational Technical High School	2201 Presstman Street
Monarch Academy Public Charter School	1200 North Freemont Avenue
University of Baltimore	1420 N. Charles Street

Source: Baltimore City, 2010

ii. *Places of Worship*

Thirty-seven places of worship are located within the Study Area and are listed in **Table 20**.

Table 20: Places of Worship within the Study Area

Name	Location
Perkins Square Baptist Church	2500 Edmondson Avenue
Faith Christian Worship Center	700 N Pulaski Street
Wayside Baptist Church	1318 Riggs Avenue
New Bethlehem Baptist Church	1370 N Carey Street
Transformation Baptist Church	815 N Mount Street
St Peter Claver Roman Catholic Church	1524 N Fremont Avenue
St Katherine's Episcopal Church	2001 Division Street

Name	Location
The Old Time Way Church of Deliverance	2100 W Lanvale Street
Trinity Baptist Church	1601 Druid Hill Avenue
Sanctuary Church	800 N Fulton Avenue
McKinney Memorial Holy Church	1334 N Calhoun Street
Holy Temple Pentecostal Church	574 Presstman Street
Refuge Church of Deliverance	2101 Edmondson Avenue
Berea Seventh Day Adventist Church	1901 Madison Avenue
World Deliverance Church	1700 McCulloh Street
Central Congregation of Jehovah's Witnesses	1107 N Fremont Avenue
Church of Christ	664 Pitcher Street
New Porters Tabernacle Church	2105 Edmondson Avenue
Bethel United Apostolic Church	631 Whitelock Street
All New Satellite Baptist Church	101 N Warwick Avenue
New Metropolitan Baptist Church	1501 McCulloh Street
Freedom Church & Ministries	813 N Pulaski Street
St Luke's United Methodist Church	1100 N Gilmor Street
All Saints Baptist Church	1300 N Mount Street
Payne African Methodist Episcopal Church	1714 Madison Avenue
St Matthew Lutheran Church	1909 Druid Hill Avenue
Triumph Church of God	1501 Myrtle Avenue
Open Door Baptist Church	1700 Madison Avenue
New Life Fellowship Church of Christ	559 Robert Street
First Emmanuel Baptist Church	2203 Park Avenue
Beth Am Congregation	2501 Eutaw Place
Strawbridge United Methodist Church	1624 Eutaw Place
Masjid ul-Haqq	514 Islamic Way
New Mount Joy Missionary Baptist Church	1725 Division Street
Life Celebration Center Church	2100 Edmondson Avenue
Christ Apostolic Church	2206 Park Avenue
Tabernacle of God Church Outreach	1520 Winchester Street

Source: United States Geological Survey Geographic Names Information System, 2012/RKK

iii. *Law Enforcement Facilities*

The Study Area is served by the North, Central, East, West, and Southwest police districts of Baltimore City. There is one police station located at 1034 North Mount Street, in the West District.

iv. *Fire and Rescue Facilities*

The Baltimore City Fire Department provides fire protection and emergency medical services to Baltimore City. The Study Area is served by the second and third Battalions of the Baltimore City Fire Department, which contain three fire stations (see **Table 21**).

Table 21: Fire and Rescue Facilities within the Study Area

Name	Location
Second Battalion Smokestack Hardy Fire Station Engine Company 13, Truck Company 16, Medic 4	405 McMechen Street
Third Battalion Charles R. Thomas Fire Station	2249 Edmondson Avenue

Engine Company 36	
Third Battalion Engine Company 8, Truck Company 10, Medic 15	1503 W Lafayette Avenue

Source: Baltimore City (2010)

v. *Parks and Recreational Facilities*

There are 104 parks in the Study Area, including city parks, neighborhood parks, and community pocket parks. Park services are provided by the Baltimore City Department of Recreation and Parks. Druid Hill Park, in the northeast Study Area, is the largest park that intersects the Study Area, encompassing approximately 615 acres. Small neighborhood and community pocket parks are prevalent throughout the Study Area.

Two parcels not occupied by buildings are located at the intersection of Whitelock Street and Brookfield Avenue in the areas of consideration for ventilation plants. These parcels are owned by the City of Baltimore Mayor and City Council and managed by the Reservoir Hill Association through the Adopt-A-Lot Program. Per the Baltimore City Department of Housing and Community Development, and confirmed through discussions with neighborhood residents at various B&P Tunnel Project Community Meetings, a community garden (Whitelock Farm) is maintained and utilized by residents at these parcels, with additional potential uses for the parcels proposed by the community. The community garden and existing use of these parcels as community gathering spaces are considered integral to the neighborhood character of Reservoir Hill by its residents.

Baltimore City Department of Recreation and Parks manages 41 recreation centers throughout Baltimore City, six of which are located within the Study Area (see **Table 22**). These centers offer programs for children and adults, including cooking classes, arts and crafts, as well as gym activities.

Table 22: Public Recreation Centers within the Study Area

Name	Location
Bentalou Recreation Center	222 N Bentalou Street
John Eager Howard Recreation Center	2100 Brookfield Avenue
Lillian S. Jones Recreation Center	1310 N Stricker Street
Mount Royal Recreation Center	120 W Mosher Street
Parkview Recreation Center	2610 Francis Street
Robert C. Marshall Recreation Center	1201 Pennsylvania Avenue

Source: Baltimore City Department of Recreation and Parks

There are three public swimming facilities in the Study Area: one park pool, located in Druid Hill Park; and one neighborhood pool and one wading pool, both located in the Sandtown-Winchester neighborhood (see **Table 23**).

Table 23: Public Pools within the Study Area

Swimming Facility	Name	Location
Park Pool	Druid Hill Park	800 Wyman Park Drive
Walk-to Pool	William McAbee	1323 N Gilmore Street
Wading Pool	Lillian S. Jones Recreation Center	1310 N Stricker Street

Source: Baltimore City Department of Recreation and Parks

vi. *Cemeteries*

The Etting Family Cemetery at 1510 West North Avenue is the only cemetery located in the Study Area. It is the oldest Jewish cemetery in Baltimore.

7. Visual and Aesthetic Resources

In order to identify and analyze changes to visual and aesthetic quality within the Study Area, during and/or after construction, the FRA Procedures for Considering Environmental Impacts (FRA, 1999) and guidance from the Federal Highway Administration (FHWA) Visual Impact Assessment for Highway Projects (FHWA, 1981) were used.

Because no specific decisions regarding construction materials, design, or location have been made, the discussion focuses on typical alternative components that will be seen with the B&P Tunnel Project, as well as their proposed locations. These components include portals, ventilation plants, and trackway.

a. Methodology

The FRA Procedures for Considering Environmental Impacts provide general guidance to identify any significant changes likely to occur in the natural landscape and in the developed environment. The Procedures suggest the EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development. The FHWA methodology provides the following seven main components to the evaluation of visual and aesthetic quality.

1. **Define Project Viewshed/Physical Limits of Visual Environment:** The "project viewshed" is the surface area visible from the project site and within the Study Area.

2. **Determine Viewer Groups:** Viewer groups were divided into those with a view of the project who would be affected by its visual elements. These include residents, workers, pedestrians, cyclists, educational institutions, recreational groups and other commercial sites within the Study Area. Viewer groups also include those with a view from the project, such as transit riders.

3. **Identify Key Viewpoints and Views and Assess Visual Quality:** The project is located within a diverse urban corridor where no natural landscape features are located. Assessment of "visual quality" is based on "vividness", "intactness" and "unity". The existing visual character of the project area is a mix of commercial, residential, industrial and transportation uses, and includes historic architecture elements within these land uses.

4. **Analyze changes in Existing Visual Resources and Viewer Response:** The alternatives would convert commercial, residential, industrial, and transportation land uses to entirely transportation land use. Residents of the Study Area would be the most affected viewer group by the project. As the majority of the proposed alternatives are underground, viewer responses are expected to focus on portal, ventilation plant, and above-ground trackway locations.

5. **Depict Visual Appearance with the Project:** The visual appearance of the B&P Tunnel Project would consist of project components that would be visible to viewer groups. The project components include tunnel portals, ventilation plants, and trackway. The most visible components of the project would be the tunnel portals and ventilation plants. The transitway would be largely underground.

6. **Assess the Project's Visual Impacts:** The project would have some visual impacts at ventilation plant and portal locations. The ventilation plant would be a new structure with a footprint of up to 100 feet by 200 feet and a height up to 55 feet within the visual landscape of the project area. Portal locations may not have significant impacts as they would be located within existing transportation and industrial land use. There would also be visual impacts during construction, which would be temporary.

7. **Propose Methods to Mitigate Adverse Visual Impacts:** Adverse visual impacts will be mitigated through urban and landscape design to improve the visual and aesthetic quality and character of the Study Area.

Based on the criteria described above, general visual effects were assigned a rating of low, medium, or high as dependent on these factors: the nature of a project component, contextual compatibility between the visual component and its surroundings, changes to the visual landscape as a result of the visual component, and viewer sensitivity. The following is a more detailed discussion of how the general visual effects ratings were assigned follows.

i. *Nature of Project Components Common to All Alternatives*

The nature of the project component refers to the project design, size and type of project element. In the analysis, the level of general visual effect (high, medium, or low) reflects the visibility of a component absent from context, location, or exposure to a specific viewing group. Therefore, the level is a reflection of the components' general size and type. The components of the Project are listed below.

- Tunnel Portal
- Ventilation Plants
- Trackway
    - At-Grade
    - Underground

ii. *Contextual Compatibility*

Contextual compatibility explains how harmoniously a project component fits into the existing visual environment of the project area. The visual effects of components can be either low, medium or high.

Low Visual Effect: A component would have a low visual effect if a new element is introduced into the project area that is the same or similar to the existing elements.

Medium Visual Effect: A component would have a medium visual effect if a new element is introduced that is different from the existing elements but is similar in scale, material and aesthetic value.

High Visual Effect: A high visual effect is incurred if a new element is introduced to the project area that is not similar to existing elements in scale, material or aesthetic value.

iii. *Changes to Visual Landscape*

Changes in visual landscape requires the assessment of whether the project brings change to or interruption of identified views or visual resources within the project viewshed.

Low Visual Effect: A low visual effect occurs if the project does not obstruct the existing viewshed from residential, commercial or institutional properties, nor is it adjacent to primary pedestrian routes or a public space or platform.

Medium Visual Effect: The project would have a medium visual effect if it moderately obstructs the viewshed from some residential, commercial or institutional properties but is either not on a primary roadway or pedestrian route or is located in an area of already compromised visual effect; not adjacent to public space.

High Visual Effect: High visual effect occurs if the project is adjacent to residential, commercial or institutional properties; it is highly visible from the primary roadway, retail locations, public space or residences; highly visible from primary pedestrian route or obstructs the existing viewshed.

iv. *Viewer Sensitivity*

Viewer sensitivity refers to the level of expected response to the introduction of project components based on the frequency and duration of the exposure of the viewer to the project components. Expected response and visual sensitivity varies based on the type of viewer group. People who are least exposed to or spend the least time in the project area would have the lowest visual sensitivity to changes in the project area, while the viewer group that spends the most time within the project area would be the most sensitive to visual changes. These groups and viewer sensitivity are described in **Table 24** below.

Table 24: Visual Sensitivity

Viewer Group	Description	General Visual Sensitivity
Transitory	People who only travel through the project area to another location. May include drivers, cyclists, transit riders or pedestrians.	Low
Limited Exposure	People who may stay within the project area for an extended period but do not have a long-term interest in property in or adjoining the project study corridor; includes workers, shoppers, tourists or other visitors	Medium
Permanent	People who hold a long-term interest in property in or adjoin the project study corridor; generally includes residents, business owners, and other property owners or renters.	High

b. Existing Conditions

The Study Area includes four viewsheds along the general project corridor. These viewsheds are 1) the location proposed for the north portal and north ventilation plant in the east Jones Falls area; 2) the location proposed for the intermediate ventilation plant in the Reservoir Hill neighborhood; 3) the location proposed for the south portal and south portal ventilation plant in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods; and 4) the transportation right-of-way surrounding the trackway located railroad south of the proposed south portal location. The existing B&P Tunnel is present in several portions of the existing viewsheds.

The viewshed at the location proposed for the north portal and north ventilation plant is in the east Jones Falls area and is shown in **Image 3, Image 5,** or **Image 7**. The landscape is characterized by transportation uses, including trackway, a warehouse facility, and a storage yard, as it is the site of the MTA Light Rail Maintenance Facility and North Avenue Light Rail Station; the Jones Falls Expressway (I-83) and North Avenue also cross the site. The landscape features trackway from the existing B&P Tunnel, a warehouse facility, a storage yard, parking lots, and roadway overpasses. The primary viewer group is transitory, and includes people who only travel through the project area to another location.

The viewshed at the location proposed for the intermediate ventilation plant is in the Reservoir Hill neighborhood, at the intersection of Brookfield Avenue and Whitelock Street; this is shown on **Image 9**. The parcel is not occupied by buildings, and operates as a community garden and gathering space for the surrounding neighborhood. The landscape is characterized by historic residential rowhouses, garden space, and a playground. The primary viewer group is permanent, including residents and nearby business employees.

The viewshed at the location proposed for the south portal and south portal ventilation plant is in the Bridgeview/Greenlawn, Midtown-Edmondson, and Rosemont neighborhoods, and is shown in **Image 4**, **Image 6**, and **Image 8**. These areas are established urban neighborhoods surrounding main roadway thoroughfares such as West Lafayette Avenue, Edmondson Avenue, and West Franklin Street/West Mulberry Street. The landscape is characterized by a mix of historic residential rowhouses, commercial storefronts, institutional

buildings, industrial buildings, and transportation uses such as roadways, bridges, and the existing B&P Tunnel trackway. The primary viewer group is permanent, including residents and nearby business employees.

The viewshed for the transportation right-of-way surrounding the trackway located railroad south of the proposed south portal location includes the transportation uses such as roadways, bridges, and the existing B&P Tunnel trackway. The primary viewer group is transitory, and includes people who only travel through the project area to another location.

