

Potomac Yard Metrorail Station Concept Development Study



Technical Memorandum Analysis of Station Location Alternatives

May 15, 2009



a joint venture of:

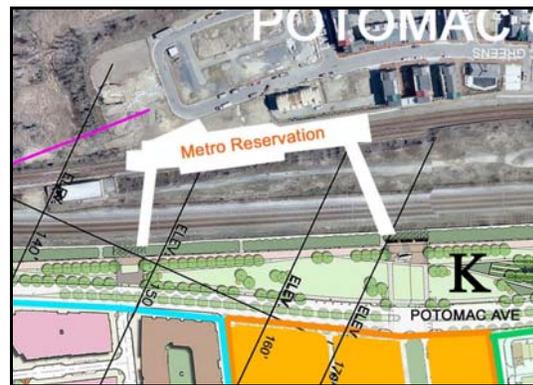
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Purpose of This Analysis

This analysis examined potential locations for a new infill Metrorail station at Potomac Yard. The analysis considered eight alternatives and addressed the station sites' relationship to planned and approved development in Potomac Yard and Potomac Greens, necessary modifications to Metrorail track and systems to accommodate a station at each site, and the estimated Metrorail construction costs. The resulting information was intended to assist the current planning efforts to select a site for a potential new Metrorail station.

Station Background

The construction of an infill station in Potomac Yard was anticipated when WMATA planned the Metrorail Adopted Regional System. At the time the Blue and Yellow Line tracks were built through the RF&P Railroad Potomac Yard, a station was not justified, but Metrorail planners recognized the potential for the yard's future development. They identified the site for a station to be added later, and the tracks there were designed to accommodate a station that would meet WMATA's design criteria. The *Final Environmental Impact Statement, Metropolitan Washington Regional Rapid Rail Transit System*, August 1975, cites the provision for this future station. The City of Alexandria subsequently acquired land at this site, now called the reserved site, shown in Figures 1 and 2.



Figures 1 and 2: Reserved Station Site

Since then, several planning and development efforts have discussed a Potomac Yard Metrorail station. In the mid-1980s, the Alexandria 2020 plan included the addition of a station and proposed approximately 16 million square feet of mixed-use development for Potomac Yard. The plan was not formally submitted to the City of Alexandria for approval. A 1997 station study by the then-owner of the yard developed conceptual designs for three alternative station sites at and slightly east and west of the reserved site. While the current zoning approvals for Potomac Yard do not require the construction of a Metrorail station, the approvals did require the reservation of land for a potential station.

In addition, the existing zoning approvals require the property owners to participate in a special tax district to assist in financing station construction.

In 2008, the City of Alexandria created a 20-member Potomac Yard Planning Advisory Group (PYPAG) to evaluate land use density and zoning for Landbays F and L. A basic principle of the group is that any redevelopment for Landbay F should be transit-oriented, mixed-use, and urban development. In addition, the City created a five-member Metrorail Station Feasibility Work Group comprising the mayor and one member each from the City Council, the Planning Commission, the Transportation Commission, and the Potomac Yard Planning Advisory Group. The work group was established to evaluate the technical elements related to a potential Metrorail station.

Transit-Land Use Relationship

A general smart growth and transit-oriented development principle is that higher density and a balanced mix of uses should be located within close walking and commuting distance of a transit station. Therefore, this analysis of alternative station sites considered possible density and uses within the commonly accepted walking distances of a quarter mile and a half mile from a Metrorail station. Transit ridership is also greatly influenced by factors such as an appropriate mix of uses (office, residential, and retail), density, parking policies, pricing and rider subsidies, connectivity, and the quality of the pedestrian realm. The planning currently being conducted through the PYPAG addresses these factors.

There are challenges to locating a Metrorail station close to development in Potomac Yard. Approximately half the land within a quarter mile of most of the alternative station sites cannot be developed due to such constraints as environmental characteristics and the presence of railroad tracks and National Park Service property, shown in Figure 3. A Federal Aviation Administration (FAA) flight path restriction on much of the central portion of the yard, shown in Figure 4, limits building heights to approximately 100 feet. The CSX railroad line separates the Metrorail tracks from the western portion of Potomac Yard, requiring a pedestrian bridge to the station and adding 200 feet to the station access distance.

Figure 5 shows the Potomac Yard Concept Plan. Table 1 lists the development maximums permitted by the current Coordinated Development District (CDD) zoning for Potomac Yard and Potomac Greens, including the existing retail center.

