APPENDIX A: TRANSPORTATION IMPACT ASSESSMENT

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George Washington Memorial Parkway
Virginia

U.S. Department of the Interior
National Park Service

Arlington County and Vicinity Boathouse Transportation Impact Assessment

FINAL

January 2018

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ACRONYMS AND ABBREVIATIONS

AADT	average annual daily traffic
AAWDT	average annual weekday traffic
ADA	Americans with Disabilities Act
ART	Arlington County Transit
CCT	Capital Crescent Trail
C&O	Chesapeake and Ohio
Custis Trail	Martha Custis Trail
DDOT	District Department of Transportation
EA	environmental assessment
GWMP	George Washington Memorial Parkway
HCM	Highway Capacity Manual
HCS™	Highway Capacity Software
HOV	High Occupancy Vehicle
HOT	High Occupancy Toll
I	Interstate
ITE	Institute of Transportation Engineers
Key Bridge	Francis Scott Key Bridge
LCT	Loudoun County Transit
LOS	level of service
MEV	million entering vehicles
MOE	Measure of Effectiveness
mph	miles per hour
MWCOG	Metropolitan Washington Council of Governments
NPS	National Park Service
pc/mi/ln	passengers cars per mile per lane
PRTC	Potomac and Rappahannock Transportation Commission
SF	square feet
TAZ	traffic analysis zone
TBC	Thompson Boat Center
TIA	Transportation Impact Assessment
TWSC	Two-way STOP-controlled
VDOT	Virginia Department of Transportation
WMATA	Washington Metropolitan Area Transit Authority

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1.0 INTRODUCTION

The findings of this Transportation Impact Assessment (TIA) were prepared as part of the environmental assessment (EA) to study implementation of a proposed boathouse located along the Arlington County, Virginia, side of the Potomac River across from Washington, DC, on land administered by the George Washington Memorial Parkway (GWMP). Developed for the National Park Service (NPS), the selection of a preferred site and construction of a boathouse is needed to meet the direction of Congress for providing enhanced public waterfront access in the proximity of Arlington County. The construction of a boathouse facility is also needed to increase access along the Virginia shoreline for non-motorized, water-based recreational activities on the Potomac River and to alleviate pressure on other area boathouses, which are currently at maximum capacity in the fall and spring during weekday practice sessions by athletes from local school crew teams.

The following provides a description of the contents of the main sections of this draft TIA.

Chapter 1 – Introduction: Describes the purpose of the TIA.

Chapter 2 – Project Framework: Describes the background, authorization, purpose and need, planning context for the project as provided in local land use plans, the jurisdictional agreement, and project study areas.

Chapter 3 – Description of Alternatives: Describes the alternatives being analyzed in the EA.

Chapter 4 – Existing Conditions: Describes the existing conditions for the study areas that the proposed actions may affect.

Chapter 5 – Alternatives Analysis: Provides a comparative assessment of the alternatives.

Chapter 6 – Analysis of No-Action Alternative: Describes the impacts of transportation in the study area as a result of the no-action alternative to represent the future condition if the proposed action is not implemented.

Chapter 7 – Analysis of Action Alternatives: Describes the impacts of implementing each of the action alternatives.

Chapter 8 – Proposed Mitigation Measures: Provides a summary of the proposed mitigation measures.

Chapter 9 – Conclusion: Provides a summary of the analysis impacts and main mitigation measures for the proposed action.

Chapter 10 – References: Contains references cited in the TIA.

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2.0 STUDY FRAMEWORK

2.1 Background

For more than a decade, rowing enthusiasts in Arlington County have actively pursued the development of a community boathouse to provide a home for the rowing programs of Arlington's public high schools, other area schools, and local rowing and paddling organizations. In August 2002, NPS released a study entitled *Facility & Site Analysis for a Boathouse on the Potomac River in Arlington County and Vicinity* (NPS 2002). Congress initiated this analysis to conduct a feasibility study to assess the potential siting and selection of a preferred alternative for a boathouse in Arlington County along the Potomac River near the GWMP, a unit of the national park system. The study examined building a boathouse with indoor storage space and floating docks at four possible locations—two on the Rosslyn Waterfront, one south of the CSX/14th Street Bridges, and one on Daingerfield Island. NPS must assess environmental impacts, including the transportation impacts, if any, of the proposed facility in accordance with the National Environmental Policy Act.

Since 2002, NPS has been analyzing the potential impacts of siting a boathouse in Arlington County and the vicinity, on both NPS and non-NPS lands. In 2012, NPS reinitiated an environmental impact statement for the Arlington County and Vicinity Boathouse Project, developed a newsletter to present the alternatives, and held a public meeting. The meetings generated public comments that led to refinement of the alternatives. Further, NPS has determined that it is likely that no significant impacts would result from development of the boathouse, and that an EA would be the most appropriate pathway under the National Environmental Policy Act.

