Chapter VI

Environmental Consequences

U.S. Department of Transportation
Federal Railroad Administration

Maryland Department
of Transportation

VI. ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental impacts of the Preferred Alternative, Alternative 3A, and Alternative 3C in comparison to Alternative 1: No-Build. Since publication of the DEIS, Alternatives 3A, 3B and 3C were carried forward and further refined as described in **Chapter III**. In addition, FRA has identified Alternative 3B as the Preferred Alternative. Identification of the Preferred Alternative was based on the alternative's ability to meet the Project Purpose and Need; an assessment of engineering factors; an assessment of all environmental impacts; and consideration of all public and agency comments received. A detailed description of the Preferred Alternative, including descriptions of the alignment, ventilation facilities, construction methods and other Project components is provided in **Chapter IV**.

As described in **Chapter III**, each of the build alternatives (Alternatives 3A, 3B and 3C) were refined after the issuance of the DEIS in December 2015. The assessment in this chapter focuses on the environmental impacts of the Preferred Alternative (Alternative 3B), Alternative 3A, and Alternative 3C in comparison with the No-Build. The environmental impacts described in this chapter take into account any changes to environmental existing conditions which have been identified since the DEIS, and also reflect refinements to the alternatives that have occurred since the DEIS. Detailed resource impact mapping is located in **Appendix A**.

FRA has performed environmental impact analysis of the alternatives for the following resources: socioeconomics, cultural resources, Section 4(f), natural resources, hazardous materials, air quality, noise, vibration, and indirect and cumulative impacts. Direct, indirect, long term and short term impacts have been evaluated for each resource.

Because the majority of each build alternative would be below ground, impacts generally occur where the alignments intersect with the ground surface, such as at the portals and proposed ventilation facility locations in the east Jones Falls area, Reservoir Hill community along North Avenue, and Midtown-Edmondson neighborhoods. The Project design of the build alternatives no longer includes emergency egress at surface locations other than the ventilation facilities, therefore there would be no additional impacts resulting from egress areas, as were described in the DEIS.

A. Socioeconomics

1. Population

Population changes are estimated based on residential displacements and relevant Census data on average persons per household. Impacts to population are assessed in terms of general population characteristics including: age distribution, racial composition, educational level, poverty, and linguistic isolation.

See **Figure VI-1** for a depiction of the Preferred Alternative and Alternatives 3A and 3C in relation to Census tracts and block groups.

a. Alternative 1: No-Build

Alternative 1 would not require any residential displacements or impact the age distribution, racial composition, educational level, poverty, and linguistic isolation of the population of the Study Area.

b. Preferred Alternative

The Preferred Alternative would demolish an estimated 22 residential buildings. Based on data from Baltimore City, as well as field reconnaissance in May, 2016, it is estimated that 17 out of the 22 potentially impacted residential buildings are currently occupied (Baltimore City, 2016). Because relocation opportunities are available and could occur within or proximal to the impacted neighborhoods, minimal impact to the Study Area population is anticipated under the Preferred Alternative. Individuals relocated would experience temporary adverse effects from relocation.

c. Alternative 3A

Alternative 3A would not require the demolition of any residential structures and would have no direct impact on population.

d. Alternative 3C

Alternative 3C would require an estimated 12 residential building demolitions. Based on data from Baltimore City, as well as field reconnaissance in May, 2016, it is estimated that nine out of the 12 potentially impacted residential buildings are currently occupied. Because relocation opportunities are available and could occur within or proximal to the impacted neighborhoods, minimal impact to the Study Area population is anticipated. Individuals relocated would likely experience temporary adverse effects from relocation.

2. Housing

a. Alternative 1: No-Build

There would be no housing displacements or other impacts to housing as a result of Alternative 1.

b. Preferred Alternative

The Preferred Alternative would demolish 22 residential buildings in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods as a result of south portal construction. Sixteen demolitions would occur west of North Payson Street and north of West Mosher Street; four demolitions would occur east of North Pulaski Street and south of West Lanvale Street; and two demolitions would occur west of North Bentalou Street and south of Lauretta Avenue. Based on Baltimore City Open GIS data and field review, five of the potentially impacted residential buildings are currently vacant (Baltimore City, 2016). None of the displacements are in publicly owned housing developments. Housing displacements are shown on the Environmental Resource Mapping in **Appendix A**.

Construction of the North Ventilation Facility and Intermediate Ventilation Facility are not anticipated to cause any housing displacements or have any other direct effects to housing. The South Ventilation Facility would be located above the cut-and-cover portion of the south portal; as such, the South Ventilation Facility itself would not result in any residential displacements beyond those required by the south portal construction.

c. Alternative 3A

Alternative 3A would have no direct impact to housing in the Study Area. No residential building demolitions would be required.

d. Alternative 3C

Alternative 3C would require demolition of 12 residential buildings in the Rosemont neighborhood. The demolitions would occur south of Edmondson Avenue between Wheeler Street and the NEC. Based on Baltimore City Open GIS data and field review, three of the potentially impacted residential buildings are currently vacant. None of the displacements are in publicly owned housing developments.


1304
1301
1303
1302
1207
1206
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1205
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1501
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1401
1001
1102
1402
1702
1101
1605
1604
1603
1602
1601
1703
Existing B & P Tunnel
Penn Station
83
40
West Baltimore MARC
Amtrak Northeast Corridor
2002
2001
2006
Gwynns Falls Bridge
Mining Portals
Block Groups
Tracts
Alternative 3A
Surface Track
Bored Tunnel
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Alternative 3C
Surface Track
Bored Tunnel
Water
Railroad
Existing B&P Tunnel
Proposed Ventilation Facility
Figure VI-1: Alternatives within Census Tracts and Block Groups
NORTH
0 500 1,000 2,000
Feet
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

3. Minority Race and Ethnicity and Low-Income Populations

The US Environmental Protection Agency has defined environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, signed by the President on February 11, 1994, directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law.

The US DOT 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.

The identification of a disproportionately high and adverse effect on EJ populations does not preclude a project from moving forward. USDOT Order 5601.2a states that a project with disproportionately high and adverse effects on low-income and minority populations may be carried out under the following conditions:

- Programs, policies, and activities that would have a disproportionately high and adverse effect on minority populations or low-income populations would only be carried out if further mitigation measures or alternatives that would avoid or reduce the disproportionately high and adverse effects are not practicable. In determining whether a mitigation measure or an alternative is "practicable," the social, economic (including costs) and environmental effects of avoiding or mitigating the adverse effects would be taken into account.
- Programs, policies or activities that would have a disproportionately high and adverse effect on populations protected by Title VI ("protected populations") would only be carried out if:

  (1) A substantial need for the program, policy or activity exists, based on the overall public interest; and

  (2) Alternatives that would have less adverse effects on protected populations (and still satisfy the need identified in subparagraph (1) above) have either:

  (a) adverse social, economic, environmental, or human health impacts that are more severe; or

  (b) would involve increased costs of an extraordinary magnitude.

Determinations of whether a project would have disproportionately high and adverse effects must take into consideration "mitigation and enhancement measures that will be taken and all offsetting benefits to the affected minority and low-income populations…" USDOT Order, Section 8.b.

This study incorporates the guidance provided in the *Environmental Justice Policy Guidance for FTA Recipients, FTA Circular 4703.1* (FTA, 2012). The FTA EJ Circular was published in 2012 to provide recipients of FTA financial assistance with guidance in order to incorporate EJ principles into plans, projects, and activities that receive funding from FTA.

a. Methodology

As a tool for evaluating the proportionality of beneficial and adverse effects, this analysis identifies EJ populations within the Study Area. Thresholds were used to identify EJ populations based on the Council on Environmental Quality (CEQ) guidance document, *Environmental Justice Guidance under NEPA* (CEQ, 1997). This approach was used in the DEIS, which identified EJ and non-EJ areas, based on the criteria described below.

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:

a) The minority or low-income population exceeds 50 percent, or

b) The percentage of minority or low-income population in the affected area is "meaningfully greater" than the percentage of minority or low-income population in the general population. (US Census Bureau Poverty Threshold for 2013 is $23,834 for a family of four).

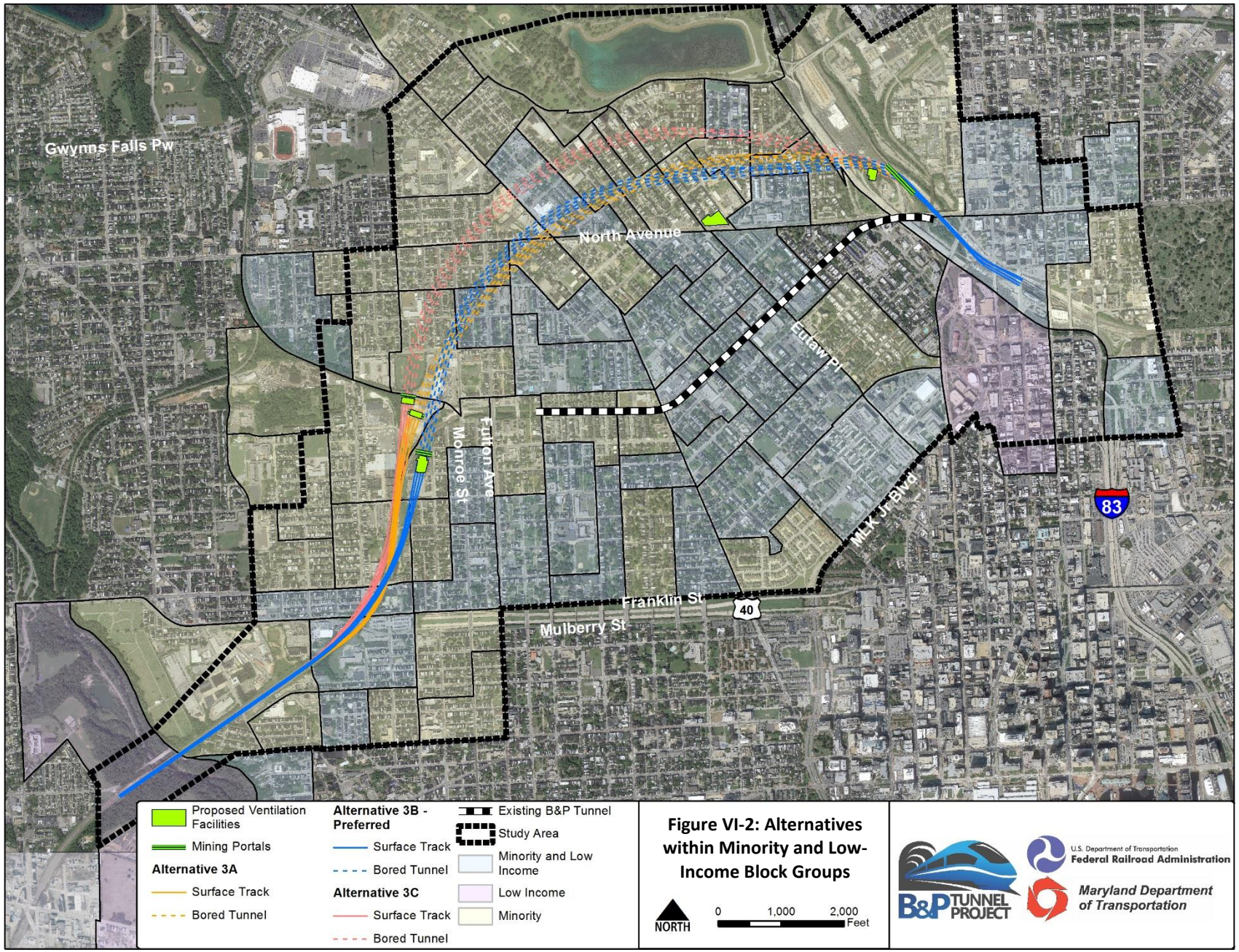
For this study, "meaningfully greater" was defined as any Census Tract in which the percentage of minority or low-income population was at least 10 percentage points higher than the percentage of minority or low-income population of Baltimore City (the "general population"). Because the 2013 minority population of Baltimore City was 74 percent, the threshold of 50 percent or greater is used for minority population Block Groups (per the first threshold above). The percentage of low-income population in Baltimore City in 2013 was 22 percent, thus, Census Block Groups that contain 32 percent or higher low-income households are considered EJ populations (per the second threshold).

To determine whether effects 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 based on analysis of other environmental impacts identified in this FEIS. Those effects by alternative, geographic areas and type of effects are identified and determined whether they occur to EJ populations. When effects to EJ populations are identified, the effects experienced by the affected population are compared to those experienced by others residing in the entire project boundary.

Additionally, measures to avoid or reduce adverse effects and the benefits to minority and low-income populations are considered in making the determination of whether an effect is disproportionately high or adverse to EJ populations in the Study Area. Overall, of the 77 Census Block Groups in the Study Area, 72 contain minority race and/or ethnicity populations of 50 percent or more. Thirty-six Census Block Groups contain 32 percent or higher low-income households (**Figure VI-2**).

Appendix D presents the minority race and/or ethnicity and low-income data for each Study Area Block Group. Two Block Groups meet the EJ population threshold for low-income composition only, and 38 Block Groups meet the EJ population threshold for minority race and/or ethnicity composition only; 34 Block Groups meet the threshold for both minority race and/or ethnicity as well as low-income composition. Three Study Area Block Groups do not meet the criteria for EJ populations: 1101.001, 1401.001, and 1401.002. This data is also represented in **Figure VI-2**. Therefore, of the 77 Block Groups within the Study Area, a total of 74 meet the criteria to be identified as EJ populations (minority and/or low-income).

All of the Census Block Groups proximal to the build alternatives are primarily occupied by minority and/or low-income populations and are therefore considered EJ populations. The following environmental resources are not directly, indirectly, or cumulatively impacted by the build alternatives: ecological resources, wetlands, water quality, flood hazards and floodplain management. Therefore, the lack of impacts to these resources would pose no disproportionately high and adverse effects to EJ populations in the Study Area and are not further discussed.


Gwynns Falls Pw
North Avenue
Eutaw Pl
Fulton Ave
Monroe St
MLK Jr Blvd
83
Franklin St
40
Mulberry St
Proposed Ventilation Facilities
Mining Portals
Alternative 3A
Surface Track
Bored Tunnel
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Alternative 3C
Surface Track
Bored Tunnel
Existing B&P Tunnel
Study Area
Minority and Low Income
Low Income
Minority
NORTH
0
1,000
2,000
Feet
Figure VI-2: Alternatives within Minority and Low-Income Block Groups
B&P TUNNEL PROJECT
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Federal Railroad Administration
Maryland Department of Transportation

FRA considered environmental impacts from the build alternatives for potential effects to low-income and minority populations as well as their potential for disproportionately high and adverse effects to these populations. Effects of the build alternatives are described based on the potential to disrupt community cohesion; change access to services, community facilities, and transportation; change the character and use of communities by land use changes or important cultural resource effects; impact quality of life through increased noise or vibration; or pose potential health issues such as changes to air quality or public safety. These effects may be beneficial or adverse.

Because the build alternatives are located only within EJ Block Groups, and the Study Area consists almost entirely of EJ Block Groups, the effects would be borne primarily by minority and low-income populations. The following discussion identifies the severity of potential effects and whether adverse effects may be mitigated. **Table VI-1** identifies the potential effects to low-income and minority communities for the Preferred Alternative, Alternative 3A and Alternative 3C.

Impacts to EJ populations were assessed by determining potential disruption in the interaction among people and groups within a community from the following:

- Possible displacements;
- Loss of housing and community facilities and access to services;
- Substantial change in land use;
- Creating physical barriers;
- Loss of important historic and archaeological resources;
- Visual quality changes;
- Transportation;
- Noise;
- Air quality;
- Vibration; and
- Impacts to public health.

FRA considered the displacements of households, businesses, and the loss of housing and community facilities for their potential to alter the physical shape, character, or function of communities or neighborhoods with predominately minority or low-income residents or use. The availability of suitable replacement housing and business locations was also examined.

Because temporary easements for construction purposes are anticipated to be relatively short term and would not preclude access to or impact major uses of a given property, potential effects during construction are not considered high or adverse to protected low-income and minority populations.

b. Alternative 1: No Build

There would be no negative impact to EJ populations from Alternative 1: No Build, in addition to no positive impact of improved transit times and capacity. Businesses and residences in EJ communities may experience negative effects if more frequent or intensive maintenance work is required in the future to maintain service through the existing tunnel, which could also result in potential delays or service interruptions on the NEC.

c. Preferred Alternative

The Preferred Alternative would improve transit times and reliable connections for transit-dependent residents in Midtown-Edmondson using the West Baltimore MARC station. Both platforms at the West Baltimore MARC Station would be improved to accommodate high-level boarding, improving accessibility at the station.

Construction of the project would benefit the local and regional economy, and mitigation measures are proposed to provide targeted local job training and encourage employment of workers of social and economic disadvantage.

Overall, the Preferred Alternative would have disproportionately high and adverse effects to EJ populations as a result of property acquisition and impacts to housing, land use/zoning, community facilities, visual quality, and noise. Impacts to property acquisition, housing, land use/zoning, community facilities, and visual quality would be more adverse within the Midtown-Edmondson neighborhood compared to other identified EJ populations, as a result of south portal construction and the South Ventilation Facility. The Preferred Alternative could have ground-borne noise impacts to EJ populations that would potentially be high and adverse, but minimization measures would be considered to reduce these to below high and adverse levels. Mitigation for the impacts to EJ populations are discussed in **Section VI.10,** as well as **Chapter VII**. **Table VI-1** describes impacts to EJ populations for the Preferred Alternative, Alternative 3A, and Alternative 3C.

d. Alternative 3A

Alternative 3A would not have a disproportionately high and adverse effect to EJ populations. The alternative would utilize existing NEC ROW for most of the south portal approach, thus minimizing the impacts to surrounding EJ populations as described in **Table VI-1**. This alignment does not require impacts to housing in EJ communities, minimizes the overall impact to businesses relative to the other alternatives, and avoids impacts to community facilities. Alternative 3A would improve transit service, but would not improve accessibility at the West Baltimore MARC Station. Construction of the project would benefit the local and regional economy, and mitigation measures are proposed to provide targeted local job training and encourage employment of workers of social and economic disadvantage. Alternative 3A could have ground-borne noise impacts to EJ populations that would potentially be high and adverse, but minimization measures would be considered to reduce these to below high and adverse levels. Overall, Alternative 3A would not have disproportionately high and adverse effects to EJ populations due to the minimized impacts and utilization of existing ROW.

e. Alternative 3C

Alternative 3C would have disproportionately high and adverse effects to EJ populations similar to those that would occur under the Preferred Alternative. The overall result of property acquisition and impacts to housing, land use/zoning, community facilities, and visual quality as described in **Table VI-1** would constitute a disproportionately high and adverse effect to the EJ communities found in the Midtown-Edmondson and Roselawn neighborhoods. Alternative 3C could have ground-borne noise impacts to EJ populations that would potentially be high and adverse, but minimization measures would be considered to reduce these to below high and adverse levels. Alternative 3C would improve transit service and accessibility at the West Baltimore MARC Station. Construction of the project would benefit the local and regional economy, and mitigation measures are proposed to provide targeted local job training and encourage employment of workers of social and economic disadvantage.

Table VI-1: Summary of Potential Effects to Low-Income and Minority Populations

Environmental Element	Alternative 1: No-Build Effect	Alternative 3A Effect	Preferred Alternative Effect	Alternative 3C Effect
Property Acquisition	No property acquisitions would occur. No disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would not result in any residential displacements. Nine businesses would be displaced. No disproportionately high and adverse effects to EJ populations would occur.	The Preferred Alternative would result in 22 residential property and 13 business displacements within EJ population areas. Disproportionately high and adverse effects would occur to EJ populations.	Alternative 3C would result in 12 residential and 16 business displacements within EJ population areas. Disproportionately high and adverse effects would occur to EJ populations.
Housing	No impacts to housing would occur. No disproportionately high and adverse effects to EJ populations would occur.	No housing units would be displaced by this alternative. No disproportionately high and adverse effects to housing within EJ populations would occur.	The Preferred Alternative would result in impacts to 22 residential buildings (no public housing impacts). Disproportionately high and adverse effects would occur to EJ populations from housing loss.	Alternative 3C would result in impacts to 12 residential buildings (no public housing impacts). Disproportionately high and adverse effects would occur to EJ populations from housing loss.
Land Use/Zoning	No impacts to land use/zoning would occur. No disproportionately high and adverse effects to EJ populations would occur.	1.4 acres of commercial land use would be converted to transportation in areas with EJ populations. No residential land use would be converted. No disproportionately high and adverse effects would occur.	3.9 acres of residential and commercial land uses would be converted to transportation use in areas with EJ populations. Disproportionately high and adverse effects would occur to land use/zoning.	2.4 acres of residential and commercial land uses would be converted to transportation use in areas with EJ populations. Disproportionately high and adverse effects would occur to land use/zoning.
Community Facilities	No impacts to community facilities would occur. No disproportionately high and adverse effects to EJ populations would occur.	No impacts to community facilities would occur. No disproportionately high and adverse effects would occur to community facilities in areas with EJ population.	Four places of worship in Midtown-Edmondson neighborhood would be displaced Disproportionately high and adverse effects would occur to community facilities in areas with EJ population.	The Charles R. Thomas Fire Station would be displaced. Disproportionately high and adverse effects would occur to community facilities in areas with EJ population.

Environmental Element	Alternative 1: No-Build Effect	Alternative 3A Effect	Preferred Alternative Effect	Alternative 3C Effect
Neighborhoods /Physical Barriers	No impacts to neighborhoods or implementation of physical barriers would occur. No disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would result in no new physical barriers in EJ communities because the alignment would be underground over most of its length. No disproportionately high and adverse effects from physical barriers would occur to EJ populations.	The Preferred Alternative would result in no new physical barriers in EJ communities because the alignment would be primarily underground, and new above ground alignment would be adjacent to the existing NEC. No disproportionately high and adverse effects from physical barriers would occur to EJ populations.	Alternative 3C would result in no new physical barriers in EJ communities because the alignment would be primarily underground, and new above ground alignment would be adjacent to the existing NEC. No disproportionately high and adverse effects from physical barriers would occur to EJ populations.
Visual Quality	No impacts to visual quality would occur. No disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would construct the south tunnel portal and South Ventilation Facility in a primarily industrial area and the Intermediate Ventilation Facility in the Reservoir Hill commercial area. FRA will work with the Reservoir Hill community and surrounding commercial stakeholders to develop a ventilation facility design that fits within existing community character and context. No disproportionately high and adverse effects to visual quality would occur in EJ population areas.	The Preferred Alternative would construct the south tunnel portal and South Ventilation Facility in the Midtown-Edmondson residential area. The Intermediate Ventilation Facility would be constructed along North Avenue within a commercial area, within the Reservoir Hill community. FRA will work with the Reservoir Hill community and surrounding commercial stakeholders to develop a ventilation facility design that fits within existing community character and context. Medium and adverse effects to EJ populations would occur from visual quality.	Alternative 3C would construct the south tunnel portal and South Ventilation Facility in the Midtown-Edmondson residential area and the Intermediate Ventilation Facility along North Avenue within its commercial corridor, within the Reservoir Hill community. FRA will work with the Reservoir Hill community and surrounding commercial stakeholders to develop a ventilation facility design that fits within existing community character and context. Medium and adverse effects to EJ populations would occur from visual quality.

Environmental Element	Alternative 1: No-Build Effect	Alternative 3A Effect	Preferred Alternative Effect	Alternative 3C Effect
Transportation	Minor impacts to roadway transportation would occur. However, no disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would improve transit times and reliable connections for transit-dependent residents in Midtown-Edmondson using the West Baltimore MARC station. Major existing crossings of the NEC would be maintained, however there may be short-term impacts during construction. No disproportionately high and adverse effects to EJ populations would occur from transportation effects.	The Preferred Alternative would improve transit times and reliable connections for transit-dependent residents in Midtown-Edmondson using the West Baltimore MARC station. Both platforms at the West Baltimore MARC Station would be improved to accommodate high-level boarding. Major existing crossings of the NEC would be maintained, however there may be short-term impacts during construction. No disproportionately high and adverse effects to EJ populations would occur from transportation effects.	Alternative 3C would improve transit times and reliable connections for transit-dependent residents in Midtown-Edmondson using the West Baltimore MARC station. Both platforms at the West Baltimore MARC Station would be improved to accommodate high-level boarding. Major existing crossings of the NEC would be maintained, however there may be short-term impacts during construction. No disproportionately high and adverse effects to EJ populations would occur from transportation effects.
Noise	No impacts to noise would occur. No disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would impact residential noise receptors within EJ population areas near the south portal. A total of 254 residential and institutional buildings would potentially experience moderate noise impacts. There would be no severe noise impacts. No disproportionately high and adverse effects to EJ populations would result from noise impacts.	The Preferred Alternative would impact residential noise receptors within EJ population areas near the south portal. A total of 297 residential and institutional buildings would potentially experience moderate noise impacts; 141 residential and institutional buildings would potentially experience severe noise impacts. Disproportionately high and adverse effects to EJ populations would occur from noise impacts.	Alternative 3C would impact residential noise receptors within EJ population areas near the south portal. A total of 979 residential and institutional buildings would potentially experience moderate noise impacts; 111 residential and institutional buildings would potentially experience severe noise impacts. Disproportionately high and adverse effects to EJ populations would occur from noise impacts.

Environmental Element	Alternative 1: No-Build Effect	Alternative 3A Effect	Preferred Alternative Effect	Alternative 3C Effect
Air Quality	No impacts to air quality would occur. No disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would have no impact to air quality. There would be no disproportionately high or adverse effects from air quality on EJ populations.	The Preferred Alternative would have no impact to air quality. There would be no disproportionately high or adverse effects to air quality on EJ populations.	Alternative 3C would have no impact to air quality. There would be no disproportionately high or adverse effects to air quality on EJ populations.
Vibration	No vibration impacts would occur. No disproportionately high and adverse effects to EJ populations would occur.	Alternative 3A would have 156 ground-borne noise impacts resulting from vibration. Disproportionately high and adverse effects to EJ populations would occur from ground-borne noise impacts.	The Preferred Alternative would have 449 ground-borne noise impacts resulting from vibration. Disproportionately high and adverse effects to EJ populations would occur from ground-borne noise impacts.	Alternative 3C would have 168 ground-borne noise impacts resulting from vibration. Disproportionately high and adverse effects to EJ populations would occur from ground-borne noise impacts.
Public Health and Safety	No impacts to public health and safety would occur. No disproportionately high and adverse effects to EJ populations would occur.	No impacts to public health and safety would occur. No disproportionately high and adverse effects to EJ populations would occur.	No impacts to public health and safety would occur. No disproportionately high and adverse effects to EJ populations would occur.	No impacts to public health and safety would occur. No disproportionately high and adverse effects to EJ populations would occur.

f. Evaluation of Effects

Determinations of whether a project would have disproportionately high and adverse effects must take into consideration "mitigation and enhancements measures that will be taken and all offsetting benefits to the affected minority and low-income populations…" USDOT Order 12898, Section 8.b.

The Project Team and FRA have determined that the Preferred Alternative and Alternative 3C would have disproportionately high and adverse effects to EJ populations. Alternative 3A would not have overall disproportionately high and adverse effects to EJ populations. In order to minimize and mitigate adverse effects where possible, a number of mitigation measures are included as part of the Preferred Alternative, which are discussed in Section **VI.A.10**, and in **Chapter VII**.

All of the project impacts, as well as the corresponding mitigation measures, would be located in predominantly low-income and minority population areas. The mitigation measures have been proposed to address, as completely as possible, all of the impacts to EJ populations resulting from the Project. Due to the permanent nature of the Project impacts, such as building demolitions and right-of-way acquisition in EJ communities, adverse effects to EJ populations would remain after mitigation. The proposed mitigation measures have been developed to address these impacts to EJ communities as completely as possible and enhance the surrounding

environment to offset Project impacts. Further mitigation measures beyond those proposed could not completely eliminate adverse effects resulting from the Project.

g. Full and Fair Access

Executive Order 12898 requires that federal agencies ensure effective, meaningful involvement of low-income and minority populations in project planning and development and that potentially affected EJ populations have fair and equal access to information. Consequently, FRA and the Project Team have conducted an EJ public and agency outreach program throughout the EIS process and this outreach will continue through the design and construction phases. Meetings were held with the public, local officials; public, local, and regional organizations; and government agencies, as well as with representatives of affected EJ communities along the evaluated alternative alignments.

Three Public Open Houses, as well as 17 community meetings have been held since the project's Notice of Intent was published. At each meeting, the public was given the opportunity to learn about the project development in-person and directly ask questions and engage in discussion with the Project Team.

The Project Team also attended several local community association meetings with EJ populations to present information on the project and respond to questions in smaller, neighborhood-focused settings. The Project Team attended meetings with:

- Alliance of Rosemont Community Organizations (ARCO) on June 17, 2015, at St. Edwards RCC
- Western District Community Council Meeting on August 27, 2015 at First Mount Calvary Baptist Church;
- Reservoir Hill Improvement Council, Inc. (RHIC) on September 1, 2015, at John Eager Howard Recreation Center

Since publication of the DEIS, FRA held three Public Hearings on February 1 and February 6, 2016 at Frederick Douglass High School and February 17, 2016 at Carver Vocational-Technical High School. The Public Hearings provided an opportunity for the public to comment on the Project. Comment themes that arose from the Public Hearings and responses to these comments are described in **Chapter VIII.** The comments from each hearing can be found in **Appendix I.**

Two Public Open Houses were also held on April 6, and April 16, 2016 at Frederick Douglass High School and Carver Vocational-Technical High School respectively, to communicate details of the Preferred Alternative to the public. The Public Involvement team worked with the Baltimore City Department of Planning to identify additional community associations within the Study Area, and to verify any changes to community association representative contact information.

The Project Team also attended additional local community association meetings with EJ populations based on their requests: Residents Against the Tunnel (RATT) on May 24, 2016 at the Beth AM Synagogue; No Boundaries Coalition on June 14, 2016 at St. Peter's Clavier Church; and Baltimore City Public Schools on June 16, 2016 at John Eager Howard Elementary School.

Direct mailings to residents in the Study Area expanded to include property owners within one-quarter mile of the build alternatives, as well as additional properties within the south portal area that could potentially be impacted by the Project. The project website continues to post meeting notices, project information, and avenues to comment. Publications including print advertisements, newsletters, and fliers have been distributed at transit hub locations, educational facilities, libraries, senior homes, shopping centers, laundromats, places of worship and other organizations.

4. Land Use and Zoning

Study Area land use and zoning are shown on **Figure VI-3** and **Figure VI-4**, respectively. The build alternatives would be bored to an average depth of 115 to 140 feet below the existing surface. As a result, surface land use impacts and zoning changes would be minimized and restricted to portal and ventilation facility locations.

The three build alternatives have similar proposed locations for the north portal. Construction of the north portal and North Ventilation Facility, on the east end of the build alternative alignments in the east Jones Falls area, would impact the Baltimore City Department of Transportation's North Avenue Facility Maintenance Yard. The north portal would pass below MTA's North Avenue Light Rail Station platform and/or adjacent tracks. The north portal would not cause a substantial land use change and would be consistent with existing land use and existing industrial zoning.

For all the build alternatives, a site located in the Reservoir Hill neighborhood at 900-940 West North Avenue is proposed for the Intermediate Ventilation Facility. The site is currently occupied by commercial businesses. As shown in **Figure VI-4**, the site is currently zoned as Community Business District (Baltimore Municipal Zoning Administration, 2015). For a comparison of environmental impacts from alternate ventilation facility sites considered, see **Section VI.P**.

Table VI-2 shows the calculated land use impacts specific to the Preferred Alternative, Alternatives 3A and Alternative 3C. The calculations include all land required by each alternative that is not in existing NEC right-of-way or city street right-of-way, including the North Ventilation Facility and Intermediate Ventilation Facility. The South Ventilation Facility would have no additional land use impact, beyond the conversion to transportation use required to construct the south portal, due to its location on the cut-and-cover portion above the south portal of the Preferred Alternative.

a. Alternative 1: No-Build

No changes to land use or zoning would occur as a direct result of Alternative 1: No-Build. Temporary construction impacts would also not occur under this alternative.

Table VI-2: Land Use Impacts

Land Use	Preferred Alternative (acres)	Alternative 3A (acres)	Alternative 3C (acres)
Residential	0.5	0.0	0.3
Industrial	2.6	2.4	6.1
Commercial	3.4	1.4	2.1
Transportation	5.8	5.4	5.9
Other	0.9	0.2	0.7
Total	**13.2**	**9.4**	**15.1**

Notes:
Other includes Undeveloped, Institutional, and Parks/Open space land uses.
Impact values do not include existing Amtrak ROW or existing street ROW.
Impact values include temporary and permanent construction impacts.
Intermediate Ventilation Facility impact values are included.

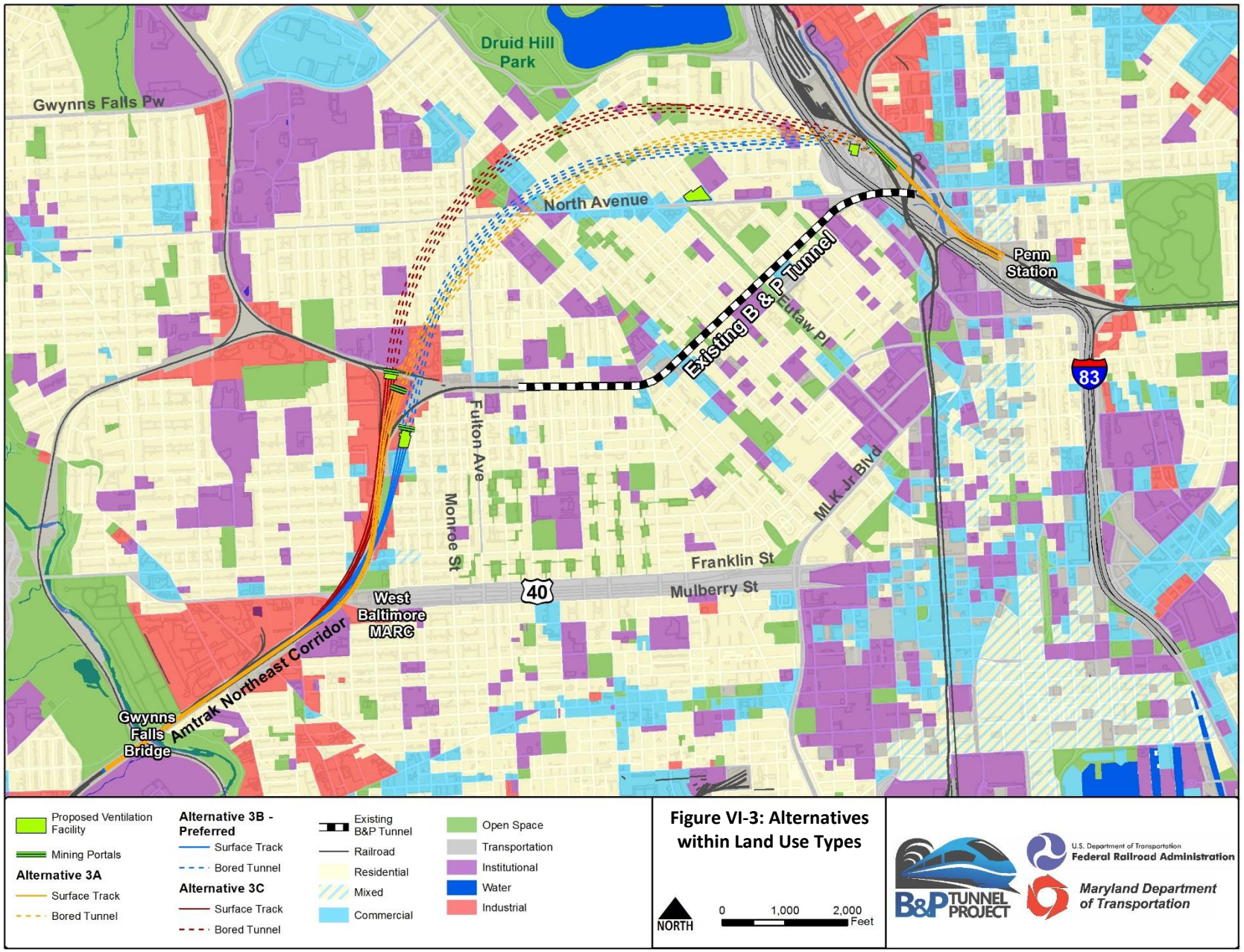


Figure VI-3: Alternatives within Land Use Types

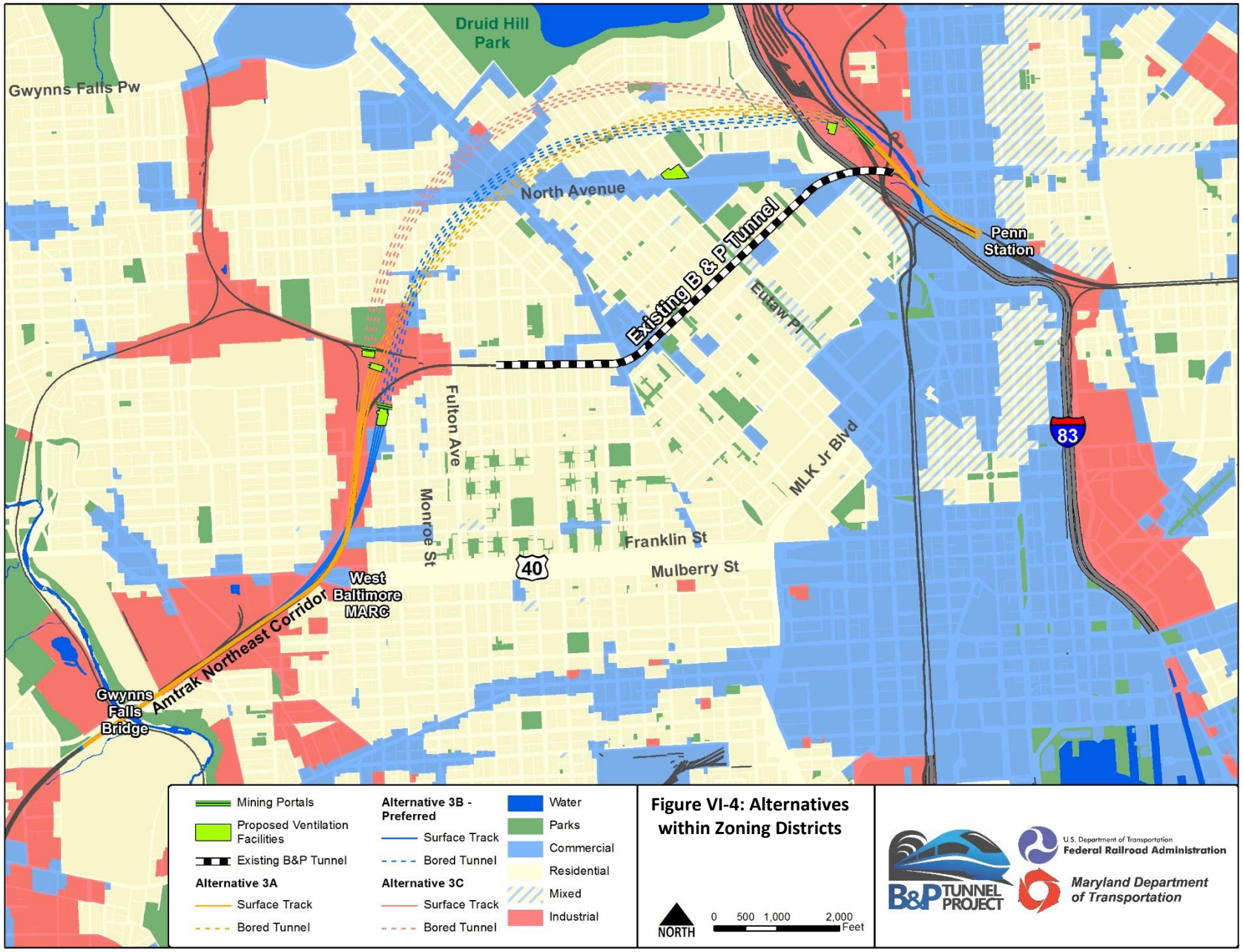


Figure VI-4: Alternatives within Zoning Districts

b. Preferred Alternative

Construction of the north and south portals and Intermediate Ventilation Facility of the Preferred Alternative would convert approximately 2.6 acres of existing industrial land use, approximately 3.4 acres of existing commercial land use, and approximately 0.5 acres of existing residential land use in the Midtown-Edmondson and Reservoir Hill neighborhoods to transportation land use. The Preferred Alternative would require a total of 13.2 acres of right-of-way, not including existing Amtrak or roadway ROW.

Changes in zoning may occur to land surrounding impacted land uses; however, any potential future alterations to existing zoning districts are under the purview of the City of Baltimore and cannot be predicted at this time.

Construction impacts to land use (included in **Table VI-2**) may include temporary conversion of land use to transportation while construction takes place.

c. Alternative 3A

Construction of the north and south portals and Intermediate Ventilation Facility of Alternative 3A would convert approximately 2.4 acres of existing industrial land use and 1.4 acres of commercial land use in the Bridgeview-Greenlawn, Midtown-Edmondson and Reservoir Hill neighborhoods to transportation land use. No residential land use would be required. Alternative 3A would require a total of 9.4 acres of ROW, not including existing Amtrak or roadway ROW.

Changes in zoning may occur to land surrounding impacted land uses; however, any potential future alterations to existing zoning districts are under the purview of the City of Baltimore and cannot be predicted at this time.

Construction impacts to land use (included in **Table VI-2**) may include temporary conversion of land use to transportation while construction takes place.

d. Alternative 3C

Construction of the north and south portals and Intermediate Ventilation Facility of Alternative 3C would convert approximately 0.3 acres of existing residential land use, 6.1 acres of existing industrial land use and 2.1 acres of commercial land use in the Bridgeview-Greenlawn, Midtown-Edmondson and Reservoir Hill neighborhoods to transportation land use. Alternative 3C would require a total of 15.1 acres of ROW, not including existing Amtrak or roadway ROW.

Changes in zoning may occur to land surrounding impacted land uses; however, any potential future alterations to existing zoning districts are under the purview of the City of Baltimore and cannot be predicted at this time.

Construction impacts to land use (included in **Table VI-2**) may include temporary conversion of land use to transportation while construction takes place.

5. Transportation

a. Alternative 1: No-Build

Alternative 1: No-Build would have minimal impacts to the existing road network and transportation services. The existing B&P Tunnel primarily runs below Wilson Street and Winchester Streets, where routine maintenance would take place. This would result in periodic disruptions to the roadway network and existing passenger and freight rail system to conduct repairs. Impacts to existing Amtrak, MARC, and NS freight operations would likely occur, including scheduled maintenance during off-peak hours and potential significant delays from emergency repairs. In the long-term, the frequency and magnitude of repairs required, and resulting impacts to Amtrak, MARC, and freight operations, would increase.

b. Preferred Alternative

The Preferred Alternative would cause long-term impacts to the roadway network in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods as a result of south portal construction. These impacts include the realignment of North Pulaski Street to connect to West Lanvale Street and the closure of West Mosher Street at North Payson Street. Additionally, the Preferred Alternative is anticipated to eliminate an estimated 85 on-street parking spaces.

Construction of ventilation facilities is not likely to cause long-term transportation impacts. The North Ventilation Facility and South Ventilation Facility would be located near or above their respective portals, and would not cause any long-term impacts to transportation outside of anticipated road realignments and loss of on-street parking for the north and south portals. The Intermediate Ventilation Facility would be located outside of existing transportation right-of-way.

The Preferred Alternative would require reconstruction of the West Baltimore MARC Station in order to align with the new trackway. The MARC Station would be shifted, but would still remain in the same general location between Franklin and Mulberry Streets and adjacent to existing West Baltimore MARC parking facilities. The Preferred Alternative would orient the reconstructed MARC station along a straighter curve, thus allowing the proposed station to be constructed with ADA compliant high-level platforms. A rebuilt station with high-level platforms would improve accessibility at the station relative to existing conditions and would be consistent with FTA and MTA goals of bringing the station into compliance with ADA requirements. The issues with the West Baltimore MARC Station platforms have been the subject of previous planning studies conducted by MTA.

The Preferred Alternative would benefit passenger rail through Baltimore City by providing more efficient travel and reduction of delays for users of Baltimore Penn Station and the West Baltimore MARC Station. The Preferred Alternative would also improve accessibility at the West Baltimore MARC Station as described above. Relative to Alternative 1, travel times (in minutes:seconds) between the Gwynns Falls Bridge and Baltimore Penn Station under the Preferred Alternative would improve by an estimated 2:31 (for Amtrak Acela), 2:32 (Amtrak Regional) and 1:42 (MARC) relative to existing conditions (average of northbound and southbound). The combined effects of better operational reliability with fewer delays, reduced NEC travel times, and increased accessibility at the West Baltimore MARC Station could encourage automobile users to use transit for commuter and intercity travel, ultimately reducing vehicle miles traveled.

Additional rail capacity will allow for a greater volume of trains to travel through the NEC, providing benefits to Amtrak Acela, Amtrak Regional, and MARC passenger trains. Additionally, the Preferred Alternative could allow for additional freight rail service; however, specific changes to freight operations cannot be determined and are assumed to remain the same as existing conditions based on current track agreements. Further discussion of potential impacts to freight rail is included in **Section VI.M**.

Construction of the Preferred Alternative would temporarily impact east-west travel along West Franklin and West Mulberry Streets, Edmonson Avenue, and West Lafayette Avenue and north-south travel along North Bentalou Street, Wheeler Avenue, North Warwick Avenue, and Franklintown Road. The duration and extent of these impacts is not currently known. A Maintenance of Traffic Plan would be developed during final design, as described in **Chapter VII**, to determine the full extent of roadway impacts and to minimize the impacts where possible.

Short-term impacts to bus, automobile, pedestrian and bicycle travel routes, including temporary street closures and detours, may occur during construction, particularly at the locations for the north and south portals and associated facilities including the North Ventilation Facility, South Ventilation Facility, and the Intermediate Ventilation Facility. The I-83 ramp off-ramp and McMechen Street MTA Entrance, adjacent to the proposed North Ventilation Facility, would experience a series of temporary, short closures during off-peak hours (i.e. overnight and weekends).

Other short-term impacts may include temporary disruption to the operation of the North Avenue Light Rail Station. Once construction has been completed, travel would resume to previous conditions.

Minor disruptions to Amtrak, MARC, and NS freight operations would occur during construction. Most work would be performed without affecting these NEC operations. However, the final cutover and track shifts from the existing tunnel to the new tunnel would cause impacts to NEC operations, such as temporary service disruption. Service at the West Baltimore MARC Station would likely be temporarily impacted during reconstruction of the station platforms.

c. Alternative 3A

Alternative 3A would intersect with West Lafayette Avenue and join the existing NEC tracks in the south portal area in the Rosemont and Midtown-Edmondson neighborhoods. Because West Lafayette Avenue crosses the NEC via an above-ground structure, Alternative 3A would not permanently impact bus, automobile, pedestrian, or bicycle travel across West Lafayette Avenue. Improvements to the West Lafayette Avenue Bridge under this alternative would also be consistent with Baltimore City plans for the bridge, which entails rehabilitating the bridge's deteriorated pier and spans (Baltimore Metropolitan Planning Organization, 2014). No permanent impacts to on-street parking would be required.

Alternative 3A would not require reconstruction of the West Baltimore MARC Station. The alternative, therefore, would not include a rebuilt station with ADA-accessible high-level platforms. The accessibility issues with the existing West Baltimore MARC Station platforms, which have been the subject of previous planning studies conducted by MTA, would not be addressed by Alternative 3A.

Alternative 3A would benefit passenger rail through Baltimore City by providing more efficient travel and reduction of delays for users of Baltimore Penn Station and the West Baltimore MARC Station. Relative to Alternative 1, travel times (in minutes:seconds) between the Gwynns Falls Bridge and Baltimore Penn Station under Alternative 3A would improve by an estimated 2:00 (for Amtrak Acela), 1:55 (Amtrak Regional) and 1:38 (MARC) relative to existing conditions (average of northbound and southbound). The combined effects of better operational reliability with fewer delays and reduced NEC travel times could encourage automobile users to use transit for commuter and intercity travel, ultimately reducing vehicle miles traveled.

Other impacts from Alternative 3A, including short-term impacts and minor disruptions to rail operations, would be similar to the Preferred Alternative as described above.

d. Alternative 3C

Alternative 3C would cause long-term impacts to the roadway network in the Rosemont neighborhood. The alternative would require permanent street closures of North Bentalou Street from Edmondson Avenue to Lauretta Avenue and Lauretta Avenue east of Wheeler Avenue near the intersection with North Bentalou Street. An estimated 35 on-street parking space would be eliminated.

Alternative 3C would require reconstruction of the West Baltimore MARC Station in order to align with the new trackway. This would result in a rebuilt platform in nearly the same location with ADA-accessible high-level platforms. This would result in similar benefits as the Preferred Alternative, described above.

Alternative 3C would benefit passenger rail through Baltimore City by providing more efficient travel and reduction of delays for users of Baltimore Penn Station and the West Baltimore MARC Station. Relative to Alternative 1, travel times (in minutes:seconds) between the Gwynns Falls Bridge and Baltimore Penn Station under Alternative 3C would improve by an estimated 2:30 (for Amtrak Acela), 2:23 (Amtrak Regional) and 1:44 (MARC) relative to existing conditions (average of northbound and southbound). The combined effects of better

operational reliability with fewer delays and reduced NEC travel times could encourage automobile users to use transit for commuter and intercity travel, ultimately reducing vehicle miles traveled.

Other impacts from Alternative 3C, including short-term impacts and minor disruptions to rail operations, would be similar to the Preferred Alternative as described above.

6. Businesses

The B&P Tunnel Project would have varying short-term and long-term impacts to businesses in the Study Area. These impacts include temporary construction impacts and permanent impacts.

Business displacements potentially occurring as a result of the Preferred Alternative are distributed among ZIP codes 21223 and 21217, shown on **Figure VI-5**. The displacements are also shown on the Environmental Resource Mapping in **Appendix A**.

Data on potentially affected businesses along the proposed alignment was collected via field research. The active or inactive statuses of the businesses, including storefront retail and industrial warehouses, regularly change and thus would be further considered during final design and the right-of-way acquisition phase.

a. Alternative 1: No-Build

The No-Build Alternative entails routine maintenance of the existing tunnel with no significant improvements. This would not cause any immediate impacts to businesses in the Study Area.

b. Preferred Alternative

The Preferred Alternative would result in a total of approximately 13 business displacements, including six at the south portal and seven at the Intermediate Ventilation Facility. These displacements would occur in the Bridgeview/Greenlawn, Midtown-Edmondson and Reservoir Hill neighborhoods. The potentially displaced businesses would be from a mix of Accommodation and Food Services, Retail Trade, Transportation, Warehousing, Professional Services and Healthcare Services. Construction of the Preferred Alternative would result in the following business displacements:

- Carpet Warehouse, LLC (2335 West Franklin Street);
- Grocery and Beauty Supply (2235 Edmondson Avenue);
- Pocopico Restaurant (2235 Edmondson Avenue);
- Wonder Enterprises, Inc. (2237 Edmondson Avenue);
- Storage Lot, Name Unknown (740 North Pulaski Street);
- Best Used Appliances (2126 Edmondson Avenue)
- Total Health Care Mt. Royal Health Center (922 West North Avenue)
- Sudsville Laundry (2000 Linden Avenue);
- Linden Bar & Liquor (904 West North Avenue);
- Always Learning Daycare Center (936 West North Avenue);
- Metropolitan Ob Gyn Associates (934 West North Avenue);
- Icetech Inc. (940 West North Avenue);
- LinkIT, LLC (940 West North Avenue);

Impacts to the Study Area would also potentially include loss of employment and loss of income to people working at these businesses.

The Preferred Alternative could cause temporary construction impacts to businesses, such as temporary disruptions or modifications to traffic, loss of parking and difficulty accessing businesses caused by roadway and sidewalk closures and disruptions in regular traffic circulation due to implementation of truck haul routes.