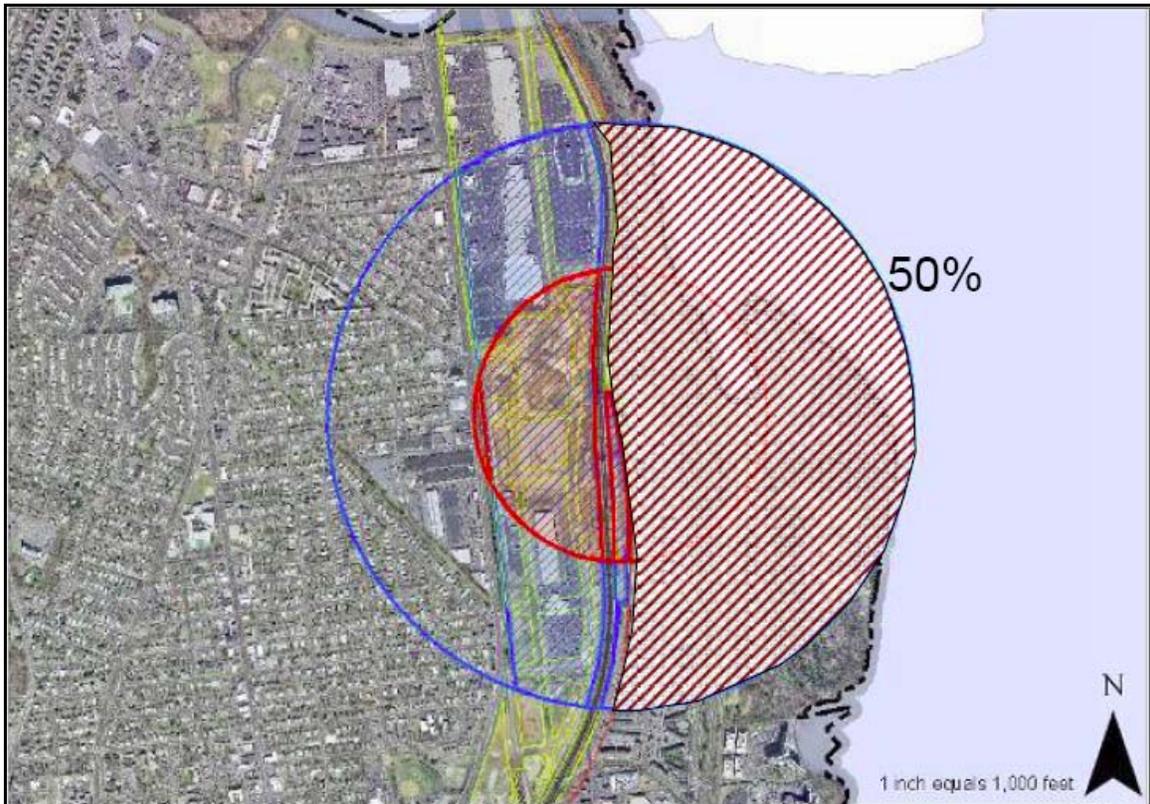


Figure 3: Development Limitations in Station Vicinity

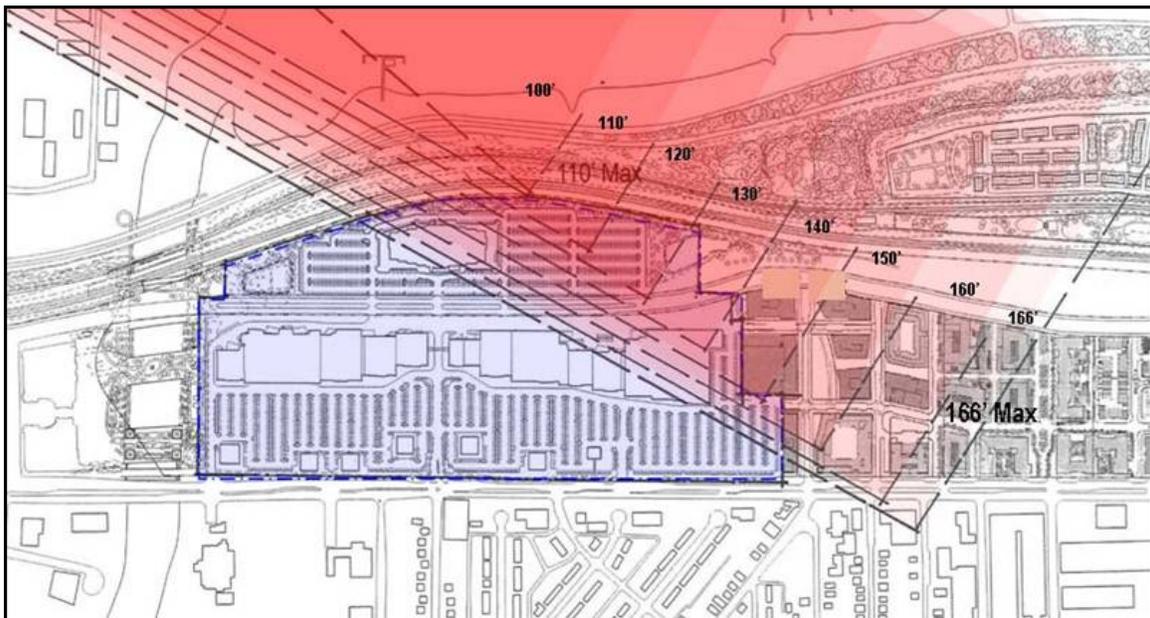


Figure 4: FAA Height Restrictions

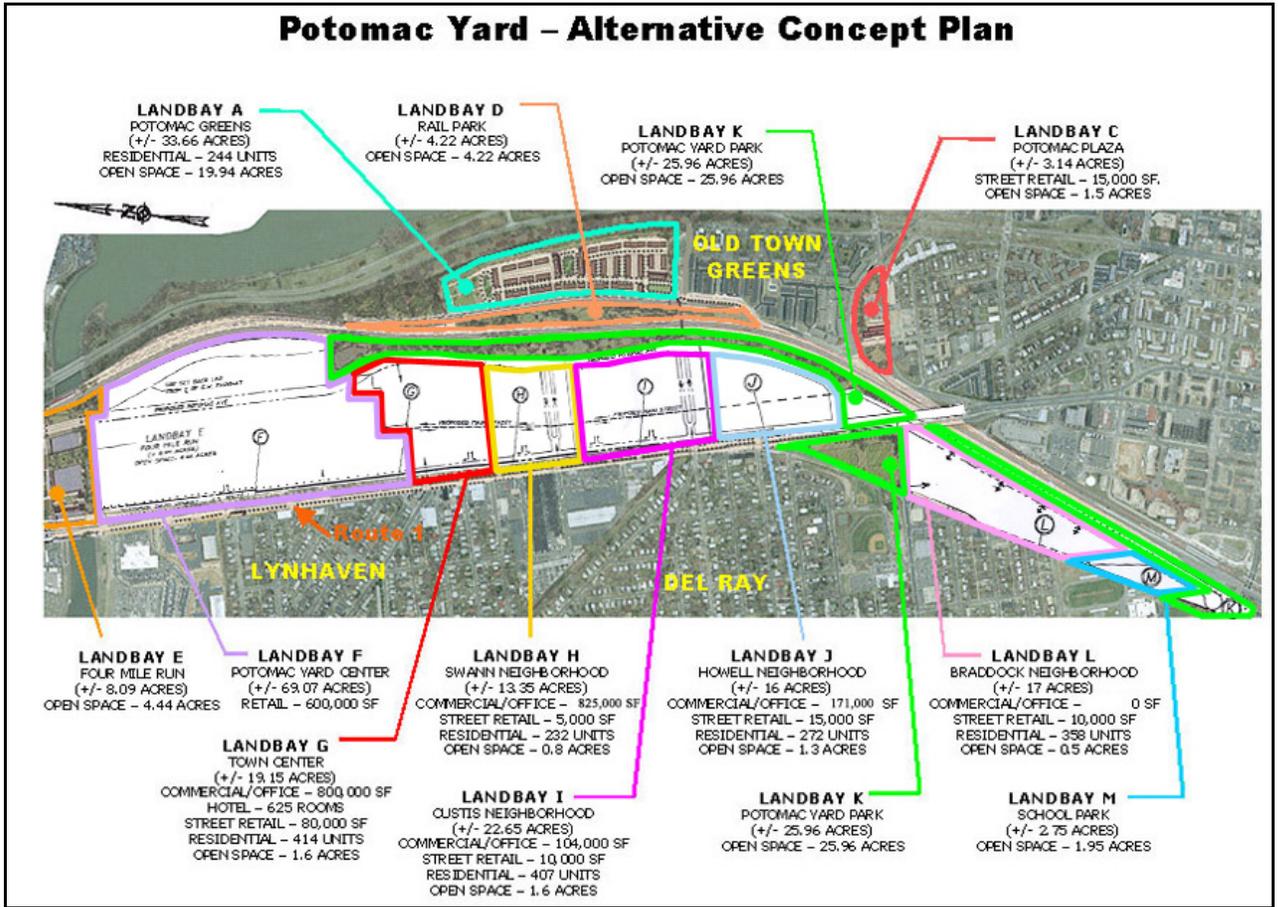


Figure 5: Potomac Yard Concept Plan

Table 1: Development Maximums

Use Maximums per Current CDD:

Landbay	Residential (Units)	Office* (sf)	Retail (sf)	Hotel (rooms)
F	0	0	600,000	0
G	414	800,000	80,000	625
H	232	825,000	5,000	0
I	407	104,000	10,000	0
J	272	171,000	15,000	0
L	358	0	10,000	0
TOTAL	1,683	1,900,000	720,000	625

* Office use can be converted to retail use with City Council approval through the DSUP process

The existing retail center in Landbay F contains approximately 600,000 square feet of retail, which is the maximum amount of development permitted with the existing zoning. Therefore, any additional density will require a rezoning of the site and associated approvals. The PYPAG has discussed a potential floor-area ratio of approximately 2.5.

Metrorail Design Requirements

A new station at any location must comply with WMATA's adopted Metrorail design criteria. If a station is built at a site other than the reserved site, the Metrorail tracks and systems would have to be modified to comply with the design criteria as well. Complying with the design criteria would require more construction at some sites than at others, and the extent of construction would affect the cost of each alternative. The design criteria define the Metrorail system characteristics in great detail; criteria that most directly affect decisions about station location are described below.

Station

The design criteria address a variety of station characteristics, including safety, capacity, ADA-compliant accessibility, architectural and aesthetic qualities, operating economy, maintainability, and commonality among system components. The station platform must be 600 feet long, the same as all Metrorail stations, to accommodate an eight-car train.

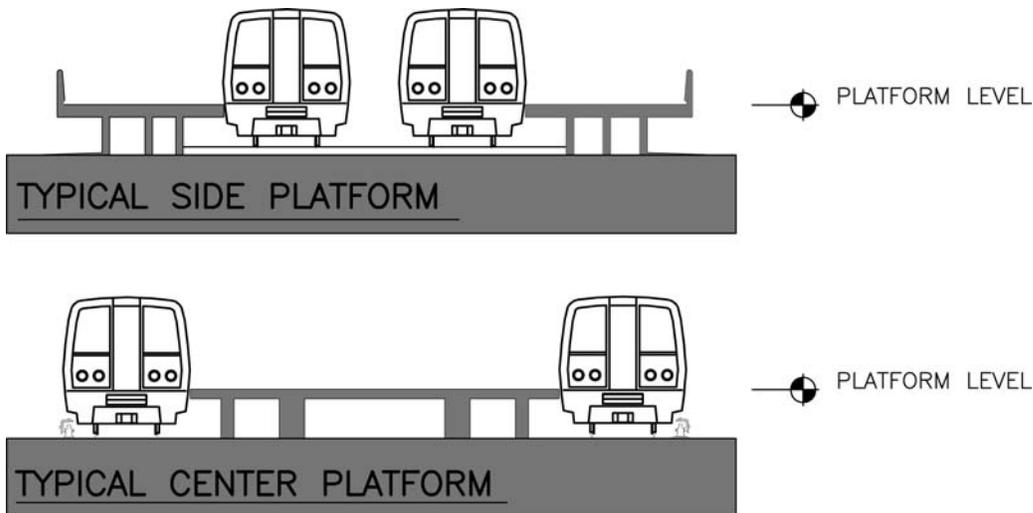


Figure 6: Metrorail Station Types

Depending upon the characteristics of the station site, a station can have a single center platform between the tracks or a pair of side platforms on the outside of the tracks; Figure 6 illustrates both types. Elevators, escalators, and stairs must meet capacity and safety requirements for vertical circulation, and redundant elevators are required to ensure accessibility when one elevator is out of service. A center-platform station requires fewer elevators, escalators, and stairs than a side-platform station, imposing lower costs for both construction and operation, but a center-platform station requires more space for the tracks to spread apart to pass on either side of the platform. Space in the station must provide not only for passenger circulation but also for Metrorail operating system equipment and station maintenance functions. A station in a tunnel would require air-conditioning, ventilation, and fire-protection systems to meet standards and codes.

Tracks

The tracks through a station must be straight, a condition called tangent track. Tracks cannot be curved at a station because the platform edges would need to be set back to clear the rail cars, creating safety concerns because of the resulting wide gap between the platform edges and rail car doors. The tangent track must be 730 feet long at a station; 600 feet for the platform plus 65 feet at each end to provide proper alignment of trains entering and leaving the station.

Any new Metrorail tracks or existing-track modifications to accommodate a station must comply with design criteria for track grade and curvature. The maximum acceptable grade is 4 percent, a rise or fall of 4 feet for every 100 feet of track. The minimum acceptable curve radius is 1,000 feet, which allows a train speed limit of 45 miles per hour though the curve, the lowest speed limit allowed in the Metrorail system. Every connection between a tangent and a curve is a spiral, a gradual track transition from straight to curved track. These design criteria are based upon safety and rider comfort.

A double crossover, an X-shaped track connection between the two running tracks that would allow trains to move from one track to the other, would need to be added north of a new station. This crossover would be needed to maintain Metrorail operations during station construction and would provide operational flexibility.

Metrorail Operating Systems

The addition of a station would require modifications to the systems that support Metrorail train operations. Trains accelerating from a stop at the station would increase the required traction power for the electric motors that propel the trains. Upgrades to the DC traction power system would include the addition of a supplemental rectifier-transformer unit to the existing traction power substation to serve a station at a nearby site; a new traction power substation would be needed to serve a station farther away. New composite contact rail (the third rail) would be installed, replacing steel contact rail where necessary.

The automatic train control system (ATC) would require changes and additions to accommodate any necessary track realignment and to implement programmed stops at the station. Ductbanks will be required for cabling to integrate the new equipment circuits into the existing system. Wayside signals, switch machines, speed command loops, and interlocking control equipment will be required to operate trains through the new double crossover.

A new station would need several communications systems for operations and customer safety, including modifications to the carrier transmission system, a public address system, a fire and intrusion-detection system, and closed-circuit television systems for surveillance.

Construction Sequence

The steps in station construction are extremely important for an infill station. Because construction of the new station and any connecting tracks would be near operating trains, the potential would exist for this construction to affect Metrorail operations. Safety must be ensured, and major service disruptions are not acceptable, so the station and tracks must be designed to be built without interfering with regular Metrorail operations.

Building a station directly on operating Metrorail tracks would impose specific construction requirements. Construction activities immediately adjacent to an operating Metrorail line are typically limited to nonrevenue hours to eliminate the possibility of construction activities damaging trains and causing injuries to riders. Enforcing this limitation on Potomac Yard station construction would raise costs considerably because construction could occur for only a short time each night. To avoid this constraint if the station is built directly on the operating tracks, trains would single-track through the station site during construction. Trains in one direction would cross to the opposite track, trains in both directions would use the same track, and construction activities could then proceed relatively uninhibited adjacent to the now-unused track. Single-tracking would begin at 8:00 p.m. and continue until closing for five nights a week for the duration of construction. The period of time prior to closing plus the nonrevenue period after closing would provide a standard eight-hour work window.

Night-time construction is more expensive because it typically requires payment of a shift differential, and it would create noise, lighting, and other impacts on nearby residences and businesses. During the periods when trains would be single-tracking, train frequency would be reduced. Some steps in the construction sequence would require shutting down Metrorail operations through this rail segment, but each closure would be limited in duration to a weekend and would not be permitted on consecutive weekends.

