Chapter IV

B&P TUNNEL PROJECT

Preferred Alternative

U.S. Department of Transportation
Federal Railroad Administration

Maryland Department of Transportation

IV. PREFERRED ALTERNATIVE

A. Introduction

Chapter III of this FEIS describes the evaluation of the four alternatives that were included in the B&P Tunnel DEIS: Alternative 1: No-Build, and three build alternatives – 3A, 3B, and 3C. As described in **Chapter III**, the three build alternatives were further refined after the DEIS. These refinements were based upon public comments and input; a desire to reduce, minimize, or eliminate impacts; and more detailed engineering analysis. FRA compared these refined build alternatives (along with Alternative 1: No-Build), and identified Alternative 3B as the Preferred Alternative. For a comparison of alternatives, please refer to FEIS **Chapter III, Section G**, Evaluation and Identification of Preferred Alternative. **Chapter VI** of this FEIS includes information on the impacts to the existing environment of the alternatives.

In summary, Alternative 3B best meets the Project's Purpose and Need while minimizing overall environmental impacts to the extent possible. Specifically, Alternative 3B replaces the aging infrastructure of the existing B&P Tunnel, which is nearing the end of its useful life; most improves travel time and reliability in the portion of the NEC between Penn Station, Baltimore, and the Gwynns Falls Bridge; and provides for an improved West Baltimore MARC Station that will be ADA compliant, all at a lower cost than the next ranked Alternative 3C.

The purpose of **Chapter IV** is to provide a detailed description of the Preferred Alternative. **Section B** of this chapter provides an overview of the Preferred Alternative. Subsequent sections of this chapter provide greater detail on the alignment, ventilation facilities, emergency egress, West Baltimore MARC Station, associated roadway and bridge improvements, major utilities to be reconstructed, construction methods to be employed, and a capital cost estimate.

B. Overview

The Preferred Alternative is 3.67 miles in length from the Amtrak Gwynns Falls Bridge to Baltimore Penn Station. From the south, the Preferred Alternative begins along the same horizontal and vertical alignment as the existing Amtrak tracks on the Gwynns Falls Bridge, traverses the same alignment as the existing Amtrak tracks, crosses over Franklintown Road and Warwick Avenue on reconstructed bridges, extends across Mulberry and Franklin Streets on a new railroad bridge, and then begins to descend into an open cut section. The open cut section then transitions into the south tunnel portal west of Payson Street between Riggs Avenue and Mosher Street. The Preferred Alternative then proceeds for 2.00 miles in tunnel bores following a generally semi-circular alignment to the north tunnel portal, located east of I-83 (Jones Falls Expressway) and immediately east of the Baltimore Central Light Rail alignment. The Preferred Alternative then proceeds into the Baltimore Penn Station area at the same elevation as the existing tracks on the north side of Penn Station. A more detailed description of the alignment of the Preferred Alternative follows in **Section C**. The Preferred Alternative will also include a newly constructed West Baltimore MARC Station, described in further detail in **Section F**.

A graphic depiction of the overall horizontal alignment of the Preferred Alternative, as well as a profile showing the vertical alignment of the Preferred Alternative, is provided on **Figure IV-1**.

The Preferred Alternative includes three ventilation facilities required to meet current industry safety standards. Ventilation facilities would be located at the south tunnel portal, near the north tunnel portal, and at an intermediate location in the vicinity of West North Avenue and Linden Avenue. For a more detailed description of the need for the ventilation facilities, please refer to **Chapter III, Section A** of the FEIS. A more detailed description of the ventilation facilities follows in **Section D** of this chapter.

Figures IV-2 through **IV-8** depict the Preferred Alternative.

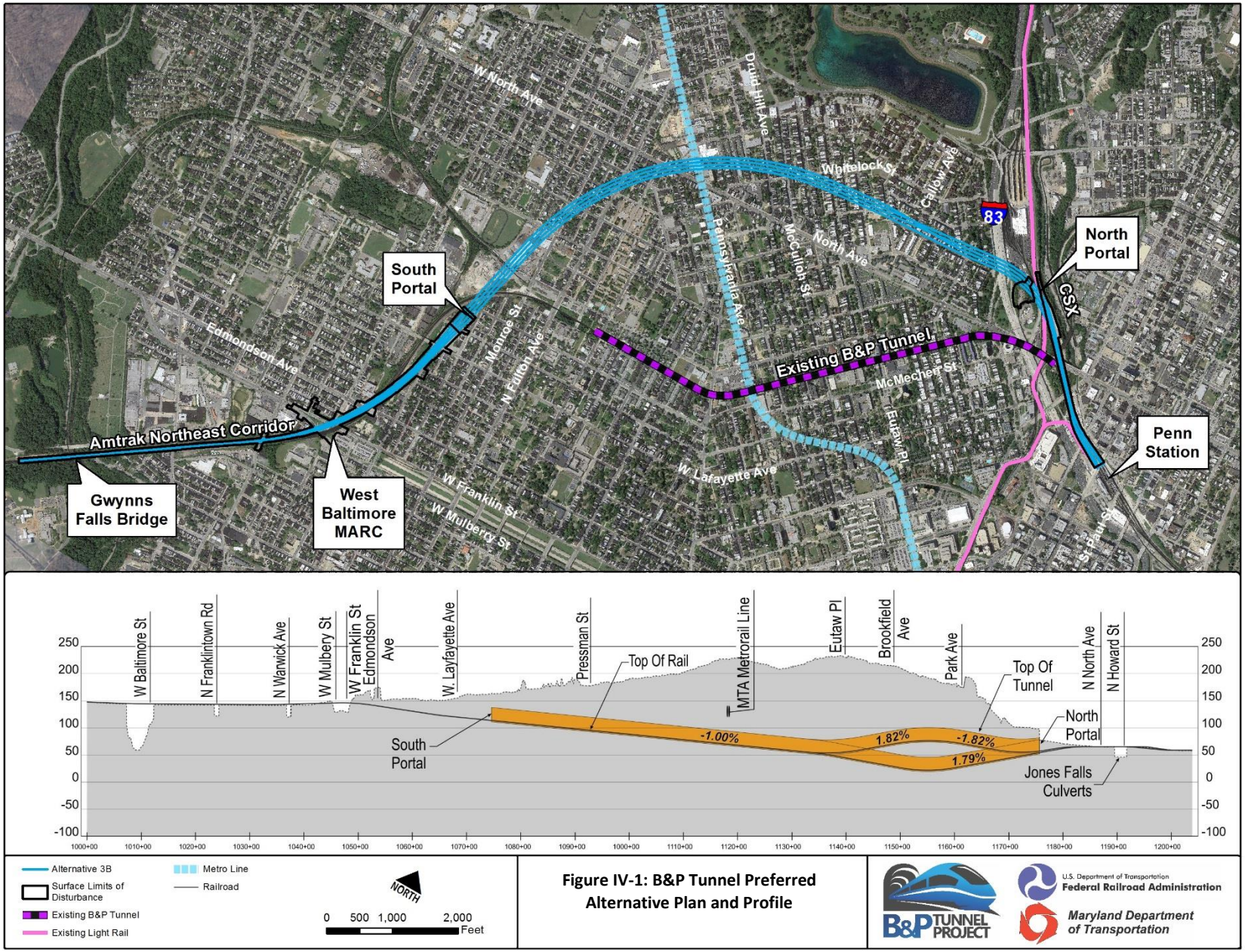
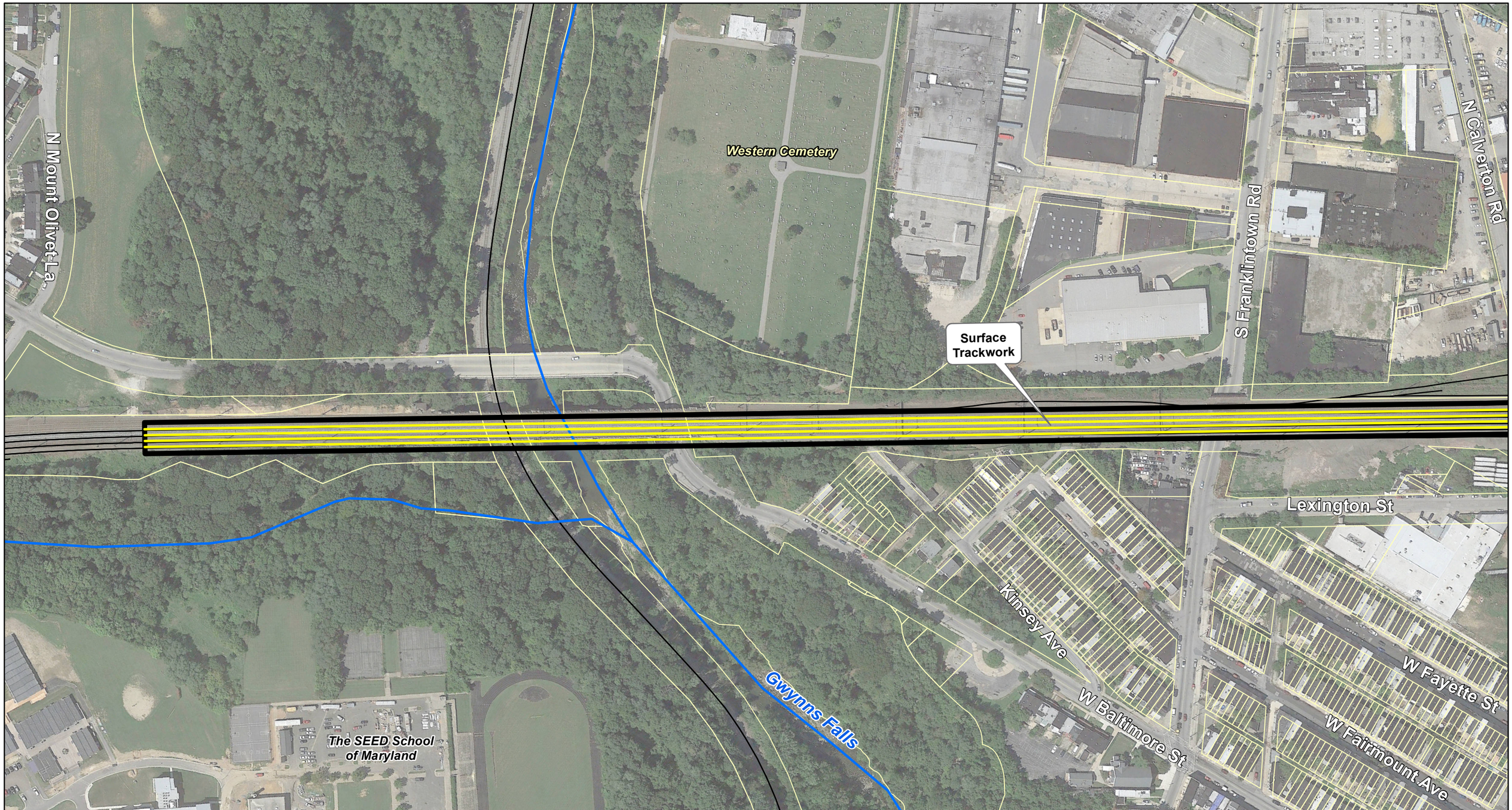