8. Minority Race and Ethnicity and Low-Income Populations

The terms "minority" and "low-income" are defined in the USDOT Order on Environmental Justice. The following definitions have been used in this analysis:

- Minority Individual: A minority individual belongs to one of the following groups: American Indian or Alaskan Native, Asian American, Native Hawaiian or Other Pacific Islander, Black (not of Hispanic origin), and Hispanic or Latino.
- Minority Populations: Any readily identifiable groups of minority people who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient people (such as migrant workers or Native Americans) who would be similarly affected by a proposed USDOT program, policy, or activity.
- Low-Income Individual: The Order definition is a person whose median household income is at or below the U.S. Health and Human Services (HHS) poverty guidelines. In 2014, the official poverty threshold for a family/household of four was an annual median household income of $23,850 (USDHHS, Accessed 2014). Because of slight differences in the length of time encompassed by datasets, the U.S. Census Bureau's 2014 poverty threshold for a household of four (no children) was $24,418.
- Low-Income Population: Any readily identifiable group of low-income people who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient people (such as migrant workers or Native Americans) who would be similarly affected by a proposed DOT program, policy, or activity.

The following data were used to identify minority and low-income populations:

- Minority Populations: ACS 2009-2013 5-year estimate (US Census Bureau, 2013a), at the Census Block Group level, provided the basis for identifying minority populations in the Study Area.
- Low-Income Populations: Poverty data was obtained from the ACS 2009-2013 five-year estimate at the Census Block Group level. The dataset is the most current dataset based on U.S. Census Bureau thresholds of poverty. It is typically used for statistical analyses and its thresholds are not substantially different from HHS guidelines; therefore, poverty level is used to indicate low-income populations.
- Data sources to confirm the location of minority and low-income populations include the National Center for Educational Statistics (NCES), government-assisted housing programs, historical references, city officials, field visits, community meetings, and a review of revitalization efforts in the Study Area.

Census block groups have populations between 600 and 3,000 people. They vary in size depending on an area's population density. They are the smallest geographical unit for which reliable data is available; they can generally be thought of as representing neighborhoods.

The Study Area includes all or parts of 77 Census Block Groups in Baltimore City. In 2013, the total population of the Study Area by Census Tract was 65,762 people (US Census Bureau, 2013a). For those people with status determined in the ACS 2009-2013 dataset, 57,362 (87.2 percent) identified as minorities, which was higher than Baltimore City's average of 72.0 percent. **Table 25** details minority race and ethnicity data for the Study Area. **Figure 31** shows the analyzed Census Block Groups.

Of the 26,358 households for which income was calculated in the Study Area, 8,812 households (33.4 percent) had income at or below the federal poverty level, which indicates low-income for the purposes of this study. The ACS data showed Study Area Census Block Groups contained a percentage of low-income households that was substantially higher (33.4 percent) than Baltimore City's average of 22.0 percent.

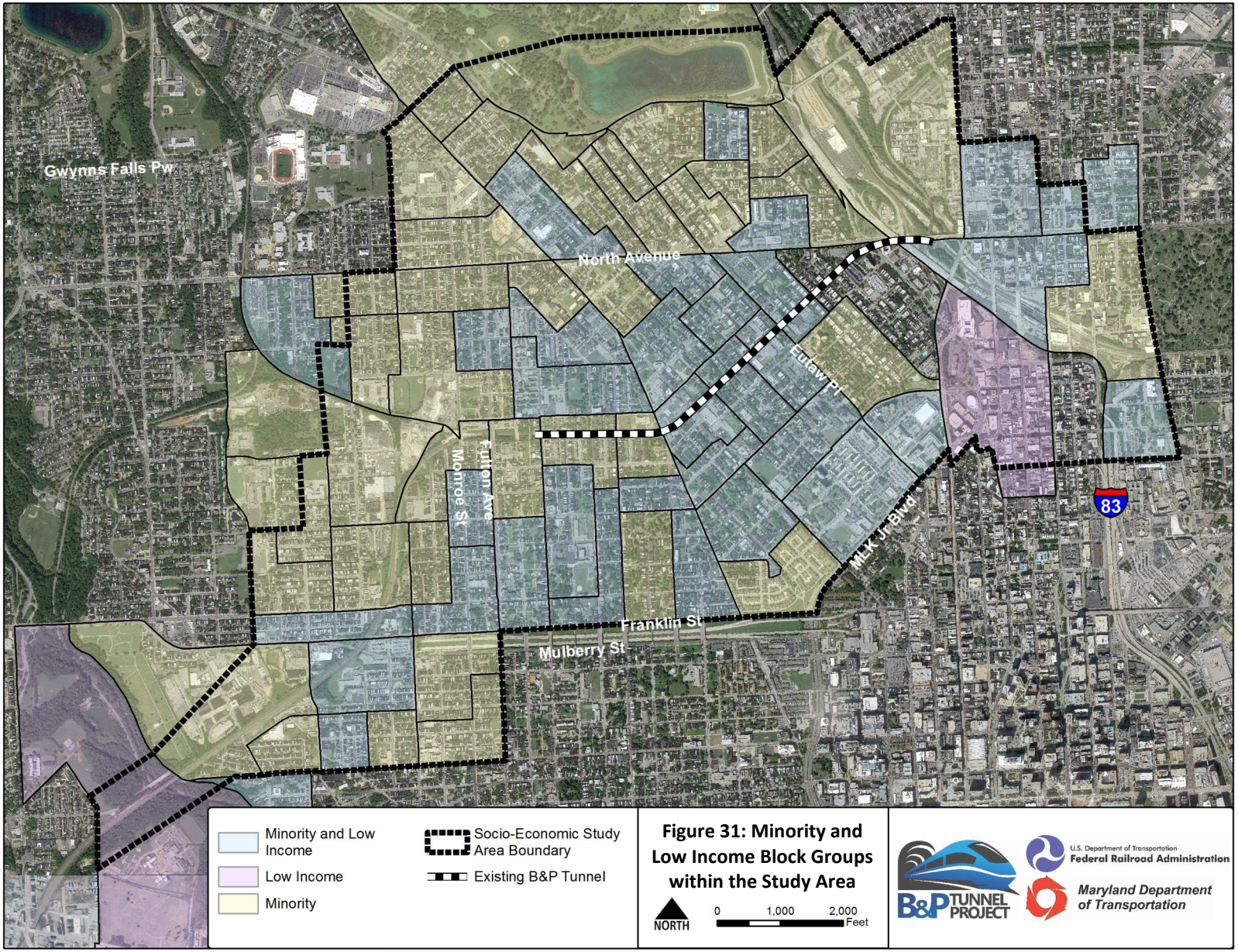
Table 25: Population and Minority Statistics in Maryland, Baltimore City, and the Study Area by Block Group

Category	Maryland	Baltimore City	Study Area
Total Population	5,834,299	621,445	65,762
White Alone	3,406,243 (58.4%)	174,590 (28.0%)	8,400 (12.8%)
Black Alone	1,717,582 (29.4%)	389,758 (63.0%)	53,407 (81.2)%
Asian Alone	332,620 (5.7%)	14,822 (2.0%)	1,515 (2.3%)
American Indian and Alaska Native Alone	17,535 0.30%	1,563 (0.0%)	82 (0.1%)
Native Hawaiian and Other Pacific Islander Alone	2,570 0.04%	178 (0.0%)	34 (0.1%)
Other Race Alone	215,749 (3.7%)	1,362 (0.0%)	163 (0.2%)
Two or more races	162,105 (2.8%)	12,400 (2.0%)	1,317 (2.0%)
Total Hispanic or Latino	493,310 (8.5%)	26,772 (4.0%)	844 (1.3%)
Total Minority	2,921,366 (50.1%)	446,855 (72.0%)	57,362 (87.2%)

Source: U.S. Census Bureau (US Census Bureau, 2013a).
Hispanic or Latino people may identify as any race.
[1]Does not include Hispanic or Latino population.
[2]Two or more races does not include people who identify as Hispanic or Latino.
[3]All people who identify as non-White, non-Hispanic or Latino, and all people who identify as Hispanic or Latino, regardless of race.

Other information sources useful in identifying minority and low-income populations include public housing and assistance programs, area revitalization programs, and community outreach.

According to the Housing Authority of Baltimore City, there are six publicly owned housing developments in the Study Area that provide 2,467 individual units (**Table 26**) (HABC, Accessed 2014). The developments range from 75 to 970 units. Two are family developments, two contain mixed populations as well as family housing, and two are mixed-population housing. The housing developments are widely dispersed throughout the Study Area and are located within minority race and/or ethnicity and low-income populations, with the exception of the J. Van Story Branch Apartments. Residents of the housing developments must meet income limits of $33,200 for a family of four, along with other qualifying criteria, in order to be eligible for the Public Housing Program.


Gwynns Falls Pw
North Avenue
Eutaw Pl
Fulton Ave
Monroe St
MLK Jr Blvd
83
Franklin St
Mulberry St
Minority and Low Income
Low Income
Minority
Socio-Economic Study Area Boundary
Existing B&P Tunnel
NORTH
0
1,000
2,000
Feet
Figure 31: Minority and Low Income Block Groups within the Study Area
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Affordable housing information was obtained from the HUD Affordable Apartment search that identifies lower cost housing supported by grant programs. There are 22 affordable housing apartment developments, with a total of 3,111 units, in the Study Area. Developments range from 12 to 521 units; seven provide family housing, 12 serve the elderly, and two provide housing for people with disabilities. One of the apartment developments is not classified. Fourteen affordable housing apartment complexes are located within minority race and/or ethnicity and low-income populations, and six are located in areas with only minority race and/or ethnicity populations; the remaining two public housing complexes are located outside of minority race and/or ethnicity and low-income areas. In order to be eligible for these apartments, residents cannot earn more than the income limit specified by the apartment complex.

Table 26: Study Area Public Housing

Name	Address	Housing Units	Residence Type
Heritage Crossing (Hope VI)	600 Brune Street, Baltimore, MD 21201	75	Family
Gilmor Homes	640 Balmor Court, Baltimore, MD 21217	571	Family
Chase House	1020 Cathedral Street, Baltimore, MD 21201	189	Mixed Population
J. Van Story Branch Apartments	11 W. 20th Street, Baltimore, MD 21218	357	Mixed Population
Lakeview Towers/Lakeview Extension & Oswego Mall	717 Druid Park Lake Drive, Baltimore, MD 21217	305	Mixed Population and Family Housing
McCulloh Homes & Extension/Albert Spencer Gardens	501 Dolphin Street, Baltimore, MD 21217	970	Mixed Population and Family Housing

Source: Baltimore Housing (HABC, Accessed 2014).

In 2014, 28 out of the 29 Census Tracts in the Study Area were qualified Low-Income Housing Tax Credit (LIHTC) program tracts (HUDuser, 2014). Census Tract 1101, located in the Mount Vernon neighborhood, is the only Census Tract in the Study Area not a LIHTC tract. In order to qualify for the LIHTC, a proposed housing development must be in a Census Tract having either 1) a poverty rate of at least 25 percent or 2) 50 percent or more of its households have incomes below 60 percent of the metropolitan or non-metropolitan area median household income (SBA, Accessed 2015).

The median monthly housing cost for 25 out of 29 Census Tracts in the Study Area is below that of Baltimore City ($1,005) (US Census Bureau, 2013a). Census Tracts 1101 (Mount Vernon), 1204 (Barclay), 1207 (Remington), and 1303 (Penn North) all had median housing costs above Baltimore City.

According to ACS poverty data from 2013, 6,113 households with incomes below the poverty level in the Study Area received federal food stamps and/or Supplemental Nutrition Assistance Program benefits the prior year. Another 4,316 of similar households in poverty did not receive these benefits, suggesting more needs could be met (US Census Bureau, 2013a). During the 2011 to 2012 school year, the majority of Kindergarten through 12 students in the Study Area received free or reduced-cost school lunches, as did the majority of citywide grade-school students (76.2 percent) (DataMind, 2012).

The majority of the Study Area also has existing urban renewal plans. These plans focus on addressing urban blight and providing employment opportunities for residents, while improving community services and conditions supporting property values.

B. Public Health and Safety

Despite the existing B&P Tunnel being more than 140 years old and approaching the end of its useful life, the tunnel remains safe for rail transportation. In addition, Amtrak operates on the B&P Tunnel in accordance with proven safety approaches, performance based safety measures and adherence to best practices.

The existing B&P Tunnel predates such standards and therefore lacks the comprehensive life safety approach contained in NFPA 130. Any Build Alternative will be designed and constructed in accordance with the National Fire Protection Association's (NFPA) Standard for Fixed Guideway Transit and Passenger Rail Systems—NFPA 130. This standard was developed and is maintained by a committee of industry professionals, regulators, and subject matter experts. The committee's primary responsibility is to set the standard for fire safety requirements in underground, surface, and elevated fixed guideway transit and passenger rail systems, including stations and tunnels. The standard prescriptively outlines the requirements for emergency ventilation systems, emergency procedures, communication and control systems, and for life safety from fire through infrastructure design and fire protection system attributes.

C. Cultural Resources

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C. 306108) and the Advisory Council of Historic Preservation's (ACHP) implementing regulations (36 CFR Part 800), FRA and MDOT are taking into account the effects of the Project on historic properties. An historic property, as defined in the NHPA, is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register of Historic Places (NRHP). Eligibility criteria for listing a property in the NRHP are found at 36 CFR Part 60. The four Criteria of Eligibility are:

- Criterion A: Properties that are associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B: properties that are associated with the lives of people significant to our past; or
- Criterion C: properties that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master; or that possess high artistic values; or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D: properties that have yielded or may be likely to yield information important in prehistory or history.

Historic architectural and archaeological research material from the Maryland Historical Trust (MHT) Library and the Maryland Environmental Resources and Land Information Network (MERLIN) were used to ascertain previously identified historic properties and archaeological sites and gather cultural resources reports from the Study Area. Additional information on historic properties was identified through the Section 106 process, including seeking input from consulting parties, the pubic, and performing field investigations.

1. Area of Potential Effects

The Area of Potential Effects (APE) is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties (36 CFR Part 800.16(d)). Indirect alterations could be based on visual, atmospheric, and audible potentials of the undertaking. The APE was determined and documented (36 CFR Part 800.4(a)(1)) using information gathered from field visits and from studying maps. Since most construction activities along the tunnel route alternatives would be well beneath the

surface, with little to no potential for impacts to historic properties anticipated, these areas were not included within the APE. The historic architectural APE was delineated as 200 feet around the outer boundaries of the north and south portal area, and 100 feet around the ventilation plant's potential location.

2. Historic Architecture

FRA has identified historic architectural properties (i.e. above-ground) within the APE for Alternatives 3A, 3B, and 3C. In total, FRA identified 18 historic architectural properties within the APE that are either listed in or eligible for listing in the NRHP. These properties are listed in **Table 27** and depicted in **Figure 32** and include industrial and residential buildings, bridges, and districts. For more information on the eligibility of each resource, see the *Architectural Historic Properties Survey Technical Report*.