Building a station on a new parallel track segment would be less disruptive. Because construction activity would not be directly adjacent to trains, operations would be less affected. The station could be built during daytime hours, allowing lower construction costs and avoiding night-time construction impacts. Some Metrorail operations changes and closures would still be necessary at the point when the new track segment would be connected to the existing tracks; their type and extent would depend upon the construction necessary to accomplish the connection in a specific design.

Potomac Yard Station Context

The Potomac Yard station would have specific requirements created by the immediate physical setting. The ability to expand the station site or realign the Metrorail tracks is constrained by the CSX freight railroad tracks on the west and National Park Service land and the Potomac Greens neighborhood on the east.

An alternative in which the station or tracks would extend beyond the present Metrorail right-of-way and City-owned land could require the acquisition of additional property. Property ownership is shown in Figure 7. Some properties will require a full title search to determine the ownership. In the area where the National Park Service easement applies, no improvements may be constructed and no clearing, grading, or tree removal may be done without National Park Service approval. The easement allows for limited uses including passive recreational activities and some active recreational facilities, also subject to National Park Service approval. The easement would not allow the construction of a Metrorail station unless the easement is amended by the National Park Service in conjunction with the City of Alexandria.

Using land for a station or tracks where development is approved could require compensating the land-owner for foregone development opportunities. In Landbay F, where planning and a potential rezoning are underway, dedication for a future Metrorail station and associated rail lines could be required as part of the planning process. Using parkland would be problematic, especially if federal funds are used, as parkland may be used for a federally funded transportation project only if no prudent and feasible alternative exists. A new station would affect open space and program uses in the previously approved plans for Potomac Yard landbays; the effects would depend upon the station location and design.

Access from the west to a station built on the existing tracks must be by a pedestrian bridge that would have to be high enough to provide at least 23 feet of clearance over the CSX tracks. Any new Metrorail tracks that crossed above the CSX tracks would have to provide the same clearance.

The existing traction power substation between the Metrorail tracks and the CSX tracks is a necessary Metrorail system facility to provide electric power to the trains. If realigning the Metrorail tracks required removing the substation, a replacement substation would need to be built nearby.

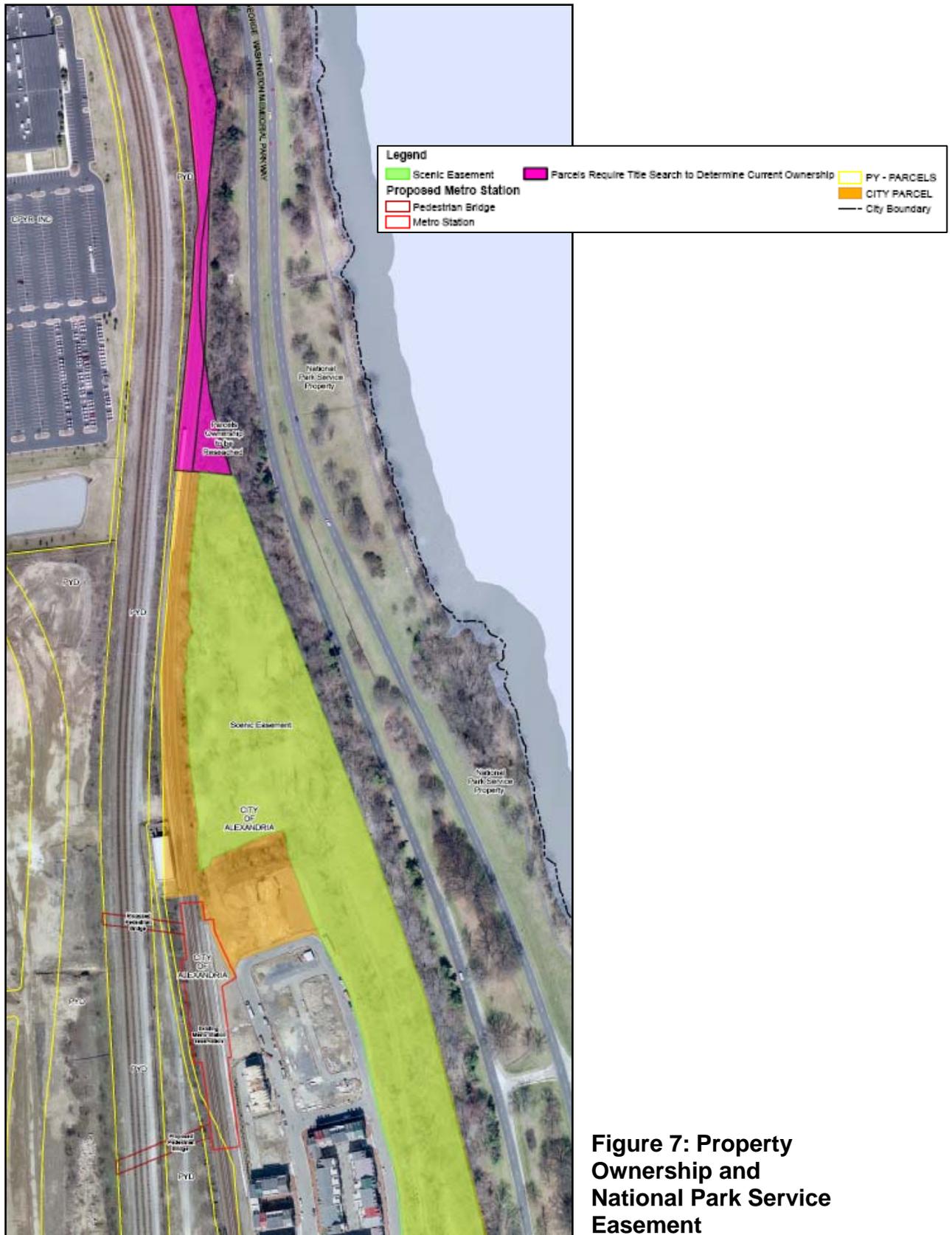


Figure 7: Property Ownership and National Park Service Easement

Capital Cost Estimates

The alternatives' capital costs were estimated in 2012 dollars, assuming that 2012 would be the midpoint of construction. Capital costs will be a function of the type and extent of construction necessary, not only for the station but also for necessary track modifications and changes and additions to Metrorail systems. Capital cost estimates developed in this analysis are order-of-magnitude and concept-level because detailed designs have not yet been prepared. Cost estimates are expressed here as ranges and include contingency factors because they are conceptual and based upon general concepts.

These cost estimates are based upon recent rail transit system construction costs nationally as well as construction costs in the Washington, DC metropolitan area. The cost estimates include all construction-related costs from project inception through completion, including planning, design, engineering, construction management, and station commissioning. The costs estimates do not include land acquisition, major utility relocation, permits, fees, financing, or costs imposed by unforeseen conditions, such as geotechnical conditions or hazmat remediation.

Alternative Station Sites

Figure 8 shows the eight alternatives considered for the station and track alignment. Several alternatives would be on or near the present Metrorail track. Others would be in Landbay F, requiring new tracks that would diverge from the existing tracks.

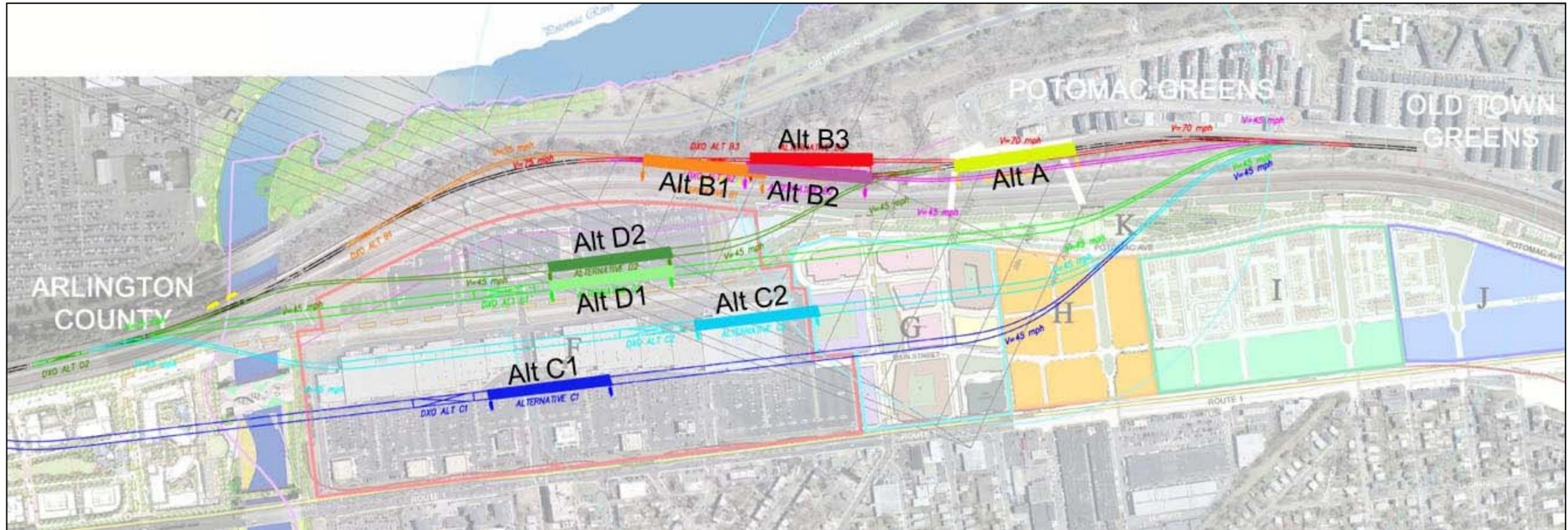


Figure 8: Alternative Station Sites

Existing Reserved Station Site—Alternative A

In Alternative A, shown in Figure 9, the station would be located at the reserved site. This site is on the existing Metrorail tracks east of the boundary between Landbays G and H.

The nearly complete 227-acre Potomac Greens townhouse development is located east of the site. To the south and west of the reservation is the approximately four-acre Rail Park, Landbay D. Landbays G, H, and K are located to the west of the existing reservation. Figure 10 shows the land use within the station site's watershed and Table 2 lists its characteristics.

The reservation was designed to be accessed primarily from the west but can also be accessed from the east. City-wide bus service and kiss-and-ride access would be on the west side of the station, and local bus service would use Potomac Greens Drive on the east.