Figure IV-1: B&P Tunnel Preferred Alternative Plan and Profile



Alternative 3B - Preferred
Limits of Surface Disturbance
Bored Tunnel
Proposed Ventilation Facilities
Proposed Noise Barriers
Existing Rail
Existing Light Rail
Existing Metro Subway
Existing Rail
Streams

B&P Tunnel Project
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FEIS Preferred Alternative
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NORTH

1 inch = 200 feet

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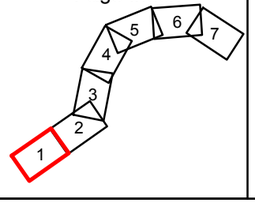

B&P TUNNEL PROJECT

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Roadway Modification

Surface Trackwork

N Calverton Rd

W Franklin St

Lauretta Ave

Wheeler Ave

Edmondson Ave

Arunah Ave

N Bentalou

Winterling Elementary School

West Baltimore MARC Station

W Mulberry St

N Brice St

N Pulaski St

Lexington St

Warwick Ave

Wheeler Ave

N Bentalou St

Penrose Ave

W Saratoga St

N Smallwood St

Pulaski St

Lauretta

Alternative 3B - Preferred

Limits of Surface Disturbance

Bored Tunnel

Proposed Ventilation Facilities

Proposed Noise Barriers

Existing Rail

Existing Light Rail

Existing Metro Subway

Existing Rail

Streams

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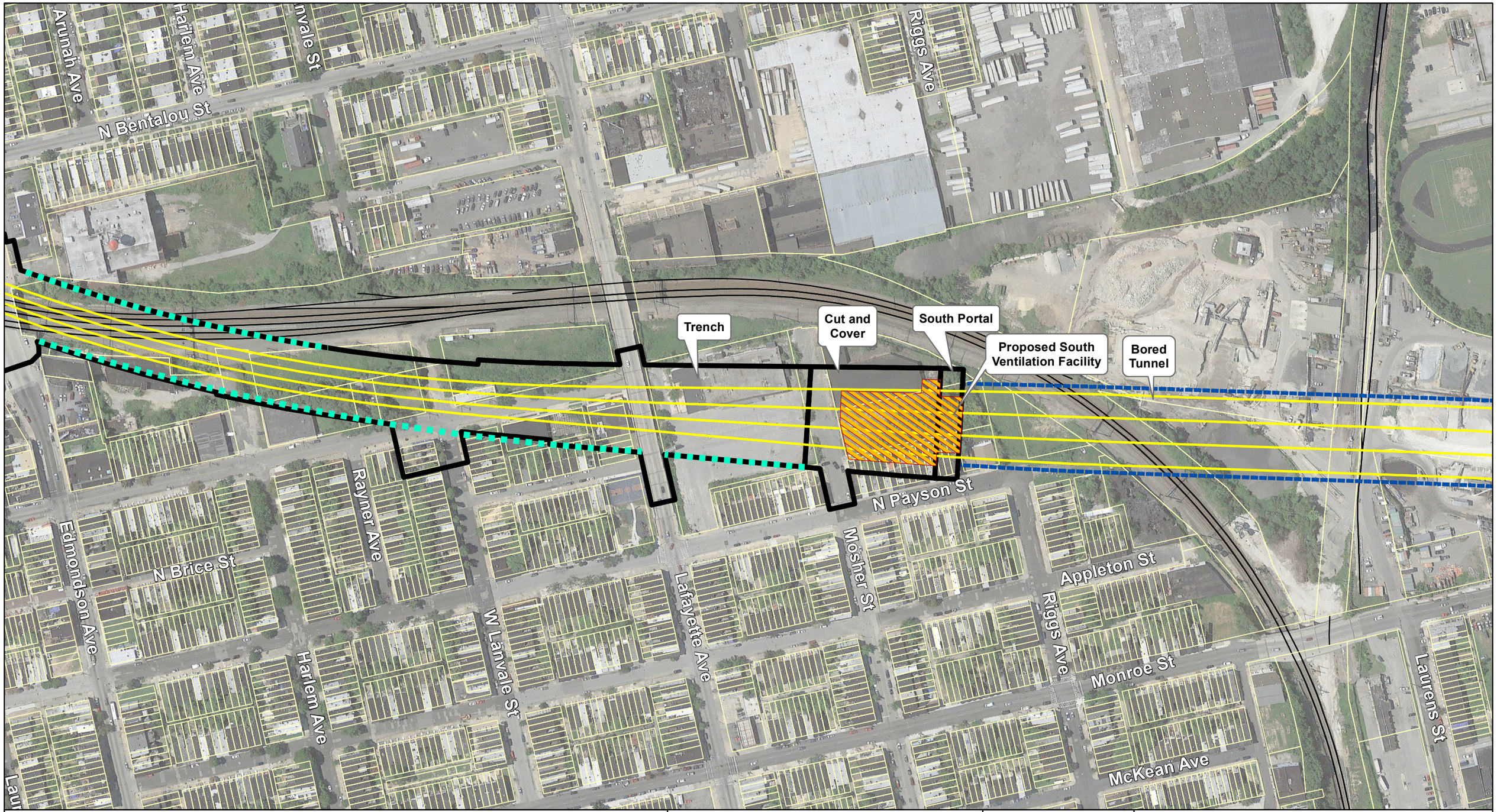

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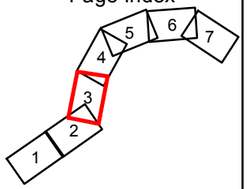

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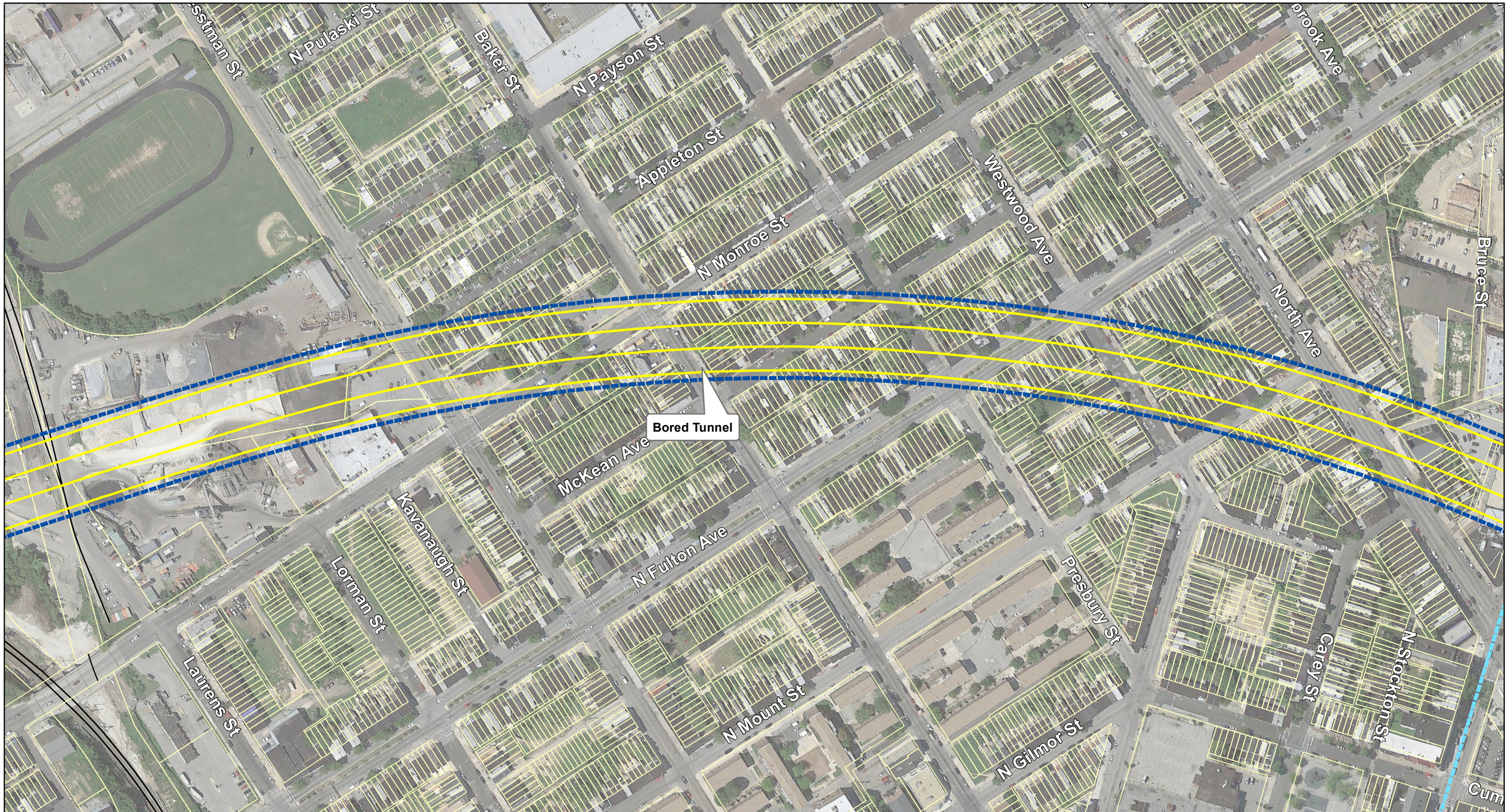