Table 27: Architectural Historic Properties within the APE

Historic Property	MIHP Identification Number
Baltimore and Ohio Belt Line Railroad	B-5287
Baltimore and Ohio Belt Line Bridge over Jones Falls Valley	B-5288
Baltimore & Potomac Railroad (Philadelphia, Baltimore & Washington Railroad)	B-5164
Howard Street Bridge	BC 1405; B-4529
North Avenue Bridge	BC 1208; B-4521
Reservoir Hill Historic District	B-1379
David Bachrach House (Gertrude Stein House)	B-4098
Carver Vocational-Technical High School	B-5294
Western Maryland Railroad, Owings Mills Division	B-5293
Midtown Edmondson Historic District	(none)
Bridge BC 2410 (Lafayette Avenue over Amtrak)	B-4553
Atlas Safe Deposit and Storage Company Warehouse Complex	B-5188-2
American Ice Company	B-1040
Greater Rosemont Historic District	B-5112
Edmondson Avenue Historic District	B-5187
Ward Baking Company	B-5112-2
Fire Department Engine House No. 36	B-5112-4
Pennsylvania Railroad Viaduct	B-5064

3. Archaeology

The archaeological assessment of the Study Area consisted of the background research on the history of the area, and on previously identified archaeological sites within a one-mile radius. The results of the survey were then combined with the archaeological predictive models and the review of historical maps and aerial imagery to divide the study corridor into areas of high, low, and no potential to contain archaeological deposits.

Documentary research conducted at MHT revealed that no previous archaeological studies have been performed within the study corridors of any of the alignment alternatives for the B&P Tunnel Project. However, according to the most recent MHT GIS database, 22 archaeological studies have been conducted within one mile of the design alternatives in the last 33 years. According to the archaeological site files maintained by MHT, no previously recorded archaeological sites are located in the APE; however, 38 sites are present within a one-mile radius. Site 18BC177 (known as "AOS #1") is the only archaeological site within one mile radius that contained a prehistoric component.

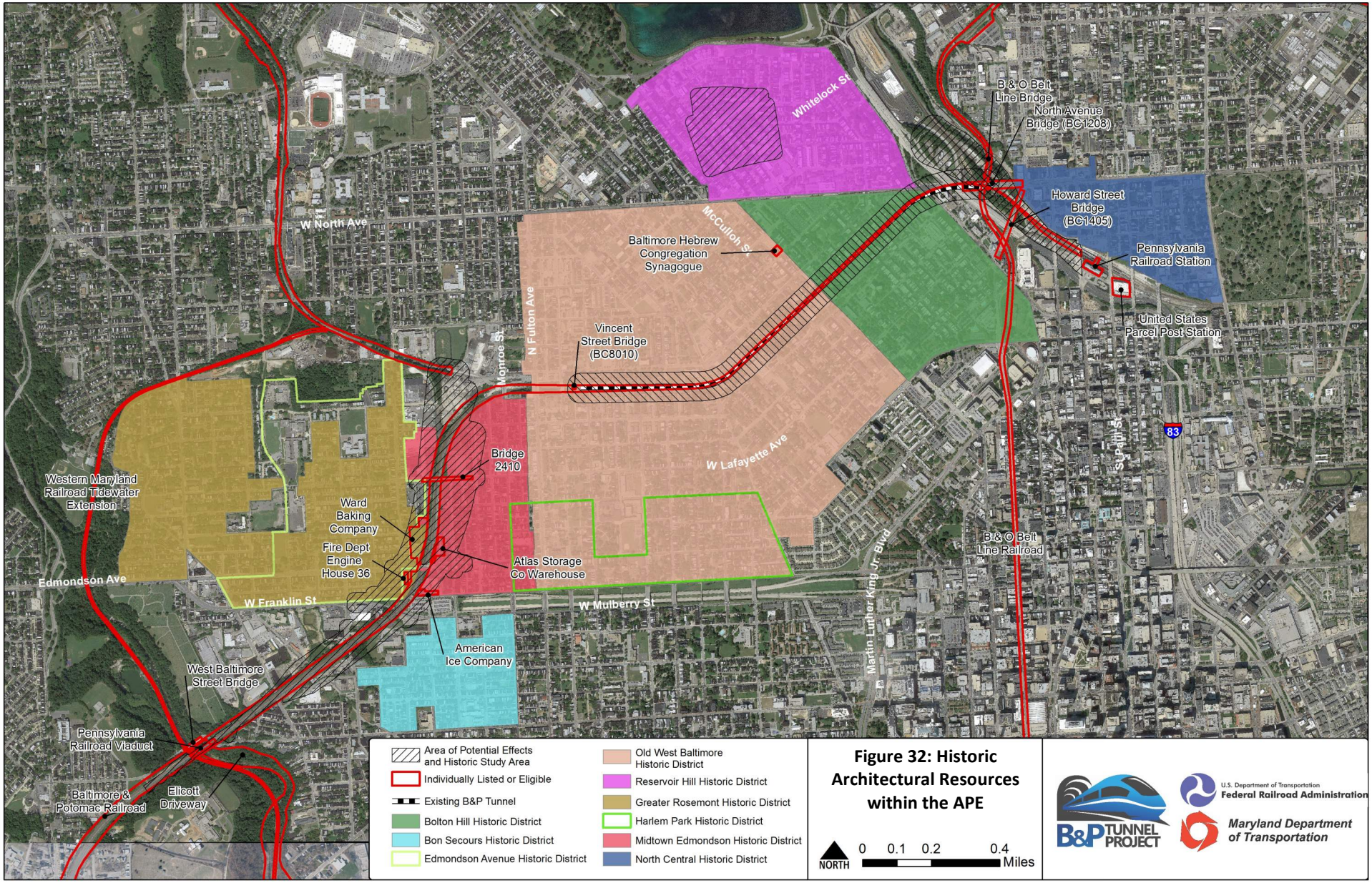


Figure 32: Historic Architectural Resources within the APE

B&P TUNNEL PROJECT

U.S. Department of Transportation Federal Railroad Administration

Maryland Department of Transportation

The remaining 37 previously documented archaeological sites within a one-mile radius of the design alternatives for the B&P Tunnel were historic and document occupation from the eighteenth through early twentieth centuries. Previously documented historic archaeological sites include eighteenth- to nineteenth-century pottery kilns, late eighteenth- to early nineteenth-century rowhouses, nineteenth- to early twentieth-century rowhouses, mills and mill worker housing, an African American church, portions of a nineteenth-century African American neighborhood, a jail, sugar refinery, and a Civil War Union Army camp and hospital.

Results of the Phase IA Archaeological Study suggest that, from a regional perspective, the Study Area falls within a portion of Maryland that has considerable potential for containing prehistoric archaeological sites. Although the general region is considered to have a high probability for containing archaeological resources, ascertaining the overall archaeological sensitivity of the study corridors associated with the B&P Tunnel Build Alternatives is complicated by the fact that while Pre-contact populations may have once occupied the general region, the extent of modern urbanization must be taken into consideration when assessing the likelihood of discovering such archaeological remains in urban settings. The results of the Phase IA cultural resource investigation clearly revealed that while the locations of the design alternatives have the potential to contain archaeological resources, landscapes within the study corridors have been subjected to considerable repeated alteration since the late eighteenth century. These alterations have included urban expansion north of the city center in the early nineteenth century, transportation improvements, and modern urbanization and suburbanization. During documentary review and field inspections, it became clear that remains of the region's pre-contact natural landscapes are limited within the study corridors. Given the severity and extent of past disturbance, most of the land within the study corridors is considered to have a low probability for containing any intact prehistoric archaeological resources.

While the subsurface integrity of most sites in the Project Area APE is probably poor, an occasional intact archaeological site could be encountered. It is anticipated the Study Areas would have a higher potential for containing post-contact sites than pre-contact sites. Suppositions are based on previous discoveries of intact archaeological sites in and around the Study Area, as well as the land use history of this portion of Baltimore City.

Due to the preliminary stage of the B&P Tunnel Project, the scale of the project APE, as well as the uncertainty of project variables pertaining to anticipated ground disturbance (e.g., cut-and-cover locations, cut locations, ventilation shafts), detailed archaeological impact studies are suspended until the selection of a Preferred Alternative.

4. Section 106 Consultation

Section 106 requires consultation with the Maryland State Historic Preservation Office (SHPO), federally recognized Native American tribes with an interest in the area, local governments, and other consulting and interested parties. The purpose of consultation has been to discuss the following:

- Methodology in developing the APE;
- Identification of historic properties listed or determined eligible for listing in the National Register of Historic Places (NRHP);
- Assessment of effects; and
- Avoidance, minimization, or mitigation efforts that may be needed to offset any adverse effects on cultural resources.

FRA initiated the Section 106 review with the SHPO and other agencies by letter on June 11, 2014. FRA also sent official invitations to consult in the Section 106 process under the provisions of 36 CFR Part 800.2 to other consulting parties on April 22, 2015. The following parties agreed to consult:

- Baltimore City Commission for Historical and Architectural Preservation
- Baltimore City Department of Planning
- Baltimore Heritage
- Baltimore Heritage Area Association, Inc.
- Delaware Tribe of Indians
- Historic Mount Royal Terrace Association
- Maryland Commission on Indian Affairs
- Midtown Edmondson Improvement Association
- Mt. Royal Improvement Association
- Preservation Maryland
- Shawnee Tribe

To date, there have been four meetings with consulting parties. The first Consulting Parties meeting was held on July 16, 2015, and provided an overview of the project, the alternatives under consideration, historic properties identified, and potential impacts. A second Consulting Parties meeting, held on August 5, 2015, provided updated alternative and historic property information and continued discussions from the first meeting. A third Consulting Parties meeting was held on September 28, 2015. This meeting included a tour of the project area, alternative updates, recent additional National Register of Historic Places evaluations, and a discussion of potential effects to historic properties. The fourth Consulting Parties meeting was held on October 29, 2015, and included a discussion of project updates, the assessment of effects to historic properties, and discussion regarding future mitigation. Consultation will continue with the consulting parties during the development of the Final EIS. Correspondence between FRA, MDOT, SHPO, and the consulting parties can be found in **Appendix B.**

D. Section 4(f) Properties

Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303(c)) is a federal law that protects publicly owned parks, recreation areas, wildlife and/or waterfowl refuges, or any significant historic sites, whether privately or publicly owned. Section 4(f) requirements apply to all transportation projects that require funding or other approvals by the USDOT. As a USDOT agency, FRA must comply with Section 4(f).

The Section 4(f) evaluation in this document follows established USDOT regulations and references 23 CFR Part 774 and the 2012 Section 4(f) Policy Paper prepared by the FHWA as guidance.

Fifteen historic properties and public parks eligible for Section 4(f) protection would be potentially impacted by one or more of the B&P Tunnel Project's Build Alternatives. Each of the properties identified is described below. Additional information on historic properties is located in the *Architectural Historic Properties Survey Technical Report.* Concurrence from the State Historic Preservation Officer (SHPO) regarding the eligibility of the historic properties is located in **Appendix B**. For more information on Section 4(f) Properties, including maps of the historic properties, see **Section V.C**, **Section VI.C,** and **Section VI.D**.

1. Public Parks and Recreation Areas

Winterling Elementary School Recreational Facilities (Bentalou Recreation Center)

The recreational facilities at Winterling Elementary, also known as the Bentalou Recreation Center, is a significant public park in the Project Area for providing recreational opportunity to students of Winterling Elementary School and other members of the surrounding community. The school property is located at 220 North Bentalou Street. Recreational facilities include basketball courts, playground, an indoor gym, and game rooms. The facility is owned by the City of Baltimore and administered by the Baltimore City Department of Recreation and Parks and Baltimore City Public Schools.

Lafayette and Payson Park

Lafayette and Payson Park, located at the corner of Lafayette Avenue and North Payson Street, is an approximately 0.25 acre park owned by the City of Baltimore and administered by the Department of Recreation and Parks. The park includes a basketball court and playground facilities.

2. Historic Properties

Baltimore and Ohio (B&O) Belt Line Railroad (MIHP #B-5287)

This 7.2-mile, double tracked freight line was constructed between 1891 and 1895 to connect the B&O's main line terminus at Camden Station in downtown Baltimore to Bay View Junction. This property is eligible for the National Register under Criterion A for its association with the transportation industry. Specifically, it is nationally significant as the first electric railway in the United States and for its role in providing the B&O Railroad with an all-rail route from Washington, D.C. to Philadelphia, thereby allowing it to more effectively compete with the Pennsylvania Railroad. It is also eligible under Criterion C because it embodies distinctive characteristics of a late nineteenth- to early twentieth-century railroad, including resources that are individually notable for their architecture and/or engineering, and for its association with noted architect E. Francis Baldwin.

Baltimore and Ohio Belt Line Bridge over Jones Falls Valley (MIHP #B-5288)

The B&O Belt Line Bridge over Jones Falls Valley is a six-span, through-plate and deck-plate girder bridge constructed between 1896 and 1899 to carry the B&O Belt Line Railroad over the Jones Falls Valley (**Image 10**). It is located immediately north of the North Avenue bridge over the Jones Falls Valley. The bridge is eligible for the National Register under Criterion A for its association with the transportation industry. It is eligible under Criterion C because it embodies distinctive characteristics of a late nineteenth-century, steel-plate girder railroad bridge.

Image 10: Baltimore and Ohio Belt Line Bridge over Jones Falls Valley

Baltimore and Potomac (B&P) Railroad (MIHP #B-5164)

The B&P Railroad, completed in 1873, extends from the Baltimore City/County Line to Baltimore Penn Station. It includes the three-part brick and stone B&P Tunnel, bridges, a circa 1910 brick railroad station on Edmondson Avenue, a brick tower at Gwynn Junction, and circa 1935 overhead catenary lines. The bridges over the alignment include the NRHP-eligible Vincent Street Bridge and Fulton Avenue over Amtrak Bridge, both built in 1873 along with the B&P Railroad and tunnel segments. The railroad is eligible for the National Register under Criterion A as a critical component of the Baltimore and Potomac Railroad alignment that established a reliable connection between Baltimore and Washington, D.C., and ultimately to Philadelphia and New York, for the Pennsylvania Railroad.

