



ROCK CREEK PARK MILITARY ROAD TRAIL FEASIBILITY STUDY

OREGON AVENUE / GLOVER ROAD NW TO 16TH STREET NW

Contract No. GSOOF247CA

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CLIN #00600 CONCEPTUAL DESIGN REPORT

FINAL REPORT



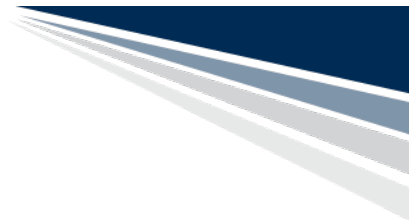


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APPENDICES

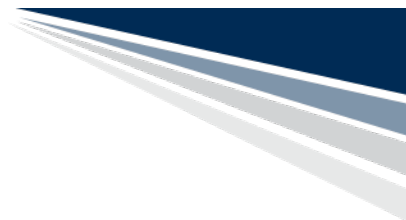
**Appendix A: Rock Creek Park Military Road Trail Feasibility Study
Existing Conditions Report**

Appendix B: Phase 1A Cultural Resource Assessment

Appendix C: Agency Letters

Appendix D: Significant and Specimen Trees

Appendix E: Conceptual Level Cost Estimates



Executive Summary

The USDOT VOLPE Center (VOLPE) managed a project for the National Park Service (NPS) and the Washington DC District Department of Transportation (DDOT) that addresses a need for an east-west pedestrian and bicycle transportation facility through Rock Creek Park in the northwestern area of the District of Columbia. Procon Consulting LLC (Procon) and Johnson, Mirmiran and Thompson, Inc (JMT) were contracted by VOLPE to complete a feasibility analysis to develop concepts for an improved on- or off-road bicycle and pedestrian facility to address this need. The facility is located between Glover Road / Oregon Avenue and 16th Street NW along Military Road in the Washington, DC, Metropolitan Area. The proposed trail will also provide connections with the extensive north-south trail network within Rock Creek Park, including the bike trail alongside Beach Drive.

The project began with an *Existing Conditions Report* that included a review of related documents, a review of natural and cultural resources within the project area, a review of subsurface utilities, and the development of four trail options at a feasibility level. The feasibility level options were then analyzed to determine potential environmental and cultural impacts, potential traffic impacts, and cost estimates. Additionally, public stakeholder meetings were held with District area bicycle and pedestrian advocacy groups. Based on the results of the stakeholder meetings and the analysis of the different options, one option was selected and moved into conceptual level design.

During the conceptual level design phase, a project limit of disturbance (LOD) was developed using cross sections and a conceptual level stormwater management design. This LOD was further refined during a minimization analysis that identified seven potential retaining walls within the project area to reduce environmental and cultural resource impacts. An impacts analysis and conceptual level cost estimate were developed for the project which are shown in the following **Table 1**.

Table 1: Conceptual Design Analysis

Item	Conceptual Design Impact
Cost Estimate	\$10.6 Million - \$13.4 Million
Right-of-Way (acre)*	2.5 – 3.0 acres
Forested Area (acre)	2.5 – 3.0 acres
Trees with DBH of > 12" (EA)	70 - 80 trees
Stream (LF)	15 – 30 LF
Wetland (SF)	400 – 500 SF
100-Year Floodplain (acre)	0.4 – 0.6 acres
Road Crossings (EA)	5 crossings, 1 mid-block crossing
Proposed Bridges (EA) (Total SF)	1 bridge, ~800 SF
Proposed Physical Barrier (LF)	~200 LF

Additionally, the project team identified permitting and mitigation strategies, performed a constructability analysis, identified potential project phasing opportunities, conducted an additional virtual public outreach meeting, and identified next steps that will need to be completed as the project continues to move forward.

INTRODUCTION

The USDOT VOLPE Center (VOLPE) is managing a project for the National Park Service (NPS) and the Washington DC District Department of Transportation (DDOT) that will address a need for an east-west pedestrian and bicycle transportation facility through Rock Creek Park in the northwestern area of the District of Columbia. Procon Consulting LLC (Procon) and Johnson, Mirmiran and Thompson, Inc (JMT) were contracted by VOLPE to complete a feasibility analysis to develop concepts for an improved on- or off-road bicycle and pedestrian facility to address this need. The facility is located between Glover Road / Oregon Avenue and 16th Street NW along Military Road in the Washington, DC, Metropolitan Area. The proposed trail will also provide connections with the extensive north-south trail network within Rock Creek Park, including the bike trail alongside Beach Drive.

The project team identified four potential alignment options and developed feasibility level impacts and cost estimates for each of the four options. After the impacts and estimates were completed, VOLPE, NPS, and DDOT, with input from public stakeholders, identified a preferred alignment option. This preferred alignment option was moved into conceptual design where cross sections and a conceptual level Limit of Disturbance (LOD) were created.

This conceptual design report will update the previously submitted Existing Conditions Report with conceptual level design of the selected option including potential impacts, stormwater management design, cross sections, and cost estimates.

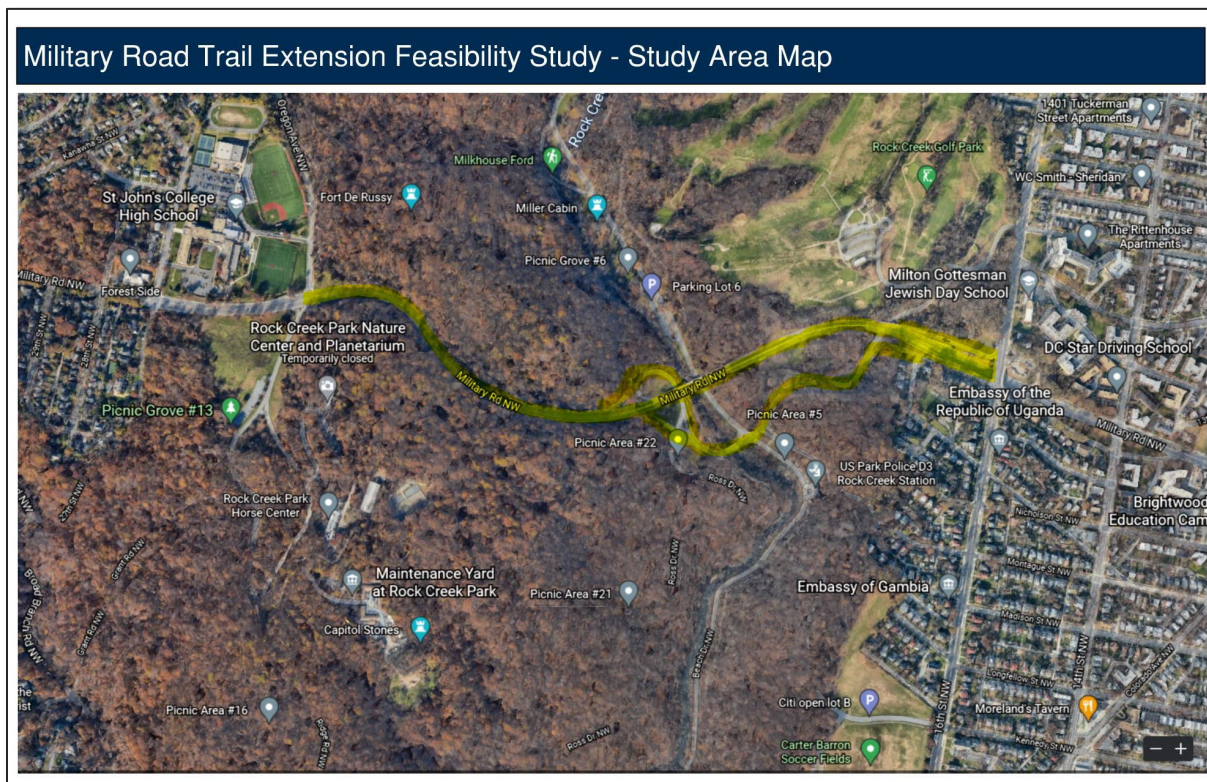


Figure 1: Study Area Map



SUMMARY OF EXISTING CONDITIONS REPORT

Existing Conditions

The *Rock Creek Park Military Road Trail Feasibility Study Existing Conditions Report* was completed and submitted to VOLPE, NPS, and DDOT on April 29, 2022. This report identified and summarized related projects and studies, existing land use, existing Natural and Cultural Resources, existing structures, and existing subsurface utilities. A summary of the report is provided herein, for a more detailed explanation please see the previously mentioned existing conditions report or the *Phase 1A Cultural Resource Assessment for Rock Creek Park Military Road Trail Feasibility Study*.

NATURAL RESOURCES

To identify existing conditions within the project area, JMT reviewed published information, conducted agency coordination, and completed field investigations at the site.

Published Information

Prior to conducting field visits, JMT performed a pre-field investigation of the following published information for the project area:

- U.S. Geological Survey (USGS) Watershed Boundary Dataset (USGS, 2009) and topographic quadrangle (USGS, 2019).
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (USFWS, 2002).
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Panels #1100010008C (FEMA, 2010).
- U.S. Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) Web Soil Survey of Washington District of Columbia (USDA-NRCS, 2006).

Review of the published information indicated that the project area contains two mapped waterways. An unnamed tributary to Rock Creek enters the project area near the intersection of Joyce Road NW and Missouri Avenue and flows southwest along Joyce Road NW before discharging into Rock Creek. Rock Creek itself intersects the study area to the east of the intersection of Military Road NW and Joyce Road NW, flowing north to south. Rock Creek is a tributary to the Potomac River, a traditionally navigable water (TNW). All wetland and waterway resources identified within the project area drain into Rock Creek, and ultimately discharge to the Potomac River.

The entirety of the project area is located within the USGS 8-digit Middle Potomac-Anacostia-Occoquan Watershed (02070010). The NWI (USFWS, 2002) wetland dataset shows two mapped riverine systems that intersect the project area, as described above. FEMA mapping shows that portions of the project area are located within the 100-year floodplain of Rock Creek, as well as the 100-year floodplain of the aforementioned tributary to Rock Creek (FIRM Panel #1100010008C).

The Web Soil Survey indicates that 11 soil survey units occur within the project area. Of these, two units are predominantly non-hydric, while the rest are not hydric. One unit (Ck) is considered to be prime farmland and two units (GgC and MbC) are considered to be farmland of statewide importance.

Agency Coordination

In a letter dated December 2, 2021, JMT contacted the District Department of Energy and Environment (DOEE) to determine the presence of fisheries resources and/or known floral or faunal species that are



District- or federally-listed rare, threatened, or endangered within the project area. DOEE did not respond to the letter, which indicates that they do not have any significant concerns with the project at this time. DOEE will be given an additional chance to review and comment on the project design during future design phases.

In a letter dated December 2, 2021, JMT contacted the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA NMFS) to determine the presence of known species listed by NOAA NMFS as threatened or endangered and/or proximate Essential Fish Habitat areas within the project area. NOAA NMFS did not respond to the letter, which indicates that they do not have any significant concerns with the project at this time. NOAA NMFS will be given an additional chance to review and comment on the project design during future design phases.

Through coordination with USFWS, the project is “not likely to adversely affect” the Hay’s spring amphipod (*Stygobromus hayi*) and northern long-eared bat (*Myotis septentrionalis*) which may be present within the project area. In a letter dated December 9, 2021, USFWS stated, “As stated in your email, best management practices for sediment and erosion control will be implemented for all work to minimize potential for impacts. If these conditions are met, the project is ‘not likely to adversely affect’ Hay’s spring amphipod. There is minimal tree clearing proposed with this project, and no known maternity roost trees in the project vicinity, therefore this project is ‘not likely to adversely affect’ northern long-eared bat under the January 5, 2016, Programmatic Biological Opinion on the final 4(d) rule.” Coordination with USFWS may be found in **Appendix C**.

Field Investigations

JMT environmental scientists conducted field visits on November 15 and November 16, 2021, and January 5, 2022, to identify environmental features. Forest resources, specimen trees (diameter at breast height (DBH) of 30” or greater), all trees greater than or equal to 12” DBH, and potential jurisdictional wetlands and waterways located within the limits of the four trail alignment options identified in this report were documented. Findings are detailed below and displayed in the separate attached plan set.

Forest and Trees

Mixed deciduous forests occur along much of the corridor length, except for mowed and maintained areas within the Military Road and Joyce Road interchange and a residential stretch along Missouri Avenue. Forest stands were observed to be diverse and healthy in all areas of the project, although the forest edges adjacent to roadways or existing trails were noticeably more disturbed than the interior. Along steep slopes adjacent to Military Road eastbound, moderate invasive species cover was observed. The invasive vine cover was more prevalent both within the shrub and tree strata, impacting the health of more heavily affected trees. Invasive species observed include English ivy (*Hedera helix*) and oriental bittersweet (*Celastrus orbiculatus*).

All forest stands observed within the study area are late successional stage dominated by oak species (*Quercus* sp.), tulip poplar (*Liriodendron tulipifera*), mockernut hickory (*Carya tomentosa*), and American beech (*Fagus grandifolia*). These stands contain many large trees, including specimen trees, and contain a healthy variety of understory and herbaceous species, including American holly (*Ilex opaca*) and American beech. These mature forests make up most of the project area.

