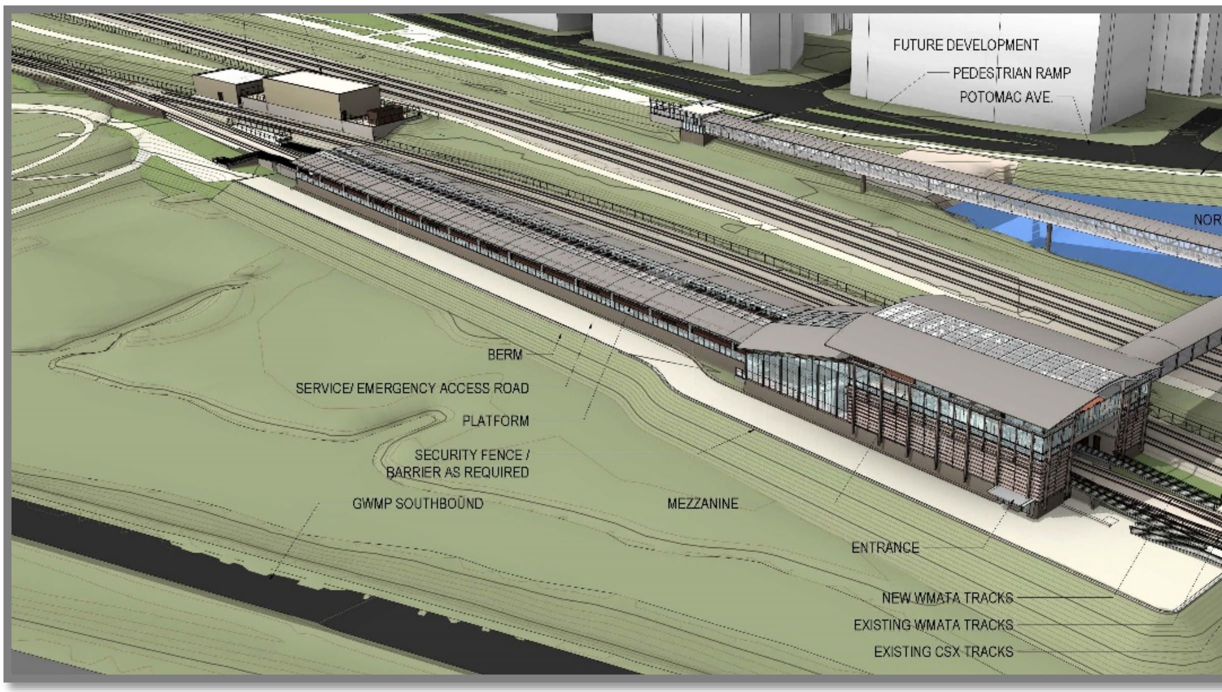
Potomac Yard Metrorail Station Alternatives Cost Review March 10, 2019