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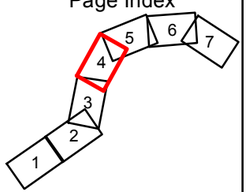

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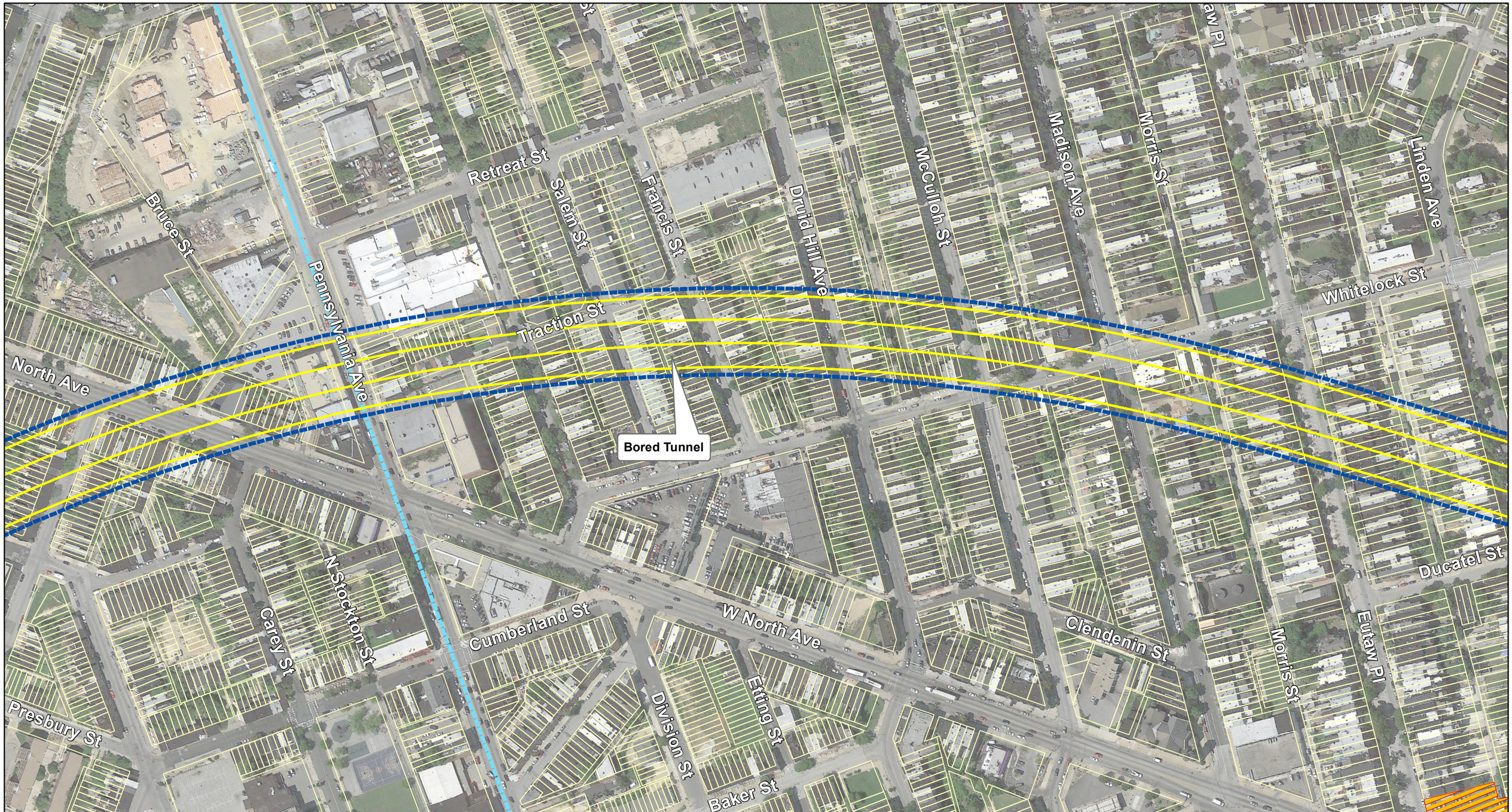

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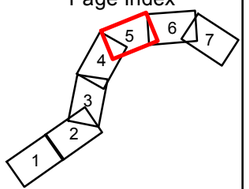

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Alternative 3B - Preferred
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1 inch = 200 feet

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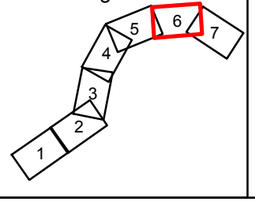

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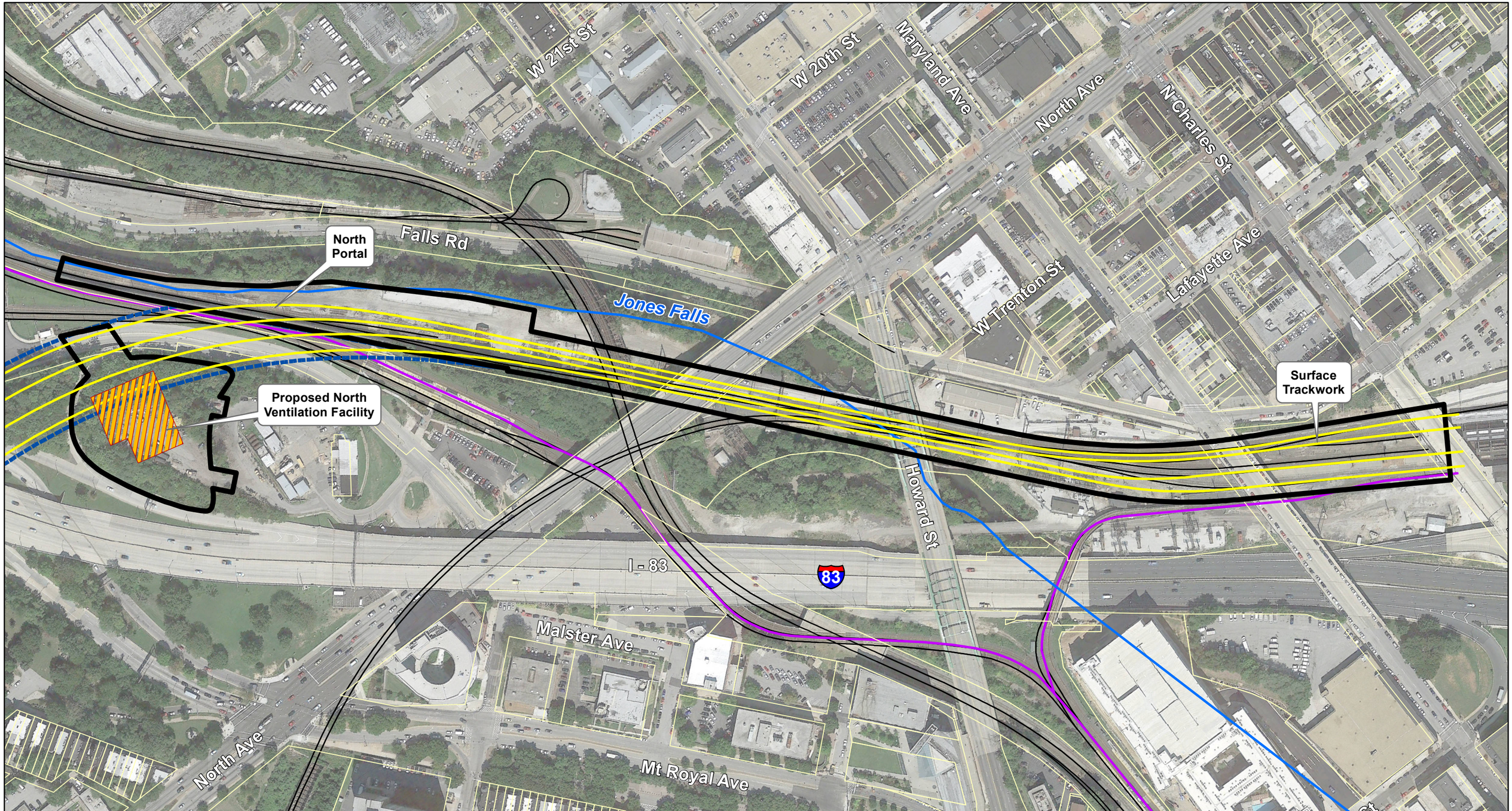

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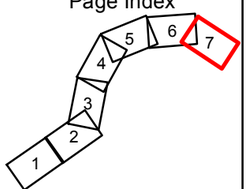

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The Preferred Alternative will consist of four new tracks. For the tunnel portion of the alignment, each of the tracks would occupy a new, separately bored tunnel. The four tracks are consistent with FRA and Amtrak policy to meet the long-term rail passenger needs in the NEC, as well as to provide increased reliability for passenger rail operations for both Amtrak and MARC. The Preferred Alternative will improve travel time by 2 minutes, 31 seconds for Amtrak and 1 minute, 49 seconds for MARC, as compared to existing conditions and the No Build Alternative.

Amtrak owns the existing B&P Tunnel and existing right-of-way and track outside the tunnel, and would retain ownership of portions of the existing NEC not specifically needed for the Preferred Alternative. There has been no decision, as part of the Preferred Alternative, as to the disposition of either the existing tunnel or excess track and right-of-way. The existing tunnel would be closed and reserved for potential future rail transportation use. Amtrak would make decisions on disposition in the future, upon implementation of the Preferred Alternative.

The capital cost estimate to construct the Preferred Alternative is $4.52 billion in escalated dollars, assuming construction completion in 2025. This capital cost estimate is based on Alternative 3B, as refined, due to further engineering refinements after the DEIS. The cost has increased from the preliminary capital cost estimates provided in **Chapter III** due to more detailed engineering, and includes the cost of the preferred Intermediate Ventilation Facility. A more detailed breakdown of the capital cost estimate can be found in **Section J**.