During the site visit, the environmental scientist team identified and GPS-located a total of 436 trees, of which 72 were specimen trees. DBH, species, and health were recorded for each tree. Most of the specimen trees observed were identified as oak species or tulip poplar, but American sycamore (*Platanus occidentalis*) and red maple (*Acer rubrum*) were also observed. One Norway maple (*Acer platanoides*), one mockernut hickory, and one American beech were also identified. Of the 72 specimen trees identified, 66 were considered to be in good to excellent health. For the remaining five that were



considered to be in fair or poor health, moderate to heavy vine cover and sparse canopy were noted. All trees identified within the study area are listed in **Appendix D**.

Wetlands and Waters of the U.S. (WUS)

The environmental scientist team observed a total of four Waters of the U.S. (WUS) and one isolated wetland. The wetland was identified, and boundaries delineated using a two-parameter approach (vegetation and hydrology); no soil samples were taken. Two of the four WUS observed in the field were perennial channels, including Rock Creek and an unnamed tributary to Rock Creek. The remaining two WUS were classified as ephemeral channels by the environmental scientist team.

Within the study area, boundaries of wetlands were field sketched and captured with a GPS, while streams were sketched by hand and are approximate. Culverts and bridge edges were captured by GPS where a stream channel traveled under Military Road or adjoining roads and ramps.

CULTURAL RESOURCES

A Phase 1A Cultural Resource Assessment was completed by the project team and can be found in the *Phase 1A Cultural Resource Assessment for Rock Creek Park Military Road Trail Feasibility Study*, which is in **Appendix B**. A summary of the findings from the assessment can be found below.

The historic resources Area of Potential Effect (APE) encompassed Military Road, the footprint of all proposed trail options discussed in the *Concepts* section of this report, and adjacent properties where there may be potential for indirect visual effects. The archaeological APE consists of all proposed trail options discussed in the *Concepts* section of this report. The anticipated ground disturbance for the project varies depending on the trail option selected, and, for the purposes of this report, all areas within and adjacent to each trail option were examined. The project area generally extends along Military Road from Oregon Avenue/Glover Road NW to 16th Street NW and the final trail is anticipated to be a maximum of 12-foot-wide throughout the project area. At this time, the final design is not complete for the project.

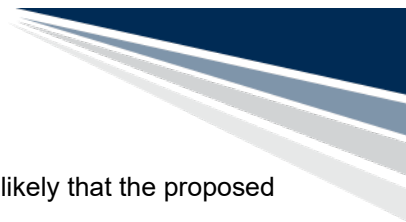
The assessment included background research of regional prehistory and history, an examination of historic sources and maps, and an evaluation of prior archaeological investigations near the APE. The goal of the assessment was to 1) locate previously identified archaeological or historic architectural resources within or in close proximity to the project area; 2) assess the potential for archaeological resources; 3) identify any unrecorded architectural resources over 50 years of age; 4) review the results of previous archaeological work within the project area and its vicinity; and 5) provide recommendations concerning the need for conducting subsequent archaeological evaluations within the APE.

Archaeological Research

The project area is located within and adjacent to known archaeological sites, including prehistoric resources and Civil War era fortifications, consequently, it is possible that *in situ* archaeological resources are located within the archaeological APE. The archaeological APE has not previously been subjected to intensive archaeological survey including subsurface testing and it is unknown if additional archaeological resources are located within the APE. Archaeological sensitivity in the APE is thus considered high.

Historic Resources

An investigation of above-ground historic resources was conducted using Open Data D.C., D.C. Atlas Plus, HistoryQuestDC, and PropertyQuest. This research concluded that the project area is located within two historic districts, Rock Creek Park Historic District (91001524) and Fort Circle Park Historic District, part of the Defenses of Washington / Civil War Fort Sites (74000274/78003439), both of which are listed in the NRHP. Additionally, there are approximately 47 previously unidentified historic resources present in the visual APE. Due to distance, the urban nature of the surrounding area, and the heavily



vegetated and wooded area directly surrounding the proposed trail routes, it is unlikely that the proposed project will be visible from most of the previously unidentified historic resources.

Visual impacts to resources in the visual APEs will largely be experienced by properties located on Military Road, Missouri Avenue, and at intersections with these roadways within the visual APE.

Military Road has existed in its approximate current location since the 1860s and was determined to be non-contributing to the Rock Creek Park Historic District. The road is within the APE for direct effects and the visual APE.

SUBSURFACE UTILITIES

For this feasibility study, a Quality Level C Subsurface Utility Survey was conducted by JMT. JMT compiled a list of utility owners through Miss Utility of Maryland and the District of Columbia. After compiling this list, the individual utilities were contacted, and requests were made for public utility records. JMT used these records to create a Utility Composite in MicroStation for the proposed corridor. These utilities have not been surveyed or field designated at this time, as that is anticipated to be completed in future design phases. **Table 2** lists the utility company and type that were identified in the compiled list.

Table 2: Subsurface Utilities

Type of Utility	Utility Owner	Date Received
Electric	PEPCO	Requested information 11/18/21, followed up again on 6/24/22, have received no response.
Gas	Washington Gas	12/03/21
Sanitary Sewer	DC Water	12/20/21
Signal / Lighting	DDOT	11/23/21
Telephone	Verizon	Requested information 11/18/21, followed up again on 6/24/22, have received no response.
Fiberoptics	Verizon	Requested information 11/18/21, followed up again on 6/24/22, have received no response.
Water	DC Water	12/20/21

Trail Concept Development

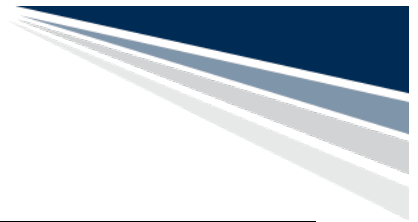
As part of the existing conditions report, the project team developed design criteria, proposed typical sections, and four trail alignment options.

DESIGN CRITERIA

The project team developed Design Criteria for the proposed Rock Creek Park Military Road Trail Feasibility Study. The purpose of these criteria is to identify design elements for the project such as trail widths, offsets, and other constraining factors. These criteria are developed based on guidance provided by international, national, state, and city literature. When conflicting information is present in these guidance documents, the strictest criteria will be used for design.

Table 3 shows the existing roadway functional classification, posted speed limit, typical section, and ownership for the existing roads within the study area.

Rock Creek Park Military Road Trail Feasibility Study
CLIN #00600 Conceptual Design Report



Facility Type: Existing Roads on Military Road

Criteria	Existing Design	Reference
Roadway Classification	Principal Arterial	Open Data DC Website
Posted Speed Limit	35 mph	
Typical Section	2 lanes in each direction with Concrete Barrier separation: Closed Section, Barrier Curb	
Ownership	District of Columbia Department of Transportation (DDOT)	

Facility Type: Existing Roads on 16th Street NW

Criteria	Existing Design	Reference
Roadway Classification	Principal Arterial	Open Data DC Website
Posted Speed Limit	30 mph	
Typical Section	2 lanes in each direction with Landscaped Concrete Median; Closed Section; 6' wide sidewalk on each side	
Ownership	DDOT	

Facility Type: Existing Roads on Oregon Avenue NW

Criteria	Existing Design	Reference
Roadway Classification	Collector	Open Data DC Website
Posted Speed Limit	25 mph	
Typical Section	Two 12' lanes, Open Section, paved Shared-Use Trail along east side	
Ownership	DDOT	

Facility Type: Existing Roads on Joyce Road NW

Criteria	Existing Design	Reference
Roadway Classification	Local Roadway	Open Data DC Website
Posted Speed Limit	20 mph	
Typical Section	Two 11' Travel Lanes, Open Section	
Ownership	National Park Service (NPS)	

Facility Type: Existing Roads on Missouri Avenue NW

Criteria	Existing Design	Reference
Roadway Classification	Local Roadway	Open Data DC Website
Posted Speed Limit	20 mph	
Typical Section	One-Way, Eastbound, One 16' Travel Lane, Closed Section, 6' wide buffered sidewalk on south side.	
Ownership	DDOT	

Table 3: Existing Road Facilities

Facility Type: Off-Road Pedestrian and Bicycle Trail

The Design Criteria for the proposed trail facilities were created using the 2012 AASHTO Guide for the Development of Bicycle Facilities, 4th Edition (AASHTO Bike Book). While a 5th edition of the AASHTO Bike Book is currently under review, it has not yet been released for use. As this project is anticipated to use federal funding, these criteria will follow the Public Rights-of-Way Accessibility Guidelines (PROWAG) to ensure accessibility to the shared use path for all users.

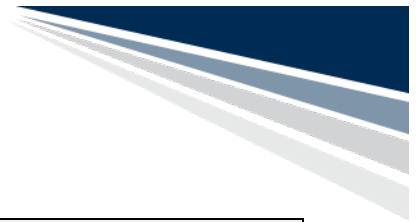


Table 4: Design Criteria

Criteria	Guidance	Proposed	Reference
Bicycle Design Speed	18 MPH min. Lower w/ exception	20 MPH	AASHTO Bike Book (pg. 5-13)
Min. Curve Radius	74 ft	-	AASHTO Bike Book (pg. 5-14)
Stopping Sight Distance	200 ft	-	AASHTO Bike Book (pg. 5-17)
Maximum Grade (within Street or Highway ROW)	Not to exceed roadway grade	-	PROWAG Supplemental Notice R302.5.1
Maximum Grade (outside Street or Highway ROW)	5% max, with allowances for: 5% < X < 8.33% for 200' max 8.33% < X < 10% for 30' max 10% < X < 12% for 10' max	-	Forest Service Trail Accessibility Guidelines (FSTAG) (pg. 10)
Cross Slope	2% max.	1.5%	PROWAG Supplemental Notice R302.6
Superelevation	Not Needed	N/A	AASHTO Bike Book (pg. 5-16)
Vertical Clearance above Path	10 ft preferred	-	AASHTO Bike Book (pg. 5-26)
Vertical Clearance above Roadway	15 ft	-	2018 AASHTO Policy on Geometric Design of Highways and Streets (2018 Green Book) (pg. 6-20)
Horizontal Sightline Offset (HSO)	58 ft	-	AASHTO Bike Book (pg. 5-23)
Shared-Use Path (SUP) Width	10 ft preferred 8 ft min for short segments of constrained areas*	12 ft preferred 10 ft minimum	AASHTO Bike Book (pg. 5-3)
Pedestrian Access Route (PAR)	Full Width of SUP	Full Width of SUP	PROWAG Supplemental Notice R302.3.1
Shoulder Clearance Width (Clear area on either side of SUP)	2 ft min. (6:1 slope) Grass shoulders	2 ft min width, Grass shoulders	AASHTO Bike Book (pg. 5-5) NPS Preferred Practice
Safety Grading	Barrier / Fence required if buffer <5' or: 3:1 for 6' vertical drop 2:1 for 4' vertical drop 1:1 for 1' vertical drop	-	AASHTO Bike Book (pg. 5-6)
Buffer Width (With and without Curbs)	5' min, greater than 5' preferred for high-speed roadways from outside edge of shoulder If the buffer < 5', a vertical barrier should be installed for separation from vehicle lanes	-	AASHTO Bike Book (pg. 5-11)
Pavement Design	Pervious or impervious depending on soil characteristics. 3" Hot Mix Asphalt (HMA) for Surface, 4" Graded Aggregate Subbase (GASB)	-	

CONCEPTS

The project team developed three primary options for the proposed trail to a feasibility level, with one option having two sub-options. All options provide an East-West connection for pedestrians and bicyclists



through Rock Creek Park between Oregon Avenue and 16th Street NW, as well as provide access to Beach Drive and the existing pedestrian and bicycle network located within the park. A brief description of all options can be found below.

Option 1

Beginning at the intersection of Oregon Avenue and Military Road, Option 1 will travel north approximately 200 feet along the existing paved Western Ridge Trail, as shown in **Figure 2**. This short segment of the trail will be widened to ten feet. Once the Western Ridge Trail intersects with the existing Bike Trail #3, approximately 200 feet north of the Military Road and Oregon Avenue intersection, the proposed trail will turn east onto Bike Trail #3. The existing Bike Trail #3 is a six-foot-wide paved trail with steep grades in several locations, which is not conducive to all trail users. The project team proposed widening the existing trail to ten feet, with two feet of additional safety grading on either side of the trail, as shown in **Figure 3**. The existing trail profile will also be adjusted to meet the Forest Service Trail Accessibility Guidelines as discussed previously in the Design Criteria section of the report.



Figure 3: Proposed Condition: Bike Trail #3

Where possible, the project team has proposed that the improved trail holds the southern edge of existing pavement and is widened to the north. This is in response to the trail being located on the middle of a hillside, with a large ditch and existing stream located south of the trail. Widening to the north will allow the trail to be widened into the uphill area of the forest instead of chasing grade on the downhill side of the forest towards the existing stream. Furthermore, holding one edge of the existing trail and widening from that edge will help limit impacts to the forests on only one side of the trail instead of impacts on both sides.

The proposed trail will continue along the existing paved trail making improvements to the trail width, running slope, and horizontal curve geometry, where necessary. The improvements will extend for approximately 3,300 feet until reaching Joyce Road adjacent to the Joyce Road bridge over Rock Creek at approximately Station 37+00. The existing bridge includes two 18-foot-wide travel lanes and a four-foot-wide pedestrian sidewalk on each side of the roadway. This sidewalk is too narrow for bicycle usage, so the project team proposes changes to the travel lane widths to provide a bicycle facility across the bridge. The new proposed typical section will include two 11-foot-wide travel lanes, a four-foot-wide buffer area, and a ten-foot-wide two-way cycle track as shown in **Figure 4**.