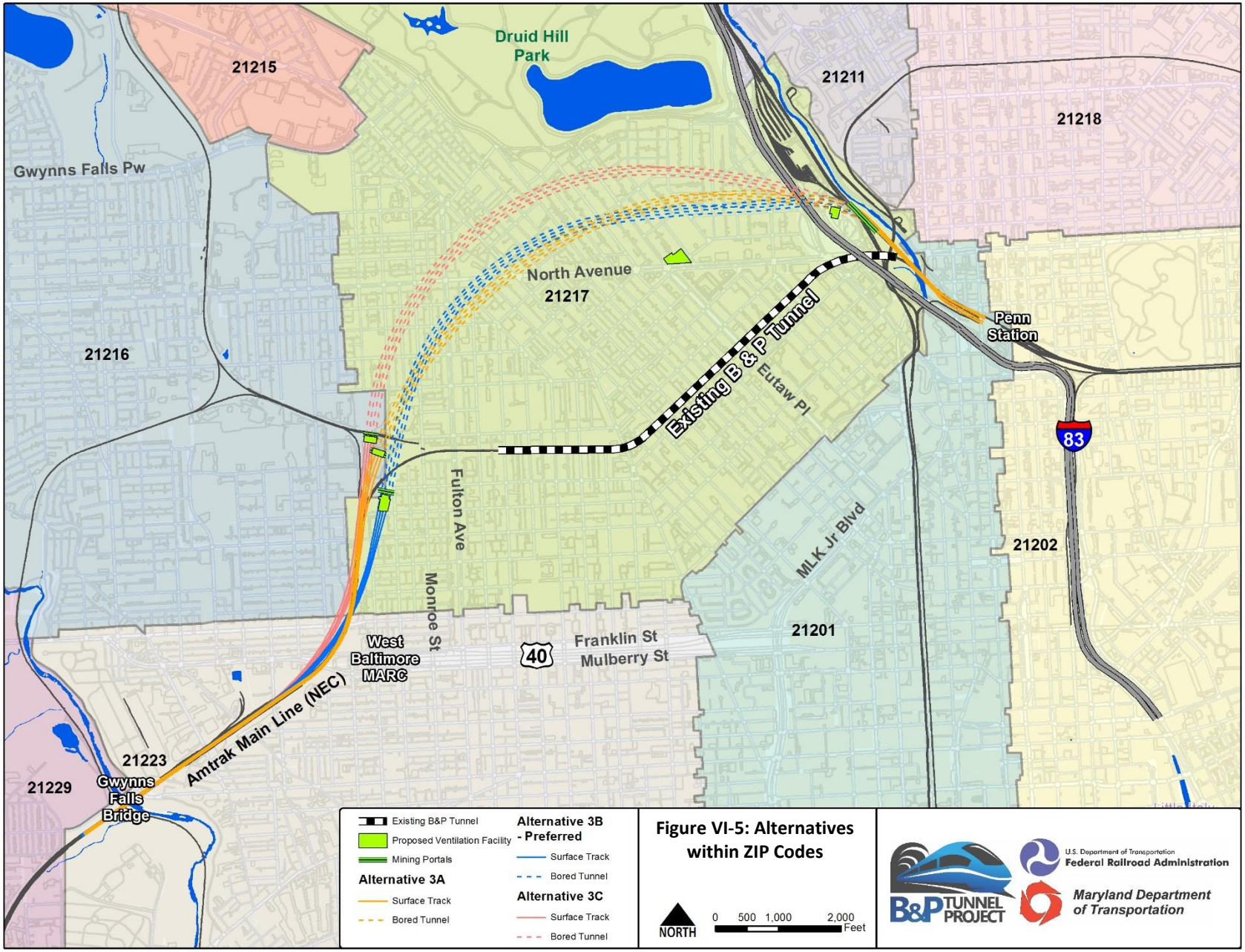


Figure VI-5: Alternatives within ZIP Codes

c. Alternative 3A

Alternative 3A would result in a total of approximately nine business displacements, including two at the south portal and seven at the Intermediate Ventilation Facility. The potential business displacements, located in Bridgeview-Greenlawn and Reservoir Hill, include:

- P. Flanigan Asphalt Company (1318 North Monroe Street)
- Warehouse, name unknown (2101 Riggs Avenue)
- Total Health Care Mt. Royal Health Center (922 West North Avenue)
- Sudsville Laundry (2000 Linden Avenue);
- Linden Bar & Liquor (904 West North Avenue);
- Always Learning Daycare Center (936 West North Avenue);
- Metropolitan Ob Gyn Associates (934 West North Avenue);
- Icetech Inc. (940 West North Avenue);
- LinkIT, LLC (940 West North Avenue);

Impacts to the Study Area would also potentially include loss of employment and loss of income to people working at these businesses. Temporary impacts would occur under Alternative 3A similar to those described under the Preferred Alternative above.

d. Alternative 3C

Alternative 3C would result in a total of approximately 16 business displacements, including nine at the south portal and seven at the Intermediate Ventilation Facility. The businesses potentially impacted under Alternative 3C are located in the Midtown-Edmondson, Penrose/Fayette and Reservoir Hill neighborhoods. They include:

- J.J. Adams Fuel Oil Company (2113 W. Lafayette Ave);
- Spincycle Coin Laundry (2200 Edmondson Ave);
- Grocery and Beauty Supply ((2235 Edmondson Avenue);
- Pocopico Restaurant (2235 Edmondson Avenue);
- Wonder Enterprises, Inc. (2237 Edmondson Avenue);
- Carpet Warehouse, LLC (2335 West Franklin Street)
- Warehouse, name unknown (2335 West Franklin Street);
- Warehouse, name unknown (2415 West Franklin Street);
- Price Busters Furniture (2415 West Franklin Street);
- Total Health Care Mt. Royal Health Center (922 West North Avenue)
- Sudsville Laundry (2000 Linden Avenue);
- Linden Bar & Liquor (904 West North Avenue);
- Always Learning Daycare Center (936 West North Avenue);
- Metropolitan Ob Gyn Associates (934 West North Avenue);
- Icetech Inc. (940 West North Avenue);
- LinkIT, LLC (940 West North Avenue);

Impacts would also potentially include loss of employment and loss of income to people working at these businesses. Temporary impacts would occur under Alternative 3C similar to those described under the Preferred Alternative above.

7. Economy

Alternative 1: No-Build would have very little direct short-term economic impact to the Study Area. In the long-term, Alternative 1: No-Build could result in economic losses to the Baltimore metropolitan region, as the B&P Tunnel would continue to exist as a bottleneck for passenger and freight rail service along the NEC, and would not support projected travel demand for high-speed regional and commuter passenger services.

The most immediate economic effect of the Preferred Alternative, Alternative 3A, or Alternative 3C would be the benefit from construction activity in the region, associated with new employment opportunities. Economic benefits from the build alternatives will be generated through the use of the rail service and market response to the additional rail activity accommodated by the proposed tunnel's greater capacity.

The build alternatives could also have implications for economic development in the West Baltimore area. These implications (both positive and negative) have been assessed in detail for Alternatives 3A, 3B and 3C in in the DEIS, and have been updated based on the Preferred Alternative (Alternative 3B). The relatively minor refinements to Alternatives 3A and 3C since the DEIS (described in **Chapter III**) did not result in changes to the DEIS assessment. The assessment is summarized below.

a. Economic Development Assessment of B&P Tunnel Alignment Options, West Baltimore

The Preferred Alternative or Alternative 3C would require reconstruction of the West Baltimore MARC station, which could potentially affect Transit Oriented Development (TOD) within the area. Alternative 3A would not directly impact the West Baltimore MARC Station. To further explore the potential TOD impacts associated with the Preferred Alternative and Alternative 3C, FRA and MDOT conducted an economic assessment to analyze the economic development opportunities each alternative may create.

The Preferred Alternative would shift the West Baltimore MARC Station slightly east and reconstruct the station along the new track alignment which will accommodate high level platforms meeting the ADA accessibility requirements. Alternative 3C would shift the MARC Station slightly west and would also allow ADA accessible platforms. Alternative 3A would not impact the MARC Station.

This analysis evaluated demographic data for a half-mile radius around the West Baltimore MARC Station. A half-mile radius was used because this distance is traditionally considered to be the walk shed from transit stops. Demographic data of the City of Baltimore and the Baltimore-Columbia-Towson Metropolitan Statistical Area (MSA) were also collected to provide a point of comparison and general idea of overall regional market conditions. Demographic conditions of the area are described below.

Between 2000 and 2010, populations within a half-mile radius of the West Baltimore MARC Station have declined by an average 1.9 percent. Between 2010 and 2015 the area experienced a 2.6 percent decrease. Across this same time period, average household sizes have also decreased from 2.91 to 2.83. The median age of the half-mile radius population is 41 years old. Generally, the educational attainment of the area is low; 28.7 percent of the population has less than a high school education, while 58.1 percent have a high school diploma. The racial composition of the area is mostly Black or African American (95.9 percent) and 1.6 percent identify as white. Currently, the median household income within the half-mile radius is $26,994, with a third of these households earning below $15,000, suggesting a high poverty rate within the area.

The majority of households within a half-mile radius of the West Baltimore MARC Station are renter-occupied (52.5 percent), with a median rent of $690 per month; 49.2 percent of the owner-occupied houses are worth between $60,000 and $124,999; the median home value is $74,878. Homes are generally older, with 90.7 percent being built in 1950 or earlier.

The average annual expenditure per household on retail goods was $11,829.88 (compared to $18,850.10 in Baltimore City and $31,097.52 in the MSA). 54.8 percent of people within the area are employed in the services industry. This is the largest employment industry in the area, the second largest being retail and trade, where 14.6 percent are employed.

The inventory of 38 retail buildings and rentable building area of 120,371 square feet has remained the same from 2010 to 2015. The vacancy rate has also remained the same at 1.5 percent annual average. There is minimal supply of office space within this area, which also has remained the same in the last five years. Rentable building area remained the same at 9,755 square feet and vacancy rate has remained zero percent in the last five years. The industrial market is the most prominent commercial use in the station area and has also experienced decreasing vacancy rates. Vacancy rate dropped significantly from 9.68 percent in 2010 to 6.63 percent in 2011; and from 4.9 percent in 2012 to 0.6 percent in 2013.

Over the past ten years, ridership for the West Baltimore MARC Station has been increasing. From 2005 to 2015, ridership at this station increased by 17.38 percent and had a 1.62 percent compound annual growth rate (CAGR). Despite a decrease in more recent years, the overall ridership trend is slowly growing at the West Baltimore MARC Station. The travel patterns of area residents show a majority of boardings in Washington DC, which had an average of 10,549 out of the 13,474 boardings in the 12 other stations on the MARC Penn Line, suggesting that the majority of passengers have Washington as their destination.

Looking at work locations of residents within the half-mile radius of the station, the majority work within the City of Baltimore or other locations not serviced by the MARC Penn Line. This suggests that the majority of commuters at the West Baltimore MARC station are not residents within the half-mile.

A previous study, the *West Baltimore MARC Transit-Centered Community Development Strategy* was conducted for West Baltimore in September, 2008 by the Maryland Department of Transportation, the West Baltimore Coalition and the City of Baltimore. This strategy recommended the following Economic Development Principles:

- Cultivate Large-Scale Economic Development Opportunities
- Attract/Develop Businesses/Facilities to Serve the Local Population
- Promote Small Business Development and Entrepreneurship
- Enhance Local Workforce, Employment Opportunities, and Local Business Participation

The build alternatives were evaluated in the context of these principles, as well as in light of the current demographic, economic and political changes that impact the neighborhoods. Details of the evaluation of these principles in relation to the alternatives are discussed below. The Project could potentially provide some development opportunities for the communities.

i. *Cultivate Large-Scale Economic Development Opportunities*

This principle focuses on redevelopment potential and inclusion of mixed-use developments to boost population of the area and spending power. It also suggests a marketing strategy for the area and removing barriers to investment for developers and businesses. The strategy specifically names several potential redevelopment sites including the MARC station parking lots, the Ice House and the Southwest Industrial Area (Warwick Triangle), which are all adjacent to the MARC station.

The build alternatives neither help nor harm this principle. Because the tracks will mostly follow the existing right-of-way, they are not anticipated to impact large portions of the developable land. The same challenges apply to land assembly and developing private and public partnerships.

ii. *Attract/Develop Businesses/Facilities to Serve the Local Population*

This principle emphasizes the inclusion of businesses and services that the neighborhoods identified as needs, including supermarkets, food stores, restaurants and cafes, a pharmacy, entertainment, dry cleaners, a hardware store, a bookstore, a pet store, medical offices, and public facilities such as a library, police substation, workforce development center, a community center, recreational/fitness facilities, playgrounds, charter schools and a business incubator.

The build alternatives neither help nor harm this principle. Potential positive impacts could occur if the Project temporarily increases employment opportunities for area residents, which could increase spending power and make it a more attractive business location.

iii. *Promote Small Business Development and Entrepreneurship*

This principle emphasized the importance of developing small business in addition to large-scale economic development for the area.

The build alternatives will not impact this principle. If, however, local, small businesses are required to be used for construction of the new tunnel, this could potentially enhance development of these services; as could a temporary construction period increase in spending on food, beverage and materials.

iv. *Enhance Local Workforce, Employment Opportunities, and Local Business Participation*

This principle emphasizes better jobs and wages for area residents, participation of local businesses and the importance of education for workforce development.

This principle can be most directly impacted by the proposed tunnel construction. Employing local tradespeople and companies and hiring at the level of the area neighborhoods for construction of the tunnel would directly impact area residents and would also enhance the potential for the other principles to have greater success. Implementing trade development programs in conjunction with construction would enable the economic impact of the construction-period employment to continue after tunnel construction is complete.

b. Transit-Oriented Development Potential

Transit-Oriented Development (TOD) is defined as "type of development that includes a mixture of housing, office, retail and/or other amenities integrated into a walkable neighborhood and located within a half-mile of quality transportation" (Reconnecting America, n.d.). The factors that make TOD successful from an economic development and real estate development standpoint include Market Demand; Fixed Guideway Transit; Available Land Sites; Community and Political Support and Joint Development/Partnership Potential. West Baltimore and the alternatives were evaluated, as applicable, qualitatively for the potential strengths and challenges of TOD.

i. *Market Demand*

West Baltimore is generally economically depressed, which creates difficulty in attracting new market-rate investment. It is also not located immediately proximate to an employment center which can add to this difficulty. In order to attract TOD, other measures would need to be taken in order for it to be successful, and it is less likely to be a value-capture on land than in other areas where demand is high and land is at a premium. Currently, MARC ridership is not sufficient to encourage development. Average daily ridership in 2015 was 773 passengers, in contrast to Odenton, a successful TOD, which had 2,730 and Baltimore Penn Station, which had 3,639 passengers. From a retail perspective, and considering a sale per square foot ratio of $250 per square foot, if every passenger spent $10 per day, totaling approximately $2 million in weekday sales, only 8,000 square feet

of retail space (the approximate size of one medium to large-sized restaurant or large convenience store or pharmacy) would be supported.

Based solely on the examined demographic and real estate data presented, there is unlikely to be sufficient demand for higher-end residential or office space without intervention.

ii. *Fixed-Guideway Transit*

The type of transit available can impact the nature of TOD development. In West Baltimore, the primary TOD opportunity is at the West Baltimore MARC station. MARC, though fixed-guideway transit, which tends to have a higher impact on property values and the ability to capture value from investment, is a commuter train, not used for intra-city transit and has overall low relative ridership. There is some potential however to boost ridership through spurring development if a market analysis suggests such. With the cancellation of the Red Line (another fixed-guideway system), which would have connected at the West Baltimore MARC, it is less likely to attract significant investment.

iii. *Available Land Sites*

The *West Baltimore MARC Transit-Centered Community Development Strategy* identified available land and redevelopment opportunities around the station (the American Ice Company building, the MARC station parking lots and adjacent industrial property). It is not known the extent or quantity of parcels that are likely to be impacted in a way that could suggest redevelopment by the build alternatives.

iv. *Community and Political Support*

Completion of the *West Baltimore Marc Transit-Centered Community Development Strategy* indicates there is community and stakeholder support for development of West Baltimore. However, no other plans, programs or initiatives were found since this strategy development.

The build alternatives do not necessarily impact the community or political support for TOD. However, if the Project provides opportunities and a positive experience in large-scale development in the area, it can set the stage for future positive relationships between the community and other external players such as developers, MARC, or other entities involved in the development of TOD.

v. *Joint Development/Partnership Potential*

There is the potential for Joint Development in the area, once the appropriate private partners and the right opportunity are found, which are impacted by the other factors previously mentioned. Through land acquisition or other assistance, it is possible that the Project could assist in this effort.

Overall, the build alternatives will not have a significant impact on the potential for TOD or area community economic development through real estate development. The primary impacts that the project can have on the community's economic health will come from:

- Project-related employment opportunities
- Construction-period spending, which has ripple effects throughout the economy
- If applicable, enhanced freight/passenger rail service (time savings and efficiency) though this is not as related to the immediate surrounding neighborhoods except to the extent these services are used by area residents/businesses.

Other large area projects, such as the University of Maryland BioPark, have successfully integrated in to the neighborhood through establishing relationships with area non-profits and community development corporations, working with educational programs and job-development. These are not the result of one particular alignment opportunity, nor are they a forgone conclusion to result from the tunnel construction, but

are available as potential tools for the project to positively impact the economy of the local community beyond the associated substantial infrastructure cost and the related expenditures on goods, labor and services.

c. Construction Impacts

A project of this magnitude will require specialized labor and equipment, and draw supplies and services from a large market. Therefore, net effects generated by construction activity from the build alternatives has been considered for two geographies: (1) the combined counties included in the Washington-Baltimore-Arlington Combined Statistical Area (CSA), Philadelphia-Reading-Camden CSA, Harrisburg-York-Lebanon CSA, Lancaster County, PA, Kent County, MD and Caroline County, MD, and (2) the State of Maryland. The economic effects are estimated in terms of net earnings and employment.

The economic impacts associated with construction expenditures are measured using regional multipliers from the Bureau of Economic Analysis (BEA) within the US Department of Commerce. Derived from the Regional Input-Output Modeling System, the so-called RIMS II multipliers measure the total change (direct, indirect, and induced effects) in output, employment, and earnings that results from an incremental change to a particular industry. Two sets of multipliers are used. The first set was constructed by BEA to reflect the combined counties noted above. The second set of multipliers corresponds to the State of Maryland's economy. The multipliers are based on the 2007 Benchmark Input-Output Table for the nation and 2013 regional accounts data; they represent the most updated version available at the time this analysis was prepared.

i. *Earnings and Employment Effects from Capital Expenditures*

Construction of a build alternative would represent a significant capital investment in the regional economy. This spending will increase the employment and earnings for the duration of the construction process. This section describes the spending and the anticipated economic impacts.

ii. *Capital Expenditures*

Table VI-3 summarizes the preliminary cost estimates for the Preferred Alternative, as well as Alternatives 3A and 3C. The cost estimate varies by alternative using six major cost categories: Construction, Force Account and Flagging, Right-of-way, Engineering, Design Development/Risk, and Escalation.

Table VI-3: Preliminary Design Cost Estimates

Category	Alternative 3A	Alternative 3B - Preferred Alternative	Alternative 3C
01- Construction Cost	$1,606.01	$1,735.45	$1,760.13
02 - Force Account and Flagging	$24.00	$24.00	$24.00
03 - Right-of-Way	$64.24	$69.41	$70.40
05 - Engineering Cost	$549.99	$584.94	$591.56
06 - Design Development / Risk	$707.24	$763.44	$773.72
08 - Escalation	$908.11	$980.93	$988.09
Total	**$3,859.59**	**$4,158.18**	**$4,207.90**

Costs in Millions of Dollars (2015). Based on preliminary estimates included in DEIS; does not include mitigation or Intermediate Ventilation Facility.

The economic impact of these expenditures will vary significantly by type and depends on the amount of locally produced goods and services embodied in the purchase.

Construction goods and services will be purchased in the local economy. Although every building material required for the project is not produced locally, the RIMS II multipliers reflect the supplier linkages for the industry, and thus account for this leakage from the local economy. These include costs within categories 01 and 08.

Boring Tunnel Machine purchases, by contrast, will not be purchased from the local economy as this very specialized type of machinery is not widely produced[1]. Therefore, it is assumed that no local labor is used to produce the machinery and no impact is generated by this purchase. These items, which fall within category 01, are included in costs shown in **Table VI-3**; however, they are excluded from the construction costs when estimating the economic impact of the project.

It is also assumed that **motor vehicle purchases** will not be purchased from the local economy. The Study Area does not appear to produce motor vehicles, limiting the potential impact this purchase can have. Thus, as no local labor is used to produce the vehicles, no local impact is generated by their purchase. Although there is likely to be some assembly required upon delivery of the vehicles and it is possible that a component of the vehicle might be made by a supplier in the Study Area, these possibilities represent a negligible share of the vehicles' cost and are excluded from this analysis. Vehicle costs fall within category 01 and are captured in **Table VI-3**; however, they are excluded from the construction costs when estimating the economic impact of the project.

The **Right-of-Way (ROW) expenditures** are for real property only. As there is no labor associated with the ROW expenditures, there is no economic impact to the pure land costs. Because of this, costs for ROW are excluded from the economic impact estimation.

The **Engineering and Design Development costs**, by contrast, are purchased in the local economy and thus have an impact in the local economy. These include costs within categories 02, 05, 06, and 08 identified in **Table VI-3**.

In sum, there are two types of capital expenditures that are expected to impact the economy: General Construction and Soft Costs. Construction goods and services are considered General Construction, and Engineering and Design Development costs are considered Soft Costs.

iii. *Funding Sources*

In order to isolate the potential economic effects of the project to the regional economy and to the State of Maryland, it is necessary to distinguish those resources that are either a) new to the economy and that would not be invested in the Study Area but for the Preferred Alternative; or b) those that would still be spent in the region with similar economic effects (for example, funds that would be allocated to other transportation construction projects in the region). The analysis assumes that the funding for the project represents 100% net new resources that are being invested in the region because of the project.

Applying the Multipliers for the Construction (General Construction) and Professional, Scientific, and Technical services (Soft Cost) industries to the amount of new funding that will be used for capital expenditures provides estimates of the net earnings and employment impacts generated by each alternative by region.

Construction and soft costs that will generate economic impacts are shown in **Table VI-4** and **Table VI-5**. Construction costs include total construction plus total escalation costs less the costs associated with the Tunnel Boring Machines (purchase, substation and switch gear, spare parts, and truck tractor and flatbed vehicle costs used to break down the Tunnel Boring Machine), management staff, vehicle purchase costs, and design development, engineering, and ROW escalation costs. Professional, Scientific, and Technical Service costs

[1] The analysis assumes that the associated substation and switch gear plus the spare parts will not be manufactured locally.

include Force Account and Flagging, Engineering, Design Development/Risk, and total escalation costs less construction and ROW escalation costs. **Table VI-6** shows the multipliers that are applied to the construction and soft costs shown in **Table VI-4** and **Table VI-5**, respectively, which are expected to impact the economy.

The interpretation of the RIMS II employment multipliers used in the analysis is as follows. The construction industry is used as an example.

The **Final Demand Earnings Multiplier** represents the total dollar change in earnings of households employed by all industries for each additional dollar of output delivered to final demand by the Construction industry. Based on the multipliers in **Table VI-6**, every $1 (in 2015 dollars) in construction goods and services delivered to final demand in the aggregated counties and in the State of Maryland yields $0.61 ($2015) and $0.59 ($2015) of earnings in all industries for the aggregated counties and for the State of Maryland, respectively.

Table VI-4: Construction Costs

	Alternative 3A	**Alternative 3B – Preferred Alternative**	**Alternative 3C**
01 Construction Cost	$1,606.01	$1,735.45	$1,760.13
Tunnel Boring Machines and Vehicle Purchase Costs excluded from the analysis	($67.12)	($67.12)	($67.12)
08 Escalation	$908.11	$980.93	$988.09
Escalation Design Development & Risk and Engineering Costs that are applied to Professional Services Costs and excluded from the construction costs	($370.07)	($396.90)	($401.87)
Escalation ROW excluded from the analysis	($12.06)	($13.03)	($13.21)
Construction Costs Used in the Analysis	**$2,064.87**	**$2,239.34**	**$2,266.01**

Costs in Millions of Dollars (2015). Based on DEIS cost estimates; does not include Intermediate Ventilation Facility or mitigation.

Table VI-5: Professional, Scientific, and Technical Services Costs

	Alternative 3A	Alternative 3B – Preferred Alternative	Alternative 3C
02 Force account and flagging	$24.00	$24.00	$24.00
05 Engineering Cost	$549.99	$584.94	$591.56
06 Design Development / Risk	$707.24	$763.44	$773.72
Design Development/Risk ROW costs excluded from the analysis	($9.64)	($10.41)	($10.56)
08 Escalation	$908.11	$980.93	$988.09
Escalation Costs applied to Construction Costs and are excluded from professional services costs	($525.98)	($571.01)	($573.00)
Escalation ROW excluded from the analysis	($12.06)	($13.03)	($13.21)
Professional, Scientific, and Technical Services Costs Used in the Analysis	**$1,641.66**	**$1,758.87**	**$1,780.60**

Costs in Millions of Dollars (2015). Based on DEIS cost estimates; does not include Intermediate Ventilation Facility or mitigation.

Table VI-6: RIMS II Multipliers by Region

Region	Industry	Final Demand	
		Earnings (dollars)	Employment (jobs)[2]
Aggregated Counties	Construction	0.6076	12.9737
	Professional, Scientific, and Technical Services	0.6654	12.659
State of Maryland	Construction	0.5931	12.249
	Professional, Scientific, and Technical Services	0.7457	14.0355

Source: Bureau of Economic Analysis, US Department of Commerce.

The **Final Demand Employment Multiplier** represents the total change in number of jobs that occur in all industries for each $1 million (in 2013 dollars) of output delivered to final demand by the Construction industry. Based on the multipliers in **Table VI-6**, every $1 million in construction goods and services delivered to final demand in the aggregated counties and in the State of Maryland (in 2013 dollars) yields 12.97 job years and 12.25 job years in all industries for the aggregated counties and for the State of Maryland, respectively. (A job year is equivalent to one job served for one year.)

iv. *Construction Impacts*

There are no long-term economic impacts generated by capital expenditures. Construction-related impacts last for the duration of the project's construction cycle from the third quarter of 2019 through the fourth quarter of 2026.

[2] As the Final Demand Employment Multiplier is based on 2013 data, the capital expenditure is deflated to 2013 dollars for this calculation. Non-defense direct capital deflator is used for construction impacts and the GDP (chained) price index is used for professional services impacts. Source: Office of Management and Budget, Table 10.1-Gross Domestic Product and Deflators used in the Historical Tables: 1940-2020, https://www.whitehouse.gov/omb/budget/Historicals.

v. *Earnings Impacts*

The results of construction spending on earnings in the aggregated counties from the Preferred Alternative would result in a total of $2,531 million ($2015), over an approximate 84-month construction period. The results of construction spending on earnings in the State of Maryland from the Preferred Alternative would result in a total of $2,640 million ($2015) over an approximate 84-month construction period. **Table VI-7** shows the net effects of total earnings from construction activity across the aggregated counties and for the State of Maryland, including Alternative 3A and 3C.

Table VI-7: Net Effects of Construction Activity on Total Earnings

Region	Industry	Total Earnings ($2015M)		
		Alternative 3A	Alternative 3B – Preferred Alternative	Alternative 3C
Aggregated Counties	Construction	$1,254.62	$1,360.62	$1,376.83
	Professional Services	$1,092.36	$1,170.35	$1,184.81
	Total	**$2,346.98**	**$2,530.98**	**$2,561.64**
State of Maryland	Construction	$1,224.68	$1,328.15	$1,343.97
	Professional Services	$1,224.19	$1,311.59	$1,327.79
	Total	**$2,448.86**	**$2,639.74**	**$2,671.76**

Costs in Millions of Dollars (2015).

vi. *Employment Impacts*

Employment impacts assessed would include one-time impacts that last for the duration of the Project's construction. The employment effects are expressed in job years, which are defined as one full-time job for one person for one year. For example, three job years are equal to three people doing a job for one year, or one person doing a job for three years.

The results of construction spending on employment in the aggregated counties from the Preferred Alternative would result in a total of 49,875 job years over the approximate 84-month construction period. The results of construction spending on employment in the State of Maryland from the Preferred Alternative would result in a total of 50,650 job years over the approximate 84-month construction period. **Table VI-8** shows the net effects of total employment from construction activity across the aggregated counties and for the State of Maryland, including Alternatives 3A and 3C.

Table VI-8: Net Effects of Construction Activity on Total Employment

Region	Industry	Total Employment (job years)		
		Alternative 3A	Alternative 3B – Preferred Alternative	Alternative 3C
Aggregated Counties	Construction	26,035	28,235	28,571
	Professional Services	20,197	21,639	21,907
	Total	**46,233**	**49,875**	**50,478**
State of Maryland	Construction	24,581	26,658	26,975
	Professional Services	22,394	23,992	24,289
	Total	**46,975**	**50,650**	**51,264**

d. Economic Effects beyond Construction

The tunnel is used by Amtrak and MARC's commuter rail services. Because of the central role of the NEC (of which the tunnel is a key asset) in the region's transportation network, the range of potential categories of economic effects extends to congestion relief to the other modes that operate in the Northeast region and which connect to the NEC. The benefits of the build alternatives thus extend beyond intercity rail passengers to existing and future rail commuters and highway drivers. Beyond the immediate construction impacts described above, there are four broad classes of benefits: 1) Costs avoided; 2) User and environmental benefits; 3) Capacity on other modes or services; and 4) Market response. The discussion below identifies and describes qualitatively these potential economic effects.

i. *Costs Avoided*

The new tunnel will have a modern design that accommodates current train specifications and operating standards, as well as greater capacity. This feature could benefit rail travelers and shippers whose goods utilize the tunnel, as well as Amtrak, MARC and NS. These benefits are realized through the following potential economic effects:

- Ability to avoid disruptions to existing rail service during construction if new tunnels are built before the existing one is rehabilitated or taken out of service.
- The avoidance of tunnel maintenance costs (may be offset by the expansion of tunnel capacity).
- Operating cost savings for rail service providers who now avoid delays.
- Greater redundancy in the event of a disruption to rail service (freight and passenger rail).

ii. *User and Environmental Benefits*

The modern designed and expanded tunnel will remove a chokepoint along the NEC that will allow service providers to offer improved service. These user benefits have economic value. User benefits can be realized as commuters, business travelers and tourists travel the corridor more efficiently and with greater safety. The capacity benefits operations in two ways: ability to accommodate higher volumes, and greater flexibility to accommodate trains of different sizes and speeds. Because of operating rules and differences in speed, one Acela train takes up the same rail network capacity as two to three extended peak commuter slots. To the degree that greater numbers of rail travelers can be accommodated, auto travelers have the ability to divert from autos to rail. As operations become more efficient, environmental benefits are generated through the avoidance of emissions and through energy savings. These are recurring benefits that support the region's economy over time:

- Improved rail service reliability
- Faster rail travel speeds
- Ability to accommodate greater intercity passenger rail travel
- Ability to accommodate greater commuter rail service, and
    - Safety
    - Travel cost savings
    - Reduced auto emissions and energy savings
- The two NS freight trains would experience greater reliability.

iii. *Capacity on Other Modes/Rail Services*

Highway travelers who divert to rail will free up capacity on the road system. This additional capacity has value for the auto travelers who remain on the highway. The degree of capacity gain will depend on the mix of services that use the tunnel. Intercity travel is a comparatively small share of the overall regional highway travel market.

The degree to which rail traffic shifts from other congested parts of the rail network to utilize the tunnel will eliminate conflicts between passenger and freight services, as well as between different types of passenger rail services that travel at different speeds.

These are recurring benefits that apply to both the surrounding Baltimore region as well as a multistate region because of the impacts on intercity travel and the national freight rail network:

- As new auto or rail travelers who are accommodated through the greater tunnel capacity and associated expansion of service divert to rail, this frees up capacity on the region's roads, potentially benefiting non-rail travelers by alleviating traffic congestion.
- The degree to which passenger service can be rerouted through the expanded tunnel frees up capacity elsewhere in the rail network, potentially benefiting freight operations in the region.

iv. *Market Response*

The magnitude and type of economic development response that could occur due to alleviating the current tunnel chokepoint on the corridor depends on how the additional capacity is utilized. Greater intercity connectivity and service has one type of impact; greater commuter service has another. To date, no service plan for how the tunnel will be used is available. However, recent work for the NEC FUTURE Tier 1 EIS asked stakeholders in Baltimore and elsewhere along the NEC about whether and how improved rail service could benefit their economy[3]. The following summarizes some of the key points from that work relevant to the tunnel.

- Stakeholders all along the NEC uniformly valued reliability of service as the most important or among the leading qualities of service. Stakeholders in the southern (including Baltimore) and central parts of the corridor indicated that travel time was secondary, and that frequency of service and connectivity to target markets were the most important qualities needed for enhanced rail service to spur development in their communities. The improved tunnel supports all of these performance objectives.
- Stakeholders maintained that increasing connections to the north invites businesses to Baltimore. People can get to locations north, which provides an opportunity for existing industries to grow because they are more accessible.
- Economic development stakeholders reported difficulty attracting young workers to Baltimore—a challenge to technology growth in the city. Greater accessibility and connectivity to other nearby cities on the corridor could expand this labor market.

[3] NEC FUTURE TIER 1 EIS, Economic Development Workshops – Summary, July 2015. Accessed November 29, 2015 at http://www.necfuture.com/pdfs/2015_0720_economic_development_workshop_summary.pdf

8. Neighborhoods and Community Facilities

Neighborhood and community facility impacts were assessed in terms of potential impact to neighborhood character, community cohesion and isolation. This evaluation determined if the build alternatives would bisect neighborhoods, impact community relationships or attachments to neighbors, groups, and institutions built as a result of continued association over time, isolate one or more portions of a neighborhood from others, or create a barrier that would isolate one neighborhood from another.

a. Alternative 1: No-Build

As the existing conditions under this alternative would not change, no impacts to neighborhoods and community facilities would occur.

b. Preferred Alternative

Neighborhood and community facility impacts from the Preferred Alternative are shown on **Figure VI-6** and **Figure VI-7**. The alignment for the Preferred Alternative would be bored underground; therefore, neighborhood and community facility impacts would primarily occur at the north and south portal and ventilation facility locations.

The north portal and North Ventilation Facility would be constructed in the east Jones Falls Area neighborhood on existing transportation right-of-way, which includes Baltimore City Department of Transportation's North Avenue Facility Maintenance yard and MTA's North Avenue Light Rail Station. Construction of the north portal and North Ventilation Facility in this area would blend with the industrial transportation character of the existing land use. Therefore, construction of the north portal and North Ventilation Facility would not result in any impact to neighborhood character or cohesion, and would not cause neighborhood isolation.

The Intermediate Ventilation Facility is proposed a site at 900-940 West North Avenue, located in the Reservoir Hill neighborhood along the commercial North Avenue corridor. The Intermediate Ventilation Facility would have visual impact to community character, as well as direct impacts to existing land uses. For comparison of the environmental impacts of other Intermediate Ventilation Facility sites considered, see **Section VI.P**.

The parcels at 900-940 West North Avenue contain seven businesses whose services include healthcare, professional services and daycare. Construction of the Intermediate Ventilation Facility on this site would have some impact to the community. The Intermediate Ventilation Facility would displace existing businesses that currently service the community in a commercial district. Replacing these businesses with a ventilation facility could lead to less community cohesion within the Study Area. These services would no longer be proximal to each other and community ties could potentially be affected or lost. The businesses could potentially be relocated near their existing location, which would reduce potential impacts to community cohesion.

The south portal and South Ventilation Facility of the Preferred Alternative would be located slightly to the east of the existing NEC railway in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods. Construction of the south portal would have impacts to community facilities, residential properties, and businesses, which would result in impacts to neighborhood character and community cohesion.

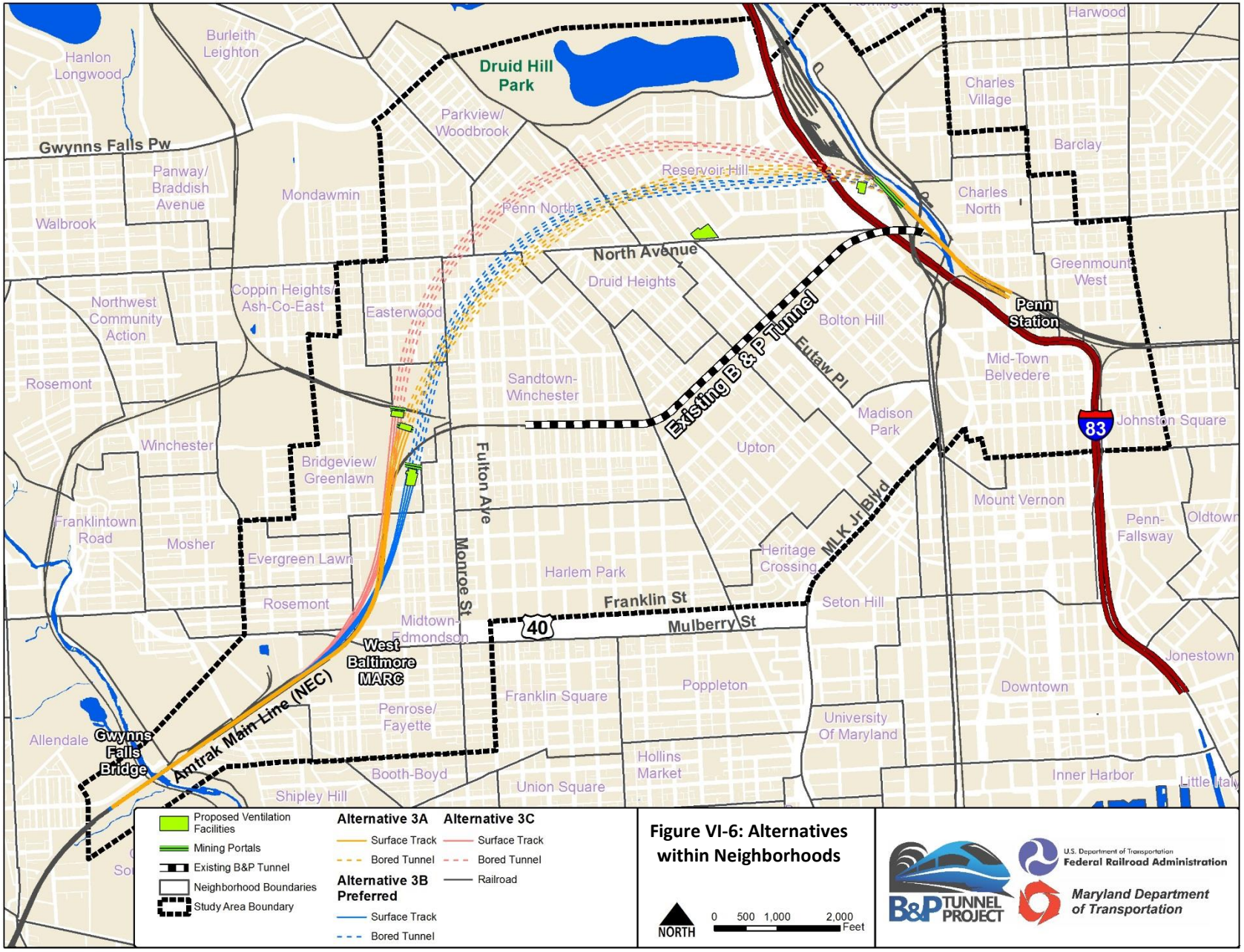


Figure VI-6: Alternatives within Neighborhoods

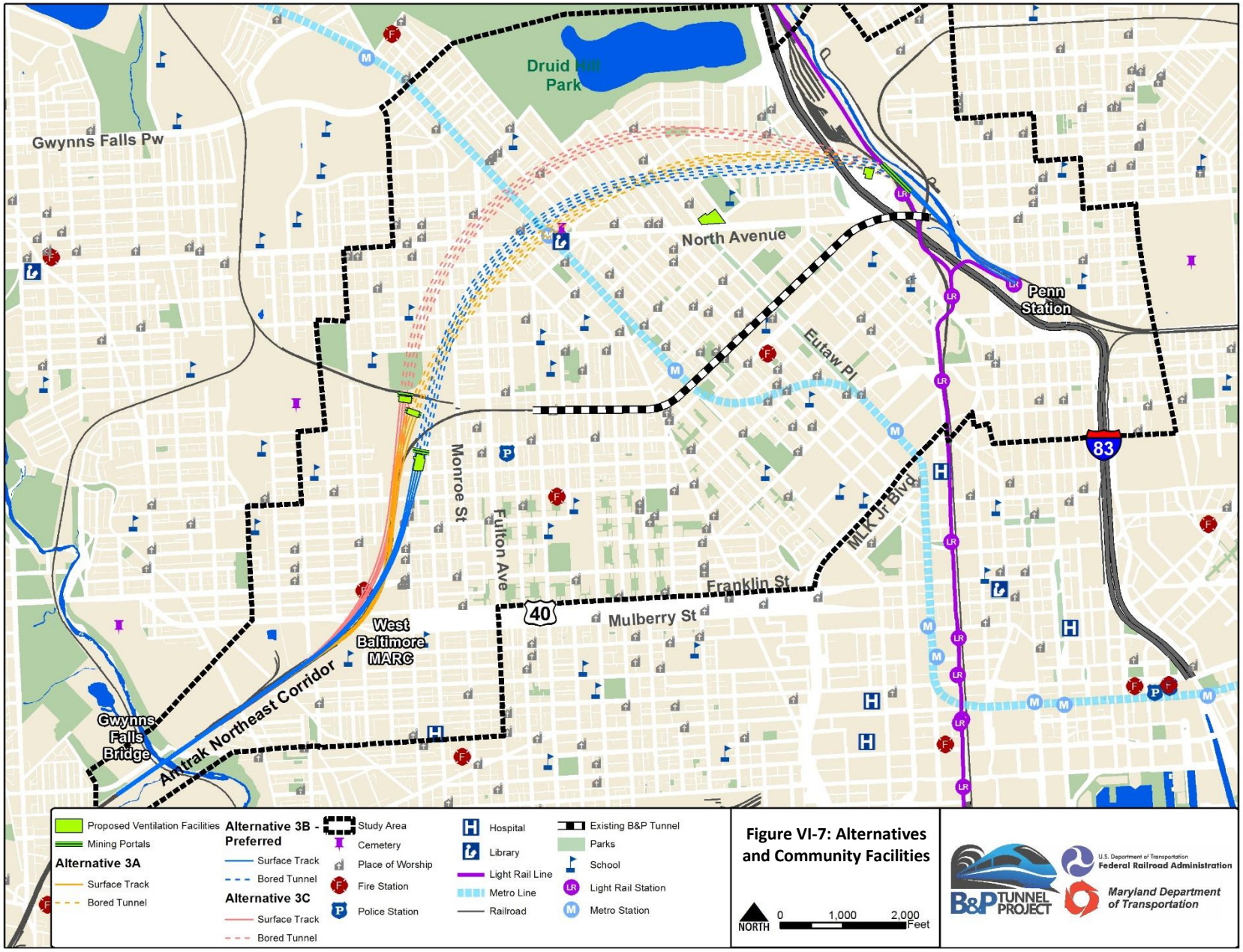


Figure VI-7: Alternatives and Community Facilities

Four places of worship, all located in the Midtown-Edmondson neighborhood would be displaced as a result of south portal construction, shown in **Table VI-9**. The places of worship are located at the edges of residential blocks that are adjacent to industrial land use in the Midtown-Edmonson neighborhood. The displacement of these places of worship would disrupt their respective operations, resulting in potential impacts to community services and networks. Existing community ties would likely be lost if facilities are not relocated within the same neighborhoods.

Table VI-9: Potential Community Facility Impacts

Community Facility	Address
Faith Christian Worship Center	700 N Pulaski Street
The Old Time Way Church of Deliverance	2100 W Lanvale Street
Freedom Church and Ministries	813 N Pulaski Street
Supreme Harvest Temple Ministries	2031-41 W Lafayette Avenue

In addition to the four displaced places of worship, the Preferred Alternative would displace 22 residential properties and six commercial and industrial properties, as a result of south portal construction, causing conversions in land use from industrial, residential, and commercial, to transportation. The conversion of residential and commercial land uses to transportation land use would alter the character of this majority residential urban neighborhood. However, the Preferred Alternative would roughly parallel the existing NEC railway and would not create new physical divisions or isolated pockets within the neighborhood.

Construction of the South Ventilation Facility is proposed to be located on the cut-and-cover portion above the south portal. The South Ventilation Facility structure would cause some visual impact to community character, in addition to neighborhood cohesion impacts caused by construction of the south portal.

The neighborhoods surrounding the surface portions of the Preferred Alternative including Jones Falls, Bridgeview/Greenlawn, Midtown-Edmondson and Reservoir Hill, would experience short-term construction impacts. These may include short-term lane or roadway closures causing changes in travel patterns and access to businesses, temporary closure of parking areas, possible noise and vibration disturbances, dust, and visual impacts from construction equipment and signing.

No parks or recreation areas would be directly impacted by right-of-way acquisition for the Preferred Alternative.

c. Alternative 3A

The alignment for Alternative 3A would be bored underground; therefore, neighborhood and community facility impacts would primarily occur at the north and south portal and Intermediate Ventilation Facility locations. The impacts from the north portal and Intermediate Ventilation Facility would be identical to those described under the Preferred Alternative above.

The south portal and South Ventilation Facility of Alternative 3A would be located near the existing NEC railway in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods. Construction of the south portal would have impacts to two businesses including the P. Flanigan asphalt facility, which would result in impacts to neighborhood character and community cohesion. No residences or community facilities would be impacted by the south portal of Alternative 3A. Construction of the South Ventilation Facility is proposed to be located on the cut-and-cover portion above the south portal. The South Ventilation Facility structure would cause some visual impact to community character, in addition to neighborhood cohesion impacts caused by construction of the south portal. No parks or recreation areas would be directly impacted by right-of-way acquisition for Alternative 3A.

Temporary construction impacts to surrounding neighborhoods such as Jones Falls, Bridgeview/Greenlawn, Midtown-Edmondson, and Reservoir Hill would occur for Alternative 3A as described above under the Preferred Alternative.

d. Alternative 3C

The alignment for Alternative 3C would be bored underground; therefore, neighborhood and community facility impacts would primarily occur at the north and south portal and Intermediate Ventilation Facility locations. The impacts from the north portal and Intermediate Ventilation Facility would be identical to those described under the Preferred Alternative above.

The south portal and South Ventilation Facility of Alternative 3C would be located west of the existing NEC railway in the Bridgeview-Greenlawn neighborhood. Construction of the south portal would have impacts to community facilities, residential properties and businesses, which would result in impacts to neighborhood character and community cohesion. One community facility, the Fire Department Engine Co. 36, would be displaced by Alternative 3C. The south portal for Alternative 3C would require nine business displacements and 12 residential building demolitions. Construction of the South Ventilation Facility is proposed to be located on the cut-and-cover portion above the south portal. The South Ventilation Facility structure would cause some visual impact to community character, in addition to neighborhood cohesion impacts caused by construction of the south portal. No parks or recreation areas would be directly impacted by right-of-way acquisition for Alternative 3C.

Temporary construction impacts to surrounding neighborhoods such as Jones Falls, Bridgeview/Greenlawn, Rosemont, Midtown-Edmondson, and Reservoir Hill would occur for Alternative 3C as described above under the Preferred Alternative.

9. Visual and Aesthetic Resources

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 to identify visual and aesthetic quality within the Study Area. The discussion of visual and aesthetic resources in this chapter focuses on the assessment methodology and anticipated changes in the Study Area as a result of the Project.

a. Methodology

The FRA Procedures for Considering Environmental Impacts provide general guidance for identifying 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. The Project viewshed is described in **Chapter V**.

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. **Chapter V** describes existing visual quality in the Project viewshed.

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 based on the following 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.

i. Nature of Project Components

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 neither on a primary roadway or pedestrian route nor is located in an area of already compromised visual effect, nonadjacent to public space.

High Visual Effect: High visual effect occurs if the Project is adjacent to residential, commercial, or institutional properties is highly visible from the primary roadway, retail locations, public space or residences; and is 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 V-10,** below.

Table VI-10: 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 adjoining the Project study corridor; generally includes residents, business owners, and other property owners or renters.	High

b. Changes to existing viewsheds as a result of the Project

The B&P Tunnel Project would result in visual and aesthetic quality changes to the surrounding environment, during and after construction. The following analysis assesses changes to existing viewsheds and is based on the methodology presented in **Section V.A.7**. A summary of effects to visual and aesthetic resources from the No-Build Alternative and the build alternatives is presented in **Table VI-11**.

Table VI-11: Summary of Effects to Aesthetics and Visual Resources

Alternative	Project Components	Contextual Compatibility	Change in Visual Landscape	Viewer Sensitivity	Overall Visual Effect
Alternative 3A (52 Percent underground)	North Portal, North Ventilation Facility, and trackway	Low visual effect	Low visual effect	Low general sensitivity	MEDIUM
	Intermediate Ventilation Facility	High visual effect	Medium visual effect	High general sensitivity	
	South Portal and South Ventilation Facility	Low visual effect	Low visual effect	High general sensitivity	
	South Trackway	Low visual effect	Low visual effect	Low general sensitivity	
Preferred Alternative (56 Percent underground)	North Portal, North Ventilation Facility, and trackway	Low visual effect	Low visual effect	Low general sensitivity	HIGH
	Intermediate Ventilation Facility	Medium visual effect	Medium visual effect	High general sensitivity	
	South Portal and South Ventilation Facility	Medium visual effect	High visual effect	High general sensitivity	
	South Trackway	Medium visual effect	Medium visual effect	Low general sensitivity	
Alternative 3C (58 percent underground)	North Portal, North Ventilation Facility, and trackway	Low visual effect	Low visual effect	Low general sensitivity	HIGH
	Intermediate Ventilation Facility	High visual effect	Medium visual effect	High general sensitivity	
	South Portal and South Ventilation Facility	Medium visual effect	High visual effect	High general sensitivity	
	South Trackway	Medium visual effect	Medium visual effect	Low general sensitivity	

a. Alternative 1: No-Build

There would be no long- or short-term impacts to visual and aesthetic resources associated with this alternative. The existing visual conditions would not change.

b. Preferred Alternative

A majority of the Preferred Alternative would be an underground tunnel and would not be visible. Changes to visual and aesthetic resources would result from three project components: tunnel portals, ventilation facilities, and the new tracks and railroad bed at each end of the portals (trackway). Changes are assessed in terms of low, medium or high visual effect for contextual compatibility, changes to visual landscape, and viewer sensitivity. Measures for low, medium or high visual effect are described in detail in **Chapter V, Section A.8.** These changes would occur within four viewsheds along the general project corridor, including:

- The location of the new northern trackway, the north portal, and North Ventilation Facility in the east Jones Falls area;
- The location of the Intermediate Ventilation Facility in the Reservoir Hill neighborhood;
- The location of the south portal and South Ventilation Facility in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods; and
- The new trackway south of the south portal location.

The north portal and North Ventilation Facility would be in the east Jones Falls area; the trackway located north of the north portal is also located in the east Jones Falls area, where it ties into the existing NEC trackway. For the Preferred Alternative, introduction of the north portal, North Ventilation Facility, and trackway into the respective viewshed would result in overall low impacts to the viewshed. The north portal, North Ventilation Facility, and trackway are visually compatible with the existing transportation land use context. The components would not obstruct the existing transportation-heavy landscape from residential, commercial, or institutional properties, resulting in a low visual effect. Finally, the components would have low general visual sensitivity, as the primary viewer groups at this location are transitory. The change in visual and aesthetic resources at the location for the north portal and North Ventilation Facility for the Preferred Alternative is shown in **Chapter IV.** See **Figures IV-23** through **IV-27**.

The Intermediate Ventilation Facility would be located in the Reservoir Hill neighborhood along the North Avenue corridor. Introduction of the Intermediate Ventilation Facility would result in medium impacts to the viewshed. The Intermediate Ventilation Facility would be visually compatible with the existing commercial corridor. The Intermediate Ventilation Facility would have high general visual sensitivity, as the primary viewer groups at this location are permanent residents as well as transitory viewer groups.

The south portal and South Ventilation Facility would be adjacent to industrial buildings and existing tunnel trackway in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods; the trackway railroad south of the south portal would also be located in this area, where it ties into the existing NEC trackway. Introduction of the south portal and South Ventilation Facility into the respective viewshed would result in overall high impacts to the viewshed. While the components would be partially located within and adjacent to existing industrial and transportation land uses, they would also be located within existing residential land use, and would not be visually compatible with this land use. The components would result in a medium visual effect, as they would obstruct the existing visual landscape from residential properties that are proximal, but not directly adjacent to, the existing B&P Tunnel. Finally, the components would have high general visual sensitivity, as the primary viewer groups, including residents and business owners, are permanent.

The trackway located south of the south portal would have overall medium visual effects from the surrounding transportation right-of-way viewshed. The trackway would cross below a modification of the existing roadway bridge at West Lafayette Avenue, and would cross below the existing roadway bridge at Edmondson Avenue; therefore, it would not change any elements of the existing visual landscape. Viewer sensitivity is low due to the transitory nature of the primary viewer groups.

The change in visual and aesthetic resources at the location for the south portal and South Ventilation Facility under the Preferred Alternative is shown in **Chapter IV.** See **Figures IV-17** through **IV-22**.

c. Alternative 3A

The northern trackway, north portal and North Ventilation Facility would be in the east Jones Falls area. Under Alternative 3A, introduction of the north portal, North Ventilation Facility, and trackway into the respective viewshed would result in overall low impacts to the viewshed.

The north portal, North Ventilation Facility, and trackway are visually compatible to the existing transportation land use context. The components would not obstruct the existing transportation-heavy landscape from residential, commercial, or institutional properties, resulting in a low visual effect. Finally, the components would have low general visual sensitivity, as the primary viewer groups at this location are transitory.

The impacts from the Alternative 3A Intermediate Ventilation Facility would be identical to those described under the Preferred Alternative.

The south portal and South Ventilation Facility would be adjacent to industrial buildings and existing tunnel trackway in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods; the trackway south of the south portal is also located in this area, where it ties into the existing NEC trackway. Introduction of the south portal, south portal ventilation plant, and trackway into the respective viewshed would result in low visual effect with respect to context and landscape changes. These components would occur only within existing industrial and transportation land uses, and would be visually compatible with these land uses. The components would not cause new obstructions from residential, commercial, or institutional properties within the existing landscape, resulting in a low visual effect. The components would have high general visual sensitivity, as the primary viewer groups, including residents and business owners, are permanent.

The trackway located south of the south portal would have low visual effects. The trackway would tie in to the existing transportation right-of-way used by the B&P Tunnel as it crosses below the existing roadway bridges at West Lafayette Avenue and Edmondson Avenue; therefore, it would not change any elements of the existing visual landscape. Viewer sensitivity is low due to the transitory nature of the primary viewer groups.

d. Alternative 3C

The northern trackway, north portal and North Ventilation Facility would be in the east Jones Falls area. Under Alternative 3C, introduction of the north portal, North Ventilation Facility, and trackway into the respective viewshed would result in overall low impacts to the viewshed.

The north portal, North Ventilation Facility, and trackway are visually compatible to the existing transportation land use context. The components would not obstruct the existing transportation-heavy landscape from residential, commercial, or institutional properties, resulting in a low visual effect. Finally, the components would have low general visual sensitivity, as the primary viewer groups at this location are transitory.

The impacts from the Alternative 3C Intermediate Ventilation Facility would be identical to those described under the Preferred Alternative.

The south portal and South Ventilation Facility would be adjacent to industrial buildings and existing tunnel trackway in the Bridgeview/Greenlawn, Rosemont and Midtown-Edmondson neighborhoods; the trackway railroad south of the south portal would also be located in this area, where it ties into the existing NEC trackway. Introduction of the south portal and South Ventilation Facility into the respective viewshed would result in overall high impacts to the viewshed. While the components would be partially located within and adjacent to existing industrial and transportation land uses, they would also be located within existing residential land use, and would not be visually compatible with this land use. The components would result in a medium visual effect, as they would obstruct the existing visual landscape from residential properties that are proximal, but not directly adjacent to, the existing B&P Tunnel. Finally, the components would have high general visual sensitivity, as the primary viewer groups, including residents and business owners, are permanent.

The trackway located south of the south portal would have overall medium visual effects from the surrounding transportation right-of-way viewshed. The trackway would cross below a modification of the existing roadway bridge at West Lafayette Avenue, and would cross below the existing roadway bridge at Edmondson Avenue; therefore, it would not change any elements of the existing visual landscape. Viewer sensitivity is low due to the transitory nature of the primary viewer groups.

10. Mitigation

Coordination among federal, state, and local agencies, as well as community members, has been continuous throughout the B&P Tunnel Project. Continued coordination among these agencies and community members, including affected property owners, would continue to promote the Project's compatibility with local land use and transportation plans. Changes to land use and zoning from the acquisition of right-of-way as well as potential short and long-term impacts to road and transit infrastructure would be coordinated with the City of Baltimore and MTA.

Specific actions proposed as part of the Preferred Alternative to mitigate socioeconomic impacts are detailed below, organized by the categories of Community, Economy, and Transportation. Although the following mitigation measures correspond with the Preferred Alternative, similar mitigation measures would be appropriate to mitigate socioeconomic impacts of Alternative 3A and Alternative 3C. The outcomes and effectiveness of mitigation efforts will be monitored by a designated lead agency, which will implement detailed tracking procedures and provide public reporting. The lead agency will be designated during the final design phase. For a list of all Preferred Alternative mitigation actions and additional detail, see **Chapter VII**.

a. Community

The Preferred Alternative includes establishment of a fund to support community development within affected communities. Examples of community development activities include but are not limited to economic development projects, installation of public facilities, community centers, public services, small business assistance, or homeowner assistance. The fund will provide grant money for operating expenses and capital projects to not for profit community development organizations that serve communities within the corridor. Funds will be awarded to organizations that are active within ¼ mile of the Project alignment that meet published eligibility criteria.