Midtown Edmondson Historic District

The Midtown Edmondson Historic District is roughly bounded by Kirby Lane on the east, West Franklin Street on the south, and Winchester Street to the north. The district is characterized as a mixed-use area of row houses, warehouses, and commercial buildings primarily constructed between the 1880s and 1910s (**Image 11**). The district is eligible for the National Register under Criterion A for its association with the growth of West Baltimore and for its association with the post-World War II racial transition of West Baltimore from European American to predominantly African American by the 1950s. It is also eligible under Criterion C for being an example of a late nineteenth-century and early twentieth-century suburb with a diverse range of rowhouse designs.

Image 11: Midtown Edmondson Historic District

Bridge 2410 / Lafayette Avenue over Amtrak (MIHP #B-4553)

Bridge 2410 / Lafayette Avenue over Amtrak is a fourteen-span plate-girder bridge with a rolled I-beam deck structure built in 1931. It is approximately 640 feet long and carries Lafayette Avenue over Amtrak's Northeast Corridor. This bridge is eligible for the National Register under Criterion C for being a significant variation of a common bridge construction type. There is often little variation in many of these bridges, and this bridge shows a unique juxtaposition of old and new elements.

Greater Rosemont Historic District (MIHP #B-5112)

The Greater Rosemont Historic District is a primarily residential area bounded by West Franklin Street, Edmondson Avenue, and Western Maryland and Pennsylvania Railroad tracks. The district dates to the late nineteenth- and early twentieth-centuries, and includes numerous commercial and industrial buildings, churches, and government buildings. Architectural styles include Colonial Revival, Spanish Revival, Craftsman, and Art Deco. The District is eligible under Criterion A for being one of a few city neighborhoods that illustrates the rapid speculative development of streetcar suburbs and the evolution of Baltimore row housing from the late Victorian period until the 1950s. It is also eligible under Criterion C for having virtually every type of attached dwelling popular during the late Victorian period to the 1950s, and for its overall level of distinctiveness and good architectural integrity.

Edmondson Avenue Historic District (MIHP #B-5187)

The Edmondson Avenue Historic District contains over 1,600 buildings, most of which are late nineteenth- to mid-twentieth-century residences with some commercial and light industrial buildings (**Image 12**). It is roughly bounded by West Franklin Street to the south, Bentalou Street on the west, Braddish Avenue on the east, and Winchester Street to the north. The District is listed under Criterion A for its association with the growth of West Baltimore, the post-World War II racial transition of West Baltimore and the role of the new African American residents in establishing enduring community institutions. It is also listed under Criterion C for being architecturally significant as an example of an early twentieth-century streetcar suburb with a diverse range of rowhouse designs.

Image 12: Edmondson Avenue Historic District

Fire Department Engine Company No. 36 (MIHP #B-5112-4)

The Fire Department Engine Company No. 36 historic property consists of a 1910 two-story brick and stone Tudor Revival fire house located at 2249 Edmondson Avenue (**Image 13**). The property is eligible for listing on the National Register under Criterion A in the areas of social history and black heritage for its associations with the expansion and professionalization of Baltimore's fire protection services during the early twentieth century, and for its role in the racial integration of the Baltimore City Fire Department in 1953. It is also eligible under Criterion C in the area of architecture as a well-preserved example of the rare and early use of the Tudor Revival style in twentieth century Baltimore fire houses, and for embodying the distinctive characteristics of the Tudor Revival style.

Image 13: Fire Department Engine Co. No. 36

American Ice Company (MIHP #B-1040)

The American Ice Company property is located between Edmondson Avenue and West Franklin Street adjacent to Amtrak's Northeast Corridor. It is a two-story brick building built in 1911, with a boiler room and engine room on the west side of the building, and a long, narrow extension attached to the powerhouse at the east end (**Image 14**). Additions from the 1950s and 1970s were destroyed by a 2004 fire.

Image 14: American Ice Company

The property is listed on the National Register under Criterion A for its role in the history of the ice industry in Baltimore. The plant successfully served the growing community of residents in Baltimore, and used the adjoining railroad line to transport ice to cities that included New York and Washington, D.C. It is also listed under Criterion C as an intact example of a purpose-built ice-manufacturing plant. The rhythmic façade, arched window openings, and use of decorative brickwork are all characteristic of industrial architecture from the early twentieth century.

Atlas Safe Deposit and Storage Company Warehouse Complex (MIHP #B-5188-2)

The Atlas Safe Deposit and Storage Company Warehouse Complex is a three-building complex located at 2126 Edmondson Avenue and adjoining the former B&P Railroad (**Image 15**). The buildings were constructed in 1925, 1946, and 1948, respectively. The property is eligible for National Register listing under Criterion A in the area of industry as a well-preserved example of a storage warehouse associated with the railroad. It is also eligible under Criterion C in the area of architecture as an excellent example of an early-twentieth century warehouse complex using specialized industrial building techniques of fireproof reinforced concrete columns and beamless slab floor construction.

Image 15: Atlas Safe Deposit and Storage Company Warehouse Complex

Reservoir Hill Historic District (MIHP #B-1379)

The Reservoir Hill Historic District contains 32 blocks of mostly late nineteenth- to early twentieth-century rowhouses (**Image 16**). It is bounded by North Avenue, Mount Royal Avenue, Druid Park Lake Drive, and Madison Avenue. Mansions, apartment buildings, religious buildings and commercial buildings are also located in the district.

Image 16: Reservoir Hill Historic District

The district is listed on the National Register under Criterion A for its association with the development of the City's Jewish community in the early twentieth century. It is also listed under Criterion C for being an architecturally significant example of a type of urban development which characterized Baltimore throughout the nineteenth and early twentieth century. Its period of significance is from 1790 to 1941.

Western Maryland Railroad, Owings Mills Division (MIHP #B-5293)

The Western Maryland Railroad Owings Mills Division is a former passenger and freight rail line constructed in 1873. The historic alignment includes five steel and concrete under-grade bridges, five at-grade crossings, one building, one structure and associated cuts and fills. The railroad is eligible for listing on the National Register under Criterion A in the area of transportation as the final link in the railroad's larger push to build an independent line into the City of Baltimore. It is also eligible under Criterion C in the area of engineering for its intact fills, cuts, and collection of twentieth century under-grade railroad bridges.

Ward Baking Company (MIHP #B-5112-2)

The Ward Baking Company property, located at 2140 Edmondson Avenue, is a historical industrial baking factory and delivery truck repair shop built between 1925 and 1927 for the country's largest and oldest baking company (**Image 17**). The facility utilized standard construction techniques and exterior ornamentation. The property is eligible for the National Register under Criterion A in the area of industry as a well-preserved example of an important baking factory associated with Baltimore's industrial development.

Image 17: Ward Baking Company

E. Natural Resources

Natural resources in the Study Area were preliminarily identified based on a review of existing scientific literature, watershed reports, GIS databases, and mapping. The *Natural Resources Technical Report* contains detailed information.

An investigation of available mapped information identified topography, geology, hydrology, vegetative cover, extents of the 100-year floodplain, and soils information from the following agency resources:

- United States Department of Agriculture, Natural Resource Conservation Service (USDA-NRCS) Web Soil Survey (WSS) for Baltimore, Maryland
- United States Geologic Survey (USGS) GIS Quadrangle Mapping
- Maryland Geological Survey
- Federal Emergency Management Agency (FEMA) GIS data
- National Wetlands Inventory (NWI) GIS data

- Maryland Department of Natural Resources (DNR) wetlands and waters GIS data
- Baltimore City GIS data

The Study Area, which included the areas of potential above-ground construction for each of the B&P Tunnel Build Alternatives, including the existing B&P Tunnel, was assessed in May 2015. These areas include portal and ventilation shaft locations for Alternatives 3A, 3B, and 3C. The assessed areas were determined based on limits of disturbance developed in preliminary engineering. All natural resources found within these potential construction areas were inventoried. These resources are shown in detail in the *Natural Resources Technical Report* and **Figure 33**.

1. Soils

The WSS for Baltimore City was used to identify 16 soil units within the Study Area, shown on **Figure 33** and described in **Table 28**. Two of the soil types, Keyport-Urban land complex and Urban land-Udorthents complex, are predominantly non-hydric, with hydric ratings of five and three percent, respectively. A hydric soil is formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the soil layers closest to the surface.

Table 28: Soil Units within the Study Area

Map Unit Symbol	Map Unit Name	Hydric Rating (%)
13UB	Joppa-Urban land complex, 0 to 8 percent slopes	0
14UB	Urban land-Joppa complex, 0 to 8 percent slopes	0
15UB	Keyport-Urban land complex, 0 to 8 percent slopes	5
16UB	Urban land-keyport complex, 0 to 8 percent slopes	0
17C	Legore loam, 8 to 15 percent slopes	0
17E	Legore loam, 15 to 45 percent slopes	0
18UC	Legore-Urban land complex, 8 to 15 percent slopes	0
19UC	Urban land-Legore complex, 8 to 15 percent slopes	0
22UB	Manor-Urban land complex, 0 to 8 percent slopes	0
24UB	Matapeake-Urban land complex, 0 to 8 percent slopes	0
29UB	Sassafras-Urban land complex, 0 to 8 percent slopes	0
31UB	Urban land-Sassafras complex, 0 to 8 percent slopes	0
40C	Udorthents, loamy, very deep, 8 to 15 percent slopes	0
42E	Udorthents, smoothed, 0 to 35 percent slopes	0
43U	Urban land-Udorthents complex, occasionally flooded	3
44UC	Urban land, 0 to 15 percent slopes	0

Hydric rating indicates the percentage of the soil unit that is hydric:

- Hydric: 100 percent
- Predominantly hydric: less than 100 percent to 66 percent
- Partially hydric: less than 66 percent to 33 percent
- Predominantly non-hydric: less than 33 percent to greater than zero percent
- Non-hydric: zero percent

The majority of the soils within the Study Area are non-hydric. No hydric soils were found in the Study Area. Further soil analysis can be found in the *Natural Resources Technical Report*.

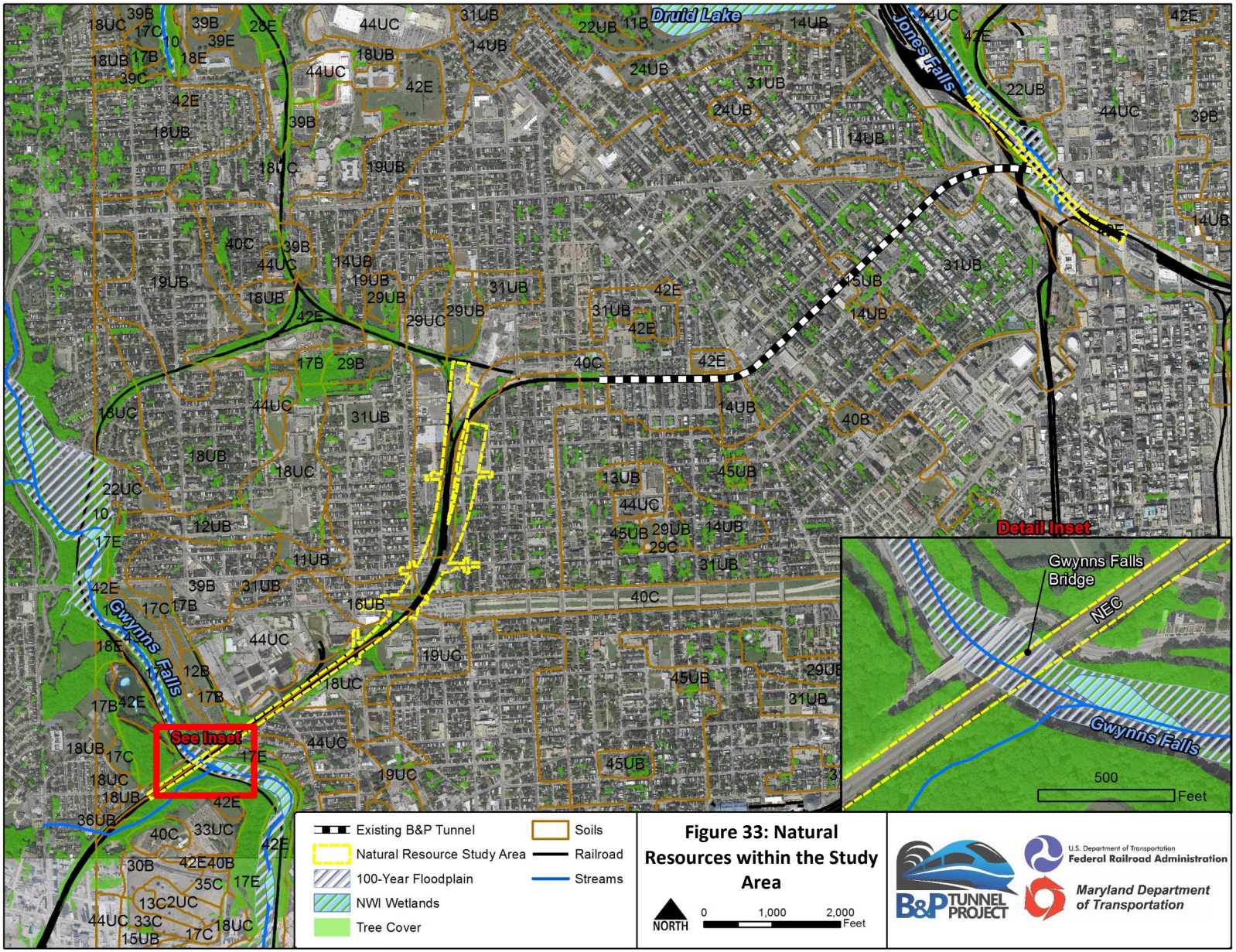


Figure 33: Natural Resources within the Study Area

2. Topography, Geology, Aquifers, and Groundwater

The information that follows is preliminary and based on available mapping, some of which was published in 1935. Borings, and possibly geophysical exploration studies, will be necessary to develop more accurate evaluations.

a. Topography

The Study Area is located in the Perry Hall Upland District of the Fall Zone Region within the Piedmont Plateau Physiographic Province of Maryland, which is within the Baltimore East and Baltimore West USGS quadrangles (7.5 minute series, 2014). The elevation is between 100 and 200 feet above mean sea level. The area is a geologic transition zone, where the sediments of the Coastal Plain Physiographic Province overlay the residual soils and basement rocks of the Piedmont Physiographic Province. The Coastal Plain deposits are found mostly in the higher elevations, whereas the soils and rock of the Piedmont are found mostly in the lower elevations of the Jones Falls Valley and the western portion of the Study Area where the sediments have been eroded, typically west of Fulton Avenue.

b. Geology

The geology of the Piedmont Plateau Province is characterized by meta-igneous and meta-sedimentary rock with igneous intrusions of pegmatite--a very hard rock with thin injection seams of quartzite--and smaller amounts of sedimentary rock interspersed (Maryland Geological Survey). Natural soils are residual soils, which have formed in place through weathering of the parent bedrock. Residual soils typically form a profile characterized by the progression from soil to decomposed rock, or saprolite, to rock with increasing depths below the ground surface. In the eastern portion of the Study Area, east of Mount Royal Avenue and Callow Avenue, parent materials are mapped as the Carroll Gneiss Member of the James Run Formation. The western portion of the Study Area, primarily west of Fulton Avenue, is also mapped as Carroll Gneiss Member to the south of Laurens Street and Jones Falls Schist to the north. The Jones Falls Schist in this area is included in the Pegmatite Injection Complex where less than 50 percent of the bedrock consists of pegmatite.