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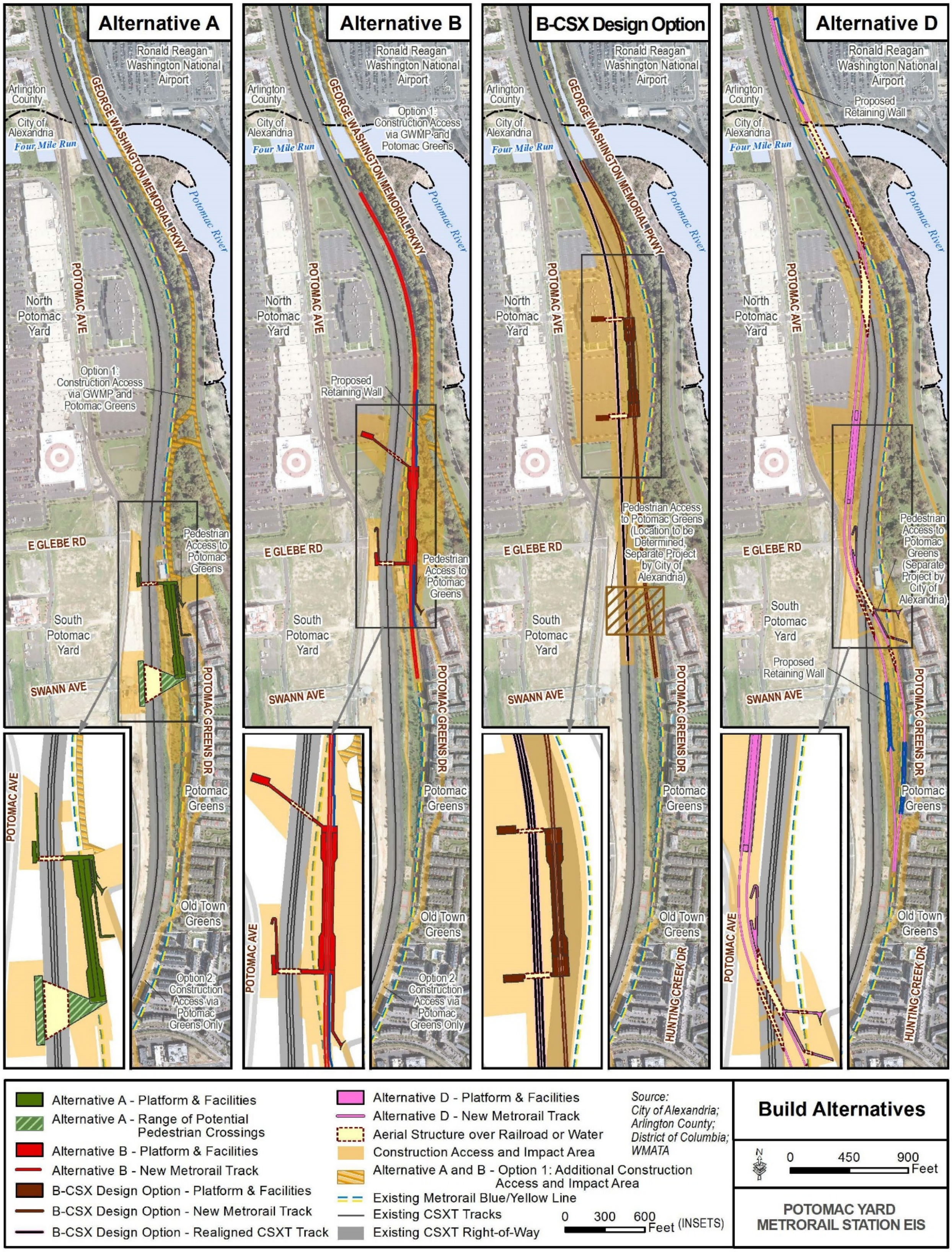
1. Background

The City of Alexandria created a Cost Review that compares the Design-Build cost of Potomac Yard Metrorail Project Alternative B to Alternative A using current dollars and the current approved Project scope. This exercise should be considered a Rough Order of Magnitude (ROM) estimate. The costs were fully assessed using available information from this Project and cost data from similar multi-million-dollar transit projects that Joe Butler, President of ButlerMatrix, LLC and Design-Build Consultant for the City of Alexandria, has actively managed in the last ten years including the $6B Dulles Corridor Metrorail Project, the $1.1B MBTA Greenline Extension Pursuit, and the $900M DART Cotton Belt Pursuit. A summary of Mr. Butler's experience can be found in Section 4, Consultant's Resume.

Four Alternatives were included in the Project's Final Environmental Impact Statement. Alternative B, as the selected Preferred Alternative, forms the basis for the current Design-Build Contract scope. The costs of this competitively bid scope are the benchmark for comparison to the theoretical costs of building a functionally similar station at the Alternative A location. There was no need to further refine the previous cost estimates for Alternative B-CSX and Alternative D because they were already substantially higher than Alternative B. Alternative B-CSX was previously 31% higher than Alternative B in a 2014 cost exercise, and Alternative D was 84% higher than Alternative B in the same exercise. Based on my analysis, an updated ROM for these Alternatives would not materially change those conclusions about the comparative costs of the alternatives. An updated ROM for Alternatives B-CSX and D would incorporate the same general and proportional cost increases reflected in the updated cost projections for Alternatives B and A. A closer look at Alternatives B-CSX and D also is likely to reveal additional costs that were not accounted for in the high-level 2014 exercise. The proportionate difference in the costs of Alternatives B-CSX and D compared to Alternative B are expected to be no less than the 2014 estimates. Therefore, that exercise still provides a valid basis for comparing the respective costs of these Alternatives