Property acquisition activities, including relocations, will be performed in accordance with the *Uniform Relocation Assistance* and *Real Properties Acquisition Act of 1970* (Uniform Act) as amended. Displaced people and businesses may be eligible for benefits under Maryland's Relocation Assistance Program. Benefits could include: advisory services, moving and reestablishment costs and other payments and services as provided by law. The owner of a displaced business is entitled to receive payment for actual reasonable expenses incurred in moving the business, or personal property; for actual direct losses of tangible personal property; and for actual reasonable expenses incurred in the search for a replacement site. For larger businesses impacted by the Preferred Alternative, finding suitable replacement sites could be more difficult. Fair market value would be provided to all property owners as compensation for land acquisition. Displaced small business owners may be eligible for reestablishment expenses.

The Preferred Alternative will also include establishment of a fund for maintenance of and improvement to publicly-owned parks and recreation facilities within affected communities. Parks and recreation facilities receiving funding should be located within ¼ mile of the Preferred Alternative alignment. The Preferred Alternative will also include separate funding to support the improvement or establishment of community gardens, vacant lot greening, and/or the establishment of improvement of public open space within ¼ mile of the Project alignment.

The Preferred Alternative will include a mechanism for public comment in the design and landscaping of project facilities such as portals, ventilation facilities, and other visible project structures. It will include visual screening of ventilation facilities adjacent to schools and other community facilities.

b. Economy

The Preferred Alternative includes coordination by the project sponsor with local job training organizations to:

1) Facilitate targeted job training by providing estimates of the type, number, and timing of jobs expected to be created by project contractors,

2) Include in construction contracts goals for nationally targeted workers of social and economic disadvantage; and

3) Require project contractors to report on a regular basis their progress in meeting contract goals. The Preferred Alternative will include public reporting on job creation.

c. Transportation

The Preferred Alternative will include funding for streetscape infrastructure, pedestrian and bicycle access improvements within ½ mile of the Preferred Alternative alignment, with emphasis on access to the West Baltimore MARC Station. Examples include landscaping and street trees, bus stop facilities, benches, trash cans, lighting, sidewalk repairs, bike lanes, crosswalk striping and signaling, traffic calming measures, ADA accessibility, street and sidewalk cleaning, and/or public art.

The Preferred Alternative includes development and implementation of a Maintenance of Traffic Plan which provides protection for safe pedestrian, bicycle, and vehicular movement around work sites during construction and maintains connectivity where possible. The plan should account for truck haul routes, construction traffic concerns, and should help to minimize transportation impacts during construction. The plan should account for community resources such as schools and parks and include security fencing for public safety.

The Preferred Alternative will include stabilizing and securing the existing B&P Tunnel for potential future rail transportation use. This will serve to ensure the ongoing safety of the existing B&P Tunnel while it is not being used, while still allowing for potential future re-use as part of a separate project or initiative.

The Preferred Alternative includes replacement of all impacted station facilities at the West Baltimore MARC Station and rebuilding the facility in compliance with ADA regulation. Furthermore, the Preferred Alternative includes additional amenities at the West Baltimore MARC Station relative to what currently exists. Improved amenities such as security lighting, full platform canopies, or public art may be considered.

B. Public Health and Safety

1. Public Health

a. Alternative 1: No-Build

No impacts to public health would occur under this alternative.

b. Preferred Alternative

No impacts to public health from the Preferred Alternative are anticipated. The Preferred Alternative would conform to federal and state air quality standards, as discussed in **Section VI.H**. The Preferred Alternative would have no significant effects to air quality in the Study Area; the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between 2040 No Build (Alternative 1) and the 2040 Build scenario (Preferred Alternative) would be below *de minimis* levels, provided by the USEPA.

Noise impacts were assessed using FTA guidelines, detailed in **Section VI.I.** The Preferred Alternative would have impacts to 437 properties, of which 141 properties would be severely impacted. The severe impacts would be at residential areas nearest the railroad between the West Baltimore MARC Station and the south portal shown in **Section VI.I**. The Preferred Alternative includes multiple mitigation measures to mitigate anticipated operational noise impacts, including noise barriers. Noise barriers would be designed to reduce the severe noise impacts to levels below the FTA severe impact criteria.

The Preferred Alternative may also have temporary noise impacts during construction at residences and other sensitive receptors along the Project alignment. The Preferred Alternative includes the development and implementation of a Construction Noise Mitigation Plan to reduce potential construction noise impacts, which is discussed further in **Section VI.I** and **Chapter VII**.

As discussed in **Section VI.F**, additional detail is needed regarding the potential for the Preferred Alternative to encounter contaminated soil and groundwater during construction near sites contaminated with hazardous material. The Preferred Alternative would be designed and constructed in accordance with *NFPA 130: Standard for Fixed Guideway Transit for Passenger Rail Systems*. If a public health and safety concern is identified during future hazardous materials investigations, provisions within the investigation Health and Safety Plan (HASP) will be implemented and regulatory authorities notified to appropriately mitigate the hazardous material concerns.

c. Alternative 3A

No impacts to public health from Alternative 3A are anticipated. The Alternative 3A would conform to federal and state air quality standards, as discussed in **Section VI.H** and in the DEIS. Alternative 3A would have no significant effects to air quality in the Study Area; the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between 2040 No Build (Alternative 1) and the 2040 Build scenario (Alternative 3A) would be below de minimis levels, provided by the USEPA. See the DEIS for more information.

Noise impacts were assessed using FTA guidelines, detailed in **Section VI.I**. The Alternative 3A would have noise impacts to 254 properties, all of which would be moderately impacted. No impacts in exceedance of FTA severe impact criteria would occur. Alternative 3A may also have temporary noise impacts during construction at residences and other sensitive receptors along the Project alignment as described above for the Preferred Alternative.

As discussed in **Section VI.F**, additional detail is needed regarding the potential for Alternative 3A to encounter contaminated soil and groundwater during construction near sites contaminated with hazardous material. The alternative would be designed and constructed in accordance with NFPA 130: Standard for Fixed Guideway Transit for Passenger Rail Systems. If a public health and safety concern is identified during future hazardous materials investigations, provisions within the investigation Health and Safety Plan (HASP) will be implemented and regulatory authorities notified to appropriately mitigate the hazardous material concerns.

d. Alternative 3C

No impacts to public health from Alternative 3C are anticipated. The Alternative 3C would conform to federal and state air quality standards, as discussed in **Section VI.H** and in the DEIS. Alternative 3C would have no significant effects to air quality in the Study Area; the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between 2040 No Build (Alternative 1) and the 2040 Build scenario (Alternative 3C) would be below de minimis levels, provided by the USEPA. See the DEIS for more information.

Noise impacts were assessed using FTA guidelines, detailed in **Section VI.I**. The Alternative 3C would have noise impacts to 1,090 properties, 111 of which would be severe impacts per FTA criteria. The remainder would be moderately impacted. Noise barriers would be designed to reduce the severe noise impacts to levels below the FTA severe impact criteria. Alternative 3C may also have temporary noise impacts during construction at

residences and other sensitive receptors along the Project alignment as described above for the Preferred Alternative.

As discussed in **Section VI.F**, additional detail is needed regarding the potential for Alternative 3C to encounter contaminated soil and groundwater during construction near sites contaminated with hazardous material. The alternative would be designed and constructed in accordance with NFPA 130: Standard for Fixed Guideway Transit for Passenger Rail Systems. If a public health and safety concern is identified during future hazardous materials investigations, provisions within the investigation Health and Safety Plan (HASP) will be implemented and regulatory authorities notified to appropriately mitigate the hazardous material concerns.

2. Safety

a. Alternative 1: No-Build

No impacts to public safety would occur under this alternative. While the current tunnel is safe to operate, potential impacts to public safety within the Study Area, as well as users of the existing tunnel may occur in the long-term operations of this alternative, as the existing B&P Tunnel would not include current comprehensive life safety approaches.

Alternative 1: No-Build is subject to the Common Carrier Obligation, currently in place, which prohibits railroads from refusing reasonable requests for their service. The Common Carrier Obligation permits transportation of hazardous materials in accordance with USDOT and FRA safety regulations.

b. Preferred Alternative

The Preferred Alternative would conform to the comprehensive life safety approach included in the NFPA Standard for Fixed Guideway Transit and Passenger Rail Systems-NFPA 130. These standards provide regulations for fire safety requirements in underground, surface, and elevated fixed guideway transit and passenger rail systems, including stations and tunnels. NFPA-130 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. Implementation of these regulations would improve tunnel conditions compared to Alternative 1: No-Build.

As with the implementation of any new transportation project, there is the potential for impacts to occur to the general Study Area public, as well as users of the proposed infrastructure. These potential impacts to general public safety may occur during construction and/or operation of the Preferred Alternative. However, these potential safety impacts would be mitigated to the fullest possible extent.

Amtrak has statutory and contractual obligations to permit the continued operation of freight trains on the NEC, which apply regardless of whether the Preferred Alternative is implemented. Also, the railroads that use the B&P Tunnel have a Common Carrier Obligation, which prohibits them from refusing reasonable requests for their service, including transportation of hazardous materials. All freight operations would be subject to safety regulations in accordance with USDOT and FRA. USDOT and FRA safety regulations include container labeling, container durability standards, emergency response information and safety and security plans. USDOT safety provisions for hazardous material transportation include specific rules regarding labeling and placarding, time-of-day restrictions, specifications for tank cars, general requirements and packaging specifications, among others. In addition, local first responders receive training in hazardous materials incidents for specific facilities, including the B&P Tunnel.

c. Alternative 3A

All safety considerations for Alternative 3A would be identical to those described above for the Preferred Alternative. Alternative 3A would conform to the comprehensive life safety approach included in the NFPA Standard for Fixed Guideway Transit and Passenger Rail Systems-NFPA 130.

d. Alternative 3C

All safety considerations for Alternative 3C would be identical to those described above for the Preferred Alternative. Alternative 3C would conform to the comprehensive life safety approach included in the NFPA Standard for Fixed Guideway Transit and Passenger Rail Systems-NFPA 130.

3. Children's Health and Safety

Children's health was assessed in accordance with US Environmental Protection Agency Executive Order 13045. *Protection of Children from Environmental Health Risks and Safety Risks.* Comprehensive and extensive analyses of air quality, noise, water, soils, and hazardous material have been conducted for the Project.

a. Alternative 1: No-Build

No disproportionate impacts to children's health would occur under this alternative.

b. Preferred Alternative

Air Quality
Comprehensive analysis of air quality impacts has been conducted for the project and is detailed in **Section VI.H**. Overall, the Preferred Alternative would have no significant effects to air quality in the Study Area, as the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between 2040 No Build (Alternative 1) and the 2040 Build (Preferred Alternative) scenario would be below *de minimis* levels. Increased diesel emissions would be due to MARC trains, there is no projected increase in diesel freight train operations through the B&P Tunnel and no significant air emissions generated by electric locomotive trains.

The proposed location for the Intermediate Ventilation Facility at 900-940 North Avenue is located adjacent to John Eager Howard Elementary School. In accordance with the Clean Air Act General Conformity Thresholds, emissions associated with the ventilation facility would not cause, or substantially contribute to a violation of NAAQS, established by the US Environmental Protection Agency (USEPA), to protect human health and welfare, including children (see **Section VI.H.4**).

Air polluting emissions from construction equipment, as well as dust control measures will be implemented in accordance with local construction regulations. The Preferred Alternative includes the development and implementation of a Construction Emission Reduction Plan.

Water
The Preferred Alternative would have no impact to drinking water or recreational waters as described in **Section VI.E.3.** Thus, there is no risk to children's welfare cause by impacts to water quality.

Soil and Hazardous Material
Children could be exposed to existing hazardous materials, such as vapors, mobilized as waste material if present within the tunnel limits of disturbance. 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. Further discussion of identified hazardous sites within the Study Area can be found in **Section VI.F.**

The Preferred Alternative is likely to encounter contaminated soil and groundwater during construction activities near contaminated sites. As discussed in **Section VI.F,** there are 112 sites of concern within 1 mile of the Preferred Alternative. Additional specific information for sites impacted by the Preferred Alternative will be collected once design is complete. Once type and extent of contamination and details of construction are known, potential risk and exposure can be assessed and appropriate documentation in place.

Contaminated soil and/or groundwater encountered during construction will be treated in accordance with federal, state, and local regulations. Any contaminants detected above MDE screening levels, soil and/or groundwater will be handled in accordance with applicable laws and regulations and disposed of at an MDE-approved treatment and/or disposal facility. Excavated soil will be contained onsite to avoid offsite migration. These measures will aid in limiting contaminated soil and/or groundwater exposure to children. Mitigation measures for contaminated sites are further discussed in **Section VI.F**.

Based on the above, the Preferred Alternative would pose no health or safety risks that would disproportionately affect children.

c. Alternative 3A

Alternative 3A would not differ substantially from the Preferred Alternative, as described above, regarding children's health and safety. The hazardous materials sites of concern for Alternative 3A are discussed in Section VI.F.

d. Alternative 3C

Alternative 3C would not differ substantially from the Preferred Alternative, as described above, regarding children's health and safety. The hazardous materials sites of concern for Alternative 3C are discussed in Section VI.F.

4. Mitigation

Specific actions proposed as part of the Preferred Alternative to mitigate safety impacts are detailed below. Although the following mitigation measures correspond with the Preferred Alternative, similar mitigation measures would be appropriate to mitigate safety impacts of Alternative 3A and Alternative 3C.

The Preferred Alternative would be designed to prevent public access and ensure safety to permanent and transitory individuals in the surrounding areas during operation. Particular attention will be given to maintaining public safety during the construction period. Public access to construction areas will be limited to the greatest extent possible. This can be accomplished with temporary fencing, warning signs and other safety precautions.

In order to mitigate potential emergency situations, particularly for users of the proposed tunnel, the Preferred Alternative would implement comprehensive life safety approaches. The Preferred Alternative would be designed and constructed in accordance with the National Fire Protection Association's Standard for Fixed Guideway Transit and Passenger Rail Systems—NFPA 130. Systems that will be designed and constructed in accordance with NFPA 130 will include the systems described below.

a. Emergency Ventilation

A mechanical ventilation system is required for tunnels longer than 1,000 feet, in accordance with design standards. The system can be comprised of either a set of ventilation buildings that provide ventilation of exhaust and supply of fresh air at specific locations, a set of jet fans for each track, or a combination. If used, jet fans should be located on the opposite side of the egress walkway to prevent excessive air speeds in the egress path. The fans will be capable of 100 percent reversible flow in order to control the propagation of smoke and hot gases away from the direction of egress. The size and power requirements for the fans is determined by a tunnel ventilation analysis. This analysis and subsequent final design will ensure the proper delineation of ventilation zones typically related to the longest operating train consist and the operating characteristics of the tunnel needed to meet projected travel demand, and to ensure proper isolation and mitigation of smoke and hot gases within an area occupied by an incident train.

b. Emergency Exits

Emergency exits will be designed in accordance with NFPA 130 as well as NFPA 101, Life Safety Code. Typically, the emergency exit locations will also provide tunnel access for emergency responders. A Fire Alarm Control Panel (FACP) and other incident command response interfaces will be accessible at the designated access locations. The maximum distance between exits to surface will not exceed 2,500 feet. Exits consist of fire-resistant enclosed stairways and passageways. Emergency exit enclosures will be separate from ventilation facilities, although they may be adjacent to them.

Exit stairs should have maximum riser heights of 7 inches, minimum tread depths of 11 inches, and minimum clear widths of 44 inches with allowance for handrail encroachment of 3-1/2 inches. Landings can be a maximum of 12 feet apart, and a minimum clear height should be 6 feet 8 inches.

In a multi-track tunnel environment with an appropriate rated divider wall or separate track tunnels, cross passageways may be used in lieu of or as a complement to conventional exits. The cross passageway would convey people to a tenable environment isolated through fire rated openings. Where incorporated, cross passageways are situated at 800-foot intervals.

All emergency exits will be properly labeled at the point of exit along with additional signage at intervals within the tunnel delineating the distances to the next exit point in either direction.

c. Walkways

Walkways are designed to allow passengers to evacuate a train at any point along the tunnels and proceed to the nearest position of safety. The walkways provide an unobstructed clear width transitioning from a minimum of 24 inches at the walkway surface to 30 inches at 62 inches above the walkway surface to 17 inches at 80 inches above the walkway surface. Although NFPA 130 does not state the maximum gap between the train and the walkway, the walkways are designed to minimize the gap between the walkway and the train such that evacuating passengers can safely exit the train onto the walkway without falling into the gap or injuring themselves.

d. Blue Light Stations

A Blue Light Station is a location along the tunnel, indicated by a blue light fixture, designating where an emergency exit is located and where emergency service or authorized personnel can use an emergency phone to communicate with the Operations Control Center (OCC). If necessary, trained personnel can disconnect traction power from an adjacent track via switches within the Blue Light Station's protective enclosure. In addition, the Blue Light Stations will provide access and storage to firefighting equipment including extinguishers, hose lines, and standpipe connections.

Blue Light Stations will be located in accordance with NFPA 130, which includes but is not necessarily limited to, emergency exits, cross-passageways at 800 feet (where utilized), emergency access points, and any other approved locations.

Each Blue Light Station has a unique identification code as established by Amtrak. This identification will be marked on the enclosure in a prominent manner and be known to the staff at the OCC to aid in response.

e. Fire Standpipe Systems

The tunnels will be provided with standpipe systems, which will be predominantly dry systems in unattended, unoccupied environments exposed to freezing temperatures. The fire standpipe system will be Class I Fire designed in accordance with appropriate Maryland fire codes and Amtrak requirements.

The standpipe system for each sectionalized zone will consist of a fire standpipe main (minimum 6 inches in diameter due to the fill time requirement of NFPA 130 and tunnel length) and hose valves installed at the regular intervals of 250 feet spacing (maximum 275-foot limit). The fire hose valves should be 2-1/2 inches, and be provided with caps and chains. These valves will be located so that any point within the tunnel may be reached with 125 feet of hose length brought in by first responders. Each fire hose valve will be provided with a specific identifying nameplate consistent with Amtrak standards which also shows location identification.

Each trainway of the tunnel will have its own separate complete fire standpipe main. It will have fire department connections (FD.C.s), hose valves, sectionalizing valves and alarms. The standpipe mains will remain accessible for easy inspections, maintenance and repair. The standpipe system will be maintained with fire department connections at grade. The FD.C.s would be used by the fire department to supply water and pressurize the system. Each FD.C. will be located within 100 feet of fire truck access and within 100 feet of a fire hydrant. FD.C.s will be provided at tunnel emergency exit locations. If there are no existing street fire hydrants which are suitable for fire department use within 100 feet of the FD.C. then the existing hydrants would be upgraded, or new hydrants would be installed, in coordination with the municipal water supply.

Water flow and supervisory alarms will be provided for the standpipe systems in each tunnel, and the signal will be sent to the local Amtrak FACP. All FACP's should interface with the Amtrak Central Command Center.

f. Emergency Management Plan

The Preferred Alternative will include development of an Emergency Management Plan to be implemented in the event of a tunnel emergency.

C. Cultural Resources

1. Historic Architecture

An effect to a historic property occurs when there is an alteration to the characteristics of an historic property qualifying it for inclusion in or eligibility for the NRHP (36 CFR Part 800.16(i)). For those properties that are potentially affected, the criteria of adverse effect from Section 106 of the NHPA were applied (36 CFR Part 800.5(a)(1)). An adverse effect to an historic property is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify it for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. The following examples of adverse effects (36 CFR Part 800.5(a)(2)) were considered in relation to the Preferred Alternative and Alternatives 3A and 3C:

- (i) – Physical destruction of, or damage to all or part of the property;
- (ii) – Alteration of a property including: restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access that is not consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (36 CFR Part 68) and applicable guidelines;
- (iii) – Removal of the property from its historic location;
- (iv) – Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- (v) – Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- (vi) – Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

- (vii) – Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

a. No-Build Alternative

The No-Build Alternative would have no effect on historic properties.

b. Preferred Alternative

The Preferred Alternative would have an adverse effect to historic properties. The Preferred Alternative includes refinements made since the DEIS to reduce impacts to historic resources. These refinements are described in **Chapter III**. **Table VI-12** provides a breakdown of effects to each of the seventeen architectural historic properties identified within the historic architectural APE (**Figure VI-8**). The Preferred Alternative would have an adverse effect on nine of these seventeen historic properties. As part of the Undertaking, the existing tunnel would essentially be "mothballed" and sealed, thus retaining it for a potential future transportation use. While the Preferred Alternative would still have an adverse effect on the B&P Railroad, the tunnel work would follow the Secretary of the Interior's Standards for the Treatment of Historic Properties.

In addition, sections of the NEC would be taken out of service, including portions of the railroad alignment that contribute to the B&P Railroad historic district. Their disposition has not yet been determined so the assessment of effects to these historic properties is not possible at this time.

FRA's continued consultation with MHT and other consulting parties to resolve the adverse effects (36 CFR Part 800.6(a)), including incorporation of their comments into the process of refining and selecting the Preferred Alternative, has aided in avoiding and minimizing adverse effects. Consulting parties' comments with regard to effects to historic properties have included the following:

- Effects to the B&P Railroad tunnel as a result of this undertaking.
- The proposed size and location of the Intermediate Ventilation Facility in the Reservoir Hill Historic District and the overall high historic integrity of this District.
- Concerns about possible vibration impacts through the tunnels underneath the Reservoir Hill Historic District.
- Effects to a large number of contributing elements, including visual effects of the new retaining walls and potential size of the South Ventilation Facility, in the Midtown Edmondson Historic District.
- Effects to the American Stores Company Warehouse, Ward Baking Company, and Fire Department Engine House No. 36, all individually eligible for NRHP listing and contributing elements to the Midtown Edmondson Historic District.
- Effects to historic properties along Edmondson Avenue, which was historically a main thoroughfare for the West Baltimore area.
- The importance of the American Ice Company, especially its historic significance and visibility in the West Baltimore community.

More details of individual architectural historic property effects are provided in the *Architectural Historic Properties Effects Assessment Report*. On November 20, 2015, MHT concurred with FRA's adverse effect determination. FRA also prepared a technical memorandum containing updates to the identified list of historic properties, adjusted mapping, additional property evaluations, and revised effects assessments due to revisions to Alternative 3B which were incorporated into the Preferred Alternative. The document also includes a clarification to the B&P Railroad historic district boundary. This memorandum, which did not change the overall adverse effect finding, was submitted to MHT and other consulting parties for review and comment on July 28,

2016, with concurrence received on October 11, 2016. Consulting parties' correspondence, including concurrence on the adverse effect finding from MHT, can be found in **Appendix B**.

c. Alternative 3A

Alternative 3A would result in an adverse effect to six historic properties, including the Baltimore and Ohio Belt Line Railroad, Baltimore and Ohio Belt Line Bridge over Jones Falls Valley, Baltimore & Potomac Railroad, Reservoir Hill Historic District, Midtown-Edmondson Historic District, and Bridge BC 2410. More information is available in the DEIS.

d. Alternative 3C

Alternative 3C would result in an adverse effect to 10 historic properties, including the Baltimore and Ohio Belt Line Railroad, Baltimore and Ohio Belt Line Bridge over Jones Falls Valley, Baltimore & Potomac Railroad, Reservoir Hill Historic District, Midtown-Edmondson Historic District, Bridge BC 2410, Greater Rosemont Historic District, Edmondson Avenue Historic District, Ward Baking Company, and Fire Department Engine House No. 36. More information is available in the DEIS. The Fire Department Engine House No. 36 and Ward Baking Company buildings have been identified by Project Consulting Parties as particularly high-priority for preservation.

2. Archaeology

The results of the *Phase IA Archaeological Study* show that although large portions of the Study Area have been disturbed, the potential for both pre- and post-contact archaeological sites still exists. While the subsurface integrity is probably poor for most areas within the project APE, an occasional intact archaeological site could be encountered. It is anticipated that the Study Area has a higher potential for containing post-contact sites than pre-contact sites. These 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 design stage of the B&P Tunnel Project at this time, the potential size and configuration of the archaeological APE, as well as the uncertainty of project variables pertaining to anticipated ground disturbance (e.g. cut-and-cover locations, cut locations, ventilation shaft locations), detailed archaeological identification and effects studies will be undertaken at a later date as described in the Section 106 Programmatic Agreement (PA).

3. Programmatic Agreement

On April 6, 2016, FRA notified ACHP of the adverse effect finding and invited the agency to participate in the consultation process and preparation of a Section 106 Project PA (36 CFR Part 800.6(a)(1)(i)(C)). FRA provided the required documentation specified in 36 CFR Part 800.11(e) to ACHP through the ACHP Electronic Section 106 Documentation Submittal System. In a letter dated June 7, 2016 and found in **Appendix B**, ACHP indicated it has chosen not to participate in the consultation (36 CFR Part 800.6(a)(1)(iii)). The PA is currently in progress, with a draft included in **Appendix H** in this FEIS. The PA documents the terms and conditions agreed upon by the signatories that include: FRA, Amtrak, and SHPO, to resolve the potential adverse effects on historic properties and conclude the Section 106 process (36 CFR Part 800.16(t)). In addition to the stipulations for archaeological identification and effects studies, some of the other major draft PA stipulations include a preservation fund, design reviews, cultural resources construction protection plans, documentation, interpretive material, and electronic informational sites.

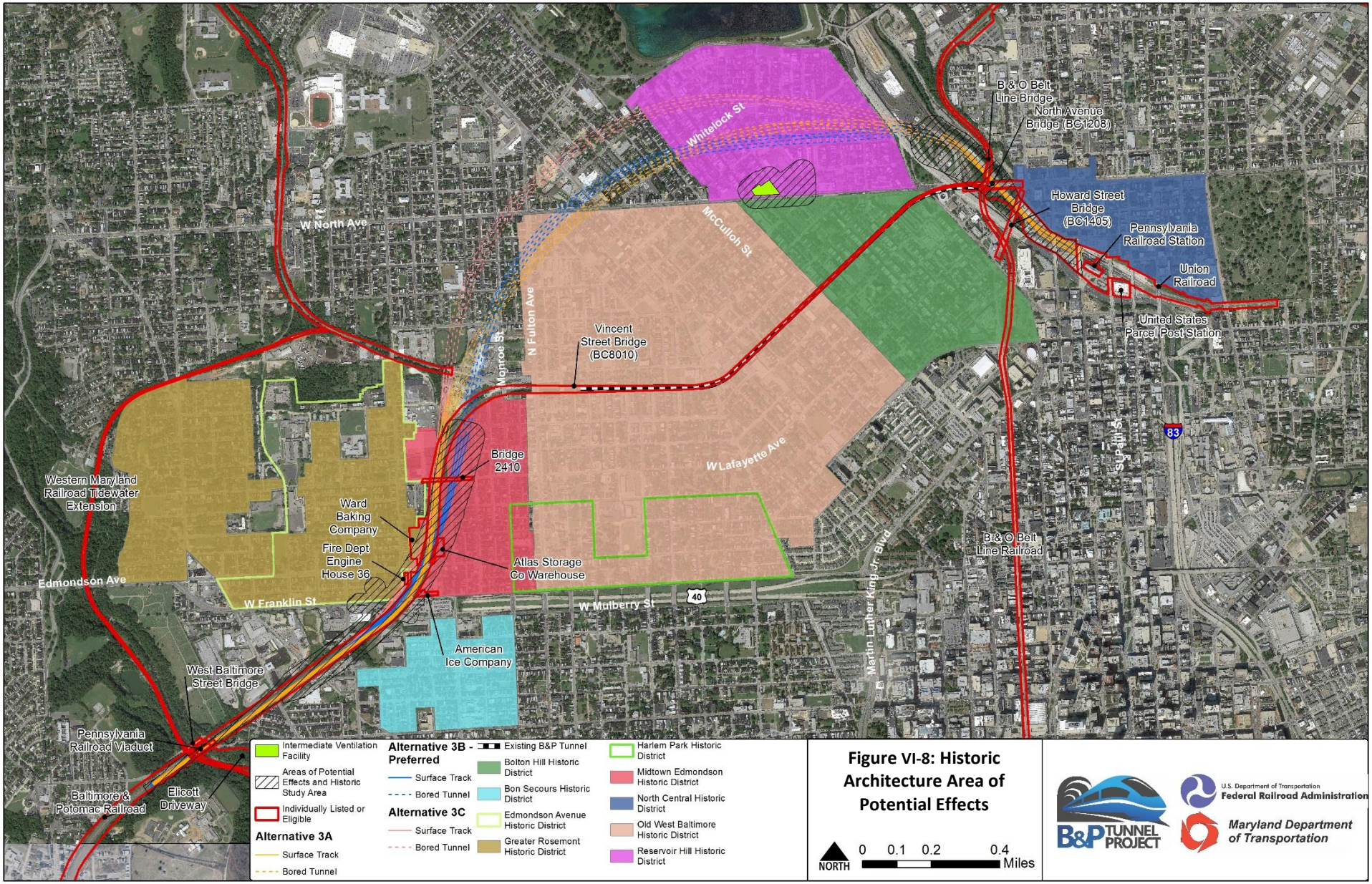


Figure VI-8: Historic Architecture Area of Potential Effects

Table VI-12: Section 106 Effects of the Preferred Alternative on Historic Properties within the Historic Architectural APE

#	NAME OF HISTORIC PROPERTY	MIHP#	PREFERRED ALTERNATIVE	ALTERNATIVE 3A	ALTERNATIVE 3C
1	Baltimore and Ohio Railroad Baltimore Belt Line	B-5287	**Adverse Effect** (1 contributing element in direct APE) Limestone pier of the bridge over Jones Falls Valley demolished and/or relocated	**Adverse Effect** (1 contributing element in direct APE) Limestone pier of the bridge over Jones Falls Valley demolished and/or relocated	**Adverse Effect** (1 contributing element in direct APE) Limestone pier of the bridge over Jones Falls Valley demolished and/or relocated
2	Baltimore and Ohio Railroad Baltimore Belt Line Bridge over Jones Falls Valley	B-5288	**Adverse Effect** Limestone pier demolished and/or relocated	**Adverse Effect** Limestone pier demolished and/or relocated	**Adverse Effect** Limestone pier demolished and/or relocated
3	Baltimore & Potomac Railroad (Philadelphia, Baltimore and Washington Railroad)	B-5164	**Adverse Effect** (7 contributing elements in direct APE) Effects to railroad catenary lines, railroad track bed, Edmondson Avenue Station, W. Mulberry St. Bridge, W. Franklin St. Bridge, Franklintown Road Bridge, and N. Warwick Avenue Bridge	**Adverse Effect** (2 contributing elements in direct APE) Effects to railroad catenary lines and railroad track bed	**Adverse Effect** (7 contributing elements in direct APE) Effects to railroad catenary lines, railroad track bed, Edmondson Avenue Station, W. Mulberry St. Bridge, W. Franklin St. Bridge, Franklintown Road Bridge, and N. Warwick Avenue Bridge
4	Union Railroad	B-5163	No Adverse Effect	No Adverse Effect	No Adverse Effect
5	Howard Street Bridge (BC 1405)	B-4529	No Adverse Effect	No Adverse Effect	No Adverse Effect
6	North Avenue Bridge (BC 1208)	B-4521	No Adverse Effect	No Adverse Effect	No Adverse Effect
7	Reservoir Hill Historic District	B-1379	**Adverse Effect** 1 contributing building demolished, and changes to the streetscape and surrounding area, with the potential to diminish integrity	**Adverse Effect** 1 contributing building demolished, and changes to the streetscape and surrounding area, with the potential to diminish integrity	**Adverse Effect** 1 contributing building demolished, and changes to the streetscape and surrounding area, with the potential to diminish integrity
8	Carver Vocational-Technical High School	B-5294	No Adverse Effect	N/A	No Adverse Effect
9	Western Maryland Railroad, Owings Mills Division	B-5293	No Adverse Effect	N/A	No Adverse Effect
10	Bolton Hill Historic District	B-64	No Adverse Effect	No Adverse Effect	No Adverse Effect
11	Midtown Edmondson Historic District	(None)	**Adverse Effect** (29 contributing elements in direct APE)	**Adverse Effect** (2 contributing elements in direct APE)	**Adverse Effect** (7 contributing elements in direct APE)

#	NAME OF HISTORIC PROPERTY	MIHP#	PREFERRED ALTERNATIVE	ALTERNATIVE 3A	ALTERNATIVE 3C
			27 buildings demolished, 2 bridges altered	1 building demolished, 1 bridge altered	5 buildings demolished, 2 bridges altered
12	Bridge BC 2410 (Lafayette Avenue over Amtrak)	B-4553	**Adverse Effect** Bridge superstructure elevated and substructure potentially modified	**Adverse Effect** Bridge superstructure elevated and substructure potentially modified	**Adverse Effect** Bridge superstructure elevated and substructure potentially modified
13	Atlas Safe Deposit and Storage Company Warehouse Complex	B-5188-2	**Adverse Effect** (1 contributing element in direct APE) Rear warehouse building demolished	No Effect	No Effect
14	American Ice Company	B-1040	No Adverse Effect	N/A	No Effect
15	Greater Rosemont Historic District	B-5112	**Adverse Effect** (5 contributing elements in direct APE) 5 buildings demolished, including the B&P Railroad Edmondson Avenue Station and 2 rowhouses	No Effect	**Adverse Effect** (17 contributing elements in direct APE) 5 commercial, industrial, or institutional properties and 12 rowhouses or rowhouse/commercial buildings
16	Edmondson Avenue Historic District	B-5187	**Adverse Effect** (2 contributing elements in direct APE) 2 rowhouses demolished	No Effect	**Adverse Effect** (12 contributing elements in direct APE) 12 rowhouses or rowhouse/commercial buildings demolished
17	Ward Baking Company	B-5112-2	No Adverse Effect	No Effect	**Adverse Effect** (2 contributing elements in direct APE) Both contributing buildings demolished (main building and garage)
18	Fire Department Engine House No. 36	B-5112-4	No Adverse Effect	N/A	**Adverse Effect** The fire house would be demolished
19	Pennsylvania Railroad Viaduct	B-5064	No Adverse Effect	No Adverse Effect	No Adverse Effect
TOTAL HISTORIC PROPERTIES WITH ADVERSE EFFECT			**9**	**6**	**10**

4. Mitigation

The Project alternatives have been refined, in consultation with the Project Consulting Parties and MHT, in order to minimize impacts to cultural resources. In addition, the Project team is proposing mitigation measures that correspond with the Project's impacts to cultural resources. Although the following mitigation measures correspond with the Preferred Alternative, similar mitigation measures would be appropriate to mitigate cultural resource impacts of Alternative 3A and Alternative 3C. Proposed measures to be implemented as part of the Project in order to mitigate the effects of the Preferred Alternative are identified in the draft Programmatic Agreement, as shown in **Appendix H**. This section provides a brief overview of these proposed measures, which are described in detail in the draft Programmatic Agreement. More detail on each measure is included in the draft PA.

- Subject to specified conditions, the Preferred Alternative proposes establishment of an architectural historic properties preservation fund to address adverse effects to historic properties.
- The Preferred Alternative proposes development of context-sensitive design treatments for new construction informed by the features of the affected historic properties.
- The Preferred Alternative proposes that relevant historic properties, including contributing elements of historic districts, be screened with appropriate sound barriers and/or vegetation when appropriate.
- The Preferred Alternative proposes development of cultural resources construction protection plans designed to protect above-and below-ground known and unknown historic properties from adverse effects during construction activities. Plans will address vibration monitoring, stockpiling, and truck routes/hauling.
- The Preferred Alternative proposes preparation of written and photographic documentation consistent with Level II Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) standards for deposit within the MHT, for the historic properties, including contributing elements of historic districts, directly adversely affected.
- The Preferred Alternative proposes preparation of interpretive material including signs and/or displays and brochure to be located in Baltimore's Pennsylvania Station. Possible themes may include the history of the B&P Tunnel, the history of the Pennsylvania Railroad and Pennsylvania Station, the influence of railroads on Baltimore City, and/or archaeological findings in the project area as relevant.
- The Preferred Alternative proposes that oral history interviews will be conducted as part of the Preferred Alternative, particularly with older, long-time residents of neighborhoods like Midtown Edmonson and Reservoir Hill, and pre-Amtrak railroad employees, made as audio and/or video recordings in addition to written transcripts.
- The Preferred Alternative proposes securing, stockpiling, and making available salvaged building materials from the demolition of historic properties and contributing elements to historic districts.
- The Preferred Alternative proposes establishment, partnering with, and/or linking to electronic informational sites in order to make available to the public information, products and updates from the Section 106 process and relevant stipulations of the PA. Partner, if warranted with established preservation/history organizations with existing electronic outreach programs.
- The Preferred Alternative proposes completion of a Phase I Archaeological Survey sufficient to identify archaeological resources that may be affected by the Project. A Phase II archaeological survey shall be conducted to evaluate the identified resources for NRHP eligibility. If an adverse effect cannot be alternatively mitigated, The Project shall develop a Phase III research design/treatment plan for each NRHP –eligible archaeological resource adversely effected by the Undertaking.
- The Preferred Alternative proposes investigation of the history, development, use, and evolution of the station facilities and yards comprising present-day Pennsylvania Station in Baltimore City for the purposes of clarifying and delineating the official boundaries of railroad-related NRHP-listed and eligible historic properties.

D. Final Section 4(f) Evaluation

In accordance with 49 USC § 303, FRA may not approve the use of publicly owned land of a public park, recreation area, or land of an historic site of national, State, or local significance unless:

(1) There is no prudent and feasible alternative to using that land; and

(2) The program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use.

A "use" of Section 4(f) property occurs:

- When land is permanently incorporated into a transportation facility;
- When there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose; or
- When there is a constructive use of a Section 4(f) property.

In some cases, even if there is a use of a resource protected by Section 4(f), FRA may determine that a use is *de minimis.* A *de minimis* determination allows the project to continue despite the use. FRA may make a *de minimis* determination on a historic site only if, pursuant to the Section 106 consultation process:

- The transportation program or project will have no adverse effect on the historic site, or there will be no historic properties affected by the transportation program or project;
- FRA's finding has received written concurrence from the applicable State historic preservation officer; and
- FRA has developed its finding in consultation with parties consulting as part of the Section 106 consultation process.

With respect to parks, recreation areas, or wildlife or waterfowl refuges, FRA may make a finding of *de minimis* impact only if:

- After public notice and opportunity for public review and comment, FRA finds that the transportation program or project will not adversely affect the activities, features, and attributes of the park, recreation area, or wildlife or waterfowl refuge eligible for protection under this section; and
- The finding has received concurrence from the officials with jurisdiction over the park, recreation area, or wildlife or waterfowl refuge.

If FRA determines that there is no feasible and prudent avoidance alternative, FRA may approve from among the alternatives that use Section 4(f) properties only the alternative that causes the least overall harm in light of the statute's preservation purpose.

FRA has prepared this Final Section 4(f) Evaluation (Evaluation) to assess the use of Section 4(f) properties by the B&P Tunnel Project alternatives, and to evaluate feasible and prudent alternatives that avoid the use of Section 4(f) properties. Based on this Evaluation, there are no feasible and prudent alternatives that would avoid use of all Section 4(f) properties therefore this Evaluation includes a determination of which of the alternatives will result in the least overall harm in light of the statute's preservation purposes This Evaluation also identifies appropriate measures to minimize harm. This Evaluation reflects comments FRA received on the Draft Section 4(f) Evaluation, and FRA has incorporated all possible planning to minimize harm to Section 4(f) properties into the Preferred Alternative. The evaluation includes consideration of one Section 4(f) property identified subsequent to the Draft Section 4(f) Evaluation, the Union Railroad, which is described in **Section V.C**.

This Final Section 4(f) Evaluation also provides FRA's *de minimis* impact findings for some Section 4(f) properties. Potential *de minimis* impacts were presented for public review and comment with the DEIS, in conjunction with the requirements of the National Environmental Policy Act (NEPA).

1. Use of Section 4(f) Properties

This section discusses the use of Section 4(f) properties that would be caused by the B&P Tunnel Project Alternatives 3A, 3B, and 3C. Where it determined the impacts would be *de minimis*, FRA coordinated with the officials with jurisdiction over the relevant Section 4(f) properties. For historic properties, FRA has received written concurrence from the State Historic Preservation Officer (SHPO, or MHT) that there would be no adverse effect or no effect to the property in accordance with 36 CFR Part 800. MHT concurred with FRA's October, 2016 determination of no adverse effects to certain Section 4(f) properties. In this correspondence, FRA notified MHT of its intent to make a determination of *de minimis* impacts resulting from the Preferred Alternative (**Appendix B**). Therefore, this Evaluation includes FRA's final *de minimis* impact determination for the Fire Department Engine Company No. 36, Ward Baking Company, and Union Railroad historic properties. **Table VI-13** provides an overview of Section 4(f) impacts resulting from the Alternatives. None of the build alternatives would result in a Section 4(f) use of Lafayette and Payson Park or Mary Ann Winterling Elementary School.

A Section 4(f) use can occur when a transportation project does not incorporate land from a Section 4(f) resource into the project, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features or attributes of the resource are substantially diminished.

For example, a substantial impairment occurs when the projected noise level increase attributable to a project substantially interferes with the use and enjoyment of a noise-sensitive facility of a property protected by Section 4(f). Examples of noise-sensitive facilities protected by Section 4(f) include outdoor amphitheaters, sleeping areas of a campground, historic sites where a quiet setting is a feature or attribute of the site's significance, urban parks where serenity and quiet are significant attributes, or an area of a wildlife and waterfowl refuge intended for wildlife viewing. Although some park and historic properties would incur a noise impact from the build alternatives, such as residences in the Midtown-Edmondson Historic District, the protected activities, features, and attributes of these Section 4(f) Properties are not considered noise sensitive. Section 4(f) properties in the vicinity of the Project are situated in developed urban areas (characterized by residential, commercial, and industrial developments) and/or are in or near transportation infrastructure such as roadways and railroads. Section 4(f) properties near the existing NEC railroad alignment currently function while experiencing noise from the railroad. Therefore, noise impacts from the Project would not substantially impair the activities, features, or attributes that qualify any park or historic properties for Section 4(f) protection.

Additionally, a substantial impairment occurs when the proximity of a proposed project diminishes the aesthetic features or attributes of a property protected by Section 4(f) The build alternatives would result in visual and aesthetic changes in the surrounding environment, which includes Section 4(f) properties. However, the proximity of the Project would not impair aesthetic features or attributes of any properties protected by Section 4(f). Presently, the Section 4(f) properties in the vicinity of the project are situated in developed urban areas (characterized by residential, commercial, and industrial developments) and/or are in or near transportation infrastructure such as roadways and railroads. Therefore, implementation of the build alternatives would not substantially detract from the views or setting of any Section 4(f) properties.

Substantial impairment also occurs when a project results in 1) restriction of access which substantially diminishes the utility of Section 4(f) resources; 2) vibration impacts that substantially impair the use of Section 4(f) resources; and 3) intrusion that substantially interferes with a wildlife and waterfowl refuge. The build alternatives would not result in these types of impacts on Section 4(f) resources.

The LOD used to determine impacts for each build alternative includes areas of temporary occupancy; however, FRA has assumed for the purposes of this Evaluation that even temporary occupancy of Section 4(f) property within the LOD would result in its permanent incorporation into the Project.

Table VI-13: Overview of Section 4(f) Impacts

Alternative	Alternative 3A	Alternative 3B - Preferred	Alternative 3C
Section 4(f) Properties	6 (use) (+3 No Use) (+1 De Minimis)	9 (use) (+1 No Use) (+3 De Minimis)	10 (use) (+1 No Use) (+2 De Minimis)
Use	• B&O Belt Line Railroad • B&O Belt Line Bridge • B&P Railroad • Bridge 2410/Lafayette Avenue • Midtown-Edmonson Historic District (1 demolition, 1 other) • Reservoir Hill Historic District (1 demolition)	• B&O Belt Line Railroad • B&O Belt Line Bridge • B&P Railroad • Bridge 2410/Lafayette Avenue • Midtown-Edmonson Historic District (27 demolitions, 8 other) • Greater Rosemont Historic District (5 demolitions, 15 other) • Edmonson Avenue Historic District (2 demolitions, 13 other) • Atlas Storage Co • Reservoir Hill Historic District (1 demolition)	• B&O Belt Line Railroad • B&O Belt Line Bridge • B&P Railroad • Bridge 2410/Lafayette Avenue • Midtown-Edmonson Historic District (5 demolitions, 2 other) • Greater Rosemont Historic District (17 demolitions, 35 other) • Edmonson Avenue Historic District (12 demolitions, 35 other) • Fire Company 36 • Ward Baking Co • Reservoir Hill Historic District (1 demolition)
De Minimis	• Union Railroad	• Fire Company 36 • Ward Baking Co • Union Railroad	• Western Maryland Railroad • Union Railroad
Total Contributing*	3 Total 2 Demolitions	54 Total 31 Demolitions	58 Total 19 Demolitions

*Number of historic resources contributing to historic districts. Note that some buildings contribute to multiple historic districts. Does not include B&P Railroad contributing elements.

a. Alternative 1: No-Build

No use of Section 4(f) properties would occur under this alternative. No new transportation facilities would be constructed, and no parks or historic resources would require Section 4(f) use.

b. Alternative 3A

Alternative 3A would result in use of six Section 4(f) properties including the B&O Belt Line Railroad, the B&O Belt Line Bridge over Jones Falls Valley, Midtown Edmondson Historic District, Bridge 2410 / Lafayette Avenue over Amtrak, the Baltimore and Potomac Railroad, and the Reservoir Hill Historic District. Alternative 3A would have a *de minimis* impact on the Union Railroad. The alternative would require the acquisition of land within the Edmonson Avenue Historic District and the Greater Rosemont Historic District, but would not use contributing elements in the districts; therefore, the impact would not constitute a Section 4(f) "use."

Section 4(f) Properties Requiring Use

Removal of major substructural pier elements of the B&O Belt Line Bridge over Jones Falls Valley would be required to construct Alternative 3A (**Figure VI-9**). This would alter historic characteristics in a manner that would diminish historic integrity, resulting in an adverse effect per 36 CFR Part 800.5 to the individually eligible Belt Line Bridge and to the B&O Belt Line Railroad district and result in a Section 4(f) use.

Alternative 3A would result in modifications to elements of the historic Baltimore and Potomac Railroad alignment, such as trackwork and catenary. The existing B&P Tunnel, a contributing element of the historic district, would be abandoned in a manner that would allow for future transportation use. The modifications to the historic site would alter historic characteristics of the rail line in a manner that would diminish the site's historic integrity and would result in an adverse effect per 36 CFR Part 800.5 and a Section 4(f) use.

Construction of the south portal approach for Alternative 3A would require the demolition of one historic building and modification of one bridge, both of which contribute to the Midtown Edmondson historic district (**Figure VI-10**). The demolition and bridge modification would alter historic characteristics in a manner that would diminish historic integrity resulting in an adverse effect per 36 CFR Part 800.5 and result in permanent incorporation resulting in a Section 4(f) use.

The Alternative 3A modifications to Bridge 2410 / Lafayette Avenue over Amtrak could include raising the bridge superstructure and potentially modifying the substructure to allow for four tracks. This would alter historic characteristics in a manner that would diminish historic integrity resulting in adverse effect per 36 CFR Part 800.5. and result in a Section 4(f) use.

Alternative 3A would require construction of an Intermediate Ventilation Facility located in the Reservoir Hill Historic District (**Figure VI-11**). The Intermediate Ventilation Facility is proposed for a site at 900-940 West North Avenue. The site would require demolition and permanent incorporation of one contributing historic element, a historic commercial building. Use of the contributing historic element at the 900-940 West North Avenue site would alter historic characteristics in a manner that would diminish historic integrity, and thus would result in adverse effect per 36 CFR Part 800.5. The Project Consulting Parties noted the low level of importance of the commercial building at 900-940 West North Avenue in relation to the Reservoir Hill Historic District.

***De Minimis* Impacts**

Alternative 3A would result in modifications to elements of the historic Union Railroad alignment, such as trackwork and catenary. The modifications to the historic site would not diminish historic integrity, resulting in no adverse effect per 36 CFR Part 800.5. Thus FRA has determined the impacts from Alternative 3A to the Union Railroad are *de minimis*.

a. Preferred Alternative

FRA has refined Alternative 3B since the publication of the Draft Section 4(f) Evaluation and DEIS. A description of the refinements and comparison of impacts between the DEIS Alternative 3B and current Preferred Alternative is included in **Chapter III**. The refinements have resulted in changes to the use of Section 4(f) properties as described below.

The Preferred Alternative would result in potential use of nine Section 4(f) properties including the Baltimore and Ohio Belt Line Railroad, Baltimore and Ohio Belt Line Bridge over Jones Falls Valley, Baltimore and Potomac Railroad, Midtown Edmondson Historic District, Bridge 2410 / Lafayette Avenue over Amtrak, Greater Rosemont Historic District, Atlas Safe Deposit and Storage Company Warehouse, the Edmonson Avenue Historic District, and the Reservoir Hill Historic District. The Preferred Alternative would have *de minimis* impacts on three Section 4(f) properties including Fire Department Engine Company No. 36, the Ward Baking Company, and the Union Railroad.

Section 4(f) Properties Requiring Use

The Section 4(f) use of the B&O Belt Line Bridge over Jones Falls Valley, the B&O Belt Line Railroad, and Bridge 2410/Lafayette Avenue over Amtrak resulting from the Preferred Alternative would be identical to the use under Alternative 3A as described above and shown in **Figure VI-12**.

Construction of the Preferred Alternative would require permanent incorporation of modifications to elements of the historic Baltimore and Potomac Railroad such as the trackwork, bridges, catenary, and right-of-way that would constitute a Section 4(f) use. These modifications would result in the permanent incorporation of land and would bisect the existing alignment and shift the alignment east. The harm to the historic site would alter historic characteristics of the rail line in a manner that diminishes historic integrity and results in an adverse effect per 36 CFR Part 800.5.

Construction of the south portal approach for the Preferred Alternative would require demolition of 27 historic buildings or other contributing elements to the Midtown Edmondson Historic District (**Figure VI-13**) and modification of two contributing bridge structures. Alternative 3B would result in permanent incorporation of portions of an additional six contributing properties that would not require demolition under the Preferred Alternative. The permanent incorporation of land would constitute a Section 4(f) use. The demolitions and modifications would alter historic characteristics of the historic buildings and contributing properties in a manner that would diminish their historic integrity, resulting in adverse effect per 36 CFR Part 800.5.

Construction of the south portal approach for the Preferred Alternative would require demolition of five historic buildings contributing to the Greater Rosemont Historic District. Portions of an additional 15 properties contributing to the Greater Rosemont Historic District would be permanently incorporated without building demolition. The demolition and permanent incorporation of historic resources would constitute a Section 4(f) use, and would alter historic characteristics in a manner that would diminish historic integrity resulting in adverse effect per 36 CFR Part 800.5.

The Preferred Alternative would require demolition of one of the three existing buildings in the Atlas Safe Deposit and Storage Company Warehouse complex in order to construct the south portal approach. Neither the building facing Lafayette Avenue or the ancillary garage would be directly impacted by the Preferred Alternative, and the rear building would be demolished. This permanent incorporation of the historic resource would result in a Section 4(f) use. Harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity resulting in an adverse effect per 36 CFR Part 800.5.

The Preferred Alternative would require demolition and permanent incorporation of two buildings contributing to the Edmonson Avenue Historic District in order to construct the south portal approaches and maintain connectivity along existing streets. An additional 13 contributing elements in the Edmonson Avenue Historic District would be partially incorporated but would not be demolished. The demolition and permanent incorporation of historic properties would result in a Section 4(f) use. The harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity, and thus would result in adverse effect per 36 CFR Part 800.5.

The Preferred Alternative would require construction of an Intermediate Ventilation Facility located in the Reservoir Hill Historic District (**Figure VI-11)** resulting in Section 4(f) use of the Historic District identical to that described under Alternative 3A above. The Project Consulting Parties noted the low level of importance of the commercial buildings at 900-940 West North Avenue in relation to the Reservoir Hill Historic District.

***De Minimis* Impacts**

The Preferred Alternative would require the incorporation of a portion of the parking lot at the Fire Department Engine Company No. 36 property which is located at the rear of the building. However, this would not diminish historic integrity of the historic site and would not result in an adverse effect per 36 CFR Part 800.5. Therefore, FRA has determined that the impact is *de minimis* pursuant to Section 4(f).

The Preferred Alternative would require the incorporation of a small portion of the Ward Baking Company property—however, the Ward Baking Company building would remain intact. This would not diminish historic integrity of the historic site and would not result in an adverse effect per 36 CFR Part 800.5. Therefore, FRA has determined that the impact is *de minimis* pursuant to Section 4(f).

The Preferred Alternative would result in modifications to elements of the historic Union Railroad alignment identical to those described under Alternative 3A above, resulting in a *de minimis* impact.

b. Alternative 3C

Alternative 3C would result in potential use of 10 Section 4(f) properties including the Baltimore and Ohio Belt Line Railroad, the Baltimore and Ohio Belt Line Bridge over Jones Falls Valley, the Baltimore and Potomac Railroad, Midtown Edmondson Historic District, Bridge 2410 / Lafayette Avenue over Amtrak, Greater Rosemont Historic District, Edmondson Avenue Historic District, Fire Department Engine Company No. 36, the Ward Baking Company, and the Reservoir Hill Historic District. Alternative 3C would have *de minimis* impacts on two Section 4(f) properties including the Western Maryland Railroad and the Union Railroad.