Military Road Trail Feasibility Study - Option 1

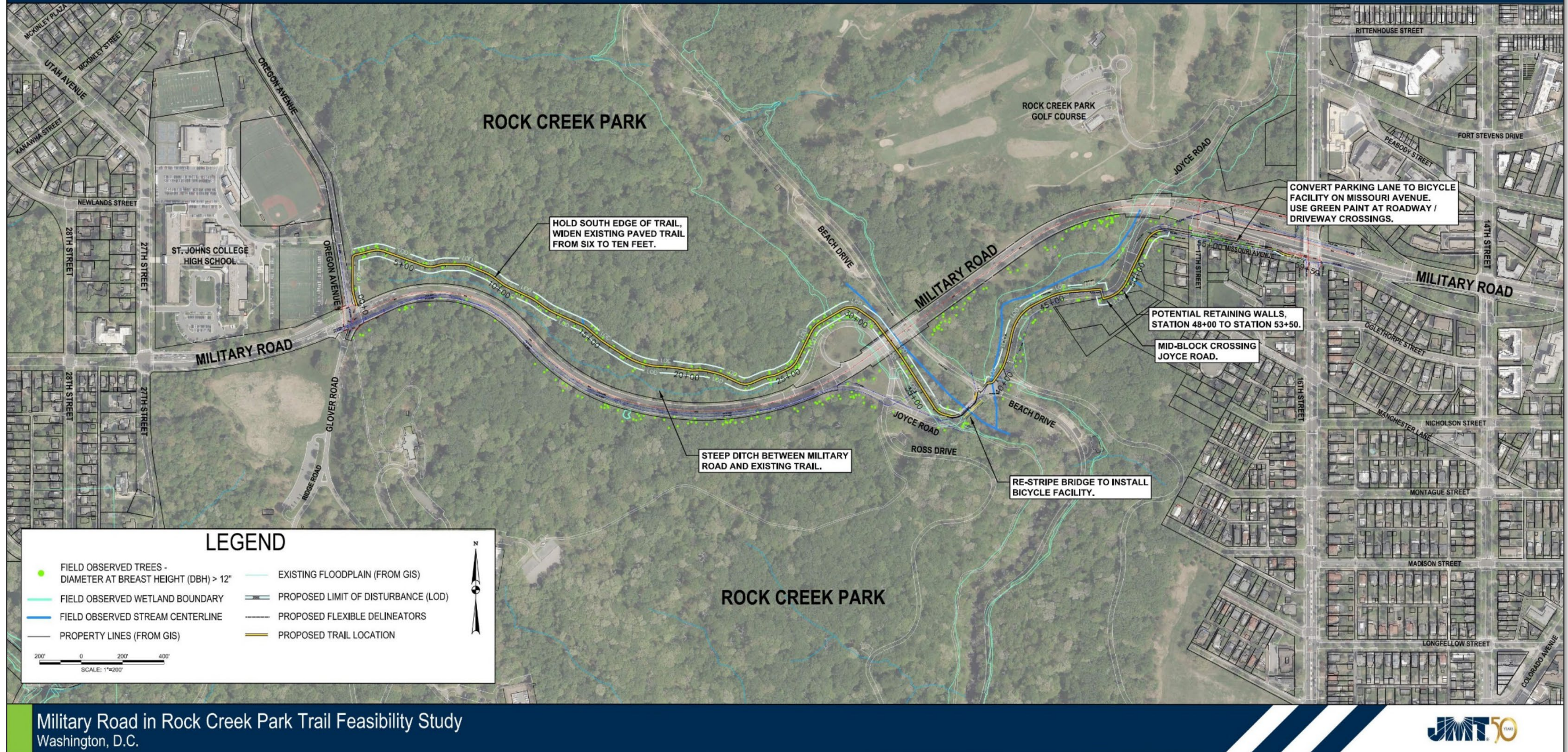


Figure 2: Option 1 Alignment

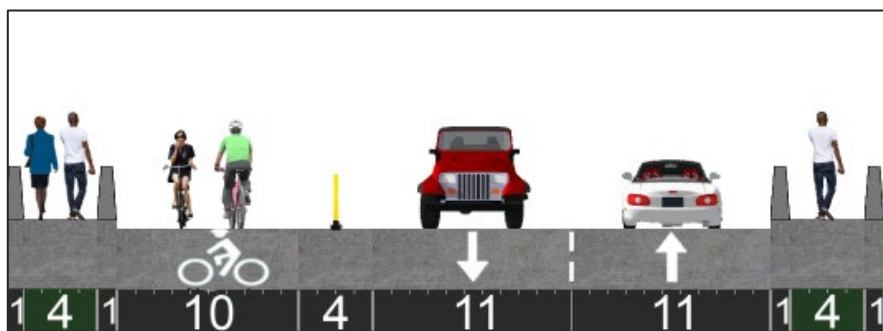
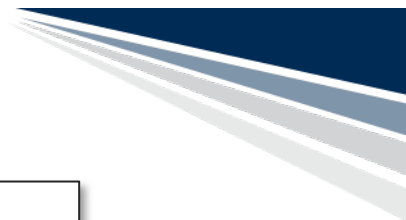


Figure 4: Proposed Condition: Joyce Road Bridge over Rock Creek

The buffer area can provide separation for cyclists through either flexible delineators or a solid barrier, depending on the desires of NPS and DDOT. A solid concrete barrier will provide the most protection for bicyclists, however it will also require structural analysis to confirm the bridge will not be negatively impacted by the additional dead load weight of the barrier. Flexible delineators provide more protection to bicyclists than a striped buffer, however flexible delineators can sometimes cause maintenance concerns due to the frequency that delineators must be replaced.

After crossing the bridge, the trail will cross Beach Drive on the north side of the intersection with Joyce Road. New ADA compliant curb ramps and new crosswalks for the crossing will be constructed with the trail continuing east along the north side of Joyce Road. The trail will be twelve-feet-wide with a five-foot buffer from the roadway, as shown in **Figure 5**. The north side of Joyce Road in this section is generally flat and clear, which will help the trail be installed with minimal environmental impacts, however there are existing utility poles and underground utilities that could potentially be impacted. The trail will continue along the north side of Joyce Road for approximately 800 feet, where it will make a mid-block crossing of Joyce Road to continue along the south side of the roadway. The mid-block crossing is necessary due to the exit ramp from Joyce Road to Missouri Avenue, where the trail will need to be located on the south side of the road. The trail will continue along the south side of Joyce Road for approximately 300 feet, until reaching the existing ramp to Missouri Avenue. The trail will then follow the existing ramp to Missouri Avenue, and merge onto the roadway at Missouri Avenue. Side slopes along the roadway indicate that a potential retaining wall may be installed in this section of the trail between Joyce Road and the merge onto Missouri Avenue.

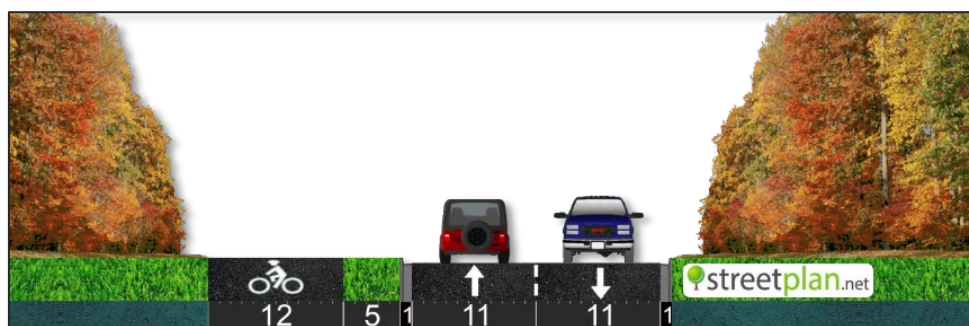


Figure 5: New Trail along Joyce Road

Existing Missouri Avenue is a 24-foot-wide one-way road with a parking lane located along the roadway. This option, as shown in **Figure 6**, proposes changing the roadway typical section by removing the parking lane and installing a nine-foot-wide two-way cycle track, a two-foot-wide buffer, and an eleven-

foot-wide travel lane. The two-foot-wide buffer would be either a striped buffer or a striped buffer with flexible delineators. Existing driveway access to residences located along this road will be maintained with gaps in the buffer area and green paint to signify potential vehicular conflict areas.

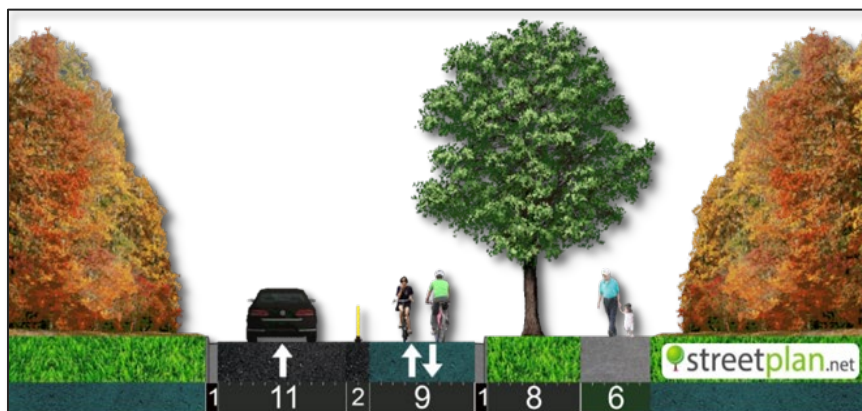


Figure 6: Two-Way Cycle Track on Missouri Avenue

The two-way cycle track will continue along Missouri Avenue until reaching the merge area with the Military Road exit ramp to 16th Street. Bicyclists will exit the roadway area and enter onto a short section of shared-use side path until reaching the intersection with 16th Street. Bicyclists are allowed to use travel lanes on 16th Street; however, this road is not conducive for bicycle use for most cyclists. The existing sidewalk along the road is too narrow for bicycle use, however DDOT plans to widen the sidewalk along 16th Street to ten feet in the future which makes a logical future endpoint for this project.

Option 2A

Beginning at the intersection of Oregon Avenue and Military Road, the proposed trail will head east along the south side of Military Road, as shown in **Figure 7**. The trail will be twelve-feet-wide with a five-foot grass buffer from Military Road, as shown in **Figure 8**. There is an existing bus stop located approximately 100 feet from the intersection of Military Road and Oregon Avenue that will remain in place as the trail will run behind the bus stop. Due to existing roadway side slopes, the trail may require a retaining wall along the south side for approximately 300 feet after leaving the intersection. After this initial section, however, the roadway side slopes become less steep, and a retaining wall will most likely not be required.

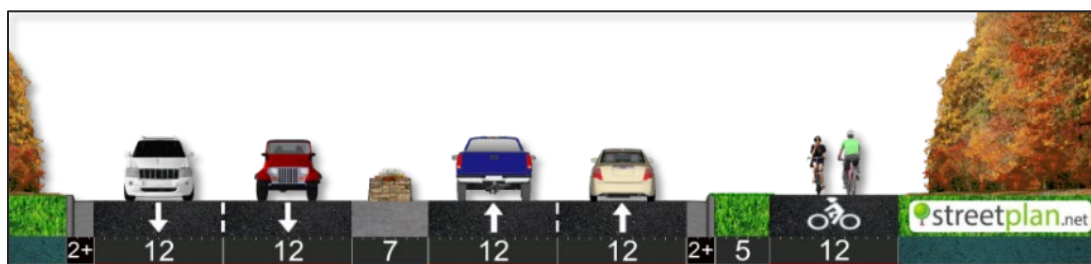
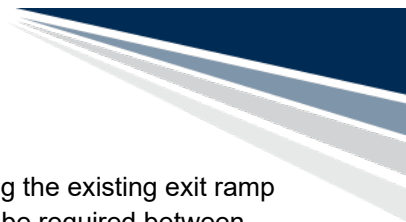


Figure 8: New Trail along South Side of Military Road

There is an existing field-identified wetland between Station 114+00 and Station 115+00. The project is currently showing impacts to the wetland, however these impacts could potentially be mitigated or eliminated in future design phases by installing a boardwalk structure over the wetland.



The proposed trail will continue along the south side of Military Road until reaching the existing exit ramp to Joyce Road at approximately Station 125+00. An additional retaining wall may be required between approximately Station 115+00 and Station 121+00. The proposed trail, continuing as an off-road facility, will then follow the exit ramp along the south side of the ramp to Joyce Road. The trail will then make an at-grade crossing of Ross Drive and continuing parallel to the roadway until approximately Station 131+50 where the bicycle users will enter an on-road facility just prior to reaching the existing Joyce Road Bridge over Rock Creek, while pedestrians will continue using the existing sidewalk along the bridge. The existing bridge includes two 18-foot-wide travel lanes and a four-foot-wide pedestrian sidewalk on each side of the roadway. This sidewalk is too narrow for bicycle usage, so the project team proposes changes to the travel lane widths to provide a bicycle facility across the bridge. The new proposed typical section will include two 11-foot-wide travel lanes, a four-foot-wide buffer area, and a ten-foot-wide two-way cycle track (see **Figure 4**).