Most rock within the Study Area has very low permeability, with little pore space to transmit water; groundwater is conveyed through joints, fractures, and other discontinuities (Trapp, H. and M.A. Horn, 1997). Piedmont rock is between 1.2 billion to 196 million years old, formed from the Precambrian through the Jurassic periods (Trapp, H. and M.A. Horn, 1997). The main types of crystalline rock found in this region are coarse-grained gneisses and schists that have undergone several periods of metamorphism (Trapp, H. and M.A. Horn, 1997). Much of the consolidated rock is overlain with unconsolidated material known as regolith, which is formed by the weathering of rock and consists of saprolite, colluvium, alluvium, fill, and natural soil (Trapp, H. and M.A. Horn, 1997).

c. Aquifers

The Study Area overlies the Piedmont Crystalline Rock Aquifer, an underground layer of water-bearing rock. Groundwater recharge is highly variable in this region, which is almost entirely dependent on precipitation and local runoff absorbed through the regolith into rock fractures (Trapp, H. and M.A. Horn, 1997).

A sole source aquifer (SSA) is the primary source of drinking water for an area; it supplies a minimum of 50 percent of the drinking water overlying the aquifer (EPA, 2015). These areas may have no alternative drinking water sources that could “physically, legally, and economically supply” those dependent on the aquifer for drinking water (EPA, 2015). No SSA, water supply reservoirs, or wells are located near the existing B&P Tunnel. Surface water from rainfall and snowmelt is the source of the Baltimore City drinking water supply. Liberty Reservoir, Loch Raven Reservoir, Prettyboy Reservoir, and the Susquehanna River contribute to Baltimore’s water supply. None of these drinking water sources would be affected by the B&P Tunnel Project.

The closest USGS groundwater well is in East Baltimore, within the Patuxent Formation Aquifer of the Lower Cretaceous age in the Coastal Plain Province. The groundwater characteristics of the well will have little bearing on the Study Area, since this aquifer is in a different physiologic province.

d. Groundwater

Groundwater typically flows along the contacts of the clay and sand facies of the Patuxent Formation, at the junction of the Coastal Plain and Piedmont Provinces. It continues through the decomposed rock in fractures and other discontinuities.

3. Water Resources

a. Streams and Navigable Waterways

The desktop investigation identified three waterways within the B&P Tunnel Study Area: Jones Falls, Gwynns Falls, and a tributary to the Gwynns Falls (see **Figure 33**).

The Jones Falls is a perennial, traditionally navigable waterway that flows through the northeastern portion of the Study Area. The waterway is considered a Navigable Water under Section 10 of the U.S. Rivers and Harbors Act. The Jones Falls mainstem, below Lake Roland, is a Maryland Department of Environment (MDE) Designated Use I Waterway for Water Contact Recreation and Protection of Warm Water Nontidal Aquatic Life. Tributaries that drain to the Jones Falls include Moores Branch, Roland Run, Towson Run, Western Run, and Stony Run. There are no high quality, Tier II, stream segments located within the Jones Falls Watershed. The Jones Falls channel and its banks also have been highly altered, its deeply incised nature and overlay of crystalline bedrock is typical of rivers of the region (Reger, J.P. and E.T. Cleaves, 2008).

The Gwynns Falls is another perennial, traditionally navigable water located in the southwest portion of the Study Area. This part of the Gwynns Falls is an MDE Designated Use I Waterway. The stream flows for 25 miles through Baltimore County and Baltimore City before emptying into the tidal Patapsco River.

b. Wetlands

Wetlands investigations were conducted in accordance with the U.S. Army Corps of Engineers, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region Version 2.0* (Ed. Berkowitz, 2012).

Routine wetland determination methods, with onsite inspection, were used to determine the presence of wetlands in the Study Area. Waters of the U.S., other than wetlands, were delineated using the limits defined in 33 CFR Part 328—Definition of Waters of the United States. The boundaries of nontidal waters of the U.S. other than wetlands were set at the ordinary high water mark (OHW). The OHW is determined in the field using physical characteristics established by the fluctuations of water (e.g., change in plant community, changes in the soil character, shelving) in accordance with U.S. Army Corps of Engineers Regulatory Guidance Letter No. 05-05.

Two NWI wetlands were identified by a desktop search; one within the 100-year floodplain of the Jones Falls (classified as riverine) and one within the 100-year floodplain of the Gwynns Falls (classified as freshwater pond) (see **Figure 33**). These wetlands would not be impacted by any of the potential B&P Tunnel alignments, directly or indirectly. The Study Area was assessed for wetland areas in May 2015. No wetlands were identified within the Study Area.

c. Water Quality

i. *Jones Falls Water Quality*

Waters of the Jones Falls watershed are considered impaired waters under the Clean Water Act (CWA), and were first identified on Maryland's 303(d) List of Impaired Waters in 1996. The stream was listed as impaired by

nutrients, sediment, copper, lead, zinc (1996), fecal bacteria (2002), and impacts to biological communities (2002, 2004, and 2006).

A Water Quality Analysis (WQA) for zinc contamination in the Jones Falls was submitted by the Maryland Department of the Environment (MDE) to the Environmental Protection Agency (EPA) in 2002. According to this analysis, the aquatic life criteria and designated uses associated with zinc are being met in the Jones Falls and the waterway does not require a Total Maximum Daily Load (TMDL) to achieve water quality standards (MDE, 2002). A WQA of copper and lead for the Jones Falls was submitted to the EPA in 2004; a TMDL is not required for the entire 8-digit basin of the Jones Falls, but is required for its lower-most 12-digit basin (basin code 02-13-09-04-10-32), which was found to be impaired by copper in the WQA. The copper and lead WQA concluded further monitoring within the 12-digit basin is required to identify the source of impairment and determine whether a TMDL will be required (EPA, 2004).

In 2009, a WQA of eutrophication for the Jones Falls Watershed in Baltimore City and Baltimore County, Maryland was submitted to the EPA. The study indicated the Jones Falls Watershed is not impaired by nutrients based on a biological stressor identification (BSID) analysis and recent water quality data analysis conducted by MDE. The WQA indicates no TMDL is required for eutrophication in the Jones Falls Watershed (MDE, 2009).

A proposed TMDL of fecal bacteria for the nontidal Jones Falls Basin in Baltimore City and Baltimore County, Maryland was submitted to EPA in 2006; the TMDL was established at 860 billion most probable number (MPN) of *E. coli* per day. The sources of fecal bacteria were estimated at five representative stations within the Jones Falls Watershed, based on one year of bacterial sampling. Multiple antibiotic resistance analysis was used to determine the bacterial source and human waste was determined to be the source of the majority of the bacteria in the Jones Falls (MDE, 2006).

A proposed TMDL of sediment in the Jones Falls Watershed in Baltimore City and Baltimore County, Maryland, was submitted to EPA in 2011. A TMDL of combined nonpoint source, stormwater, and processed wastewater allocations was established to ensure sediment loads and their effects would support the Use I, II, and IV designations and protect against sediment-related impacts to aquatic health.

The Jones Falls average annual TMDL of sediment/total suspended solids (TSS) was established at 7,109.3 tons per year. The average annual TMDL is a total load allocation for nonpoint sources, regulated stormwater, and process water waste combined. The load allocation for nonpoint sources is 1,022.0 tons per year; National Pollutant Discharge Elimination System (NPDES) regulated stormwater load allocation is 6,084.9 tons per year; Process Water Waste Load Allocation is 2.4 tons per year. Load allocations were set based on a BSID methodology, which concluded biological communities in the Jones Falls Watershed are impaired due to flow and sediment-related stressors. Stressors affecting the biological community of the Jones Falls were identified as channelization, channel alteration, poor epifaunal substrate, poor bank stability, and high embeddedness. The sediment TMDL will not completely resolve the biological impairment of the Jones Falls Watershed, since other potential stressors to biological communities including chlorides, sulfate, and conductivity were identified during the BSID analysis and other biological monitoring. Further analyses will be conducted by MDE to establish TMDLs for all impairing substances in the watershed (MDE, 2011).

ii. *Gwynns Falls Water Quality*

Waters of the Gwynns Falls Watershed are considered impaired under the CWA and were first identified on Maryland's 303(d) List of Impaired Waters in 1996. The stream was listed as impaired by nutrients, sediments (1996), fecal bacteria, and impacts to biological communities (2002).

A WQA of eutrophication for the Gwynns Falls Watershed in Baltimore County and Baltimore City, Maryland was submitted by MDE in 2009 and approved by the EPA in 2010. According to this analysis, a TMDL for nutrients is not necessary to achieve water quality standards. EPA approved TMDLs for nitrogen and phosphorous in the

Baltimore Harbor in 2007. The Gwynns Falls drains into the Baltimore Harbor, so best management practices (BMPs) to improve water quality in the Harbor will require nutrient reductions in the Gwynns Falls. The nutrient WQA supports a revision of the phosphorous listing for the Gwynns Falls watershed from an impaired Category 5 waterbody to a Category 2 waterbody, indicating that it meets some water quality standards, but that there is insufficient data for all impairments to be assessed (MDE, 2009).

A proposed TMDL of fecal bacteria for the nontidal Gwynns Falls Basin in Baltimore City and Baltimore County, Maryland, was submitted to EPA in 2006 and approved in 2007, establishing a TMDL at 917.4 billion *E. coli* MPN per day. USGS daily flow monitoring data were collected at four representative monitoring stations in the Gwynns Falls Watershed for one year. Multiple antibiotic resistance analysis was used to determine the bacterial source and human waste was found to be source of the majority of the bacteria in the Gwynns Falls.

A proposed TMDL of sediment in the Gwynns Falls Watershed in Baltimore City and Baltimore County, Maryland, was submitted to EPA in 2009 and approved in 2010. MDE used BSID methodology to determine whether elevated sediment loads were negatively impacting the stream environment. This analysis determined biological communities of the Gwynns Falls Watershed are impaired by flow and sediment-related stressors, including channelization, channel alteration, and bar formation. A reference watershed approach was used to quantify the negative impact of sediment-related stressors on the biological communities and a sediment loading threshold established. The threshold was used to determine a TMDL for the Gwynns Falls Watershed. The Gwynns Falls average annual TMDL of TSS is 13,996.2 tons per year. This TMDL ensures the watershed can meet its use class criteria with no negative impacts from sediment loads.

d. Floodplains and Flood Hazards

Data from the FEMA Flood Insurance Rate Maps (FIRM) was obtained and overlaid on GIS mapping of the B&P Tunnel potential alignments to identify regulated floodplains within the Study Area (see **Figure 33** and project mapping in the *Natural Resources Technical Report)*. See **Section VI.E.4** for information on project flood plain impacts. Floodplains are also regulated at the state level and any construction in the nontidal floodplain will require a Waterway Construction Permit from MDE.

4. Coastal Zones

Coastal zones are not a resource within the Study Area; therefore, they are not described further in this DEIS.

5. Wildlife and Habitat

Wildlife habitat within the Study Area is limited due to high levels of urbanization. Potential wildlife habitat in the region includes the Jones Falls, street trees, residential yards, landscaped areas around buildings, and hedgerows and forested areas around the I-83 interchange, and Baltimore City parks including: Druid Hill Park, Madison & Whitelock Park, John E. Howard Park, Brookfield Park, Pauline Founteroy Park, William Mcabee Park, Lafayette & Payson Park, Harlem Inner Block Park, Cumberlands and Carey Park, Eutaw Place Median Park, Pennsylvania Triangle Park, Reverend Quille Park, Saint Katherine's Park, North & Woodbrook Park, Druid Hill & Baker Park, Park Avenue Median Park, Reservoir Hill Park, Maple Leaf Park, Mount Royal Terrace Park, Newington Avenue Park, and Whitelock & Park Avenue Park.

Some of the wildlife species known to inhabit Baltimore City include songbirds such as mockingbirds (*Mimus polyglottos*) and robins (*Turdus migratorius*), rock doves (*Columba livia*), mourning doves (*Zenaida macroura*), Eastern gray squirrels (*Sciurus carolinensis*), Eastern chipmunks (*Tamias striatus*), house mice (*Mus musculus*), Norway rats (*Rattus norvegicus*), Virginia opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), American toads (*Anaxyrus americanus*), and white-tailed deer (*Odocoileus virginianus*). The Study Area likely supports populations of many of these species. Some of the fish species commonly found in the lower Jones Falls include: white sucker (*Catostomus commersoni*), yellow bullhead (*Ameiurus natalis*),

satinfin shiner (*Cyprinella analostana*), redbreast sunfish (*Lepomis auritus*), longnose dace (*Rhinichthys cataractae*), green sunfish (*Lepomis cyanellus*), and American eel (*Anguilla rostrata*). (For discussion of invasive species, see **Section V.E.5.c** below.)

a. Aquatic Habitat

The Jones Falls watershed is listed on the Maryland list of water quality limited (WQLs) segments as impaired for impacts to biological communities. Maryland DNR conducts a quantitative assessment of the health of biologic communities within stream systems called the Index of Biological Integrity (IBI). The percentage of stream miles with an IBI of less than three is calculated and compared to a reference stream less than 10 percent degraded to determine the relative biological health of the stream. The Code of Maryland Regulations (COMAR) requires the Jones Falls support a minimum Use I designation for water contact recreation and protection of nontidal warmwater aquatic life. The Jones Falls is not attaining the designated use of supporting aquatic life, since it is biologically impaired. Biological impairment is evaluated by assessing the Benthic and Fish Indices of Biological Integrity (BIBI/FIBI), developed by the Maryland Biological Stream Survey. Biological impairment is assessed using a BSID that determines the main causes of reduced biological function.