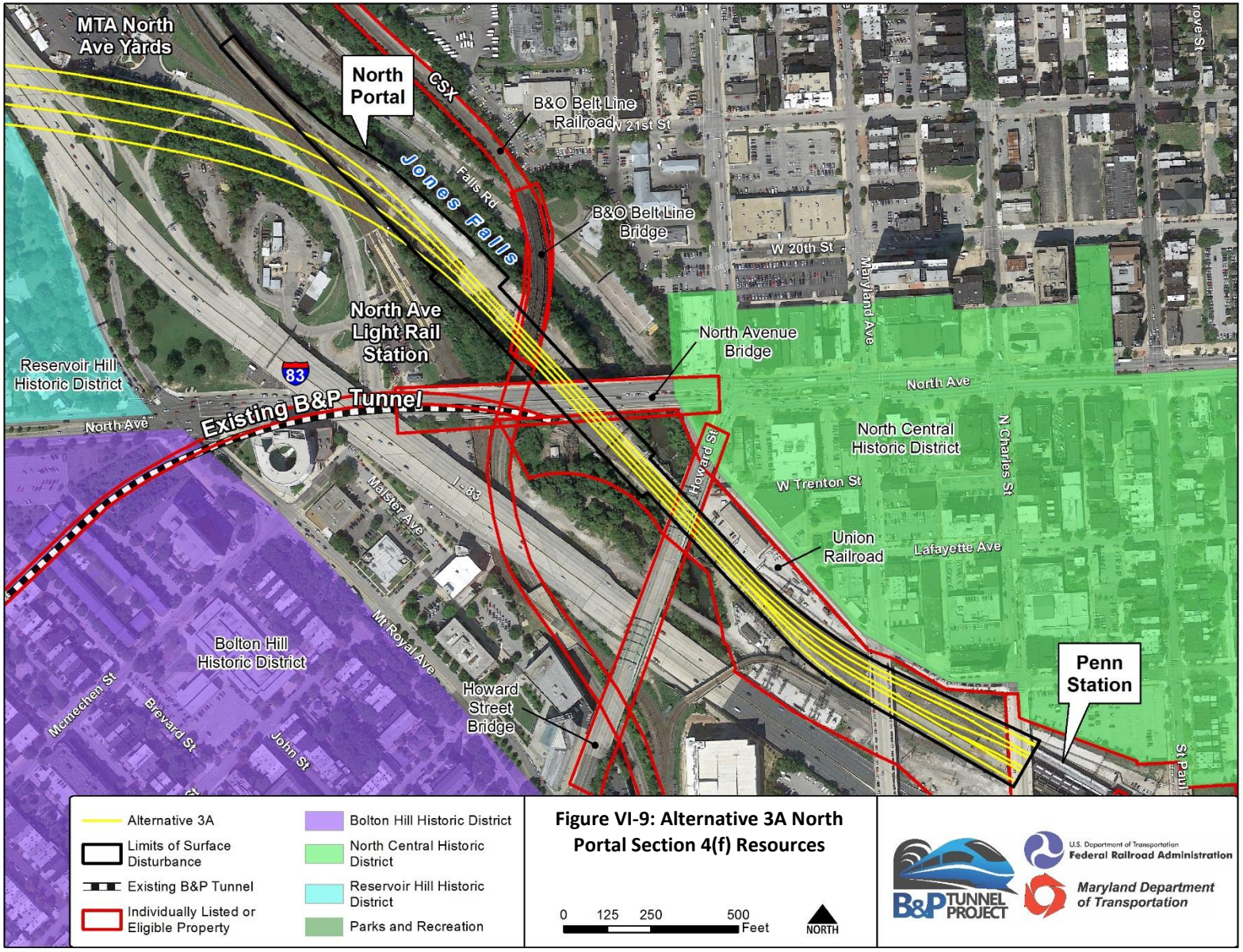


Figure VI-9: Alternative 3A North Portal Section 4(f) Resources

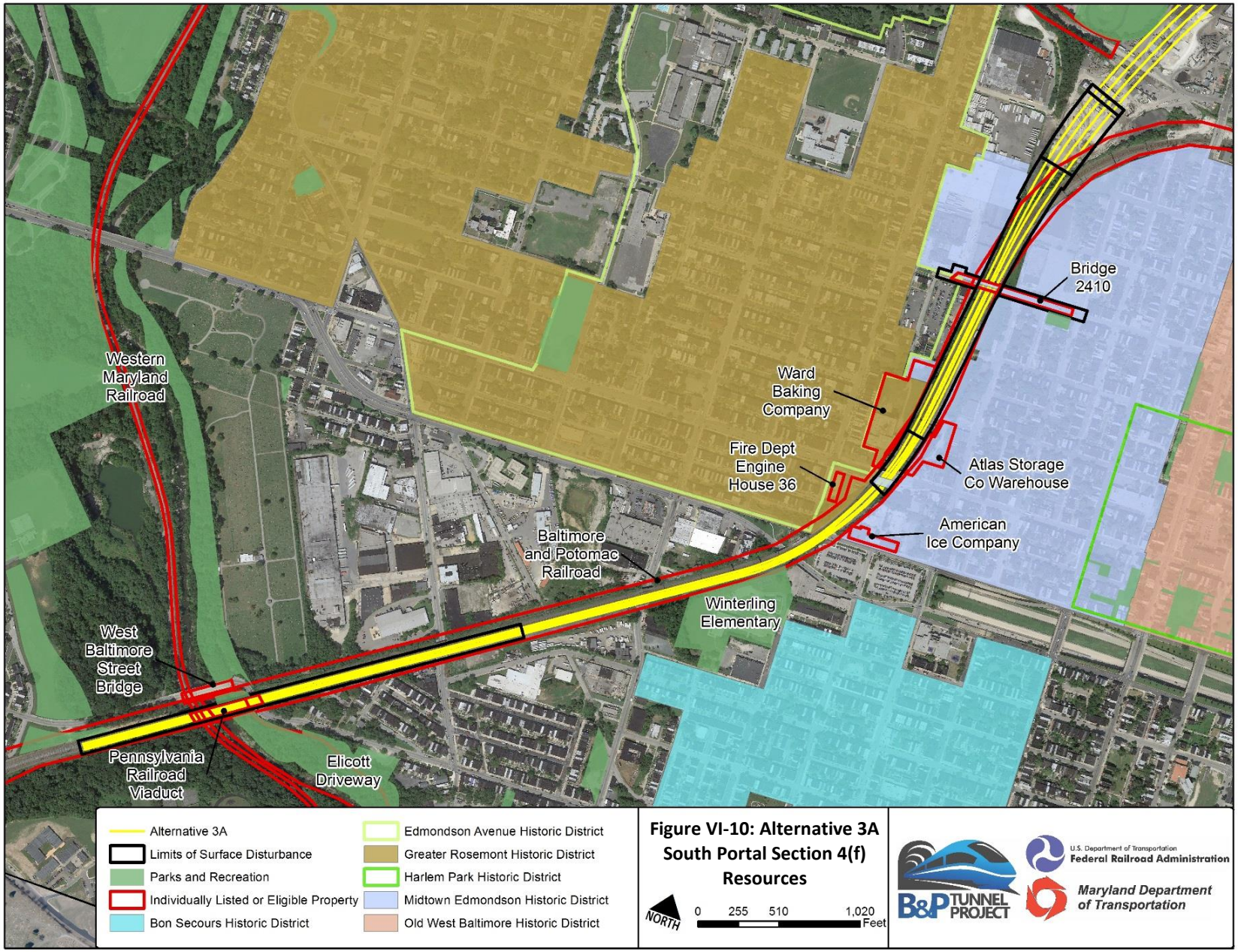
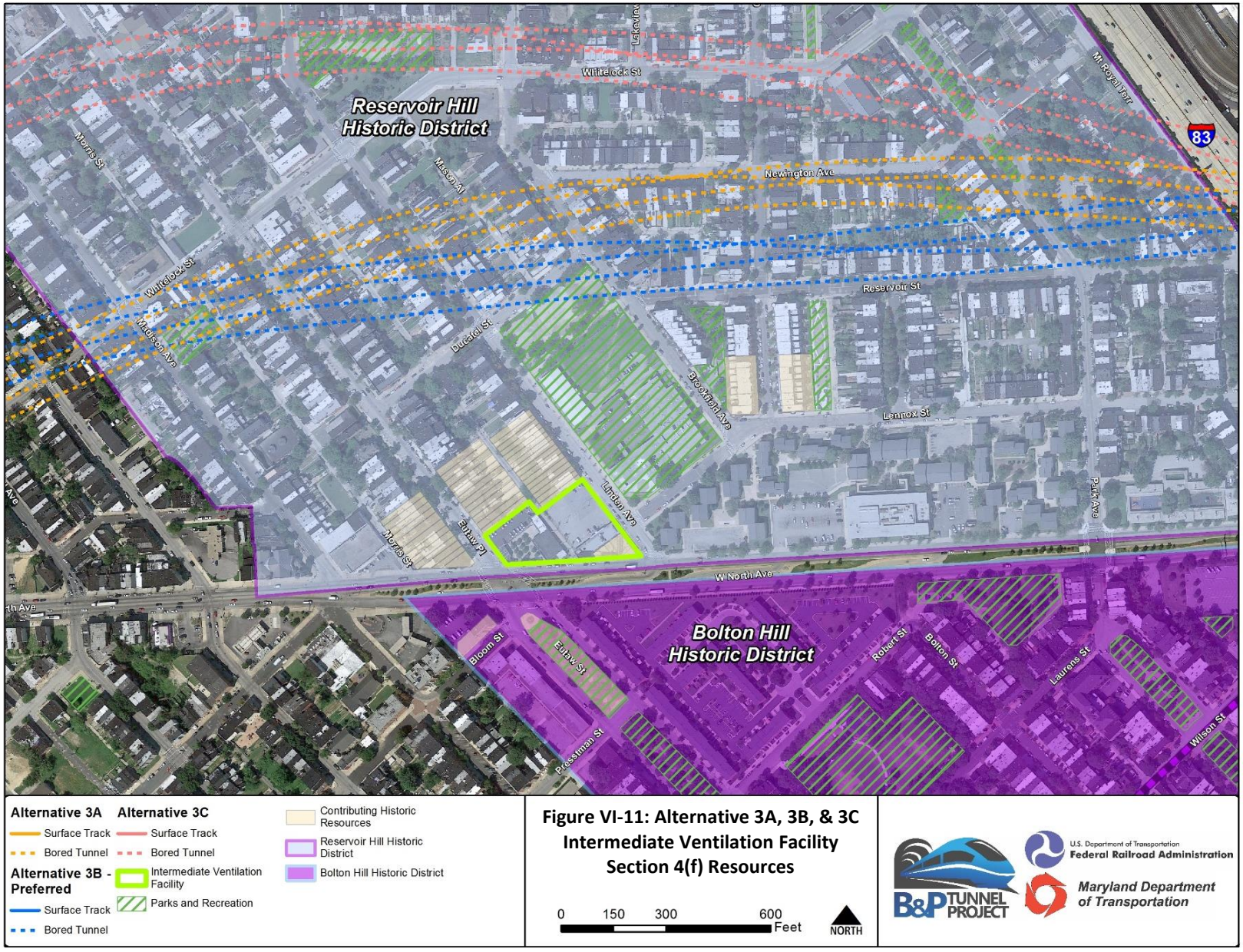
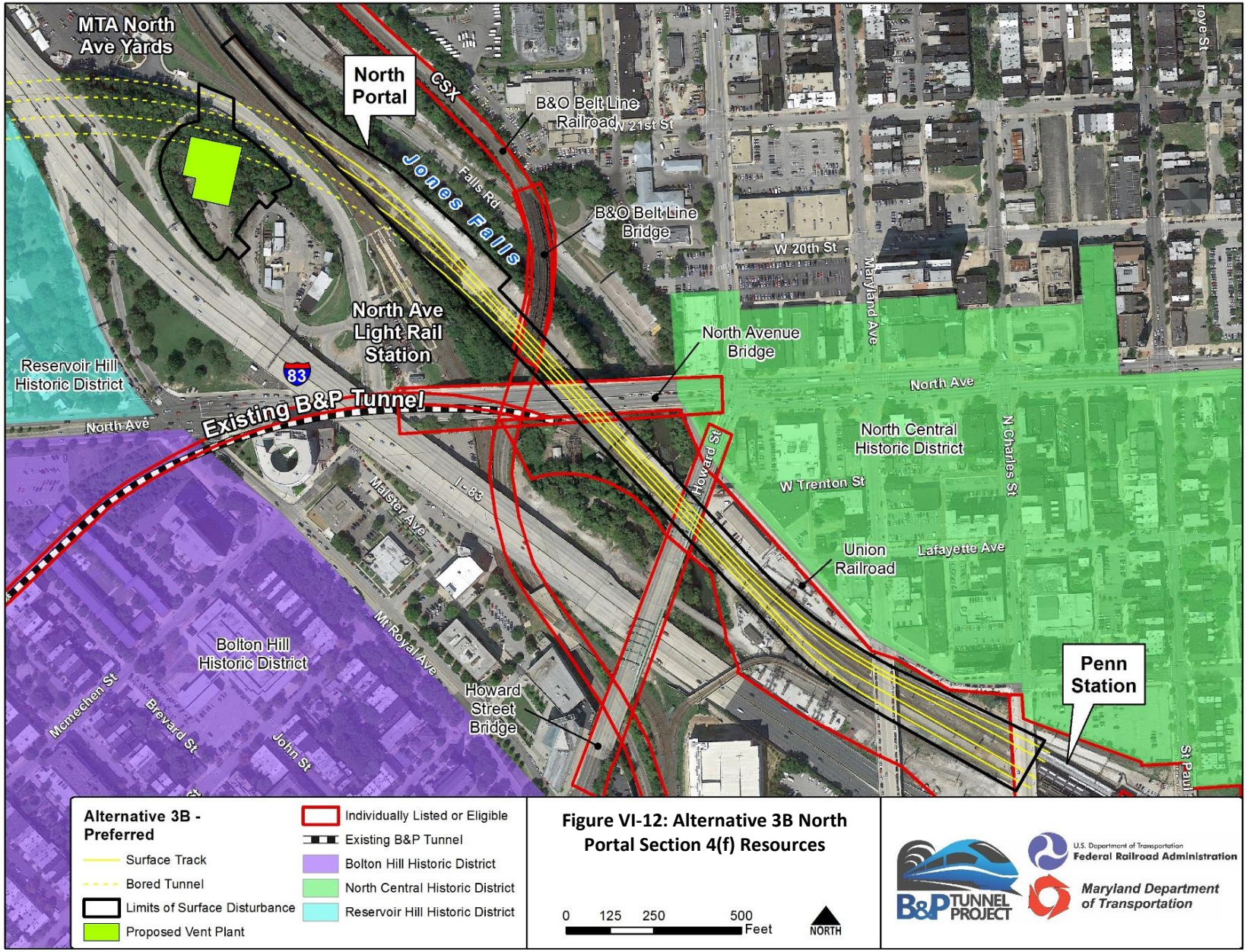
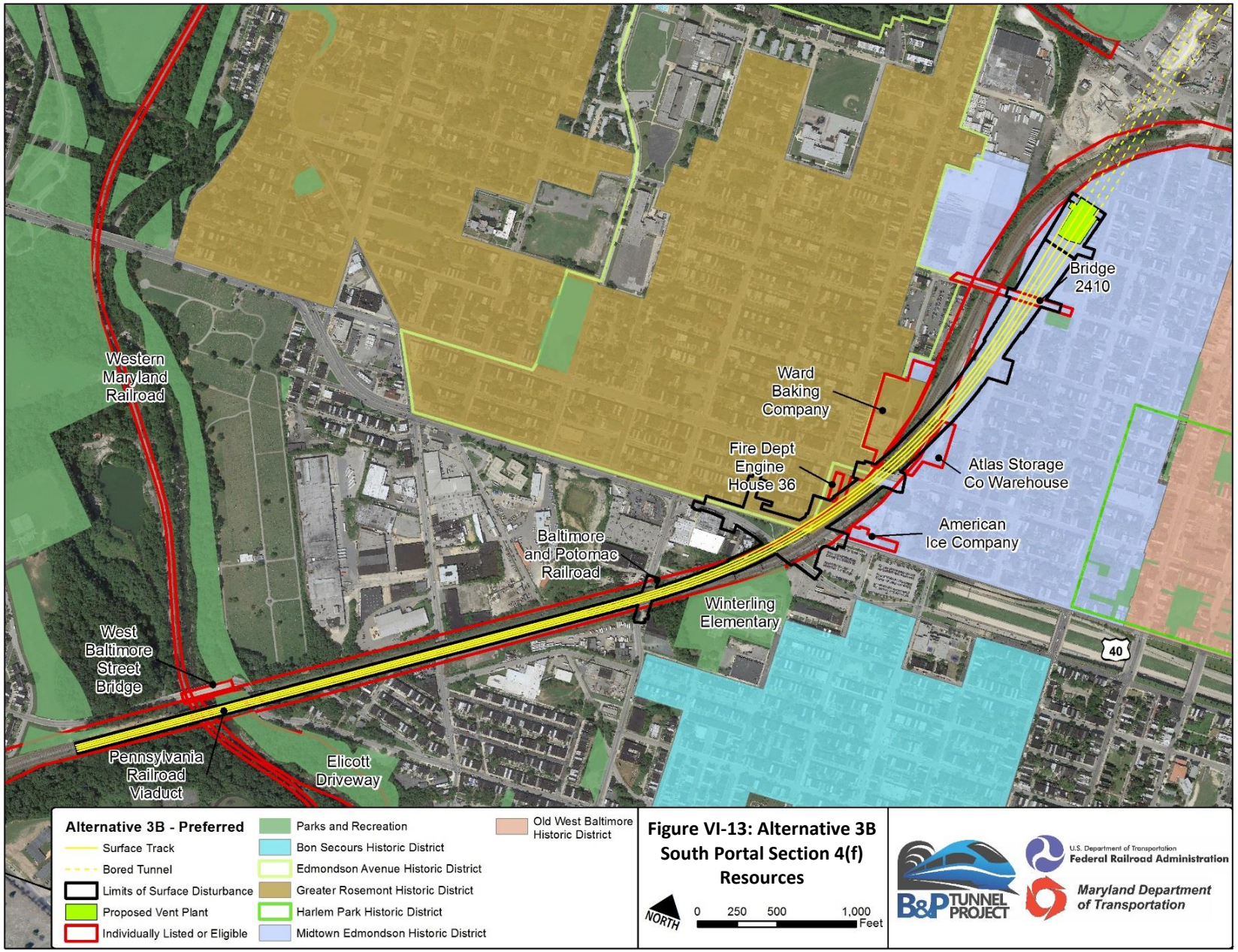


Figure VI-10: Alternative 3A South Portal Section 4(f) Resources


Reservoir Hill Historic District
Bolton Hill Historic District
Whitelock St
Newington Ave
Reservoir St
Lennox St
W North Ave
Bloom St
Robert St
Bolton St
Laurens St
Wilson St
Presstman St
Eutaw St
Eutaw Pl
Linden Ave
Brookfield Ave
Ducatel St
Madison Ave
Mosher Al
Morris St
Park Ave
Mt Royal Ter
83
Alternative 3A
Surface Track
Bored Tunnel
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Alternative 3C
Surface Track
Bored Tunnel
Intermediate Ventilation Facility
Parks and Recreation
Contributing Historic Resources
Reservoir Hill Historic District
Bolton Hill Historic District
0 150 300 600 Feet
NORTH
Figure VI-11: Alternative 3A, 3B, & 3C Intermediate Ventilation Facility Section 4(f) Resources
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation


MTA North Ave Yards
North Portal
CSX
B&O Belt Line Railroad
W 21st St
Falls Rd
Jones Falls
B&O Belt Line Bridge
W 20th St
Maryland Ave
North Ave Light Rail Station
North Avenue Bridge
Reservoir Hill Historic District
83
Existing B&P Tunnel
North Ave
North Ave
North Central Historic District
N Charles St
Howard St
W Trenton St
I-83
Malster Ave
Union Railroad
Lafayette Ave
Mt Royal Ave
Bolton Hill Historic District
Howard Street Bridge
Penn Station
Mcmechen St
Brevard St
John St
St Paul
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Limits of Surface Disturbance
Proposed Vent Plant
Individually Listed or Eligible
Existing B&P Tunnel
Bolton Hill Historic District
North Central Historic District
Reservoir Hill Historic District
0 125 250 500 Feet
NORTH
Figure VI-12: Alternative 3B North Portal Section 4(f) Resources
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation


Western Maryland Railroad
Ward Baking Company
Fire Dept Engine House 36
Atlas Storage Co Warehouse
Bridge 2410
American Ice Company
Baltimore and Potomac Railroad
Winterling Elementary
West Baltimore Street Bridge
Pennsylvania Railroad Viaduct
Elicott Driveway
40
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Limits of Surface Disturbance
Proposed Vent Plant
Individually Listed or Eligible
Parks and Recreation
Bon Secours Historic District
Edmondson Avenue Historic District
Greater Rosemont Historic District
Harlem Park Historic District
Midtown Edmondson Historic District
Old West Baltimore Historic District
NORTH
0 250 500 1,000 Feet
Figure VI-13: Alternative 3B South Portal Section 4(f) Resources
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Section 4(f) Properties Requiring Use

The Section 4(f) use of the B&O Belt Line Bridge over Jones Falls Valley, the B&O Belt Line Railroad, and Bridge 2410/Lafayette Avenue over Amtrak resulting from Alternative 3C would be identical to the use under Alternative 3A as described above and shown in **Figures VI-14** and **VI-15**.

Alternative 3C would result in modifications to elements of the historic Baltimore and Potomac Railroad resulting in a Section 4(f) use identical to the Preferred Alternative as described above.

Alternative 3C would result in demolition and permanent incorporation of five historic buildings and modification of two bridges contributing to the Midtown Edmondson Historic District (**Figure VI-15**) resulting in a Section 4(f) use. 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 Part 800.5.

Demolition of 17 historic buildings contributing to the Greater Rosemont Historic District would be required for construction of Alternative 3C. An additional 35 contributing properties would have portions incorporated into transportation use but would not require demolition. The permanent incorporation and demolition of historic properties would result in a Section 4(f) use. The harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity, resulting in adverse effect per 36 CFR Part 800.5.

Under Alternative 3C, use of the Edmondson Avenue Historic District would include demolition of 12 historic buildings or other elements contributing to the district. An additional 35 contributing properties would be partially incorporated into the transportation use and would not be demolished. The demolition and permanent incorporation of historic properties would result in a Section 4(f) use. The harm to the historic district would alter historic characteristics in a manner that would diminish historic integrity, resulting in adverse effect per 36 CFR Part 800.5.

Alternative 3C would require demolition and permanent incorporation of the Fire Department Engine Company No. 36 historic site resulting in Section 4(f) use. The harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity, resulting in adverse effect per 36 CFR Part 800.5.

Alternative 3C would require demolition and permanent incorporation of the Ward Baking Company building in order to construct the south portal approach, resulting in a Section 4(f) use. Harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity and would thus constitute an adverse effect per 36 CFR Part 800.5.

Alternative 3C would require construction of an Intermediate Ventilation Facility located in the Reservoir Hill Historic District, (**Figure VI-11)** resulting in Section 4(f) use of the historic district identical to that described under Alternative 3A above.

***De Minimis* Impacts**

Alternative 3C would impact the historic railroad right-of-way of the Western Maryland Railroad but would not affect the alignment or operation of the railroad. The harm to the railroad would not diminish historic integrity and would result in no adverse effect per 36 CFR Part 800.5. Therefore, FRA has determined the impact would be considered *de* pursuant to Section 4(f).

Alternative 3C would result in modifications to elements of the historic Union Railroad alignment identical to those described above under Alternative 3A, resulting in a *de minimis* impact.

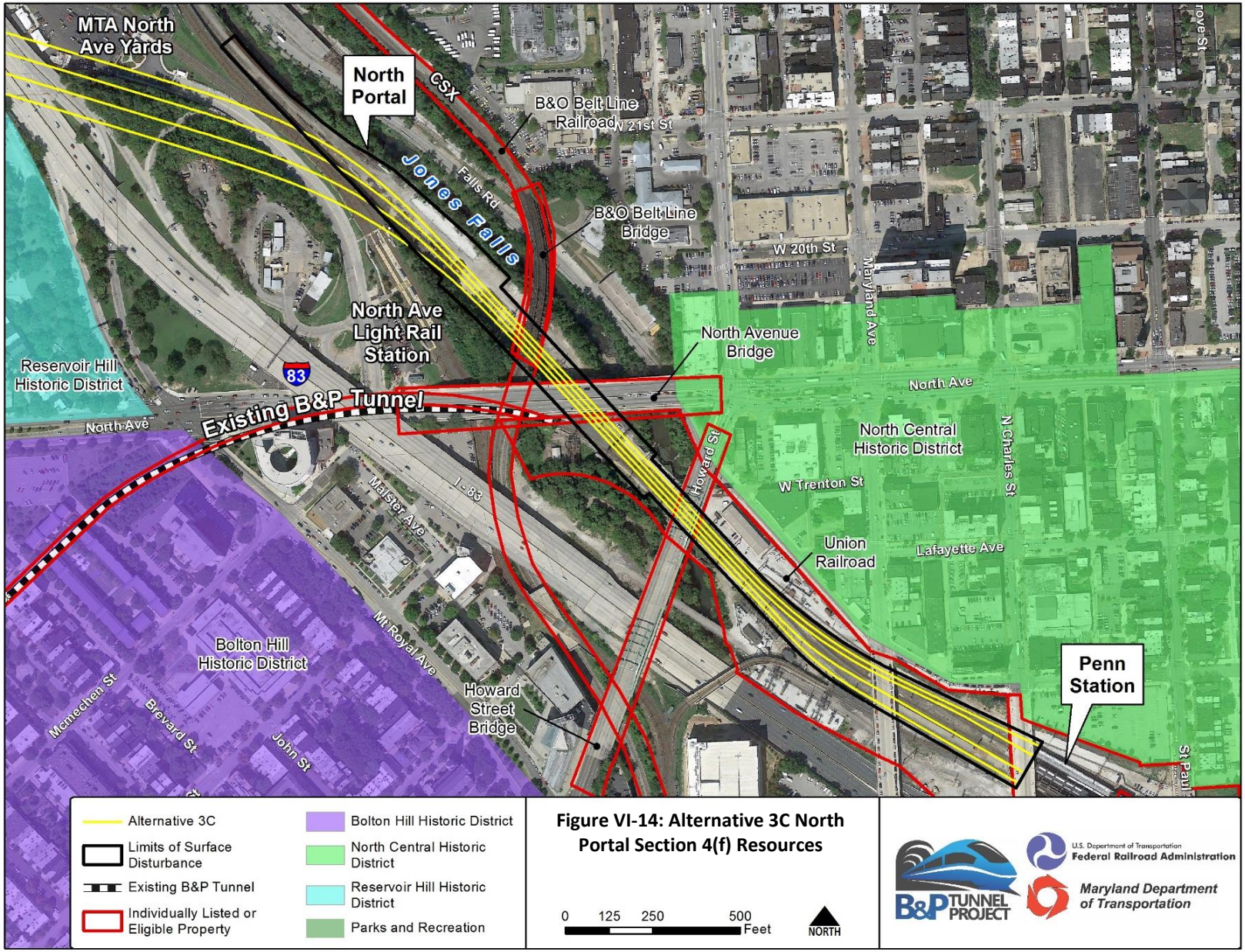


Figure VI-14: Alternative 3C North Portal Section 4(f) Resources

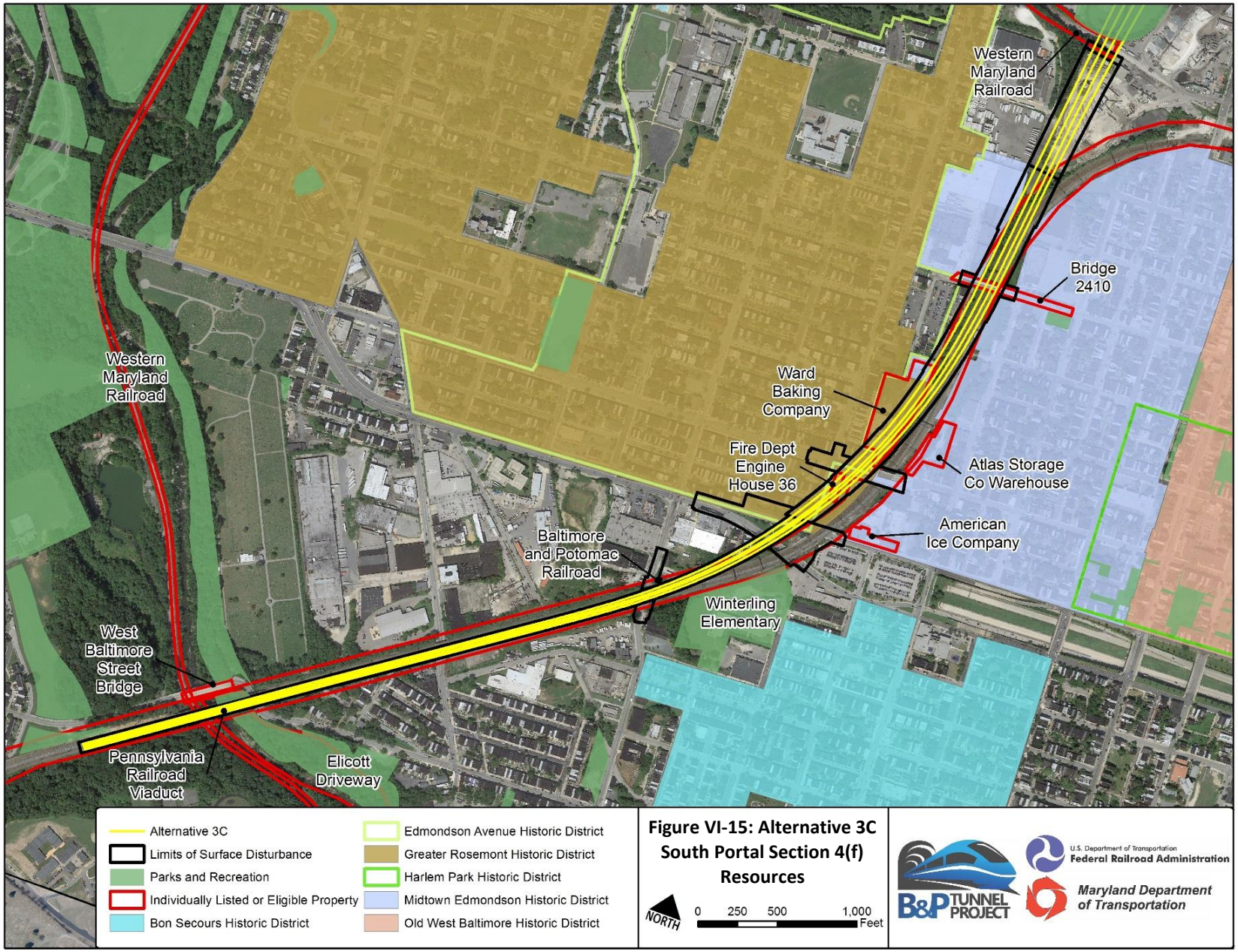


Figure VI-15: Alternative 3C South Portal Section 4(f) Resources

2. Avoidance Analysis

The purpose of Section 4(f) is to avoid and, when avoidance is not feasible or prudent, minimize the use of Section 4(f) properties. See FHWA's *Section 4(f) Policy Paper* (FHWA, 2012). Through the NEPA process, FRA has analyzed whether there is a feasible and prudent avoidance alternative. An avoidance alternative is an alternative that would not result in the use of Section 4(f) property. This analysis focuses on FRA's identification, development, evaluation, elimination, and documentation of potential feasible and prudent avoidance alternatives.[4]

An alternative is not ***feasible*** if it cannot be built as a matter of sound engineering judgment.

An alternative is not ***prudent*** if:

- It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
- It results in unacceptable safety or operational problems;
- It causes severe social, economic, or environmental impacts even after reasonable mitigation; severe disruption to established communities; severe disproportionate impacts to minority or low income populations; or severe impacts to environmental resources protected under other Federal statutes;
- It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;
- It causes other unique problems or unusual factors; or
- It involves multiple factors above that while individually minor, cumulatively cause unique problems, or impacts of extraordinary magnitude.

a. Avoidance Alternatives

All three build alternatives, including the Preferred Alternative, would result in the use of Section 4(f) properties. Eleven of the 16 Preliminary Alternatives previously evaluated and documented in the *Preliminary Alternatives Screening Report* are located in the same vicinity as the Preferred Alternative between the Amtrak Gwynns Falls Bridge and Baltimore Penn Station. FRA has determined that those eleven alternatives could not avoid the numerous parks and historic resources located in the Study Area vicinity, as they would require similar north and south portal impacts as the Preferred Alternative. This determination is based on the approximate location of the alignments, as documented in the *PASR*, relative to the locations of known Section 4(f) properties.

Nearly the entire area surrounding the existing NEC through West Baltimore is designated within one or more NRHP listed or eligible historic districts, which extend continuously from Druid Hill Park in the north to the Route 40 corridor in the south. Additionally, any alternatives that require the use of the portion of Amtrak's NEC currently located on the historic Baltimore and Potomac Railroad between the Baltimore City/County Line and Baltimore Penn Station cannot be avoidance alternatives because they do not avoid the use of Section 4(f) properties.

FRA identified three potential avoidance alternatives: Alternative 1: No Build, Preliminary Alternative 6: Locust Point, and Preliminary Alternative 7: Sports Complex. Alternative 1: No-Build would not construct improvements beyond maintenance through the Study Area and thus would avoid use of any Section 4(f) property. Preliminary Alternatives 6 and 7 would each bypass the historic Baltimore and Potomac Railroad, as well as Baltimore Penn Station, and thus could potentially avoid the numerous Section 4(f) resources clustered around the existing B&P

[4] FRA has conducted its Section 4(f) analysis consistent with FRA's Procedures for Considering Environmental Impacts (64 FR 28545, May 26, 1999) and using the Federal Highway Administration's (FHWA) regulations as guidance (23 CFR Part 774).

Tunnel. Thus, FRA has discussed these three potential avoidance alternatives in this Section 4(f) avoidance analysis (see **Figure VI-16**).

b. Alternative 1: No-Build

The No-Build Alternative would entail continued operation of the existing B&P Tunnel with no significant improvements aside from the routine maintenance currently being conducted. The tunnel's basic geometry and structure would not be improved and the existing tunnel and tracks would be left in place. This alternative would not modernize the tunnel or bring it into a "state of good repair," but would rather maintain the existing service and ongoing maintenance as currently practiced with minimal disruption. Because no improvements would be completed under this alternative, no use of Section 4(f) property would result.

Alternative 1: No Build would not, however, meet the B&P Tunnel Project's Purpose and Need of addressing the structural and operational deficiencies of the B&P Tunnel, reducing travel times, accommodating projected travel demand for passenger services, eliminating impediments to existing and projected operations along the NEC, or providing operational reliability. Because the No-Build Alternative fails to meet the Project's Purpose and Need, it would compromise the Project to a degree that would render it unreasonable to continue. Therefore, FRA has determined that the No-Build Alternative is not prudent and, thus, is not a viable avoidance alternative.

c. Preliminary Alternative 6: Locust Point

Alternative 6: Locust Point originated in the 2011 *Baltimore's Railroad Network: Analysis and Recommendations* (FRA and MDOT, 2011) report and was further analyzed in the B&P Tunnel *Preliminary Alternatives Screening Report*. The alignment would, from the south, depart from the existing NEC at Halethorpe Interlocking in Baltimore County, just outside of the I-695 Baltimore Beltway, to travel along the CSX main line to Curtis Bay Junction in southwest Baltimore City. At a location east of Curtis Bay Junction, the alignment would diverge to the east from CSX right-of-way. It would continue to the northeast, crossing over local roads and streets, to Westport. Trains would then cross the Middle Branch of the Harbor on an elevated structure above the former Western Maryland moveable bridge. The alignment would enter tunnels to pass below a portion of Locust Point and the Northwest Branch of the Inner Harbor before rising to ground level north of I-95 in Canton. The alternative would then curve to the north and follow existing NS tracks to rejoin the existing NEC at Bay Interlocking.

Alternative 6 would avoid Section 4(f) properties by following existing CSX alignment and bypassing the densely developed and historic central portion of Baltimore and traveling through several largely industrial areas in southern Baltimore City. While the conceptual alternative does not appear to result in the use of Section 4(f) properties, FRA would need to complete further engineering analysis and identify potential historic properties and parks and recreational areas in order to determine whether any use of Section 4(f) properties would be required. For the purposes of this evaluation FRA has assumed that Alternative 6 would result in total avoidance of Section 4(f) properties.

Alternative 6 would compromise the project to a degree that it is unreasonable to proceed with the project in light of its stated Purpose and Need. The alignment would result in a slow and circuitous route on existing freight railroad alignment, and would therefore not reduce travel time along the NEC. While the alignment would eliminate some existing impediments to operations along the NEC such as the existing B&P Tunnel, new impediments would likely be introduced under this alternative such as speed-restricting curves and at-grade crossings that would substantially compromise the Purpose and Need.

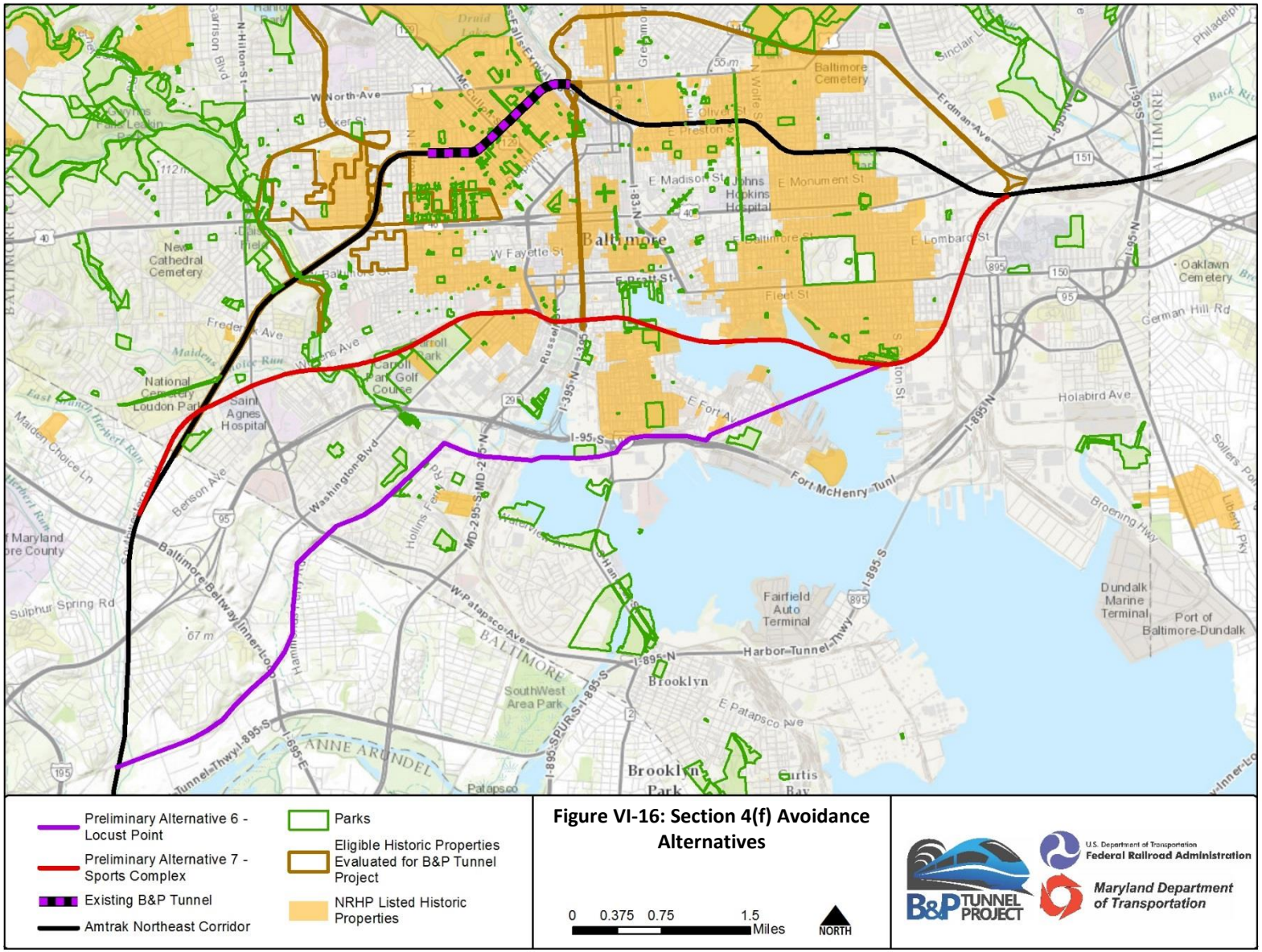


Figure VI-16: Section 4(f) Avoidance Alternatives

The alternative would result in unacceptable operational problems. The alternative would require Amtrak, CSX, NS, and MARC to all operate on the already overburdened CSX corridor, resulting in unacceptable operational problems such as delays resulting from conflicts between passenger and freight service. One major flaw of the alternative is that it would require a new station to replace Baltimore Penn Station, and no advantageous station location has been determined to replace it. Furthermore, discontinuing service to Baltimore Penn Station would be inconsistent with the currently active Baltimore Penn Station Master Plan, described in **Section II.E.4.j**. Additional details on the operational problems caused by Alternative 6 are documented in the 2011 *Baltimore's Railroad Network: Analysis and Recommendations* report.

The construction of a new intercity passenger rail station required under Alternative 6 would also create operational problems for maintaining commuter service along the existing MARC Penn Line. The relocated NEC would be in the vicinity of the existing MARC Camden Line, but additional infrastructure improvements such as restoration of the existing tunnel would be required to maintain MARC Penn Line service to the existing stations at West Baltimore MARC and Baltimore Penn Station.

Alternative 6 would result in additional construction and maintenance costs of an extraordinary magnitude due to the inability to utilize existing infrastructure at Baltimore Penn Station and the West Baltimore MARC Station. FRA eliminated this alternative from consideration during the Preliminary Alternatives Screening phase of the Project, as documented in the PASR, due to the alignment bypassing existing infrastructure. FRA considered this a "fatal flaw" as described in the PASR and summarized in **Section III.B**.

FRA has determined that Alternative 6: Locust Point is therefore not a prudent avoidance alternative. The alternative would compromise the Project to a degree that it is unreasonable to proceed with the Project in light of its stated Purpose and Need; it would result in unacceptable operational problems, and would result in additional construction and maintenance costs of an extraordinary magnitude.

d. Preliminary Alternative 7: Sports Complex

Preliminary Alternative 7: Sports Complex was conceptualized to serve, in particular, the Inner Harbor area of downtown Baltimore. The alignment would divert from the Amtrak NEC about 0.5 miles north of the I-695 Baltimore Beltway over crossing in southwest Baltimore. The alignment would follow Wilkins Avenue and transition into a tunnel section, continuing eastward to a location between the Oriole Park at Camden Yards baseball stadium and the M&T Bank Stadium. This would be the site for a downtown underground station in lieu of service to Baltimore Penn Station. The alignment would continue eastward in new tunnels under the Northwest Branch, past Fells Point to the vicinity of Boston Street where the alignment would curve to the northeast. Cut-and-cover tunneling would begin near Boston Street with a portal located near Eastern Street on an existing NS route. The NS tracks would be used until Bayview Junction where the alignment would rejoin Amtrak's NEC.

The alternative would avoid Section 4(f) properties by bypassing the more densely developed and historic central portion of Baltimore near Baltimore Penn Station and traveling through a tunnel below the heart of downtown Baltimore and the Inner Harbor. While the alternative does not appear to result in the use of Section 4(f) properties, FRA would need to complete further engineering analysis in order to determine whether any use of Section 4(f) properties would be required. However, for the purposes of this evaluation FRA assumes that Alternative 7 would result in total avoidance of Section 4(f) properties.

Alternative 7 would result in additional construction and maintenance costs of an extraordinary magnitude due to the length of the tunnel alignment and need for a new underground station in the central business district. An underground station, in particular, would be extraordinarily expensive due to the amount of excavation required underneath the densely developed central business district of Baltimore.

The alternative would also result in operational problems similar to Alternative 6 regarding the MARC Penn Line, resulting from the relocation of the NEC away from the existing Baltimore Penn Station. Additional infrastructure improvements, such as restoration of the existing tunnel, would be required to maintain MARC Penn Line service to the existing stations at West Baltimore MARC and Baltimore Penn Station.

Alternative 7 would also potentially result in severe impacts to environmental resources such as wetlands and floodplains due to the need for substantial length of new tunnels located underneath the Baltimore Harbor.

FRA does not consider Alternative 7: Sports Complex to be a prudent avoidance alternative due to the additional construction and maintenance costs of an extraordinary magnitude, operational problems resulting from relocating the NEC away from Baltimore Penn Station, and potential for impacts to protected environmental resources such as wetlands.

3. All Possible Planning to Minimize Harm

Through the avoidance analysis, FRA has determined there are no feasible and prudent avoidance alternatives for this Project. FRA has refined the alternatives throughout the alternatives development process to incorporate all possible planning to minimize harm to Section 4(f) properties. "All possible planning" includes all reasonable measures to minimize harm and mitigate for adverse impacts and effects. FRA has designed the Preferred Alternative to further minimize harm, including minimization measures such as shifts to the alignment, narrowed track spacing, and a relocated Intermediate Ventilation Facility. Mitigation will be used when impacts to Section 4(f) resources cannot be eliminated through avoidance or minimization measures.

a. Minimization

In response to public comments and to minimize environmental impacts, including impacts to Section 4(f) resources, FRA has refined the Preferred Alternative (Alternative 3B) since publication of the DEIS. FRA shifted the horizontal and vertical alignment of the tunnel and south portal approach tracks shifted and narrowed the south portal approach track spacing to reduce the project footprint at that location. FRA also shifted the alignment west of the existing right-of-way in the vicinity of Franklin and Mulberry Streets so that the alignment stays closer to the existing right-of-way and reduces impacts compared to the Alternative 3B alignment presented in the DEIS.

FRA refined the design of the Preferred Alternative alignment to minimize impacts to historic resources in the south portal area while still retaining the speed benefits from improving Curve 381. The Preferred Alternative alignment would pass between the Ward Baking Company and Atlas Storage Company Warehouse properties; avoiding demolition of the Ward Baking Company building and one of the two buildings in the Atlas Storage Company Warehouse complex that would have been demolished by the DEIS Alternative 3B. Project Consulting Parties expressed a preference to avoid impacts to both the Ward Baking Company building and the Atlas Storage Company property, but indicated that the Atlas Storage Company property was of less relative importance. The Preferred Alternative alignment also impacts fewer resources contributing to historic districts. Revisions to the design reduced the impacts to historic resources from 51 demolitions in the DEIS Alternative 3B to 31 demolitions in the Preferred Alternative. The alignment was shifted to reduce impacts while still avoiding demolition of other key historic resources near the south portal, such as the Fire Department Engine Company No. 36 and American Ice Company buildings. **Section III** provides more information comparing the DEIS Alternative 3B to the current Preferred Alternative.

b. Mitigation

For Section 4(f) uses that cannot be avoided or further minimized, FRA will incorporate all reasonable and feasible mitigation measures into the Project. Mitigation would be commensurate with the severity of the impact on the Section 4(f) resource. FRA has determined potential historic resource mitigation commitments through consultation with the officials having jurisdiction over each resource. At this stage of the Project, FRA has developed mitigation concepts to include in final design as described below and specified in a draft Programmatic Agreement (PA) in **Appendix H**. FRA has prepared the PA in accordance with Section 106 of the National Historic Preservation Act, as amended. The Draft PA includes mitigation measures developed in coordination with the SHPO (Maryland Historical Trust) and Project Consulting Parties. These measures will be fully designed and implemented during the final design and construction phases of the Project.

Mitigation measures have been included in the Draft PA and are intended to be implemented as mitigation for impacts to historic resources resulting from the Preferred Alternative. These measures are subject to revision until the Draft PA is finalized. More detail of each measure is included in the Draft PA, but the following list is an overview of these measures.

- Subject to specified conditions, the Preferred Alternative proposes establishment of an architectural historic properties preservation fund to address adverse effects to historic properties.
- The Preferred Alternative proposes development of context-sensitive design treatments for new construction informed by the features of the affected historic properties.
- The Preferred Alternative proposes that relevant historic properties, including contributing elements of historic districts, be screened with appropriate sound barriers and/or vegetation when appropriate.
- The Preferred Alternative proposes development of cultural resources construction protection plans designed to protect above-and below-ground known and unknown historic properties from adverse effects during construction activities. Plans will address vibration monitoring, stockpiling, and truck routes/hauling.
- The Preferred Alternative proposes preparation of written and photographic documentation consistent with Level II Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) standards for deposit within the MHT, for the historic properties, including contributing elements of historic districts, directly adversely affected.
- The Preferred Alternative proposes preparation of interpretive material including signs and/or displays and brochure to be located in Baltimore's Pennsylvania Station. Possible themes may include the history of the B&P Tunnel, the history of the Pennsylvania Railroad and Pennsylvania Station, the influence of railroads on Baltimore City, and/or archaeological findings in the project area as relevant.
- The Preferred Alternative proposes that oral history interviews will be conducted as part of the Preferred Alternative, particularly with older, long-time residents of neighborhoods like Midtown Edmonson and Reservoir Hill, and pre-Amtrak railroad employees, made as audio and/or video recordings in addition to written transcripts.
- The Preferred Alternative proposes securing, stockpiling, and making available salvaged building materials from the demolition of historic properties and contributing elements to historic districts.
- The Preferred Alternative proposes establishment, partnering with, and/or linking to electronic informational sites in order to make available to the public information, products and updates from the Section 106 process and relevant stipulations of the PA. Partner, if warranted with established preservation/history organizations with existing electronic outreach programs.
- The Preferred Alternative proposes completion of a Phase I Archaeological Survey sufficient to identify archaeological resources that may be affected by the Project. A Phase II archaeological survey shall be conducted to evaluate the identified resources for NRHP eligibility. If an adverse effect cannot be alternatively mitigated, The Project shall develop a Phase III research design/treatment plan for each NRHP –eligible archaeological resource adversely effected by the Undertaking.

- The Preferred Alternative proposes investigation of the history, development, use, and evolution of the station facilities and yards comprising present-day Pennsylvania Station in Baltimore City for the purposes of clarifying and delineating the official boundaries of railroad-related NRHP-listed and eligible historic properties.

c. Analysis of Least Overall Harm

If there is no feasible and prudent avoidance alternative, FRA may only approve the alternative that results in the least overall harm in light of Section 4(f)'s preservation purpose. FRA has conducted the least overall harm analysis by considering the following factors (as set forth in 23 CFR 774.3(c)(1)):

- The ability to mitigate adverse impacts to each Section 4(f) Property
- Severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection
- The relative significance of each Section 4(f) Property
- The views of the official(s) with jurisdiction over each Section 4(f) Property
- The degree to which each alternative meets the Purpose and Need for the Project
- After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)
- Substantial differences in costs among the alternatives

As described above, FRA has evaluated numerous alternatives throughout the NEPA process and determined that there are no feasible and prudent alternatives that completely avoid the use of Section 4(f) properties. Therefore, since all alternatives use Section 4(f) properties, FRA has undertaken a least harm analysis to determine the alternative with the least overall harm. **Table VI-13** above provides an overview of Section 4(f) impacts resulting from each of the build alternatives. Below is a summary of FRA's analysis with respect to each factor.

The ability to mitigate adverse impacts to each Section 4(f) Property

The Section 4(f) uses that FRA has identified in each of the build alternatives primarily involve the demolition of buildings that contribute to a historic district and/or that are individually eligible historic resources. Thus, the mitigation strategies FRA would employ are similar among all alternatives. More information on potential mitigation measures for the Preferred Alternative is available in **Chapter VII.**

FRA, in coordination with MHT and the Project Consulting Parties, has developed an extensive set of cultural resource mitigation measures through the Section 106 process to mitigate for the impacts of the Preferred Alternative. The PA (see draft in **Appendix H**) will document the terms and conditions agreed upon by the signatories to resolve the potential adverse effects on historic properties. The mitigation measures are summarized above.

Severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection

Alternative 3A would result in use of the fewest Section 4(f) properties of all the build alternatives. FRA has refined Alternative 3B to minimize use of Section 4(f) properties in the Preferred Alternative. The Preferred Alternative would result in use of fewer overall historic properties and historic contributing resources than Alternative 3C, though it would require a greater number of demolitions than Alternatives 3A and 3C. Alternative 3A and the Preferred Alternative would avoid demolition of several individually-eligible historic properties including the Ward Baking Company and the Fire Department Engine Company No. 36 buildings, both of which would be demolished under Alternative 3C. The Preferred Alternative would require demolishing only the rear

building of the Atlas Storage Company building, reduced reduction from the DEIS Alternative 3B impact to the Atlas Storage Company.

The relative significance of each Section 4(f) Property

Individually-listed or eligible historic properties are considered by MHT and the Project Consulting Parties to be of greater significance than resources contributing to historic districts. The Preferred Alternative and Alternative 3A would avoid use of the Ward Baking Company and Fire Department No. 36, two individually eligible properties that Alternative 3C would demolish. The Project Consulting Parties indicated through Section 106 consultation that the Ward Baking Company building is a higher preservation priority than the Atlas Storage Company Warehouse complex, which would be partially demolished by the Preferred Alternative.

The views of the official(s) with jurisdiction over each Section 4(f) Property

The Project Consulting Parties, including MHT, expressed the following views at Project Consulting Parties meetings:

- The Ward Baking Company building has greater historic importance than the Atlas Storage Company Warehouse complex.
- Preserving a portion of a resource with multiple buildings (such as the Atlas Storage Company property) is preferable to demolishing all of the resource.
- The American Ice Company building is the most important building to protect in the project area.
- Individually listed or eligible resources warrant higher preservation priority than elements contributing to historic districts that are not individually eligible.
- An Intermediate Ventilation Facility on the periphery of the Reservoir Hill Historic District is preferable to one in its interior.

A summary of each Project Consulting Parties meeting is included on the Project website (www.bptunnel.com).

The degree to which each alternative meets the Purpose and Need for the Project

The Preferred Alternative and Alternative 3C would meet the Project Purpose and Need to a greater degree than Alternative 3A. The Preferred Alternative and Alternative 3C would better meet the Project goal of reducing travel time through the B&P Tunnel and along the NEC by providing higher travel speeds and thus faster travel times along the NEC through the Study Area. Alternative 3A would improve travel times by a lesser amount than the Preferred Alternative or Alternative 3C. **Table VI-14** provides travel time savings information comparing the Preferred Alternative, Alternative 3A, and Alternative 3C. The Preferred Alternative and Alternative 3C would also accommodate accessible high-level platforms at West Baltimore MARC, which Alternative 3A would permanently preclude in the station's current location. Because they allow for high-level platforms at the current station location, the Preferred Alternative and Alternative 3C better meet the Purpose and Need regarding accommodation of existing and projected travel demand for commuter passenger service, and eliminating impediments to existing and projected operations along the NEC.

Table VI-14: Estimated Travel Time Savings from Build Alternatives

Service	Alternative 3A	Preferred Alternative (Alternative 3B)	Alternative 3C
Amtrak ACELA	2:00	2:31	2:30
Amtrak Regional	1:55	2:32	2:23
MARC	1:38	1:49	1:44

Note: Average of northbound/southbound trains.

After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)

Alternative 3A would have no impacts to residences or community facilities as it uses of existing Amtrak right-of-way and surrounding industrial land in the south portal vicinity. Alternative 3A would impact nine businesses including a portion of the P. Flanigan Asphalt facility (a major local employer).

The Preferred Alternative would impact 22 residences in the south portal vicinity, all located within minority and low income communities. Five of these 22 residences are estimated to be vacant. An additional 29 residential properties would be affected without requiring demolition. The Preferred Alternative would displace approximately 13 businesses and four community facilities. The Preferred Alternative would avoid direct impacts to the P. Flanigan Asphalt facility.

Alternative 3C would impact 12 residences in the south portal vicinity, all located within minority and low-income communities. Three of the 12 residences are estimated to be vacant. An additional 35 residential properties would be impacted without requiring demolition. Alternative 3C would impact approximately one community facility and 16 businesses, including the P. Flanigan Asphalt Company.