Currently, Arlington County residents and the three public high schools use area boathouses located in Washington, DC. Wakefield High School rows out of the Capitol Rowing Club on the Anacostia River. On the Potomac River, Washington-Lee High School rows out of the Potomac Boat Club, and Yorktown High School rows out of Thompson Boat Center (TBC). The rowing conditions, potential conflicts with motorized watercraft, and travel times between Arlington and the boat clubs make some of these locations less than ideal for the high school rowing programs and other community users. Other Virginia area schools have generated additional demand for rowing programs and associated storage spaces, including Bishop O'Connell High School in Arlington County, McLean High School in Fairfax County, and Langley High School in Fairfax County.

2.2 Authorization

The GWMP was authorized as part of the Capper-Crampton Act in 1930 and was administered by NPS beginning in 1933. Congress authorized the establishment of the parkway to preserve the natural and historic landscape along the Potomac River and linked the parkway name to George Washington, who frequently traveled by horseback across the same land. The parkway opened in 1932 and took 36 years to complete, creating a connection between Washington, DC, and Mount Vernon. The parkway was planned to extend north to Great Falls, but conservationists who opposed the parkway prevented that connection from being built. The existing GWMP is approximately 40 miles long (NPS n.d.a).

2.3 Purpose and Need

The purpose of taking action is to identify a preferred site for an environmentally sustainable public rowing facility along the Virginia shoreline, while ensuring the protection of the natural and cultural resources of the GWMP, as well as visitor safety.

The selection of a preferred site and construction of a boathouse is needed to meet the direction of Congress for providing enhanced public waterfront access in the proximity of Arlington County. A boathouse facility is also needed to increase access along the Virginia shoreline for non-motorized, water-based recreational activities on the Potomac River and to alleviate pressure on other area boathouses, which are currently at maximum capacity.

2.4 Planning Context

This section summarizes the local land use and regulatory plans that apply to the study area; these plans serve as background for the remainder of the report and provide context for the evaluation of the alternatives.

2.4.1 ARLINGTON COUNTY COMPREHENSIVE PLAN

The *Arlington County Comprehensive Plan* was established by a County Board resolution in 1960 to serve as a decision-making tool for the County Board, Planning Commission, and County departments. The plan has been continually updated since its inception in the 1960s to the most recent update in 2015. The plan coordinates a host of goals and objectives, including, but not limited to, land use, housing, natural resource management, historic preservation, transportation networks, public spaces, and county utilities including stormwater management and water distribution (Arlington County 2017a).

The *Master Transportation Plan* within the *Comprehensive Plan* includes countywide transportation recommendations through 2030 regarding the county bicycle, pedestrian, street, and transit networks. While these recommendations are at a county-level scale, many reinforce specific improvement recommendations found in the *Rosslyn Sector Plan* described below. Countywide transportation recommendations in the study area include:

- Complete, manage, and maintain the bicycle network (Bicycle Element).
- Integrate all modes of transportation with bicycling (Bicycle Element).
- Complete the pedestrian network, and operate and maintain it to a high-quality standard (Pedestrian Element).
- Complete streets that accommodate all users and encourage alternatives to driving (Streets Element).
- Increase and improve transit service options and access (Streets and Transit Elements).
- Create multi-modal centers for convenient transfer between providers and modes (Transit Element) (Arlington County 2017b).

Arlington County began updating the 2008-adopted Bicycle Element in 2017 with an 11-person working group and community engagement events. Recommendations from the County Manager and adoption by the County Board are anticipated in 2018.

2.4.2 ARLINGTON COUNTY ROSSLYN SECTOR PLAN 2015

The Arlington County Board adopted the *Rosslyn Sector Plan* in July 2015. The plan updates the 1992 *Rosslyn Station Plan Addendum* and was developed through a community planning process (Realize Rosslyn) that involved a number of stakeholders and the public. It serves as a guiding document for development of the Rosslyn Coordinated Redevelopment District over the next 25 years (Arlington County 2015).

The Transportation Element of the plan established a new street and block pattern that reduces block lengths, improves pedestrian access, and provides for a better distribution of traffic over the network through new east-west and north-south connections between major corridors. The Transportation Element was coordinated with the *Rosslyn Multi-Modal Transportation Study*, which evaluated the existing and planned transportation facilities, services, and operations for Rosslyn over the next 20 years (Arlington County 2012a).

1. **Two-Way Streets:** The plan proposes to convert N. Fort Myer Dr. and N. Lynn St. from one-way streets to two-way streets between Lee Hwy. and Fairfax Dr. to provide more direct access, traffic calming measures, improved pedestrian safety, better vehicular traffic balance, and more bus

route options. Additionally, the Fort Myer Dr. tunnel through Wilson Blvd. would be removed and replaced with a signalized intersection.