Alternative A
Alternative B
B-CSX Design Option
Alternative D
Ronald Reagan Washington National Airport
Arlington County
City of Alexandria
Four Mile Run
GEORGE WASHINGTON MEMORIAL PKWY
Potomac River
North Potomac Yard
POTOMAC AVE
Option 1: Construction Access via GWMP and Potomac Greens
Proposed Retaining Wall
Pedestrian Access to Potomac Greens
Pedestrian Access to Potomac Greens (Location to be Determined, Separate Project by City of Alexandria)
Pedestrian Access to Potomac Greens (Separate Project by City of Alexandria)
E GLEBE RD
South Potomac Yard
SWANN AVE
POTOMAC GREENS DR
Potomac Greens
Old Town Greens
Option 2: Construction Access via Potomac Greens Only
HUNTING CREEK DR
Alternative A - Platform & Facilities
Alternative A - Range of Potential Pedestrian Crossings
Alternative B - Platform & Facilities
Alternative B - New Metrorail Track
B-CSX Design Option - Platform & Facilities
B-CSX Design Option - New Metrorail Track
B-CSX Design Option - Realigned CSXT Track
Alternative D - Platform & Facilities
Alternative D - New Metrorail Track
Aerial Structure over Railroad or Water
Construction Access and Impact Area
Alternative A and B - Option 1: Additional Construction Access and Impact Area
Existing Metrorail Blue/Yellow Line
Existing CSXT Tracks
Existing CSXT Right-of-Way
0 300 600 Feet (INSETS)
Source: City of Alexandria; Arlington County; District of Columbia; WMATA
Build Alternatives
0 450 900 Feet
POTOMAC YARD METRORAIL STATION EIS

2. Alternative A Analysis

The Alternative A site is located just south of the southern end of the Alternative B station platform, directly over the existing WMATA Blue/Yellow Lines. WMATA's original long-term plans from the 1970s included constructing an "in-line" station at this location, so the current rail line was installed at the desired alignment and elevation to support a future station. The Cost Review for Alternative A is constructed by assuming that the components common to the competitively bid Alternative B will remain virtually the same on the Alternative A site, with the only adjustments needed for variations in site-specific elements like constructability, safety, geotechnical conditions, hazardous materials, environmental impacts, track and systems differences. The following cost topics **A**, **B**, **C**, **D, E,** and **F** were considered in developing the Alternative A Design-Build Cost summarized in the **Conclusions** section.

A. <u>Protective Cover (Cost increase to Items 2, 5, and 9)</u>

Constructing Alternative A using an "in-line" technique is a new and unproven approach. None of the professionals associated with the Project (with many decades of combined construction experience) could identify a heavy rail station ever being constructed in this manner. The "in-line" technique proposed involves building the station over the active Blue/Yellow Lines which remain in the current alignment. The Project Team's experience on other rail station projects involves building the station "off-line" or as a new extension to an existing line. "Off-line" means building the station adjacent to the existing active line and then transferring train traffic through the new station after the new lines are completed and safety certified. This "off-line" technique is being implemented on Alternative B and would be the choice for Alternative B-CSX and Alternative D also.

Constructing an "in-line" station presents the unique challenges of maintaining a safe environment for construction workers, project staff, and Metro passengers while constructing a new 850-foot long station over and around a very active Metrorail line. This situation presents numerous safety hazards that would be present for the multiple years it would take to construct the station. Extraordinary safety mitigation measures would be necessary to mitigate the safety hazards listed above. WMATA's vision for building a station at the Alternative A location involved constructing a protective structure over the line during construction.

The challenges to safely operating a Metro station construction site around an active, electrified transit track include:

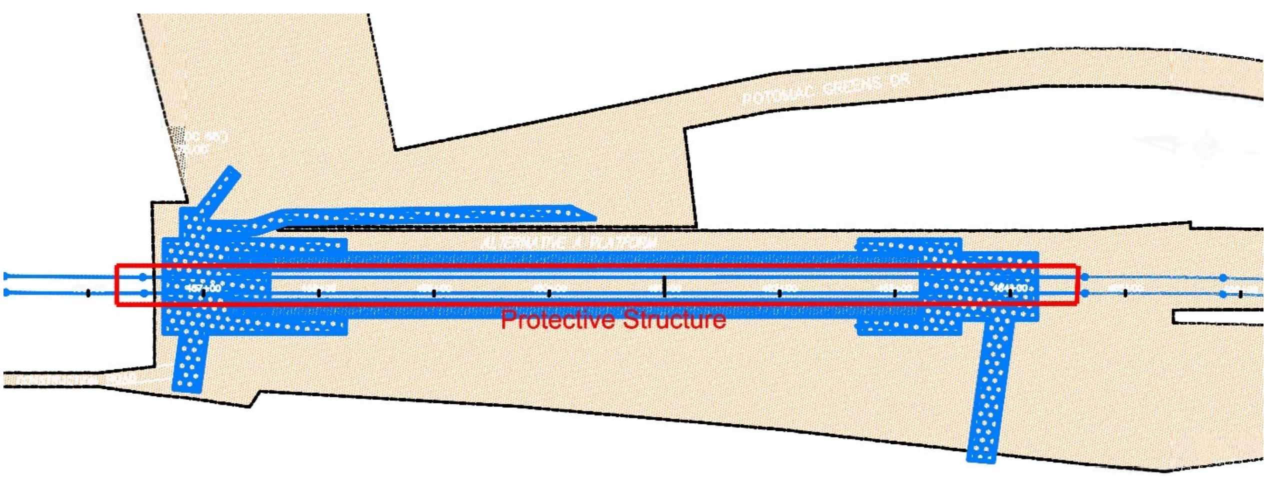
- The 750 volts of Direct Current (DC) electricity present in the third rail on both sides of the track will certainly cause death to any persons unlucky enough to touch it, but current of this magnitude can also kill by ‘jumping’ (meaning you don’t have to touch the third rail to get electrocuted because it can arc like lightning over short distances). The current also would travel through any piece of equipment made of conductive material that may inadvertently touch the third rail. Although this risk will be present for the duration of the project, the protective structure helps mitigate the risk by creating a physical barrier between the workers and the third rail.
- In most circumstances, the WMATA trains cannot stop in time to avoid catastrophe if the track is “fouled” by falling debris, equipment, or construction workers. Even an object as small as a hammer, if dropped on the tracks, has the potential for fouling the tracks. With over a hundred construction workers working adjacent to and above the active tracks, this presents an unacceptable level of risk without mitigation.
- Multiple crane picks over several years means that even equipment that is positioned tens of feet away from the tracks can fail (e.g., tip over) and foul the tracks. Although precautions can be taken, without mitigation there is still a risk of fouling from equipment and slung loads.
- Having an active rail line bisecting the construction site makes it much more challenging to move workers and equipment around the site.
- Without mitigations, the extreme precautions necessary to work adjacent to an active track slow the production of the crews to the point that the cost and schedule impact becomes insurmountable.

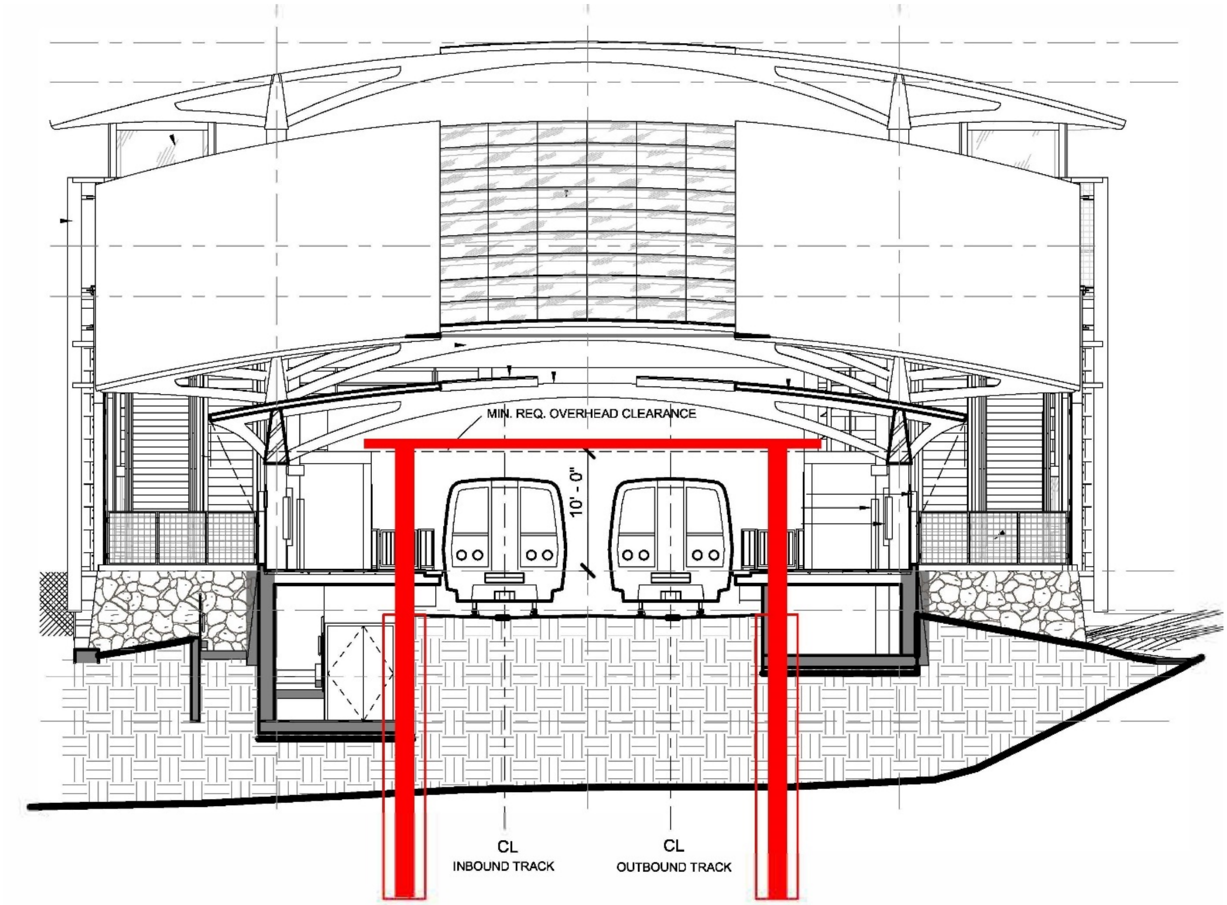
The construction of Alternative A using a protective structure would mitigate, but not eliminate, the foreseeable safety hazards. The protective structure would need to be able to satisfy each of the following criteria:

- Be designed so that it can be quickly constructed and removed during a series of planned single tracking or weekend shutdowns to minimize the disruption of train traffic and meet WMATA’s standards for shutdowns.
- Be sufficiently robust to protect against track fouling by materials, equipment, construction workers. That is, it must be completely enclosed, so that small construction tools and materials do not foul the line below.
- Be sufficiently strong to withstand the impacts of potentially heavy equipment and materials dropped from a height.

Even with a protective structure in place, this would not eliminate all safety risks and construction-related line closures. Certain hazards—such as the heavy lifting of large structural steel members—will require addition weekend shutdowns or night work because these elements, if accidentally dropped, would make even the strongest protective structure fail.

Specific details on WMATA's original assumption were not made available, but this review has assumed the following solution. The concept developed involves constructing a series of concrete encased steel "soldier piles" along both sides of the existing track for the entire 850-foot-long station structure. Steel beams would connect these columns longitudinally and across the tracks forming a steel frame to protecting against falling debris. 40-foot-long precast hollow core panels would then be placed on top of the steel structure, and 12-foot-high chain link fence (with gates) would be installed on both sides to discourage fouling of the track and to avoid electrocution from the active third rail. The below-ground portions of the structure could utilize the soldier piles for earth retaining purposes using lumber lagging. The entire structure would need to have a grounding and stray current protection system to protect against corrosion from the WMATA traction power system. All the existing signal and communication circuits would need protection during the installation of the protective structure. Once the station elements are constructed to the point that it is safe to remove the protective structure, the structure could be cut flush with the ground level and the foundations abandoned in place to avoid damage to the surrounding structure.





Using the protective structure to construct Build Alternative A will significantly increase the length of time it takes to construct the station because many of the major construction activities could only be completed during single tracking or weekend shutdown periods. We have estimated that constructing Build Alternative A would require 48 - weekend shutdowns. To minimize impacts on public ridership, WMATA typically limits shutdowns to less than three weekends per month on the average to minimize impacts to the traveling public during holidays and special events. The impacts on the Project construction schedule are summarized as follows:

- Construction of the protective structure would take approximately 12-weekend shutdowns spread out over 4 months.
- Construction of the large structural elements of the station will require 12-weekend shutdowns spread out over 4 months.
- Once the primary station elements are complete, removal of the protective structure is projected to require other 6-weekend shutdowns over 2 months.
- Building the permanent station elements around this structure reduces productivity, and certain elements (e.g., platform edges, basement walls, new tracks, systems, finishes)

would need to be built after the protective structure removal, necessitating additional an additional 18- weekend shutdowns spread out over 6 months).

In sum, factoring in these weekend shutdowns, we reasonably estimate that building Alternative A as an “in-line” station would add 16 months to the construction schedule versus an “off-line” structure, significantly increasing the design-build contractor’s general conditions cost. In additions, the insurance increase due to the risk of building this unique structure in a hazardous environment will increase the general conditions cost also.

B. <u>Geotechnical/Foundation Systems (Net cost increase to Items 2, 5 and 9)</u>

The geotechnical and foundation solution chosen for Alternative B involves pre-loading the site with approximately 75,000 cubic yards (CY) of imported clean fill and allowing the underlying soils to consolidate over time. This allows relatively inexpensive spread footings to be utilized on the station structure for all but the heaviest column loads. The heavy column loads will be supported by driven piles and pile caps.

Alternative A cannot utilize the same geotechnical and foundation technique because it would be built over an active rail corridor. Instead, we assumed that drilled caisson piles would need to be extensively utilized to support the Alternative A structures on the poor-quality fill soils at this location. Driven piles are not acceptable due to the proximity of the adjacent residential structures.