Substantial differences in costs among the alternatives

Based on preliminary estimates, Alternative 3A would have the lowest capital cost at an estimated $3.8 billion. The Preferred Alternative would cost an estimated $4.0 billion, and Alternative 3C would have the highest estimated capital cost at $4.2 billion. These preliminary cost estimates do not include mitigation or the preferred Intermediate Ventilation Facility site.

d. Conclusion

Alternative 3A would use the least number of Section 4(f) properties. Both the Preferred Alternative and Alternative 3C would have greater Section 4(f) impacts compared to Alternative 3A, which would require fewer demolitions and fewer overall Section 4(f) resources used. The Preferred Alternative would have less severe Section 4(f) impacts compared to Alternative 3C because it uses fewer Section 4(f) properties and avoids demolishing two important individually eligible historic properties, the Ward Baking Company and Fire Engine Co. 36 buildings. Both of these would be demolished under Alternative 3C, and were recommended as high priority for preservation by the Project Consulting Parties and MHT. The Preferred Alternative would impact more historic rowhomes contributing to the Greater Rosemont, Midtown-Edmonson, and Edmonson Avenue Historic Districts; however, many of these have relatively less historic integrity due to their poor physical condition and thus may have less historic significance than individually eligible buildings.

The Preferred Alternative and Alternative 3C would meet Purpose and Need to a much greater degree than Alternative 3A because they both improve the existing curve (Curve 381) along the NEC where the West Baltimore MARC Station is currently located, thus eliminating an impediment to existing and projected operations along the NEC. The Preferred Alternative or Alternative 3C would allow for higher train speeds and greater travel time savings along the corridor compared to Alternative 3A (**Table VI-14**), and thus would better meet the stated Purpose and Need regarding reducing travel time through the B&P Tunnel along the NEC.

The Preferred Alternative and Alternative 3C would also allow for accessible high-level platforms at the West Baltimore MARC Station, thus better accommodating existing and projected travel demand for commuter passenger service and eliminating impediments to operations along the NEC. Improvements to Curve 381 would be precluded for the lifespan of the new tunnel under Alternative 3A, preventing future speed improvements and ADA accessible MARC platforms in the current station location.

After balancing the factors above, particularly the relative ability to meet the Purpose and Need, FRA has determined that Alternative 3B, as modified in this FEIS, has the least overall harm in light of the Section 4(f) statute's preservation purpose, and has thus identified it as the Preferred Alternative. The Preferred Alternative has less severe impacts to Section 4(f) resources compared to Alternative 3C and meets the Project Purpose and Need to a greater degree than Alternative 3A. Moreover, the substantial mitigation measures included in the Preferred Alternative, developed in consultation with Project Consulting Parties and MHT and included in the draft PA (**Appendix H**), will help to mitigate the impacts to Section 4(f) resources resulting from the Preferred Alternative. Though the Preferred Alternative requires greater use of Section 4(f) resources compared to Alternative 3A, the benefits of meeting the Purpose and Need to a greater degree outweighs the remaining harm, after mitigation, to Section 4(f) properties.

E. Natural Resources

Impacts to natural resources are shown on **Figure VI-17**. No impacts to natural resources would occur under Alternative 1: No-Build. Additional information regarding impacts to natural resources, is available in the *Natural Resources Technical Report.*

1. Soils

a. Alternative 1: No-Build

No impacts would occur under Alternative 1: No-Build. No improvements beyond maintenance would occur, thus no soils would be impacted.

b. Preferred Alternative

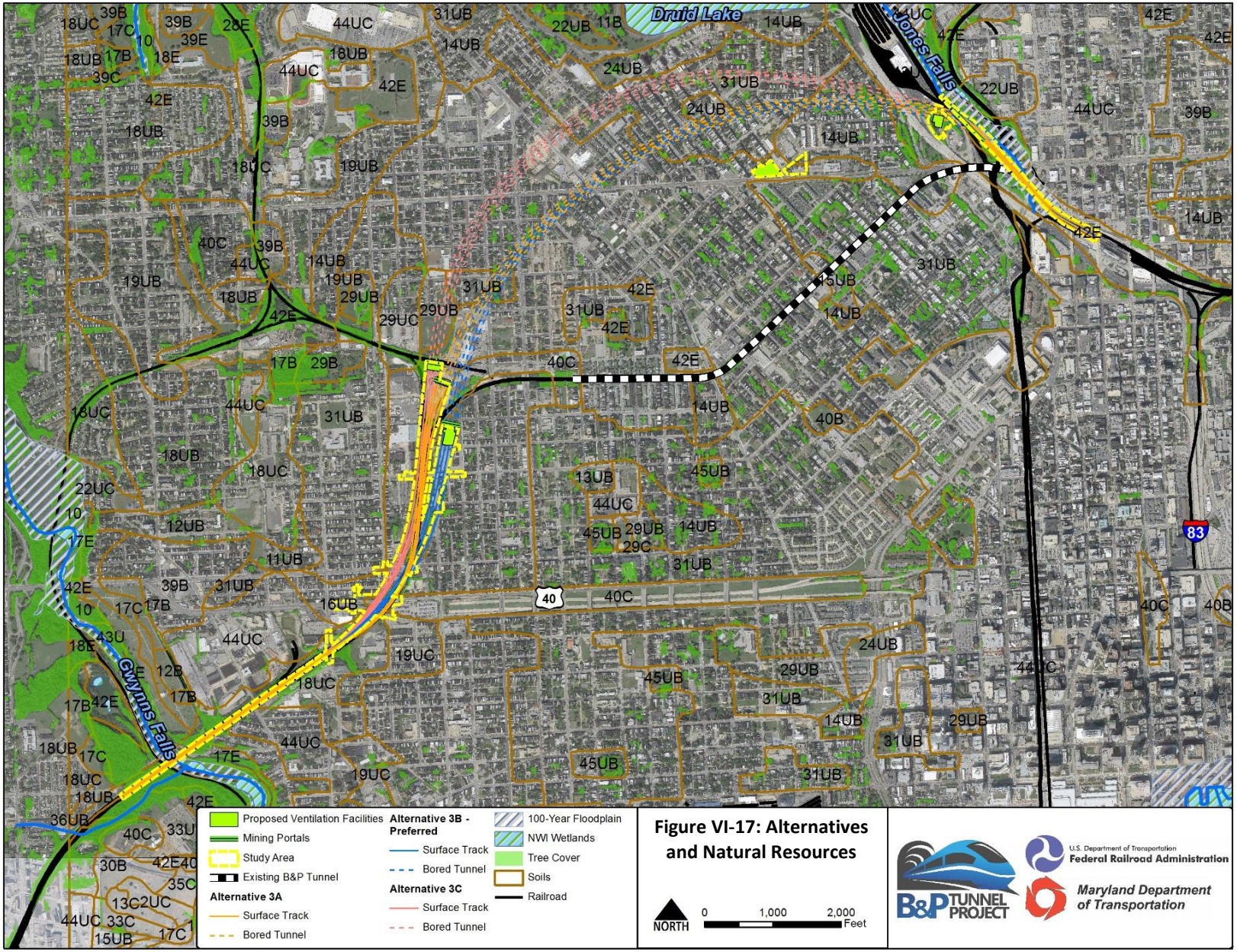
The Preferred Alternative would remove large quantities of soil through either tunnel boring or cut-and-cover construction. Construction areas would also expose the soil surface in portal and vent shaft locations, requiring stabilization to limit surface runoff and sediment pollution to surface waters. Soil types within the Study Area will not likely be significantly impacted by the Preferred Alternative, as the soil is already highly urbanized.

c. Alternative 3A

Impacts to soils resulting from Alternative 3A would be similar to the Preferred Alternative as described above.

d. Alternative 3C

Impacts to soils resulting from Alternative 3C would be similar to the Preferred Alternative as described above.


Druid Lake
Jones Falls
Gwynns Falls
40
83
Proposed Ventilation Facilities
Mining Portals
Study Area
Existing B&P Tunnel
Alternative 3A
Surface Track
Bored Tunnel
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Alternative 3C
Surface Track
Bored Tunnel
100-Year Floodplain
NWI Wetlands
Tree Cover
Soils
Railroad
NORTH
0
1,000
2,000
Feet
Figure VI-17: Alternatives and Natural Resources
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

2. Topography, Geology, Aquifers, and Groundwater

a. Alternative 1: No-Build

No impacts would occur under Alternative 1: No-Build. No improvements beyond maintenance would occur, thus topography, geology, aquifers, and groundwater would not be impacted.

b. Preferred Alternative

The elevations used in assessing topography, geology, aquifers, and groundwater were based on a review of the *Map of Baltimore City Showing the Configuration of the Underlying Rock Floor* (Baltimore City, 1935). These elevations were based on the datum in use in 1935, not the accepted present day datum, and are approximate.

Most of the Preferred Alternative alignment would be located below the upper contour of the mapped surface of the rock, except south of Presstman Street where it would start to emerge from the rock into mixed face conditions. A similar situation would be encountered east of Mt. Royal Avenue to the north portal.

The Study Area overlies the Piedmont Crystalline Rock Aquifer, an underground layer of water-bearing rock. Groundwater recharge is highly variable in this region, since it is almost entirely dependent on precipitation and local runoff that is absorbed through the regolith and into rock fractures (Trapp, H. and M.A. Horn, 1997). No Sole Source Aquifers, active water supply reservoirs, or wells are located near the Preferred Alternative, thus there would be no impact to these resources. Surface water from rainfall and snowmelt is the source of the Baltimore City drinking water supply. Further discussion of groundwater is included in **Section VI.E.3** below.

c. Alternative 3A

Alternative 3A would be similar to the Preferred Alternative regarding topography, geology, aquifers and groundwater as described above.

d. Alternative 3C

Alternative 3C would be similar to the Preferred Alternative regarding topography, geology, aquifers and groundwater as described above.

3. Water Resources

a. Alternative 1: No-Build

No impacts would occur under Alternative 1: No-Build.

b. Preferred Alternative

Streams and Navigable Waterways

The Jones Falls, the Gwynns Falls, and a tributary of the Gwynns Falls are located within the Study Area. The Preferred Alternative would remain on existing structures over these waterbodies, and therefore will not directly impact them.

Wetlands

The Preferred Alternative would not directly or indirectly impact wetlands. The two NWI wetlands near the Study Area are located away from the Preferred Alternative.

Water Quality

Minor impacts to water quality are possible from sediment and other construction-related runoff, but would be limited by required erosion and sediment control measures. An Erosion and Sediment Control Plan for construction activities would be developed during the final design phase.

The Gwynns Falls and a tributary of the Gwynns Falls would not be impacted by the Preferred Alternative, which would remain on existing structures over these waterways.

The Preferred Alternative includes measures to ensure compliance with all applicable stormwater management regulations. A stormwater Management Plan will be developed during the final design stage of the Project and implemented in coordination with the City of Baltimore and MDE. The plan will focus on stormwater runoff associated with construction activities and surface impacts, both temporary and permanent, throughout the Study Area.

Groundwater

Technical specifications will require the excavation contractor to be responsible for the collection, control and disposal of all groundwater infiltration and other water sources during construction. Low inflow rates into excavations are currently anticipated and the water may be simply channeled to the invert and directed to flow by gravity back to the south portal or a shaft collection point from which it can be pumped to the surface. The flow can also be captured in advance by small local sumps spaced along the tunnel to collect the water and then pumped to the surface.

The main running tunnels will be bored by pressurized-face Tunnel Boring Machines (TBMs) using a precast concrete segmental lining which functions simultaneously as both ground support and waterproofing. The precast lining is installed by a special TBM component; the lining is installed immediately as the TBM moves forward. Behind the TBM, the completed lining will have essentially no flowing water. Any significant water bearing zones ahead of the TBM excavation (which is not currently expected) can be quickly completely sealed off due to the type of TBM (pressurized-face). The water bearing zone can then be locally grouted (though a sealing system) if needed before excavation proceeds further.

There will be some freshwater lines to the TBM for activities such as cooling certain motors. Once used, this water will be piped back to a wastewater collection point for required processing. Other parts of the tunnels excavated by non-TBM methods (e.g. drill & blast) will generate some water volumes (expected to be low) of both groundwater inflows and drilling water. Thus, overall, the collection, diversion and disposal of any captured groundwater plus any return water from the TBM and other excavation machinery will be the responsibility of the contractor. The collection/diversion system will be compatible with the contractor's actual final excavation methods and sequences. The disposal will be in accordance with all applicable local, state and federal environmental regulations, which vary depending on the groundwater chemistry, the presence of suspended solids, and the potential for groundwater contaminants.

Currently, it is anticipated that no major active dewatering equipment (e.g., deep wells, ejectors, vacuum well points, etc.) will be required or allowed outside the limits of the excavations, so any groundwater requiring handling will come exclusively from within the excavations. Two exceptions may be the north portal area and the plenum tunnel which may require some minor horizontal dewatering. This would be contained within the north portal excavation area and within the plenum tunnel excavation.

It is proposed to discharge collected groundwater into public sewers near project areas in accordance with the applicable regulations at each particular discharge site. Before discharge, some forms of treatment are expected to be necessary. As a minimum, the removal of suspended solid and removal of oils/greases would be addressed.

Floodplains and Flood Hazards

The Preferred Alternative would impact approximately 3.4 acres of the Jones Falls' 100-year and 500-year floodplains. This impact would include permanent impact from new track construction, as well as temporary impact from construction staging areas. The floodplain of the Gwynns Falls would not be impacted. Because the north portal would be within the Jones Falls floodplain, final design of the Preferred Alternative would be designed to minimize flood hazard risk for the new infrastructure.

c. Alternative 3A

Alternative 3A would not differ from the Preferred Alternative with regard to impacts to water resources including streams and navigable waterways, wetlands, water quality, floodplains and flood hazards, or groundwater as described above.

d. Alternative 3C

Alternative 3C would not differ from the Preferred Alternative with regard to impacts to water resources including streams and navigable waterways, wetlands, water quality, floodplains and flood hazards, or groundwater as described above.

4. Coastal Zone

Although the project is within Baltimore City, a designated portion of Maryland's Coastal Zone, no impacts are anticipated. However, due to project location, Coastal Zone Consistency is required. The Coastal Zone Consistency would be issued after final design by MDE as part of the floodplain impact authorization. The federal consistency requirements are carried out by the Coastal Zone Consistency Division of MDE. Coastal Zone Consistency determines whether proposed activities are consistent with the enforceable policies of the State's Coastal Zone Management Program.

a. Alternative 1: No-Build

No impacts would occur under Alternative 1: No-Build.

b. Preferred Alternative

No impacts would occur under the Preferred Alternative.

c. Alternative 3A

No impacts would occur under Alternative 3A.

d. Alternative 3C

No impacts would occur under Alternative 3C.

5. Wildlife and Habitat

a. Alternative 1: No-Build

No impacts would occur under Alternative 1: No-Build.

b. Preferred Alternative

The B&P Tunnel would have minor impacts on wildlife and their habitat, since most of the project will take place underground. Above-ground trackwork, portals, and ventilation facilities will primarily impact urban areas with little habitat value.

Aquatic Habitat

The Jones Falls, Gwynns Falls, and a tributary of the Gwynns Falls are located within the Study Area. These waterways and associated aquatic habitats would not be directly impacted by the Preferred Alternative. Since the Study Area is located within a highly urbanized area, the Preferred Alternative is anticipated to have no adverse impact on aquatic habitat.

Terrestrial Habitat

Trees, hedgerows, and forest stands were identified based on field review conducted from public right-of-way. The Preferred Alternative would impact a total of approximately 106,400 SF of forest stands and 60,700 SF of hedgerow.

Street trees would be affected due to construction impacts near the tunnel portals and ventilation facilities. Approximate impacts to street trees within the portal and vent shaft locations of the Preferred Alternative are included in **Table V-15**. No specimen trees were identified in the Study Area. No street trees are anticipated to be affected within the north portal location. Approximately seventy-four street trees would be impacted within the south portal area. Approximately seventeen street trees and ten landscaped trees within the property boundary would potentially be impacted by the Intermediate Ventilation Facility at 900-940 West North Avenue.

Table VI-15: Potential Street Tree Impacts

Project Area	Preferred Alternative Number of Trees Affected
North Portal	0 street trees
South Portal	74 street trees
Intermediate Ventilation Facility, 900-940 West North Avenue	27 street trees and landscaped trees

Invasive Species

The Study Area is located in residential, industrial, and railroad areas. Non-native, invasive species commonly found within the study area that would be impacted by the Preferred Alternative include Princess tree (*Paulownia tomentosa*), Tree of Heaven (*Ailanthus altissima*), Norway maple (*Acer platanoides*), multiflora rose (Rosa multiflora), Oriental Bittersweet (*Celastrus orbiculatus*), and Japanese honeysuckle (*Lonicera japonica*). Construction in portal and vent shaft areas has the potential to spread invasive species by creating new areas of disturbance in which these opportunistic species can spread quickly.

c. Alternative 3A

Alternative 3A would have minor impacts on wildlife and their habitat, since most of the project would take place underground. Above-ground trackwork, portals, and ventilation facilities would primarily impact urban areas with little habitat value. No adverse impact to aquatic habitat is expected under Alternative 3A, as described above for the Preferred Alternative. Portal areas for Alternative 3A would impact approximately 64,200 SF of forest stand, 88,100 square feet of hedgerow and one street tree. Alternative 3A would impact the same 27 street trees and landscaped trees at the Intermediate Ventilation Facility as the Preferred Alternative. Alternative 3A would not differ from the Preferred Alternative with regard to invasive species as described above.

d. Alternative 3C

Alternative 3C would have minor impacts on wildlife and their habitat, since most of the project will take place underground. Above-ground trackwork, portals, and ventilation facilities will primarily impact urban areas with little habitat value. No adverse impact to aquatic habitat is expected under Alternative 3C, as described above for the Preferred Alternative. Portal areas for Alternative 3C would impact an estimated 84,200 SF of forest stands, 126,600 SF of hedgerows, and 35 street trees. Alternative 3C would impact the same 27 street trees and landscaped trees at the Intermediate Ventilation Facility as the Preferred Alternative. Alternative 3C would not differ from the Preferred Alternative with regard to invasive species as described above.

6. Rare, Threatened, and Endangered Species

a. Alternative 1: No-Build

No impacts would occur under Alternative 1: No-Build.

b. Preferred Alternative

The USFWS has concurred that no Maryland or federally-listed threatened or endangered species are known to exist within the Study Area. The Preferred Alternative would therefore not impact threatened or endangered species. Agency correspondence regarding rare, threatened, and endangered species is included in **Appendix B** as well as the *Natural Resources Technical Report*.

c. Alternative 3A

Alternative 3A would not impact threatened or endangered species, as described above for the Preferred Alternative.

d. Alternative 3C

Alternative 3C would not impact threatened or endangered species, as described above for the Preferred Alternative.

7. Mitigation

The Project includes the following mitigation measures that correspond with the Project's impacts to natural resources, including avoidance and minimization considerations. Although the following measures correspond with the Preferred Alternative, similar measures would be appropriate to mitigate natural resources impacts of Alternative 3A and Alternative 3C.

a. Soils

The majority of soils potentially affected by the Preferred Alternative have already been disturbed, manipulated, or covered by development. During construction, large areas of exposed soil can be eroded by wind and rain when vegetation and naturally occurring soil stabilizers are removed. The potential for soil and sedimentation impacts to water quality would be minimized by adhering to the MDE-approved Erosion and Sediment (E&S) Control plans, including best management practices (BMPs) such as silt fence, straw bales, and other methods to prevent sediment from entering surface waters. Stormwater management planning and design will occur later in the project design process.

Stormwater Management and Erosion and Sediment Control plans would be developed during final design for the Preferred Alternative. Mitigation measures for soil erosion and sediment control will be detailed in the MDE stormwater and E&S control permitting process documents, likely to include BMPs such as silt fencing and straw bales to limit sediment influx to surface waters.

b. Topography/Geology

Underground boring would have impacts on geology, but above ground topography is unlikely to change significantly. Dewatering would likely be needed in excavating the tunnel. Care will be exercised during construction to avoid settlements of the existing utilities and structures, and to monitor potential settlements. This will be crucial when boring under the existing Metro tunnel and when excavating in the mixed face and unconsolidated material near the portals.

Since there are no significant geologic resources within the study area corridor, no mitigation is expected to be required. The Preferred Alternative would not have a significant impact on geologic resources such as mines or quarries. Some grading and small changes to drainage patterns to redirect surface runoff may be required, but would be minimized under the E&S Control plans.

c. Water Resources

Water quality impacts would be minimized through the MDE stormwater and E&S control permitting process. Direct impacts to waterways and the 100-year and 500-year floodplains would be minimized in the aboveground portions of the project by maintaining construction within the existing track area at the north portal location and on existing structure in the south portal location.

A plan for floodplain mitigation would be developed during final design of the Preferred Alternative. A MDE Non-Tidal Wetlands and Waterways Permit would be required for work within the 100-year floodplain. In-water work is not anticipated for the Preferred Alternative, but if it were necessary, coordination would need to take place with MDE and the US Army Corps of Engineers (USACE). FEMA coordination would be required only if impacts were significant enough to require a floodplain map change.

Technical specifications will require the excavation contractor to be responsible for the collection, control and disposal of all groundwater infiltration and other water sources during construction. It is proposed to discharge collected groundwater into public sewers near project areas in accordance with the applicable regulations at each particular discharge site. Before discharge, some forms of treatment are expected to be necessary. As a minimum, the removal of suspended solids and removal of oils/greases would be addressed.

d. Coastal Zone

Coastal Zone consistency is required, but no impacts to the Coastal Zone are expected to result from this project and therefore no mitigation would be necessary.

e. Wildlife and Habitat

The B&P Tunnel project is proposed within a highly-urbanized environment. Terrestrial habitats are limited within the Study Area, thereby reducing the diversity of wildlife. Wildlife use of the affected areas would be expected to be limited due to their relatively small size, limited cover, and isolation from larger vegetated corridors. However, trees within the Study Area do provide habitat for urban wildlife species. Trees within forest stands, hedgerows, and the public road ROW are the primary natural resources that would be potentially impacted by the tunnel project. Specific tree impact avoidance and minimization techniques would be detailed in the Forest Conservation Plan (FCP). The Project would develop and implement a Street Tree Protection Plan and FCP as required during final design for the Preferred Alternative. Under the Preferred Alternative, affected street trees, forest stands, and hedgerows would be replaced in accordance with Baltimore City and Maryland DNR requirements. Mitigation within the ROW would be on a 1:1 basis, and on private land, landscaping and tree replacement would be considered within the immediate vicinity of the resource effects.

A Forest Conservation Worksheet will be prepared during the design stage to determine the amount of planting that will be required for mitigation. This worksheet will be used to calculate the amount of reforestation and afforestation planting required for the Preferred Alternative based on the area of the LOD, forest cleared and retained, and the applicable land use category.

Tree protection fencing, as indicated in the FCP, would be installed along the boundary between tree protection area LOS to prevent access by construction equipment and the staging and stockpiling of materials within tree protection areas. Additional construction techniques may be considered to avoid and minimize tree effects including tree wells, retaining walls, air spading, root aeration matting, and at-grade sidewalk construction.

An Erosion and Sediment Control Plan would be developed during the Final Design stage of the project for approval by MDE. The plan minimizes the potential for sediment and other construction-related runoff, including concrete wash-out, to leave the LOD and contaminate tree protection areas.

Construction in portal and ventilation facility areas has the potential to spread invasive species by creating new areas of disturbance in which these opportunistic species can spread quickly. The Street Tree Protection Plan and Forest Conservation Plan, as well as the landscape design to be completed during final design of the Preferred Alternative, will emphasize the planting of native vegetation and take into account the potential for spread of invasive species.

f. Rare, Threatened, and Endangered Species

No state or federally listed RTE species have been identified within the study area corridor, therefore no mitigation would be required.

F. Hazardous Materials

This section describes the environmental consequences for hazardous materials for the Preferred Alternative, Alternative 3A, and Alternative 3C in comparison to Alternative 1: No-Build. Mitigation measures addressing hazardous materials are listed below and in **Chapter VII**: Mitigation. Additional information regarding Alternatives 3A and 3C is included in the DEIS.

1. Alternative 1: No-Build

Alternative 1 presents little to no potential for the mobilization of hazardous materials or contaminants, as no construction activity will occur. Maintenance of the existing tunnel infrastructure may expose local residents and the surrounding community to hazardous materials as a result of spills or accidental releases of maintenance chemicals or supplies. Due to the lack of a major construction effort, occupational hazards would be low. Train traffic would continue to use the existing B&P Tunnel.

2. Preferred Alternative

The Preferred Alternative is expected to encounter contaminated soil and groundwater during construction activities near contaminated sites. The Preferred Alternative's at-grade alignment sections will require less management of contaminated materials compared to tunnel sections and deep utility relocations, which will require more effort to remove, handle, and dispose of contaminated materials.

Further targeted investigations will occur during the final design phase. Targeted investigations within the Preferred Alternative alignment and construction limits of disturbance (LOD) will identify existing contaminant conditions that could be mobilized during construction. Hazardous materials or contaminated sites in the vicinity of the Preferred Alternative will be identified, and, if they 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.

Investigations should confirm the presence of subsurface contamination; type and extent of soil and groundwater contamination; migration direction and depth of groundwater contamination, if present; and proximity, direction, and relative elevation. Data will be used to assess potential effects of contaminated soil and groundwater on design and construction of the tunnel.

a. Sites of Concern

A total of 112 sites of concern were identified within one mile of the Preferred Alternative alignment (see **Table VI-16**), including 67 low-priority sites (see **Table VI-17**), 38 moderate priority locations (see **Table VI-18**) and 7 high-priority sites (see **Table VI-19** and **Figure VI-18)**. Hazardous material sites include residences, dry cleaners/laundromats, schools, automotive maintenance facilities, gas stations, fire stations, community resource centers, industrial properties, and railway yards within the Study Area. Eight low-priority sites of concern were identified within 500 feet of the Intermediate Ventilation Facility.

Table VI-16: Hazmat Sites Impacted under the Preferred Alternative

	# Low Priority Sites	# Medium Priority Sites	# High Priority Sites	Total Hazmat Sites
Preferred Alternative	67	38	7	112

Hazards associated with the low priority sites include petroleum, automotive, dry-cleaning, railway contamination, and 'hazardous waste' as well as industrial history and a Voluntary Cleanup Program (VCP) site. Half of the sites have current or historical petroleum use and/or release.

Table VI-17: Low Priority Hazardous Material Sites near the Preferred Alternative

Site ID #	Property Description	Address	Hazard Type
BP-011	Baltimore Pre-Release Unit	301 North Calverton Road	Petroleum use
BP-012	Baltimore Substation	239 North Calverton Road	Petroleum release
BP-015	City of Baltimore Franklin Street Yard	231 North Calverton Road	Petroleum release
BP-016	Lexington Auto Service/Motor Pool West	2560 West Lexington Street	Automotive and hazardous waste history
BP-019	Baltimore Uniform Rental, Inc.	2555 West Lexington Street	Petroleum use, Dry-cleaning history
BP-021	Former Acme Pad Factory	330 North Warwick Avenue	Petroleum release
BP-026	unknown	311 North Warwick Avenue	Petroleum release
BP-027	Cosmechem	215 North Warwick Avenue	Hazardous waste history
BP-032	Bentalou Elementary School	220 North Bentalou Street	Petroleum release
BP-033	Baltimore City	2305 W Franklin Street	Automotive history
BP-034	Victor Graphics	200 North Bentalou Street	Petroleum release
BP-039	Apex Oil, Co.	2109 West Lafayette Avenue	Petroleum release
BP-043	LA Auto Service	2124 Edmondson Avenue	Automotive history
BP-044	McDowell's Auto Service	2135 Edmondson Avenue	Automotive history
BP-047	Matthew A. Henson Elementary School	1600 North Payson Street	Petroleum use
BP-048	Keen Leasing, Inc.	1900 Elgin Avenue	Petroleum release
BP-058	Cloverland Dairy	2200 North Monroe Street	Petroleum use
BP-061	One & One Carry Out	1550 North Monroe Street	Automotive history

Site ID #	Property Description	Address	Hazard Type
BP-068	Kim property	1655 North Monroe Street	Petroleum release
BP-069	Sunoco Service Station	1829 Baker Street	Automotive history
BP-071	Papa Auto Parts	2218 Reisterstown Road	Petroleum release
BP-074	Perfect Cleaners	700 McKean Avenue	Dry-cleaning history
BP-081	People's Valet Service, Inc.	1827 North Fulton Avenue	Dry-cleaning history
BP-088	Parham & Spriggs Laundry	1704 West North Avenue	Dry-cleaning history
BP-089	F. A. Taylor	1568 Clifton Avenue	Petroleum release
BP-097	Mel and Logan Auto	2608 Pennsylvania Avenue	Automotive history
BP-098	Gilmore Homes, Baltimore Housing Authority	1601 Vincent Court	Petroleum release
BP-100	National Auto Repair	2600 Pennsylvania Avenue	Automotive history
BP-102	Westside Elementary School	2335 North Fulton Avenue	Petroleum release
BP-104	Colonial Launderers	2542 Pennsylvania Avenue	Dry-cleaning history
BP-107	Whitelock Towing	2634 Flora Street	Petroleum release
BP-110	Fish Rental Services	2565 Pennsylvania Avenue	Petroleum use, Dry-cleaning history
BP-112	Wareheim's Garage	2480 Woodbrook Avenue	Automotive history
BP-113	Baltimore Transit Co. – Retreat Street Repair Shop	1511 Retreat Street	Automotive history, Railway history
BP-114	residence	717 Cumberland Street	Petroleum release
BP-115	Former auto service facility (Theo Messersmith)	2468 Woodbrook Avenue	Automotive history
BP-116	CVS Pharmacy	2523 Pennsylvania Avenue	hazardous waste history
BP-122	H&B Manufacturing Co., Inc.	1415 Retreat Street	Automotive history
BP-128	City of Baltimore	2311 Pennsylvania Avenue	Petroleum release
BP-130	residence	2427 Francis Street	Petroleum use
BP-145	Exxon #22758	1201 West North Avenue	Petroleum release
BP-147	Former auto service facility (Jason Litchfield)	1006 Whitelock Street	Automotive history
BP-155	Penrose property	2520 Linden Avenue	Petroleum release
BP-156	Amoco Station	1101 West North Avenue	Petroleum release
BP-163	Wonder Cleaners & Tailors	954 Whitelock Street	Dry-cleaning history
BP-165	Lee, Sun F	925 Whitelock Street	Dry-cleaning history
BP-167	Housing & Urban Development	827 Druid Park Lake Drive	Petroleum release
BP-168	Crown Station (Quest Station)	1001 West North Avenue	Petroleum use
BP-169	Former Cove One Hour Cleaners	919 Whitelock Street	Dry-cleaning history
BP-170	Snow White Self Service Laundry	915 Whitelock Street	Dry-cleaning history
BP-172	Fish Dry Cleaning & Laundry Co.	2270 Brookfield Avenue	Dry-cleaning history
BP-174	VI Contracting Site	841 Whitelock Street	Petroleum release
BP-179	Minor's Cleaners	1800 Linden Avenue	Dry-cleaning history
BP-194	Tune Up City, Inc.	701 Whitelock Street	Automotive history
BP-205	Sisson Realty Company/Sun Cab	2600 Sisson Street	Petroleum release
BP-208	Baltimore Fire Department, Aerial Tower 111	401 West North Avenue	Petroleum use
BP-209	Southern Fuel Company	401 West 26th Street	Petroleum release
BP-210	Lincoln Motor	410 West North Avenue	Automotive history

Site ID #	Property Description	Address	Hazard Type
BP-211	AAA Mid-Atlantic Inc.	1401 West Mount Royal Avenue	Petroleum use
BP-212	Maryland Institute College of Art - Fox Building	1341 Dickson Street	Petroleum use
BP-213	Bolton Yard	80 West Oliver Street	VCP action
BP-215	Maryland Institute College of Art	113 West North Avenue	Petroleum release
BP-216	Maryland Community Resource Center	1734 Maryland Avenue	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

Hazards associated with the medium priority sites include petroleum, automotive, dry-cleaning, railway contamination, and 'hazardous waste,' as well as industrial history and coal use, Brownfields, and VCP sites. Half of the sites have current or historical petroleum use and/or release.

Table VI-18: Medium Priority Hazardous Material Sites near the Preferred Alternative

Site ID #	Property Description	Address	Hazard Type
BP-013	L & J Processing Facility	222 North Calverton Road	Hazardous waste history
BP-017	Can-Do Fuel Oil Company, Inc.	2527 Baker Street	Petroleum contamination
BP-018	Maryland Lumber Co.	2601 West Franklin Street	Petroleum release
BP-020	Emanuel Tire, LLC	1300 Moreland Avenue	Hazardous waste history, Petroleum use
BP-022	Baltimore Car & Truck Rental, Inc.	200 North Warwick Avenue	Petroleum release
BP-023	G&M Oil Company, Inc.	1549 Warwick Avenue	Petroleum release
BP-024	Trans Realty, Inc.	2501 West Lexington Street	Petroleum use
BP-025	Franklin Fuel Express	2417 W Franklin Street	Petroleum use
BP-028	Blue Ridge Fuel Co.	1400 Moreland Avenue	Petroleum use
BP-029	Marco Shoe Company/Nelco Shoes	2415 West Franklin Street	Petroleum use
BP-030	Tedco Industries	2335 W Franklin Street	Petroleum use
BP-031	Kaufman Products	1330 North Bentalou Street	Petroleum use, Industrial history
BP-035	Jung, Youngok Ann	501 North Bentalou Street	Automotive history
BP-036	Exxon Station	2200 Edmondson Avenue	Petroleum use
BP-038	Alpha One, Inc.	2140 Edmondson Avenue	Petroleum release
BP-040	Emanuel Tire	2120 West Lafayette Avenue	Brownfields
BP-042	Carver Vocational Technical Senior High School	2201 Presstman Street	Petroleum use
BP-045	The Old Time Way Church of Deliverance	2104 West Lanvale Street	Coal history
BP-059	Stop Shop Save	1410 North Monroe Street	Automotive history
BP-062	Exxon Company	1542 North Monroe Street	Petroleum use

Site ID #	Property Description	Address	Hazard Type
BP-063	E. S. Brady & Co., Inc.	1310 North Monroe Street	Railway history
BP-064	Jolly's Food and Convenience Mart	1500 North Monroe Street	Automotive history
BP-066	Former Coliseum Building	2201 North Monroe Street	VCP action, Petroleum use
BP-067	BP Service Station	900 North Monroe Street	Petroleum release
BP-077	JJ Adams Fuel Oil Company	1810 Winchester Street	Petroleum use
BP-080	Watkins residence	2037 North Fulton Avenue	Petroleum release
BP-086	American Oil Co., Penn Square II	1655 Old Lane	Petroleum release
BP-099	George G. Ruppersberger & Sons, Inc.	2639 Pennsylvania Avenue	Petroleum release
BP-108	Part Terminal Station	2331 North Fulton Avenue	Petroleum release
BP-119	MTA Terminal	2471 Woodbrook Avenue	Petroleum use
BP-133	Greenwood Towing Inc./Auto Title Service Corp.	1370 West North Avenue	Petroleum use, Automotive history
BP-203	Norfolk Railway Yard (Hollin Yard)	340 West North Avenue	Petroleum use, railway history
BP-206	Baltimore City DPW Highway Maintenance Garage	560 West North Avenue	Petroleum use
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-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

Hazards associated with the high priority sites include petroleum and railway contamination as well as industrial history, Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), and VCP sites. The majority of the sites have current or historical petroleum use and/or release.

Table VI-19: High Priority Hazardous Material Sites near the Preferred Alternative

Site ID #	Property Description	Address	Hazard Type
BP-037	ABEX Baltimore – ABC Rail Products Corp.	2200 Winchester Street	CERCLIS, Industrial history
BP-041	American Ice Company	2100 West Franklin Street	Brownfields assessment, Hazardous waste history
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-095	Penn Square Property	2632 Pennsylvania Avenue	VCP action, Petroleum release
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

b. Construction Impacts

Construction of the Preferred Alternative would include transporting and using construction-related hazardous materials and wastes, and could potentially result in accidental releases of hazardous material. Additionally, construction of the Preferred Alternative has the potential of mobilizing contaminants already present in the soil or groundwater. Exposure of the local population to groundwater pollutants is mitigated since the City of Baltimore conversion from water supply wells to a municipal supply system in the 1800s. Construction areas for the Project would have restricted access (fencing, gates, barriers, security guards, etc.) to help prevent accidental exposure.

Temporary Use and Storage of Hazardous Materials

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. 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 (PCBs) within transformer insulating oil. In some cases, the proposed action will require the 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 downstream potential to generate hazardous waste (e.g., tunnel muck, asbestos demolition material). Discussion of mitigation is included in the following sections.

Construction on or in Proximity to Sites of Concern

Based on the industrial history of properties within the Preferred Alternative's limit of disturbance, the mobilization of some impacted soil and groundwater during construction is anticipated. Phase II environmental site assessments are recommended for high and medium priority sites to further screen and characterize potential contaminant concentrations prior to mobilization for field activities. A total of 11 high, 24 medium, and 36 low-priority sites are identified for Phase II assessment under the Preferred Alternative. The sites identified are based on the potential risk of encountering contaminants during construction of the tunnel based on distance from the alignment, and type of contaminant (i.e. mobility, hazard, quantity released). All environmentally hazardous materials and contaminants encountered or mobilized during construction of the

project will be investigated, handled, and mitigated in accordance with applicable Federal, state, and local laws and regulations.

Although the hazardous materials assessment focused on historical environmental releases in the vicinity of the Preferred Alternative, other sources of contamination or hazardous materials mobilized during construction of the project have the potential to impact the surrounding community or local environment. Remediated sites may also contain residual subsurface contamination that could be impacted by construction.

Figures VI-18, **VI-19**, **VI-20**, **and VI-21** depict the location of sites of concern identified for this FEIS in relation to the Preferred Alternative alignment.

Construction of the tunnel portals is anticipated to mobilize significant quantities of soil and groundwater. One high priority site (Amtrak Pennsylvania Station – BP-224), six medium priority sites (see **Table VI-18**) and nine low priority locations (see **Table VI-17**) are within 500 feet of the north portal (see **Figure VI-21**). Due to the industrial history of the site and surrounding area, potential contaminant concerns include petroleum constituents, corrosive waste, halogenated solvents, chlorinated solvents, cadmium, chromium, lead, mercury, and benzene.

Two high priority sites (The American Ice Company – BP-041 and Matrix Metals – BP-050), thirteen medium priority sites (see **Table VI-18**) and twelve low priority locations (see **Table VI-17)** are within 500 feet of the south portal (see **Figure VI-19**). Historical contaminant concerns underlying and surrounding the south portal area include arsenic, cadmium, chromium, mercury and other metals, benzene petroleum constituents, tetrachloroethylene and other chlorinated solvents, PAHs, ammonia and coal tar.

In addition to the potential contaminants identified above, tunnel construction activities are potential sources of hazardous materials, which include work in and around:

- Gas lines and other subsurface utility systems;
- Construction equipment fuel tanks;
- Compressed gas canisters for welding;
- Building demolition material including asbestos or lead-based paint; and
- Chemicals present in tunneling muck.

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.

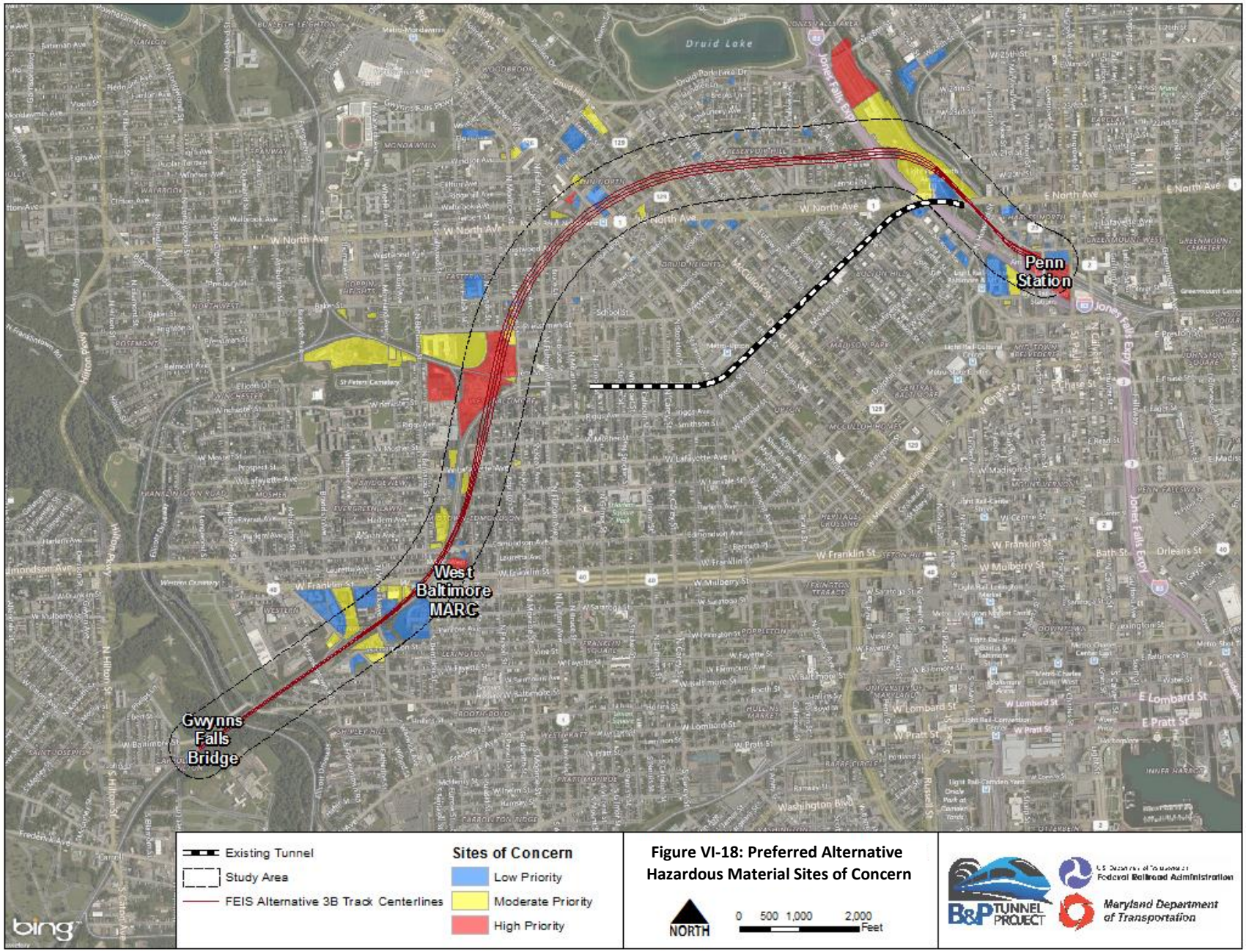


Figure VI-18: Preferred Alternative Hazardous Material Sites of Concern

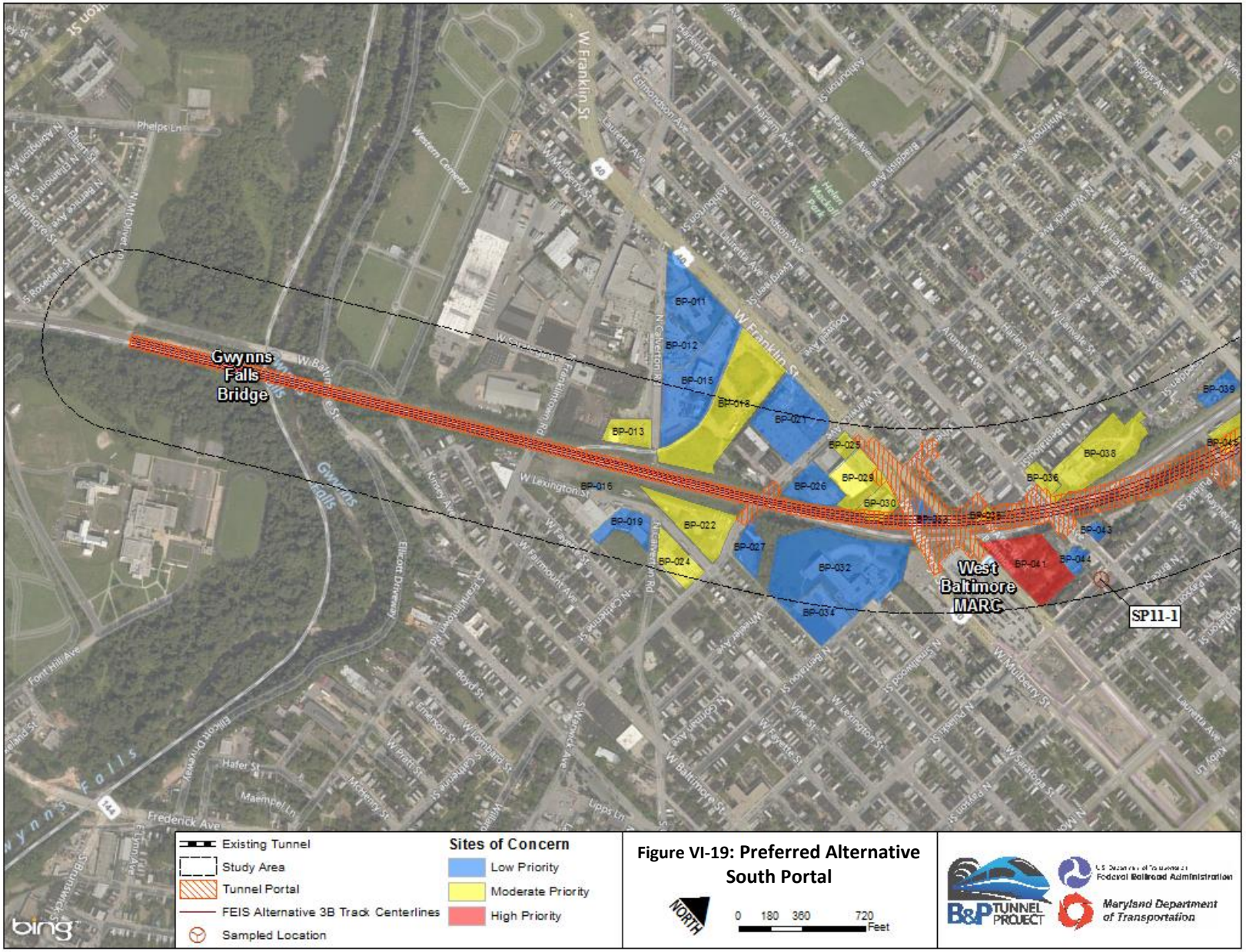


Figure VI-19: Preferred Alternative South Portal

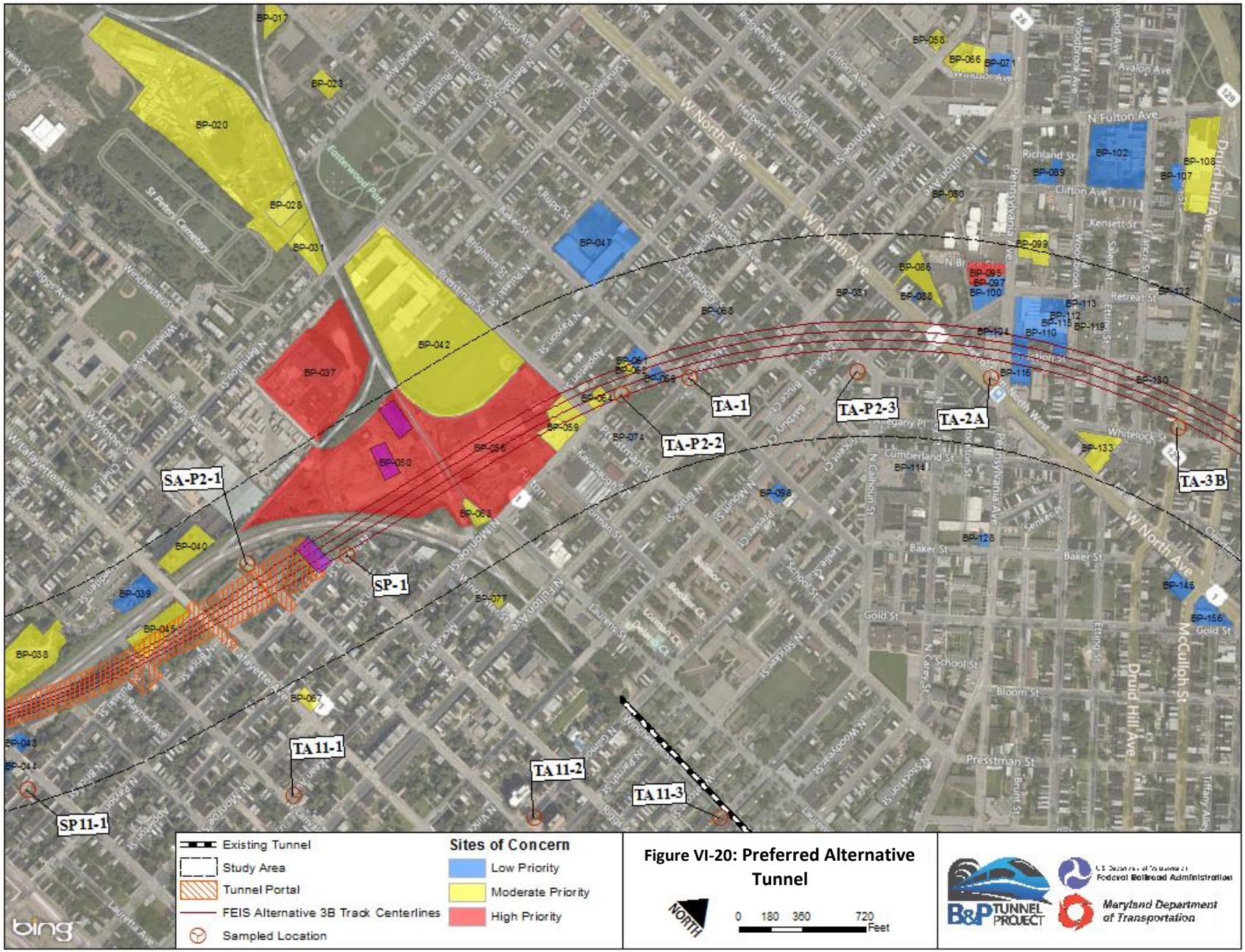
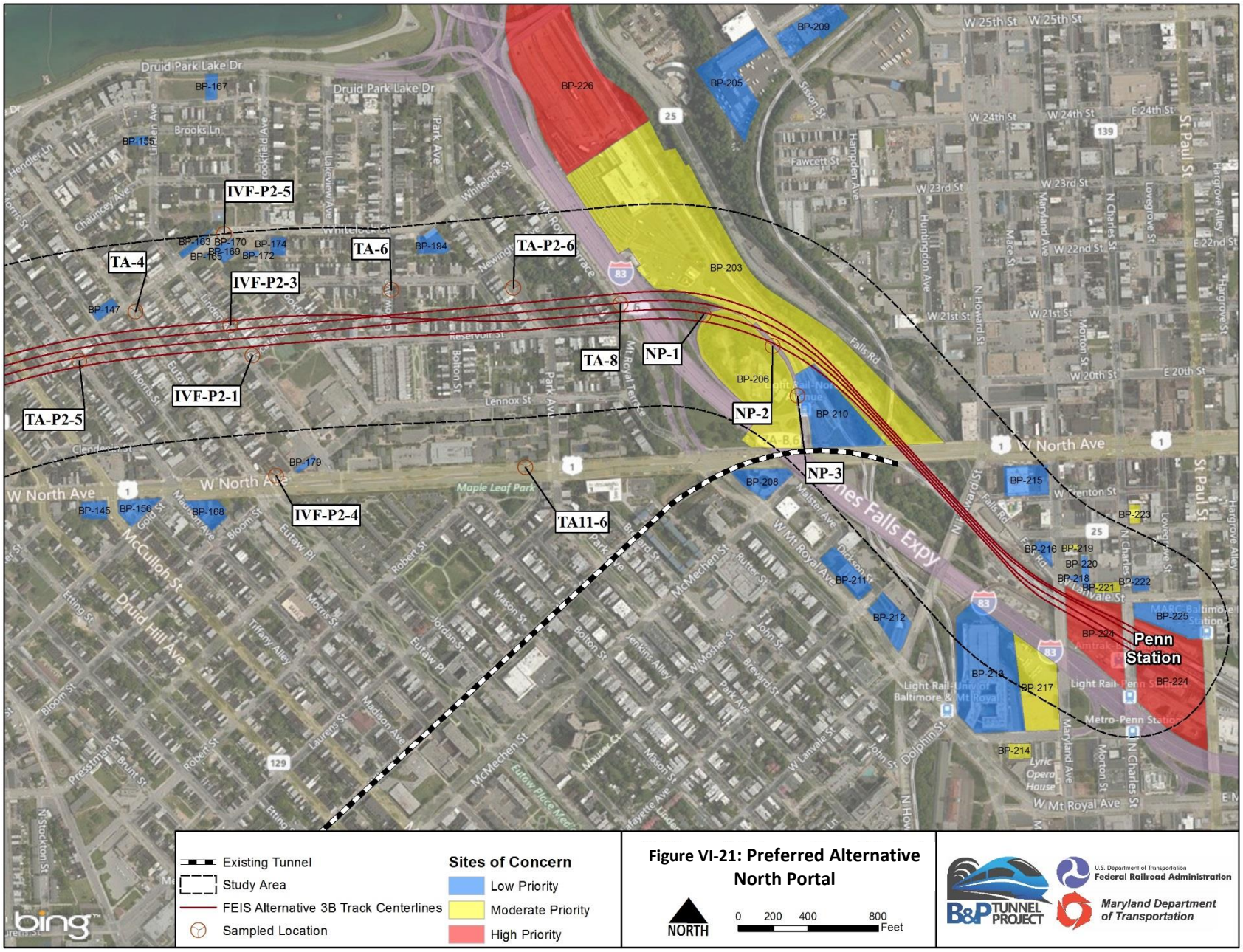


Figure VI-20: Preferred Alternative Tunnel


IVF-P2-5
IVF-P2-3
IVF-P2-1
IVF-P2-4
TA-4
TA-6
TA-8
TA-P2-6
TA-P2-5
TA11-6
NP-1
NP-2
NP-3
Penn Station
Druid Park Lake Dr
W North Ave
W Mt Royal Ave
Jones Falls Expy
Maple Leaf Park
Existing Tunnel
Study Area
FEIS Alternative 3B Track Centerlines
Sampled Location
Sites of Concern
Low Priority
Moderate Priority
High Priority
NORTH
0 200 400 800 Feet
Figure VI-21: Preferred Alternative
North Portal
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation
B&P TUNNEL PROJECT

3. Alternative 3A

There are 92 hazardous material sites, including residences, dry cleaners/laundromats, schools, automotive maintenance facilities, gas stations, fire stations, community resource centers, industrial properties, and railway yards within the Study Area of Alternative 3A. Of the 92 sites, 57 sites are low priority, 29 medium priority, and six high priority. A full list of hazardous materials sites identified for Alternative 3A is included in the DEIS.

Table VI-20, **Table VI-21**, and **Table VI-22** summarize the low, medium, and high priority sites, respectively, for Alternative 3A.