2. **18th Street Corridor and Extension:** The plan proposes to extend and enhance the 18th St. N. corridor from N. Quinn St. to Arlington Ridge Rd. to serve as a primary pedestrian and bicycle corridor through Rosslyn's downtown. The plan would replace the existing skywalk, break up north-south oriented large blocks, and provide exclusive pedestrian and bicycle access between N. Oak and N. Lynn Streets due to significant topography. The plan would also enhance the overall pedestrian and bicycle environment and provide improved access to the Rosslyn Metro Station.
3. **New Pedestrian and Bicycle Bridge over Interstate 66 (I-66) and the GWMP:** The plan proposes a new pedestrian and bicycle bridge over I-66 and the GWMP to provide a new access point from the 18th St. N. corridor to the Mt. Vernon Trail from Rosslyn's downtown.
4. **Esplanade:** The plan proposes a new esplanade along the eastern edge of Rosslyn's downtown between the intersection of the Mt. Vernon Trail and Lee Hwy. EB and the Marine Corps Water Memorial. The esplanade would enhance the overall pedestrian and bicycle network by providing a new connection in Rosslyn's downtown and points beyond.

The sector plan proposes bicycle and pedestrian network improvements to accommodate Rosslyn's high density of office use and increased bicycling activity from the Martha Custis Trail (Custis Trail) and Mt. Vernon Trail that travels through the area . Conditions in the area are challenging for bicyclists (especially for street bicycle lanes) because of the high volume of vehicular traffic using the roadways and pedestrians using the sidewalks. Recommendations to improve bicycle and pedestrian conditions in vicinity of the study area include:

- Implement cycle tracks/protected bicycle lanes along Fort Myer Dr. and N. Lynn St.
- Apply intersection treatments such as marked bicycle travel paths, bicycle boxes, or protected intersection design.
- Potentially construct a Custis Trail underpass at N. Lynn St. Currently, at-grade improvements are planned for this intersection.
- Increase street-side bicycle parking opportunities and enhance provision of secure bicycle parking in existing and planned developments.
- Build a pedestrian and bicycle bridge over I-66 and GWMP to connect to the Mt. Vernon Trail.

2.4.3 GEORGETOWN – ROSSLYN GONDOLA FEASIBILITY STUDY

The *Georgetown – Rosslyn Gondola Feasibility Study* is a high-level, preliminary assessment of feasibility to construct a gondola transportation system between Georgetown in Washington, DC, and Rosslyn in Arlington County, Virginia. The study was developed in 2016 by an executive committee of private-public partners consisting of Arlington County and the District of Columbia governments, Georgetown and Rosslyn Business Improvement Districts, Georgetown University, and three real estate developers in collaboration with consultants lead by ZGF Architects LLP. The study aimed to evaluate whether a gondola system was technically and financially feasible for a future detailed study.

The feasibility study concluded that the gondola system does not have any identified fatal flaws, is technically feasible, and legally permit-eligible. Further, it would provide a new transit option for an estimated 6,500 daily riders from workers, residents, students, and tourists. The system is estimated to take two years to construct after an estimated three-to-four-year National Environmental Policy Act review process. Within Rosslyn, the loading/unloading station point would be sited near the Rosslyn Metro Station, with the aerial alignment generally following the Francis Scott Key Bridge (Key Bridge) across the Potomac River (ZGF Architects LLP 2016).

2.4.4 DC CIRCULATOR 2014 TRANSIT DEVELOPMENT PLAN UPDATE

The *DC Circulator 2014 Transit Development Plan Update* is the planned three-year update to the *DC Circulator 2011 Transit Development Plan*. The plan update included stakeholder outreach, an operations analysis of the existing system, an evaluation of future potential service corridors, and recommendations for future expansion. The operations analysis assessed boarding and alighting at each stop, route and system productivity, costs, and operational issues. Stakeholder feedback was combined with the data to identify opportunities to improve bus service. Some of the opportunities identified include using additional vehicles, consolidating bus stops, and developing options to deal with underutilization. One of the DC Circulator's priorities is to connect activity centers to increase efficiency. The corridors between the activity centers were evaluated for existing and planned transit options to avoid duplication of services, and the corridors with growth potential for Circulator service were identified.

Presently, the study area is served by the Dupont Circle – Georgetown – Rosslyn route. In Rosslyn, the route makes a loop around the Rosslyn Metro Station, crosses the Potomac River via the Key Bridge, continues through Georgetown on M Street NW, passes within two blocks of the Foggy Bottom Metro Station, and ends in Dupont Circle near the southern entry of the Dupont Circle Metro Station. The plan notes that this route connects one block short of Metrorail stations at each end in an attempt to shorten the route sufficiently to provide service with five buses and avoid the congestion in Dupont Circle and the Rosslyn Metro Station. Further, on weekdays it serves a commuter-oriented market with strong peak-period demand that diminishes during off-peak periods. Weekend demand is also strong because both Rosslyn and Dupont Circle are major shopping, entertainment, and recreation destinations. No route adjustments or extensions are proposed in vicinity of the study area (DDOT 2014a).