C. <u>Hazardous Materials (Cost increase to Items 2, 13, 14, 15 and 16)</u>

The Alternative B design has minimized the excavation of on-site, potentially contaminated, material since the structure is built on imported clean fill material and utilizes driven piles that don’t generate spoils. The total quantity of hazardous material haul-off included in the current Design-Build Contract is estimated at a total of 4,800 cubic yards (CY) of various forms of contamination. Alternative A has several increased opportunities to generate hazardous spoils including:

- Additional cut areas for basement service rooms and service crawl space – 15,000 CY
- Drilled Caissons spoils and contaminated drilling mud – 8,000 CY
- Protective Structure drill shaft spoils – 5,000 CY
- New RCP Pipe along the East side – 4,000 CY

Alternative A is located in the former *Central Operations Area* of Potomac Yard that produced significant environmental degradation over many years as documented in Section 4.3 of the DRAFT Phase I ESA and Hazardous & Contaminated Materials Technical Memorandum) Central Operations Area **– "***The former Central Operations Area was bordered by U.S. Route 1 to the west and the Metrorail Blue/Yellow Line to the east and extended south to Swann Avenue and north to the northern edge of a parking lot ….. The Central Operations Area covered the portion of the rail yard where the majority of the former rail yard buildings were located and most refueling operations took place. A 105-foot locomotive turntable and roundhouse area were located at the Central Operations Area. The turntable was excavated and removed in 1994. This area was used to service, maintain, clean, and repair "yard" locomotives used on site. Just west of the main turntable, an 80-foot turntable was used until the 1930s or 1940s before being backfilled and subsequently uncovered during downsizing activities in 1993. Excavation of the turntable led to the discovery of an underground storage tank (UST) which held 30 gallons of oil containing 231 milligrams per liter (mg/l) of polychlorinated biphenyls (PCBs). The tank, its contents, and the smaller turntable were removed and disposed of offsite by RF&P in 1994 (ETI, 1995).*

The refueling area consisted of a minimum of eight underground storage tanks (USTs) located in and around the Central Operations Area, four large 25,000-gallon ASTs, and one smaller AST of approximately 10,000 to 15,000 gallons. All the USTs and ASTs were removed by RF&P as a part of the CERCLA and VDEQ remedial activities discussed in Section 5.0. A transformer and equipment storage area were located south of the 105-foot turntable. This storage area contained two transformer shells, three unused capacitors, several cable spools, and various other pieces of unused track equipment. An electrical substation was located immediately south of the transformer and equipment storage area. All remnants of this substation, as well as a second substation near Four Mile Run, have been removed. More than 80 electrical transformers were present in these substations and in other locations throughout the former rail yard. In 1984, RF&P removed all regulated transformers from the rail yard property. In 1992 and 1993, RF&P inventoried and removed 85 remaining non-essential transformers from the rail yard (ETI, 1995)."

We have assumed that all the on-site excavated materials will need to be removed from the site and disposed of at regulated disposal site by specialist contractors.

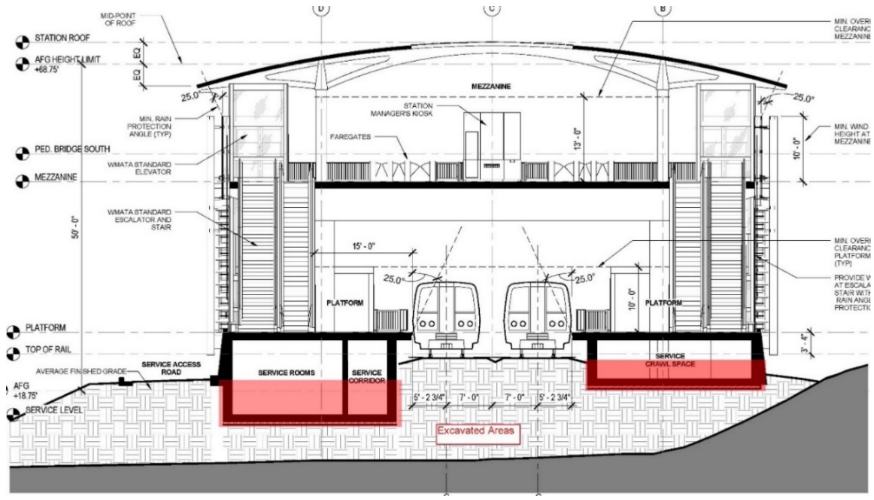


Diagram of Excavation of Below Ground Structures. Note for Alternative B that excavation is taking place in the clean fill that was imported to the site but for Alternative A this will be potentially contaminated material.