C. Alignment

1. Description

Figures IV-2 through **IV-8** depict the Preferred Alternative. Detailed plan and profile drawings for the Preferred Alternative are provided in **Appendix J**. The plan drawings show the centerline locations of each of the four tracks, track geometry, areas of open cut, cut-and-cover areas, and tunnel portal locations. The horizontal alignment shown on the plan drawings are overlaid on Baltimore City topographic mapping to demonstrate the location of the Preferred Alternative alignment with respect to above-ground land use such as buildings, roadways, and open space. The profile drawings depict the vertical profile of the track alignments and vertical geometry. The profile drawings show the relationship of the tracks to existing ground elevations at-grade, on aerial structure, or below-grade. By using the plan and profile drawings together the tunnel location and depth at any point along the alignment can be determined.

a. Gwynns Falls Bridge to Warwick Avenue

The Preferred Alternative alignment meets the existing four tracks of the Amtrak NEC at both the same horizontal and vertical location south of the Gwynns Falls Bridge. As the alignment proceeds north, it crosses over the Gwynns Falls and Baltimore Street on an existing bridge. Continuing northward, the horizontal location of the four tracks occupies the existing track alignment but the elevation gently rises one to two feet above the existing tracks. The alignment crosses over Franklintown Road and Warwick Avenue on reconstructed four-track railroad bridges, necessary to accommodate the new bridge interlocking at this location instead of on the Gwynns Falls Bridge.

b. Warwick Avenue to Franklin Street

After crossing Warwick Avenue, the alignment begins to shift to the west of the existing alignment and crosses Mulberry Street and Franklin Street on a new bridge structure. At this point, the alignment is approximately 100 feet west of the existing alignment. This change in horizontal alignment creates a much straighter curve when compared to Curve 381 on the existing alignment, resulting in an increase in speed and the ability to include a high-level platform at a newly constructed West Baltimore MARC Station, to be located in approximately the same location as the current West Baltimore MARC Station.

c. Franklin Street to South Tunnel Portal

After crossing Franklin Street, the alignment begins to transition into the tunnel portion of the Preferred Alternative. This portion of the alignment is in an open cut section that crosses under Edmondson Avenue and Lafayette Avenue to the Tunnel Portal west of Payson Street, between Riggs Avenue and Mosher Street. In this portion of the Preferred Alternative, the horizontal alignment shifts from west of the existing tracks to east of the existing tracks, crossing the existing tracks just north of Edmondson Avenue.

A rendering of the alignment between Franklintown Road and the south portal is shown on **Figure IV-9.**

Figure IV-9: Alignment between Franklintown Road and the South Portal

d. Tunnel Portion

The tunnel portion of the Preferred Alternative is 2.00 miles in length in a generally semi-circular alignment, running between the south and north portals. From the south portal, the tunnel alignment traverses under the property of P. Flanigan and Sons Asphalt Plant, and then predominantly under the residential communities of Penrose/Fayette, Midtown-Edmondson, Bridgeview/Greenlawn, Easterwood, Penn North, and Reservoir Hill.

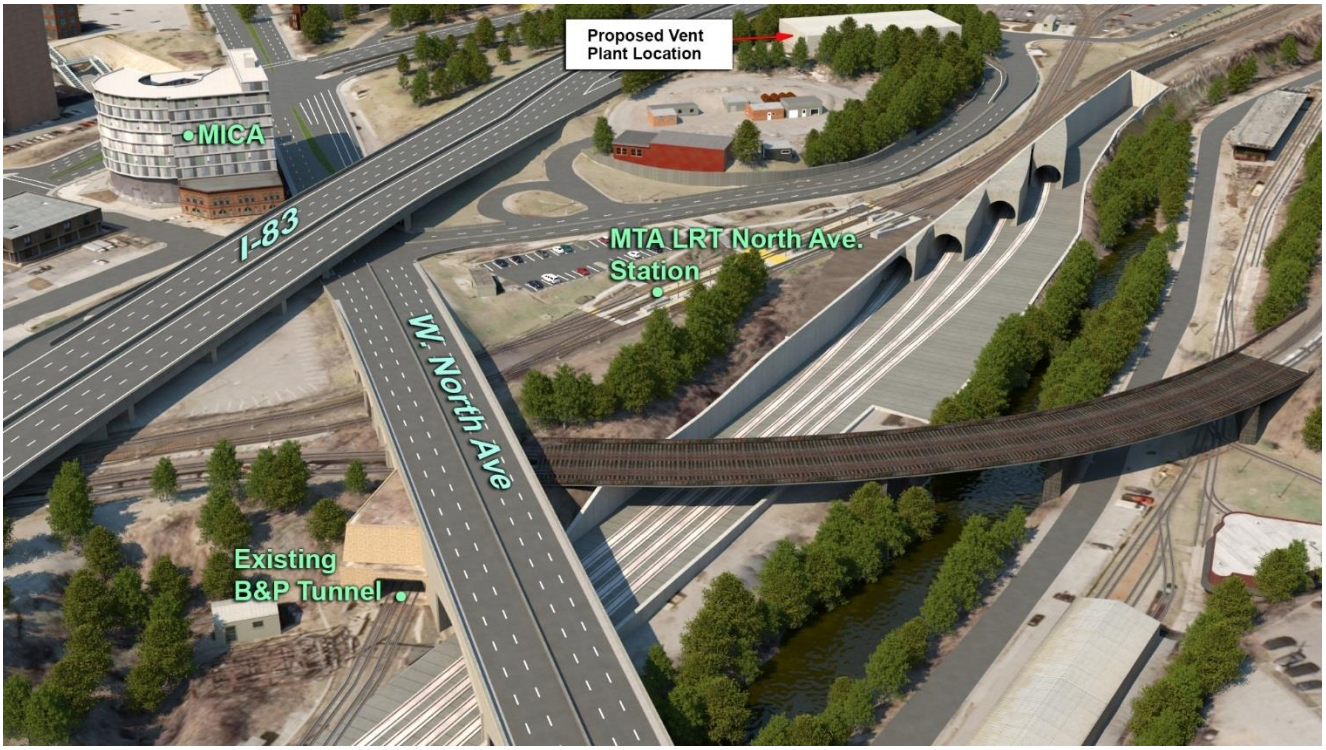
The depth of the tunnel at any point relative to the existing ground elevation can be viewed in the profile drawings in **Appendix J**. The depth of the tunnel is not at a constant number of feet below the ground because the existing surface elevation varies. The maximum depth of the tunnel is approximately 150 feet from top of the tunnel to existing ground elevation. For a majority of the tunnel length the distance between the top of the tunnel and existing ground elevation is in the range of 100 to 150 feet. The Preferred Alternative tunnel alignment must also pass under the Baltimore Metro tunnel in the vicinity of Pennsylvania Avenue.

e. North Portal to Penn Station

The tunnel emerges at the north portal, located east of I-83, immediately east of the existing MTA Light Rail line, and north of West North Avenue. A rendering of the north portal area is shown on **Figure IV-10**.

After leaving the portal area, the Preferred Alternative would cross under a CSX bridge, under the West North Avenue bridge, and under the Howard Street bridge to merge with existing tracks adjacent to and immediately north of Penn Station.

Figure IV-10: Rendering of North Portal Area



D. Ventilation Facilities

The need for ventilation for the tunnel portion of the Preferred Alternative is described in **Chapter III Section A**. The Preferred Alternative requires two ventilation zones to meet the capacity and operational performance required for train operations. Since the ventilation network works as a system (pushing or pulling air depending on the needs of a particular situation), the two ventilation zones require three ventilation facilities. To meet operational requirements, one ventilation facility is located at each end of the tunnel and one ventilation facility must handle ventilation from the middle of the tunnel. This section describes these three ventilation facilities.

Each of the three ventilation facilities would be an essential Life/Safety component of the Preferred Alternative, including an above-ground structure housing fans and ancillary equipment, operations and control equipment, fire protection equipment, silencers and dampers, ductwork to connect to the tunnels, and emergency access/egress for the tunnels. Exhaust will be directed vertically from the ventilation buildings to maximize dispersion and distance from any receptors so as to facilitate compliance with federal air quality standards and to minimize the visual impact of the ventilation buildings on the surrounding community. The site upon which the Ventilation Facility is placed will also include parking for employees, loading dock, and site landscaping. These facilities have not been designed, nor have decisions been made as to architectural finish or even the final layout of the sites. For informational purposes, and to provide a sense of size, scale, and aesthetics, representative graphics are included in this chapter. These site layouts and architectural finishes are all subject to change, based

upon more detailed engineering and coordination with local communities. Input on design will also be incorporated from consultation with Section 106 Consulting Parties.

1. Intermediate Ventilation Facility

The location of the Intermediate Ventilation Facility at 900-940 West North Avenue is based on consideration of impacts, integration into local land use plans and development, costs to construct, engineering and operational aspects, and agency and public comment input. The identification of this site is described in **Chapter III Section F**.

The approximate dimensions for the Intermediate Ventilation Facility are shown in **Table IV-1,** and the site is shown on **Figure IV-11**.

Table IV-1: Intermediate Ventilation Facility Dimensions

Building Footprint Length	Building Footprint Width	Building Height (above grade)	Chimney Height (above grade)
220 ft.	110 ft.	45 ft.	60 ft.

Figure IV-11: Intermediate Ventilation Facility

a. Intermediate Ventilation Facility: 900-940 West North Avenue

The 900-940 West North Avenue site is comprised of three real estate parcels:

- 900-918 West North Avenue, which includes the Sudsville Laundry and the Linden Bar & Liquor store;
- 920-940 West North Avenue, which includes the Always Learning Daycare Center, Metropolitan OB GYN Associates, Icetech Inc., LinkiT, LLC; and Total Health Care.
- 1000 Linden Avenue, which includes a parking lot.

A representative site layout for the 900-940 West North Avenue site is shown on **Figure IV-12**.

Figure IV-12: Representative Site Layout for Intermediate Ventilation Site at 900-940 West North Avenue

Representative views of the Intermediate Ventilation Facility at 900-940 West North Avenue are shown in **Figures IV-13, 14, 15, and 16** from the east, west, south, and north directions. These figures correspond with the numbered arrows on **Figure IV-12**.

Figure IV-13: East Elevation at 900-940 West North Avenue Site ①
Representative View from Linden Avenue and John Eager Howard Elementary School

Figure IV-14: West Elevation at 900-940 West North Avenue Site ②
Representative View from Eutaw Place

Figure IV-15: South Elevation at 900-940 West North Avenue Site ③
Representative View from West North Avenue

Figure IV-16: North Elevation at 900-940 West North Avenue Site ④
Representative View from Jordan Street

2. South Ventilation Facility

For the Preferred Alternative, the South Ventilation Facility is integrated into the south portal area. The approximate dimensions are shown in **Table IV-2. Figure IV-17** shows the proposed location and representative site plan. One section of the South Ventilation Facility is provided on **Figure IV-18**, and six representative views of the South Ventilation Facility are provided on **Figures IV-19** through **IV-24** from the east, north, south, and west corresponding with the numbered arrows on **Figure IV-17**.