A Watershed Report for Biological Impairment of the Gwynns Falls Watershed in Baltimore City and Baltimore County and BSID results and interpretation were submitted to EPA in 2009 and approved in 2010. The BSID data suggests degradation of biological communities of the Gwynns Falls is due in large part to the impacts of urban land use and related impacts of altered hydrology, elevated ammonia levels, chlorides, and conductivity. It also suggests biological communities of the Gwynns Falls are likely degraded by flow and sediment-related stressors and anthropogenic channelization of streams.

There is no National Marine Fisheries Service (NMFS) designated essential fish habitat in the Study Area.

b. Terrestrial Habitat

A desktop assessment was conducted prior to the initiation of field work to approximate the potential boundaries of existing forest stands through review of current aerial photography in GIS (see **Figure 33**). Areas of above ground disturbance were identified along the entire length of the existing B&P Tunnel corridor and at proposed ventilation shafts and tunnel portals. Reconstructing and modernizing the existing B&P Tunnel would require cut-and-cover construction in existing tunnel ROW and therefore the entire length of the alignment was investigated. A field survey of natural resources was conducted in these areas in May 2015 to identify any forest/street tree resources that may be impacted by proposed construction. The *Natural Resources Technical Report* contains a list of potential impacts.

The Maryland Department of Natural Resources (MDNR) defines a forest as follows:

- Biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or larger and at least 35 feet wide.
- Areas with at least 100 trees per acre with at least 50 percent having a two-inch or greater diameter at breast height (dbh).
- Areas that have been cut, but not cleared.
- Does not include orchards.

MDNR defines specimen trees as having a dbh of 30 inches or greater, or trees with 75 percent or more dbh of the current state champion of that species.

The Maryland Forest Conservation Act applies to any activity requiring application for subdivision, grading permit, or sediment control permit for an area 40,000 square feet or greater. Applicants following the Forest

Conservation Act are required to submit a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP), prepared by a Maryland-qualified forest professional, to MDNR or the local reviewing agency for review and approval. A FSD is an inventory of existing forest/trees and other environmental site features. It provides a basis for determination of the most suitable forest and resource protection areas during the early stages of site development planning.

A FCP is prepared during the latter stages of site design and details the limits of disturbance; amount of forest that would be retained, removed, reforested, and afforested during site development; locations of specimen trees for retention and removal; types and locations of tree/forest protection devices and supplemental tree care; maintenance and monitoring parameters; and long-term protection measures. The State Forest Conservation Technical Manual (Manual), Third Edition outlines the requirements for FSD and FCP preparation and submittal (Howell, G.P. and T. Ericson, 1997).

The Maryland Roadside Tree Law was passed in 1914 to ensure that roadside trees were properly protected and cared for and to ensure compatibility with public utilities. A Roadside Tree Care Permit must be obtained from MDNR prior to pruning, fertilizing, removing, planting, or caring for any roadside tree. A roadside tree grows all or in part within a public road ROW. Any work (including removal) conducted on a roadside tree that is 20 feet or higher must be performed by a Maryland licensed tree expert. A Roadside Tree Permit applies to trees within the public ROW that are not within forest stands. Most street trees occur along roadways either between the road and a sidewalk or within a center island between two roadways. Specimen tree removals would require a variance in compliance with the 2009 Maryland Forest Conservation Act amendment, No Net Loss of Forest Policy (Senate Bill 666), which would be coordinated with MDNR during final design.

No forests were identified within the Study Area. The majority of the trees are identified as planted street trees.

c. Invasive Species

The Study Area is located in residential, industrial, and railroad areas. The majority of the species identified during the field investigation were planted street trees. None of the alternatives intersect forested areas. A full characterization of plant species was not conducted in this preliminary field investigation, although some invasive species were identified within the rail facilities, including tree-of-heaven, English ivy, and honeysuckle vine.

6. Rare, Threatened and Endangered Species

Based on agency correspondence received to date, no state- or Federally-listed threatened or endangered species are known to exist within the Study Area. The MDNR Project Review Division (PRD) response from June 29, 2015 indicates no threatened or endangered species are located in the Study Area. The United States Fish and Wildlife Service (USFWS) response, dated September 8, 2015 also indicated no threatened or endangered species in the Study Area; however, several transient species of migratory birds may traverse the Study Area. The B&P Tunnel Project will comply with the provisions of the Migratory Bird Treaty Act to implement appropriate conservation measures for all project activities.

Correspondence with the USFWS regarding the Northern Long-eared Bat indicates that the USFWS has refined its original critical habitat area for the bat to exclude major cities and some Maryland counties. The *Information for Planning and Conservation* (IPaC) species list for the B&P Tunnel does not include the Northern Long-eared Bat within the Study Area (USFWS, 2015).

F. Hazardous Materials

A Preliminary Screening Assessment (PSA) to identify potential sites of environmental concern during construction was conducted throughout the Study Area. The assessment includes the evaluation of sites with historical associations with contaminants or hazardous materials that may have migrated into the proposed

limits of disturbance and could be mobilized during tunnel construction activities (see **Figure 34**). Throughout the investigation area there is a history of industrial activity, including dry-cleaning, rail maintenance, gas stations, and automotive repair. Current and historical hazardous materials used within the Study Area include, but are not limited to, petroleum, solvents, and other industrial contaminants.

Local communities and the surrounding environment could be exposed to existing hazardous materials mobilized as waste material if present within the tunnel limits of disturbance. Mobilization could include vapors in the soil pore space mobilized due to tunnel pressurization, dust and solids mobilized during tunneling, excavation, transport and disposal or groundwater impacted by the movement of hazardous materials or contaminants into the dissolved phase. In addition, materials and chemicals brought to the project site to aid in the construction process could experience an uncontrolled release due to mishandling or an accident.

The Resource Conservation and Recovery Act (RCRA), implemented by the U.S. Environmental Protection Agency (USEPA), is the primary federal regulatory framework for monitoring and tracking the generation and disposal of hazardous wastes in the United States, while the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a framework for remediation and site clean-up. For the state of Maryland, MDE is the primary regulatory authority, under Title 26 of COMAR. Other Federal agencies with responsibilities for protecting human health and the environment from the impact of hazardous wastes or contaminants include, but are not limited to, the U.S. Department of Labor (USDOL) Occupational Safety and Health Administration (OSHA); U.S. Department of Health and Human Services and the U.S. Department of Transportation (USDOT). MDE enforces federal and state hazardous material and contamination requirements through its Land Redevelopment Program (LRP) and Oil Control Program (OCP). The complete list of reviewed Federal and state regulatory databases is included in the *Hazardous Materials Assessment* Technical Report.

As part of the PSA evaluation, Federal and state environmental database records were reviewed in an effort to evaluate historical environmental incidents in the vicinity of each proposed alternative that could impact local communities or the surrounding environment if contamination is encountered during construction. The federal and state regulatory databases have been researched and reported in accordance with the search radii specified by ASTM Standard E 1527-05.

Sites in proximity to the alternatives/options with environmental concerns were ranked as low, medium, or high priority in accordance with the criteria outlined below. Specific sites of environmental concern for each alternative are detailed in the *Hazardous Materials Assessment*.

The following criteria provide general guidelines for priority ranking; with each site evaluated using a weight of evidence approach to create a final priority ranking based on the risk associated with the contaminant and probability of mobilization during construction.

Sites were not included in the PSA if**:**

- No history of contamination or spills; and
- Down or cross gradient from the alternative; and
- Greater than 500 feet from the alternative.

A site was considered a low priority if:

- No history of contamination or spills; or
- MDE cases are closed with good information on cleanup; and
- Down or cross gradient and greater than 250 feet, but less than 500 feet from the alignment; or
- Low quantity generator; or

- Contains single heating oil tank or a historical or operable Above-ground Storage Tank (AST) or Underground Storage Tank (UST) less than 550-gallon in volume.

A site was considered a medium priority if:

- History of contamination, dumping and/or spills; and
- MDE cases are closed with insufficient information regarding resolution; and
- Greater than 500 feet upgradient of the alignment; or
- Down or cross gradient and greater than 100 feet, but less than 250 feet from the alignment; or
- Only listed as historical dry cleaner or gasoline/auto station; or
- Large quantity generator; or
- Single historical or operable AST/UST greater than 550-gallons in volume;
- Multiple historical or operable ASTs/USTs; or
- Hazardous waste disposal or storage onsite; or
- Violation notices.

A site was considered a high priority if:

- History of contamination, dumping and/or spills; and
- MDE cases are open; and
- Less than 500 feet upgradient of the alignment; or
- Down or cross gradient and less than 100 feet from the alignment; or
- Multiple historical or operable ASTs/USTs; or
- Voluntary Cleanup Program (VCP) or Superfund site.

The priority ranking system provides a basis for further site investigations once a preferred alternative is selected. Residential properties have the least potential risk for environmental concern due to storage of relatively small quantities in USTs or ASTs. Releases or spills are normally minor unless improperly stored or used in large quantities. Railroad operations can be a major source of surface and subsurface contamination on properties adjacent to railroad lines. Contamination can result from hazardous cargo spills as well as incremental releases of fuel and lubricants from equipment. Project activities along or near these rail lines may encounter undocumented contamination from railroad operations.

In addition to a review of regulatory database information, Sanborn Fire Insurance maps covering each proposed alternative alignment were reviewed to identify the presence of historical industrial or hazardous materials handling sites that may have released contaminants that could be present within the proposed construction limits of disturbance. The Sanborn maps provide detailed historical information for property development and use areas dating back to the late 1800's and provide property information prior to the initiation of environmental regulatory database listings in the 1970s. The Sanborn findings were incorporated into the PSA sheets and site priority rankings.

As a final step in the PSA review, a visual, noninvasive reconnaissance of high and medium priority sites and properties adjacent to each alternative was performed. No buildings or sites were entered during the reconnaissance. The B&P Tunnel Project hazardous material personnel performed site reconnaissance to verify existing onsite conditions and map visible environmental conditions, including: stained soil/pavement; dumping/burning areas; oil and gas-fuel dispenser, surface sheen; roads/tracks; transformers; drum storage; and above ground storage tanks. Visual observations were conducted for high and medium priority sites within a 500- foot distance from each alternative.

Through the identification of potential contaminants and sites of concern, the B&P Tunnel Project will compare the number of potential hazardous materials or contaminated sites in the vicinity of each proposed alignment. Once a preferred alternative is selected, targeted investigations within the alignment limits of disturbance will identify existing contaminant conditions that could be mobilized during construction of the B&P Tunnel. If contaminants or hazardous materials are encountered during the subsurface investigation, mitigation and remediation actions will occur in the design and construction phases of the project to minimize or eliminate potential impacts to the surrounding community or local environment.

The PSA identified 71 potential hazardous material or contaminated sites proximal to the existing B&P Tunnel. There were 36 sites with a low-priority ranking (**Table 29**), 24 sites with a medium-priority ranking (**Table 30**), and 11 sites with a high-priority ranking (**Table 31**).