D. <u>Restoration of Temporary Wetland Impacts (Cost decrease to Items 2,4 and 9)</u>

Alternative A does not require the restoration of temporary wetland impacts and thus has a decreased restoration budget as compared to Alternative B. The remaining restoration cost are associated with park and landscaping restoration.

E. <u>Installation of RCP Stormwater System to replace open ditch East of the Station (Cost increase to Items 2.3 and 9)</u>

The Alternative A has an open drainage ditch running the length of the structure on the east side that will need to be converted to an underground Reinforced Concrete Pipe (RCP) closed system.

F. <u>Reuse of existing Traction Power, Train Control, and Track at Alternate A (Cost decrease to Items 2, 3, 9, 10 and 12)</u>

Since the track was originally installed at the correct grade for a future station at Alternative A, certain track and systems components are already in place in the ideal location for Alternative A and can be rehabilitated and utilized instead of installing new components producing significant cost savings. For example, the track is at the correct alignment and elevation, so completely new direct fixation track through the station is not necessary. Also, the traction power budget is reduced at this location because a new Tie Breaker Station is not required. In addition, the requirement for new train control components is only approximately fifty percent those of the Alternative B location.

3. Conclusions

ITEM		ALT B ($M)	Topic A	Topic B	Topic C	Topic D	Topic E	Topic F	ALT A ($M)	*Var. ($M)*	*% Var.*
	Design-Build Contract Scope	**214.2**	**20.0**	**6.3**	**8.0**	**-0.7**	**0.6**	**-10.8**	**237.6**	***23.4***	***10.9%***
1	Mobilization	3.0							3.0	*0.0*	*0.0%*
2	General Conditions	22.5	9.0	0.5	0.7	-0.1	0.1	-0.5	32.2	*9.7*	*43.1%*
3	Sitework	26.0					0.5	-1.0	25.5	*-0.5*	*-1.9%*
4	Site Restoration and Mitigation	1.0				-0.6			0.4	*-0.6*	*-60.0%*
5	Station Structure	38.7	10.0	5.0					53.7	*15.0*	*38.8%*
6	Station Finishes	17.3							17.3	*0.0*	*0.0%*
7	AC Room Building	3.2							3.2	*0.0*	*0.0%*
8	Pedestrian Bridge and Pavilion	17.3							17.3	*0.0*	*0.0%*
9	Design Items 3 through 11	24.9	1.0	0.8		-0.1	0.1	-0.1	26.5	*1.6*	*6.6%*
10	Traction Power	15.4						-3.0	12.4	*-3.0*	*-19.5%*
11	Communications	7.4							7.4	*0.0*	*0.0%*
12	Automatic Train Control	12.3						-6.2	6.2	*-6.2*	*-50.0%*
13	Hazardous Waste	0.5			2.6				3.1	*2.6*	*523.6%*
14	PCB-Contaminated Soil	0.6			3.6				4.2	*3.6*	*595.0%*
15	Petroleum-Contaminated Soil 1	0.1			0.5				0.6	*0.5*	*544.0%*
16	Petroleum-Contaminated Soil 2	0.1			0.5				0.6	*0.5*	*544.0%*
17	Permitting Allowance	0.1							0.1	*0.0*	*0.0%*
18	Utility Allowance	0.3							0.3	*0.0*	*0.0%*
19	Conduit, Cable Troughs & Duct Bank	11.0							11.0	*0.0*	*0.0%*
20	Hydraulic Elevators	4.7							4.7	*0.0*	*0.0%*
21	Optional Pedestrian Ramp	7.8							7.8	*0.0*	*0.0%*

<u>TOPIC</u>

A. Protective Cover
B. Geotechnical/Foundation Systems
C. Hazardous Materials
D. Restoration of Temporary Wetland Impacts
E. East Side Stormwater System
F. Savings for using existing traction power, track, and ATC

The Design-Build cost of constructing a functionally similar station at the Alternative A site will be **$23.4M** or **10.9% more expensive** than constructing the same components at the Alternative B location.