Table IV-2: South Ventilation Facility Dimensions

Building Footprint Length	Building Footprint Width	Building Height (above grade)	Chimney Height (above grade)
220 ft.	190 ft.	40 ft.	55 ft.

Figure IV-17: Proposed Location and Representative Site Plan for the South Ventilation Facility

Figure IV-18: Section Ⓑ of South Ventilation Facility
Representative View from Ventilation Facility Parking Lot

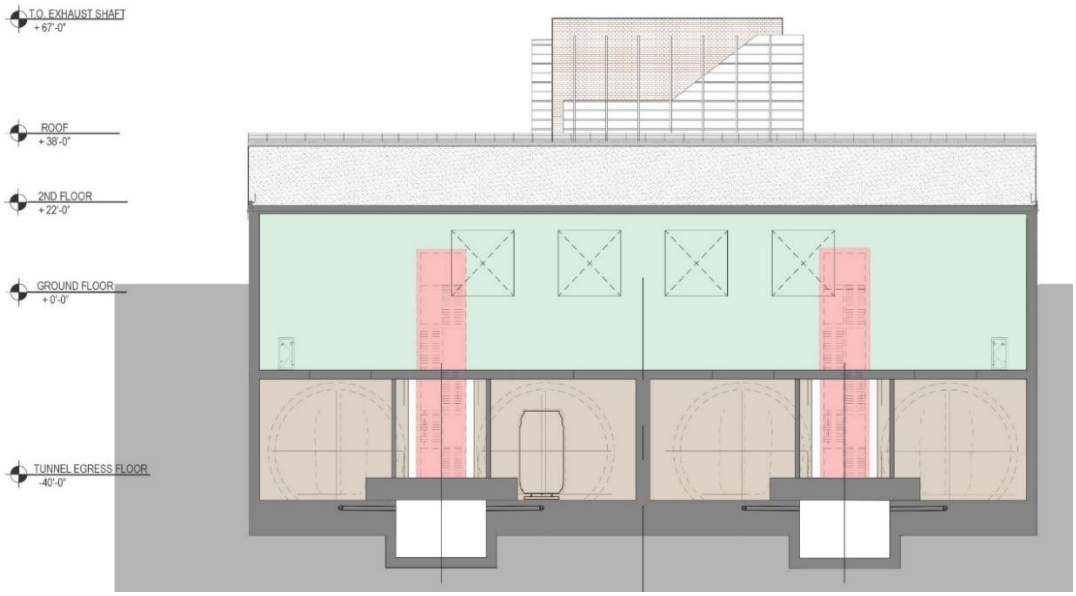


Figure IV-19: East Elevation of South Ventilation Facility ①
Representative View from Payson Street

Figure IV-20: North Elevation of South Ventilation Facility ②
Representative View from Ventilation Facility Parking Lot

Figure IV-21: South Elevation of South Ventilation Facility ③
Representative View from Mosher Street

Figure IV-22: West Elevation of South Ventilation Facility ④
Representative View from Existing NEC

3. North Ventilation Facility

For the Preferred Alternative, the North Ventilation Facility is located west of the north tunnel portal in an area that is part of the West North Avenue Interchange with I-83. The parcel is bounded by I-83 and the northbound off-ramp from I-83 to West North Avenue. Currently, the site is partly occupied by Baltimore City maintenance facilities. The North Ventilation Facility would occupy undeveloped land within the parcel. The approximate dimensions are shown in **Table IV-3,** and **Figure IV-23** shows the proposed location and representative site plan. **Figures IV-24** through **IV-27** show four representative views of the North Ventilation Facility from the south, north, east, and west corresponding with the numbered arrows on **Figure IV-23**.

Table IV-3: North Ventilation Facility Dimensions

Building Footprint Length	Building Footprint Width	Building Height (above grade)	Chimney Height (above grade)
175 ft.	145 ft.	45 ft.	50 ft.

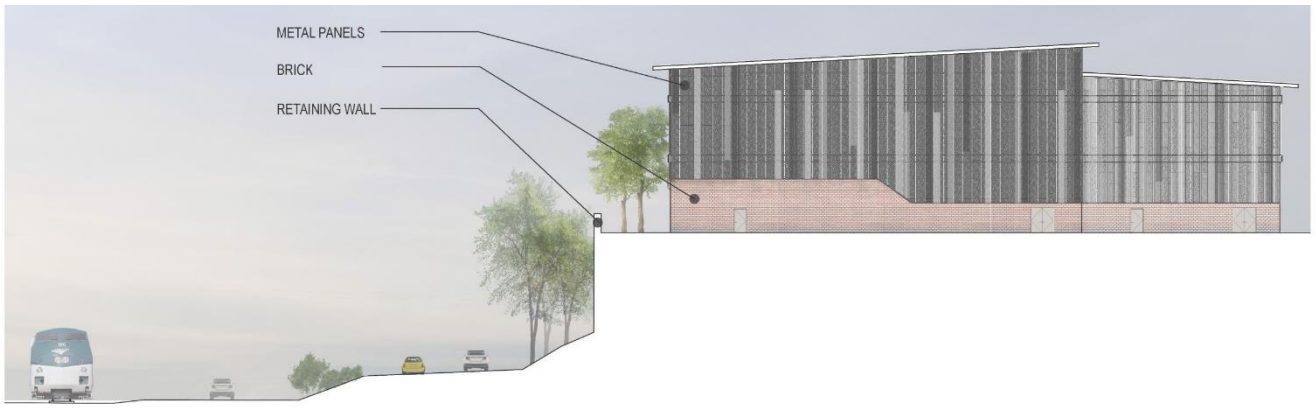
Figure IV-23: Proposed Location and Representative Site Plan for the North Ventilation Facility

Figure IV-24: South Elevation of the North Ventilation Facility ①
Representative View from Jones Falls Expressway

Figure IV-25: North Elevation of the North Ventilation Facility ②
Representative View from I-83 Ramp

Figure IV-26: East Elevation of the North Ventilation Facility ③
Representative View from Light Rail

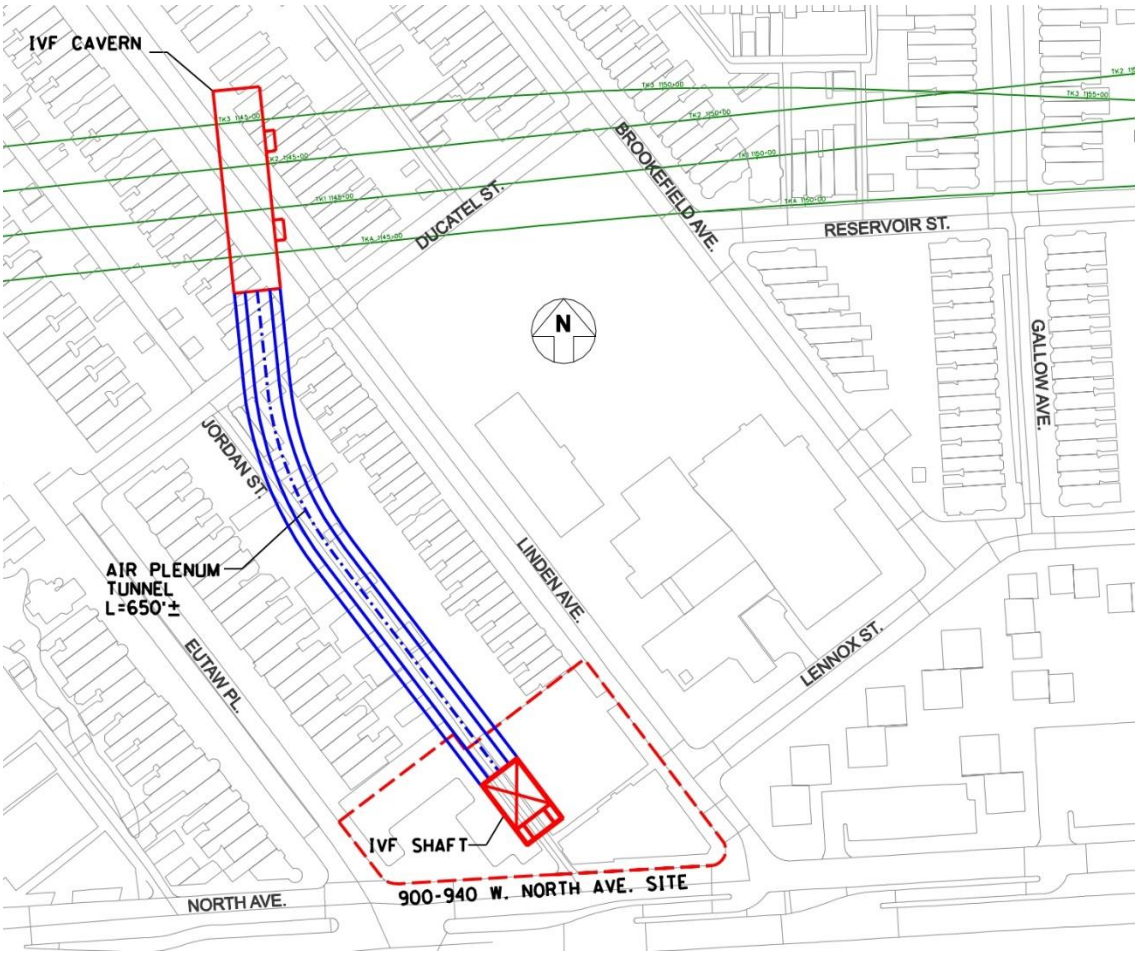
Figure IV-27: West Elevation of the North Ventilation Facility ④
Representative View from Jones Falls Expressway