Table VI-20: Alternative 3A Low Priority Hazardous Material Sites

Site ID #	Property Description	Address	Hazard Type
BP-036	Exxon Station	2200 Edmondson Avenue	Petroleum release
BP-039	Apex Oil, Co.	1829 Baker Street	Petroleum release
Bp-043	LA Auto Service	2124 Edmondson Avenue	Petroleum use
BP-047	Matthew A. Henson Elementary School	2218 Reisterstown Road	Petroleum use
BP-048	Keen Leasing, Inc.	700 McKean Avenue	Petroleum release
BP-058	Cloverland Dairy	2200 North Monroe Street	Petroleum release
BP-061	One & One Carry Out	1827 North Fulton Avenue	Automotive history
BP-069	Sunoco Service Station	1568 Clifton Avenue	Automotive history
BP-071	Papa Auto Parts	2600 Madison Avenue	Petroleum release
BP-074	Perfect Cleaners	2335 North Fulton Avenue	Dry-cleaning history
BP-079	Steve Auto	2608 Pennsylvania Avenue	Petroleum release
BP-081	People's Valet Service, Inc.	2600 Pennsylvania Avenue	Dry-cleaning history
BP-088	Parham & Spriggs Laundry	2542 Pennsylvania Avenue	Dry-cleaning history
BP-089	F. A. Taylor	2634 Flora Street	Petroleum release
BP-093	Druid Hill Park	2565 Pennsylvania Avenue	Petroleum use
BP-097	Mel and Logan Auto	2468 Woodbrook Avenue	Automotive history
BP-098	Gilmore Homes, Baltimore Housing Authority	1800 Linden Avenue	Petroleum release
BP-100	National Auto Repair	2523 Pennsylvania Avenue	Automotive history
BP-102	Westside Elementary School	2480 Woodbrook Avenue	Petroleum release
BP-103	Gilmore Homes	401 West North Avenue	Petroleum use
BP-104	Colonial Launderers	1415 Retreat Street	Dry-cleaning history
BP-107	Whitelock Towing	2562 McCulloh Street	Petroleum release
BP-110	Fish Rental Services	2427 Francis Street	Petroleum use, Dry-cleaning history
BP-112	Wareheim's Garage	2560 Madison Avenue	Automotive history
BP-113	Baltimore Transit Co. – Retreat Street Repair Shop	1511 Retreat Street	Automotive history, Railway history
BP-114	residence	1341 Dickson Street	Petroleum release
BP-115	Former auto service facility (Theo Messersmith)	1006 Whitelock Street	Automotive history
BP-116	CVS Pharmacy	2520 Linden Avenue	hazardous waste history
BP-122	H&B Manufacturing Co., Inc.	827 Druid Park Lake Drive	Automotive history
BP-128	City of Baltimore	80 West Oliver Street	Petroleum release
BP-129	Dix residence	1001 West North Avenue	Petroleum release

Site ID #	Property Description	Address	Hazard Type
BP-130	residence	919 Whitelock Street	Petroleum use
BP-134	Accent Displays, Inc.	2270 Brookfield Avenue	Petroleum release
BP-144	Modern Junk & Salvage Co.	2109 West Lafayette Avenue	industrial history
BP-145	Exxon #22758	1201 West North Avenue	Petroleum release
BP-147	Former auto service facility (Jason Litchfield)	841 Whitelock Street	Automotive history
BP-155	Penrose property	701 Whitelock Street	Petroleum release
BP-156	Amoco Station	1600 North Payson Street	Petroleum release
BP-163	Wonder Cleaners & Tailors	954 Whitelock Street	Dry-cleaning history
BP-165	Lee, Sun F	925 Whitelock Street	Dry-cleaning history
BP-167	Housing & Urban Development	410 West North Avenue	Petroleum release
BP-168	Crown Station (Quest Station)	113 West North Avenue	Petroleum use
BP-169	Former Cove One Hour Cleaners	1734 Maryland Avenue	Dry-cleaning history
BP-170	Snow White Self Service Laundry	915 Whitelock Street	Dry-cleaning history
BP-172	Fish Dry Cleaning & Laundry Co.	1800 Linden Avenue	Dry-cleaning history
BP-174	VI Contracting Site	401 West North Avenue	Petroleum release
BP-179	Minor's Cleaners	1900 Elgin Avenue	Dry-cleaning history
BP-194	Tune Up City, Inc.	1341 Dickson Street	Automotive history
BP-205	Sisson Realty Company/Sun Cab	2600 Sisson Street	Petroleum release
BP-208	Baltimore Fire Department, Aerial Tower 111	1410 North Monroe Street	Petroleum use
BP-209	Southern Fuel Company	401 West 26th Street	Petroleum release
BP-210	Lincoln Motor	80 West Oliver Street	Automotive history
BP-211	AAA Mid-Atlantic Inc.	1401 West Mount Royal Avenue	Petroleum use
BP-212	Maryland Institute College of Art - Fox Building	1550 North Monroe Street	Petroleum use
BP-213	Bolton Yard	1500 North Monroe Street	VCP action
BP-215	Maryland Institute College of Art	2109 West Lafayette Avenue	Petroleum release
BP-216	Maryland Community Resource Center	1600 North Payson 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

Hazards associated with the low priority sites include: Petroleum, automotive, dry-cleaning, railway contamination, and "hazardous materials" as well as industrial history and a VCP site. Over half of the sites have current or historical petroleum use and/or releases.

Table VI-21: Alternative 3A Medium Priority Hazardous Material Sites

Site ID #	Property Description	Address	Hazard Type
BP-017	Can-Do Fuel Oil Company, Inc.	2527 Baker Street	Petroleum contamination
BP-020	Emanuel Tire, LLC	1300 Moreland Avenue	Hazardous materials
BP-023	G&M Oil Company, Inc.	1549 Warwick Avenue	Petroleum release
BP-028	Blue Ridge Fuel Co.	1400 Moreland Avenue	Petroleum use
BP-031	Kaufman Products	1330 North Bentalou Street	Petroleum use, Industrial history
BP-038	Alpha One, Inc.	2140 Edmondson Avenue	Petroleum release
BP-040	Emanuel Tire	2120 West Lafayette Avenue	Brownfields
BP-042	Carver Vocational Technical Senior High School	2201 Presstman Street	Petroleum use
BP-045	The Old Time Way Church of Deliverance	2104 West Lanvale Street	Coal history
BP-059	Stop Shop Save	1410 N Monroe Street	Petroleum use
BP-062	Exxon Company	1542 North Monroe Street	Petroleum use
BP-063	E. S. Brady & Co., Inc.	1310 North Monroe Street	Railway history
BP-064	Jolly's Food and Convenience Mart	1704 West North Avenue	Automotive history
BP-066	Former Coliseum Building	2201 North Monroe Street	VCP action, Petroleum use
BP-068	Kim property	1655 North Monroe Street	Petroleum release
BP-077	JJ Adams Fuel Oil Company	1810 Winchester Street	Petroleum use
BP-080	Watkins residence	2037 North Fulton Avenue	Petroleum release
BP-086	American Oil Co., Penn Square II	1655 Old Lane	Petroleum release
BP-099	George G. Ruppersberger & Sons, Inc.	2639 Pennsylvania Avenue	Petroleum release
BP-108	Part Terminal Station	2331 North Fulton Avenue	Petroleum release
BP-119	MTA Terminal	2471 Woodbrook Avenue	Petroleum use
BP-133	Greenwood Towing Inc./Auto Title Service Corp.	1370 West North Avenue	Petroleum use, Automotive history
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-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-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

Hazards associated with the medium priority sites include: Petroleum, automotive, dry-cleaning, railway contamination, and "hazardous materials" as well as industrial history and coal use, Brownfields, and a VCP site. The majority of sites have current or historical petroleum use and/or release.

Table VI-22: Alternative 3A High Priority Hazardous Material Sites

Site ID #	Property Description	Address	Hazard Type
BP-037	ABEX Baltimore – ABC Rail Products Corp.	2200 Winchester Street	CERCLIS[1] screening, Industrial history
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-095	Penn Square Property	2632 Pennsylvania Avenue	VCP action, Petroleum release
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

Hazards associated with the high priority sites include: Petroleum and railway contamination, as well as CERCLIS, industrial history, and VCP sites. The majority of sites have current or historical petroleum use and/or release.

4. Alternative 3C

There are 153 hazardous material sites, including residences, dry cleaners/laundromats, schools, automotive maintenance facilities, gas stations, fire stations, community resource centers, industrial properties, and railway yards within the Study Area of Alternative 3C. Of the 153 sites, 92 sites are low priority, 52 sites medium priority, and nine sites high priority. **Table VI-23**, **Table VI-24**, and **Table VI-25** summarize the low, medium, and high priority sites, respectively for Alternative 3C.

Table VI-23: Alternative 3C Low Priority Hazardous Material Sites

Site ID #	Property Description	Address	Hazard Type
BP-002	Southwestern Senior High School	200 Font Hill Avenue	Petroleum use
BP-003	Mount Nebo Church	240 North Franklintown Road	Petroleum release
BP-004	Franklintown Road Assoc./The Service Composition Company Inc.	232 North Franklintown Road	Petroleum use
BP-007	Supervisor of Elections	301 North Franklintown Road	**Petroleum use**
BP-008	Baltimore City Water Meter Shop	200 North Franklintown Road	**Petroleum use**
BP-009	Maryland Food Bank	241 North Franklintown Road	**Petroleum use**
BP-011	Baltimore Pre-Release Unit	301 North Calverton Road	Petroleum use
BP-012	Baltimore Substation	239 North Calverton Road	Petroleum release
BP-014	Zimmer Development Company	2600 West Franklin Street	**Petroleum use**

Site ID #	Property Description	Address	Hazard Type
BP-015	City of Baltimore Franklin Street Yard	231 North Calverton Road	Petroleum release
BP-016	Lexington Auto Service/Motor Pool West	2560 West Lexington Street	Automotive and Hazardous waste history
BP-019	Baltimore Uniform Rental, Inc.	2555 West Lexington Street	Petroleum use, Dry-cleaning history
BP-021	Former Acme Pad Factory	330 North Warwick Avenue	Petroleum release
BP-026	Unknown site	311 North Warwick Avenue	Petroleum release
BP-027	Cosmechem	215 North Warwick Avenue	Hazardous waste history
BP-032	Bentalou Elementary School	220 North Bentalou Street	Petroleum release
BP-034	Victor Graphics	200 North Bentalou Street	Petroleum release
BP-043	LA Auto Service	2124 Edmondson Avenue	Automotive history
BP-044	McDowell's Auto Service	2135 Edmondson Avenue	Automotive history
BP-046	C & P Telephone	2010 Windsor Avenue	**Petroleum use**
BP-047	Matthew A. Henson Elementary School	1600 North Payson Street	Petroleum use
BP-048	Keen Leasing, Inc.	1900 Elgin Avenue	Petroleum release
BP-051	How-Nor Partnership/Baltimore Design Center	2000 West North Avenue	**Petroleum release**
BP-060	Fingles Metalworks Inc.	2256 Reisterstown Road	**Hazardous waste history**
BP-061	One & One Carry Out	1550 North Monroe Street	Automotive history
BP-062	Exxon Company	1542 North Monroe Street	Petroleum use
BP-065	Dulany-Varney Inc.	2250 Reisterstown Road	**Hazardous waste history**
BP-068	Kim property	1655 North Monroe Street	Petroleum release
BP-069	Sunoco Service Station	1829 Baker Street	Automotive history
BP-071	Papa Auto Parts	2218 Reisterstown Road	Petroleum release
BP-081	People's Valet Service, Inc.	1827 North Fulton Avenue	Dry-cleaning history
BP-082	Orange Cleaners	1740 West North Avenue	Dry-cleaning history
BP-083	Druid Hill Park Conservatory	3100 Swann Drive	**Petroleum release**
BP-084	Eurco One Hour Cleaners	2214 North Fulton Avenue	Dry-cleaning and Hazardous waste history
BP-087	Eagle Dyeing & Dry Cleaning Company	2658 Pennsylvania Avenue	Dry-cleaning history
BP-088	Parham & Spriggs Laundry	1704 West North Avenue	Dry-cleaning history
BP-092	Christy Motor Company	2634 Pennsylvania Avenue	Automotive history
BP-093	Druid Hill Park	2600 Madison Avenue	Petroleum use
BP-096	Hop, Lee	2249 North Fulton Avenue	Dry-cleaning history
BP-097	Mel and Logan Auto	2608 Pennsylvania Avenue	Automotive history
BP-100	National Auto Repair	2600 Pennsylvania Avenue	Automotive history
BP-101	Whiteley, George S	2550 Woodbrook Avenue	Automotive history
BP-104	Colonial Launderers	2542 Pennsylvania Avenue	Dry-cleaning history

Site ID #	Property Description	Address	Hazard Type
BP-110	Fish Rental Services	2565 Pennsylvania Avenue	Petroleum use, Dry-cleaning history
BP-111	Baltimore City	2565 Francis Street	**Petroleum use**
BP-112	Wareheim's Garage	2480 Woodbrook Avenue	Automotive history
BP-113	Baltimore Transit Co. – Retreat Street Repair Shop	1511 Retreat Street	Automotive history, Railway history
BP-115	Former auto service facility (Theo Messersmith)	2468 Woodbrook Avenue	Automotive history
BP-116	CVS Pharmacy	2523 Pennsylvania Avenue	Hazardous waste history
BP-121	L & J Cleaners	2501 Francis Street	Dry-cleaning history
BP-122	H&B Manufacturing Co., Inc.	1415 Retreat Street	Automotive history
BP-126	Sisa Enterprises	2580 McCulloh Street	**industrial history**
BP-127	Druid Park Motors Inc.	2509 Druid Hill Avenue	Automotive history
BP-131	H M Auto Service/Daw's Body & Fender Repair Shop	2493 Druid Hill Avenue	Automotive history
BP-133	Greenwood Towing Inc./Auto Title Service Corp.	1370 West North Avenue	Petroleum use, Automotive history
BP-135	Temple Gardens Apartments	2601 Madison Avenue	**Petroleum use**
BP-137	Emersonian Apartments	2502 Eutaw Place	**Petroleum use**
BP-141	Esplanade Apartments	2525 Eutaw Place	**Petroleum use**
BP-142	Feeser-Murphy property	2511 Eutaw Place	**Petroleum use**
BP-147	Former auto service facility (Jason Litchfield)	1006 Whitelock Street	Automotive history
BP-153	Penrose property	901 Druid Park Lake Drive	Petroleum use
BP-155	Penrose property	2520 Linden Avenue	Petroleum release
BP-158	Adolohla Garage	2415 Linden Avenue	Automotive history
BP-160	unknown	2411 Linden Avenue	**Petroleum release**
BP-161	Baltimore City	2423 Linden Avenue	Automotive history
BP-163	Wonder Cleaners & Tailors	954 Whitelock Street	Dry-cleaning history
BP-165	Lee, Sun F	925 Whitelock Street	Dry-cleaning history
BP-167	Housing & Urban Development	827 Druid Park Lake Drive	Petroleum release
BP-169	Former Cove One Hour Cleaners	919 Whitelock Street	Dry-cleaning history
BP-170	Snow White Self Service Laundry	915 Whitelock Street	Dry-cleaning history
BP-172	Fish Dry Cleaning & Laundry Co.	2270 Brookfield Avenue	Dry-cleaning history
BP-175	Lakeview Tower Extension	737 Druid Park Lake Drive	**Petroleum use**
BP-180	Housing and Urban Development	735 Druid Park Lake Drive	**Petroleum use**
BP-189	Lakeview Tower	717 Druid Park Lake Drive	**Petroleum use**
BP-192	Beres, Michael	705 Whitelock Street	Dry-cleaning history
BP-193	White Park Apartments	2220 Park Avenue	**Petroleum use**
BP-205	Sisson Realty Company/Sun Cab	2600 Sisson Street	Petroleum release
BP-208	Baltimore Fire Department, Aerial Tower 111	401 West North Avenue	Petroleum use
BP-209	Southern Fuel Company	401 West 26th Street	Petroleum release
BP-210	Lincoln Motor	410 West North Avenue	Automotive history

Site ID #	Property Description	Address	Hazard Type
BP-211	AAA Mid-Atlantic Inc.	1401 West Mount Royal Avenue	Petroleum use
BP-212	Maryland Institute College of Art - Fox Building	1341 Dickson Street	Petroleum use
BP-213	Bolton Yard	80 West Oliver Street	VCP action
BP-215	Maryland Institute College of Art	113 West North Avenue	Petroleum release
BP-216	Maryland Community Resource Center	1734 Maryland Avenue	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

Hazards associated with the low priority sites include: Petroleum, automotive, dry-cleaning, railway contamination, and "hazardous waste" as well as industrial history and a VCP site. Half of the sites have current or historical petroleum use and/or release.

Table VI-24: Alternative 3C Medium Priority Hazardous Material Sites

Site ID #	Property Description	Address	Hazard Type
BP-005	H & S Bakery Company/A & P Bakery	230 North Franklintown Road	Petroleum use
BP-006	Harowitz property	222 North Franklintown Road	Petroleum release
BP-010	Jesus Collision Center/Cooks Tank Line	110 North Franklintown Road	Petroleum release
BP-013	L & J Processing Facility	222 North Calverton Road	Hazardous waste history
BP-017	Can-Do Fuel Oil Company, Inc.	2527 Baker Street	Petroleum contamination
BP-018	Maryland Lumber Co.	2601 West Franklin Street	Petroleum release
BP-020	Emanuel Tire, LLC	1300 Moreland Avenue	Hazardous waste history
BP-022	Baltimore Car & Truck Rental, Inc.	200 North Warwick Avenue	Petroleum release
BP-023	G&M Oil Company, Inc.	1549 North Warwick Avenue	Petroleum release
BP-024	Trans Realty, Inc.	2501 West Lexington Street	Petroleum use
BP-025	Franklin Fuel Express	2417 W Franklin Street	Petroleum use
BP-028	Blue Ridge Fuel Co.	1400 Moreland Avenue	Petroleum use
BP-029	Marco Shoe Company/Nelco Shoes	2415 West Franklin Street	Petroleum use
BP-030	Tedco Industries	2335 West Franklin Street	Petroleum use
BP-031	Kaufman Products	1330 North Bentalou Street	Petroleum use, industrial history
BP-033	Baltimore City	2305 West Franklin Street	Automotive history
BP-035	Jung, Youngok Ann	501 North Bentalou Street	Automotive history

Site ID #	Property Description	Address	Hazard Type
BP-036	Exxon Station	2200 Edmondson Avenue	Petroleum use, Automotive history, Dry-cleaning history
BP-038	Alpha One, Inc.	2140 Edmondson Avenue	Petroleum release
BP-039	Apex Oil, Co.	2109 West Lafayette Avenue	Petroleum release
BP-040	Emanuel Tire	2120 West Lafayette Avenue	Brownfields assessment
BP-041	American Ice Company	2100 W Franklin Street	Petroleum use
BP-042	Carver Vocational Technical Senior High School	2201 Presstman Street	Petroleum use
BP-045	National Railroad	2104 West Lanvale Street	Coal-use history
BP-058	Cloverland Dairy	2200 North Monroe Street	Petroleum contamination
BP-059	Stop Shop Save	1410 North Monroe Street	Automotive history
BP-063	E. S. Brady & Co., Inc.	1310 North Monroe Street	Railway history
BP-064	Jolly's Food and Convenience Mart	1500 North Monroe Street	Automotive history
BP-066	Former Coliseum Building	2201 North Monroe Street	VCP action, Petroleum use
BP-067	BP Service Station	900 North Monroe Street	Petroleum release
BP-070	Green, Jeffrey E	1814 McKean Avenue	**Automotive, Industrial history**
BP-077	JJ Adams Fuel Oil Company	1810 Winchester Street	Petroleum use
BP-079	Steve Auto	2115 North Fulton Avenue	Petroleum release
BP-085	Penn North Partners LLLP	2632 Pennsylvania Avenue	Dry-cleaning history
BP-086	American Oil Co., Penn Square II	1655 Old Lane	Petroleum release
BP-089	F. A. Taylor	1568 Clifton Avenue	Petroleum release
BP-099	George G. Ruppersberger & Sons, Inc.	2639 Pennsylvania Avenue	Petroleum release
BP-102	Westside Elementary School	2335 North Fulton Avenue	Petroleum release
BP-107	Whitelock Towing	2634 Flora Street	Petroleum release
BP-119	MTA Terminal	2471 Woodbrook Avenue	Petroleum use
BP-125	Baltimore City	2513 Druid Hill Avenue	**Automotive, painting history**
BP-129	Dix residence	2562 McCulloh Street	Petroleum release
BP-134	Accent Displays, Inc.	2560 Madison Avenue	Petroleum release
BP-174	VI Contracting Site	841 Whitelock Street	Petroleum release
BP-194	Tune Up City, Inc.	701 Whitelock Street	Automotive history
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-214	Amtrak/Jones Falls Substation	151 West Oliver Street	Petroleum release
BP-217	Baltimore Postal Service Vehicle Maintenance	60 West Oliver Street	Petroleum release

Site ID #	Property Description	Address	Hazard Type
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

Hazards associated with the medium priority sites include: Petroleum, automotive, dry-cleaning, railway contamination, and "hazardous waste" as well as industrial history and coal use, Brownfields, and VCP sites. Half of the sites have current or historical petroleum use and/or release.

Table VI-25: Alternative 3C High Priority Hazardous Material Sites

Site ID #	Property Description	Address	Hazard Type
BP-001	Potts and Callahan Quarry	2902 West Baltimore Street	**VCP action**
BP-037	ABEX Baltimore – ABC Rail Products Corp.	2200 Winchester Street	CERCLIS screening, industrial history
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-080	Watkins residence	2037 North Fulton Avenue	Petroleum release
BP-095	Penn Square Property	2632 Pennsylvania Avenue	VCP action, Petroleum release
BP-108	Part Terminal Station	2331 North Fulton Avenue	Petroleum release
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

Hazards associated with the high priority sites include: Petroleum and railway contamination as well as industrial history, CERCLIS, and VCP sites. The majority of the sites have current or historical petroleum use and/or release.

5. Mitigation

The Project includes the following mitigation measures that correspond with potential impacts related to hazardous materials. Although the following measures correspond with the Preferred Alternative, similar measures would be appropriate to mitigate impacts of Alternative 3A and Alternative 3C.

Mitigation measures will be needed where construction encounters contaminated soil and/or groundwater. Excavated soil will be sampled, treated, and/or disposed of in accordance with Federal, state, and local regulations. If other contaminants, such as metals, are detected above MDE non-residential screening levels, soil and/or groundwater will be handled in accordance with applicable laws and regulations and disposed of at an MDE-approved treatment and/or disposal facility. Any hazardous wastes will be transported by a licensed/certified hazardous waste transporter. Measures will need to be taken to contain excavated soil onsite

and avoid offsite migration. 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.

The following mitigation measures are included in the Preferred Alternative:

- Development and implementation of a Hazardous Spill Prevention Plan and a Hazardous Materials Remediation Plan.

- Creation of a Soil Screening and Impacted Materials Handling Plan for the excavation, segregation, transportation and disposal of potentially impacted soils, as well as dewatering of potentially impacted groundwater. The plan would also include personal protective equipment (PPE), dust control, and safety requirements for workers who may be exposed to impacted soils. If contaminated soils or groundwater are identified or encountered during excavation or mobilization activities, additional mitigation strategies may be applicable. Heightened protective measures will be implemented to safeguard onsite personnel, the public and the environment from excavated or disturbed contaminated soil or groundwater. Such measures will include, but are not limited to, appropriate PPE, water and soil containment and/or treatment, dust control and suppression activities and dust monitoring. MDE will be consulted to determine the proper mitigation response and reporting requirements should a release of hazardous materials occur during operations.

- Inclusion of a qualified environmental professional to implement a screening and monitoring program. Screening and monitoring will be for the identification and segregation of impacted materials onsite for additional testing or immediate offsite disposal using a photoionization detector (PID) and visual and/or olfactory evidence. The monitoring program will include measures for preventing further distribution of potentially contaminated materials to other areas of the worksite or offsite through the implementation of segregated materials berms, plastic sheeting, or other applicable methods.

- Evaluation of any screening and sampling results by an environmental professional to determine health and safety, material handling, and off-site disposal requirements for impacted soils.

The investigation, handling, storage and disposal of all hazardous and contaminated materials will occur in accordance with applicable Federal, state, and local regulations and requirements. Project specific material handling, health and safety and emergency response plans will minimize risks. Additional targeted hazardous materials investigations may be conducted to further delineate and characterize potential contaminant concerns in the vicinity of the Preferred Alternative.

G. Solid Waste

1. Alternative 1: No-Build

Alternative 1: No-Build would not generate additional solid waste.

2. Preferred Alternative

The Preferred Alternative would generate large quantities of material. One source is chunks of concrete and pavement rubble from street and sidewalk destruction. An additional source would be building demolition materials from displaced residential and commercial properties. Another source would be soil and rock excavation, which may be suitable for reuse as backfill (which would comply with the directives of the *Zero Waste Plan for Maryland* (Executive Order 01.01.2015.01).

Because the Preferred Alternative involves boring a new underground tunnel it would generate solid waste, specifically excavated earthen material. The total amount of soil and rock to be excavated for the B&P Tunnel project is about 47 million cubic feet (1.8 million cubic yards) of material. About 78 percent of that volume is from the four running tunnels excavated by Tunnel Boring Machine. The balance comes from the shafts, cross passages, cut sections, cut and cover sections, as well as ventilation plenum tunnels and evacuation tunnels. Once excavated from its natural state, the volume increases. The project will need to dispose of some 70 million cubic feet (2.7 million cubic yards) of material. The site preparation phases may also involve the removal of additional amounts of excavated material. Building material resulting from demolition of buildings would also be generated. Any solid waste including construction, demolition and land clearing debris generated from the project must be properly disposed of at a permitted solid waste acceptance facility.

During construction, the Preferred Alternative would generate a small volume of waste such as product packaging, broken equipment, and site litter. Lingering construction waste would also amass once main construction activity commences; this includes building materials such as metal, wood, and concrete. A minimal amount of solid waste would also be generated by general construction worker activities and would include food or paper trash, cardboard, aluminum, plastic, etc.

Some of the excavated earth material will be suitable for backfill for the newly created tunnel. Minor hydraulic fluid, motor oil, and fuel spills could require the disposal of contaminated soil, spill clean-up kits would be kept on-site at all times. Contaminated solid waste will be collected and disposed of appropriately in accordance with Maryland and Baltimore City regulations.

3. Alternative 3A

Alternative 3A would not differ substantially from the Preferred Alternative as described above regarding solid waste.

4. Alternative 3C

Alternative 3C would not differ substantially from the Preferred Alternative as described above regarding solid waste.

5. Mitigation

An adequate staging area would be identified for each major excavation that includes consideration for spoil operations. The construction contract specifications would include requirements for a Materials Handling and Disposal Plan that describes how the spoil will be handled, stored, hauled, and disposed. Disposal sites should be identified for inclusion in the construction bid documents.

All excavated materials requiring off-site disposal would be handled and disposed of in accordance with applicable regulations. The re-use of some earthen material as fill and the status of land fill capacity being at an acceptable level to handle the increase mean disposal of generated solid waste by the B&P Tunnel Project should be manageable.

H. Air Quality

This section presents information on air quality impacts resulting from general operations and construction of the Preferred Alternative, Alternative 3A, and Alternative 3C in comparison to the No-Build Alternative. The build alternatives (Preferred Alternative, Alternative 3A, and Alternative 3C) would not differ substantially in air quality effects, therefore the analyses in this section is applicable to each of the three build alternatives. More information is available in the *B&P Tunnel FEIS Air Quality Technical Report,* published on the Project website.

1. Operational Emissions Analysis

Generalized air quality effects due to operations are presented here for the Preferred Alternative, Alternative 3A, and Alternative 3C. The tunnel operations data for the No-Build year 2040 (Alternative 1) and Build year 2040 (build alternatives) are summarized in **Table VI-26** and **Table VI-27**, respectively. Although the number of Amtrak operations increases with the Build Year, the Acela, Northeast Regional, and Metropolitan trains are powered by electric locomotives which do not directly generate significant air emissions. Regardless of whether the Preferred Alternative or another alternative is implemented, the regional MARC commuter train service plans to replace all existing electric locomotives with diesel-powered locomotives by 2019 (MTA, 2013), as well as doubling operations in 2040. The assumed conversion of MARC trains from electric to diesel is included in the operating characteristics presented in **Table VI-26** and **Table VI-27**.

Table VI-26: Tunnel Operating Characteristics in the No-Build Alternative (2040)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	# of Locos	# of Cars	
MARC (Regional)	Diesel	82	7	1	8	30/30
Acela (Intercity Express)	Electric	58	4	N/A	14	30/30
NE Regional (Intercity Corridor)	Electric	52	3	1	8	30/30
Metropolitan	Electric	0	0	N/A	N/A	30/30
Freight	Diesel	2	0	1	30	30/30
Total	**All**	**194**	**14**			

*Note: Average train speed entering and exiting the north portal (N) and south portal (S).
Source: Federal Railroad Administration NEC FUTURE Project, Tier I EIS Alternatives (Alternative 1).

Table VI-27: Tunnel Operating Characteristics for the Build Alternatives (2040)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	# of Locos	# of Cars	
MARC (Regional)	Diesel	164	15	1	8	30/70
Acela (Intercity Express)	Electric	82	8	N/A	14	30/70
NE Regional (Intercity Corridor)	Electric	48	4	1	8	30/70
Metropolitan	Electric	92	8	N/A	14	30/70
Freight	Diesel	2	0	1	30	30/70
Total	**All**	**388**	**35**			

*Note: Average train speed entering and exiting the north portal (N) and south portal (S).
Source: NEC FUTURE Project (USDOT, Accessed September 8, 2014).

Table VI-28 summarizes the analysis of diesel locomotive emissions. Increased diesel emissions are anticipated to come only from MARC trains. Amtrak's trains are electric, and freight rail operations are not expected to increase as a result of the Preferred Alternative. The No-Build and build alternative diesel emissions were estimated based upon the length of the tunnel and emissions factors provided by US EPA for CO, VOC, NO_x, and PM. Emissions of SO_2 are dependent on fuel properties, and therefore the US EPA does not provide any locomotive-specific emission factors. As shown in **Table VI-28**, the MARC equipment and operational changes would not have any significant effects on air quality because the net changes in emissions of VOC, NO_x, and $PM_{2.5}$ would be below the *de-minimis* levels.

Table VI-28: Diesel Locomotive Emissions (2040)

Scenario	CO	VOC	NO_x	PM_{10}	$PM_{2.5}$
2040 No Build Alternative	8.6	0.3	6.7	0.1	0.1
2040 Build Alternatives	19.4	0.6	15.2	0.2	0.2
Net Increase	**10.9**	**0.3**	**8.5**	**0.1**	**0.1**
De Minimis Threshold	--	50	100	--	100
Below *De Minimis*?	**--**	**Yes**	**Yes**	**--**	**Yes**

Notes: De Minimis thresholds do not apply within an area in attainment for that specific pollutant. The Project is in an attainment area for CO and PM_{10}.
Values of "Net Increase" subject to rounding. All values in table rounded to the nearest 0.1 tons.
US EPA does not provide any SO2 or SOx emissions factors (see *Emission Factors for Locomotives,* EPA-420-F-09-025, April 2009); furthermore, the project is in an attainment area for SOx.

The results of the emissions inventory are presented in **Table VI-21** in tons per year of pollutants by the build alternatives and No-Build Alternative under future-year conditions. For ease of comparison, the *de minimis* thresholds are also shown. No impacts to air quality exceeding *de minimis* thresholds would occur under the No-Build Alternative.

As shown in **Table VI-28**, the build alternatives would have no net increase in operational emissions exceeding applicable *de minimis* thresholds. The build alternatives would result in no projected increase in diesel freight train operations, and no significant air emissions are generated by electric locomotive trains (e.g., Amtrak). Net increases in emissions would be due to diesel MARC trains. The No-Build and build alternatives diesel emissions were estimated based upon emissions factors provided by the EPA (EPA, 2009). As shown in **Table VI-28**, the MARC equipment and operational changes would have no significant effects on air quality, as the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between the 2040 No-Build and the 2040 build alternative scenarios would be below the *de minimis* levels.

As noted above, the net emissions increases would be due to diesel MARC trains. These diesel engines could also produce higher operational costs for the ventilation facilities. This increase comes from an estimated need to operate more ventilation fans at a higher normal frequency to evacuate heat and emissions from the tunnel system. On average, diesel engines generate 5 MW of heat per locomotive as well as combustion by-products, while electric locomotives generate 0.67 MW of heat per locomotive and no combustion by-products.

2. Greenhouse Gas Emissions

It is possible that additional GHG emissions, relative to existing conditions, could be generated due to the increased use of electricity from rail traffic using electrically-driven locomotives and increased GHG emissions from MARC trains. The extent of such an increase is not currently known, and cannot be estimated at this time based on readily available data. However, there is potential for increased rail travel in place of automobile use that would result in a decrease in GHG emissions compared to Alternative 1: No-Build. Improvements to passenger rail infrastructure in the B&P Tunnel corridor resulting in improved travel times, greater reliability, and increased accessibility have the potential to improve the competitiveness of Amtrak and MARC with other modes of transportation, such as automobiles.

The Council on Environmental Quality (CEQ) issued the *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews* on August 1, 2016 (CEQ, 2016). This guidance is issued with the intention to provide greater clarity and more consistency in how agencies address climate change in the environmental impact assessment process. The guidance explains the application of NEPA principles and practices to the analysis of greenhouse gas emissions and climate change, and recommends that "where agencies do not quantify a proposed agency action's projected greenhouse gas emissions because tools, methodologies, or data inputs are not reasonably available to support calculations for

a quantitative analysis, agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available."

The specific data inputs for the quantification of greenhouse gas impacts are not available. Forecasts of reductions in vehicle miles traveled (VMT) due specifically to the Project would be required to estimate potential changes in greenhouse gas emissions. Estimates at such a high level of detail appropriate to estimate project-specific impacts are not reasonably available to support a quantitative greenhouse gas emissions analysis. Therefore, a qualitative analysis is included below to show that that increased passenger rail travel, supported by the benefits of the Preferred Alternative, would likely lead to a decrease in GHG emissions.

Improvements to passenger rail infrastructure along the NEC resulting in improved travel times, greater reliability, and increased accessibility have the potential to improve the competitiveness of Amtrak and MARC with other modes of transportation, such as automobiles. According to the US Department of Energy (USDOE), rail travel contributes less per passenger mile greenhouse gas emissions than either automobiles or airplanes (USDOE, 2015). Per the FTA's Public Transportation's Role in Responding to Climate Change (2010) document, the average single-occupancy automobile emits 0.96 pounds (lbs) of carbon dioxide (CO2) per passenger mile; and the average commuter rail (average occupancy) emits 0.33 lbs of CO2 per passenger mile. If the commuter rail was to operate with full occupancy the emission rate would decrease to 0.10 lbs CO2 per passenger mile.

There are approximately 21,600 passengers traveling through the existing B&P Tunnel every day. As an illustrative example, 21,600 passengers multiplied by 0.33 lbs of CO_2 per passenger mile equates to 7,128 lbs of CO_2 per day per mile (3.2 metric tons). In contrast, 21,600 passengers in single-occupancy vehicles would equate to 20,736 lbs of CO_2 per day per mile (9.4 metric tons).

Moreover, a study summarized in the FTA document (FTA, 2010), concluded public transportation reduces U.S. travel by an estimated 102.2 billion VMT each year. The study also found that public transportation reduces CO_2 emissions by 37 million metric tons each year.

In summary, support for the increased competitiveness of Amtrak and MARC passenger rail with other travel modes, particularly single-occupancy vehicles, would potentially result in increased efficiency per passenger mile and corresponding reductions in GHG emissions that would not otherwise occur under Alternative 1: No-Build.

3. Construction Emissions

To evaluate air emissions during the construction of the Preferred Alternative (or Alternative 3A or 3C), equipment activity levels and vehicle parameters were estimated based on the expected construction project elements and construction schedule. The construction project elements involve the realignment and replacement of existing tracks and the construction of new tunnels. Specifically, the project will require the construction of four single-track tunnels each with a cross-section capable of accommodating both passenger and freight service, tunnel portals, and walkways and vent shafts along the tunnel.

The construction activities associated with these project elements include, but are not limited to: site clearing, boring, cut and cover, grading, earthwork, material handling, concrete operations, and staging areas. These construction activities would also require the use of heavy haul and delivery trucks, excavating and grading equipment, material loaders, cranes, and other construction equipment. For the purpose of the evaluation, it was assumed that construction of the Project elements would occur within a six-year period starting in January 2020 and ending December 2025.

Construction-related emissions were estimated using the EPA's Motor Vehicle Emissions Simulator (MOVES Version 2014a) motor vehicle emission factor model, the NONROAD (Version 2008a) emission factor model, and other appropriate guidelines. During construction, air emissions are attributed to the exhaust of heavy equipment (i.e., cranes, excavators, loaders, etc.) and trucks (i.e., water trucks, delivery/haul trucks, etc.).

Emissions also result from construction crew worker vehicles travelling to and from the construction site; and fugitive dust from site preparation, land clearing, material handling and equipment movement on unpaved areas along construction staging areas. Notably, these emissions are temporary in nature and generally confined to the construction site and access/egress roadways.

Emissions from construction activities were estimated based on the projected construction activity schedule, the number of vehicles/pieces of equipment, the types of equipment/type of fuel used, vehicle/equipment utilization rates (including usage factor), the equipment size (horsepower), and the year in which construction would occur. A total of eight different types of standard construction equipment were used as a basis of the construction activities required. It was assumed that this equipment would be on-site for the duration of the construction period of six years. The types of equipment and trucks included are:

- Cranes
- Tractors/Loaders/Backhoes
- Air Compressors
- Rollers
- Excavators
- Signal Boards/Light Plants
- Other Construction Equipment
- Off-highway Truck

The analysis also includes the vehicle miles travelled (VMT) by the construction crew vehicles associated with water, delivery, and haul trucks, as well as miles travelled by construction crew vehicles commuting to and from the site. The construction crew VMT were based on the following current assumptions:

- Water trucks were based on assuming six trucks per day and an on-site trip travel distance of 20 miles.
- Haul truck trips were based on the cubic yards of materials being excavated and a haul truck capacity of 16 cubic yard, which resulted in 107 trucks per day. An on- and off-site trip travel distance of 40 miles was also assumed.
- The delivery truck trips were based on the cubic yards of concrete being delivered and a concrete truck capacity of 10 cubic yard, which resulted in 25 trucks per day. An on- and off-site trip travel distance of 40 miles was also assumed.
- Commuter construction crew vehicles were based on manpower needs and an average roundtrip travel distance of 30 miles.

Additionally, the construction emissions inventory for fugitive dust sources was calculated using emission factors within US EPA's Compilation of Air Pollutant Emission Factors (AP-42). Fugitive dust emissions result from site preparation, land clearing, material handling, and equipment movement on unpaved areas. A fugitive dust (PM_{10}) emission factor of 1.2 tons per acre disturbed per month during construction activity was used, assuming that fugitive dust is generated throughout the construction period such that 25 percent of the Project area would be disturbed in any given construction month. Based on US EPA's AP-42, $PM_{2.5}$ emissions were assumed to be 10 percent of PM_{10} emissions. Erosion control measures and water programs are typically taken into account to minimize fugitive dust and particulate emissions at construction sites. For this analysis a dust control efficiency of 75 percent due to daily watering and other measures (limiting vehicle speed, stockpile control) was assumed. The total disturbed area associated with the B&P Tunnel Project is estimated to be 18.7 acres; based on the size of the staging areas surrounding the south and north portals.

Construction emissions associated with the Preferred Alternative are presented in **Table VI-29** for construction years 2020 through 2025. This analysis applies equally to Alternative 3A or Alternative 3C. As shown, the total emissions associated with construction activities are below the *de minimis* threshold of 100 tons per year for NO_x and $PM_{2.5}$, and 50 tons per year for VOC. Therefore, a Conformity Determination is not required and the B&P Tunnel project is presumed to comply with the SIP.

Table VI-29: Construction Emissions (tons)

Year	CO	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$
2020	75	9	45	0.1	20	4
2021	72	9	44	0.1	20	4
2022	68	9	43	0.1	19	4
2023	64	8	42	0.1	19	3
2024	60	8	41	0.1	19	3
2025	57	7	41	0.1	19	3
De Minimis Threshold (tons per year)	--	50	100	--	--	100
Below *De minimis* for Every Year?	**--**	**Yes**	**Yes**	**--**	**--**	**Yes**

4. Ventilation Facility Emissions

The B&P Tunnel ventilation system serves multiple purposes including: furnishing outside "fresh" air into the underground spaces, removing air emissions and heat from inside the tunnel, and providing a means for evacuating smoke and other by-products in the event of a fire or other emergency. Under normal operating conditions, the removal/dilution of air emissions is aimed primarily at the combustion products from the burning of diesel fuel. The pollutants of concern include NO_x, CO, VOC, and PM.

The American Meteorological Society/US EPA Regulatory Model (AERMOD)[5] was used to evaluate the potential 1-hour NO_2 emissions from the proposed B&P Tunnel Project. For the AERMOD analysis, a "worst case" scenario was analyzed assuming an average of ten diesel trains per hour operating between the hours of 8:00 am to 8:00 pm as these are assumed to be peak hours of operation. No diesel operations were assumed from 12:00 am to 4:00 am and partial operations (i.e., five diesel trains per hour) were assumed for the remaining time.

For this analysis, air emissions from the diesel train operations were assumed to exit through the north and south portals, and from all of the three ventilation facilities (i.e., South, Intermediate, and North). Each ventilation facility is defined in AERMOD as a single "point source", and the portals are considered as "area sources".[6] Each ventilation facility represents the location where air from the tunnel is exhausted vertically into the atmosphere. Seasonal variability (i.e., summer and winter) was used when calculating the potential emission rates at each ventilation facility and tunnel portal. The temperature of the air being exhausted from each ventilation facility is based on assumed train operations and tunnel thermal properties. **Tables VI-30 and VI-31** present the parameters and NO_2 emission rates used to model each vent and portal in AERMOD.

[5] US EPA, AERMOD (Version 15181), https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod.

[6] In AERMOD point sources are defined as a single, identifiable source of emissions and area sources are defined as a two-dimensional source of diffuse emissions.

Table VI-30: Ventilation Facility Emission Parameters and Rates

Ventilation Facility	Total Vent Area (ft^2)	Vent Height (ft)	Vent Diameter (ft)	Vent Exhaust Temperature (°F)	Vent Exhaust Flow Rate (kcfm)	Vent Exhaust Velocity (ft/s)	NO_2 Emission Rate (lb/hr)
Summer Season (April – September)							
SVF	530	55	26.0	105	1,598	50	17.0
IVF	400	62	22.6	88	1,180	50	3.6
NVF	530	50	26.0	92	1,598	50	7.3
Winter Season (October – March)							
SVF	530	55	26.0	92	1,598	50	15.0
IVF	400	62	22.6	74	1,180	49	3.2
NVF	530	50	26.0	73	1,597	50	6.3

Note: IVF = Intermediate Ventilation Facility, NVF = North Ventilation Facility, SVF = South Ventilation Facility, °F = degrees Fahrenheit, ft/s = feet per second, kcfm = thousand cubic feet per minute, and lb/hr = pounds per hour.
Source: Parsons Brinckerhoff, 2016.

As the train exits the tunnel, it has a continuous source of momentum which creates a mechanically mixed "jet" of air with a length, width, and height. Based on the geometry of the exit portals, as well as the speed and size of the trains, the jet of air from each portal was computed to be 80 feet wide, 28 feet high, and 300 feet long.[7] The NO_2 emission rates from the jet of air exiting the tunnel portals used in the analysis are shown in **Table VI-31**.

Table VI-31: Portal Emission Rates

Tunnel Portal	NO_2 Emission Rate (lb/hr)
Summer Season (April – September)	
South	0.009
North	<0.001
Winter Season (October – March)	
South	0.001
North	<0.001

Note: lb/hr = pounds per hour.
Source: Parsons Brinckerhoff, 2016.

The effects of building downwash from the ventilation facilities were included in the air dispersion modeling analysis and were calculated using US EPA's Building Profile Input Program (BPIP).[8] **Table VI-32** presents the ventilation facilities' building dimensions.

Table VI-32: Ventilation Facilities Dimensions

Ventilation Building	Building Dimensions (feet)			
	Building Height	Stack Height	Width	Length
SVF	38	55	190	220
IVF	59	62	125	180
NVF	40	50	30	60

Note: IVF = Intermediate Ventilation Facility, NVF = North Ventilation Facility, and SVF = South Ventilation Facility.
Source: Parsons Brinckerhoff, 2016.

[7] Parsons Brinckerhoff, 2016.
[8] US EPA, BPIP (Version 04274), https://www3.epa.gov/ttn/scram/dispersion_related.htm#bpipprm.

The locations at which concentrations are estimated within the model are known as "receptors". A Cartesian receptor grid (with over 2,000 receptors) was used to predict concentrations around the locations of the ventilation facilities and portals. The receptor grid extended out to approximately 2.5 miles from the center of the emissions sources and was spaced as follows:

- 0 to 2 km = 200-meter receptor spacing, and
- 2 to 4 km = 300-meter receptor spacing.

This grid spacing resulted in a receptor point being located on about every city block, including locations immediately surrounding each portal and ventilation facility.

US EPA modeling guidance recommends using five years of meteorological data when predicting pollutant concentrations with AERMOD. The most recent meteorological data (i.e., from 2011 through 2015) from Baltimore-Washington International Airport (KBWI) and Phillips Army Airfield/Aberdeen Proving Ground (KAPG) were used in the air dispersion analysis. Notably, the B&P Tunnel Project is located approximately 9 miles north of KBWI and approximately 29 miles southwest of KAPG; therefore, it is assumed that meteorological conditions at KBWI and KAPG are representative of the project location.

Background concentrations account for existing nearby emissions sources. The background concentration was obtained from the nearby EPA monitoring station located in the Oldtown Fire Station at 100 Hillen Street in Baltimore, which is approximately 1.5 miles from the project. Following US EPA guidance, the 1-hour NO_2 background concentration was based on the most recent (i.e., 2013 through 2015) three-year average of the 98th percentile of the daily 1-hour maximum value, which equals 51 ppb.

The results of the ventilation facility and portal dispersion modeling are shown in **Table VI-33.** The maximum predicted 1-hour NO_2 concentration from all sources combined (the three ventilation facilities as well as the north and south portals) was 12.8 ppb. When added to the NO_2 background concentration of 51 ppb, the total predicted 1-hour concentration amounted to 63.8 ppb, which is below the NAAQS of 100 ppb. The table also presents the individual concentrations due to each emissions source individually.

Notably, because the concentrations of NO_2 were within acceptable levels, all other criteria pollutant concentrations would be within acceptable levels of the NAAQS.

Table VI-33: Ventilation Facility and Portal Emissions Results (parts per billion [ppb])

Emissions Source	Maximum Predicted 1-hour NO_2 Concentration	Measured Background NO_2 Concentration	Total 1-hour NO_2 Concentration	1-hour NO_2 NAAQS Threshold	Below NAAQS Threshold?
SVF	12.6	51.0	63.6	100	Yes
IVF	2.9	51.0	53.9	100	Yes
NVF	7.5	51.0	58.5	100	Yes
South Portal	1.8	51.0	52.8	100	Yes
North Portal	0.2	51.0	51.2	100	Yes
All Sources	**12.8**	**51.0**	**63.8**	**100**	**Yes**

5. Mitigation

a. Construction

Exhaust emissions due to construction activities can be reduced by reducing equipment idling times, storing recyclable construction materials on-site to reduce the amount of haul truck trips, and using low- or zero-emissions equipment. Employees could also be encouraged to carpool in order to reduce the vehicle miles travelled associated with their trips to and from the site.

Fugitive dust (PM) emissions can be mitigated by regularly watering or applying dust suppressants to unpaved areas, installing pads to deter track-out as vehicles enter and leave the site, reducing vehicle speeds on unpaved roads, covering materials stockpiles, covering haul trucks during materials transportation, and limiting construction activity during high wind events. Ensuring the contractor has knowledge of appropriate fugitive dust and equipment exhaust controls is also a measure to reduce emissions.

The Preferred Alternative will include development and implementation of a Construction Emission Reduction Plan to include measures such as reducing equipment idling times, utilizing on-site storage to reduce truck haul trips, using low-emissions equipment, dust suppression measures, ensuring the contractor has knowledge of appropriate fugitive dust and equipment exhaust controls, and other measures.

In order to reduce emissions, construction activities will be performed in accordance with Maryland's *Standard Specifications for Construction and Materials* which outlines the procedures to be followed by contractors involved in site work. In addition, the Maryland Air and Radiation Management Administration has determined that the specifications are consistent with the requirements of the Regulations Governing the Control of Air Pollution in the State of Maryland. Therefore, during the construction period, all appropriate measures cited in the Code of Maryland Regulations (COMAR) 26.11.06.03D - *Fugitive Particulate Matter from Materials Handling and Construction* would be employed to reduce emissions.

b. Ventilation

Preliminary design of the ventilation facilities has been coordinated with development of the air quality dispersion modeling presented here, and design of the ventilation facilities has been modified in order to ensure no violation of NAAQS. In particular, the Preferred Alternative was modified to include vertically-oriented fans at ventilation facilities to facilitate dispersion and avoid violation of applicable air quality regulations.

6. Conclusions

The Preferred Alternative, as well as Alternatives 3A and 3C, would not result in adverse impacts to air quality due to operational emissions. The net change in diesel locomotive emissions of NO_x, VOC, and $PM_{2.5}$ with the proposed project would be below the applicable *de minimis* levels. The analysis accounted for the projected increase of MARC operations in 2040 and the planned replacement of existing MARC electric locomotives with diesel-powered locomotives. Furthermore, there are no projected increases in diesel freight train operations, and no significant direct air emissions generated by the electric locomotive trains operated by Amtrak. Emissions would still occur from operations under Alternative 1: No-Build.

The construction of the Preferred Alternative, Alternative 3A, or Alternative 3C would not result in adverse impacts to air quality. The emissions of NO_x, VOC, and $PM_{2.5}$ would be below the *de minimis* levels for every construction year. The Study Area is currently in attainment for CO, so no *de minimis* threshold applies. In addition, emissions associated with the construction of the project would be short-term and would not result in a long-term change to local air quality. Application of the measures in Maryland's *Standard Specifications for Construction and Materials* as well as COMAR 26.11.06.03D would reduce construction-related emissions.

The ventilation system emissions analysis results show that the ventilation facilities, currently included as part of the Preferred Alternative, would be below applicable de minimis levels and would not result in violation of NAAQS air quality regulations.

I. Noise

This section presents an assessment of potential noise impacts for the Preferred Alternative, Alternative 3A, and Alternative 3C. This FEIS includes an overview of methodology, predicted impacts, and potential mitigation measures. More information on the noise assessment is available in the *B&P Tunnel FEIS Noise Technical Report* published on the Project website.

1. Impact Assessment Methodology

Because FRA has not established noise and vibration regulations, FRA defers to regulations published by the FTA. The operational noise effects were evaluated using the guidelines set forth by the FTA Transit Noise and Vibration Impact Assessment (FTA, 2006). The temporary construction effects were also evaluated using both the FTA guidelines and COMAR 26.02.03—Control of Noise Pollution.

In accordance with the FTA Transit Noise and Vibration Impact Assessment guidelines, a screening assessment was conducted to identify locations where the project may cause noise impact. The FTA screening distances for operations are based on typical commuter rail systems. A screening distance of 750 feet was computed and used to determine if noise-sensitive land uses are present within a defined area of project noise influence. This distance represents the unobstructed distance from a commuter rail line to where the project noise reaches an Ldn of 50 dBA. The screening distance was applied from the centerline of the proposed project to determine the noise area of potential effect (APE). Since noise-sensitive land uses were within the screening distance, further analysis was needed.

An FTA General Assessment analysis was conducted for the DEIS Alternatives 3A, 3B, and 3C and summarized below (see the DEIS for more detail). Noise impact was then assessed for the Preferred Alternative using the FTA Detailed Assessment methodology. Based on the results of the prior DEIS analysis (i.e., FTA General Assessment), noise impacts were predicted to occur only in vicinity of the south portal. Therefore, a Detailed Noise Analysis was carried out for noise sensitive receptors in this area.

Noise exposure due to the ventilation of the proposed B&P Tunnel Project was assessed in terms of the construction and operation of the ventilation facilities. The applicable noise ordinances and guidelines were assessed relative to the land uses surrounding each portal and the intermediate mid-tunnel location. The ventilation facilities would be designed in order to meet the Baltimore Health Code noise regulations. This would ensure that, during operation of the ventilation facilities, the resulting noise levels in the adjacent communities would meet the applicable standards.

2. Evaluation Criteria

a. Operational

The FTA's guidance manual, *Transit Noise and Vibration Impact Assessment* (FTA, 2006), presents the basic concepts, methods and procedures for evaluating the extent and severity of noise impacts from transit projects. Transit noise impacts are assessed based on land use categories and sensitivity to noise from transit sources under the FTA guidelines.

The reference noise levels for each of the proposed noise sources and related operating characteristics are summarized in **Table VI-34**. These data are based on default FTA data.

Table VI-34: Summary of Noise Source Reference Data

Source Type	Specific Source	Reference Conditions	Reference SEL (dBA)
Fixed Guideway	Locomotive	Diesel-electric, 3000 hp, throttle 5	92
	Rail Cars	Ballast, welded rail	82

Note: SEL noise levels are reported in decibels at a reference distance of 50 feet and a reference speed of 50 mph. SEL is the sound exposure level that converts the cumulative noise energy of an event into one second.
Source: Transit Noise and Vibration Impact Assessment (FTA, 2006).

The tunnel operations data are summarized in **Table VI-35** for the Preferred Alternative. Existing average train operating speeds are projected to be an estimated 30 mph at the north portals and approximately 70 mph at the south portal based on the NEC FUTURE Project (FRA, 2015).

Table VI-35: Tunnel Operating Characteristics in the Build Year (2040)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	# of Locos	# of Cars	
MARC (Regional)	Diesel	164	15	1	8	30/70
Acela (Intercity Express)	Electric	82	8	n/a	14	30/70
NE Regional (Intercity Corridor)	Electric	48	4	1	8	30/70
Freight	Electric	2	0	1	14	30/70
Metropolitan	Diesel	92	8	n/a	30	30/70
Total	All	388	35			

*Weighted average speeds based upon projected speeds of Amtrak and MARC trains. Of note, MARC trains stop at the West Baltimore Station located approximately 1/2-mile south of the proposed south portal.
Source: NEC FUTURE Project (FRA, 2015).

The FTA noise criteria are delineated into two categories: moderate and severe impact. 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. Noise monitoring locations are displayed below on **Figure VI-22**.