The station would be a side-platform station, and an overhead walkway would provide access across the CSX tracks. Figure 11 shows a potential station concept. A station entrance pavilion would be on each side of the station with elevators and escalators providing access to the overhead walkway. The west station entrance and the associated circulation, including ramps, elevators, and escalators, would be built within Landbay K, the nearly 24-acre linear park along the eastern edge of Potomac Yard. The station entrance and possibly a bus loading area and Kiss & Ride would need to be incorporated into the Landbay K park plan. To reach the station from the west, a Metrorail rider would have the challenge of walking across the four-lane Potomac Avenue, Landbay K, and a pedestrian bridge over the CSX railroad, a distance of almost 400 feet.

Alternative A would require the least modification of the existing Metrorail facilities because some provisions were made for a station at this site. Additional traction power equipment would be needed in the existing traction-power substation, and additional train-control equipment would need to be installed.

Because the station would be built on the operating Metrorail line, trains on the Blue and Yellow Lines would single-track through the station site from 8:00 p.m. to closing five nights a week for the duration of construction. To allow single-tracking, the first step in the project would be the installation of a new double crossover north of the station site. The installation of the double crossover, the only necessary track modification in Alternative A, could be done by closing the Metrorail line over a weekend.

The Alternative A capital cost is estimated to be **\$140 million to \$180 million** in 2012 dollars.



Figure 9: Existing Reserved Station Site—Alternative A

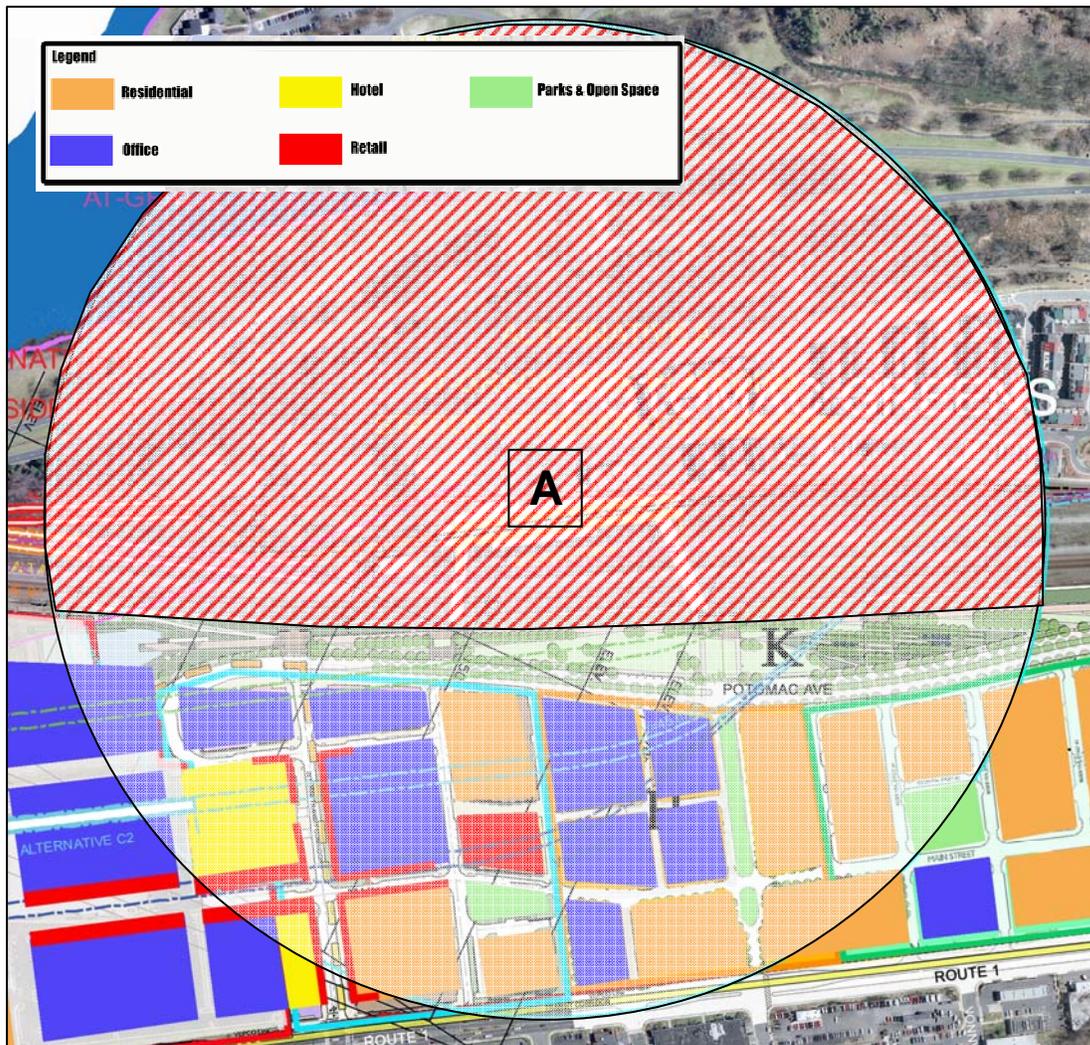


Figure 10: Alternative A Land Use Analysis

Table 2: Alternative A Land Use Analysis

Analysis	Office (%)	Residential		Other (%)	Total sf (millions)
		(%)	Units		
Quarter mile	49.0	34.0	775	17.0	3.5
Half mile*	23.0	66.0	2,953	11.0	6.6
Total	32.0	55.0	3,728	13.0	10.1

* Excludes quarter mile

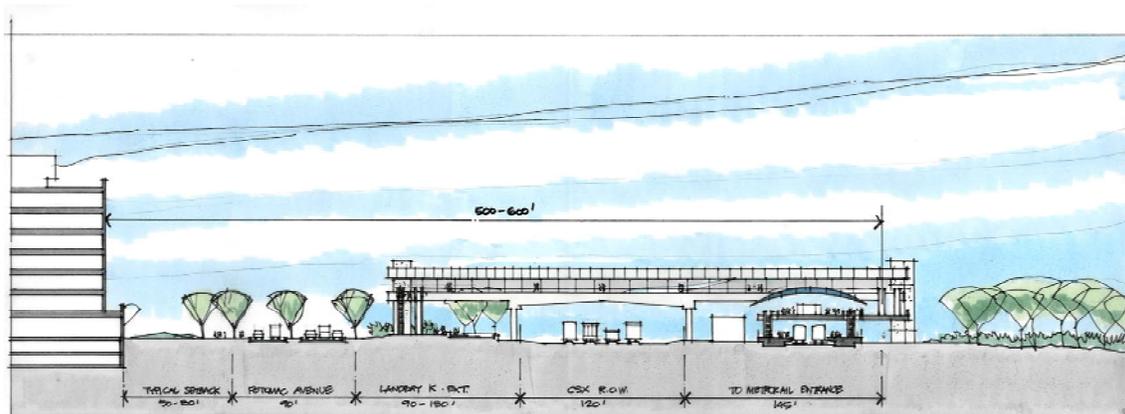


Figure 11: Station Concept

Northern Station Sites—Alternatives B1, B2, and B3

To enable additional density within the quarter-mile and half-mile walking distances of the station, three alternatives farther north along the Metrorail tracks, shown in Figure 12, were considered. A station site farther north would capture more density approved for Landbays G and H and planned in Landbay F as compared to the existing reservation site.

The northern alternatives would also serve a larger land area that is outside the flight path with its associated height restrictions. However, the northern alternatives would be less accessible to the residential area to the east. Figure 13 shows the land use within the Alternative B station site's walkshed and Table 3 lists its characteristics.

These alternatives would present an opportunity to reduce the distance between the station and the density in Potomac Yard. As illustrated in Figure 14, a westward inflection could be created in Potomac Avenue, allowing new mixed-use development between the avenue and the CSX right-of-way. This development would incorporate a station entrance and anchor the western end of the pedestrian bridge over the CSX tracks, providing a direct and convenient linkage. The open space of Landbay K (extended) could wrap around both the east and west sides of the station development site, offering a greenway to the east and an active urban experience to the west.

The configuration of a station at the northern locations would be similar to the Alternative A station—a side-platform station with an overhead walkway to the west over the CSX tracks. A station entrance pavilion would be on each side of the station with elevators and escalators providing access to the overhead walkway. As in the Alternative A station, the west station entrance and the associated circulation would be built within Landbay K. The station entrance and possibly a bus loading area and Kiss & Ride would need to be incorporated into the Landbay K park plan. A new double crossover would be installed farther north, and additional traction power and train control equipment would be needed.