4. Intermediate Ventilation Facility Plenum

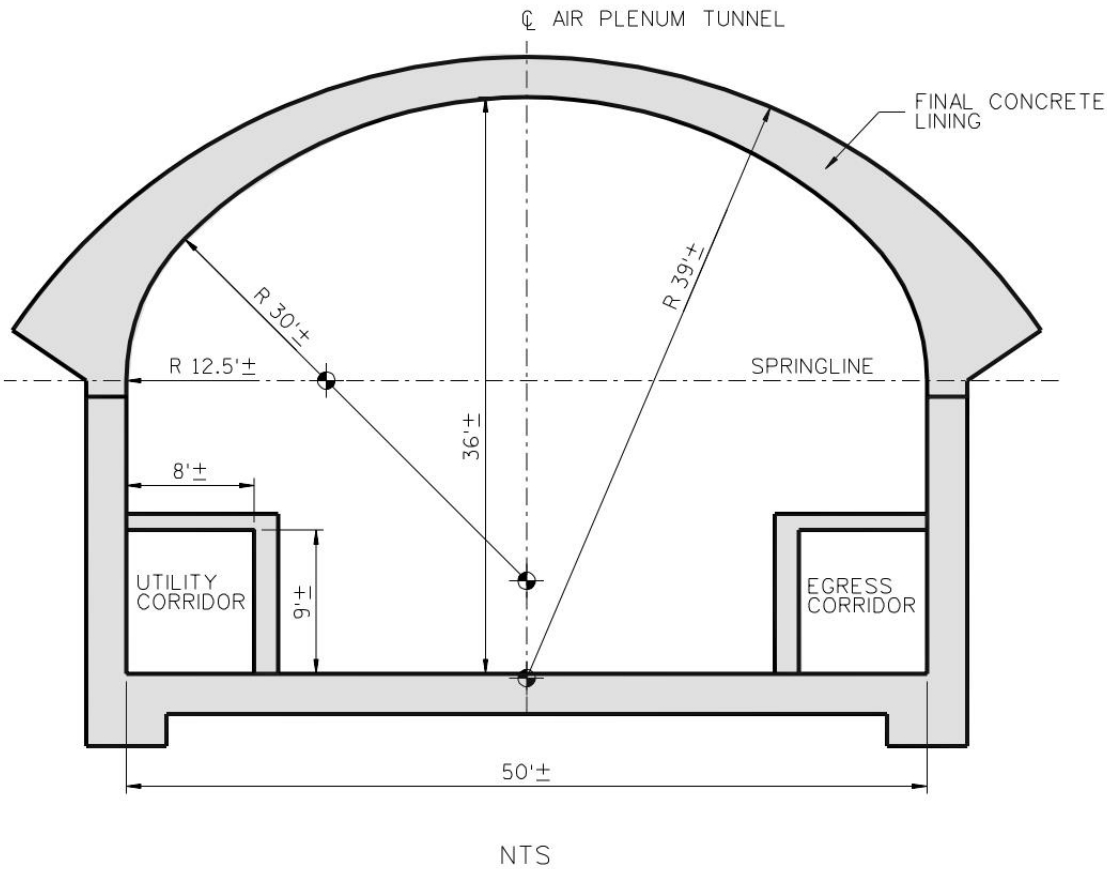
Since the Intermediate Ventilation Facility would be offset from the four tunnels, that is, not directly above or immediately adjacent to the tunnels, the Intermediate Ventilation Facility must be connected to the tunnels through an underground air passage referred to as a plenum. The plenum for the Intermediate Ventilation Facility location at 900-940 West North Avenue is shown in **Figure IV-28.**

Figure IV-28: Ventilation Plenum (900-940 West North Avenue)



The plenum will require a cross-sectional area of 1,400 square feet to accommodate the airflow required **(Figure IV-29).** The shape of the plenum will likely be horseshoe shaped with a flat bottom. An egress/access corridor about 9 feet high by 8 feet wide and a utility corridor, also 9 feet high by 8 feet wide, will be incorporated into the ventilation plenum tunnel. The egress/access corridor will accommodate emergency egress for rail patrons and access for emergency respondents.

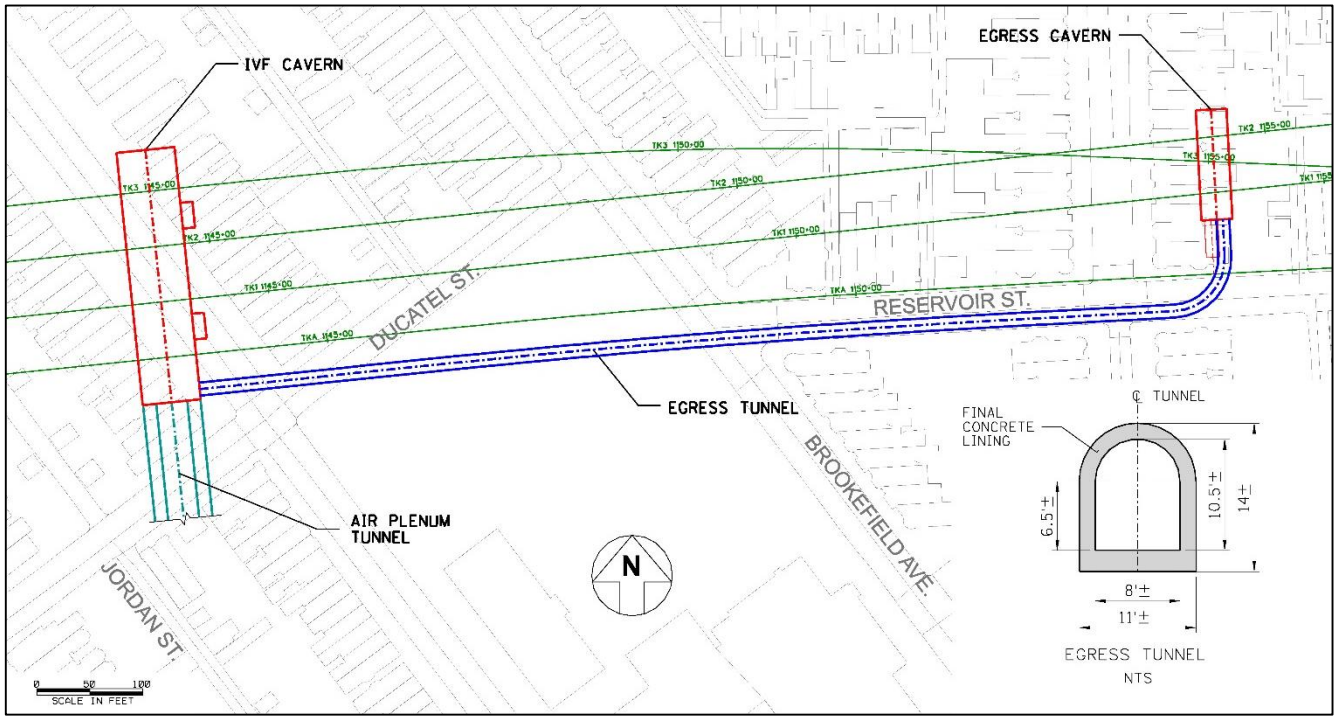
Figure IV-29: Cross-section of Plenum to Intermediate Ventilation Facility



E. Emergency Egress

The Preferred Alternative must be designed and constructed in compliance with all current standards relative to Fire, Life and Safety, which includes compliance with the National Fire Protection Association (NFPA) 130. Emergency access/egress for pedestrians must be accomplished via emergency exits no farther than 2,500 feet apart or cross passages between tunnels every 800 feet or less, or in some situations, a combination of both. For the Preferred Alternative, three locations would be provided for emergency egress to the surface, working with cross passages in the tunnels. The emergency egress to ground level would be provided at the South Ventilation Facility, at the Intermediate Ventilation Facility, and at the North Ventilation Facility. Additionally, an egress tunnel located parallel to the main tunnel bores would provide an egress passage from an egress cavern located between the Intermediate Ventilation Facility and the north portal. This egress tunnel would connect to the egress corridor incorporated into the Intermediate Ventilation Facility air plenum tunnel, as shown in **Figure IV-30,** below.

Figure IV-30: Parallel Egress Tunnel



F. West Baltimore MARC Station

The existing West Baltimore MARC Station is located on the existing NEC south of the existing B&P tunnel. The station is located on an embankment between the two NEC bridges which cross over Franklin and Mulberry Streets. The NEC track at this location is on a curve designated by Amtrak as Curve 381. Due to the curvature of Curve 381, the West Baltimore MARC Station platforms are low level, which means the platform is lower than the floor of the rail car. If the existing platforms were raised to the high-level position, there would be unsafe gaps between the platform and the floor of rail cars, creating an unacceptable safety hazard and lack of compliance with current design standards. The existing low-level platforms do not meet ADA design standards, but the station continues to operate because it was constructed prior to the establishment of the ADA standards. The low-level platforms also have an impact on the amount of time needed to board and alight passengers with the MARC trains, increasing this time substantially compared to high-level platforms. This boarding and alighting time also affects overall MARC train service reliability. The West Baltimore MARC Station experiences high demand, as indicated by recent initiatives to expand the surface parking provided at the station. It is highly desirable to improve the station to incorporate high-level platforms and achieve full ADA accessibility.

The Preferred Alternative creates a new track alignment in the West Baltimore MARC Station area. This new track alignment straightens the curve in the station area and shifts the alignment approximately 100 feet to the west. This results in the opportunity to construct a new West Baltimore MARC Station that can accommodate high-level platforms, thereby meeting ADA standards and allowing for faster, more efficient boarding and alighting with MARC trains. The new station can also continue to be strategically located near the existing station parking and MTA bus service that runs along Franklin and Mulberry Streets.

In addition to the high-level platforms, the Preferred Alternative would construct other features at the West Baltimore MARC Station to achieve ADA compliance, such as wheelchair-accessible vertical pedestrian connections to and from the elevated new station and street level. In general, the new West Baltimore MARC Station would be constructed to replace the components of the existing station. As part of the overall B&P Tunnel

mitigation efforts, some enhancements to the station would be implemented as well, such as platform canopies, public art, and security lighting.