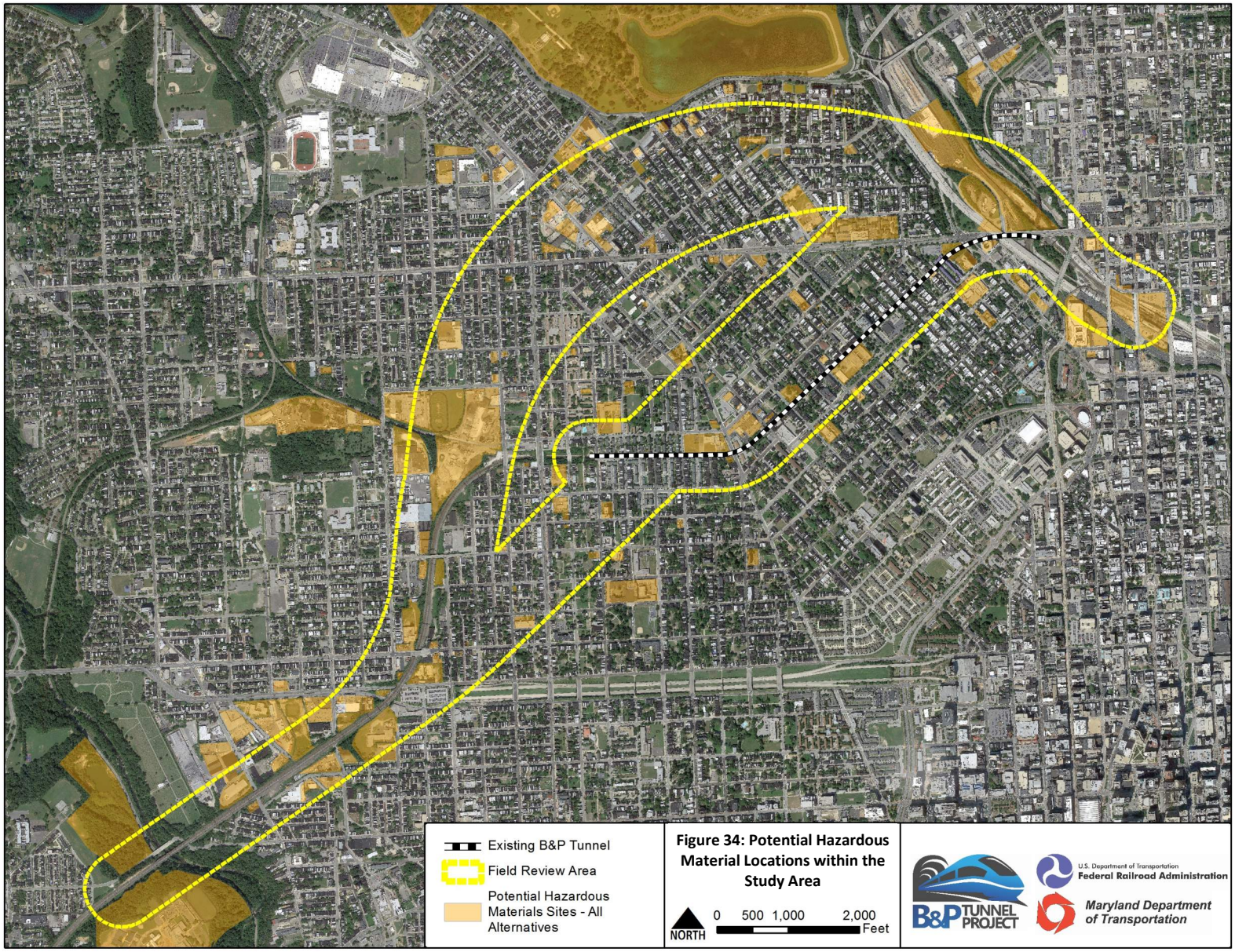


Figure 34: Potential Hazardous Material Locations within the Study Area

Table 29: Low Priority Hazardous Material Sites near the Existing B&P Tunnel

Site ID #	Property Description	Address	Hazard Type
BP-078	William R Lockhart residence	1803 Riggs Avenue	Petroleum release
BP-098	Gilmore Homes, Baltimore Housing Authority	1601 Vincent Court	Petroleum release
BP-103	Gilmore Homes	1640 Balmor Court	Petroleum use
BP-123	Sharon Baptist Church, Inc.	1373 North Stricker Street	Petroleum use
BP-128	City of Baltimore	2311 Pennsylvania Avenue	Petroleum release
BP-132	Cearney's Radiator Service	1204 North Calhoun Street	Automotive history
BP-136	Baltimore City	1301 Laurens Street	Petroleum use
BP-140	Empire Laundry & Dry Cleaners	1201 North Carey Street	Dry-cleaning history
BP-143	William Pinderhughes Elementary School	1200 North Fremont Avenue	Automotive history
BP-144	Modern Junk & Salvage Co.	1423 North Fremont Avenue	Industrial history
BP-148	Lieu Yaw Laundry	1220 North Fremont Avenue	Dry-cleaning history
BP-149	Ernest Arjone	1208 North Fremont Avenue	Automotive history
BP-150	K & L Auto Service	1206 North Fremont Avenue	Automotive history
BP-151	Fremont Service Station	1202 North Fremont Avenue	Automotive history
BP-152	United States Post Office	1832 Pennsylvania Avenue	Petroleum use
BP-154	Inland Oil Co.	1126 North Fremont Avenue	Automotive history
BP-162	St. James Terrace Apartments	827 North Arlington Avenue	Petroleum release
BP-166	Talk Dirty Laundry	1729 Pennsylvania Avenue	Dry-cleaning history
BP-171	Goldenberg's Bargain Outlet	1705 Pennsylvania Avenue	Petroleum use
BP-173	Jason H Tilbillman	545 Wilson Street	Dry-cleaning history
BP-176	Wilson & Etting Park	1709 Division Street	Automotive history
BP-177	Jim's Auto Repair	528 Wilson Street	Automotive history
BP-179	Minor's Cleaners	1800 Linden Avenue	Dry-cleaning history
BP-182	Ernest Brooks	1711 Druid Hill Avenue	Dry-cleaning history
BP-183	Mitchell Cleaners & Dyers	414 Wilson Street	Dry-cleaning history
BP-187	Total Health Care	1501 Division Street	Petroleum use

Site ID #	Property Description	Address	Hazard Type
BP-204	Mount Royal Elementary School	121 McMechen Street	Petroleum use
BP-210	Lincoln Motor	410 West North Avenue	Automotive history
BP-211	AAA Mid-Atlantic Inc.	1401 West Mount Royal Avenue	Petroleum use
BP-213	Bolton Yard	80 West Oliver Street	VCP action
BP-214	Amtrak/Jones Falls Substation	151 West Oliver Street	Petroleum release
BP-217	Baltimore Postal Service Vehicle Maintenance	60 West Oliver Street	Petroleum release
BP-218	Penn Esso Station	1716 Maryland Avenue	Automotive history
BP-220	Atlantic Automobile Repairs	6 West Lanvale Street	Automotive history
BP-222	Binswanger, Sylvan W	2 East Lanvale Street	Automotive history
BP-225	National Auto Radiator and Fender Company Inc.	9 East Lanvale Street	Automotive history

Table 30: Medium Priority Hazardous Material Sites near the Existing B&P Tunnel

Site ID #	Property Description	Address	Hazard Type
BP-050	Matrix Metals	2045 Winchester Street	VCP action, Petroleum use
BP-056	The Baltimore Asphalt Paving Co. (P. Flanigan & Sons, Inc., Pen Mar Company, Inc.)	1320 North Monroe Street	Petroleum use, Industrial history
BP-090	Sandtown Winchester Community Center	1114 North Mount Street	Petroleum use
BP-117	Harvey Johnson Towers	1510 West Mosher Street	Petroleum release
BP-120	Baltimore City Fire Department #8	1503 West Lafayette Avenue	Petroleum release
BP-138	Whitaker Citgo and Fuel Co.	920 North Carey Street	Petroleum release
BP-139	St. Peter Claver Catholic Church	1542 North Fremont Avenue	Petroleum release
BP-146	William G Brown Community Funeral Home	1308 North Fremont Avenue	Petroleum release
BP-156	Amoco Station	1101 West North Avenue	Petroleum release
BP-159	Lafayette Market	1700 Pennsylvania Avenue	Petroleum use
BP-164	Ball property and alleyway	634 Pitcher Street	Petroleum use
BP-186	Druid Heights Community Development Corp.	1711 McCulloh Street	Petroleum use
BP-191	Valentine residence	1513 Druid Hill Avenue	Petroleum release

Site ID #	Property Description	Address	Hazard Type
BP-196	Baltimore City Fire Station #13	405 McMechen Street	Petroleum release
BP-200	B & E Properties	1631 Park Avenue	Petroleum release
BP-202	Bolton House North Apartments	1600 West Mount Royal Avenue	Petroleum use
BP-203	MTA Light Rail Maintenance Facility	344 West North Avenue	Petroleum use, Railway history
BP-206	Baltimore City DPW Highway Maintenance Garage	560 West North Avenue	Petroleum use
BP-207	Golden Touch Care Center	140 West Lafayette Avenue	Petroleum release
BP-208	Baltimore Fire Department, Aerial Tower 111	401 West North Avenue	Petroleum use
BP-212	Maryland Institute College of Art - Fox Building	1341 Dickson Street	Petroleum use
BP-219	Maryland Community Resource Center/Sterling Auto Radiator Works	1731 Maryland Avenue	Petroleum release
BP-221	Metro Laundry & Cleaners/La La Auto Repair Inc./Atlantic Auto Service	1700 North Charles Street	Dry-cleaning history, Petroleum use
BP-223	Vincent Gulf Service Station/Hess	1801 North Charles Street	Petroleum release

Table 31: High Priority Hazardous Material Sites near the Existing B&P Tunnel

Site ID #	Property Description	Address	Hazard Type
BP-077	JJ Adams Fuel Oil Company	1810 Winchester Street	Petroleum use
BP-091	Western District Police Station	1034 North Mount Street	Petroleum release
BP-118	Gilmor Elementary School #107	1311 North Gilmor Street	Petroleum release
BP-157	Bank of America	1808 Pennsylvania Avenue	Petroleum release
BP-178	Lafayette Center	1915 Madison Avenue	Petroleum remediation
BP-184	Midtown Development Corporation	1820 Eutaw Place	Petroleum release
BP-185	Conor residence	1815 Madison Avenue	Petroleum release
BP-195	Eutaw-Marshburn Elementary School	1624 Eutaw Place	Petroleum use
BP-201	Ditch Bowers & Taylor, Inc.	415 West North Avenue	Petroleum release, Railway history
BP-224	Amtrak Pennsylvania Station	1500 North Charles Street	Petroleum release, Railway history
BP-226	Norfolk Railway Yard	340 West North Avenue	Petroleum release, Railway history

In addition to existing conditions in the subsurface, other hazardous materials or contaminants may be mobilized due to materials stored and used within the construction limits of disturbance during the proposed action. Potential materials of concern include fuel sources for backup power generators, compressed gases used for welding and metal cutting, lead-acid batteries, fluorescent lamps containing mercury vapors, and polychlorinated biphenyls (PCB) within transformer insulating oil. In some cases, the proposed action will require use of potentially toxic products (e.g. herbicides, pesticides, rodenticides, lubricants, muck additives). Secondary hazardous materials (e.g. exhaust fumes) may be a greater health risk than the primary hazardous material (e.g., diesel fuel). The use of hazardous materials creates down-stream potential to generate hazardous waste (e.g., tunnel muck, asbestos demolition material).

The investigation, handling, storage and disposal of all hazardous and contaminated materials will occur in accordance with applicable Federal, state local regulations and requirements. Project specific material handling, health and safety and emergency response plans will minimize risks. The general public, unless a work site allows unrestricted access, is typically shielded from hazardous materials and hazardous wastes that are components of site work.

As the tunnel design and environmental investigations progress, additional targeted hazardous materials investigations may be conducted to further delineate and characterize potential contaminant concerns in the vicinity of the preferred alternative alignment.

G. Solid Waste

The regulations of the EPA under the Resource Conservation and Recovery Act (RCRA), MDE under COMAR Title 26.04.07, and the Baltimore City Department of Public Works (Bureau of Solid Waste) under Baltimore County Code Article 13 Title 04, govern activities that involve the generation, handling, and disposal of solid wastes.

Currently, solid waste generation from the existing B&P Tunnel comes from activity surrounding maintenance of the structure (worker trash, worker equipment, general debris from the existing structure) and fugitive trash from the City streets above.

Wastes containing contaminated materials require special handling, storage, transportation, and disposal methods to prevent releases that could impact human health or the environment. Depending on the nature of the material, Federal, state and municipal regulations require the use of special containers or stockpiling practices for on-site storage to prevent the release of contaminated materials. The Federal and State Departments of Transportation have requirements for transportation of wastes containing contaminated materials. Facilities that receive contaminated materials require Federal, state, and municipal permits to accept the waste, and generally require specific representative waste sampling and laboratory analysis prior to accepting material for disposal.

Two types of landfills that accommodate solid waste from projects like the B&P Tunnel are Rubble (Construction & Debris [C&D]) Landfills, and Land Clearing Debris Landfills. A rubble (C&D) landfill is a solid waste acceptance facility that is restricted to accepting waste derived from building construction, demolition, or remodeling. As of 2013, there were five permitted rubble landfills in the state and one more under construction. At the 2013 disposal rate, there would be approximately 25 years of available C&D landfill capacity in the state. Land clearing debris (LCD) landfills are solid waste acceptance facilities that are restricted to acceptance of earthen materials such as clays, sands, topsoil, rock, and vegetation. As of 2013, there were five permitted LCD's accepting solid waste and one more under construction. At the 2013 disposal rate, there would be approximately 58 years of available land clearing debris landfill capacity in Maryland (Waste Diversion and Utilization Program, 2015).

H. Air Quality

Air quality describes the level of pollutants in the air. Individual air pollutants degrade the atmosphere and can harm human or animal health, reduce visibility, damage property, and reduce productivity of crops or natural vegetation.

Pursuant to the requirements of the Clean Air Act (CAA), the EPA establishes, enforces, and periodically reviews the National Ambient Air Quality Standards (NAAQS) for six common air pollutants, referred to as criteria pollutants--carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, sulfur dioxide (SO_2), and particulate matter (PM) which includes particulate matter with a diameter of 10 microns or less (PM_{10}) and particulate matter less than or equal to 2.5 micrometers ($PM_{2.5}$).The MDE has adopted the same standards as the NAAQS.

The EPA designates areas as either meeting (attainment) or not meeting (nonattainment) the NAAQS. An area with measured pollutant concentrations lower than the NAAQS is designated as an attainment area and an area with pollutant concentrations that exceed the NAAQS is designated as a nonattainment area. Once a nonattainment area meets the NAAQS and the additional redesignation requirements in the CAA, the EPA will designate the area as a maintenance area. Ozone nonattainment areas are further classified as extreme, severe, moderate, or marginal.

The CAA requires states to develop a general plan to attain and/or maintain the primary and secondary NAAQS in all areas of the country and to develop a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as State Implementation Plans (SIPs), are developed by state and local air quality management agencies and submitted to the EPA for approval.

The General Conformity Rule of the federal CAA prohibits federal agencies (such as FRA) from permitting or funding projects that do not conform to an applicable SIP. The General Conformity Rule applies only to areas that are in nonattainment or within a maintenance status. Under the Rule, project-related emissions of the applicable nonattainment/maintenance pollutants are compared to *de minimis* level thresholds. If the emissions exceed the thresholds, a formal Conformity Determination is required to demonstrate that the action conforms to the applicable SIP. Conversely, if project-related emissions are below the *de minimis* levels the project is assumed to conform to the SIP. The proposed project would require input and/or approval by the FRA; therefore, the General Conformity requirements of the CAA are applicable. The General Conformity *de minimis* levels for the B&P Tunnel Replacement Project are presented in **Table 32**.

Table 32: General Conformity *de minimis* Thresholds (tons per year)

Pollutant	Primary/ Secondary (tons per year)	Area Designation
Ozone (NO_x)	100	Marginal and moderate nonattainment inside an ozone transport region
Ozone (VOC)	50	Marginal and moderate nonattainment inside an ozone transport region
$PM_{2.5}$	100	All nonattainment & maintenance areas

Note: Ozone thresholds are for locations inside an Ozone Transport Region (OTR).
Source: USEPA, De-Minimis Levels, http://www.epa.gov/oar/genconform/deminimis.html.

The B&P Tunnel Project is located in Baltimore City, Maryland, which is presently designated by the EPA as a moderate nonattainment area for the eight-hour ozone, and a maintenance area for CO and $PM_{2.5}$. The existing B&P Tunnel operations data for 2014 is summarized in **Table 33**. Additional information regarding air quality of the Study Area can be found in the *Air Quality Technical Report* and the *Noise and Air Quality Technical Memorandum for Ventilation Plants*.

Table 33: Tunnel Operating Characteristics in the Existing Year (2014)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	Number of Locos	Number of Cars	
MARC (Regional)	Diesel (~60%) & Electric (~40%)	57	4	1	8	30/30
Acela (Intercity Express)	Electric	39	2	1	8	30/30
NE Regional (Intercity Corridor)	Electric	49	3	1	8	30/30
Freight	Diesel	2	0	1	30	30/30
Total	**All**	**145**	**9**			

** Average train speed entering and exiting the North Portal (N) and South Portal (S).*
Source: General Orders Timetable (Amtrak, December 2012 and 2014).

Historically, Greenhouse Gas (GHG) emissions have not been regulated under the CAA as air pollutants. However, after the U.S. Supreme Court clarified in 2007 that CO_2 is an "air pollutant" subject to regulation under the CAA, the EPA embarked on developing requirements and standards for GHG emissions from mobile and stationary sources. There are however, no current NAAQS or *de minimis* thresholds in place for GHG.