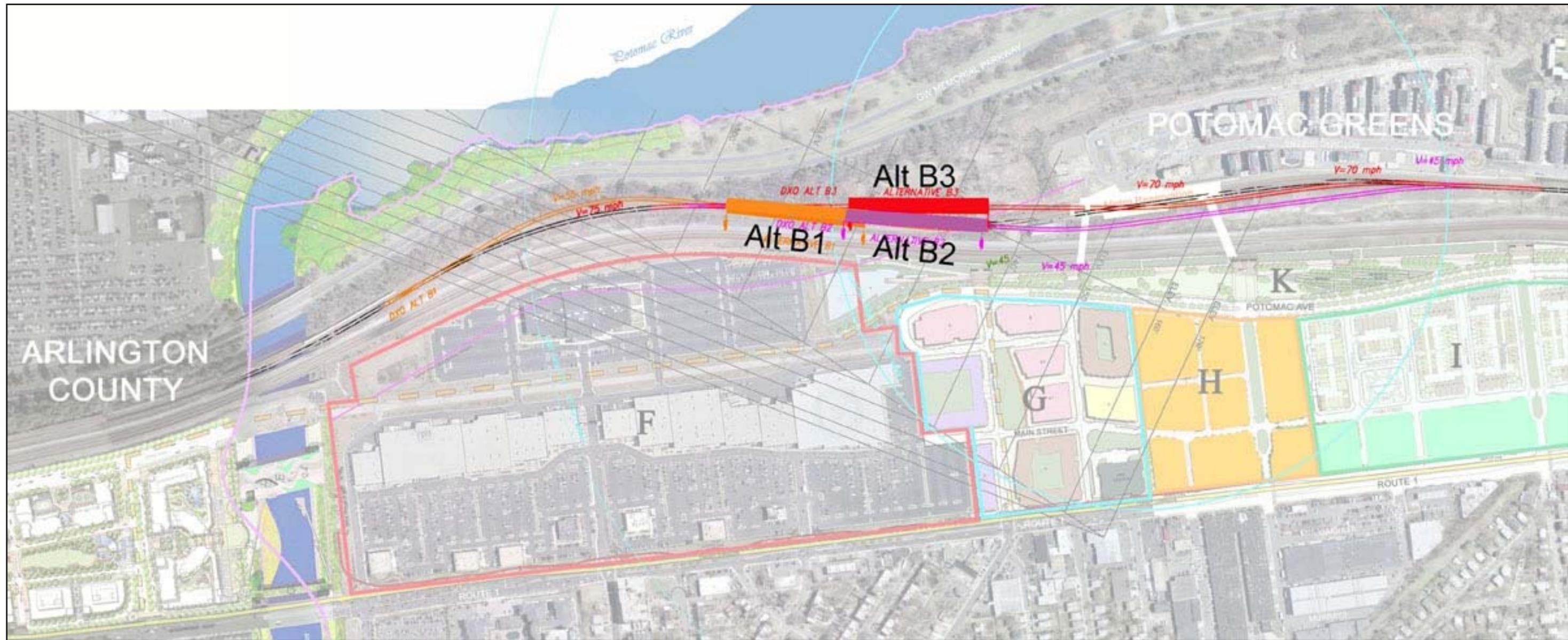


Figure 12: Alternative B Station Sites

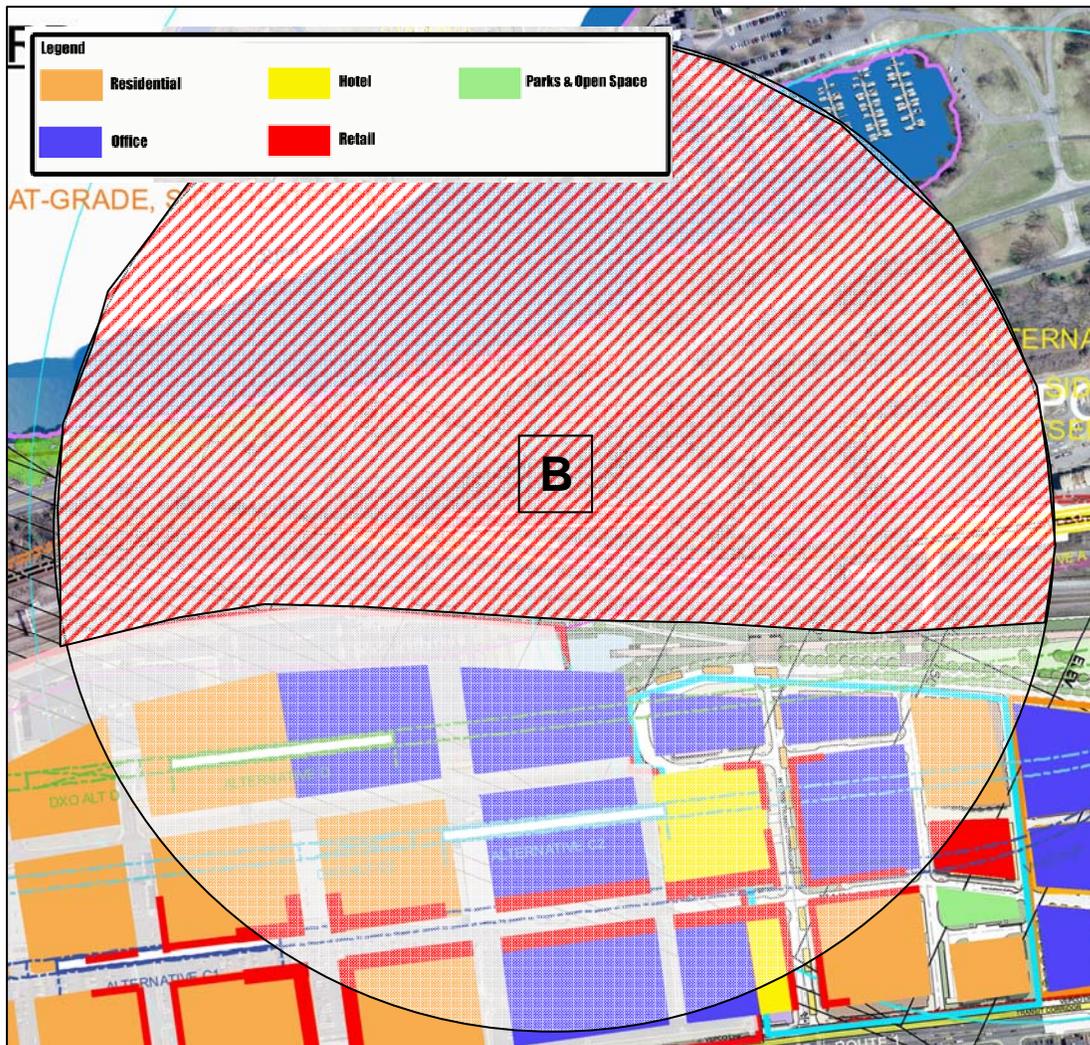


Figure 13: Alternative B Land Use Analysis

Table 3: Alternative B Land Use Analysis

Analysis	Office (%)	Residential		Other (%)	Total sf (millions)
		(%)	Units		
Quarter mile	43.0	37.0	1,376	20.0	5.6
Half mile*	9.8	85.0	4,416	9.8	8.2
Total	23.0	63.0	5,792	14.0	13.8

* Excludes quarter mile

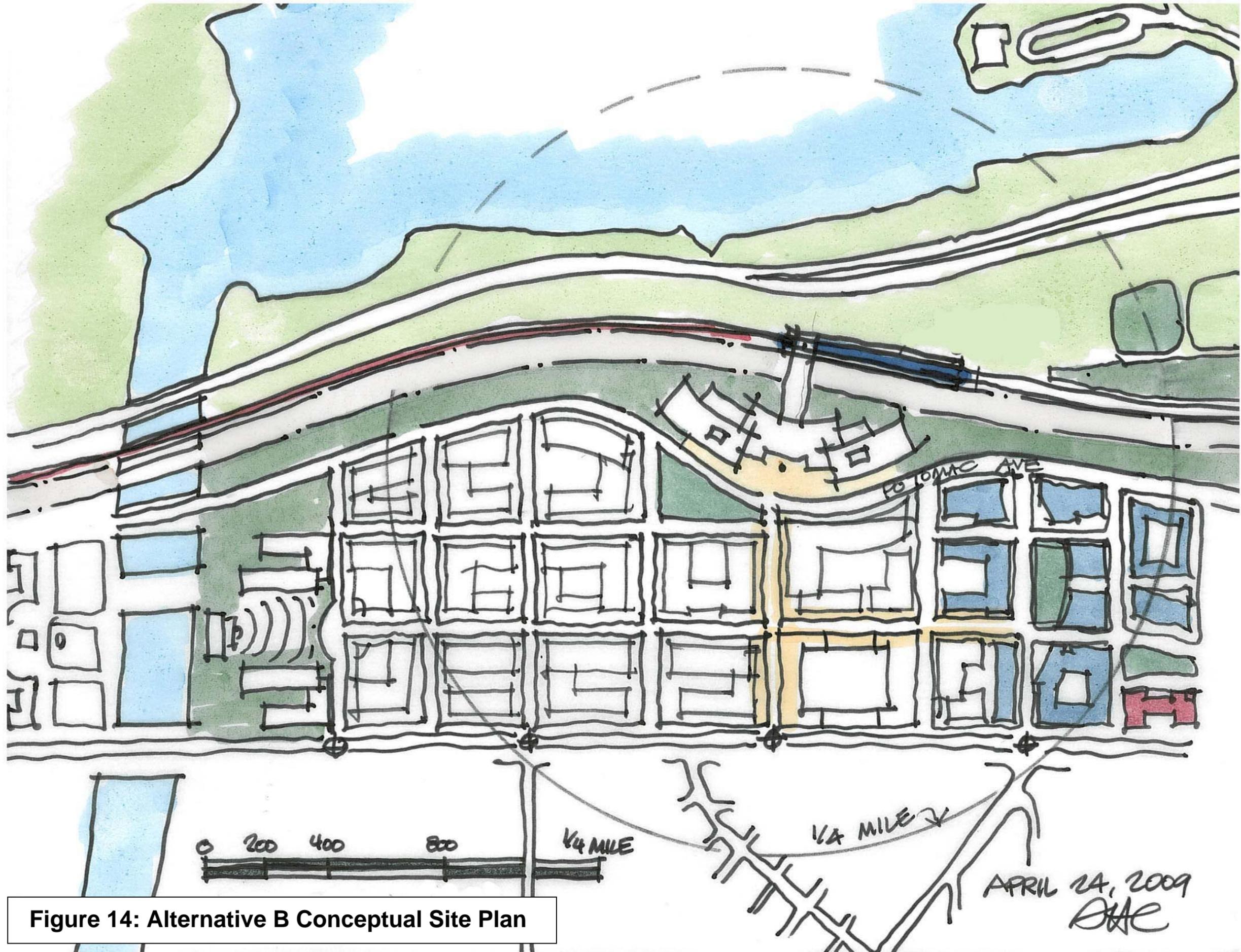


Figure 14: Alternative B Conceptual Site Plan

Because the northern sites were not designed to accommodate a station, the existing Metrorail tracks would require modification. Depending upon the exact track alignment, additional right-of-way and the construction of new retaining walls could be needed. Longer walkways would be required between the station and Potomac Greens Drive.

Alternative B1

The station in Alternative B1 would be 1,600 feet north of the Alternative A site. The existing tracks curve where the station would be located, so the tracks would need to be realigned to create a 730-foot tangent. A tighter track curve would have to extend eastward north of the station to meet the track design criteria, and new right-of-way would need to be acquired from the National Park Service where the new curved track would be built. Because of the impacts on the National Park Service property, this is not a viable alternative.

Alternative B2

Alternative B2 was developed to avoid impacts to National Park Service land identified in Alternative B1. Avoiding the impacts would locate the station about 950 feet north of the Alternative A site.

The Metrorail tracks would be shifted westward closer to the CSX tracks. Three or more acres of land that is now inaccessible because it is between the Metrorail and CSX rights-of-way would become easily accessible from Potomac Greens and the wetlands walkway to the north.