The buffer area can provide separation for cyclists through flexible delineators or a solid barrier, depending on the desires of NPS and DDOT. A solid concrete barrier will provide the most protection for bicyclists, however it will also require structural analysis to confirm the bridge will not be negatively impacted by the additional dead load weight of the barrier. Flexible delineators provide more protection to bicyclists than a striped buffer, however flexible delineators can sometimes cause maintenance concerns due to the frequency that delineators must be replaced. A striped buffer will provide the least protection for cyclists but will most likely require less maintenance than flexible delineators.

After crossing the bridge, the trail will cross Beach Drive and then Morrow Drive along the southern edge of Joyce Road with green pavement at the crossings to signify potential vehicle conflict points. At this location, Joyce Road is a two-lane road that is 38-feet-wide, and the project team recommends restriping the roadway so that there are two 12' wide vehicular lanes, a two-foot striped buffer, and a twelve-foot-wide two-way cycle track.

Once reaching the east side of Morrow Drive, the trail will once again transition to being a shared-use side path with a grass buffer separating it from the roadway. There is the potential for small retaining walls to be required along the south side of the proposed trail due to side slopes along the roadway. These potential small retaining walls will continue intermittently along both Joyce Road and the Missouri Avenue ramp from approximately Station 135+00 to Station 147+00. The typical section for this shared-use path is shown in **Figure 9**.

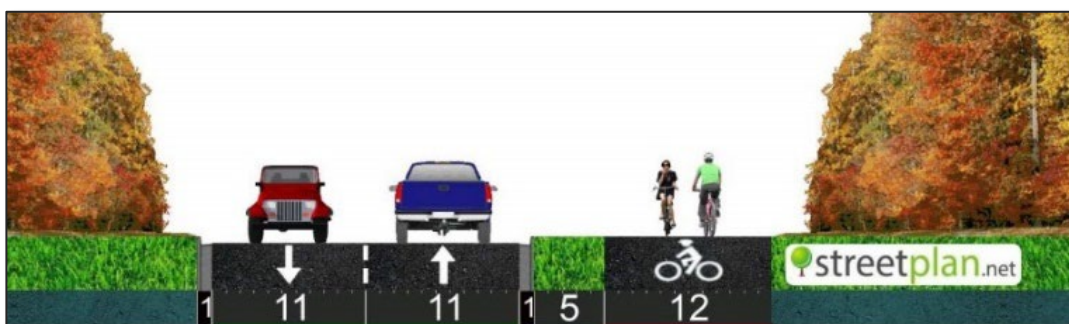
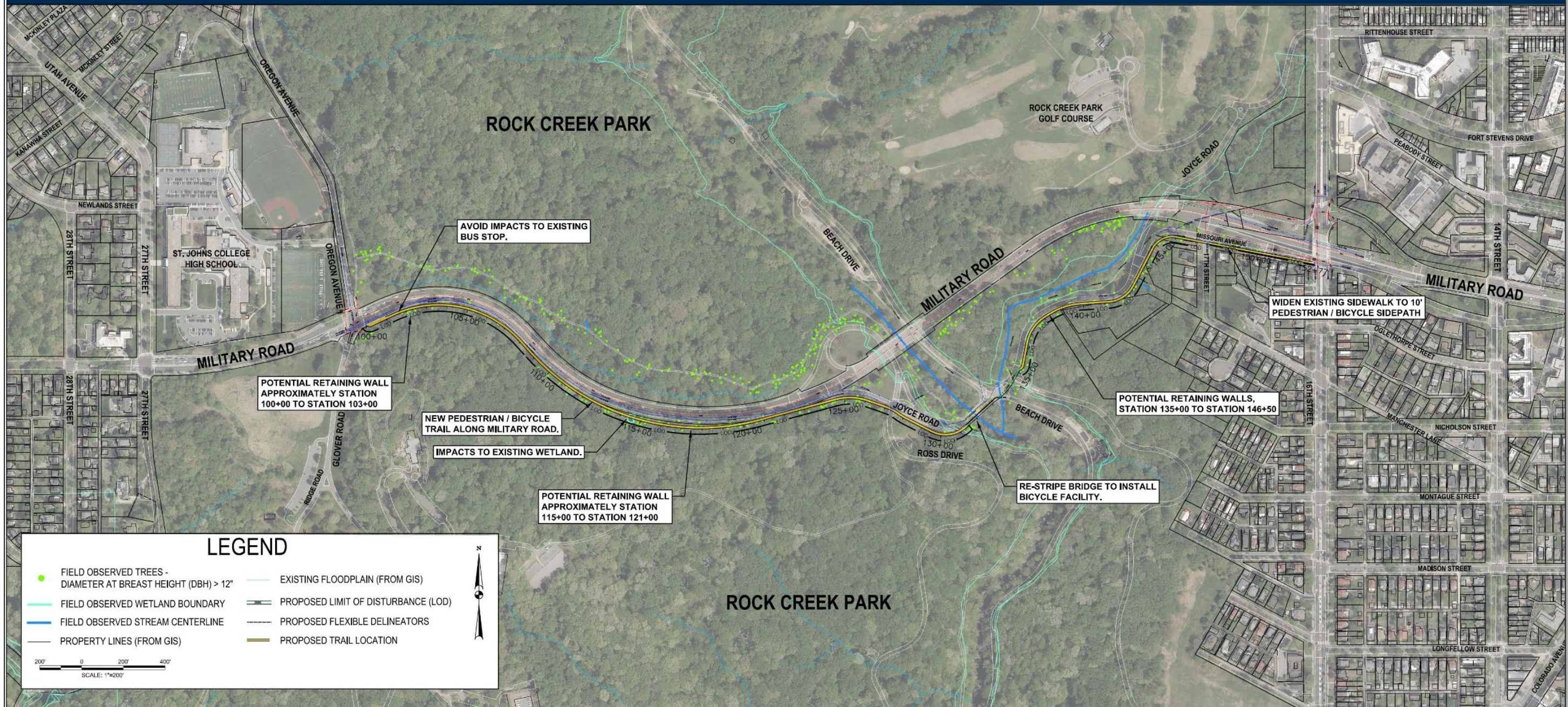


Figure 9: New Trail along South Side of Joyce Road

Military Road Trail Feasibility Study - Option 2A



Military Road in Rock Creek Park Trail Feasibility Study
 Washington, D.C.



Figure 7: Option 2A Alignment

The proposed trail will then cross 17th Street at-grade and continue adjacent to Missouri Avenue as a shared-use path until reaching the intersection with 16th Street. There is existing six-foot-wide sidewalk between 17th Street and 16th Street that is too narrow for bicycle use and would need to be widened to the north (towards Missouri Avenue) to ten feet. However, widening the sidewalk will be difficult due to existing retaining walls, stairs, driveways, and mature street trees along both sides of the sidewalk.

Figure 10 shows the proposed typical section along Missouri Avenue.



Figure 10: New Shared-Use Path along Missouri Avenue

Once reaching 16th Street, bicyclists are allowed to use travel lanes on 16th Street, however this road is not conducive for bicycle use for most cyclists. The existing sidewalk along the road is too narrow for bicycle use, however DDOT plans to widen this sidewalk along 16th Street to ten feet in the future which will turn 16th Street into a logical endpoint for this project.

Option 2B

Beginning at the intersection of Oregon Avenue and Military Road, the proposed trail will head east along the south side of Military Road, as shown in **Figure 11**. The trail will be twelve-feet-wide with a five-foot grass buffer from Military Road (see **Figure 8**). There is an existing bus stop located approximately 100 feet from the intersection of Military Road and Oregon Avenue that will remain in place, as the trail will run behind the bus stop. Due to roadway side slopes, the trail may require a retaining wall along the south side for approximately 300 feet after leaving the intersection. After this initial section, however, the roadway side slopes become less steep, and a retaining wall will most likely not be required.

There is an existing field-identified wetland between Station 114+00 and Station 115+00. The project is currently showing impacts to the wetland, however these impacts could potentially be mitigated or eliminated in future design phases by installing a boardwalk structure over the wetland.

The proposed trail will continue along the south side of Military Road until reaching the existing exit ramp to Joyce Road at approximately Station 125+00. An additional retaining wall may be required between approximately Station 115+00 and Station 121+00. Once reaching the exit ramp to Joyce Road, the trail will diverge, one section of the trail will cross the Joyce Road ramp at-grade, while the other section of the trail will follow the Joyce Road exit ramp like Option 2A to provide a connection to Beach Drive. The connection to Joyce Road will continue along the exit ramp to Joyce Road, making an at-grade crossing of Ross Drive, and continuing parallel to the roadway until entering the roadway just prior to reaching the existing Joyce Road Bridge over Rock Creek. The existing bridge includes two 18-foot-wide travel lanes and a four-foot-wide pedestrian sidewalk on each side of the roadway. This sidewalk is too narrow for bicycle usage, so the project team proposes changes to the travel lane widths to provide a bicycle facility across the bridge. The new proposed typical section will include two 11-foot-wide travel lanes, a four-foot-wide buffer area, and a ten-foot-wide two-way cycle track (see **Figure 4**).

Military Road Trail Feasibility Study - Option 2B

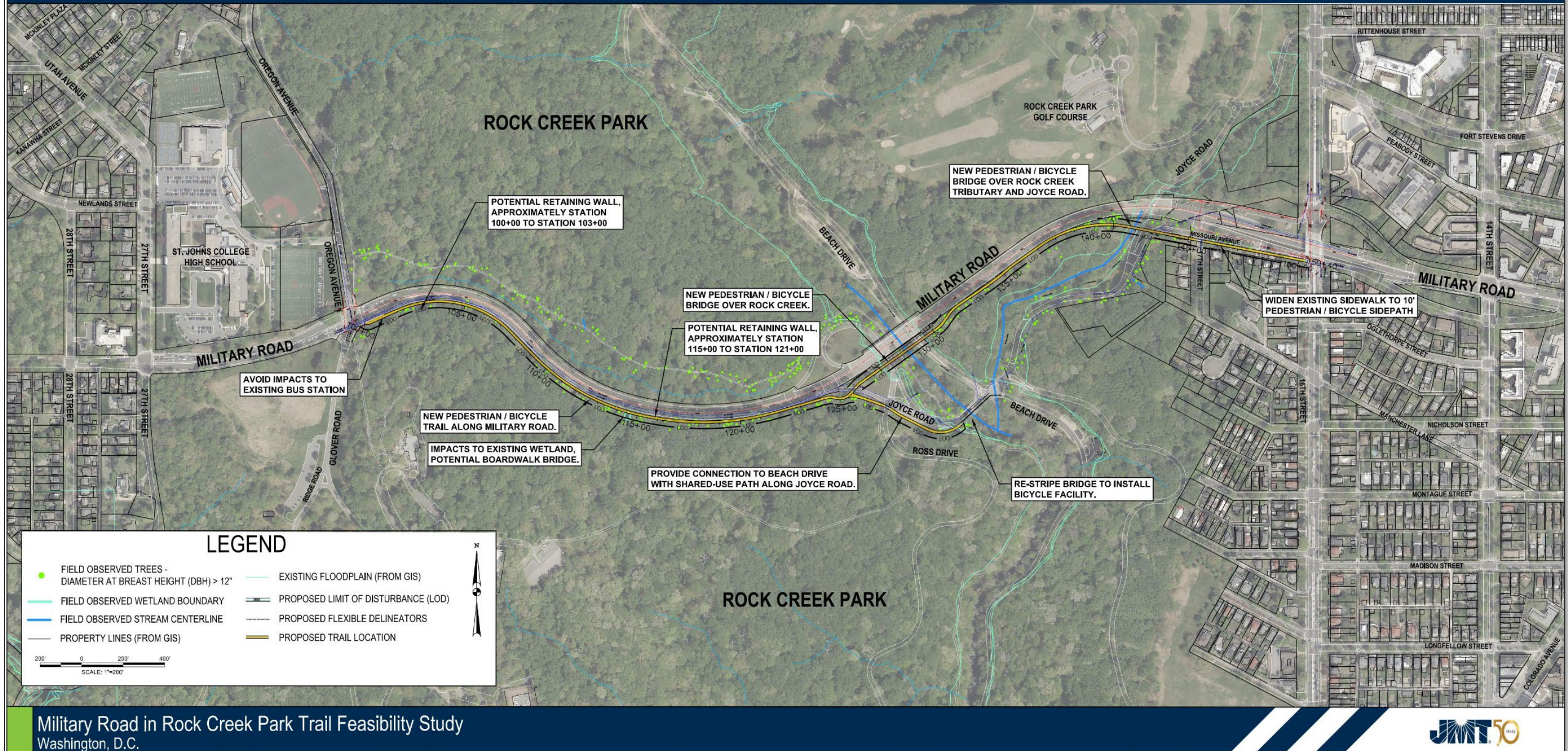


Figure 11: Option 2B Alignment

The buffer area can provide separation for cyclists through flexible delineators or a solid barrier, depending on the desires of NPS and DDOT. A solid concrete barrier will provide the most protection for bicyclists, however it will also require structural analysis to confirm the bridge will not be negatively impacted by the additional dead load weight of the barrier. Flexible delineators provide more protection to bicyclists than a striped buffer, however flexible delineators can sometimes cause maintenance concerns due to the frequency that delineators must be replaced. A striped buffer will provide the least protection for cyclists but will most likely require less maintenance than flexible delineators.