2.4.5 METRO MOMENTUM

Momentum is Metro's strategic plan for its metro and bus operations and investments from 2013 to 2025. The plan's vision is to ensure that the system continues to support the region's competitiveness and growth in the future. The plan establishes priorities for near and long-term actions and provides vision and guidance for decision making to efficiently meet the needs of today and support the future. In addition, it sets the stage for addressing Metro's chronic funding challenges and calls on Metro to fill a critical role in regional transit leadership. This guidance was derived through technical analyses and extensive outreach and feedback from regional stakeholders.

Goals in the plan include building and maintaining a premier safety culture and system, meeting or exceeding expectations by consistently delivering quality service, improving regional mobility and connecting communities, ensuring financial stability, and investing in people and assets. Specific capital initiatives include acquiring additional rail cars to allow operation of eight-car rush hour trains, expanding high volume transfer stations in the system core, completing the Metrobus priority corridor network to make service faster, expanding the bus fleet, and building new pocket tracks and crossovers to enhance rail service.

Metrorail's Orange, Silver, and Blue lines serve the Rosslyn Metro Station. Metrobus has a number of stops and lines throughout Rosslyn. The plan would allow Metro to continue to operate reliable service on bus and rail lines if its goals are achieved. For example, operating eight-car trains at rush hour would provide enough capacity on the Orange and Silver lines to prevent extreme crowding until 2040, whereas without this expansion these lines would be extremely crowded by 2020 (WMATA 2013).

2.4.6 COMPREHENSIVE PLAN FOR THE NATIONAL CAPITAL

The Comprehensive Plan for the National Capital guides planning and development in Washington, DC, and the surrounding region, including Arlington County in which the study area is located. The plan is a unified plan comprising two components—the Federal and District Elements. The Federal Elements are prepared by the National Capital Planning Commission and provide a policy framework for the federal government to manage its operations and activity in the National Capital Region, including federal

workplace, foreign missions and international organizations, transportation, parks and open space, federal environment, preservation and historic features, and visitors.

Specific policy recommendations within the Transportation and Parks and Open Space Elements with some impact on the study area include:

- Support capacity and service expansion of the regional Metrorail and Metrobus systems, and other local and regional transit services (Transportation Element).
- Support the establishment of multimodal connections in the regional transportation system (Transportation Element).
- Promote public access along the region's waterfronts (Parks and Open Space Element).
- Protect, restore, and enhance the Anacostia and Potomac Rivers as great open space resources and as recreational amenities, including shorelines and waterfront areas along rivers (Parks and Open Space Element).
- Encourage swimming, boating, and fishing facilities, as well as water-oriented tourist activities, on the Anacostia and Potomac Rivers (Parks and Open Space Element).

2.4.7 NATIONAL PARK SERVICE NATIONAL CAPITAL REGION PAVED TRAILS STUDY

NPS completed a comprehensive study in 2016 to inventory, assess, and provide recommendations regarding its paved trail network in the National Capital Region, which encompasses five national park units, five counties in Virginia and Maryland, the District of Columbia, and the City of Alexandria. The study also included a literature review of NPS and other federal regulations and policies that guide trail planning, stakeholder outreach, and an assessment of local government trail plans and priorities. One of the main outcomes of the study was 121 capital and programmatic recommendations (NPS 2016a).

Specific recommendations within the study area include:

- Develop a connection from the Mt. Vernon Trail to the Roosevelt Bridge.
- Improve access to the Mt. Vernon Trail from the Airport Access Road overpass at Reagan National Airport/Aviation Circle.
- Improve safety and access at the intersection of the Mt. Vernon Trail and the Custis Trail in Rosslyn (N. Lynn St. and Lee Hwy. WB).

2.5 Transportation Assumption Agreement

Prior to initiating the transportation analysis, it was essential to determine what analysis tools, data parameters, and assumptions would provide the basis of the analysis. In coordination with NPS, the project team met with the Virginia Department of Transportation (VDOT) and Arlington County to agree on the assumptions to follow. The first meeting took place with Arlington County on October 6, 2016, and the second with VDOT and Arlington County on February 21, 2017.

VDOT, through its *Traffic Impact Analysis Regulations* (VDOT 2012), requires that a scoping form be approved prior to analysis outlining the agreed upon level of detail, the data parameters, and type of analysis. These parameters and assumptions include a study area, trip generation, trip distribution, modal split, analysis years, analysis methods, and no-action transportation assumptions (background growth, planned developments, and planned roadway improvements). Attachment 1 contains the VDOT scoping form. VDOT approved the scoping form and assumptions on March 27, 2017.