The existing tracks would need to be realigned to create a 730-foot tangent. This alternative would require the construction of about 3,000 feet of new track west of the existing Metrorail tracks. The realigned tracks would pass through the location of the existing traction power substation, requiring the construction of a new substation before any other construction could occur and adding to the construction cost. A new double crossover would then be installed north of the station site to allow creation of the same work window as for Alternative A.

The Alternative B2 capital cost is estimated to be **\$150 million to \$200 million** in 2012 dollars.

Alternative B3

Alternative B3 would be a new track segment built to straighten curves on the existing tracks. The new track would allow the station to be about 1,250 feet north of the Alternative A site.

This alternative would require the construction of about 3,000 feet of new track, but it would have a distinct construction advantage—the station would be built on tracks that

were not carrying trains during the station construction. Potential Metrorail operations disruptions would be less than in Alternative A or Alternative B2, and construction would be more or less unimpeded, improving construction efficiency and reducing costs. After the station was built, the new tracks would be connected to the existing ones. To accommodate the new tracks, additional right-of-way would be needed on the east side of the existing right-of-way.

The Alternative B3 capital cost is estimated to be **\$140 million to \$180 million** in 2012 dollars.

Landbay F Tunnel Station Sites—Alternatives C1 and C2

A station in the middle of Landbay F would be closest to the highest amount of development. Two underground station sites in a new Metrorail tunnel in Landbay F, shown in Figure 15, were analyzed.

New buildings could be directly adjacent to the station. Much of Landbay F is not subject to the FAA flight path restriction and could be planned for higher densities; the amount of additional density above the 2.5 floor-area ratio discussed by the PYPAG will require additional analysis. Landbay G would still be within the quarter-mile walkshed, and Landbay H would still be within the half-mile walkshed. Although access from the east would be challenging, the station would be more accessible to properties and neighborhoods west of Route 1.

Figure 16 shows the land use within the Alternative C station site's walkshed and Table 4 lists its characteristics. The development on Landbay F was assumed to be the same in both amount and distribution for all alternatives and does not account for likely density increases for alternatives located in the main body of Potomac Yard.

Locating a station in Landbay F would allow a segment of the existing Metrorail tracks to be removed and the existing right-of-way used to substantially increase the buffer between new development and the George Washington Parkway. The new development would also be farther from the parkway, reducing its perceived impact to the parkway. Virtually all of Landbay F would be within a quarter-mile walkshed, and Landbays G and H would be within a half-mile walkshed.

In each alternative, the Metrorail tunnel would run across part of Landbay F beneath one of the north-south streets to be built there, similar to the Metrorail tunnels beneath streets in other urban centers in the region. The station would be a below-grade, center-platform station, and station entrances could be incorporated into nearby buildings. There would be flexibility in station design because it would not be constrained by the existing Metrorail track configuration. The station could be farther north or south along the tunnel beneath Landbay F to create the best connections to new development.

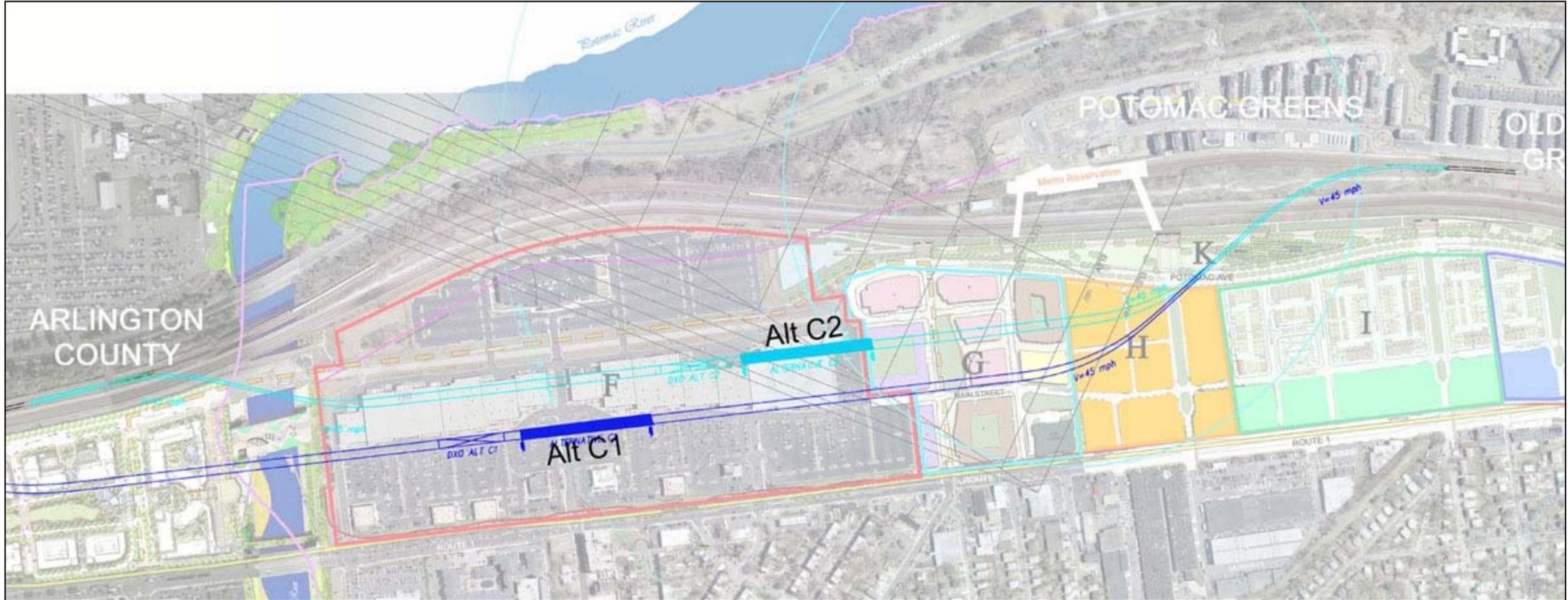


Figure 15: Alternative C Station Sites

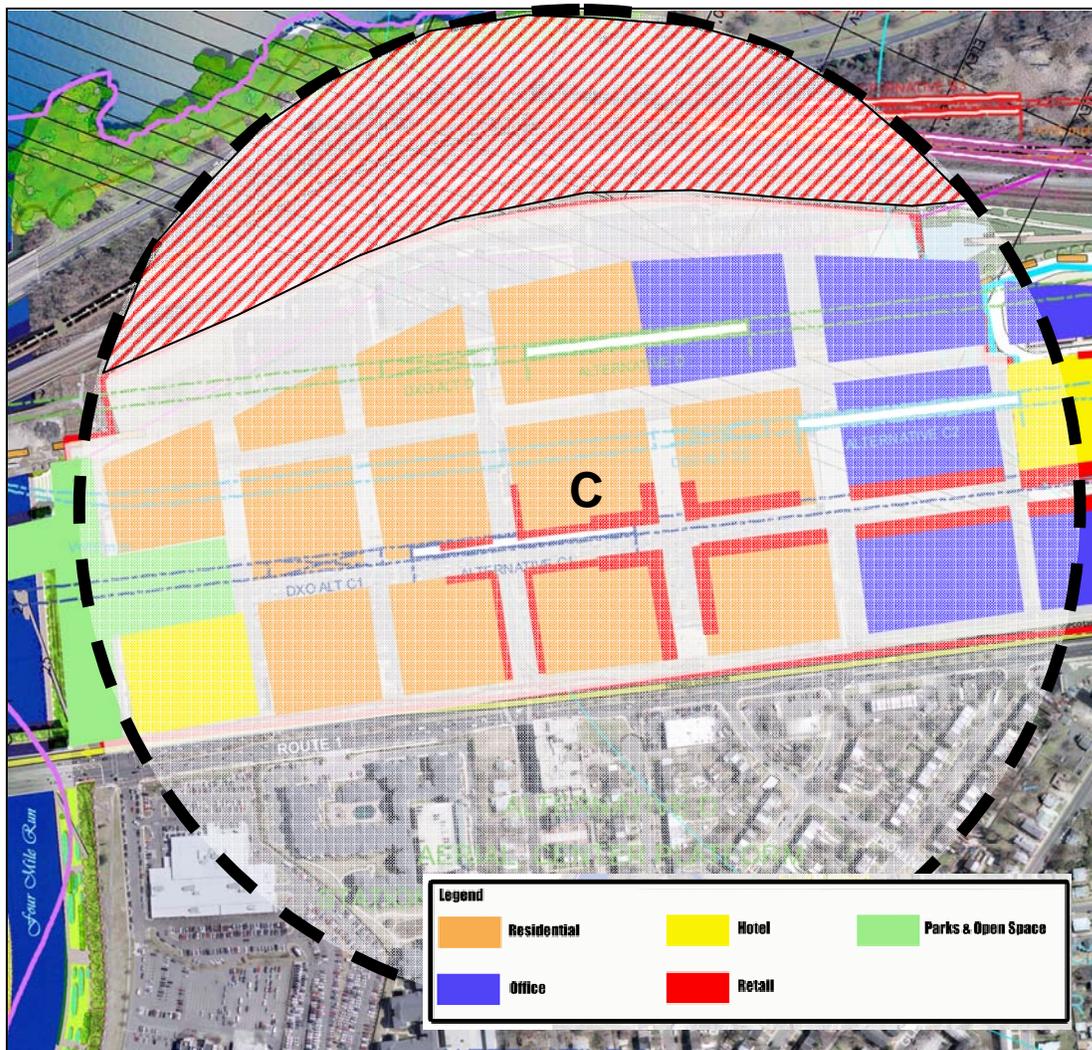


Figure 16: Alternative C Land Use Analysis

Table 4: Alternative C Land Use Analysis

Analysis	Office (%)	Residential		Other (%)	Total sf (millions)
		(%)	Units		
Quarter mile	15.0	70.0	4,750	15.0	10.1
Half mile*	44.0	40.0	1,393	16.0	4.3
Total	24.0	61.0	6,143	15.0	14.4

* Excludes quarter mile

The tunnel alternatives would require extensive construction. New Metrorail tracks would have to be built from north of Four Mile Run to the existing tunnel section near the south end of Potomac Yard, a distance of approximately 1.65 miles. The new tracks would have to cross above the CSX railroad tracks twice on aerial structures. North of Four Mile Run, the existing aerial Metrorail track structure would have to be modified and a new structure would be built to carry the Metrorail tracks over the CSX tracks, Four Mile Run, and Landbay E. Modifying the existing structure would require taking the Blue and Yellow Lines out of service for an extended period of time. A tunnel portal would be built in Landbay F where the tracks would come down to grade and enter the new tunnel. At the south end of Landbay F, another portal would be built in Landbay G where the tracks would come up to grade and rise onto a new structure over Landbay K and the CSX tracks. This structure would displace planned recreational facilities such as the regional playground, create approximately a thousand feet of shadow over Landbay K, and reduce future opportunities for Landbay D, Rail Park. Since the existing traction power substation is too far from the station site to provide the required power, a new traction power substation would be required in this alternative. The new substation could be located in one of the new buildings near the station.