G. Roadway

The construction of the Preferred Alternative requires the reconstruction of several roadways or portions of roadways in the Project area, as well as the reconstruction of several bridges, including:

- Warwick Avenue between Franklin Street and Lexington Street
- Franklin Street between Warwick Avenue and Smallwood Street
- Mulberry Street between Warwick Avenue and Smallwood Street
- Wheeler Avenue between Franklin Street and Edmondson Ave
- Lauretta Avenue at the intersection with Wheeler Avenue
- Bentalou Street south of Lauretta Avenue
- Edmondson Avenue bridge over NEC
- Lanvale Street between Payson Street and NEC
- Pulaski Street north of Rayner Avenue
- Lafayette Avenue Bridge over NEC
- Mosher Street between Payson Street and NEC
- NEC Bridge over Franklintown Road

H. Utilities

The construction of the Preferred Alternative requires the relocation of many utilities in the Project area. The more significant utilities include:

- Payson Street Inverted Siphon
- BGE 115 kV cable in Jones Falls Tunnel (84” diameter liner plate tunnel)

I. Construction

This section describes major construction elements for the Preferred Alternative. Descriptions of tunnel construction, ancillary structure construction, and open cut and cut-and-cover construction are provided. In addition, major construction staging areas are identified and associated truck routes for those staging areas are described.

1. Tunnel Construction Methods

The following construction methods will be employed on the Project:

- Construction by Tunnel Boring Machine (TBM)
- Construction by Mined Excavation Methods
- Construction by Open Cut and Cut-and-Cover Excavation Methods

The Project will be constructed in variable ground conditions, including:

- Soft ground (soil)
- Mixed Face (concurrent exposure of soil and rock in the tunnel face)
- Rock

a. Construction by Tunnel Boring Machine

The rail or running tunnels will be constructed by TBM and lined with a precast concrete segmental lining installed at the rear of the TBM, concurrent with excavation. **Figure IV-31** depicts a TBM and precast concrete segments.

Figure IV-31: Tunnel Boring Machine and Precast Concrete Segments

The TBM excavates a full-circle cross-section using excavation tools contained in the TBM cutter head. The precast concrete segmental linings will be installed within the TBM tailskin concurrent with excavation.

b. Construction by Mined Excavation Methods

Underground ancillary structures required for tunnel operation will be constructed by mined excavation methods, generally using the Sequential Excavation Method (SEM). Initial structural support of different types, suitable for the range of anticipated ground conditions, will be installed concurrent with the excavation. The final lining of these structures will be cast-in-place concrete.

The SEM involves dividing the tunnel face into a series of horizontal and vertical excavation segments. Rock excavations will use modern controlled blasting methods, which reduce noise and vibration. The excavation cycle for rock excavation will include the drilling of blast holes, loading and detonating explosives, ventilating, inspecting blast results, removing excavated rock, and installing initial ground support.

Ancillary structures to be constructed by mined excavation methods include:

- Cross passages necessary for conformance to National Fire Protection Association (NFPA) 130 requirements for passenger evacuation in event of an emergency.
- Tunnel sump/pump stations.
- An underground ventilation plenum for the Intermediate Ventilation Facility.
- Adits to vertical egress shafts necessary for conformance to NFPA requirements for passenger evacuation in event of an emergency.

c. Construction by Open Cut and Cut-and-Cover Methods

Excavation by open cut and cut-and–cover methods will be performed for the following types of structures that will be included in the Project: ventilation facilities, vertical egress shafts, and for trackwork near the tunnel. Open cut and cut-and-cover construction means that earth will be excavated from the surface, removed from the area, and the resulting excavated area will be structurally supported from adjacent soils and ground.

The excavation support systems typically used include: Soldier pile and lagging walls, Secant pile walls, and Concrete slurry wall (diaphragm wall).

2. Construction Staging Areas

Four major construction staging areas would be required to construct the Preferred Alternative. The locations are at the south portal area, the Intermediate Ventilation Facility site, the north portal ventilation facility, and the north portal area. See **Figures IV-32** through **IV-35** for the proposed location of the four construction staging areas near the portals and Intermediate Ventilation Facility.