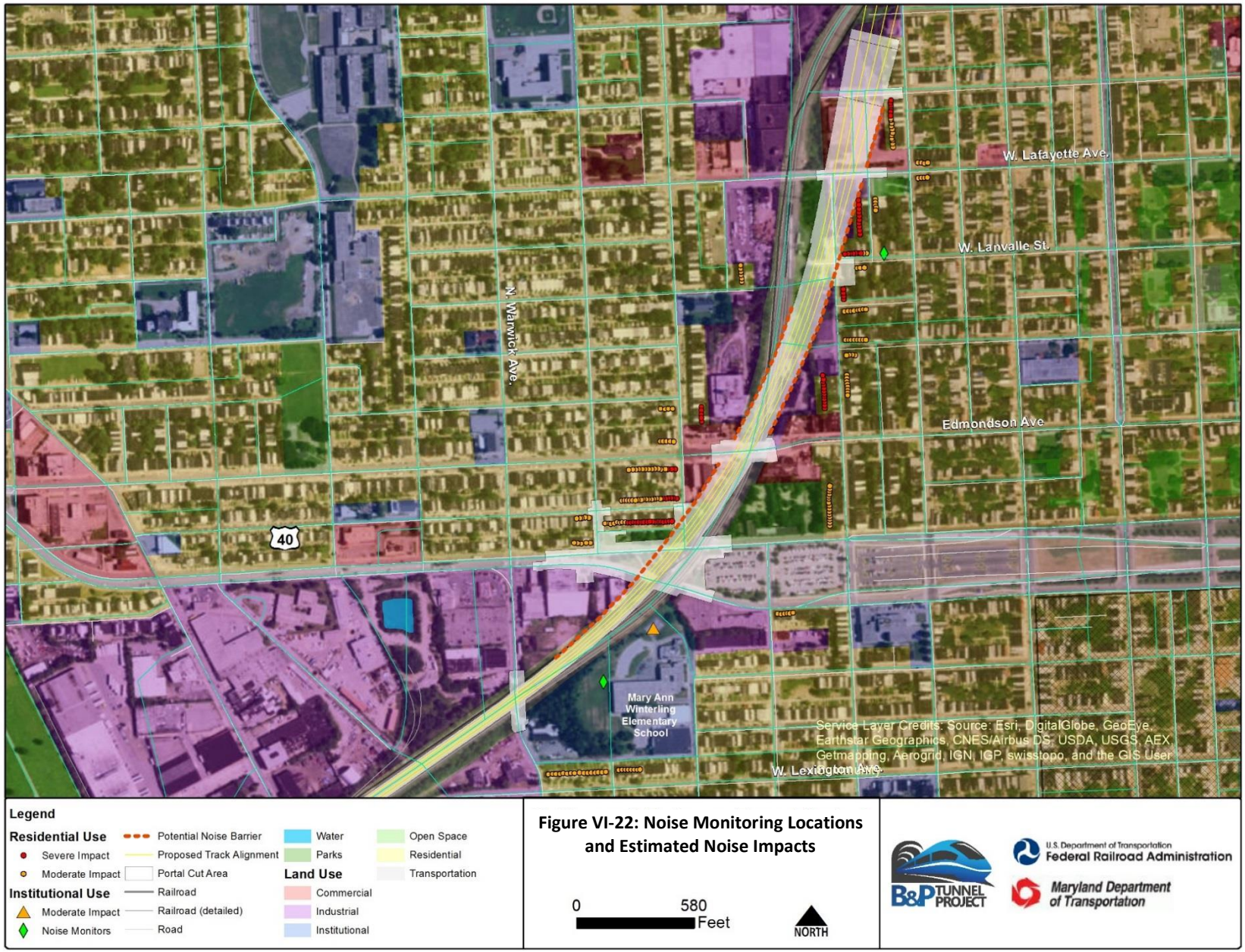


Figure VI-22: Noise Monitoring Locations and Estimated Noise Impacts

b. Ventilation

Stationary sources of noise, such as ventilation facilities, would be subject to the operational noise level standards included in the Noise Regulation of the Health Code of Baltimore City. 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 project it is assumed that the noise limit for the ventilation facilities is L_{max} 50 dBA at the property boundary of each ventilation facility.

c. Construction

During the EIS development phase of a project, construction details are limited. Therefore, the FTA guidelines suggest evaluating prototypical construction scenarios against local ordinances (if applicable criteria are available). The FTA design guidelines, for example, are evaluated against noise levels from the two loudest pieces of equipment that, under worst case conditions, are assumed to operate continuously for one hour during both the daytime (7 am to 10 pm) and nighttime (10 pm to 7 am) periods.

In Baltimore City, the local noise ordinance identified for the project study corridor exempts construction activities. Since the local noise ordinance does not provide quantitative noise limits on construction activities, the noise policy from MDE was reviewed to assess temporary construction activities.

The MDE has established the following noise guidelines for construction activities (MDE 26.02.03, Control of Noise Pollution). These maximum allowable sound pressure levels, although not specified as such, are assumed to be L_{max} levels:

- 90 dBA – daytime (7 am to 10 pm) – residences,
- 55 dBA – nighttime (10 pm to 7 am) – residences,
- Blasting during construction is exempt during the daytime (7 am to 10 pm),
- Pile driving during construction is exempt from 8 am to 5 pm, and
- Construction activities on public property are exempt.

3. Impacts

a. Alternative 1: No-Build

Future ambient noise levels under Alternative 1: No-Build are anticipated to be similar to those under existing conditions. The Study Area is characterized by urban communities that include major highways (such as I-83) and arterials (such as North Fulton Avenue and West North Avenue). Regardless of other projects in the Long-Range Transportation Plan, ambient noise under the Alternative 1: No-Build is anticipated to be similar to that of the existing conditions, as shown in **Table VI-36**. Existing conditions are notably already above the 55 dBA residential nighttime thresholds recommended.

b. Preferred Alternative

Noise levels were calculated at discrete receptor locations along the railroad including any noise reduction from shielding due to building rows or where the alignment was in a cut (i.e., trench). The results were then compared to the FTA impact criteria to identify moderate and severe impacts. Based on current US Census data, a total of 437 persons were predicted to be impacted, of which 141 were predicted to be severely impacted. The total number of moderate and severe impacts predicted is reduced substantially from those presented in the DEIS due to revised alignment that more closely aligns with the existing NEC. The severe impacts are predicted at

residential areas nearest the railroad between the West Baltimore station and the south portal. One school, the Mary Ann Winterling Elementary School, is predicted to be moderately impacted. **Table VI-36** summarizes the detailed results of the impact assessment, and **Table VI-37** provides a comparison of the impacts to the DEIS Alternatives. **Figure VI-22** shows the locations of the noise impacts.

Table VI-36: Number of Buildings Potentially Affected by Noise from the Preferred Alternative

Receptor Area Description	Side of Tracks*	Land Use Category**	Noise Metric	Existing Noise Level	Noise Impact Criteria		Project Noise Levels	Impact Type
					Moderate	Severe		
Residences South of the West Baltimore Station	EB	2	L_{dn}	63	60	66	60-63	Moderate
Mary Ann Winterling Elementary School	EB	3	L_{eq}	64	66	71	68	Moderate
Residences between the West Baltimore Station and the South Portal	EB	2	L_{dn}	63	60	66	60-68	Moderate to Severe
Residences between the West Baltimore Station and the South Portal	WB	2	L_{dn}	63	60	66	60-72	Moderate to Severe

Count of Impacts	Moderate	Severe	Total
Residential (Number of Persons)	296	141	437
Institutional (Number of Schools)	1	0	1

*Eastbound (EB) and Westbound (WB)

Land uses defined in **Chapter V, **Table V-25**

Table VI-37: Comparison of Preferred Alternative Noise Impacts to DEIS Alternatives

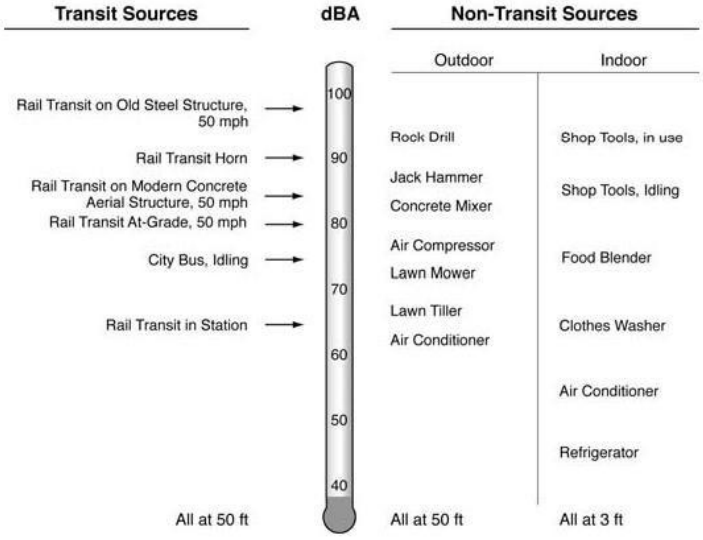
Alternative	Number of Affected Residential (Persons)		Number of Affected Institutional (Buildings)	
	Moderate	Severe	Moderate	Severe
3A (DEIS)	254	0	0	0
3B (DEIS)	1,077	175	1	0
3C (DEIS)	975	111	4	0
FEIS Preferred Alternative	296	141	1	0

Noise levels in the immediate vicinity of the ventilation facilities would be caused by the continual operation of the ventilation fans within each facility. The horizontal fans would operate periodically and would generate sound that would propagate through the louvers on the top of the ventilation facilities. As discussed in **Section III.B.6**, fans would operate periodically when NO_2 levels in the tunnel exceed a set threshold or in emergencies when smoke is present in the tunnel. NO_2 levels are likely to be highest when the levels of diesel locomotive operations are highest, or when congestion causes trains to operate slowly or at idle in the tunnel. However, there is not enough information currently available to determine the duration or specific hours per day the fans would run.

The Preferred Alternative tunnel design includes three ventilation facilities: one near each portal and an intermediate facility located above the tunnel. The three ventilation facilities would be subject to the noise level standards included in the Noise Regulation of the Health Code of Baltimore City.

The ventilation facilities would be designed to be below the L_{max} 50 dBA noise limit. A noise level of 50 dBA is roughly between that of a refrigerator and an air conditioner at a distance of three feet, as shown in **Figure VI-23**. The design standard for the ventilation facilities would limit the outdoor noise level, when the fans are in operation, to L_{max} 50 dBA or below at the facility property lines.

Figure VI-23: Typical A-Weighted Sound Levels



c. Alternative 3A

Alternative 3A was assessed in the DEIS for potential operational noise impacts. The assessment estimated that 254 residential persons would be moderately affected. No severe residential affects would occur, and no institutional buildings would be affected (**Table VI-37**). Refer to the DEIS for more information on the operational noise assessment of Alternative 3A. Ventilation facilities for Alternative 3A would emit noise identical to that described under the Preferred Alternative above. Additional information on Alternative 3A can be found in the DEIS.

d. Alternative 3C

Alternative 3C was assessed in the DEIS for potential operational noise impacts. The assessment estimated that 975 residential persons would be moderately affected and 111 would be severely affected. Four institutional buildings would be moderately affected, and no institutional buildings would be severely affected (**Table VI-37**). Refer to the DEIS for more information on the operational noise assessment of Alternative 3C. Ventilation facilities for Alternative 3C would emit noise identical to that described under the Preferred Alternative above. Additional information on Alternative 3C can be found in the DEIS.

4. Mitigation

FTA's guidance states that noise mitigation should be considered for areas of severe impact, unless the project's location or alignment can be modified to eliminate the impact. Noise impacts designated as moderate also require consideration for mitigation, but additional project factors should first be considered when assessing mitigation (such as the cost of the mitigation relative to the amount of noise reduction, the number of affected receptors, etc.). Since noise impacts were predicted for the proposed project, a range of mitigation measures were investigated for addressing train operations.

Table VI-38 shows the amount of noise reduction that a mitigation measure or combination of mitigation measures would need to provide to mitigate severe impacts. Mitigating severe impacts within these areas is likely achievable as the maximum reduction required to reduce levels below the Severe threshold is 7 dB.

Table VI-38: Required Noise Reduction to Mitigate Noise Impacts

Receptor Area Description	Mitigate Severe Impacts
Residences South of the West Baltimore MARC Station, EB	No severe impacts
Mary Ann Winterling Elementary School, EB	No severe impacts
Residences between West Baltimore MARC Station and South Portal, EB	1-3 dB
Residences between West Baltimore MARC Station and South Portal, WB	1-7 dB

The Preferred Alternative will include design and implementation of noise barriers to mitigate anticipated severe operational noise impacts. The implementation of noise barriers along the railroad right-of-way would be effective in reducing outdoor noise levels, within practical limits of cost and feasibility. The approximate locations of proposed noise barriers are shown in **Figure VI-22** and the results of the noise barrier analysis are provided in **Table VI-39**. The approximate height of 6-7 feet above ground-level was based on reducing the severe noise impacts to levels below the FTA impact criteria. Of note, some of the projected moderate noise impacts would also be reduced somewhat by the proposed barriers. The total barrier length for the project would be approximately 3,700 feet (0.7 miles) at a total cost of about $700,000.

A more-detailed noise barrier design will be conducted during the final design phase of the project. Factors that could affect the final barrier design include: barrier installation on rail bridges and at the West Baltimore MARC station; gaps in the barriers that would be necessary to accommodate roadway overpasses at Edmondson Avenue and West Lafayette Avenue; and, the varying depth of the portal cut area from at-grade near Edmondson Avenue to tunnel elevation at the south portal (which could vary the barrier height along this section).

Table VI-39: Preliminary Noise Barrier Design

Location of Barrier	Height (feet)	Length (feet)	Cost (Dollars)*	Noise Reduction (dB)
Eastbound Side				
Edmondson Avenue to W. Lafayette Avenue	6	1,370	$246,600	9
W. Lafayette Avenue to W. Mosher Street	6	320	$57,600	9
Westbound Side				
N. Warwick Avenue to Edmondson Avenue	7	1,290	$270,900	13
Edmondson Avenue to W. Lanvale Street	6	720	$129,600	7
Total		**3,700**	**$704,700**	7 to 13

a. Construction

Temporary noise impacts may occur during construction of the B&P Tunnel at residences and other sensitive receptors along the proposed project. To reduce any construction noise impacts that may occur, the Project will develop and implement a Construction Noise Mitigation Plan. The plan will include the following measures, to the extent practicable:

- Location of construction equipment and material staging areas away from sensitive receptors where possible
- Temporary noise barriers and advanced construction of permanent barriers to serve during construction where possible

- Routing of construction traffic and haul routes along roads in non-noise sensitive areas.

All mitigation measures would be confirmed and refined during the final design and permitting phase of the project.

b. Ventilation System Noise

To achieve the required reduction in noise level, cylindrical or rectangular sound attenuators would be mounted directly to each fan or to the ductwork within the system. In addition, the building itself would partially shield noise generated within the interior of the ventilation facility, which would further reduce noise levels outside of the building. The proposed ventilation facilities, with attenuators installed, will emit noise at approximately 45 dBA. This would meet the design standard of L_{max} 50 dBA at the facility property lines (i.e., the noise level generated would be less than the design standard). By comparison, the measured L_{max} at a nearby site ranged from 47 dBA to 92 dBA, and the average of all measured L_{max} values was 72 dBA.

J. Vibration

This section provides an assessment of potential vibration and ground-borne noise impacts resulting from construction and operation of the B&P Tunnel Preferred Alternative, as well as Alternative 3A and Alternative 3C. More detailed information can be found in the *B&P Tunnel FEIS Vibration Technical Report* published on the Project website.

Vibration originates at the track bed, where the train wheels rolling on the rails create vibration energy that is transmitted into adjacent ground and propagated through soil and rock strata to the foundations of nearby buildings. Ground-borne noise is the noise radiated from the motion of room surfaces. When buildings vibrate, they can emit a noise or rumble known as ground-borne noise which may be perceptible to people inside them.

1. Operational Impact Assessment Methodology

The operational impacts were evaluated using the guidelines set forth by the FTA *Transit Noise and Vibration Impact Assessment* (FTA, 2006). Vibration impacts were evaluated using prediction modeling according to the FTA's "General Assessment" guidelines. To determine the appropriate FTA evaluation criteria, rail operations along the NEC were evaluated using bi-directional train frequencies, number of locomotives, number of coaches, and speed for MARC, Acela, NE Regional, and freight services. The vibration levels from a diesel locomotive are assumed to be the same regardless whether it is pulling a passenger train or a freight train. In addition, temporary construction vibration levels were also evaluated using both the FTA guidelines as well as standard industry practices for evaluating vibration due to tunnel boring and other tunnel excavation activities. The modeling assumptions and input data used to predict existing and future vibration levels from rail service in the existing B&P Tunnel are summarized as follows:

- A screening assessment identified 6,858 land-uses within the FTA screening distance of 300 feet, including:
  - 6,287 Residential and Mixed-Use parcels;
  - 101 Institutional properties;
  - 2 Parks (Maple Leaf Park and Arnold Sumpter Park);
  - 179 Commercial parcels;
  - 9 Industrial parcels; and
  - 280 Unknown or undeveloped parcels.

- The FTA vibration thresholds selected for the evaluation criteria are based on the total number of daily trains traveling through the community. Based on the average daily operations for each alternative and as described in the *Vibration Technical Report,* the FTA "frequent" criteria were selected to evaluate the potential impacts.

- Train speeds were applied using the same assumptions as the noise assessment, which include 30 miles per hour (mph) under Alternative 1 and a range of speeds from 30 mph at the east or north portal to 70 mph at the west or south portal for Alternatives 3A, 3B, and 3C.
- Adjustments for continuously-welded track were applied using the FTA guidelines for Alternatives 3A, 3B and 3C.
- To account for improvements to the existing corridor as well as the proposed tunnels, an increase of 5 VdB was applied to Alternative 1 to reflect adverse track and tunnel conditions similar to jointed-rail track.
- The FTA default ground-surface vibration curves for diesel-electric locomotives (which are heavier than the railcars) were utilized to reflect typical ground propagation characteristics.
- Adjustments for ground-borne noise reflect typical ground conditions with peak frequencies between 30-60 Hz.

Compared to the original analysis conducted as part of the DEIS, the analysis for the FEIS applied additional adjustments based on new information collected since the DEIS. As a result, predicted impacts are reduced due to refinements in Project alignments and modeling assumptions. A comparison of the two approaches is summarized below.

- The DEIS applied a highly conservative approach assuming the following:
    - Tunnels bored through soil
    - Typical soil-propagation characteristics
    - No building coupling losses
    - Safety factor of 3 VdB
- The FEIS revised analysis applied an updated set of adjustments based on new information developed by the project team since completion of the DEIS:
    - Tunnels bored through rock
    - Efficient soil-propagation characteristics
    - Building coupling losses typical for single-family wood-frame structures
    - No safety factor

The FTA vibration criteria are related to ground-borne vibration levels that are expected to result in human annoyance, and are based on root mean square (RMS) velocity levels expressed in VdB. FTA's experience with community response to ground-borne vibration indicates that when there are only a few train events per day, it would take higher vibration levels to evoke the annoyance level that would be expected from more frequent events. This experience is taken into account in the FTA criteria by distinguishing between projects with frequent, occasional, or infrequent events. The frequent events category is defined as more than 70 events per day; to be conservative, the FTA frequent criteria were used to assess ground-borne vibration impacts in the Study Area.

The vibration criteria levels shown in **Table VI-40** are defined in terms of human annoyance for different land use categories such as high sensitivity (Category 1), residential (Category 2), and institutional (Category 3). In general, the vibration threshold of human perceptibility is approximately 65 VdB.

Table VI-40: Ground-Borne RMS Vibration Impact Criteria for Annoyance During Operations and Construction

Receptor Land Use		Ground-borne Vibration Levels (VdB)			Ground-borne Noise Levels (dBA)		
Category	Description	Frequent Events	Occasional Events	Infrequent Events	Frequent Events	Occasional Events	Infrequent Events
1 (High)	Buildings where low vibration is essential for interior operations	65	65	65	N/A	N/A	N/A
2 (Residential)	Residences and buildings where people normally sleep	72	75	80	35	38	43
3 (Institutional)	Daytime institutional and office use	75	78	83	40	43	48
Specific Buildings	TV/Recording Studios/Concert Halls	65	65	65	25	25	25
	Auditoriums	72	80	80	30	38	38
	Theaters	72	80	80	35	43	43

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

2. Operational Vibration Impact Assessment

To assess impacts along an existing, heavily-used rail corridor, the Preferred Alternative was modeled and compared to the FTA impact criteria to evaluate the change in ground-borne vibration. The assessment incorporates the most up-to-date alignment including all refinements made since the DEIS. Additional geotechnical information has also been incorporated since the DEIS to establish more accurate modeling assumptions. Along the existing tunnel alignment, future predicted vibration levels under Alternative 1: No-Build were compared against the levels predicted for the Existing Condition to determine the relative change in impact. Along the Preferred Alternative, future predicted vibration levels were compared against the FTA absolute criteria threshold limits to determine the onset and magnitude of impact. As shown in **Table VI-41**, no ground-borne vibration impacts from the Preferred Alternative are predicted. Predicted impacts from ground-borne noise are shown in **Table VI-42**. Alternatives 3A and 3C are provided in the tables below as comparison.

Table VI-41: Inventory of Ground-Borne Vibration Impacts Predicted During Operation

Alternative	Number of Impacts (Ground-Borne Vibration)			
ID	Total	Residential (Cat. 2)	Parks (Cat. 3)	Institutional (Cat. 3)
No-Build Alternative	0	0	0	0
3A	0	0	0	0
3B Preferred Alternative	0	0	0	0
3C	0	0	0	0

NB: 6858 receptor set used for alternative analyses.

Table VI-42: Inventory of Ground-Borne Noise Impacts Predicted During Operation

Alt.	Number of Impacts (Ground-Borne Noise)			
ID	Total	Residential (Cat. 2)	Parks (Cat. 3)	Institutional (Cat. 3)
No-Build Alternative	12	12	0	0
3A	156	156	0	0
3B Preferred Alternative	449	444	0	5
3C	168	168	0	0

NB: 6858 receptor set used for alternative analyses

a. Alternative 1: No-Build

Predicted vibration levels under Alternative 1: No-Build due to ground-borne vibration from train passbys remain unchanged, and are not predicted to exceed the FTA frequent impact criteria at any receptors or institutional land-uses. Similarly, no exceedances of the FTA ground-borne vibration impact criteria are predicted at any Category 1 land-uses (highly sensitive equipment) under Alternative 1.

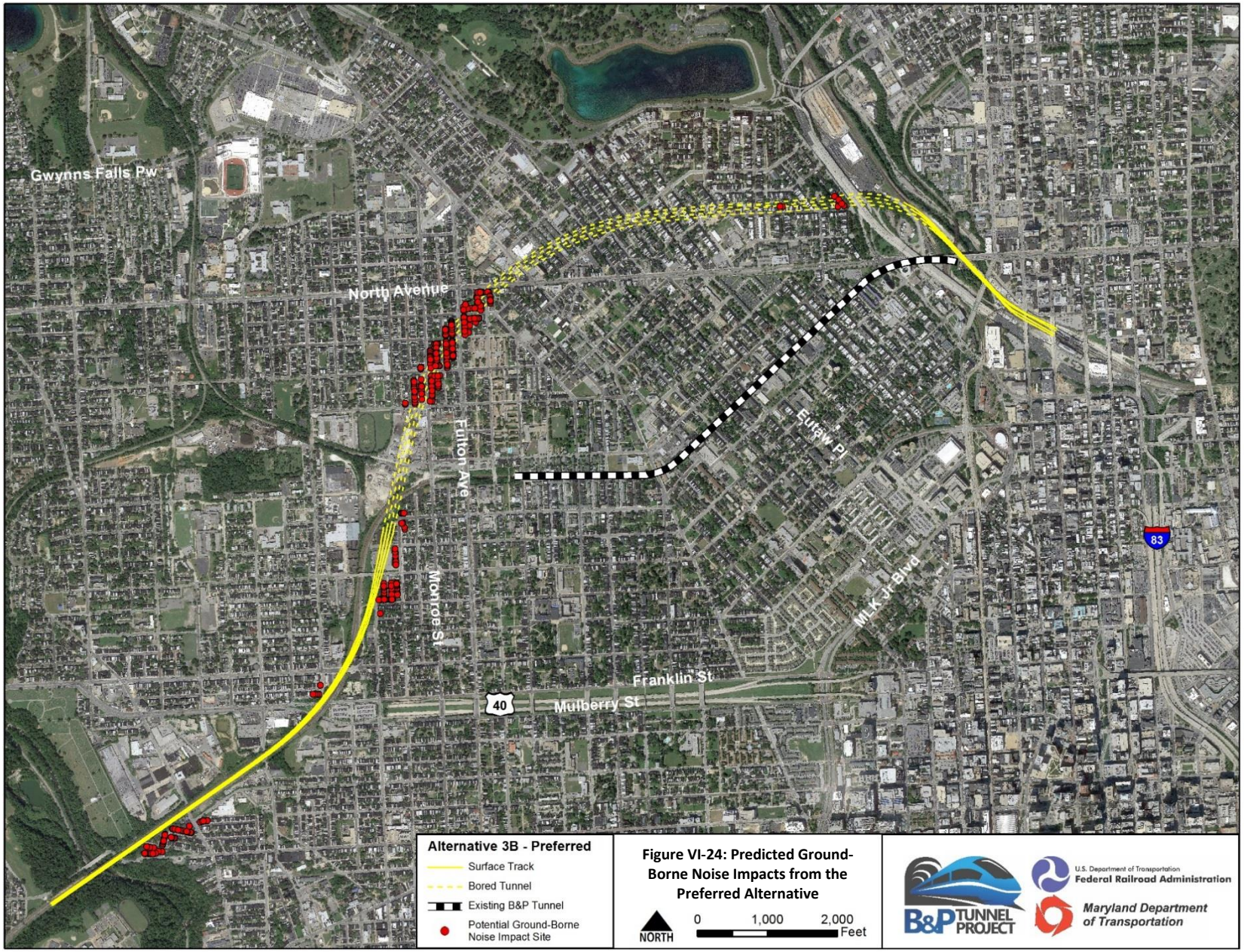
Vibration from train passbys in tunnels could contribute to ground-borne noise inside residences due to vibrating surfaces. Impacts under Alternative 1: No-Build due to ground-borne noise from train passbys are predicted to exceed the FTA frequent impact criterion of 35 dBA at 12 residences and other FTA Category 2 land-uses, **Table VI-42**. No exceedances of the FTA impact criterion of 40 dBA are predicted at FTA Category 3 receptors. FTA Category 1 land-uses (highly sensitive equipment) are generally not sensitive to ground-borne noise.

Alternative 1: No-Build would result in vibration impacts equivalent to existing conditions. Future vibration levels under Alternative 1: No-Build are expected to be similar to those currently experienced, because existing vibration is dominated by existing rail traffic along the NEC. Since no project components or design elements are included under Alternative 1: No-Build, the alternative would not cause any new vibration impacts, and existing impacts would remain unchanged.

b. Preferred Alternative

Impacts from the Preferred Alternative due to ground-borne vibration from train passbys are not predicted to exceed the FTA *frequent* impact criteria at FTA Category 1, 2, or 3 land uses (**Table VI-41**). No vibration levels high enough to damage buildings are estimated from operations, including fragile historic buildings. Humans can sense vibration at approximately 65 VdB. Vibration levels between 0 and 65 VdB are anticipated for areas within approximately 500 feet of the proposed track centerlines. Some locations directly adjacent to the surface tracks near the south portal will have estimated vibration levels between 65 and 72 VdB.

Levels under the Preferred Alternative due to ground-borne noise from train passbys are predicted to exceed the FTA *frequent* impact criteria at 444 residences and other FTA Category 2 land-uses (**Table VI-42**). Exceedances of the FTA ground-borne noise impact criteria are predicted at five Category 3 land-uses (institutions) with the Preferred Alternative. More detailed vibration analysis and monitoring will occur during the final design stage. **Figure VI-24** shows the location of predicted ground-borne impacts resulting from the Preferred Alternative. The Preferred Alternative will implement vibration control measures to mitigate the ground-borne noise impacts in exceedance of FTA frequent impact criteria. Further discussion on mitigation is included in **Section VI.J.4** below.


Gwynns Falls Pw
North Avenue
Fulton Ave
Monroe St
Eutaw Pl
MLK Jr Blvd
Franklin St
Mulberry St
40
83
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Existing B&P Tunnel
Potential Ground-Borne Noise Impact Site
Figure VI-24: Predicted Ground-Borne Noise Impacts from the Preferred Alternative
NORTH
0
1,000
2,000
Feet
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

c. Alternative 3A

Impacts from Alternative 3A due to ground-borne vibration from train passbys are not predicted to exceed the FTA frequent impact criteria at FTA Category 1, 2, or 3 land uses (**Table VI-41**). No vibration levels high enough to damage buildings are estimated from operations, including fragile historic buildings.

Levels under Alternative 3A due to ground-borne noise from train passbys are predicted to exceed the FTA *frequent* impact criteria at 156 residences and other FTA Category 2 land-uses (**Table VI-42**). No exceedances of the FTA ground-borne noise impact criteria are predicted at Category 3 land-uses (institutions) with Alternative 3A.

d. Alternative 3C

Impacts from Alternative 3C due to ground-borne vibration from train passbys are not predicted to exceed the FTA frequent impact criteria at FTA Category 1, 2, or 3 land uses (**Table VI-41**). No vibration levels high enough to damage buildings are estimated from operations, including fragile historic buildings.

Levels under Alternative 3C due to ground-borne noise from train passbys are predicted to exceed the FTA *frequent* impact criteria at 168 residences and other FTA Category 2 land-uses (**Table VI-42**). No exceedances of the FTA ground-borne noise impact criteria are predicted at Category 3 land-uses (institutions) with Alternative 3C.

3. Construction Vibration

Ground-borne vibration would be generated from construction activities from the Preferred Alternative (as well as Alternative 3A and 3C), with potential impacts on surrounding areas near the proposed portals and above the proposed tunnels. Tunnel boring machine (TBM) tunneling would be used to bore the four primary train tunnels. Drill and blast excavation would be used to construct cross-passages and ancillary underground structures. TBM tunneling and drill and blast excavation have been evaluated for a preliminary estimate of potential construction vibration impacts, and presented in this section. The assessment of construction vibration included in this section has been completed for the Preferred Alternative; however, it is not expected that construction vibrations from Alternative 3A or Alternative 3C would be substantially different from the Preferred Alternative.

a. Tunnel Boring Machine Vibration Assessment

Ground-borne vibrations, which include those generated by TBM tunneling, are transmitted easier and further in hard-rock ground conditions. However, the on-site soils, due to their very dense consistency, have vibration transmitting characteristics close to those of rock. The soil deposit vibration transmission characteristics are essentially the same as rock, based on soil boring data collected for the Baltimore Red Line Project (FTA and MTA, 2012).

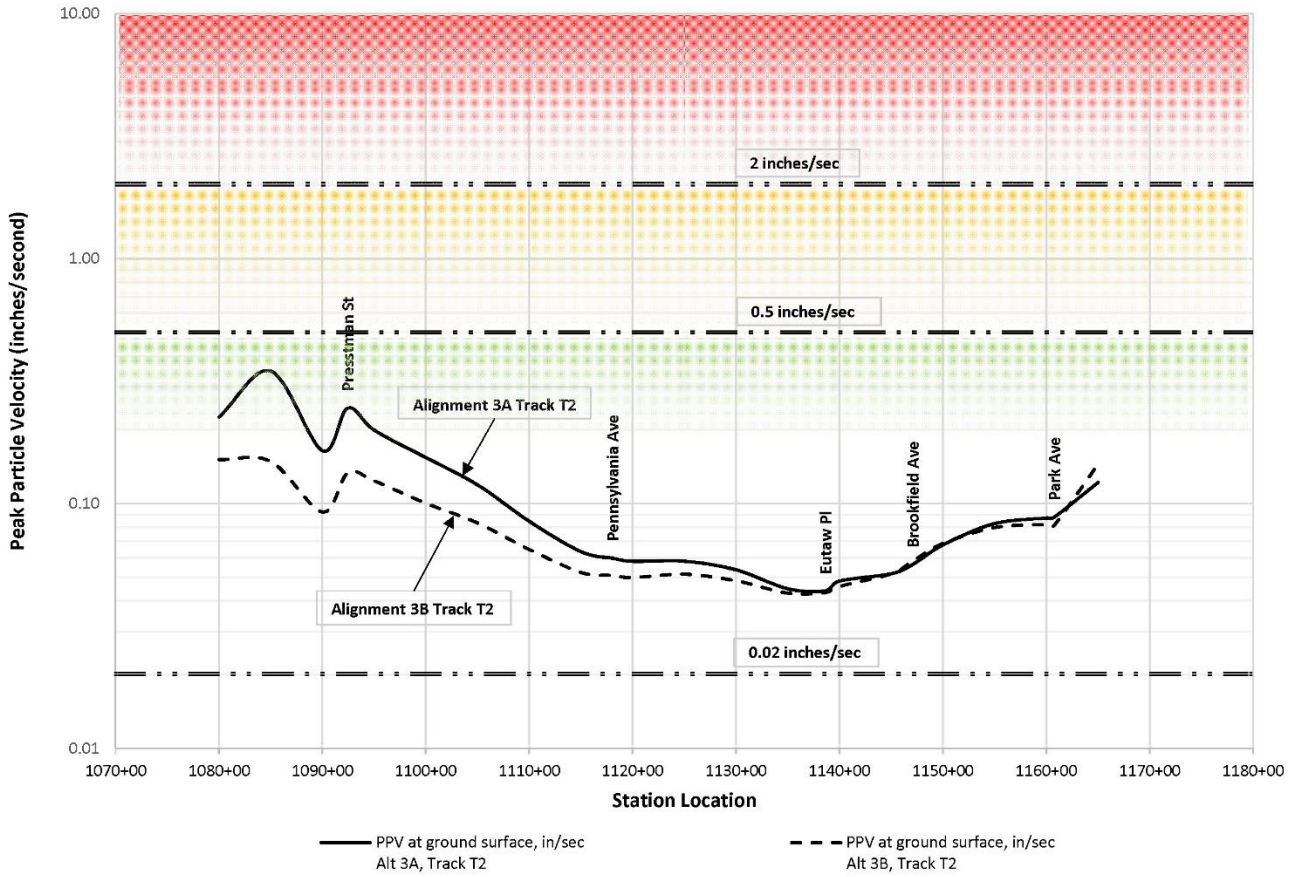
The TBM induced ground-borne vibrations attenuate with distance. Construction related ground-borne vibrations are frequently discussed as Peak Particle Velocity (PPV) at a given location. PPVs generally use units of inches per second or millimeters (mm)/second. Damage potential (to structures) as well as disturbance to humans can be related to the Resultant PPV (RPPV) magnitude.

To estimate a vibration attenuation curve, one needs the distance between the source (the TBM) and the receptor (such as a surface structure). For the Preferred Alternative, the distance used is the distance from the TBM tunnel centerline to the ground surface (depth of the tunnel centerline below ground). The vibration attenuation is related to the ground conditions, which are estimated as similar to solid rock as explained above.

Figure VI-25 below presents the estimated PPV at ground surface resulting from TBM construction for the Preferred Alternative. Alternative 3A is included for comparison. Three reference points are shown on this logarithmic plot to help clarify the results. Two inches per second is the level at which potential damage to structures would likely occur. At 0.5 inches per second, old residential structures in poor condition would likely

be damaged. Humans are able to sense vibration at approximately 0.02 inches per second. The results show that TBM vibrations during construction would generally be between 0.04 and 0.2 inches per second for the Preferred Alternative, and thus are not likely to risk damaging buildings near or above the proposed tunnels but would be perceptible to humans.

Figure VI-25: Estimated Vibration at Ground Surface from TBM Tunneling



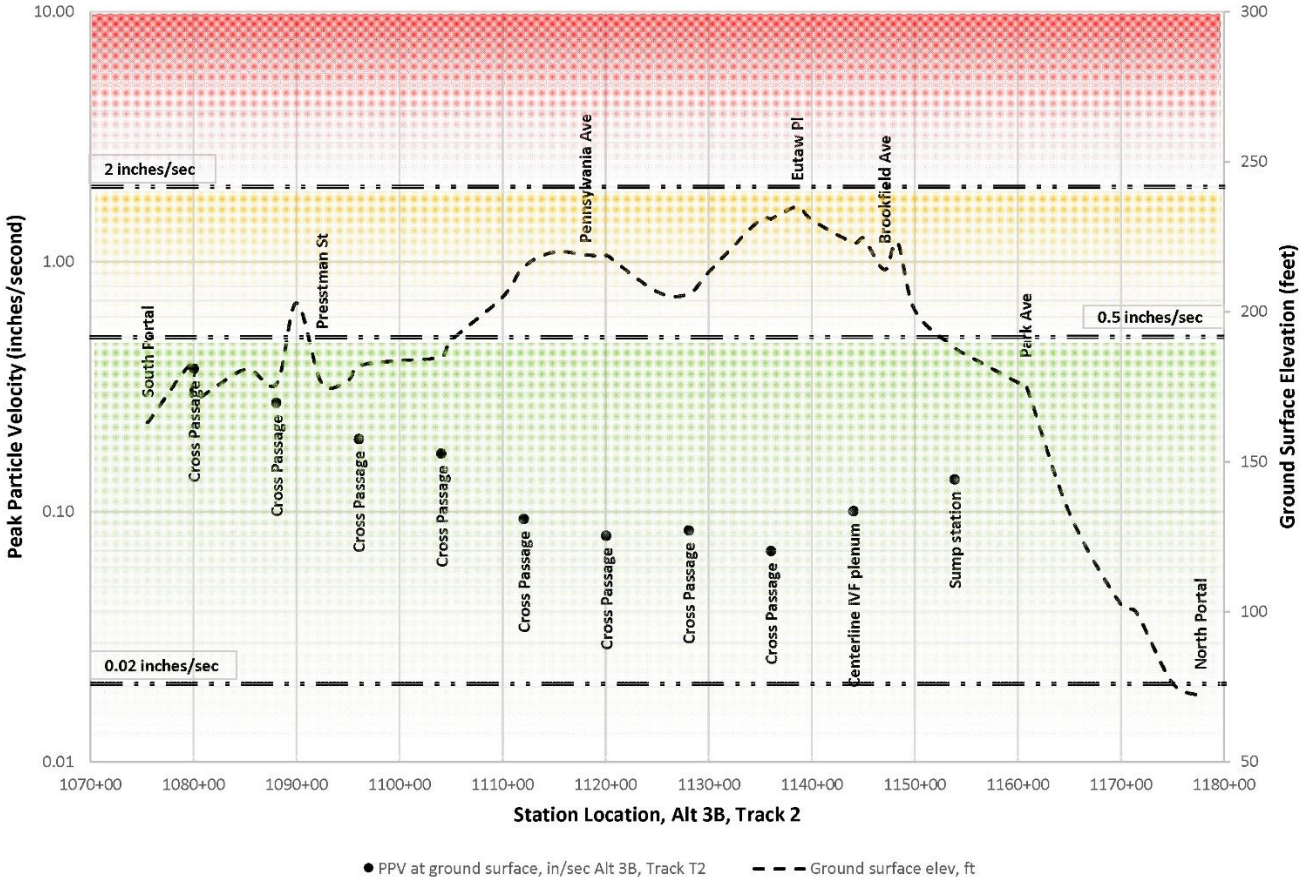
The results indicate that humans would likely be able to sense the vibration from most of the TBM tunneling. Observations show that TBMs closer than 150-160 feet away can be felt by humans, and a good portion of the Preferred Alternative alignment is at or less than this distance. However, the TBM would advance around 30 feet per day, meaning the vibration source would likely only be felt for a short duration before the vibration source moves away from a given location. This means that someone may sense the TBM vibrations for a day or two when tunneling is continuous. One could compare the perceived vibrations to common activities such as traffic or construction equipment. The range of PPVs estimated here would be comparable to the vibration (but not the noise) of a truck traveling 20-30 feet away from an observer.

b. Drill and Blast Tunnel Excavation

The potential vibration effects resulting from tunnel blasting for cross passages and ancillary underground structures was also assessed. Drill and blast tunnel excavation would be used for cross-passages located underground at 16 locations between the south portal and Intermediate Ventilation Facility, one sump station located underground between the Intermediate Ventilation Facility and the south portal, and the intermediate vent cavern, plenum, tunnel and shaft. The intermediate vent plenum would run underneath Jordan Street between approximately Ducatel Street and West North Avenue. In addition, there would be blasting for the egress cavern and tunnel, the North Ventilation Facility, and minor blasting at each portal area.

Current state-of-the-art "controlled blasting" will be specified in the tunnel construction contract, and thus has been assumed in these estimations. Controlled blasting, unlike TBM vibration, is a transient vibration. To control vibrations, the blast holes are fired in a sequential manner at small time intervals resulting in a "rumbling" vibration. In a large tunnel, this rumbling can be sensed for several seconds. The results of this analysis are presented in **Figure VI-26**. The PPV at ground surface in inches per second is depicted as black dots, with one dot per facility that would be constructed with drill and blast excavation under the Preferred Alternative. The continuous dashed line represents the ground surface elevation in feet. The analysis shows that blasting for the Preferred Alternative can be controlled to allow for reasonable advance of excavation activities while controlling vibration to a practical level. No vibration levels would exceed 0.5 inches per second, the level at which damage is likely to occur to old residential buildings in poor condition. The PPVs would generally range between 0.07 to 0.4 inches per second. The threshold for human perception is approximately 0.02 inches per second, however, such vibrations are likely to be barely perceptible.

Figure VI-26: Estimated Vibration at Ground Surface due to Blasting for the Preferred Alternative



c. Drill and Blast Shaft Excavation

The evaluation of blast-induced vibrations for shaft construction is complex and is anticipated to have the most impact to the public. One shaft would be located at the Intermediate Ventilation Facility, and one at the North Ventilation Facility. The magnitude of disturbance from vibrations depends on the construction sequencing and general configuration of the shaft and connecting tunnel. For blasting at shaft areas, both ground-borne vibrations and air overpressures were considered. Air overpressures are vibrations from pressure shock waves being transmitted by the atmosphere. Ground-borne vibrations are typically less disturbing and lower potential for damage during shaft excavation. However, overpressures pose more potential for disturbance when blasting for shafts.

It is anticipated that the distance to the closest adjacent building structures would typically be in the range of 100-200 feet since the immediate surrounding area of the shaft would be a working construction zone. Anticipated PPV vibration levels would be less than approximately 0.25 inches per second and thus below 0.5 inches per second, the typical threshold level of potential damage to historic structures.

Recorded data from past blasting activities in similar conditions can be used to estimate potential order of magnitude of air overpressures, measured in decibels (dB). Based on this data, sound levels could range from about 102 to 145 dB at adjacent structures, without considering potential mitigation measures. For the purpose of comparison, 100 dB is approximately like the overpressure from a motorcycle, and 145 dB would be roughly equivalent to a fire cracker. The latter value, 145 dB, is considered high for blasting; this would be representative of a poorly controlled blast and should be considered an exception rather than typical.

4. Mitigation

Since exceedances of the FTA impact criteria are predicted for the project alternatives, candidate mitigation measures have been identified for operational ground-borne noise. The vibration control measures to mitigate the ground-borne noise impacts predicted by modeling will to be developed during final design. Factors such as the level of impact, cost, and effectiveness of mitigation measures will be considered in determining measures that will be included in the project. All vibration control measures would need to be evaluated in more detail during final design when the track alignments are finalized. Additionally, ground propagation characteristics determined through field measurements would also be required to accurately evaluate the various control measures considered. **Table VI-43** provides a list of potential mitigation measures, the approximate vibration reduction potential, and estimated cost.

Table VI-43: Potential Operational Mitigation Measures

Mitigation Measures	Approximate Vibration Reduction Potential	Approximate Cost
Resilient Fastener	5-10 VdB	$300 per track foot
Ballast Mats	10-15 VdB	$180 per track foot
Resiliently Supported Ties	10-15 VdB	$400 per track foot
Floating Slab Track	15-20 VdB	$600 per track foot
Rail Vibration Absorbers	3-5 VdB	$40 per track foot
Rail Vibration Dampers	3-5 VdB	$40 per track foot

The Project will include development of a Construction Vibration Mitigation Plan during the final design phase in order to mitigate for construction vibrations. The plan will include the following measures where practicable:

- Use controlled blasting construction for vibration mitigation during drill and blast and utilize blast covers when applicable. Test blasting and monitoring of blasting for noise and vibrations at sensitive nearby structures will be implemented.
- Implement contractor control measures to ensure vibration from TBM is kept low enough to avoid damaging historic buildings and remains below applicable FTA impact criteria.
- Implement vibration monitoring program and pre-survey of buildings in tunneling and blasting areas.

K. Energy

1. Alternative 1: No-Build

Alternative 1 would continue operation of the B&P Tunnel at current service levels with no major changes. Therefore, energy consumption from the use of fuel and electricity by trains and/or for the operation of the B&P Tunnel would not change under this alternative. Also, no new construction would occur that would potentially consume more energy. Ongoing maintenance on the tunnel would become more intensive as the tunnel ages, potentially requiring increased energy consumption.

2. Preferred Alternative

Table VI-44 provides the estimated future daily energy consumption of Amtrak and MARC trains for the Preferred Alternative based on statistics provided by Amtrak, the US Department of Energy (DOE), and the number of daily passenger trips forecasted by the NEC FUTURE Program to 2040 (Alternatives 3A and 3C are shown for comparison). This estimate uses current Btu-per-passenger-mile data in the calculations; future gains in efficiencies would be speculative. As shown in the table, daily energy consumption by Amtrak and MARC trains in terms of Btu-per-passenger-mile would increase from existing levels due to the increased capacity the Preferred Alternative would support and the longer travel distance. The primary factor that differentiates the alternatives in this analysis is the length of travel; Alternative 3A and Alternative 3B would be roughly identical in their length of travel and are presented together in the table.

Although energy consumption would increase under the Preferred Alternative, the forecasted increase in daily passenger trips includes passengers diverted from other, less energy efficient modes of travel, such as single-occupant automobiles. However, these potential diversions from less energy efficient modes of travel are speculative.

The number of forecasted daily freight trains traveling through the new B&P Tunnel is not expected to increase under the Preferred Alternative; therefore, no change in energy consumption by freight in the Study Area would occur.

Table VI-44: Maximum Estimated 2040 Amtrak and MARC Service Energy Consumption in the Study Area

Alternative	Type of Service	Daily Passenger Trips[2]	Length of Travel (Miles)	Daily Passenger Miles	Average Btu Per Passenger-Mile[3]	Daily Estimated Energy Consumption (Btu)	Percent Difference from Existing Daily Energy Consumption
Preferred Alternative and Alternative 3A	Amtrak	55,800	3.7	206,460	2,214[4]	457,102,440	247%
	MARC	11,800	3.7	43,660	2,838[5]	123,907,080	228%
Alternative 3C	Amtrak	55,800	3.8	212,040	2,214[4]	469,456,560	256%
	MARC	11,800	3.8	44,840	2,838[5]	127,255,920	237%

Source: Baltimore Penn Station Master Plan (Amtrak, 2015)*, NEC FUTURE Program* (USDOT, Accessed September 8, 2014)*, and Transportation Energy Data Book* (USDOE, 2014).

[1]Maximum estimate is based on NEC FUTURE Program B (medium level of service) because higher service level alternatives propose a new high speed route through Baltimore, resulting in lower traffic through the B&P Tunnel

[2]NEC FUTURE Program 2040 forecast data.

[3] Average Btu per passenger-miles are the most current available data estimates, not forecasted to 2040.

[4]2014 Amtrak data.

[5]2012 commuter rail data

Construction of the Preferred Alternative would require additional energy use beyond what would be used for normal operations. This additional energy would be consumed on a short-term basis as required for construction of the new tunnel, associated trackwork, and intersecting roadways modifications. In the long-term, energy consumption to operate the new tunnel may increase as well. Overall, once the Preferred Alternative becomes operational, long-term energy savings are expected from more efficient operations.

3. Alternative 3A

The primary factor that differentiates the alternatives in this analysis is the length of travel; Alternative 3A and The Preferred Alternative would be roughly identical in their length of travel, as shown in **Table VI-44**.

4. Alternative 3C

Alternative 3C would have a slightly longer length of travel, and would therefore require additional energy for Amtrak and MARC service compared to the Preferred Alternative or Alternative 3A as shown in **Table VI-44**.

L. Construction

This section is intended as a general overview of temporary project-related construction impacts and potential mitigation measures that could be considered. Temporary impacts from the construction process to the individual resources described in this FEIS are included under each resource in **Chapter VI**.

1. Impacts

a. Alternative 1: No-Build

Alternative 1: No-Build would not implement major improvements to the existing B&P Tunnel. Construction activities associated with ongoing maintenance of the tunnel would have localized effects such as noise, dust and vibration from construction equipment and potential temporary interruptions to vehicular and pedestrian traffic. It is expected that, as the existing tunnel continues to age, maintenance activities would become more frequent and/or intensive.

b. Preferred Alternative

Construction of the main tunnel bores for the Preferred Alternative would primarily involve horizontal mining with a tunnel boring machine (TBM). The outside approaches and portal areas 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, and excavating a 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. Ancillary structures such as cross passages, egress passage, and shafts would be constructed using drill and blast excavation.

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 ventilation facilities. These ancillary structures could be mined in a combination of mechanical excavation and controlled blasting.

Construction impacts associated with construction of the Preferred Alternative 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, temporary loss of on-street parking, and major utility relocations. Demolition of buildings, clearing land, and other construction activities could displace and increase activity from urban rodents, including rats.

Tunnels are typically constructed from one portal location, known as the "mucking shaft" through to the far portal. The mucking shaft is the scene of the most visible tunnel activity, as it is the passageway through which the excavated material (muck) is removed and the tunnel lining segments and construction materials enter. The mucking shaft will require a laydown and staging area. It is not yet known how large of a staging area is required, but several acres or more could be required.

Construction staging areas for the Preferred Alternative would be located adjacent to the north portal, south portal, and ventilation facilities. Construction staging areas would include facilities such as materials storage and lay down areas, water treatment, parking, power generation, offices, and others. Construction staging for the south portal and south ventilation facility would be primarily to the east and west of the proposed trench and cut-and-cover areas, within the limits-of-disturbance and existing Amtrak right-of-way. At the Intermediate Ventilation Facility, construction staging would be confined to the site limits identified in **Chapter IV**. The north portal construction staging area would be located between the existing light rail tracks and the Jones Falls waterway, in the vicinity of the North Avenue, Howard Street, and CSX Bridges over Jones Falls. Construction staging for the north ventilation facility would occur within the I-83 loop ramp area, currently in use as a BCDOT facility.

Construction activities would result in temporary interruptions to both vehicular and pedestrian traffic patterns, including temporary closure of roads and sidewalks. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation spoils and building materials. Increased traffic, noise, and vehicular emissions along waste hauling routes would likely occur as the muck material is trucked to appropriate waste facilities (as described in **Section VI.G**). The truck haul routes for the south portal construction area would run along Monroe, Pulaski, Payson, Lanvale, and Brice streets in order to connect the south portal construction staging areas to US 40. At the north portal and north ventilation facility construction area, trucks would utilize Falls Road, North Charles Street, Maryland Avenue, and West North Avenue in order to access I-83. Truck haul routes for the Intermediate Ventilation Facility would utilize Linden Avenue and West North Avenue to access I-83. Frequency of trips or waste destinations are not yet known at this phase of the project.

c. Alternative 3A

Construction impacts from Alternative 3A would be largely similar to that of the Preferred Alternative as described above, differing primarily in the location of the south portal. Construction of the tunnel bores, portals, approach tracks, and ancillary structures would be undertaken in the same manner as the Preferred Alternative. Construction impacts associated with construction of the Alternative 3A 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, temporary loss of on-street parking, and major utility relocations. Demolition of buildings, clearing land, and other construction activities could displace and increase activity from urban rodents, including rats.

Construction activities would result in temporary interruptions to both vehicular and pedestrian traffic patterns, including temporary closure of roads and sidewalks. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation spoils and building materials. Increased traffic, noise, and vehicular emissions along waste hauling routes would likely occur as the muck material is trucked to appropriate waste facilities. Construction staging areas and truck haul routes have not been determined for Alternative 3A at this stage.

d. Alternative 3C

Construction impacts from Alternative 3C would be largely similar to that of the Preferred Alternative as described above, differing primarily in the location of the south portal. Construction of the tunnel bores, portals, approach tracks, and ancillary structures would be undertaken in the same manner as the Preferred Alternative.

Construction impacts associated with construction of the Alternative 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, temporary loss of on-street parking, and major utility relocations. Demolition of buildings, clearing land, and other construction activities could displace and increase activity from urban rodents, including rats.

Construction activities would result in temporary interruptions to both vehicular and pedestrian traffic patterns, including temporary closure of roads and sidewalks. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation spoils and building materials. Increased traffic, noise, and vehicular emissions along waste hauling routes would likely occur as the muck material is trucked to appropriate waste facilities. Construction staging areas and truck haul routes have not been fully determined for Alternative 3C at this stage.

2. Mitigation

The Project includes the following mitigation measures that correspond with construction impacts. Although the following measures correspond with the Preferred Alternative, similar measures would be appropriate to mitigate impacts of Alternative 3A and Alternative 3C. These mitigation measures would be refined and developed in further detail during the final design phase.

a. Noise

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.

To mitigate construction noise resulting from the Preferred Alternative, a Construction Noise Mitigation Plan will be developed during the final design phase. The plan will provide for the following to the extent practicable:

- Location of construction equipment and material staging areas away from sensitive receptors;
- Temporary noise barriers and advanced construction of permanent barriers to serve during construction; and
- Routing of construction traffic and haul routes along roads in non-noise sensitive areas.

b. Air Quality

The Preferred Alternative includes development and implementation of a Construction Emission Reduction Plan to include measures such as reducing equipment idling times, utilizing on-site storage to reduce truck haul trips, using low-emissions equipment, dust suppression measures, ensuring the contractor has knowledge of appropriate fugitive dust and equipment exhaust controls, and other measures.

Dust control measures will be in conformance with COMAR 26.11.06.03D pertaining to Particulate Matter from Materials Handling and Construction and may include application of water and calcium chloride to haul roads, provision of truck wheel wash stands, minimization of exposed, erosion prone areas to the greatest extent possible; stabilization of exposed earth with grass, geotextile fabric, ground cover, paving, or other finished surface as easily as possible; and covering or shielding stockpiled materials from wind.

c. Vibration

Construction activities can result in varying degrees of ground vibration that diminish in strength with distance. Construction activities that typically generate the most severe vibrations are impact pile driving and blasting. Smaller, less perceptible vibrations will also occur in tunneling. The Preferred Alternative includes development of a Construction Vibration Mitigation Plan to include the following measures:

- Use of controlled blasting construction methods for vibration mitigation during drill and blast, and use of blast covers when applicable;
- Implementation of contractor control measures to ensure vibration from TBM is kept low enough to avoid damaging historic buildings and remains below applicable FTA impact criteria; and
- Implementation of a vibration monitoring program and pre-surveying of buildings in tunneling and blasting areas.

d. Transportation

The Preferred Alternative includes development and implementation of a Maintenance of Traffic Plan which provides protection for safe pedestrian, bicycle, and vehicular movement around work sites during construction and maintains connectivity and access where possible. The plan will account for truck haul routes, construction traffic concerns, and will help to minimize transportation impacts during construction. The plan will account for community resources such as schools and parks.

e. Hazardous Materials

The Preferred Alternative includes development and implementation of a Hazardous Spill Prevention Plan to mitigate the potential for accidental release of hazardous materials during construction. The Preferred Alternative also includes development of a Hazardous Materials Remediation Plan, and a Screening and Materials Handling Plan for pumping, segregation, transportation, and disposal of groundwater. Similarly, the Preferred Alternative includes implementation of a program for the identification and segregation of impacted soils for additional testing and offsite disposal. Evaluation of any soil or groundwater screening and sampling results by an environmental professional will determine health and safety, handling, and offsite disposal requirements.

f. Natural Resources

The Preferred Alternative includes development and implementation of an E&S Control Plan for construction activities, in coordination with MDE and the City of Baltimore. The plan will be developed during the final design phase.