2.6 Study Area Description

The transportation assessment in this report covers several study areas. Two study areas are proposed for traffic assessment, a Rosslyn study area covering 11 intersections (10 existing intersections and 1

proposed new intersection [Intersection #2] to serve a proposed boathouse driveway) and a second study area at Gravelly Point. The Rosslyn study area extends north to the Key Bridge, south to N. 19th St., east to N. Lynn St., and west to N. Nash St. The Gravelly Point study area is focused on the access ramps connecting the GWMP to Gravelly Point. The Rosslyn and Gravelly Point study areas encompasses pedestrian, transit, parking, and traffic networks. The bicycle study area includes up to a 1-mile bikeshed centered on the Rosslyn Metro Station and Gravelly Point to incorporate the regional bicycle network. Figure 2-1 shows the Rosslyn study area, and figure 2-2 shows the Gravelly Point traffic study area.

FIGURE 2-1. ROSSLYN AREA STUDY AREA

FIGURE 2-2. GRAVELLY POINT STUDY AREA

3.0 DESCRIPTION OF ALTERNATIVES

This chapter provides a description of the proposed alternatives under study.

3.1 Alternative A: No-Action Alternative

Under alternative A, a boathouse facility and docks would not be constructed near the GWMP. Arlington County public high school rowing programs would continue to use area boathouses located in Washington, DC. Existing and future public demand for rowing programs and related boat storage space would be accommodated by these existing facilities, other planned rowing facilities, or would remain unmet.

3.2 Alternative B: Lower Rosslyn Site

Alternative B is presented in figure 3-1. It would include a boathouse facility and floating docks for non-motorized boats along the Potomac River shoreline in Virginia, south of the Key Bridge, east of the GWMP, and north of the existing Roosevelt Island parking lot. Site access would be predominantly by transit, bicycle, and foot. This alternative would provide approximately 14,000 square feet (SF) of boat storage and a boat repair bay along with additional space for a rigging area/apron. The space would be split with a third of the space reserved for scholastic teams and the remaining two-thirds for community users. A path would connect the rigging area/apron to a 300-foot-long floating dock for canoe and kayak launching points.

3.3 Alternative C: Combined Upper and Lower Rosslyn Sites

Alternative C, presented in figure 3-2, would include the same facility and configuration on the lower Rosslyn site as described under alternative B but would provide additional support facilities, including locker rooms, on the upper Rosslyn site. Two possible locations are available for the 8,000 SF support facility on the upper Rosslyn site along the Mt. Vernon Trail that connects N. Lynn St. to the lower Rosslyn site. The support facility would include office space, locker rooms, bathrooms, and space for education and outreach. A small parking area for Americans with Disability Act (ADA) access and service vehicles and an access road associated with the support facility would connect to N. Lynn St. in Rosslyn. Similar to alternative B, boat storage, the floating dock, and rigging area would be located on the lower Rosslyn site, while other support functions would be located in a facility on the upper Rosslyn site, accessible by trail. Site access would be predominantly by transit, bicycle, and foot.

3.4 Alternative D: Gravelly Point Site

Alternative D, presented in figure 3-3, would include a boathouse facility and docks for non-motorized boats located on the gravelly point area, east of the GWMP and adjacent to the existing Gravelly Point parking lot and recreational fields. Locating the facilities for this alternative in the southern part of Gravelly Point would avoid potentially sensitive resources and reduce the amount of road infrastructure needed to access the facilities. This alternative would include one larger boathouse facility (28,000 SF) with 14,000 SF of storage space and 14,000 SF for bathrooms and locker rooms, exercise equipment, team meeting space, and a community room. Similar to alternatives B and C, there would be an associated rigging area/apron and 300-foot-long floating dock. To provide drop-off access to the boathouse facility, a driveway would need to be constructed. A playing field on the site would need to be relocated slightly to the north. Access would be predominantly by car.