March 10, 2019
Joseph M Butler, President of ButlerMatrix, LLC

4. Consultant's Resume

JOE BUTLER – President, ButlerMatrix LLC
407-625-4794, Email: Joe@ButlerMatrix.com

EDUCATION & LICENSES

MBA	University of Florida (2003) – Executive Masters in Business Administration
B.S. in Civil Engineering	Purdue University (1990) - Major: Construction Engineering & Management
Professional Engineer	Licensed Florida Professional Engineer (1997)
Licensed Contractor	Florida Commercial Building Contractor (1997) & Underground Utility Contractor (1998) – {Inactive}

EXPERIENCE

President – ButlerMatrix LLC (Program Management / Forensic Engineering), USA/Nationwide – April 2016 to Present

- City of Alexandria, VA Project Management for the $320M Potomac Yard Metro Rail Design-Build Project (2018 – Present)
- Design-Build Integration Management for Five Star Partners JV pursuit on DART's $900M Cotton Belt Project (2018)
- Design-Build Project Manager for the Green Line Partners JV on the +$1B MBTA Green Line Extension pursuit (2017)
- Design-Build Management consulting for Transurban USA - $400M 395 Express Lanes Project in VA (2016)

Design-Build Project Manager – Fletcher Infrastructure & Beca Ltd., Auckland, New Zealand – Aug 2014 to April 2016

- Design-Build Project Management of several Waikato Expressway Segments for the New Zealand Transport Agency
- Detailed Design Management for the Pacific Coast Highway, NSW, Australia, W2B(B) Section - $450M new highway

Contracts Manager - Dulles Corridor Metrorail Project, (www.dullesmetro.com) Washington, DC Metro - 2009 to Aug 2014

- Design-Build Project Management of a $6B, 23-mile metro rail extension, including 11 transit stations, segmental precast elevated guideways, NATM and cut & cover tunnels, maintenance yards, traction power, train control systems, bridges, and highways
- Department Manager responsible for all commercial negotiation and correspondence, leading a team of lawyers, architects, and engineers; successful in proactively navigating through +$1B in allowances, changes, and claims with no arbitration necessary
- Drafted and negotiated contracts including terms and conditions with senior management and outside legal counsel, including Program Management, GMP, Design-Build, GC, property, public utility, design services, and subcontractor agreements

Director of Business Development (Eurovia North America), Vinci ($40B/YR Contractor), France (www.vinci.com) - 2006 to 2009

- Directed due-diligence, project financial analysis, and negotiations for the acquisition of several +$100M heavy civil construction companies, new quarry developments, port facilities, shipping agreements, C&D landfills, asphalt plants, and concrete plants, Public-Private Partnership (PPP) proposals, joint venture, and teaming agreements

Design-Build Project Manager (Land Development) - Ginn Clubs & Resorts (Developer / Contractor), Florida, USA - 2003 to 2006

- Design-Build Project Management of +$1B multi-use resort developments, including clubhouses, food and beverage facilities, golf shops, tennis facilities, maintenance buildings, beach clubs, marinas, roads, bridges, underground utilities, highway interchanges, mass earthworks, wetlands, irrigation systems, beach restoration, and golf course construction. (e.g., www.tesoroclub.com)
- Managed property entitlement process with local, state and federal agencies to obtain approvals and permits
- Directed the work of several hundred craft workers per shift, hired and supervised contractors, consultants, and design firms
- Designed buildings, golf courses, roads, bridges, water, sewer, storm, grading, wetlands, shoring, dewatering systems, MOT plans, retention ponds, waste containment systems, pumping stations, cofferdams, concrete forming systems, and retaining walls

Design-Build Project Manager / Preconstruction Manager / Estimator / Project Controls / Engineer (NZ & USA) - 1990 to 2003

- Preconstruction Manager for large Design-Build golf clubhouse and golf course construction projects across the USA
- Obtained community project approval using design presentations and conceptual budgets that were later transformed into final plans and hard numbers through a managed "design to budget" process under a Guaranteed Maximum Price (GMP) contract
- Project Management and Estimating of civil and highway construction projects, office/warehouse/industrial buildings, reverse osmosis water plant, new water supply wells, a 3MG water tank, deep gravity sanitary, pump stations, force main installations, design-build waste transfer station, marinas, large earthworks, drainage, site development, specialized geotechnical ground improvements, rock blasting, bridges, asphalt and concrete road paving, structural concrete, piling, and dewatering systems
- Managed crews of several hundred craft workers per shift performing vertical and horizontal construction, directed means and methods, designed temporary works, led field survey crews, managed heavy equipment operation and maintenance programs, created and managed quality and safety programs, inspected work, initiated and closed-out construction permits
- Created integrated program schedules and budgets using historical costs, conceptual plans, and detailed estimates; cost analyses and trending; created real-time cost tracking systems based on work in place and cost to complete forecasts
- Mastered horizontal and vertical estimating techniques, including conceptual, hard bid, self-perform, parameter, and feasibility phase through construction; sales presentation to clients, identified markets and projects to pursue, reviewed take-off and production assumptions and managed the estimating department staff on both vertical and horizontal infrastructure and commercial buildings