To avoid disruption to the development in Landbay F, the tunnel and station should be built before the new streets and buildings, which could complicate the development schedule. The southern tunnel portal and aerial tracks in Landbays G, H, and K would require modifications to the planned and approved development there.

Alternative C1

Although the central segment of Alternative C1 would be in a tunnel, the northern segment would be an aerial Metrorail track structure through the recently built buildings north of Four Mile Run. This would create unacceptable impacts, and Alternative C1 is not a viable alternative.

Alternative C2

To avoid Alternative C1's negative impacts, the Alternative C2 tunnel and station would be farther east in Landbay F, allowing the new structure carrying the Metrorail tracks over the CSX tracks and Four Mile Run to diverge from the existing structure farther south and avoid existing buildings. However, as currently defined, this option would still significantly impact planned and approved development in Landbays G, H, and K.

The Alternative C2 capital cost is estimated to be **\$410 million to \$520 million** in 2012 dollars. This estimate includes the tunnel, the station, connecting tracks and supporting structures to the north and south, the traction power substation, and the necessary Metrorail operating system modifications. This estimate does not include any costs to modify the development in Landbays G, H, and K to accommodate the tunnel portal and aerial Metrorail tracks.

Landbay F Aerial Station Sites—Alternatives D1 and D2

Two alternatives that would include an aerial Metrorail line and station in Landbay F were also analyzed. These alternatives, shown in Figure 17, would also be close to the highest amount of development but would not have the high cost of tunnel construction.

An aerial Metrorail line would be built farther east in Landbay F than the line in Alternative C. Figure 18 shows the land use within the Alternative D station sites' walkshed and Table 5 lists its characteristics.

Locating a station in Landbay F would allow a segment of the existing Metrorail tracks to be removed and the existing right-of-way used to substantially increase the buffer between new development and the George Washington Parkway. The new development would also be farther from the parkway, reducing its perceived impact to the parkway. Virtually all of Landbay F would be within a quarter-mile walkshed, and Landbays G and H would be within a half-mile walkshed.

Alternative D would have the same advantages as the Alternative C tunnel stations resulting from location within Landbay F—a segment of the existing Metrorail tracks would be removed and the existing right-of-way would be used to increase the buffer between new development and the George Washington Parkway. Virtually all of Landbay F would be within a quarter-mile walkshed, and Landbays G and H would be within a half-mile walkshed. Like the Alternative C station, there would be flexibility in station design, and the station could be located farther north or south. Access to a new aerial station could be through adjacent buildings, potentially creating opportunities for integrating new interior public spaces with retail related to the station entrances. Access from Potomac Greens would be by the previously planned pedestrian bridge located adjacent to Landbay G.

This alternative would also require extensive construction. As in the tunnel alternatives, new Metrorail tracks would have to cross above the CSX railroad tracks twice. At the north end, new structure would carry the Metrorail tracks over the CSX tracks, over Four Mile Run and Landbay E, and into Landbay F. At the south end, the aerial structure would have to connect to the existing tunnel segment. As in Alternative C, this aerial structure at the south end of the new tracks would displace planned recreational facilities such as the regional playground, create approximately a thousand feet of shadow over Landbay K, and reduce future opportunities for Landbay D, Rail Park. Since the existing traction power substation is too far from the station site to provide the required power, a new traction power substation would be required, possibly in one of the new buildings near the station.

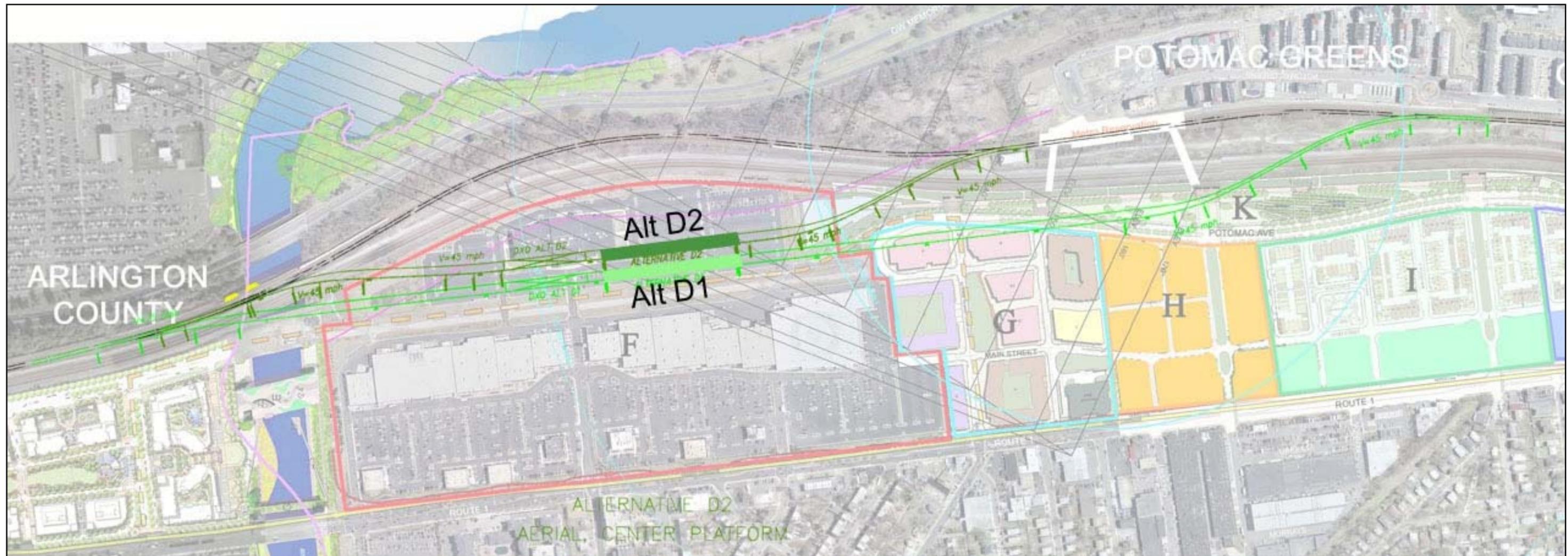


Figure 17: Alternative D Station Sites

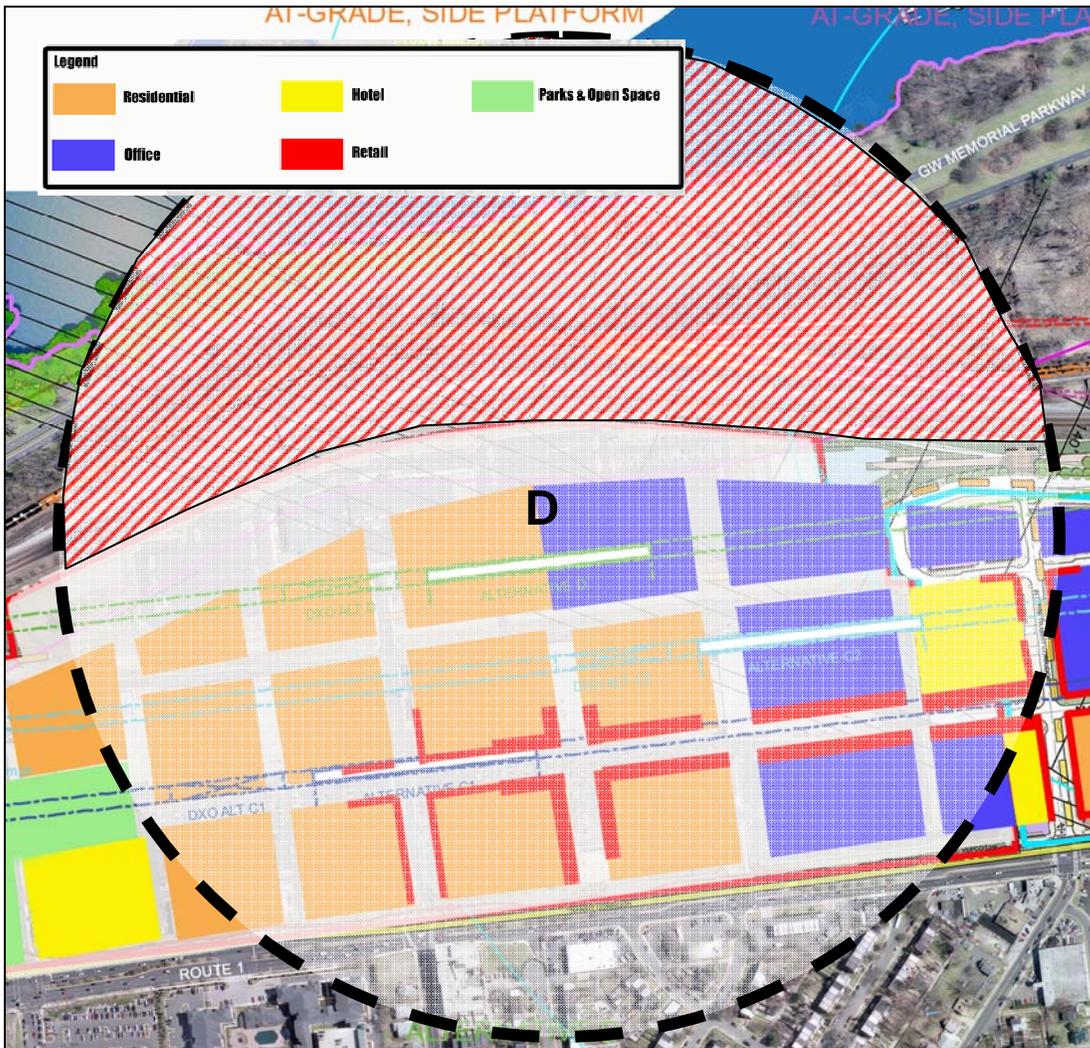


Figure 18: Alternative D Land Use Analysis

Table 5: Alternative D Land Use Analysis

Analysis	Office (%)	Residential		Other (%)	Total sf (millions)
		(%)	Units		
Quarter mile	15.0	74.0	4,750	11.0	9.6
Half mile*	43.0	34.0	1,185	23.0	4.4
Total	24.0	61.0	5,935	15.0	14.0

* Excludes quarter mile

To achieve the required clearance above the CSX tracks, the Metrorail line would probably be at the second- or third-floor level of the adjacent buildings, but more-detailed design analysis of both the Metrorail track structure and the buildings would be necessary to determine this relationship. To avoid disruption to the development in Landbay F, the station and aerial track structure should be built before the new buildings, but their design would have to be carefully coordinated to ensure physical and functional compatibility.