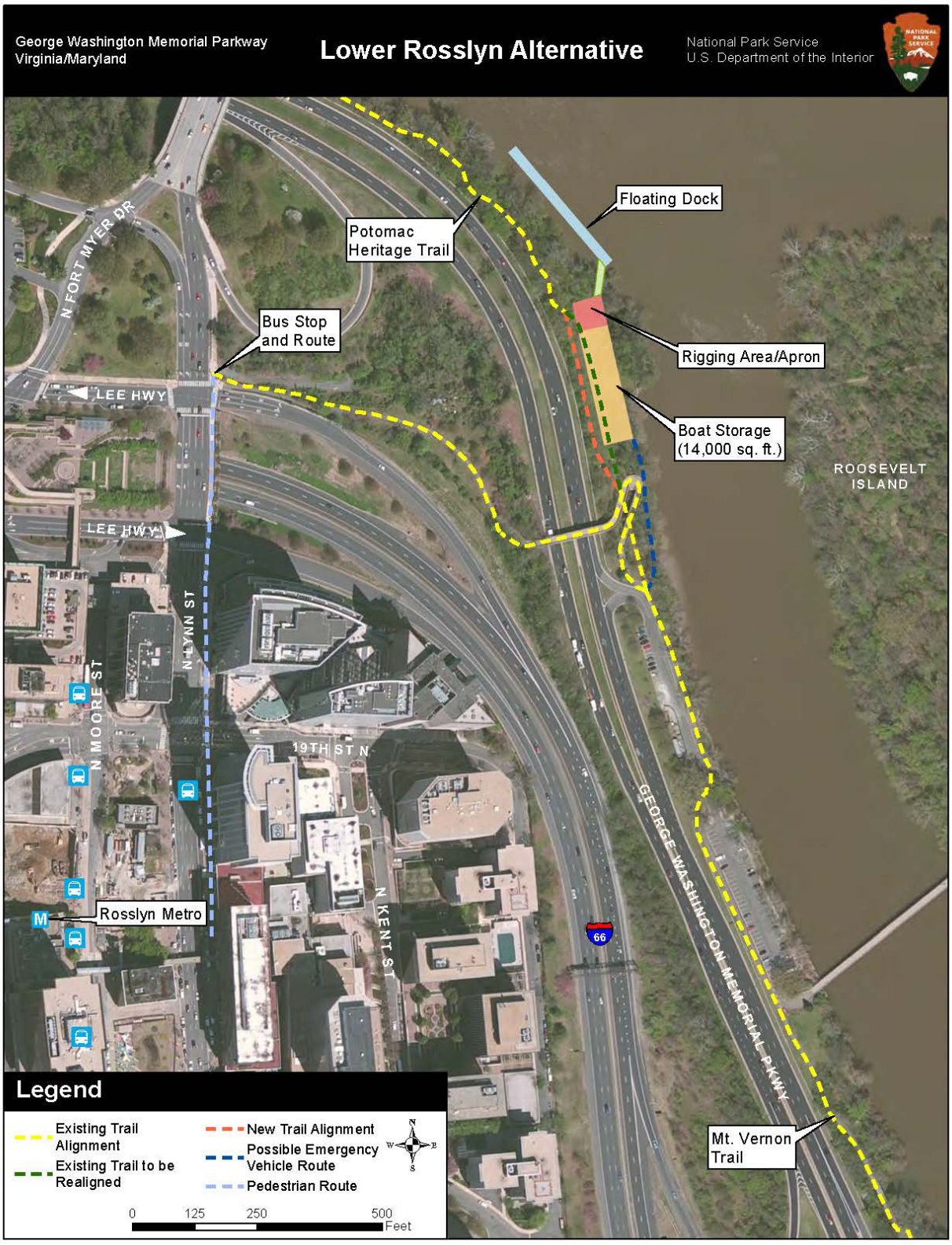

FIGURE 3-1. ALTERNATIVE B—LOWER ROSSLYN SITE

FIGURE 3-2. ALTERNATIVE C—COMBINATION OF UPPER AND LOWER ROSSLYN SITES

FIGURE 3-3. ALTERNATIVE D—GRAVELLY POINT SITE

3.5 Alternatives Considered But Dismissed

After further study, the Dangerfield Island site presented in the 2012 newsletter was determined to present too many conflicts in the channel between rowers, paddlers, and sailing vessels for Dangerfield Island to be considered further. This alternative was dismissed following scoping for several reasons:

- Water conditions are not ideal for rowing.
- Conflicts with navigation and sailboats could occur—the entrance channel where new rowing facilities would be most likely be placed is narrow.
- Rowing and sailing would not be compatible in the basin.
- The site is not in Arlington County.

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4.0 EXISTING CONDITIONS

This chapter covers the existing conditions for the roadways, pedestrian, bicycle, transit network, and traffic analysis serving two study areas.

4.1 Park Visitation

This study covers two parks along the GWMP—Roosevelt Island and Gravelly Point. According to NPS, Roosevelt Island had 164,360 visitors, and Gravelly Point had 630,360 visitors in 2016 (NPS 2016b). Gravelly Point had a much higher volume of visitors averaging 131,372 visitors per month compared to the 13,697 at Roosevelt Island. Figure 4-1 compares the 2016 visitor for the two parks.