The Preferred Alternative includes development and implementation of a Rodent Abatement Plan to be written into contract specifications for construction. The plan will account for and mitigate potential disturbance to rodents such as rats that may cause mobilization during construction.

The Preferred Alternative includes development and implementation of a Stormwater Management Plan in accordance with MDE guidelines. The plan will focus on stormwater runoff associated with construction activities and surface impacts, both during and after construction, throughout the study area.

g. Public Notification

FRA will work with communities to minimize potential community effects during construction. Appropriate signing, the project website, and other means will be used to notify motorists of road closures and detours and pedestrians of sidewalk closures and detours. Particular attention will be given to maintaining public safety during the construction period; public access to construction areas will be limited to the greatest extent possible.

The Preferred Alternative will include utilization of public information and feedback methods such as construction-alert publications and complaint hotlines to handle complaints and keep the public informed. Notifications will include information about construction schedules, road closures, transit service impacts, blasting, and contact information.

M. Indirect and Cumulative Impacts

1. Regulatory Requirements

The CEQ regulations set forth in 40 CFR § 1500 et. Seq., require federal agencies to also consider the potential for indirect and cumulative effects (ICE) from a proposed project. The terms "effects" and "impacts" are considered synonymous, as used in the CEQ regulations. The CEQ regulations define the impacts and effects that must be addressed and considered to meet NEPA requirements, as follows:

- Direct effects are caused by the action and occur at the same time and place (40 CFR § 1508.8(a))
- Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8(b)).
- Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

2. Methodology

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. Information was obtained from the Baltimore City Planning Department and the Baltimore Development Corporation.

A combination of analysis methodologies was employed to assess indirect and cumulative effects. The analyses were based on readily available information and data including:

- Trend Analysis: historic data were collected to understand past events and patterns, as well as the rates at which effects occurred, and projected data consulted to assess anticipated development or other trends and changes that could have future effects on the resources assessed
- Transportation and Community Planning: existing planning documents of transportation agencies and communities within the analysis area were consulted to identify future planned projects, community visions for their future, and potential impacts to planned actions
- Map Overlays: mapping layers were compiled to identify a reasonable and foreseeable future land use scenario

The ICE analysis includes the identification of resources of interest and establishment of the geographic boundary and temporal boundary (time frame) for the analysis. Analysis includes determination of past, present and reasonably foreseeable future actions and analysis of indirect and cumulative effects to resources from evaluated alternatives within the defined temporal and geographic boundaries.

3. Resources to Be Evaluated

All resources included in the 1999 FRA *Procedures for Considering Environmental Impacts* have been considered as part of this ICE analysis. Those resources impacted directly by the build alternatives, as described throughout **Chapter VI**, form the basis for the analysis. Although considered, biodiversity areas, Special Protected Areas, protected species, wetlands, sole source aquifers, groundwater, wild and scenic rivers, and agriculture are not included in the analysis because these resources are not present in the analysis area and there are no direct effects to these resources.

4. Geographic Boundary

The indirect and cumulative effects analysis geographic boundary was developed using the boundaries of environmental resources and socioeconomic units that would be directly and indirectly impacted by the B&P Tunnel Project (**Figure VI-27**). The ICE analysis Study Area is identical to the Study Area used for Socio-Economic and Environmental Justice assessments, as described in **Section V.A** and **Section VI.A**, and extends from the Gwynns Falls Bridge to the west, the Barclay-Midway-Old Goucher neighborhoods to the east, Druid Lake to the north, and West Baltimore Street and US 40 to the south.

5. Temporal Boundary

The temporal boundaries for the ICE analysis generally extend from approximately 1970 to 2040. The past time frame was selected based on available census and land use data, development trends, and population trends. Population in the city historically peaked post-war in the 1950's (MDP, 2010). The city's population decreased 33 percent between 1970 and 2010, then increased approximately 4.2 percent by 2013 to 622,104. Population is projected to increase 5.0 percent from 2010 to 2040 (MDP, 2010; US Census Bureau, Accessed 2014).

The 2040 end year for the analysis is based on projections of population, households, and employment in the analysis area endorsed by the Baltimore Metropolitan Council (Cooperative Forecasting Group, 2014) and long-range transportation plans extending to 2040. This period encompasses the anticipated construction and beginning operation of the selected alternative. Actions intended for a time beyond 2040 are not considered reasonably foreseeable.

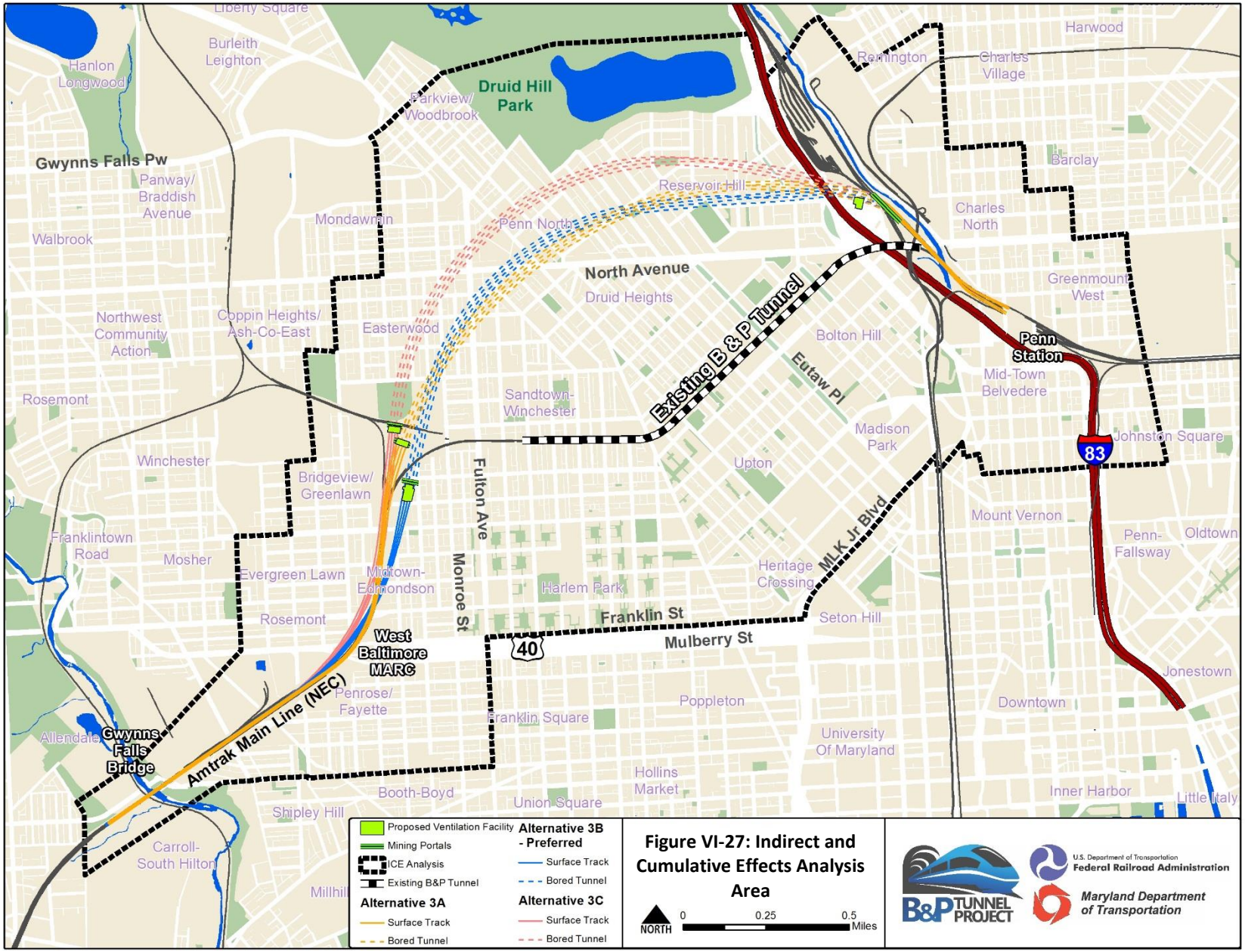
6. Land Use and Zoning

a. Existing Land Use

Existing land use in the ICE analysis area has been evaluated using aerial mapping, readily available Baltimore City land use data, and field reconnaissance. The analysis area (approximately 2,600 acres) comprises about five percent of Baltimore City. Current land uses in the ICE analysis area are primarily residential (49%), followed in area by institutional (14%), transportation-related (11%), parks/open space (10%), commercial (8%), industrial (7%) and mixed (1%).

b. Zoning

The Baltimore City zoning code was last comprehensively updated in 1971. At that time, the focus was on automobile-oriented development, separation of uses, and preserving the city's heavy manufacturing base. Baltimore City has recently initiated the first substantial zoning changes since the last effort 44 years ago. Overall goals are to promote pedestrian-oriented, mixed-use development, allow for the creative and flexible reuse of older buildings, encourage campus master planning, and to protect open space. The new code has design standards to improve the quality of Baltimore's built environment, which would restrict building materials while allowing for modern approaches to building design, and creating specific architectural guidelines to maintain the unique character of the older areas of the city. The city is currently eliciting public comment on the new draft zoning code.


Liberty Square
Burleith Leighton
Hanlon Longwood
Druid Hill Park
Parkview/ Woodbrook
Harwood
Remington
Charles Village
Gwynns Falls Pw
Panway/ Braddish Avenue
Barclay
Reservoir Hill
Mondawmin
Penn North
Charles North
Walbrook
North Avenue
Druid Heights
Greenmount West
Northwest Community Action
Coppin Heights/ Ash-Co-East
Easterwood
Existing B&P Tunnel
Bolton Hill
Penn Station
Eutaw Pl
Mid-Town Belvedere
Rosemont
Sandtown-Winchester
Madison Park
Johnston Square
83
Winchester
Bridgeview/ Greenlawn
Upton
Fulton Ave
Mount Vernon
Franklintown Road
Mosher
Penn-Fallsway
Oldtown
Evergreen Lawn
Midtown-Edmondson
Monroe St
Heritage Crossing
MLK Jr Blvd
Harlem Park
Rosemont
Franklin St
Seton Hill
West Baltimore MARC
40
Mulberry St
Jonestown
Penrose/ Fayette
Poppleton
Downtown
Amtrak Main Line (NEC)
Gwynns Falls Bridge
Allendale
Franklin Square
University Of Maryland
Hollins Market
Booth-Boyd
Union Square
Inner Harbor
Little Italy
Shipley Hill
Carroll-South Hilton
Millhill
Proposed Ventilation Facility
Mining Portals
ICE Analysis
Existing B&P Tunnel
Alternative 3A
Surface Track
Bored Tunnel
Alternative 3B - Preferred
Surface Track
Bored Tunnel
Alternative 3C
Surface Track
Bored Tunnel
Figure VI-27: Indirect and Cumulative Effects Analysis Area
NORTH
0
0.25
0.5
Miles
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Existing zoning in the analysis area is generally consistent with current land use. Analysis area zoning is comparable to citywide zoning in most categories, except proportionately more properties are zoned community businesses, central commercial, community commercial, and as office-residences (Baltimore City, 2008). Substantially less acreage is zoned industrial in the analysis area compared to citywide. Existing right-of-way for the B&P Tunnel and approach tracks are zoned as industrial or are an approved conditional use through other zones such as residential and commercial areas.

7. Planning

a. Community Planning

Completed in 2009, Baltimore City's most recent Comprehensive Master Plan emphasizes directing compatible growth to suitable areas that promote mixed uses, nodal activity centers and access to multiple modes of transit. It provides the policies and guidance to encourage development, infill and redevelopment that is transit oriented and brings vacant areas back into productive use. The principal method to implement these changes discussed by the plan is updating the city's zoning code, currently underway.

In the ICE analysis area there are seven Area Master Plans that implement the Comprehensive Plan goals tailored to their individual communities. Common to the Area Master Plans is the desire to create vibrant, mixed use communities that encourage new growth on vacant lands but is respectful of existing land uses and the historic character of neighborhoods, and reduction of industrial uses incompatible with residential areas. The seven Area Master Plans included in this analysis are:

- Operation Reach Out Southwest (2002)
- Barclay-Midway-Old Goucher (2005)
- Upton (2005)
- Penn North (2006)
- West Baltimore MARC Station (2008)
- Greater Rosemont and Mondawmin (2012)
- Mount Vernon (2013)

The NEC FUTURE Program is FRA's comprehensive planning effort to define, evaluate, and prioritize future investments in the NEC, from Washington, DC, to Boston. Through the NEC FUTURE Program, FRA will determine a long-term vision and investment program for the NEC that addresses current and future rail passenger service needs and considers the appropriate role of passenger rail within the larger transportation system of the region. Outcomes of NEC FUTURE include the release, in 2016, of a Tier 1 EIS and Service Development Plan in 2017 to support the selected vision. FRA considered the corridor-wide service requirements of NEC FUTURE alternatives related to the B&P Tunnel project. As a preferred alternative has not yet been identified for NEC FUTURE, FRA has not included it in this cumulative impact assessment for the B&P Tunnel project.

b. Transportation Planning

Several comprehensive transportation plans and supportive studies evaluating the state of current transportation infrastructure and capital needs have been completed that address needs in the ICE analysis area. **Table VI-45** summarizes the most relevant recent plans. A common theme of the plans is the challenge of initiating projects addressing longer term needs in light of current and projected budget constraints, and the major investments needed to achieve a state of good repair of existing infrastructure.

Table VI-45: Transportation Plans Encompassing the ICE Analysis Area

Plan	Agency	Description
NEC Infrastructure Master Plan 2010	Amtrak	Anticipating a 60% increase in commuter trips by 2030, the plan identifies $52 billion in investments to cover system repair, upgrades, and capacity increases.
2011 - Plan It 2035	Baltimore Regional Transportation Board	The region's long-range transportation plan for the years 2016 to 2035. Identifies $11.5 billion worth of projects to expand the region's transportation system. This includes $6.7 billion for new and improved highways, $4.3 billion for expanded transit service, and $93 million for new and improved bicycle/pedestrian facilities.
The Amtrak Vision for the Northeast Corridor 2012 Update Report	Amtrak	The plan outlines recent actions and initiatives taken by Amtrak and others since the 2010 Master Plan. It supports the FRA NEC FUTURE Passenger Rail Corridor Investment Plan EIS currently being prepared. The plan would invest $151 billion from 2012-2040 using a phased approach.
2013 Critical Infrastructure Needs of the Northeast Corridor	NEC Infrastructure Operations Advisory Commission	The report identifies priority needs along the NEC. Proposed projects in Baltimore include BWI Marshall Airport Station improvements and a 4th track, the B&P Tunnel, and improvements at Baltimore Penn Station.
MARC Growth and Investment Plan 2013	Maryland Transit Administration	This multi-phased, multi-year plan aims to triple the capacity of MARC. Goals include support of multi-modal access, improved parking along Penn Line stations, enhancing bike/pedestrian access, and a new Penn Line maintenance facility.
NEC FUTURE - A Rail Investment Plan for the NEC	Federal Railroad Administration	Initiated in 2012, its goal is to develop a comprehensive long-term vision to guide investment in the NEC. A Tier 1 Programmatic Environmental Impact Statement and Service Development Plan are underway to be completed in 2016.
2035 Maryland Transportation Plan—Moving Maryland Forward (2015)	Maryland Department of Transportation	This plan outlines the transportation strategies to achieve broad transportation improvement goals by 2035. In the analysis area the strategies identified include MARC improvements, completion of the Red Line light rail service (which has since been canceled), addressing congestion on I-83, and investing in multimodal transportation capacity to support State designated TOD areas such as State Center.
AMTRAK FY 2014 Budget and Business Plan, FY2015 Budget Request Justification, FY2014-2018 Five Year Financial Plan	Amtrak	Presents the goals and strategies to implement its program from FY 2014-2018. The five-year financial plan estimates approximately $6.2 billion in capital investments in the NEC.
Maximize 2040 (in development)	Baltimore Regional Transportation Board	Currently in development, this long range plan would address transportation goals in the Baltimore region until 2040. Preliminary goals center on improving safety, improve and maintain the existing infrastructure, improve accessibility, increase mobility, conserve and enhance the environment, improve security, and promote prosperity and economic opportunity, among others.

8. Past, Present and Reasonably Foreseeable Projects

a. Past Projects

The B&P Tunnel was opened in 1873, approximately 144 years after the founding of Baltimore. Baltimore Penn Station was constructed in Jones Falls Valley in 1911 to serve the Pennsylvania Railroad. The Jones Falls Expressway (I-83) was conceived in the 1940's, and after many iterations to reduce its impacts to industry in the Jones Falls Valley and connect to other proposed interstates in the city, was constructed through the analysis area in 1961-1962.

The project to extend I-70 into the Baltimore City, dating back to the 1960s, was completed between Pulaski Street and Martin Luther King Jr. Boulevard along the Franklin—Mulberry corridor. Located along the southern margins of the analysis area, this highway now known as US 40 still functions as a highway but was never connected as planned and did not become part of the interstate system.

By 1976 Amtrak owned most of the NEC extending between Washington, D.C. to Boston. In 1978, Amtrak began running the Chesapeake commuter train on what is the NEC alignment today, which stopped at Edmonson Avenue. MARC took over the route as far as Perryville with a stop at the West Baltimore MARC Station on Franklin Street in 1983. In 1987, the Baltimore Metro was built through Upton, Penn North, and Mondawmin in the analysis area, extending to Owings Mills northwest of the city. Light Rail from Timonium to Glen Burnie opened in 1992, extending along North Howard Street through Midtown and Bolton Hill in the analysis area. Today, Baltimore Penn Station serves Amtrak, MARC, and the light rail systems. The West Baltimore MARC Station serves MARC trains only.

The West Baltimore MARC Station Parking Expansion and Enhancements Project was completed in 2014. The project expanded parking at the West Baltimore MARC Station, reconnected Payson Street to the street grid, and improved the US 40 highway entrances and exits. The project was also designed to enable future development and community open space.

b. Present Projects

Planned improvements and developments within the ICE analysis area are used to qualitatively analyze potential for indirect and cumulative effects. Present projects are those currently underway or planned to occur in the next five years (2015-2020). Planned improvements evaluated include:

- Ongoing development of transit service
- Planned roadway improvements
- Planned bicycle and pedestrian improvements
- Planned development and municipal capital improvements
- Demolition of vacant properties

Forty development projects and 13 transportation projects were identified from available sources such as agency websites and published plans. One major project recently announced, known as Project CORE (Creating Opportunities for Renewal and Enterprise) will demolish substantial amounts of vacant, blighted housing including buildings in close proximity to the Preferred Alternative. Projects underway include the Franklin Entrepreneurial and Apprenticeship Center located at 2118 Madison Avenue, and the $51 million Remington Row Planned Unit Development (PUD) project providing new office, retail and residential space at 2700 Remington Avenue. In general, the development projects identified include retail, office, housing, institutional, and mixed-use developments. Numerous building renovation, rehabilitation, and demolition projects are also planned in the ICE analysis area. Revitalization programs such as the Baltimore Innovation Village are currently active in the ICE analysis area. Transportation projects identified generally include roadway resurfacing, sidewalk repair, storm drain improvements, and intersection improvements.

c. Future Projects

Reasonably foreseeable future projects within the ICE analysis boundary have been gathered from the long range planning document, *Plan It 2035*, adopted by the Baltimore Metropolitan Council in November 2011. *Plan It 2035* was developed with local, state, and federal transportation agencies, area business leaders, community advocates and other stakeholders. No specific projects are identified within the analysis boundaries, however; the plan generally indicates improvements to facilities throughout the MARC system and bicycle/pedestrian access to rail transit stations are priorities (including West Baltimore MARC). In addition, the Maryland Department of Transportation *2035 Moving Maryland Forward* plan prioritizes Red Line light rail service (which has since been canceled), addressing congestion on I-83, and investing in multimodal transportation capacity to support state-designated transit-oriented development, such as at State Center in the analysis area.

A federal grant was recently approved for the BaltimoreLink North Avenue Rising project which is planned under City and State initiative to include dedicated bus lanes, bike facilities, transit station enhancements, bus stops, sidewalks, streetscaping, and re-paving along North Avenue within the ICE Study Area.

Specific future development projects by private industry and Baltimore City are not reasonably foreseeable as these entities have not produced long range plans. However, the Baltimore City Comprehensive Master Plan and Area Plans, as well as the *West Baltimore MARC Transit-Centered Community Development Strategy* outline the goals of individual communities for their growth and development, and are indicators of potential future projects if supporting conditions are realized.

While no final plans are in place to establish a double-stack (Plate H) freight corridor through Baltimore City, either by CSX, NS, or others, it is reasonably foreseeable that future efforts would be made to establish one. A stated objective of *Baltimore's Railroad Network* study (FRA and MDOT, 2011) is "Provide tri-level auto carrier clearance (Plate H) routes through Baltimore for both NS and CSXT freight trains." It is considered highly desirable by freight rail carriers to connect the Port of Baltimore with inland markets via a double-stacked Baltimore freight line. Both NS and CSX have expressed interest in the B&P Tunnel Project; correspondence from both railroads is provided in **Appendix B**.

Double-stack cargo trains are trains that include flat-bed trailers on each of which are stacked two semi-trailer trucks, one on top of the other. These trains are approximately five feet taller than normal freight trains (20'-3" tall vehicles, 26'-9" including catenary clearance), and therefore require five feet more vertical clearance than normal rail equipment to the underside of bridges, overpasses, signal trusses, and other infrastructure that spans the rail right of way in order to use the tracks.

In 2016, CSX Transportation and MDOT completed a feasibility study, and announced a plan to add additional clearance to the Howard Street tunnel to allow CSX to route double-stack trains through its existing mainline through Baltimore. The feasibility study found it is possible to modify the tunnel without full replacement to achieve the required clearance. The CSX mainline is currently a separate route from the NEC through Baltimore with no direct connection. The scope of work for the project consists of two components: 1) modifications to the floor and ceiling of the Howard Street Tunnel to increase its vertical clearance, and 2) track lowering and bridge modifications at ten overhead bridges located between the Howard Street Tunnel and the Port of Baltimore's Seagirt Marine Terminal to increase the vertical clearance. CSX and MDOT are currently seeking a $155 million grant for the Howard Street Tunnel through the 2016 Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) grant program. If full funding can be secured, MDOT and CSX anticipate the project can be completed in 2023.

The NEC does not feature sufficient vertical clearance to allow double-stack operation in most places, as most of the bridges and spanning infrastructure was built before double-stack train systems were invented, and can only accommodate railroad equipment of normal height. Therefore, before double-stack trains can operate through the B&P Tunnel, many nearby bridges, tunnels, and signal trusses north and south of the tunnel – as

well as the station mezzanine and platform canopies at and the underpasses beneath the streets and Union Tunnel surrounding Baltimore Penn Station – would have to be raised at significant cost. Therefore, while the proposed B&P Tunnels themselves will be tall enough to accommodate double-stack trains, virtually none of the trackage north or south of the tunnel in the vicinity of Baltimore can accommodate the extra height, and, without additional investment in the hundreds of millions of dollars, it is unlikely that double-stack trains will operate through Baltimore on the Northeast Corridor in the near future. Any potential freight corridor improvements, if they were to move forward, would be completed wholly independently of the B&P Tunnel Project.

9. Indirect Effects

Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8).

Under Alternative 1: No-Build, no major improvements to the existing B&P Tunnel would occur and routine maintenance would continue. Indirect effects could potentially occur to the local economy and transportation system if more frequent and intensive maintenance work is required to keep the existing B&P Tunnel in service, resulting in potential delays or service interruptions along the NEC. No other known indirect effects to any of the resources evaluated would occur from Alternative 1: No-Build.

The Preferred Alternative could potentially result in indirect effects. These effects are individually discussed below by resource. Indirect effects from Alternative 3A and Alternative 3C would be largely similar in nature to those resulting from the Preferred Alternative as described in this section. Refer to the DEIS for additional information.

a. Land Use

The Preferred Alternative could indirectly result in changes in land use, population density, or growth rate in the city but any effects would likely be relatively minor. No new transit facilities would be created in an area where none currently exist; any of these alternatives would only replace a segment of the existing alignment in the general vicinity of the existing tracks. Thus, any indirect effects on land use or population would be the result of improved MARC and Amtrak passenger service to West Baltimore MARC, Baltimore Penn Station, and other passenger stops along the NEC. The Preferred Alternative would provide greater improvements in Penn Line and Amtrak passenger service, thus resulting in a greater potential for indirect land use impacts. Given the City's plans for redevelopment at West Baltimore MARC and Baltimore Penn Station, any growth-inducing effects of this improved service would be beneficial in working towards Baltimore City's goals of fostering transit-oriented development and regaining population lost in previous decades. In particular, improved speed and reliability of MARC Penn Line service could provide greater incentive for workers in D.C. to live in Baltimore City.

b. Socioeconomics and Environmental Justice

The Preferred Alternative would impact an estimated 13 businesses in the Study Area. The project alternatives could potentially result in impacts which are further removed in time or distance than direct effects, such as a lack of availability or higher cost of goods and services, and loss of employment which could degrade the community economic conditions. The Preferred Alternative would avoid direct impacts to the P. Flanigan & Sons asphalt manufacturing facility, which would have been substantially impacted under Alternatives 3A or 3C, thus avoiding potential indirect effects as there are few nearby facilities with similar capabilities.

Construction of an Intermediate Ventilation Facility at 900-940 West North Avenue could permanently preclude future redevelopment at the site within the footprint of the ventilation facility. Efforts to redevelop and enhance the West North Avenue corridor in this vicinity are reasonably foreseeable. Furthermore, direct visual impacts from the proposed Intermediate Ventilation Facility could indirectly affect future development by influencing

the general character and cohesion of the surrounding blocks along the West North Avenue corridor, Reservoir Hill, and the adjacent Bolton Hill neighborhood. The Intermediate Ventilation Facility will be designed, so far as possible, to blend in to the surrounding community and to minimize indirect impacts on potential future development projects. Mitigation measures such as building design, façade treatments, and landscaping will be included in the Intermediate Ventilation Facility in order to reduce potential direct and indirect impacts.

The Preferred Alternative could have indirect community impacts resulting from conversion of residential areas in the Midtown Edmondson and Bridgeview-Greenlawn neighborhoods to transportation use. Direct noise, vibration, and visual impacts from new infrastructure and rail traffic through this neighborhood could result in less community cohesion near the new alignment. This could further contribute to issues of vacancy and housing deterioration already prevalent in the area.

Indirect effects to minority and low-income populations were assessed in relation to environmental justice guidelines as described in **Section VI**. All of the potential indirect impacts described above would occur in low-income and/or minority population areas. There would potentially be disproportionately high and adverse effects to low-income and minority populations resulting from indirect effects, as most of the effects would be borne by these populations.

c. Cultural Resources

The Preferred Alternative would have community impacts that would potentially result in indirect impacts to historic architecture. Because the alternative would introduce major new transportation infrastructure into the residential portions of neighborhoods including Midtown-Edmondson, Rosemont, and Bridgeview-Greenlawn; impacts from the new transportation infrastructure could lead to less community cohesion in the Study Area. Such an effect could then contribute indirectly to the ongoing deterioration of the numerous historic buildings contributing to the Midtown-Edmondson, Monroe-Riggs, Edmondson Avenue, and/or Greater Rosemont historic districts.

d. Natural Resources

Due to the highly-developed, urban nature of the Study Area, no indirect effects to natural resources would be anticipated from the Preferred Alternative. The relatively minor direct impacts to floodplains, forested land and street trees, with appropriate mitigation measures, would not be expected to result in indirect impacts to natural resources. The Preferred Alternative would include implementation of stormwater management and sediment and erosion control plans during construction and operations, which would limit the potential for indirect downstream effects to water quality.

e. Air Quality, Noise and Vibration

Although no increase has been identified, if greater volumes of freight traffic are allowed through the Northeast Corridor in the Study Area in the future, increased air quality impacts from diesel freight trains would need to be assessed in accordance with Clean Air Act requirements. Any increase in future air emissions would be in compliance with applicable air quality regulations.

Similarly, greater volumes of freight traffic, while not currently predicted, could result in increased severity of noise and vibration impacts relative to those described in **Section VI.I** and **Section VI.J** due to diesel freight trains traveling through the corridor more frequently. Although not determined and not currently planned as part of the B&P Tunnel Project, increased capacity for freight traffic through the Study Area could result in additional indirect noise and vibration impacts. Any potential noise and vibration impacts would likely occur near portals and at open sections.

f. Transportation

The Preferred Alternative would result in a beneficial indirect effect to transportation. The alternative 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 travel bottleneck. Indirect effects could also include changing travel behavior from automobile, air travel and bus to passenger rail.

The Preferred Alternative could have indirect effects to transportation as a result of modifications to the roadway network in West Baltimore. This would result in changes to community access across the NEC, thereby resulting in long-term changes to travel patterns.

Impacts from any future increases in freight volume resulting solely from B&P Tunnel Project improvements are considered potential indirect impacts and are qualitatively assessed in this section. No additional improvements, beyond the Preferred Alternative, are assumed here. For discussion of the potential impact on freight traffic when considered in conjunction with other reasonably foreseeable projects, see **Section VI.M.10** below.

The Preferred Alternative could increase throughput capacity for freight traffic through the Study Area. CSX and NS both currently have trackage rights on the NEC through the existing B&P Tunnel. CSX freight lines do not currently connect with the NEC in a manner that would allow CSX trains to travel through the proposed tunnels, or the existing B&P Tunnel, without construction of additional connections as part of a separate project from the B&P Tunnel Project. At present, there are no indications from the freight railroads that existing freight levels through the B&P Tunnel are to change in the near future. It is up to the freight railroads to determine if using the B&P Tunnel is reasonable within the context of their overall operating strategy and rail network, and then whether Amtrak can accommodate the movement in a timeframe that meets the freight railroad needs.

While no specific increases in freight traffic are planned or proposed with the B&P Tunnel Project, increased throughput capacity and operational flexibility on the NEC could allow an option for Amtrak to route more freight trains through the Study Area without impeding their passenger operations. The demand for, and feasibility of, freight traffic along Amtrak's NEC through the Study Area will ultimately be determined by several relatively unpredictable variables such as market conditions and national government policy. Any increases would also need to be determined via agreement with Amtrak. The new tunnels will feature relatively steep grades that may not be desirable for freight carriers. Furthermore, CSX and NS would not be able to route double-stack freight through the proposed tunnels without constructing substantial additional improvements and connections elsewhere along the NEC, and the Preferred Alternative would be no more attractive for handling regular dimension loads as the existing B&P Tunnel.

g. Other

There would be no indirect effects to utilities, visual quality, hazardous materials, or safety and security from the Preferred Alternative.

10. Cumulative Impacts

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

Under Alternative 1: No-Build, no major improvements to the existing B&P Tunnel would occur and routine maintenance would continue. No cumulative impacts to the resources included in this analysis would therefore occur.

The resources evaluated for cumulative effects include those socioeconomic, cultural, and natural resources potentially affected, either directly or indirectly, by the project. Cumulative impacts from Alternative 3A and Alternative 3C would be largely similar in nature to those resulting from the Preferred Alternative as described in this section. Refer to the DEIS for additional information.

a. Land Use

The recently announced Project CORE initiative would involve demolition of vacant, blighted houses in various locations throughout Baltimore City including many in close proximity to the Preferred Alternative. The Preferred Alternative would require demolition of 22 residential structures, resulting in a cumulative impact when added to the demolitions occurring under Project CORE. A review of master plans and planned development projects in the area does not indicate any other projects or plans that would result in impacts or land use changes similar in nature to those resulting from the build alternatives such as residential displacements, community facility and business displacements, historic building impacts, or conversion of land to transportation use.

b. Socioeconomics and Environmental Justice

The Preferred Alternative would have community impacts similar in nature to the US 40 highway project (formerly I-70) along the Franklin – Mulberry corridor. Community impacts such as displacements, noise, and visual impacts resulting from the Preferred Alternative would be similar in nature to those resulting from construction and operation of the US 40 highway. Creating a new trenched transportation corridor in close proximity to affected portions of the Midtown-Edmondson neighborhood would cumulatively add to the past, present, and future impacts occurring as a result of the highway project. These cumulative impacts would occur in areas identified as low-income and/or minority population areas.

c. Cultural Resources

Project CORE would involve demolition of historic rowhomes in close proximity to those which would be demolished under the Preferred Alternative, including homes which are likely contributing to the Midtown Edmonson Historic District. Thus a potential cumulative impact to the Midtown Edmonson Historic District would result. Project CORE, like the B&P Tunnel Project, is being undertaken in consultation with the Maryland Historical Trust. A review of master plans and planned development projects in the area does not indicate any other reasonably foreseeable projects or plans that would result in demolition of historic architecture near the Preferred Alternative impacts.

d. Natural Resources

The only natural resource impacts identified for the Preferred Alternative are to floodplains, street trees and forested areas. A review of master plans, transportation plans, and planned development projects in the area does not indicate any reasonably foreseeable projects or plans that would require loss of street trees or forested areas near the build alternative impacts. Therefore, no cumulative impacts to natural resources are expected under the Preferred Alternative. Potential water quality impacts would be mitigated with the use of stormwater management and erosion and sediment control plans in accordance with applicable regulations to avoid direct or cumulative impacts.

e. Air Quality, Noise and Vibration

No impacts to air quality, in exceedance of the NAAQS, are anticipated under the Preferred Alternative. However, increased air quality impacts could result if additional rail projects, none of which are currently planned or are part of the B&P Tunnel Project, establish additional freight connections to allow CSX to route double-stack freight trains through the proposed tunnels. Any additional air quality impacts would still be subject to NAAQS air quality regulations.

A review of master plans, transportation plans, and planned development projects in the analysis area does not indicate any reasonably foreseeable projects or plans that would result in increased noise or vibration near the Preferred Alternative impacts. Therefore, no cumulative noise and vibration impacts are currently anticipated. However, increased noise and vibration impacts could potentially occur if additional projects, none of which are currently planned, establish additional freight rail connections to allow additional freight trains to route double-stack trains through the proposed tunnels or a repurposed B&P Tunnel. Any noise impacts from other projects would be subject to local noise regulations, as well as federal noise requirements if completed as part of a USDOT action.

f. Transportation

Any reasonably foreseeable cumulative effects of the Preferred Alternative along with planned projects along Amtrak's NEC would be beneficial improvements to regional and high-speed rail service. The Preferred Alternative would improve travel times, improve reliability and safety, increase capacity, and allow for more high-speed travel.

The Preferred Alternative, along with the reasonably foreseeable past, present, and future actions along the MARC Penn Line, would likely result in beneficial cumulative effects. Support of increased ridership, improved operational flexibility and reliability, and support of Amtrak's high-speed rail expansion are among the reasonably foreseeable cumulative impacts. The Preferred Alternative would contribute to this cumulative improvement of the MARC Penn Line.

Potential increases in freight traffic occurring as a result of other, independent projects not directly associated with the B&P Tunnel project are recognized as reasonably foreseeable. It is reasonably foreseeable that CSX would modify the Howard Street Tunnel to double-stack clearance in the near future. Should this happen, CSX will have its own double-stack route serving the Seagirt and Dundalk terminals of the Port of Baltimore through a north-south double-stack route. A double-stack Howard Street tunnel would significantly reduce the potential for use of the Preferred Alternative tunnels for Plate H freight service by CSX.

Although no such projects are currently planned, efforts to establish a double-stack freight corridor along the NEC through Baltimore City could potentially result in greater volumes of freight traffic through the Study Area. Substantial improvements would be necessary in order to establish a Plate H (double-stack) freight corridor along the NEC through Baltimore.

The Preferred Alternative would accommodate double-stack freight clearance in the new proposed tunnels, but restrictions would still exist to the north and south along the NEC. While no projects are currently planned or underway that would allow freight carriers such as CSX and NS to establish double-stack corridors through Baltimore, it is reasonably foreseeable that future efforts, independent of the B&P Tunnel Project, could lead to a double-stack corridor. The additional capacity and clearance would potentially make the proposed corridor a desirable route for freight operators, allowing a double-stack connection between the port of Baltimore and inland markets. Other projects would require evaluation through separate environmental analyses. The potential provision of Plate H on the NEC through Baltimore and to the north would require consideration of the following factors:

- Increasing the bridge and catenary clearance on the NEC where Plate H trains are to travel
- Construction of a new or modified Union Tunnel to Plate H/K clearances
- NS currently favors the Harrisburg-Perryville route for intermodal service
- Freight schedules limited to off peak/night time periods which affects the scheduling flexibility and transit time for high priority (intermodal) shipments for which time is absolutely critical.
- Uncertainty of the impacts of future government regulation
- Construction of track connection/s between the CSX and the NEC (if CSX chooses to use the NEC)

The Preferred Alternative would also include reserving the existing B&P Tunnel for potential future transportation use. The reservation of the existing B&P Tunnel would allow for potential re-use of the tunnel as a freight and/or passenger rail tunnel, possibly resulting in additional cumulative effects. No such re-use is currently planned or forecasted for the foreseeable future, but would not be precluded by the Preferred Alternative.

g. Other

There would be no cumulative effects to energy, water quality, utilities, visual quality, hazardous materials, or safety and security from the Preferred Alternative.

N. Irreversible or Irretrievable Commitments of Resources

The National Environmental Policy Act (NEPA) requires that environmental analyses include identification of "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible or irretrievable commitment of resources results in the permanent loss of a resource for future uses (or alternative purposes) as they cannot be replaced or recovered. Irreversible commitments involve the use or destruction of a specific resource (for example, natural resources such as water, minerals, or timber) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (for example, extinction of a threatened or endangered species or disturbance of a cultural site). Irreversible and irretrievable impacts were reviewed in accordance with NEPA (42 USC 4332(C)(v)); guidelines published by CEQ on implementing NEPA (40 CFR 1502.16); and FRA's Environmental Procedures Section 14(n)(10), (11) and (22).

Alternative 1: No-Build would not require an increase in irreversible and irretrievable commitment of resources above the current conditions and continued maintenance of the tunnel. Under the No Build, new commitments of resources would not occur beyond those that could occur related to other projects in the region.

The construction of the Preferred Alternative, or Alternative 3A or 3C would require the commitment of natural, human, and monetary resources. Generally, these resources would be committed irreversibly and irretrievably.

Construction materials such as wood, steel, fossil fuels, cement, aggregate, and bituminous material would be irretrievably expended during grading, tunneling, and track construction. Whereas these materials would be largely irretrievable when used, these resources are not in short supply and many of the materials could be recycled for other projects when they no longer meet the design needs for passenger rail service.

Construction of the Preferred Alternative, Alternative 3A, or Alternative 3C would require a one-time investment of federal funds, and potentially state and local funds, which are irretrievable because these funds would not be available for other projects.

The commitment of these resources is based on the recognition that residents in the area, state and region would benefit from the improved quality of the transportation system. These benefits would consist of improved accessibility and mobility, savings in time and greater availability of quality services that are anticipated to outweigh the commitment of these resources.

O. The Relationship between Local Short-Term Uses and the Maintenance and Enhancement of Long-Term Productivity

Short-term impacts to and use of resources in relation to long-term productivity were evaluated in accordance with NEPA (42 USC 4332(C)(iv)); guidelines published by CEQ on implementing NEPA (40 CFR 1502.16); and FRA's Environmental Procedures Section (14)(n)(22). This analysis qualitatively discusses the relationship between short-term impacts to and use of resources, and the long-term benefits and productivity of the environment. For this document, short-term refers to the estimated five to seven-year period of construction—the time when

the largest number of temporary environmental effects is most likely to occur. Long-term refers to the more than 100-year life span estimated for the proposed tunnel following the completion of construction activities.

Alternative 1: No-Build would not involve any project-related construction; therefore, short- and long-term project-related effects from Alternative 1: No-Build are not anticipated.

Construction activities associated with the Preferred Alternative, Alternative 3A, or Alternative 3C could have short-term and construction effects related to the following items, which are also described in **Section VI.L**:

- Hazardous materials and waste disposal
- Water quality (erosion and sedimentation, and/or potential fuel and lubricant spills)
- Air quality (equipment emissions and fugitive dust)
- Noise and vibration (construction equipment)
- Property acquisition
- Traffic and pedestrian delays and detours

In addition, short-term employment, use of materials to construct the project, and purchases of goods and services generated by construction could create a short-term improvement in the local economy that would diminish once the construction is completed. For more information on potential economic effects, see **Section VI.A**.

Any inconveniences to residents, motorists, and rail patrons would be offset by the improved rail network once construction is completed. Any short-term uses of human, physical, socioeconomic, cultural, and natural resources would contribute to the long-term benefits of improved travel times, operations and reliability along the NEC corridor. Since the Northeast Corridor Improvement Program (NECIP) era 1976 – 1980, Amtrak has been making incremental improvements to increase speed and reduce travel time for train passengers for nearly 40 years. They have cumulatively delivered significant changes in the inter-city rail experience, amounting since 1980 to between a one-hour and a one-and-one-half hour reduction (Regional vs. Acela) of the travel time between NYC and Washington, D.C.

A rail program of continuous, small improvements can cumulatively produce a significant transformation in the quality of inter-city rail services. Individual investments to straighten curves and eliminate other impediments to high-speed travel are – over time – producing a steady migration of travelers from air and automobiles to trains, conserving energy, land, and air quality.

P. Comparison of Intermediate Ventilation Facility Sites

As described in **Chapter III**, FRA has identified the site at 900-940 West North Avenue as the preferred Intermediate Ventilation Facility site. The resulting environmental impacts of this preferred site are included in the build alternatives analysis throughout the discussion of environmental impacts presented in **Chapter VI**. This section includes a comparison of the environmental impacts resulting from three site options that were evaluated in detail for this FEIS: 900-940 West North Avenue, 850 West North Avenue, and Whitelock Street at Brookfield Avenue. All three of the sites are located in the Reservoir Hill neighborhood. **Figure VI-28** shows the three site options. **Table VI-46** provides a summary comparison between the Intermediate Ventilation Facility site options.


Whitelock St at Brookfield Ave
Eutaw Pl
Linden Ave
Whitelock St
Morris St
Madison Ave
Whitelock St
Newington Ave
Brookfield Ave
Reservoir St
Ducatel St
Morris St
Clendenin St
850 W North Ave
W North Ave
900-940 W North Ave
Alternative 3B - Preferred Track Centerlines
Intermediate Ventilation Facility Sites
850 W North
900-940 W North
Whitelock St at Brookfield
0 100 200 400 Feet
NORTH
Figure VI-28: Intermediate Ventilation Facility Site Options
B&P TUNNEL PROJECT
U.S. Department of Transportation
Federal Railroad Administration
Maryland Department of Transportation

Table VI-46: Intermediate Ventilation Facility Site Options Comparison

Site	900-940 West North Avenue	850 West North Avenue	Whitelock Street at Brookfield Avenue
Cost	$590 Million	$820 Million	$325 Million
Land Use and Neighborhoods	• 7 Business Displacements • Commercial/residential uses nearby • Adjacent to Elementary School	• Vacant housing complex • Commercial/residential uses nearby • Adjacent to Elementary School	• Whitelock Community Farm • Residential uses nearby • 3 blocks away from Elementary School
Cultural Resources	• 1 historic building demolition • Periphery of Reservoir Hill Historic District	• No historic building demolitions • Periphery of Reservoir Hill Historic District	• No historic building demolitions • Interior of Reservoir Hill Historic District
Natural Resources	17 street trees and 10 landscaped trees	4 street trees and 20 landscaped trees	13 street trees and 22 landscaped trees
Hazardous Materials	8 sites in vicinity	8 sites in vicinity	10 sites in vicinity
Air Quality	2.9 ppb NO_2 – No Impact above NAAQS	2.9 ppb NO_2 – No Impact above NAAQS	2.9 ppb NO_2 – No Impact above NAAQS
Operational Noise	45 dBA	45 dBA	45 dBA
Construction Vibration	0.07 to 0.4 inches per second – No damage to old residential buildings in poor condition	0.07 to 0.4 inches per second – No damage to old residential buildings in poor condition	0.07 to 0.4 inches per second – No damage to old residential buildings in poor condition
Construction	Drill and blast – approximately 650-foot plenum length	Drill and blast – approximately 1,115-foot plenum length	Drill and blast – approximately 380-foot plenum length

1. Socioeconomic

This section discusses potential socioeconomic impacts resulting from each of the three Intermediate Ventilation Facility sites considered. There would be no difference in impacts among the site options for population, housing, environmental justice, or transportation.

a. 900-940 West North Avenue

No residences or community facilities would be impacted by the 900-940 West North Avenue site. The site is located along the commercial North Avenue corridor in Reservoir Hill. This location on the periphery of the residential neighborhood is more compatible with current surrounding land uses compared to the interior residential area of Reservoir Hill. However, the site is directly adjacent to residences.

The site at 900-940 West North Avenue would displace an estimated seven businesses currently located at the site. Replacing these businesses with a ventilation facility could lead to less community cohesion within the Study Area. These services would no longer be proximal to each other and community ties could potentially be affected or lost. The businesses could potentially be relocated near their existing location, which would reduce potential impacts to community cohesion. The impacted businesses include:

- Total Health Care Mt. Royal Health Center (922 West North Avenue)
- Sudsville Laundry (2000 Linden Avenue);
- Linden Bar & Liquor (904 West North Avenue);
- Always Learning Daycare Center (936 West North Avenue);
- Metropolitan Ob Gyn Associates (934 West North Avenue);
- Icetech Inc. (940 West North Avenue); and
- LinkIT, LLC (940 West North Avenue).

The 900-940 West North Avenue site would result in visual impact to the viewshed and community character in Reservoir Hill. Compared to the site on Whitelock Street, the site would be more visually compatible with the existing commercial corridor. The Intermediate Ventilation Facility would have high general visual sensitivity, as the primary viewer groups at this location are permanent residents as well as transitory viewer groups.

b. 850 West North Avenue

No residences, community facilities, or businesses would be directly impacted by an Intermediate Ventilation Facility at 850 West North Avenue. A portion of a vacant housing complex is currently located at the site. As with the 900-940 West North Avenue site, the 850 West North Avenue site is located along the commercial North Avenue corridor. This location on the periphery of the neighborhood is more compatible with current surrounding land uses compared to the interior residential area of Reservoir Hill. The site would be in close proximity to residential land uses, though it would be separated by roadways from nearby residences.

The site would result in visual impact to the viewshed and community character in Reservoir Hill. The Intermediate Ventilation Facility would be visually compatible with the existing commercial corridor compared to the Whitelock Street site. The Intermediate Ventilation Facility would have high general visual sensitivity, as the primary viewer groups at this location are permanent residents as well as transitory viewer groups.

c. Whitelock Street at Brookfield Avenue

No residences or businesses would be directly impacted by an Intermediate Ventilation Facility at the Whitelock Street at Brookfield Avenue site. The site's current use as a portion of the Whitelock Community Farm would be displaced. Public consultation has indicated that the community farm use is considered an important community asset by residents, and replacing the community farm with an Intermediate Ventilation Facility could lead to less community cohesion in Reservoir Hill. The site is located in the interior of the residential portion of Reservoir Hill, and would not be compatible with surrounding residential land uses. The facility would also be directly adjacent to residences.

The site would result in high visual impact to the viewshed and community character in Reservoir Hill. The Intermediate Ventilation Facility would not be visually compatible with the existing community garden context, and would be surrounded by primarily residential properties. The Intermediate Ventilation Facility would have high general visual sensitivity, as the primary viewer groups at this location are permanent residents.

2. Cultural Resources

a. 900-940 West North Avenue

The 900-940 West North Avenue site would require demolition of one historic building, located at 900-908 West North Avenue. The building is a contributing element to the Reservoir Hill Historic District. Project consulting parties have indicated, through the Section 106 process, that the historic building at 904 West North Avenue is a relatively low preservation priority, and the site is preferable to one in the interior of the historic district despite the direct effect on a historic building. The site would result in an adverse effect on the Reservoir Hill Historic District, per Section 106, due to the building demolition, and visual and atmospheric effect on the historic district. More information on the Section 106 process is available in **Section VI.C**.

Demolition and permanent incorporation of the historic building at 900-908 West North Avenue would result in a Section 4(f) Use of the Reservoir Hill Historic District. Refer to the Final Section 4(f) Evaluation (**Section VI.D**) for more information.

b. 850 West North Avenue

The 850 West North Avenue site would have no direct effect on historic buildings. However, it would be located within the Reservoir Hill Historic District, and would have a visual and atmospheric effect on the historic district. Project consulting parties indicated that the site's location on the periphery of the Reservoir Hill Historic District is preferable to a location in the district's interior. However, the site would still result in an adverse effect on the Reservoir Hill Historic District due to the visual and atmospheric effect on the historic district.

No Section 4(f) use would result from the 850 West North Avenue site. The site is located in the Reservoir Hill Historic District but would not permanently incorporate any historic elements contributing to the district.

c. Whitelock Street at Brookfield Avenue

The Whitelock Street at Brookfield Avenue site would have no direct effect on historic buildings. However, it would be located within the Reservoir Hill Historic District, and would have a visual and atmospheric adverse effect on the historic district. Project consulting parties indicated that this site's location in the interior of the Reservoir Hill Historic District would have a more substantial visual and atmospheric effect compared to a site on the periphery of the district along West North Avenue, and that a site along West North Avenue would be preferable overall.

No Section 4(f) use would result from the Whitelock Street at Brookfield Avenue site. The site is located in the Reservoir Hill Historic District but would not permanently incorporate any historic elements contributing to the district.

3. Natural Resources

This section discusses potential natural resource impacts resulting from each of the three Intermediate Ventilation Facility site options considered. There would be no substantial impacts from the site on soils, topography, geology, aquifers and groundwater, water resources, coastal zone, or rare, threatened, and endangered species.

a. 900-940 West North Avenue

The 900-940 West North Avenue site would require impact to approximately 17 street trees and 10 landscaped trees within the site. No additional wildlife and habitat impacts would occur at the site.

b. 850 West North Avenue

The 850 West North Avenue site would require impact to approximately four street trees and 20 landscaped trees within the site. No additional wildlife and habitat impacts would occur at the site.

c. Whitelock Street at Brookfield Avenue

The Whitelock Street at Brookfield Avenue site would require impact to approximately 13 street trees and 22 landscaped trees. No additional wildlife and habitat impacts would occur at the site.

4. Hazardous Materials

Potential hazardous materials impacts would be similar for the three Intermediate Ventilation Facility sites considered. Eight low-priority sites of concern were identified within 500 feet of the 900-940 West North Avenue and 850 West North Avenue sites. Ten low-priority sites of concern were identified within 500 feet of the Whitelock Street at Brookfield Avenue site.

5. Air Quality

The results of the ventilation facility and portal dispersion modeling are presented in **Section VI.H.** The maximum predicted 1-hour NO_2 concentration for any of the Intermediate Ventilation Facility site options is 2.9 ppb. When added to the NO_2 background concentration of 51 ppb, the total predicted 1-hour concentration amounted to 53.9 ppb, which is below the NAAQS of 100 ppb. Because the concentrations of NO_2 were within acceptable levels, all other criteria pollutant concentrations would be within acceptable levels of the NAAQS. None of the three Intermediate Ventilation Facility site options considered would result in an exceedance of applicable NAAQS thresholds.

6. Noise

Noise levels in the immediate vicinity of the ventilation facilities would be caused by the operation of the ventilation fans within each facility. The horizontal fans would operate periodically and would generate sound that would propagate through the louvers on the top of the ventilation facilities. For noise generated within residential zones, there is a limit of 55 dBA at any point on the property line of the use. 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 project it is assumed that the noise limit for the ventilation facilities is L_{max} 50 dBA at the property boundary of each ventilation facility. Each of the three Intermediate Ventilation Facility site options would be designed to be below the L_{max} 50 dBA noise limit. A noise level of 50 dBA is roughly between that of a refrigerator and an air conditioner at a distance of three feet.

7. Vibration

Drill and blast tunnel excavation would be used to construct the intermediate ventilation cavern, plenum, tunnel, and shaft. Vibration resulting from drill and blast construction would range from approximately 0.07 to 0.4 inches per second for any of the three Intermediate Ventilation Facility site options considered. No vibration levels would exceed 0.5 inches per second, the level at which damage is likely to occur to old residential buildings in poor condition.

8. Construction

Each Intermediate Ventilation Facility site option would be connected to the underground railroad tunnels by a vent plenum constructed by drill and blast excavation. Vibration, noise, dust, and other effects from this underground blasting during construction would occur as described in **Section VI.I**, **VI.J**, and **VI.L.** The three ventilation facility sites would each require a different ventilation plenum route constructed underneath the Reservoir Hill neighborhood. The total length of the plenum would vary depending on the site chosen. The Whitelock Street at Brookfield Avenue site would have the shortest plenum route, approximately 380 feet long, resulting in less disruption during construction. The 900-940 West North Avenue site would require a plenum approximately 650 feet in length; and the 850 West North Avenue site would require a plenum approximately 1,115 feet long.

9. Indirect and Cumulative Effects

This section presents a comparison of potential indirect effects resulting from the three Intermediate Ventilation Facility sites considered. The sites would be roughly similar in their potential for indirect land use effects, as discussed below. See **Section VI.M** for more discussion of potential indirect and cumulative effects.

Construction of an Intermediate Ventilation Facility could permanently preclude future redevelopment at the site within the footprint of the ventilation facility. Efforts to redevelop and enhance the West North Avenue corridor and Reservoir Hill neighborhood in the vicinity of all three sites are reasonably foreseeable, though no specific plans are in place for development of the sites. Furthermore, direct visual impacts from the proposed Intermediate Ventilation Facility could indirectly affect future development by influencing the general character and cohesion of the surrounding blocks along the West North Avenue corridor, Reservoir Hill, and the adjacent Bolton Hill neighborhood. The Intermediate Ventilation Facility will be designed, so far as possible, to blend in to the surrounding community and to minimize indirect impacts on potential future development projects. The three sites would be largely the same in regard to this potential indirect impact; however, the Whitelock Street at Brookfield Avenue site would be less compatible with existing land uses and would therefore have a greater impact on the character and cohesion of Reservoir Hill. Mitigation measures such as building design, façade treatments, and landscaping will be included in the Intermediate Ventilation Facility in order to reduce potential direct and indirect impacts. Furthermore, cumulative impacts could result from other developments occurring in this vicinity with impacts to the visual character and cohesion of the community.