Alternative D1

To limit the visual intrusion of the aerial structure, the Metrorail line could run north-south in an alley between new buildings. The minimum width of an aerial Metrorail station is 60 feet. The Metrorail tracks would be visible where they would cross above Potomac Avenue and east-west streets. Aerial Metrorail tracks through Landbays G, H, and K would require modifications to the planned and approved development there.

The Alternative D1 capital cost is estimated to be **\$230 million to \$300 million** in 2012 dollars. This estimate includes about 6,500 feet of aerial structure, the station, connecting tracks to the north and south, the traction power substation, and the necessary Metrorail operating system modifications. This estimate does not include any costs to modify the development in Landbays G, H, and K to accommodate the aerial Metrorail tracks.

Alternative D2

Alternative D2 was designed to reduce the length of new track construction from about 7,300 to about 5,400 and limiting impacts to development in Landbays G and H while still locating the station within area of the highest amount of development. Consequently, the station would be relatively far to the east in Landbay F, as shown in Figure 19.

As in Alternative B, Potomac Avenue could be curved westward around the station, creating space for new mixed-use development between the avenue and the CSX right-of-way. The station could be directly connected to this development, and the open space in Landbay K (extended) could wrap around both the east and west sides of the station. The Metrorail tracks would not cross over any streets.

The Alternative D2 capital cost is estimated to be **\$200 million to \$260 million** in 2012 dollars.

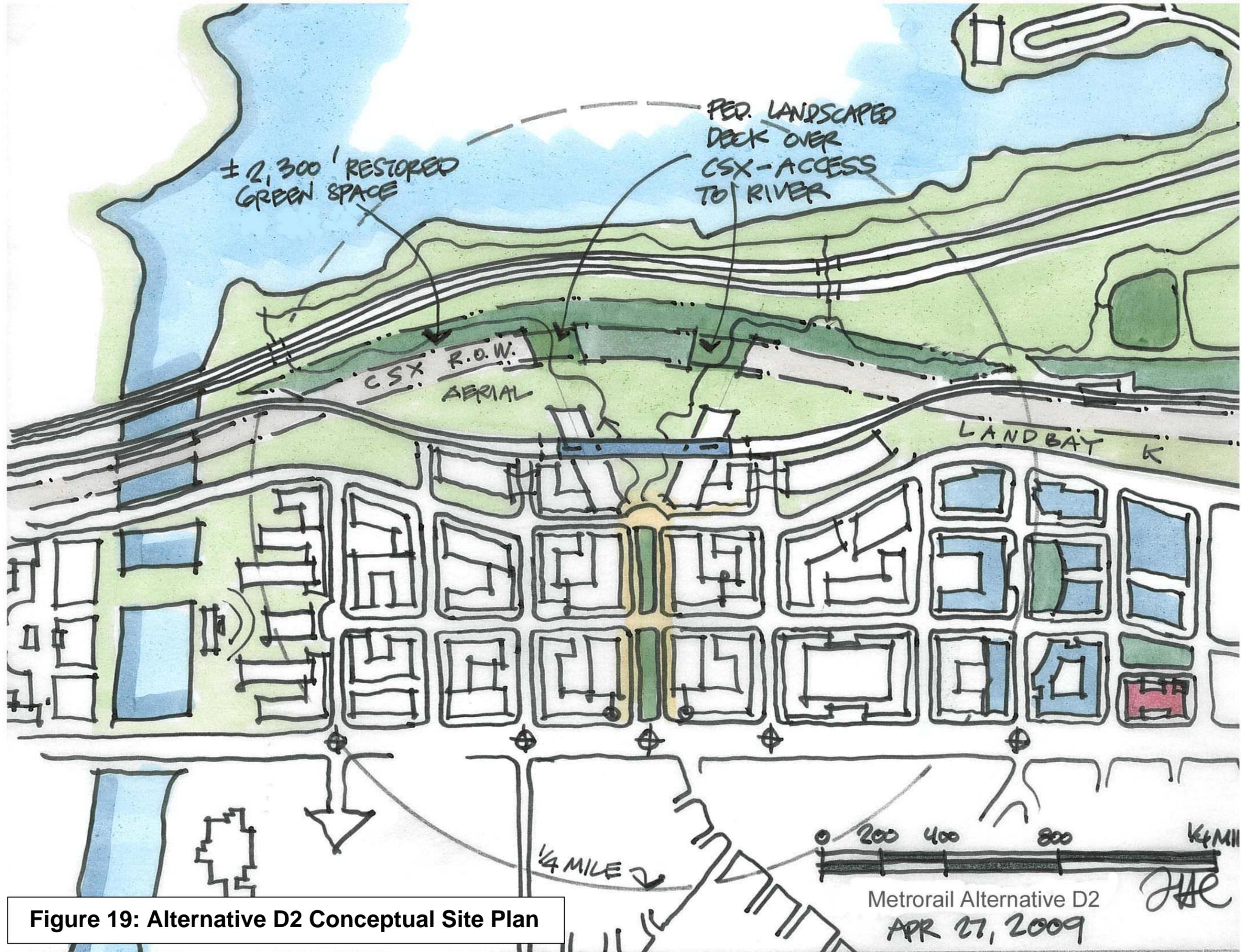


Figure 19: Alternative D2 Conceptual Site Plan

Summary of Alternative Station Site Characteristics

Figure 20 compares the development within the walksheds at the alternative station sites, and Table 6 summarizes selected characteristics of the alternatives.

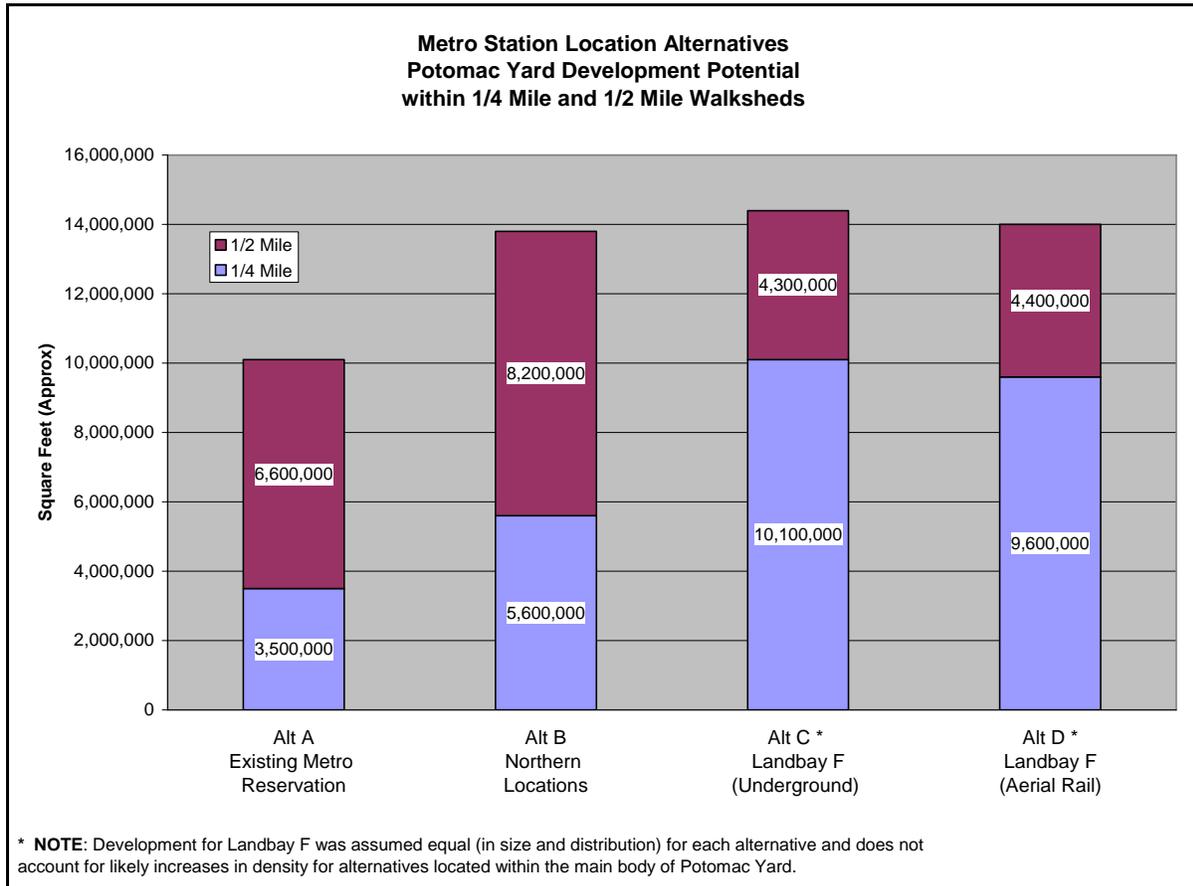


Figure 20: Development Potential

Table 6: Summary of Alternatives

Characteristic	Alternatives							
	A	B1	B2	B3	C1	C2	D1	D2
Station Type	At-grade, side platform	Not Viable	At-grade, side platform	At-grade, side platform	Not Viable	In tunnel, center platform	Aerial, center platform	Aerial, center platform
Approximate development within ¼ mile, million square feet	3.5		5.5	5.5		10.0	9.5	9.5
Approximate development within ½ mile, million square feet	10.0		14.0	14.0		14.5	14.0	14.0
Construction impacts on Metrorail operations	High		High	Medium		Medium	Medium	Medium
Preliminary estimated capital cost, million 2012 dollars	\$140-180		\$150-200	\$140-180		\$410-520	\$230-300	\$200-260

Note: Some station characteristics will require more detailed analysis in future planning phases. They include environmental impacts, detailed architectural and design characteristics, and operating and maintenance costs.