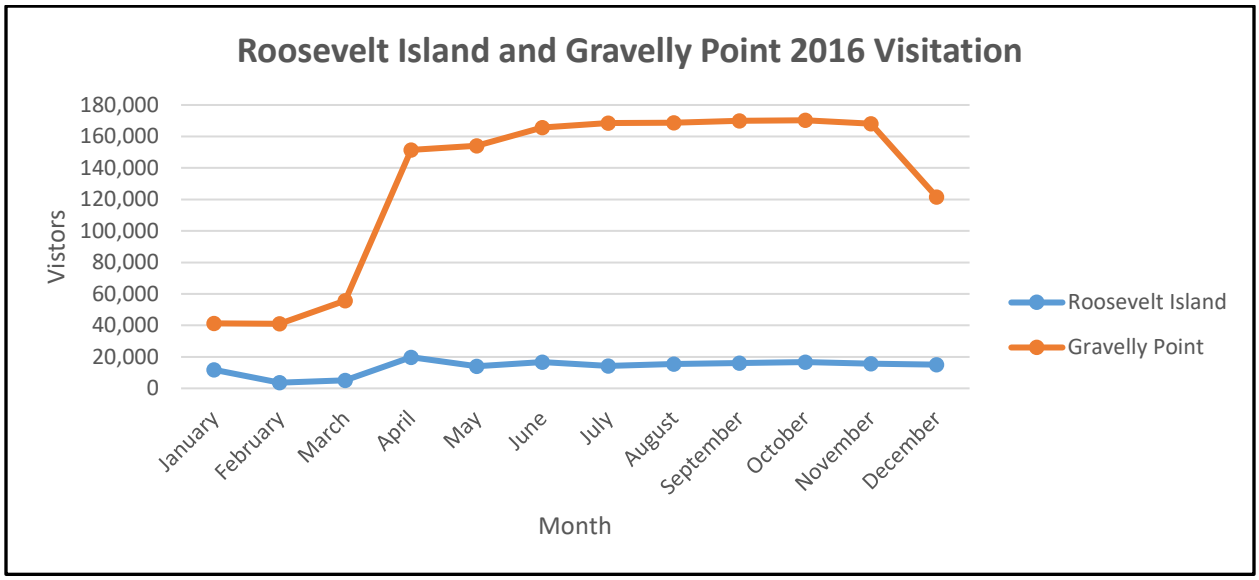


FIGURE 4-1. 2016 ROOSEVELT ISLAND AND GRAVELLY POINT PARK VISITATION

4.2 Data Collection and Observations

Data covering the Rosslyn and Gravelly Point study areas were collected to present the existing condition. Data were also collected at the Roosevelt Island parking lot along the GWMP because several of the proposed actions reference this location.

4.2.1 ROSSLYN STUDY AREA DATA COLLECTION

The Rosslyn study area defined in chapter 3.0 is part of Rosslyn's core downtown area. Key Bridge at northern edge of the study area is a major route into Washington, DC with N. Lynn Street funneling northbound traffic and Fort Myer Drive funneling southbound traffic through the Rosslyn downtown.

The traffic, bicycle, and pedestrian data covering the Rosslyn study area were obtained from three sources.

1. **Arlington County** provided traffic, bicycle, and pedestrian counts obtained in June and July 2017 representing 9 out of the 10 study area intersections recorded from 7:00 a.m. to 7:00 p.m. during weekdays.
2. **Louis Berger** obtained traffic, bicycle, and pedestrian counts representing 5 out of the 10 study-area intersections recorded from 1:00 p.m. to 5:00 p.m. on Saturday, September 26, 2015.
3. **Rosslyn Plaza Traffic Impact Study** recorded traffic counts in 2014.

The one remaining study area intersection missing from the weekday counts (Intersection #10) was estimated by applying the vehicle turning movement percentages from the Rosslyn Plaza Traffic Impact

Study to the adjacent intersections using 2017 data. The remaining five study area intersections missing from the Saturday counts were estimated by applying the vehicle turning movement percentages from the Arlington County midday peak hour traffic counts or 2:00 p.m. to 3:00 p.m. to the adjacent intersections using 2015 data. Based on these traffic counts, the weekday system peak hours occurred from 7:45 a.m. to 8:45 a.m. and 4:45 p.m. to 5:45 p.m. The Saturday system peak hour occurred from 1:30 p.m. to 2:30 p.m.

4.2.2 ROSSLYN STUDY AREA OBSERVATIONS

During the AM peak period, the highest traffic volume occurred along Lee Hwy. EB through the intersections at N. Nash St., N. Fort Myer Dr., and N. Lynn St. At N. Lynn St., the majority of traffic turned left toward the Key Bridge. There were also vehicles observed queueing along the I-66 westbound off-ramp trying to merge onto N. Lynn St. destined north towards the Key Bridge. N. Lynn St. was observed congested with traffic moving slowly past N. 19th St. and Lee Hwy.; however, because the traffic lights remained green for a long time, minimal queues were observed.