Figure IV-32: Construction Staging Area Near South Portal

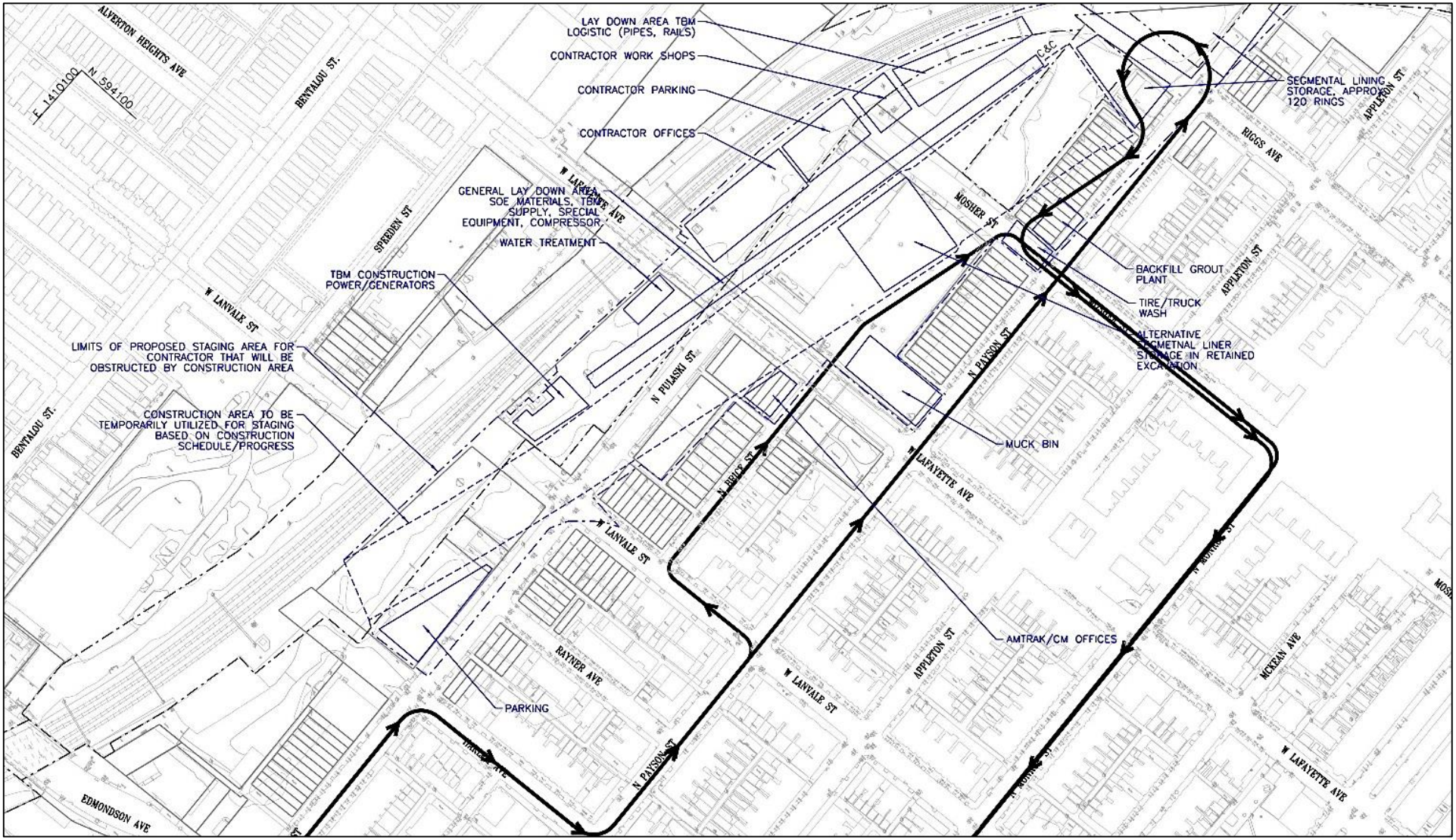


Figure IV-33: Construction Staging Area at Intermediate Ventilation Facility

Figure IV-34: Construction Staging Area at North Ventilation Facility

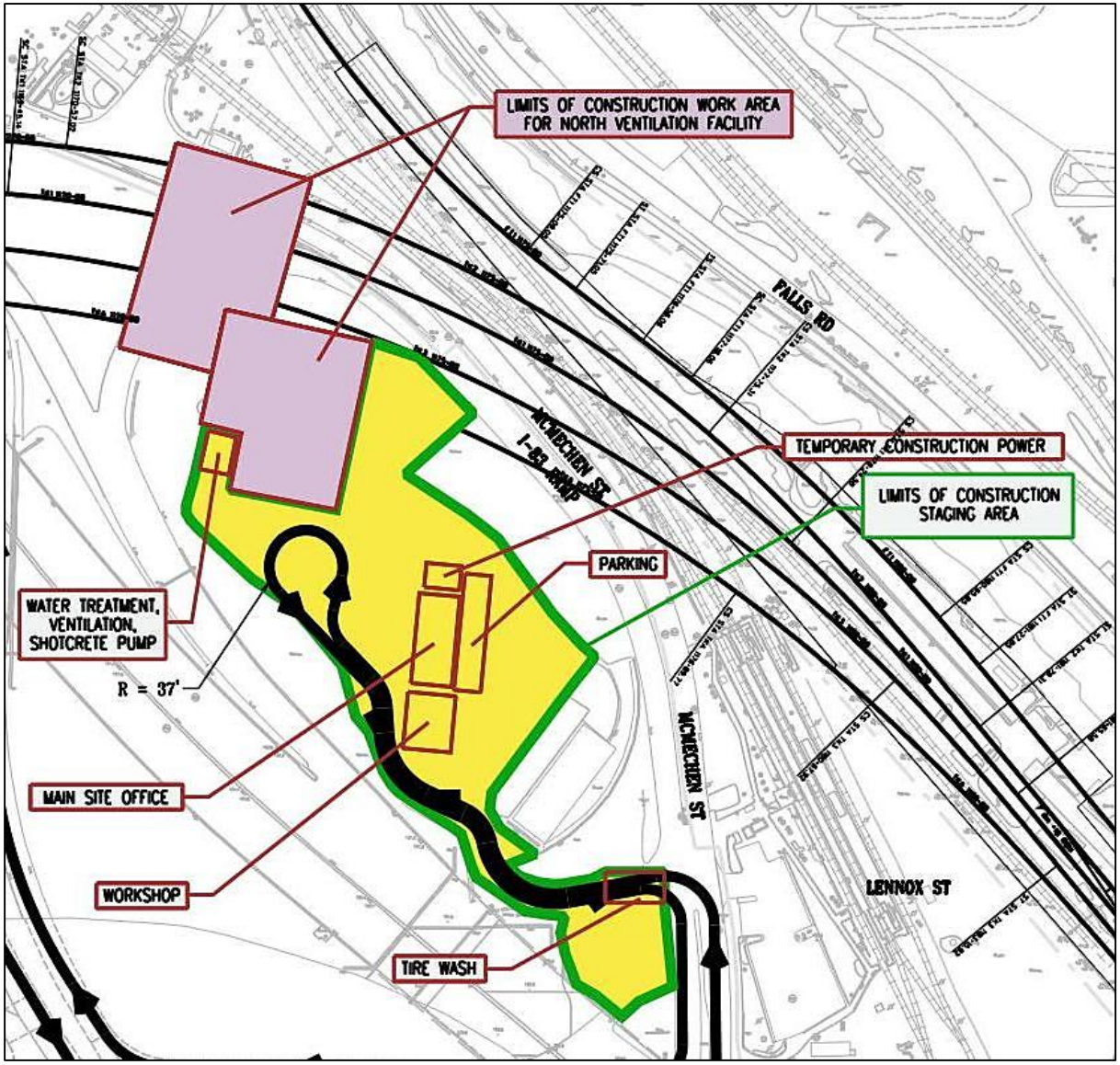
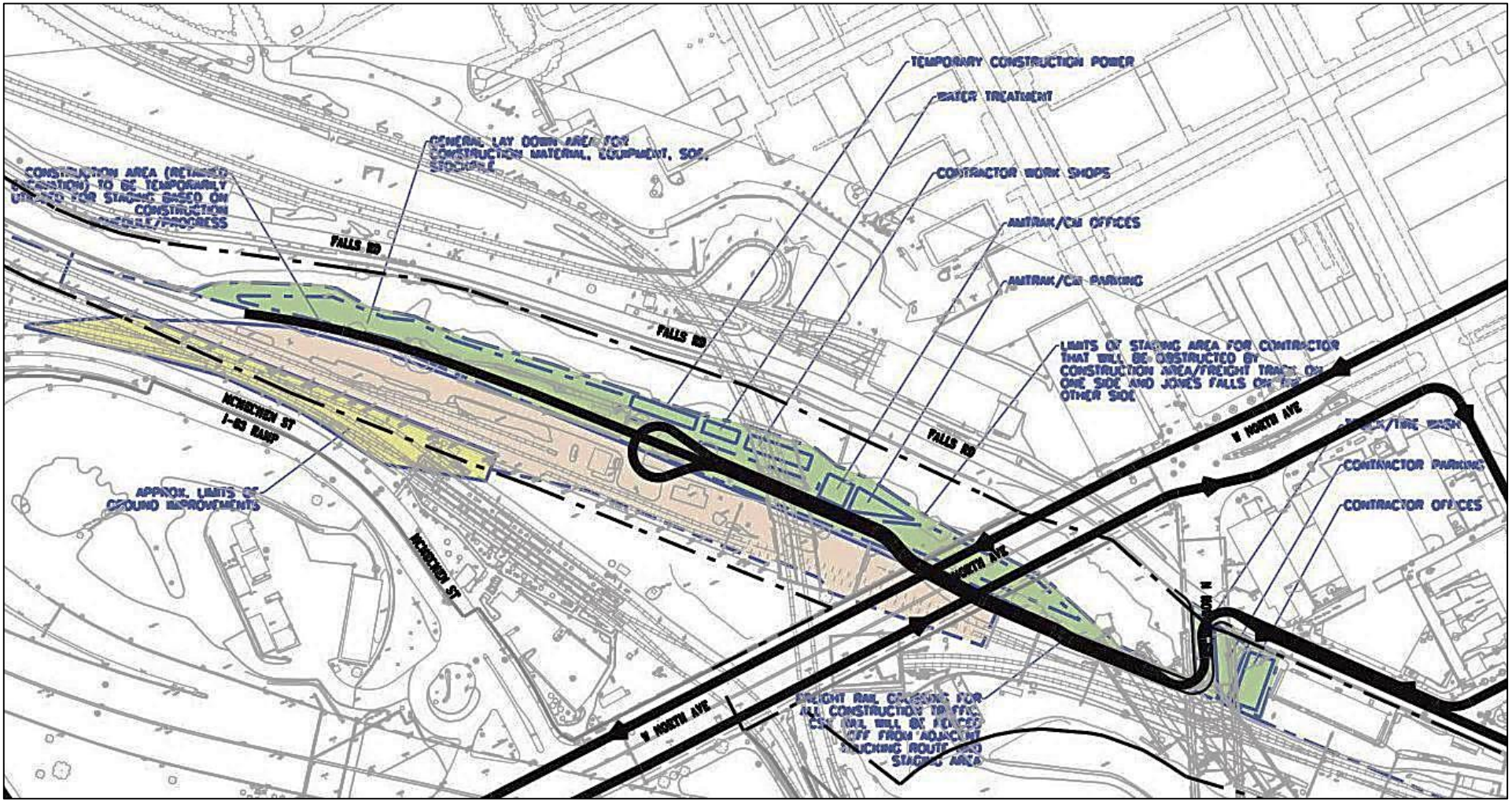


Figure IV-35: Construction Staging Area Near North Portal



3. Truck Routes for Construction Staging Areas

For the Intermediate Ventilation Facility construction staging area, truck access to the site would be via I-83 southbound to the West North Avenue exit, and west on West North Avenue to the Intermediate Ventilation Facility site. Truck egress from the site would be eastbound on West North Avenue, and the entrance ramp on to I-83 to northbound I-83.

For the south portal construction staging area, truck access to the site would be via eastbound US 40 to northbound Pulaski Street, to eastbound Harlem Avenue, and to northbound Payson Street. At that point, there are two separate access routes. The first turns onto westbound Lanvale Street and then northbound Brice Street into the construction staging area. The second continues on northbound Payson Street to access the construction staging area near Riggs Avenue. Truck egress would be from the construction staging area to eastbound Mosher Street, to southbound Monroe Street, and to US 40 west.

For the North Ventilation Facility construction staging area, truck access to the site would be via I-83 southbound to the West North Avenue exit, east on West North Avenue, and north on the I-83 Ramp/McMechen/light rail access road to the construction staging area. Truck egress would be from the construction staging area to the I-83 Ramp/McMechen/light rail access road to westbound West North Avenue, and the entrance ramp onto I-83 northbound.

For the north portal construction staging area, truck access to the site would be via I-83 southbound to the West North Avenue exit, east on West North Avenue, south on Maryland Avenue, west on Lafayette Avenue, north on Falls Road, then turning left into the construction staging area. Truck egress would be from the construction staging area to south on Falls Road, east on Lanvale Street, north on Charles Street, west on West North Avenue, and the entrance ramp onto I-83 northbound.

4. Impacts to Light Rail, Metro, and I-83

The Preferred Alternative would be constructed below the existing MTA Light Rail line in the vicinity of the North Avenue Light Rail Station. The Project Team will coordinate with MTA to ensure minimal disruption to light rail service during construction of the Project. It is possible that disruptions to light rail service may occur for a limited timeframe; however, construction schedules would be developed to minimize disruptions to the extent possible, such as overnight when light rail revenue operations are not occurring or potentially over a weekend.

The alignment of the tunnels would be constructed at an adequate depth below the Baltimore Metro tunnels to ensure there is no disruption to MTA Metro service or damage to the MTA Metro tunnels.

The Preferred Alternative maintains the existing northbound I-83 off ramp to West North Avenue. Construction of the Preferred Alternative may include temporary closures of the ramp. The Project team will coordinate any short-term closures with the Baltimore City and the Federal Highway Administration (FHWA).

J. Capital Cost Summary

A capital cost estimate has been calculated for the Preferred Alternative and is shown in **Table IV-4**. The total capital cost for the Project is estimated at $4.52 billion in escalated dollars, assuming Project completion in 2025. The capital cost estimate is comprised of all major Project components as shown in the table below, including: construction for four new tunnels, trackwork, new MARC station, support facilities, sitework, Amtrak force account and flagging, right-of-way, engineering design, program management, agency support, construction support and management, mitigation, and risk. The cost estimate also includes cost escalation, assuming a design and construction period leads to Project completion in 2025. Any lengthening of the Project schedule would increase costs over this estimate. This estimate includes the preferred Intermediate Ventilation Facility site at 900-940 West North Avenue.

Table IV-4: Capital Cost Estimate for the Preferred Alternative

Code	Description	Item Cost (Million)	Cost Summary (Million)
1	***Construction Cost - Four New Tunnels***		
10	GUIDEWAY AND TRACK ELEMENTS	$1,020	
20	STATIONS, STOPS, TERMINALS, INTERMODAL	$5	
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	$310	
40	SITEWORK AND SUPPORT CONDITIONS	$270	
50	SYSTEMS	$305	
	Total Construction		$1,910
2	***Force Account and Flagging***		
2.1	Amtrak F/A	$20	
2.2	LRT F/A	$4	
	Total F/A		$24
3	***Right of Way***		
3.1	Real Estate	$76	
	Total ROW		$76
4	***Existing B&P - Repair Construction Cost***		
	Total Construction		*TBD*
5	***Engineering Cost***		
5.1	Program Management (including the PM of existing Tunnel)	$15	
5.2	MDOT/City of Baltimore Support	$20	
5.3	Amtrak Project Support Phase 1	$80	
5.4	Final Engineering	$115	
5.5	Mitigation Tracking & Document Revision FE	$1	
5.6	Construction Support	$150	
5.7	Construction Management	$99	
	Total Engineering Cost		$480
6	***Design Development/Risk***		
6.1	New Tunnel Design Development	$573	
6.2	New Tunnel - Risk Cost	$191	
6.3	Engineering/Management Change Process	$45	
6.4	ROW	$11	
	Total Design Development/Risk		$820
7	***Total Project Cost (2015 $$$)***		
7.1	Sum of Categories 1 through 6	$3,310	
7.2	Mitigation Cost	$50	
	Total Project Cost (2015 $$$)		$3,360
8	***Escalation and Risk***		
8.1	Const. & F/A	580	
8.2	ROW	15	
8.3	Design Development & Risk Costs	385	
8.4	Engineering Cost	180	
	Total Escalation and Risk		1,160
	Total Project Budget for Completion in 2025		**$4,520**