Returning to the point where the trail diverged to provide a connection with Beach Drive at approximately Station 125+00, the main trail will cross the Joyce Road exit ramp at-grade and continue through the area between the ramps before turning into a new proposed bridge at approximately Station 127+40. The at-grade crossing of the ramp is a potential safety concern and care should be taken in future design phases to ensure that proper sightlines and advance signage, for both trail users and drivers, is in place to minimize potential safety risks.

The proposed bridge will be approximately 400-feet-long by 14-feet-wide and will cross above Beach Drive, Rock Creek, and the existing ramp network for vehicles traveling between Joyce Road and westbound Military Road. The new bridge will end at approximately Station 130+60, roughly adjacent to the eastern limit of the existing Military Road bridge over Rock Creek. The proposed trail will then continue along the south side of Military Road, avoiding impacts to the existing police pull-off area at approximately Station 134+00, until approximately Station 139+00 where the trail will turn southeast into the woods adjacent to the roadway.

The proposed trail is moving further from the roadway at this location to provide space for a new proposed pedestrian and bicycle bridge adjacent to the existing Military Road bridge over Joyce Road. The new proposed bridge will cross over an existing tributary to Rock Creek, Joyce Road, and the existing Joyce Road ramp to Missouri Avenue before ending adjacent to Missouri Avenue at approximately Station 144+70. The new proposed bridge will be approximately 370-feet-long by fourteen-feet-wide, and the approximate bridge location is shown in **Figure 12**.

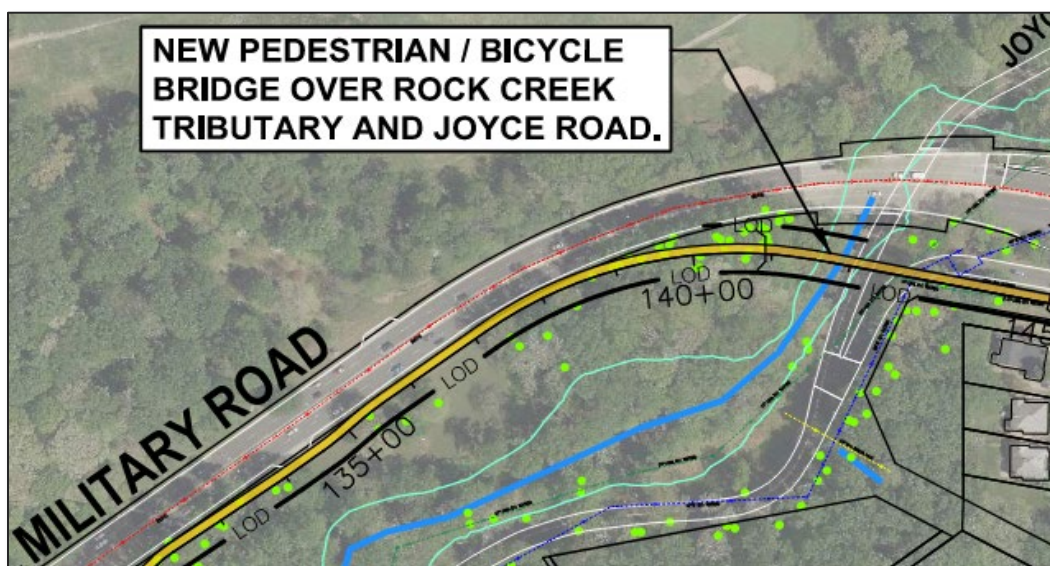


Figure 12: Proposed Bridge over Joyce Road and Rock Creek Tributary



The proposed trail will then cross 17th Street at-grade and continue adjacent to Missouri Avenue as a shared-use path until reaching the intersection with 16th Street. There is existing six-foot-wide sidewalk between 17th Street and 16th Street that is too narrow for bicycle use and would need to be widened to ten feet. However, widening the sidewalk will be difficult due to existing retaining walls, stairs, driveways, and mature street trees along both sides of the existing sidewalk.

Once reaching 16th Street, bicyclists are allowed to use travel lanes on 16th Street, however this road is not conducive for bicycle use for most cyclists. The existing sidewalk along the road is too narrow for bicycle use, however DDOT plans to widen the sidewalk along 16th Street to ten feet in the future which will turn 16th Street into a logical endpoint for this project.

Option 3

Option 3 proposed to convert an existing travel lane to a shared pedestrian and bicycle facility, as shown in **Figure 13**. A traffic report is currently ongoing to determine the feasibility of this option, however the initial results of the study indicate that removing a travel lane will significantly impact traffic operations through the corridor.

Beginning at the western end of the project area at Oregon Avenue, the proposed improvements will include a new shared-use side path for approximately 200 feet before the proposed trail merges onto the existing roadway. The side path will provide access for the existing bus stop and will also allow space for vehicles to merge into a single lane. At approximately Station 102+50, the side path ends and the trail merges onto the roadway. The new roadway typical section will include a two-foot-wide inside shoulder, a single eleven-foot-wide travel lane, a three-foot-wide buffer, and a ten-foot-wide two-way shared-use trail. The proposed typical section is shown in **Figure 14**.

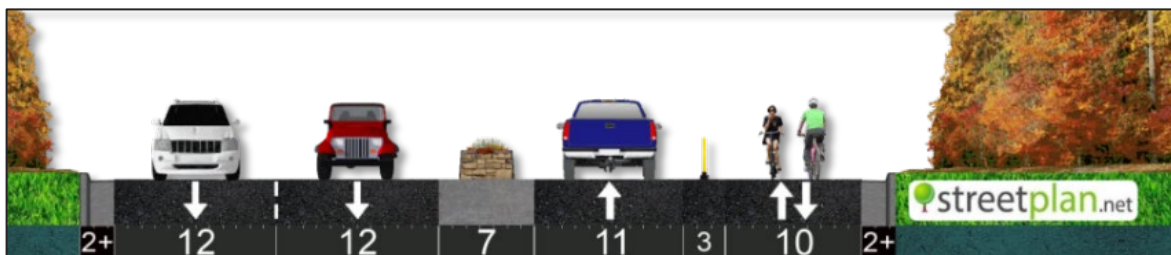


Figure 14: Convert Travel Lane to Ped / Bike Facility

The buffer could provide separation through striping, flexible delineators, bollards, wheel stops and/or a concrete physical barrier. For a principal arterial with a 35 MPH posted speed limit, DDOT guidelines recommends the preferred treatment to be a raised protected bicycle lane with concrete protection. In general, it is recommended to have a minimum width of 17' between physical barriers for a single vehicle lane to allow one vehicle to pass another when there may be a broken-down vehicle or a need for emergency vehicles to pass stalled traffic. However, as shown in **Figure 14**, a 17' minimum width is not attainable within the existing road curb-to-curb width. For this reason, the project team does not recommend using a permanent and continuous concrete physical barrier in the buffer area. If a concrete physical barrier is still desired, it could potentially be non-continuous with gaps where the buffer is striping only, and emergency vehicles can still bypass stalled traffic. For the purposes of cost estimating, and to be conservative, it was assumed that the barrier separation on Military Road would be provided by a mountable curb with flexible delineators.

The trail will continue on the roadway, separated from traffic until approaching the exit ramp to Joyce Road. Access to Joyce Road and Beach Drive for vehicles via the existing exit ramp will be maintained,



however, this will create a conflict point with vehicles crossing the pedestrian and bicycle path to access the exit ramp. To increase awareness of the conflict point for both vehicles and trail users, the project team proposes using green paint at the location where vehicles are crossing the exit ramp.

Just east of the exit ramp, at approximately Station 123+50, the trail will diverge like Option 2B. The main trail will continue on Military Road, while a secondary branch of the trail will create a new shared-use side path along the south side of the Joyce Road exit ramp to provide access to Beach Drive for trail users. This additional branch of the trail will follow the Joyce Road ramp making an at-grade crossing of Ross Drive and continuing parallel to the roadway until entering the roadway just prior to reaching the existing Joyce Road Bridge over Rock Creek. The existing bridge includes two 18-foot-wide travel lanes and a four-foot-wide pedestrian sidewalk on each side of the roadway. This sidewalk is too narrow for bicycle usage, so the project team proposes changes to the travel lane widths to provide a bicycle facility across the bridge. The new proposed typical section will include two 11-foot-wide travel lanes, a four-foot-wide buffer area, and a ten-foot-wide two-way cycle track (see **Figure 4**).

The buffer area for crossing the bridge can provide separation for cyclists through either a striped buffer, flexible delineators, or a solid barrier, depending on the desires of the NPS. A solid concrete barrier will provide the most protection for bicyclists, however it will also require structural analysis to confirm the bridge will not be negatively impacted by the additional dead load weight of the barrier. Flexible delineators provide more protection to bicyclists than a striped buffer, however flexible delineators can sometimes cause maintenance concerns due to the frequency that delineators must be replaced. A striped buffer will provide the least protection for cyclists but will most likely require less maintenance than flexible delineators.

The main trail will continue on Military Road, using the existing Military Road bridges over Rock Creek and over Joyce Road until reaching the existing Military Road exit ramp to 16th Street at approximately Station 143+00. The existing ramp will be restriped so that the trail can use the ramp and remain separated with a buffer area from vehicular traffic. At approximately Station 146+00 just east of 17th Street, the proposed trail will exit the roadway, cross a short grass strip separating the ramp from Missouri Avenue, and then cross Missouri Avenue at-grade. After crossing Missouri Avenue, the trail will continue east towards 16th Street by widening the existing six-foot-wide sidewalk to ten feet (see **Figure 8**). However, widening the sidewalk will be difficult due to existing retaining walls, stairs, driveways, and mature street trees along both sides of the existing sidewalk.

Once reaching 16th Street, bicyclists are allowed to use travel lanes on 16th Street, however this road is not conducive for bicycle use for most cyclists. The existing sidewalk along the road is too narrow for bicycle use, however DDOT plans to widen the sidewalk along 16th Street to ten feet in the future, which will turn 16th Street into a logical endpoint for this project.

Military Road Trail Feasibility Study - Option 3

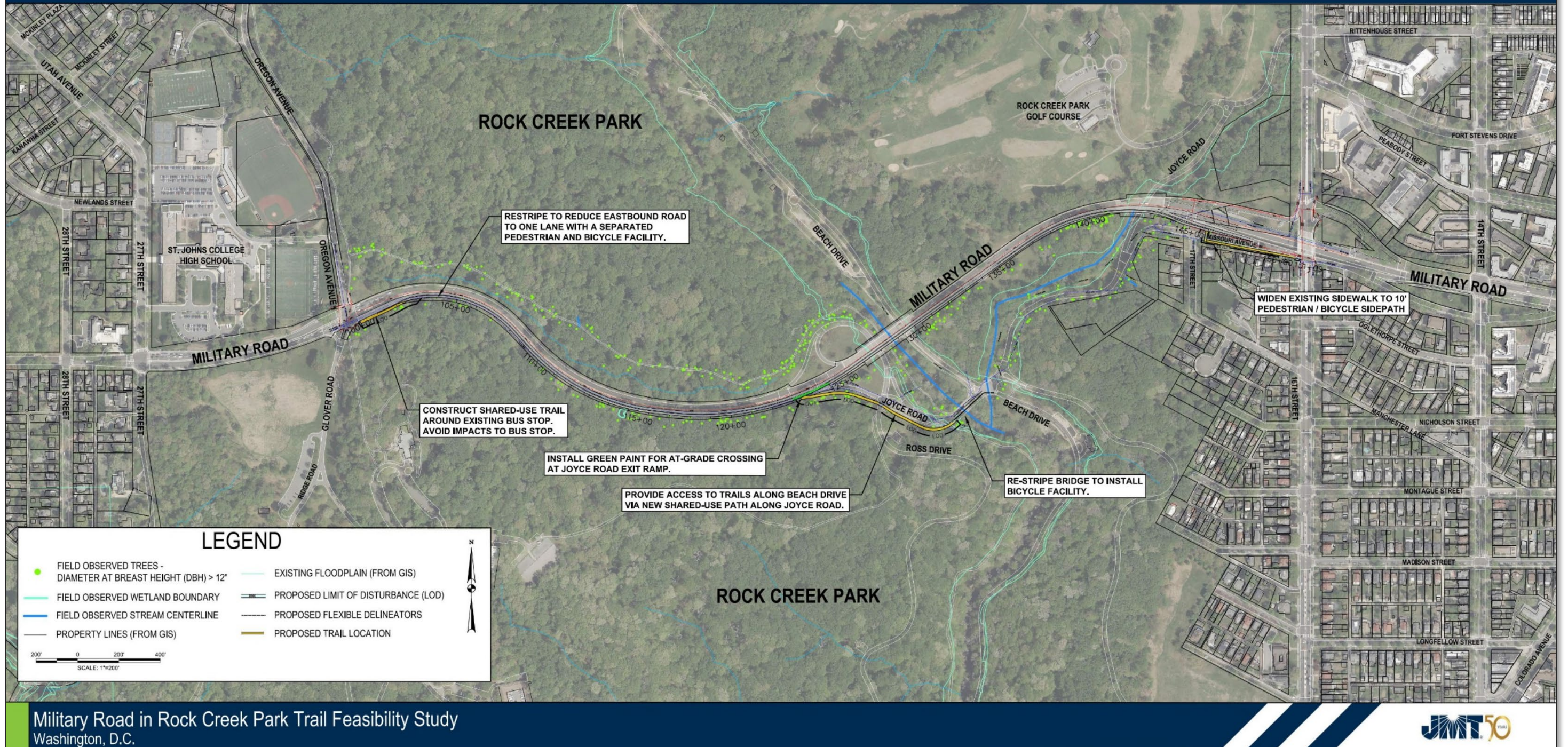
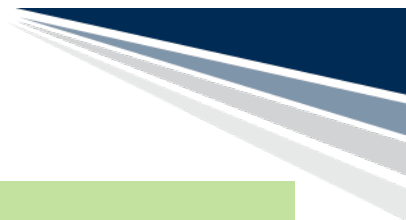


Figure 13: Option 3 Alignment



TRAFFIC ANALYSIS SUMMARY

Traffic analysis was conducted by the project team to determine the feasibility of Option 3, which involves removing a vehicle travel lane for eastbound Military Road and converting it into a pedestrian and bicycle facility as discussed above. The traffic analysis was completed in March of 2022 based on traffic volumes that were collected in December of 2021.