In February 2010, the CEQ released a draft guidance memorandum addressing the ways Federal agencies can improve their consideration of the effects of GHG emissions and climate change in their evaluation of proposals for Federal actions under NEPA (CEQ, 2010). On December 2014, CEQ released revised draft guidance which supersedes the guidance released in February 2010. The revised guidance explained that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated GHG emissions, and the implications of climate change for the environmental effects of a proposed action. The guidance also emphasized that agency analyses should employ quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations. CEQ recommends that agencies consider 25,000 metric tons of carbon dioxide equivalent (CO_{2e}) emissions on an annual basis as a reference point below which a quantitative analysis of GHG is not recommended unless it is easily accomplished based on available tools and data (CEQ, 2015).

I. Noise

According to the FTA, noise is generally considered unwanted sound[12]. Transit noise impacts are assessed based on land use categories and sensitivity to noise from transit sources (see **Table 34**) under FTA's guidance manual, *Transit Noise and Vibration Impact Assessment.* The FTA noise criteria are delineated into two categories: *moderate* and *severe* impact. The moderate threshold defines areas where the change in noise is noticeable but

[12] Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, Washington, DC, May 2006

may not be sufficient to cause a strong, adverse community reaction. The *severe* impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site is established by comparing the predicted future Project noise level at the site to the existing noise level at the site.

Various sound metrics are used to quantify noise from transit sources. The A-weighted decibel (abbreviated "dBA") is used to describe the overall noise level and closely matches the human ear's response to audible frequencies. The following A-weighted noise metrics are used to describe impacts from transit related sources:

- L_{max}: The maximum noise level that occurs during an event (such as a train passby);
- L_{eq}: The equivalent sound level, which is the level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a given time interval (such as one hour); and
- L_{dn}: The 24-hour day-night average sound level, an average sound level which includes a 10-decibel penalty added between 10:00 pm and 7:00 am to account for greater nighttime sensitivity to noise.
- SEL: The sound exposure level that converts the cumulative noise energy of an event into one second.

The L_{dn} is used to characterize noise exposure for residential areas (i.e. FTA Category 2). The L_{dn} metric describes a receiver's cumulative noise exposure from all events over 24 hours. For other noise sensitive land uses, such as schools and libraries (FTA Category 3) and outdoor amphitheaters (FTA Category 1), the average hourly equivalent sound level $L_{eq}(h)$ is used to represent the peak operating hour. See **Table 34** for FTA land use categories and noise metrics.

Potential noise impacts from the B&P Tunnel Project were also evaluated using the noise level standards included in the Noise Regulation of the Health Code of Baltimore City.[13] This regulation provides the noise limits for manufacturing, commercial, and residential zones in Baltimore City—depending on the source of noise and the types of adjacent land uses. For noise generated within residential zones, there is a limit of 55 dBA at any point on the property line of the use (the noise limit is described as a measured maximum sound level; although not specifically stated, it is assumed to be in terms of L_{max}). Between 9:00pm and 7:00am, the limit is 5 dBA lower for any uses within a residential zone (that is, 50 dBA). Although the Health Code allows for different noise limits for "short, durational deviations" for the purposes of this report it is assumed that the noise limit for the ventilation plants is L_{max} 50 dBA at the property boundary of each ventilation plant facility. Additionally, regulations from COMAR 26.02.03—Control of Noise Pollution, were applied, as appropriate, to the impact evaluation.

Table 34: FTA Land use Categories and Noise Metrics

Land-Use Category	Noise Metric	Description
1	$L_{eq}(h)$	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and historic landmarks.
2	L_{dn}	Buildings used for sleeping such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance.
3	$L_{eq}(h)$	Institutional land uses with primarily daytime and evening uses including schools, libraries, churches, museums, cemeteries, historic sites, and parks, and certain recreational facilities used for study or meditation.

Source: Transit Noise and Vibration Impact Assessment (FTA, 2006).

[13] Health Code of Baltimore City, § 9-206 Noise Regulation, 2015.

1. Existing Noise Levels

A noise monitoring program was conducted at three representative locations near the south portal (**Figure 34**) on May 14th and May 28th, 2015. Since measurements near the north portal were not available, existing noise levels were estimated using tabulated values from the FTA's General Noise Assessment guidelines. At this location, existing noise levels were estimated based on proximity to major roads, such as I-83, and existing railroad lines. The noise measurements documented existing noise sources within the Study Area, such as rail traffic (including passenger and freight traffic along the NEC) and motor vehicle traffic along surface streets. As shown in **Table 35**, measured peak-hour noise levels near the south portal ranged from 64.3 dBA to 70.3 dBA, and the measured day-night noise levels range from 63.2 dBA to 64.7 dBA. The estimated noise levels near the north portal are 60.0 dBA for both the peak-hour and day-night noise levels. More detailed information regarding noise within the Study Area can be found in the *Noise Technical Report* and the *Noise and Air Quality Technical Memorandum for Ventilation Plants*.

Table 35: Existing Noise Levels [1]

Receptor Location	FTA Land Use Category	FTA Description	Peak Hour L_{eq}(h) (dB)	24-Hour L_{dn} (dB)
Near South Portals *(Measured)*				
N Mount Street	2	Residential	N/A	64.7
W Lanvale Street	2	Residential	N/A	63.4
Mary Ann Winterling Elementary School	3	Institutional	64.3	N/A
Near North Portals *(Estimated)*				
Residential and Institutional receptors in vicinity of the project	2 and 3	Residential and Institutional	60.0	60.0

Source: Study Team conducted noise measurements near the South Portals on May 14th and May 28th, 2015. North Portal data are estimates based on FTA's Transit Noise and Vibration Impact Assessment (FTA, 2006).

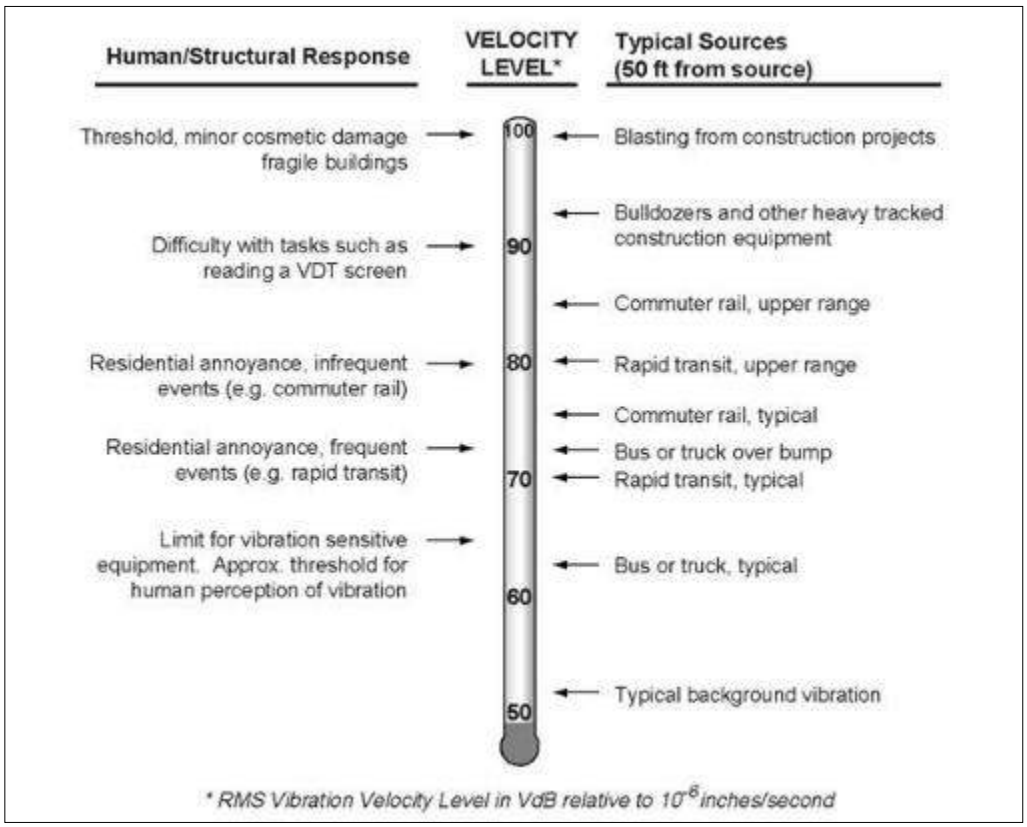
J. Vibration

Because FRA has not published noise and vibration regulations, the agency defers to regulations published by the FTA. The vibration assessment was prepared in accordance with NEPA and the guidelines set forth by FTA's *Transit Noise and Vibration Impact Assessment* (FTA, 2006). The future predicted vibration levels from the B&P Tunnel Project were evaluated using the FTA guidelines. The FTA criteria are used to evaluate instantaneous levels from single events (such as a single train passby).

1. Technical Overview

Typical ground-borne vibration levels, in addition to typical sources and human/structural responses, are shown in **Figure 35**.

Figure 35: Typical Ground-Borne Vibration Levels (FTA, 2006)



Ground-borne vibration associated with vehicle movements is usually the result of uneven interactions between wheels and the road or rail surfaces. Examples of such interactions (and subsequent vibrations) include train wheels over a jointed rail and an untrue rail car wheel with flats spots. Typical ground-borne vibration levels at a receptor 50 feet from a diesel locomotive traveling at 50 miles per hour is 85 VdB and 73 VdB for LRT vehicles. Similarly, a typical background vibration velocity level in residential areas is usually 50 VdB or lower, well below the threshold of human perception, which is around 65 VdB. Typical background levels refer to ambient ground vibrations not related to any specific transportation source (e.g. naturally occurring ground vibration). This background vibration level is assumed to be fairly constant from site to site, except near active fault lines.

Unlike noise, which travels in air, transit vibration typically travels along the surface of the ground. Depending on the geological properties of the surrounding terrain and the type of building structure exposed to transit vibration, vibration propagation can be more or less efficient. Buildings with a solid foundation set in bedrock are “coupled” more efficiently to the surrounding ground and experience relatively higher vibration levels than buildings located in sandier soil. Heavier buildings (such as masonry structures) are less susceptible to vibration than wood-frame buildings because they absorb more vibration energy.

Vibration induced by passing rail vehicles can generally be discussed in terms of displacement, velocity, or acceleration. However, human responses and responses by monitoring instruments and other objects are most accurately described with velocity; therefore, vibration velocity level is used to assess vibration impacts from transit projects.

2. Existing Vibration Levels

Baseline (or background) vibration measurements (vibration levels under Alternative 1) were not conducted as part of the B&P Tunnel Project because the focus of this preliminary phase is intended to compare the potential impacts between different alternatives and options. Typical background levels refer to ambient ground vibrations not related to any specific transportation source (e.g. naturally occurring ground vibration). This background vibration level is assumed to be fairly constant from site to site, except near active fault lines. Background vibration levels near the proposed B&P Tunnel Project alternatives are dominated by local traffic, while background vibration levels near the existing B&P Tunnel are dominated by current rail operations due to Amtrak, MARC and freight train passbys along the NEC.

Ground-borne vibration from train passbys under Alternative 1 is predicted to exceed the FTA frequent impact criterion of 72 VdB at 23 residences and other FTA Category 2 land-uses. Exceedances of the FTA impact criterion of 75 VdB are predicted at one FTA Category 3 receptor (Eutaw-Marshburn Elementary School). No exceedances of the FTA ground-borne vibration impact criteria are predicted at any Category 1 land-uses (highly sensitive equipment) under Alternative 1.

Vibration from train passbys in tunnels could contribute to ground-borne noise inside residences due to vibrating surfaces. Ground-borne noise from train passbys under Alternative 1 is predicted to exceed the FTA frequent impact criterion of 35 dBA at 126 residences and other FTA Category 2 land-uses. Exceedances of the FTA impact criterion of 40 dBA are predicted at one FTA Category 3 receptor (Eutaw-Marshburn Elementary School). FTA Category 1 land-uses (highly sensitive equipment) are generally not sensitive to ground-borne noise. Additional information regarding vibration within the Study Area can be found in the *Vibration Technical Report.*

K. Energy

Consideration of energy consumption and conservation potential of alternatives and mitigation measures in EIS documents is required by CEQ guidance at 40 CFR Part 1502.16(e)—Environmental Consequences and FRA regulations. Amtrak and MARC trains traveling through the Study Area in the existing B&P Tunnel are electric or diesel powered, while NS freight trains are fueled primarily by diesel. Catenary lines provide overhead electric power to Amtrak and MARC trains along the trackway and through the existing B&P Tunnel in the Study Area.

Nationally, Amtrak trains use 2,214 Btu per passenger mile and traveling by Amtrak is 11 percent more efficient than domestic airline travel (2,484 Btu) and 31 percent more efficient than auto travel (3,193 Btu) on a per-passenger-mile basis (USDOE, 2014). In contrast, freight rail uses on average 13,800 Btu per freight-car-mile. Amtrak's goal is to reduce its consumption of diesel fuel by improving operating practices and conservation measures. Diesel fuel use in revenue-generating trains was reduced by 1.11 percent from Fiscal Year 2012 to 2013 (Amtrak, 2013).

Table 36 presents the estimated daily energy consumption of Amtrak and MARC services through the Study Area based on NEC FUTURE 2014 data and statistics available from the National Bureau of Transportation Statistics. As discussed in the Need for the Project section, freight traffic through the existing B&P Tunnel is currently limited by the configuration of the Port of Baltimore and the current B&P Tunnel clearances, resulting in most freight on the NEC being rerouted around the existing B&P Tunnel. As only two NS freight trains travel through the Study Area per day, their energy use is nominal.

Table 36: Estimated Energy Consumption of Existing Amtrak and MARC Service in the Study Area

Type of Service	Daily Passenger Trips	Length of Travel (Miles)	Daily Passenger Miles	Average Btu Per Passenger-Mile	Daily Estimated Energy Consumption (Btu)
Amtrak	17,000[1]	3.5	59,500	2,214[1]	131,733,000
MARC	4,600[1]	3.5	16,100	2,838[2]	45,691,800

Source: NEC FUTURE (USDOT, Accessed September 8, 2014).

[1] *2014 data*

[2] *2012 data*

Energy is also consumed by the operation of facilities such as tunnels, where power is needed for lighting, trackway signage, and operating ventilation and safety equipment. Petroleum and electrical energy are also typically consumed during construction to operate various equipment.