The analysis considered two alternatives, an Option 3 Full Build and an Option 3 Partial Build. The Full Build alternative proposed to remove the outside lane for eastbound traffic on Military Road for the full length of the road between Oregon Avenue and the existing ramp from Military Road to 16th Street. The Partial Build alternative proposed to remove the outside lane for eastbound traffic only between the existing Joyce Road exit ramp and the existing ramp from Military Road to 16th Street. This Partial Build alternative was developed do to the large (approximately 2,600-foot-long) queues that were created by the two-to-one lane merge on Military Road. By relocating the merge point further into the park, the large queues that are developed on Military Road would have less on cross street traffic.

After completing the traffic analysis and traffic modeling, the team determined that Military Road would operate at a Level of Service (LOS) F during the PM Peak Hour under both the Full Build and Partial Build future conditions. Based on this, the project team agreed that these options are infeasible and were dropped from further study.

SELECTED OPTION

After reviewing the concepts developed, their cost estimates and impacts, as well as taking into account input from the stakeholder meetings, NPS and DDOT requested a combination of Option 1 and Option 2A to be further analyzed for the Conceptual Design phase of the project. This alignment can be seen in **Figure 15**. The project will primarily utilize Option 2A for the corridor, with the Option 1 alignment used east of Beach Drive. Option 2A was used in most of the project area to reduce impacts to natural and cultural resources and avoid impacting traffic operations. Displays showing the proposed horizontal alignment in plan view, proposed profiles, and proposed cross sections can be found in the separate attached Rock Creek Park Military Road Trail Feasibility Study plan set.

Military Road Trail Feasibility Study

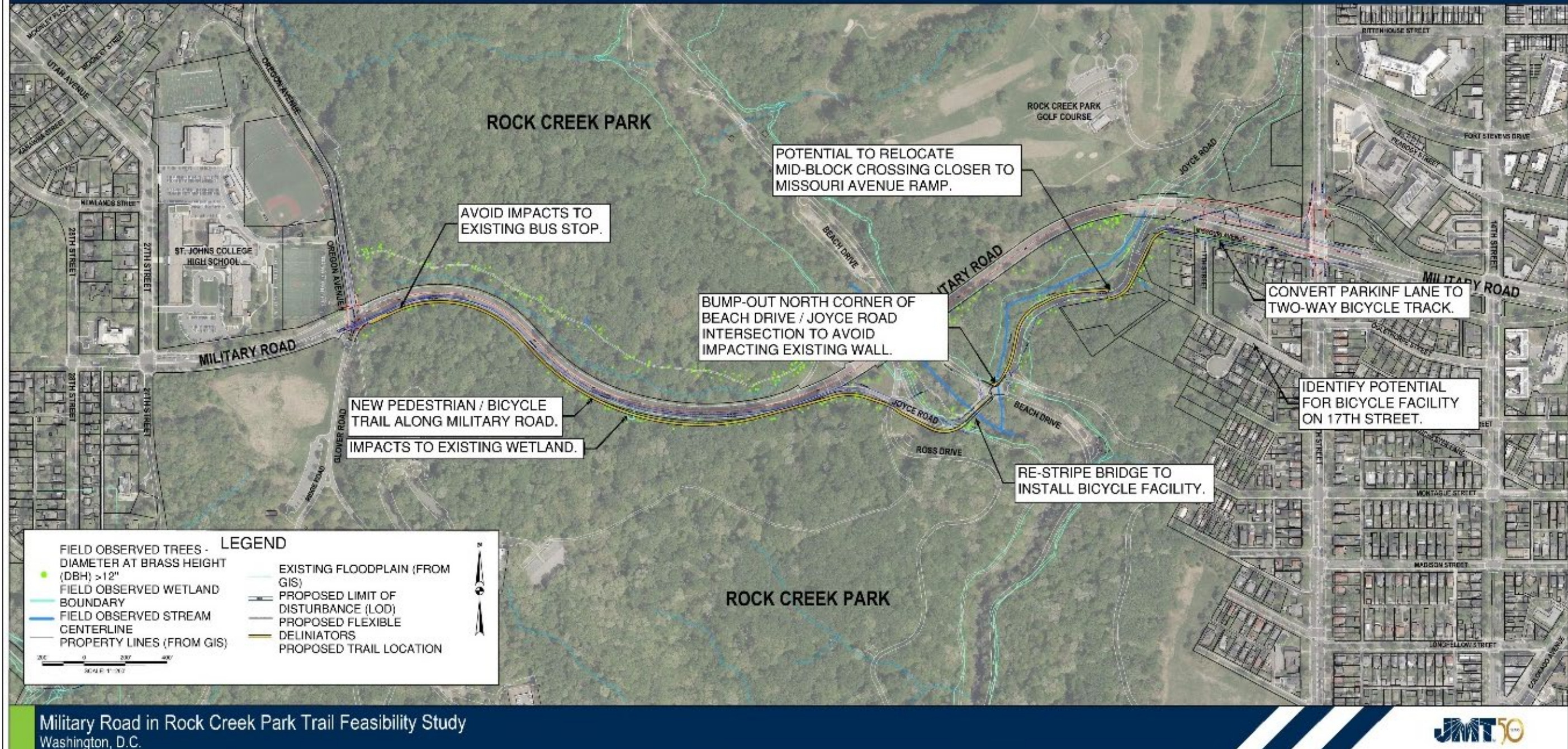
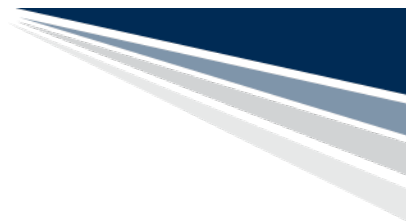


Figure 15: Selected Option



CONCEPTUAL DESIGN

Conceptual Trail Design

The combination of Options 1 and 2A as discussed above, was moved into conceptual design. This combination is the baseline design for the conceptual trail design discussed hereafter. The project team used this baseline design and GIS level contours to create cross sections to identify an LOD, identify potential alignment alternatives to be further analyzed in future design phases, create conceptual level stormwater management design, and identify potential impacts, constructability concerns, and proposed construction phasing. In addition, the project team also updated the feasibility level cost estimates and identified the next steps to be completed as the project moves into preliminary design. The separate attached conceptual level Construction Plan Set includes plan view and profiles of the baseline design.

The two alternatives that were developed are discussed on the following pages with plan view displays showing the changes proposed in each of the alternatives. These alternatives are independent of each other and can be combined or mixed and matched together as desired.

ALTERNATIVE 1 – BEACH DRIVE / JOYCE ROAD INTERSECTION

This alternative proposes a different crossing of the Beach Drive and Joyce Road intersection. The selected option proposed to cross Joyce Road on the west side of Beach Drive and to cross Beach Drive on the north side of Joyce Road. This alternative proposes crosswalks across all four legs of the intersection and to bump-out Joyce Road between Beach Drive and Morrow Avenue to reduce the roadway crossing distance for pedestrians and bicyclists. Future studies of this alternative, along with additional coordination with DDOT, will be required to determine the exact location of the proposed crosswalks and vehicle stop bars to ensure that vehicles have adequate visibility for all legs of the intersection. A zoomed-in plan view display of this alternative is shown in **Figure 16**.

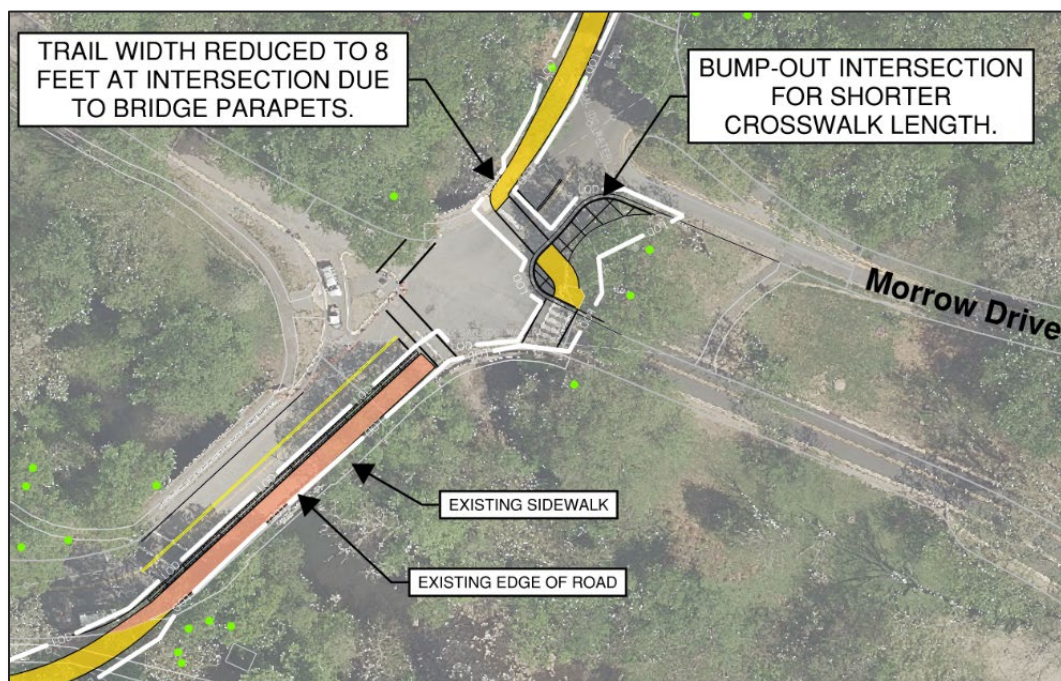


Figure 16: Alternative Alignment 1

ALTERNATIVE 2 – RELOCATE JOYCE ROAD MID-BLOCK CROSSING

Alternative 2 will relocate the proposed mid-block crossing of Joyce Road further north, near the ramp to Missouri Avenue. The existing road is very wide at this location, creating a long crossing for pedestrians and bicyclists. To compensate for this, the project team is proposing to create a bump-out on Joyce Road that will reduce the crossing length to approximately 24'. This bump-out should also help to slow down vehicular traffic using Joyce Road and will force vehicles turning onto Missouri Avenue to significantly reduce their speeds. A plan view display of this alternative is shown in **Figure 17**.

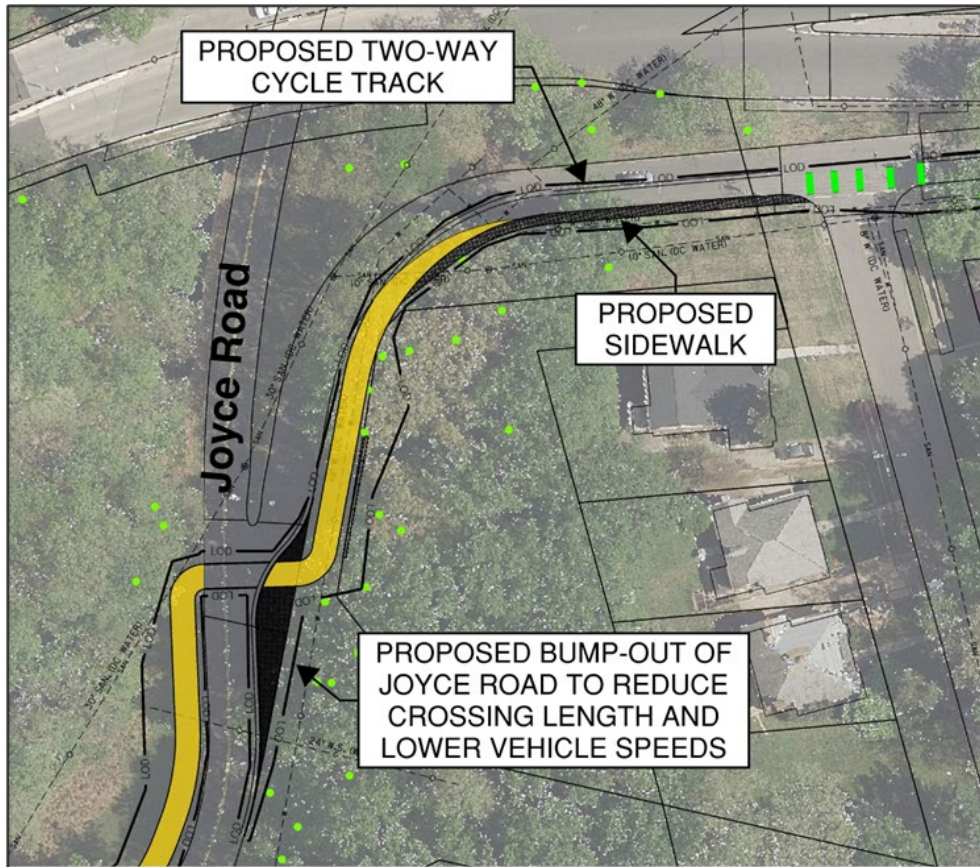
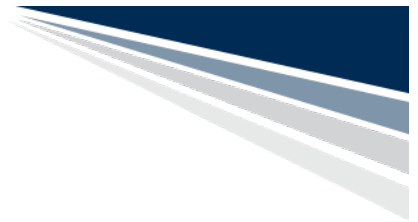


Figure 17: Alternative Alignment 2



Conceptual Stormwater Management Design

METHODOLOGY

The Conceptual Stormwater Management design was developed utilizing the District of Columbia Stormwater Management Guidebook, January 2020 (Guidebook) issued by the department of Energy and Environment (DOEE). The design was based on the Selected Option that combined Options 1 and 2A. The design did not consider the two alternatives described under the Conceptual Trail Design. Eight (8) Site Drainage Areas (SDA) were identified for the project where runoff drains to a single discharge point or sheet flows from a single area of the site. The limits of disturbance used for establishing the SDAs were based on the design of the proposed trail and excluded roadway areas that would not be disturbed for the construction of the project.

Drainage areas were determined for each SDA. The required Stormwater Retention Volume (SWRV) was computed for each SDA. The SWRV is based on the limits of disturbance within each SDA. The rainfall amount used to compute the SWRV was 1.2 inches since this project is a Major Land Disturbing activity according to the Guidebook. The project has a total SWRV of 7,823 cubic feet. This volume must be treated in a DOEE accepted treatment practice to remove 80% of Total Suspended Solids (TSS). In addition, quantity control for the increase in impervious area must be considered for the project for the 2-year and 15-year storm event.

Constraints in meeting the stormwater management requirements include steep slopes, and environmental features such as wetlands and streams. Steep slopes make it difficult to locate stormwater facilities. If facilities are located near steep slopes, additional cut or fill will be required to accommodate the facility, and this cut or fill can impact resources such as trees or wetlands. Environmental features, such as wetlands and streams, should generally be avoided when placing stormwater facilities to prevent unnecessary impacts to resources.

The conceptual stormwater design discussed below examines the project as a whole. If the project were to be split into phases, each phase would require an independent stormwater management design that could stand on its own, meeting the requirements for that phase. In addition, the cost estimates are also based on the project as a whole. If this project is phased, the SWM design and implementation will need to be advanced, which may impact the projected cost and schedule by phase. Displays showing the locations and approximate sizing of proposed stormwater management facilities are located on pages 10-15A of the Rock Creek Park Military Road Trail Feasibility Study plan set, under separate cover. The design discussed is based on the baseline design and does not include the two alignment alternatives, although any effects upon the design based on the alignment alternatives are anticipated to be minor.

STORMWATER MANAGEMENT QUALITY CONTROL

To meet the SWRV requirement for the project, nine (9) bioretention facilities are proposed. The number, location, and size of these facilities can be expected to change during detailed design. Seven (7) of the bioretention facilities do not treat the proposed trail, but instead treat other areas including portions of Joyce Road, Beach Road, 16th Street NW, parking lots and ramps between 16th Street NW and Military Road. The remaining two (2) bioretention facilities treat the proposed trail directly. The proposed stormwater facilities provide an SWRV of 8,732 cubic feet, exceeding the requirements.

Bioretention facilities are practices that capture and store stormwater runoff and pass it through a filter bed of engineered filter media composed of sand, soil, and organic matter. Filter runoff may be collected and returned to the conveyance system or allowed to infiltrate into the soil. There are several design

variants of Bioretention facilities, and this project will use traditional bioretention given the project location and surrounding land use. Bioretention practices that follow the standard design use a standard underdrain design and at least 18 inches of filter media depth. Enhanced designs use underdrains with at least 24 inches of filter media depth and an infiltration sump/storage layer, or practices can infiltrate the design storm volume within 72 hours. The specific design configuration to be implemented is typically dependent on specific site conditions and the characteristics of the underlying soils. The design configuration will be determined during the detailed design of the project.



Figure 18: Bioretention

STORMWATER MANAGEMENT QUANTITY CONTROL

The project will need to provide control for the 2-year 24-hour and 15-year 24-hour storm event. For the 2-year storm event, the proposed discharges must be reduced to the predevelopment peak discharge rate for the site as a whole. Predevelopment conditions are defined hydrologically as “meadow in good condition” or better, assuming good hydrologic conditions and land with grass cover. For the 15-year storm event, the proposed discharge must be reduced to the pre-project discharge based on the existing site conditions. For both the 2-year and 15-year storm there is an increase in discharge as a result of the project. Stormwater detention facilities will need to be provided to manage the increase in discharge.

Proposed Structures

During the conceptual design phase of the project, the project team identified one potential future structure. The potential bridge, with approximate size and location, is identified in **Table 5**. All Station locations are approximate.

Table 5: Proposed Bridge

Location	Description
Station 114+30 to Station 114+80	~50-foot-long boardwalk over existing wetland, 16-foot width



In addition, the new trail will include improvements to two existing structures, the Joyce Road Bridge over Rock Creek, and the Joyce Road / Beach Drive Bridge over a Rock Creek Tributary. The proposed improvements on the Joyce Road Bridge over Rock Creek are considered unlikely to impact the existing structure, however the proposed improvements on the bridge over the tributary to Rock Creek will include more significant deck reconstruction, and a structural analysis of the bridge should be completed to confirm that the improvements will not affect the existing structure.

Cross Sections

Cross sections were completed at 50-foot intervals for the length of the project. At this stage of design, the cross sections show the proposed trail and proposed grading to provide an approximate Limit of Disturbance (LOD). The LOD was identified by creating both an existing and proposed surface using MicroStation Inroads. The existing surface was created using GIS level contours since surveys have not yet been completed at this stage of design. The proposed surface was created using the design criteria as discussed above, including a 12' (8' minimum) wide trail with a maximum cross slope grade of 50:1 (2%), two feet of safety grading on each side of the trail with a maximum grade of 6:1 (~16.7%), and tie-in slopes of either cut or fill with a preferred maximum grade of 3:1 (33.3%) and an absolute maximum grade of 2:1 (50%). The cross sections can be seen on pages 31-65 of the Rock Creek Park Military Road Feasibility Study plan set, under separate cover.

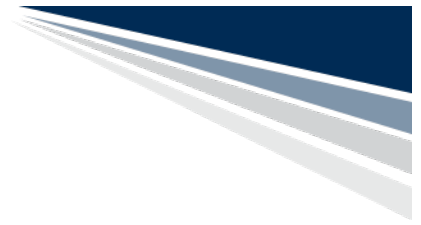
Minimization

After completing the cross sections and identifying an initial LOD, minimization was completed to reduce the total amount of impacts where possible. This primarily included minor adjustments to the horizontal and vertical alignments of the trail to tie-in proposed grades closer to the trail. In addition, seven proposed retaining walls were added to reduce impacts in locations where tie-in slopes would create significant impacts. Six of the seven retaining walls are located on the western half of the project area, with the seventh wall located along the ramp to Missouri Avenue. **Table 6** includes a listing of all seven proposed walls along with their length and average height.

Table 6: Proposed Retaining Walls

Wall	Total Length	Average Height
Wall 1 – Station 100+40	265'	7'
Wall 2 – Station 110+00	100'	5.5'
Wall 3 – Station 112+50	75'	6'
Wall 4 – Station 114+00	50'	4'
Wall 5 – Station 115+00	265'	7'
Wall 6 – Station 118+50	220'	4.5'
Wall 7 – Station 144+75	60'	6'

There is potential for some or all of these proposed retaining walls to be removed in future design phases as more detailed survey data becomes available. In particular, Wall 7 may potentially be removed or reduced by reducing the width of the Missouri Avenue travel lane to 17-feet.



Impacts Analysis

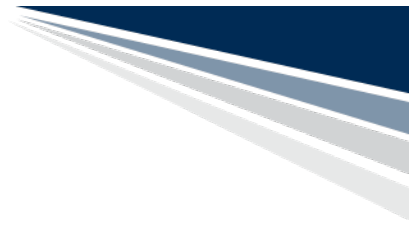
A conceptual level impacts analysis was developed for the selected option. All impacts are conservative estimates and are likely to be reduced in future phases of design. The analysis focused on the following items:

- Right-of-Way Impacts
- Forested Area Impacts
- Tree Impacts with diameter at breast height (DCH) > 12"
- Potential Stream Impacts
- Potential Wetland Impacts
- Impacts to 100-Year Floodplain
- Number of Road Crossings
- Proposed Bridges
- Proposed Physical Barrier

Estimates are based on GIS Mapping from the DC Open Data website, except for the Specimen Trees, Trees with DBH of 12" to 29.9", Potential Streams, and Potential Wetland impacts, which were field delineated. The findings of this analysis are summarized in the following table. A limit of disturbance (LOD) was developed based on cross sections completed at 50-foot intervals and proposed stormwater management facility locations. To be conservative, all items located within the LOD were considered impacts at this stage of design.

Table 7: Impacts Analysis

ITEM	PRELIMINARY DESIGN IMPACT
Right-of-Way (acre)*	2.5 – 3.0 acres
Forested Area (acre)	2.5 – 3.0 acres
Trees with DBH of > 12" (EA)	70 - 80 trees
Stream (LF)	15 – 30 LF
Wetland (SF)	400 – 500 SF
100-Year Floodplain (acre)	0.4 – 0.6 acres
Road Crossings (EA)	5 crossings, 1 mid-block crossing
Proposed Bridges (EA) (Total SF)	1 bridge, ~800 SF
Proposed Physical Barrier (LF)	~200 LF



Permitting and Mitigation

NATURAL RESOURCES

The National Park Service (NPS) issues a Special Use Permit (SUP) for any invasive work proposed on their property. Separate SUPs will be required for construction of the trail and for any pre-construction activities that are considered invasive, such as the wetland delineation that will be required during the design process.

Any proposed impacts to forest, wetlands, or WUS will need to be authorized by the regulating agency. Unavoidable impacts to forest and individual trees will be authorized by NPS. Minimizing tree removal is a high priority for NPS and it is possible comments will be provided that request revisions to the plans to protect trees.

Unavoidable impacts to wetlands and WUS will be authorized by DOEE and the U.S. Army Corps of Engineers (USACE). A Water Quality Certification from DOEE is required to authorize proposed impacts to wetlands and WUS. A Joint Permit Application (JPA) is required to be submitted to USACE (and to DOEE as an attachment to the Water Quality Certification request) to quantify and justify the proposed impacts. Acquiring permits from both agencies is a six- to ten-month process, with the exact time determined by the quantity of impacts being proposed.

Additionally, NPS may require a Wetlands and/or Floodplain Statement of Findings (SOF). As the project progresses, National Environmental Policy Act (NEPA) coordination will need to be initiated. The SOF may be prepared and included as a part of or in conjunction with the final NEPA document.

The quantity of impacts to resources that can be anticipated will be determined by the trail alignment that is selected. **Table 7** in the Impacts Analysis section of this report shows a breakdown of resources that are located within the proposed alignment for selected option. Wetland and WUS boundaries sketched in the field are approximate, and as a result, the estimated impacts are also approximate. Additionally, it is likely that overall impacts will decrease as the design is refined.

Mitigation will be required for impacts to wetlands, WUS, and forest clearing. NPS will dictate the mitigation required for forest clearing and/or the removal of individual specimen trees. The amount and type of mitigation will be dictated by the quantity of tree clearing that is proposed. If a small amount of tree clearing is proposed, mitigation requirements may be satisfied through equivalent tree planting. If this is not possible, financial mitigation may be required.

Wetland and WUS mitigation ratios are summarized below. Wetland mitigation ratios are determined by wetland cover type, which is determined in the field by the wetland delineation team prior to submitting permit applications.

- Ephemeral Stream – 1 LF credit required per 1 LF stream impacted (1:1)
- Intermittent/Perennial Stream – 2 LF credit required per 1 LF stream impacted (2:1)
- Palustrine Emergent (PEM) wetland – 1 SF credit required per 1 SF wetland impacted (1:1)
- Palustrine Scrub-Shrub (PSS) wetland – 2 SF credit required per 1 SF wetland impacted (2:1)
- Palustrine Forested (PFO) wetland – 2 SF credit required per 1 SF wetland impacted (2:1)

Prior to applying for permits, a full wetland delineation will be needed within the project limits, as determined by the selected trail alignment. Wetland delineations conducted on NPS property must satisfy NPS *Director's Order #77-1: Wetland Protection*. Under Section 4.1.2 of *National Park Service Procedural Manual # 77-1: Wetland Protection*, in areas where plants and soils are present, the most recent version

of the U.S. Army Corps of Engineers (USACE) *Wetland Delineation Manual* and any approved Regional Supplements should be utilized to delineate wetlands. Therefore, the wetland delineation should be performed according to *Director's Order #77-1*, the *Corps of Engineers Wetlands Delineation Manual*, and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region, Version 2.0*.

Additionally, NPS requires that all vegetation with a DBH of five inches and greater be inventoried within all proposed areas of disturbance, including planned access areas. NPS will also require a vegetation survey of potential LODs, wetlands, seeps, and springs to be completed prior to finalizing the design. However, this survey and vegetation inventory are both beyond the scope of this feasibility and conceptual design level study and will be conducted during a future design phase.

CULTURAL RESOURCES

Archaeology

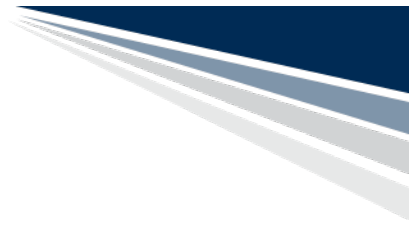
The area along the south side of Military Road where the proposed trail will be located has not been previously surveyed for archaeological resources and is located near areas known to have high archaeological potential. Geoarchaeological evaluation is recommended to be completed within the project footprint to indicate archaeological potential within this area. This evaluation would verify the extent of previous ground disturbance analyses and determine which locations along the proposed trail may warrant subsequent phased archaeological testing.

Historic Resources

In all areas where the proposed improvement involves widening into existing vegetation and mature forests has the potential to have a visual impact on the historic district along Military Road.

Additionally, the proposed trail would involve improvements to the historic Old Military Road Bridge – Joyce Road Bridge. This would have a direct impact on the existing bridge and visual impacts to the Rock Creek Park Historic District.

Additional survey work will need to be conducted to determine the effects that these impacts will have on previously identified resources and to locate and / or identify previously unidentified resources.



Cost Estimate

The cost estimates that were completed during the feasibility phase of design were updated based on the conceptual level design of the selected option. The conceptual level cost estimates include proposed grading, paving, barriers, structures, retaining walls, stormwater management facilities, and Maintenance of Traffic (MOT). A 40% contingency was added to the estimate to account for uncertainty at this stage of design. The conceptual level cost estimates for the selected option and each of the four previously discussed alternatives can be found in **Appendix E**. The cost estimates for the selected option, along with each of the two alternative alignments, are shown in **Table 8**. As a reminder, each of the two alternative alignments are independent of each other and can be used in any combination.

Table 8: Cost Estimates

OPTION	COST RANGE
Selected Option (Base Bid)	\$10 - \$12 Million
Alternative 1 – Beach Drive / Joyce Road Intersection	Base Bid plus \$10,000 - \$20,000
Alternative 2 – Relocate Joyce Road Mid-Block Crossing	Base Bid minus \$50,000 - \$100,000

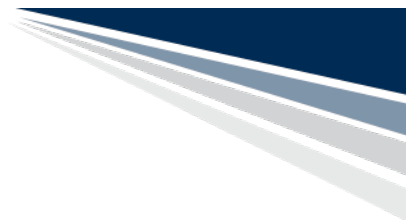
Constructability

MISSOURI AVENUE PARKING LANE

The current design of this project relies on the removal of an existing parking lane along Missouri Avenue and the construction of a two-way cycle track in its place. Using the District Department of Transportation (DDOT) standard of 22 feet spaces and spaces beginning five feet from driveways, 13 spots will be affected. Initial public outreach has indicated no major concerns from the public about this design, however parking is frequently a contentious issue for projects. The project should continue to provide public outreach and engagement to ensure that the public is bought-in on the project design.

RARE, THREATENED, OR ENDANGERED SPECIES

There are several rare, threatened, or endangered species (RTE's) located within Rock Creek Park. As described previously in the *Summary of Existing Conditions Report* section of this report, initial agency coordination has indicated that this project is “not likely to adversely affect” any RTE's at this time. Continuing agency coordination will be required as this project continues to move forward to ensure that any future RTE concerns located within the project area are quickly identified.



Construction Phasing

Since this is a large project requiring extensive coordination and permitting, the project team identified potential logical endpoints for the project to be split into four phases. Cost estimates were completed for each of the proposed phases and are shown in **Table 9**. The cost estimates were completed based on the assumption of calculating SWM for the project as a whole, if the project is broken into phases, the SWM design and implementation will need to be advanced, which may impact the projected cost and schedule by phase. At this stage of design, the phasing sequence has not yet been chosen, as all potential phases will have logical termini independent of each other. For this reason, and to limit confusion, the four phases are discussed as “Area 1”, “Area 2”, “Area 3”, and “Area 4” below.

Table 9: Estimated Cost per Project Phase

OPTION	COST RANGE
Area 1 (Oregon Avenue to the Joyce Road Ramp)	\$6.2 Million - \$7.5 Million
Area 2 (Joyce Road Ramp to Beach Drive)	\$1.9 - \$2.5 Million
Area 3 (Beach Drive to 17 th Street)	\$2.2 - \$3 Million
Area 4 (Missouri Avenue from 17 th Street to 16 th Street)	\$300,000 - \$400,000

AREA 1 (OREGON AVENUE TO THE JOYCE ROAD RAMP)

Area 1 is recommended to be constructed from Oregon Avenue to the Joyce Road ramp. This will provide a connection to Ross Drive and to pedestrian and bicycle networks near Ross Drive from areas west of the park and will include the proposed trail along the south side of Military Road and along the Joyce Road exit ramp.

AREA 2 (JOYCE ROAD RAMP TO BEACH DRIVE)

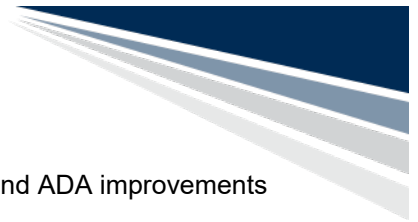
Area 2 is recommended to be constructed from the Joyce Road ramp to Beach Drive. This will provide a connection from the extensive north / south network of trails within Rock Creek Park along Beach Drive and Morrow Drive to Ross Drive and to the portion of the trail that will be constructed within Area 1. This will include a new shared-use path between the Joyce Road ramp and the existing Joyce Road bridge over Rock Creek as well as a new two-way cycle track across the existing bridge until arriving at the Beach Drive intersection.

AREA 3 (BEACH DRIVE TO 17TH STREET)

Area 3 is recommended to be constructed from Beach Drive to 17th Street. This will provide a connection from the north-south pedestrian and bicycle network along Beach Drive to existing residences along Missouri Avenue and 17th Street. This area will include improvements to the Beach Drive / Joyce Road intersection, a new shared-use path along Joyce Road, and new sidewalk / a new two-way cycle track along Missouri Avenue.

AREA 4 (MISSOURI AVENUE FROM 17TH STREET TO 16TH STREET)

Area 4 is recommended to be constructed from 17th Street to 16th Street. This will provide a connection from the sidewalk and residences along 16th Street to the portion of the trail that will be constructed within



Area 3. This area will include a new two-way cycle track along Missouri Avenue and ADA improvements to the existing sidewalk along Missouri Avenue.

Public Outreach Meeting Summary

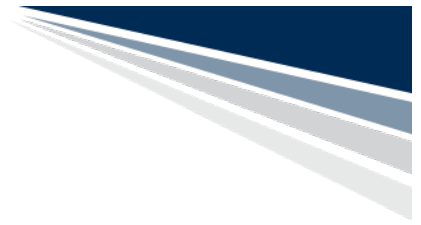
The project team conducted a virtual public outreach meeting on Microsoft Teams on May 24, 2022. The meeting included a Power Point presentation by JMT explaining the project and was followed by a Question-and-Answer session. During the Q&A, members of the public were invited to type questions into the chat for the project team to respond.

In general, the public expressed a high degree of interest in the completion of this project to create an east-west pedestrian and bicycle connection between 16th Street and Oregon Avenue. While the public's response to the project was generally very positive, concerns were raised about the steep grades, the mid-block crossing, and the lack of a viable bicycle facility at the eastern terminus of the project on 16th Street. Additionally, multiple commenters expressed concerns with the section of Joyce Road between Missouri Avenue and Rittenhouse Street, which is currently a primary access point for pedestrians and bicycles within the park. The project team explained that this stretch of Joyce Road was beyond the scope of this study, however future studies should analyze the potential for safety improvements along this stretch of roadway. Additional comments during the meeting focused on items such as: potential traffic calming measures, wayfinding, and the anticipated timeframe for the project.

At the conclusion of the meeting, a public survey was posted online to give all members of the public a chance for commenting on the proposed project. The commenters were almost exclusively positive, with most expressing excitement for the project to be completed. The topics of the project that were most frequently commented on were:

- Project scope and boundaries – Many commenters expressed a desire for the project scope to be expanded to include one or all of the following: Joyce Road between Missouri Avenue and Rittenhouse Drive, Military Road between 16th Street and 14th Street, Military Road west of Oregon Avenue, and along Glover Road. In general, the commenters were excited about the potential for the project and wanted to expand access to neighborhoods further away from Rock Creek Park.
- Lighting – Commenters also expressed a desire for lighting to be included with the project so that the trails are safer during winter when there is less daylight.
- Traffic Calming / Mid-block crossing – Commenters would prefer to remove the mid-block crossing; however, most commenters understood the reasoning for why the mid-block crossing is necessary. The general sentiment is that if traffic calming measures are installed along with the mid-block crossing and Beach Drive north remains closed to traffic, that the mid-block crossing is acceptable if not desirable.
- Separation from vehicles – Several commenters discussed including a physical barrier between vehicles and the trail to provide additional levels of safety for pedestrians and bicyclists.
- Beach Drive – Commenters expressed a desire for Beach north of the project area to remain closed to vehicular traffic in the future.

A full list of all comments received during both the public meeting and the public comment period can be found in the separately submitted *CLIN 00202 – Additional Public Outreach Summary* deliverable report.



Next Steps

This feasibility study will be completed at the conclusion of the conceptual design of the project. These Next Steps are potential challenges to the project that should be completed prior to or during the early stages of the next design phase of the project to keep the project moving forward as efficiently as possible.

AGENCY REGULATORY COMPLIANCE

NPS will need to undertake Agency Regulatory Compliance, including NEPA and NHPA Section 106 as the next major step in moving this project forward.

FULL SURVEYS AND CONCEPT REFINEMENT

The proposed alignment should be field surveyed prior to additional design work. The surveys will provide a higher level of accuracy than the GIS-based mapping data that has been used for the feasibility and conceptual stages. Subsurface utilities should also be designated and surveyed as part of this phase. After the surveys have been completed, the proposed alignment should be run again using surveyed information to identify in advance any other potential issues that have not been identified during the feasibility phase.

WETLAND DELINEATION AND FOREST STAND DELINEATION

Potential wetlands and stream locations were approximated in the field to assist in the feasibility analysis of the three proposed alignments identified in the Existing Conditions Report. The chosen alignment should be revisited, and a full forest stand delineation and wetland delineation should be completed to identify the boundaries of wetlands, streams, and forest stands more accurately. Additionally, NPS requires that all vegetation with a DBH of five inches and greater be inventoried within all proposed areas of disturbance, including planned access areas.

Completing the above delineations early in the design process allows for more precise impact avoidance and minimization practices and allows any potential permitting concerns to be identified early.

CONTINUING COORDINATION

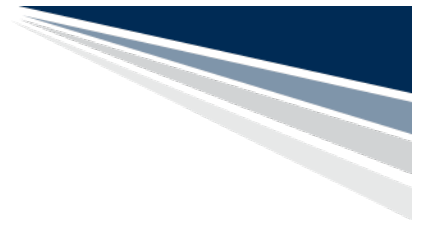
NPS and DDOT should continue to coordinate throughout future design phases to ensure that both stakeholders have input on the project throughout. This partnership is important for both agencies as the new pedestrian and bicycle connections that will be developed will help both agencies to meet their future goals in the Rock Creek Park area. Additionally, all future designs should continue to utilize the DDOT Bicycle Facility Design Guide as the project continues to move forward.

FUTURE TRAIL CONNECTIONS

This project terminates on the eastern side of Rock Creek Park at 16th Street, however, it was revealed during public meetings that the public would like to see additional connections to the bicycle network beyond 16th Street. The public raised concerns that Joyce Road north of the project area, between Missouri Avenue and Rittenhouse Street, is dangerous for pedestrians and bicyclists due to vehicle speeds and a lack of sight distance. NPS should continue to work with their stakeholders to identify safety improvements and a trail network along this stretch of roadway.

Rock Creek Park Military Road Trail Feasibility Study
CLIN #00600 Conceptual Design Report

The public also raised concerns about the lack of existing bike infrastructure on 16th Street and requested for the project to be extended to 14th Street, where there are existing bike lanes. The project team explained that this connection was beyond the scope of this study, however, DDOT stated during the meeting that they are actively planning improvements along Missouri Avenue between 16th Street and 14th Street to create this connection in the future.



APPENDIX A: ROCK CREEK PARK MILITARY ROAD FEASIBILITY STUDY EXISTING CONDITIONS



APPENDIX B:

PHASE 1A CULTURAL RESOURCE ASSESSMENT



APPENDIX C: AGENCY LETTERS



APPENDIX D: SIGNIFICANT AND SPECIMEN TREES



APPENDIX E: CONCEPTUAL LEVEL COST ESTIMATES



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d. WE ARE WASHINGTON **DC** GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

U.S. Department of Transportation
Volpe Center