During the PM peak period, traffic queued along the westbound I-66 off-ramp, merging onto N. Lynn St. destined north toward the Key Bridge. Some congestion also occurred along Lee Hwy. EB approaching N. Lynn St. Vehicles were observed queued across the Key Bridge headed southbound toward N. Fort Myer Drive. Since the traffic light remained green at the Lee Hwy. intersections, a majority of cars were able to pass through the study area with only minor queuing.

Figure 4-2 shows the existing condition Rosslyn study area turning movement counts covering the AM and PM peak hours, and figure 4-3 shows the existing condition Rosslyn study area turning movement counts covering the Saturday peak hour. Attachment 2 contains the Arlington County weekday traffic, pedestrian, and bicycle counts. Attachment 3 contains the Saturday traffic, pedestrian, and bicycle counts from the Louis Berger team.

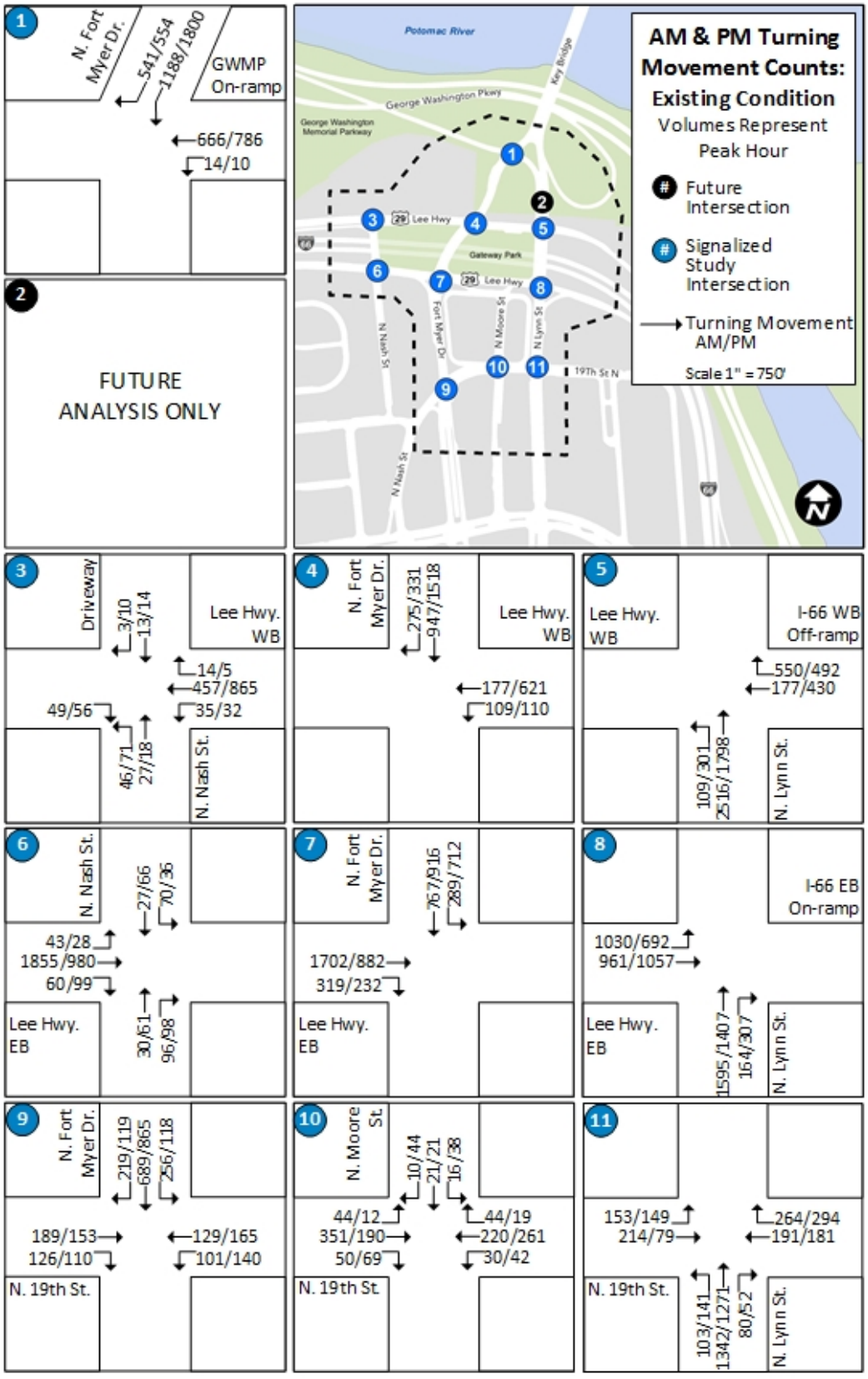


FIGURE 4-2. AM AND PM EXISTING TURNING MOVEMENT VOLUMES – ROSSLYN STUDY AREA

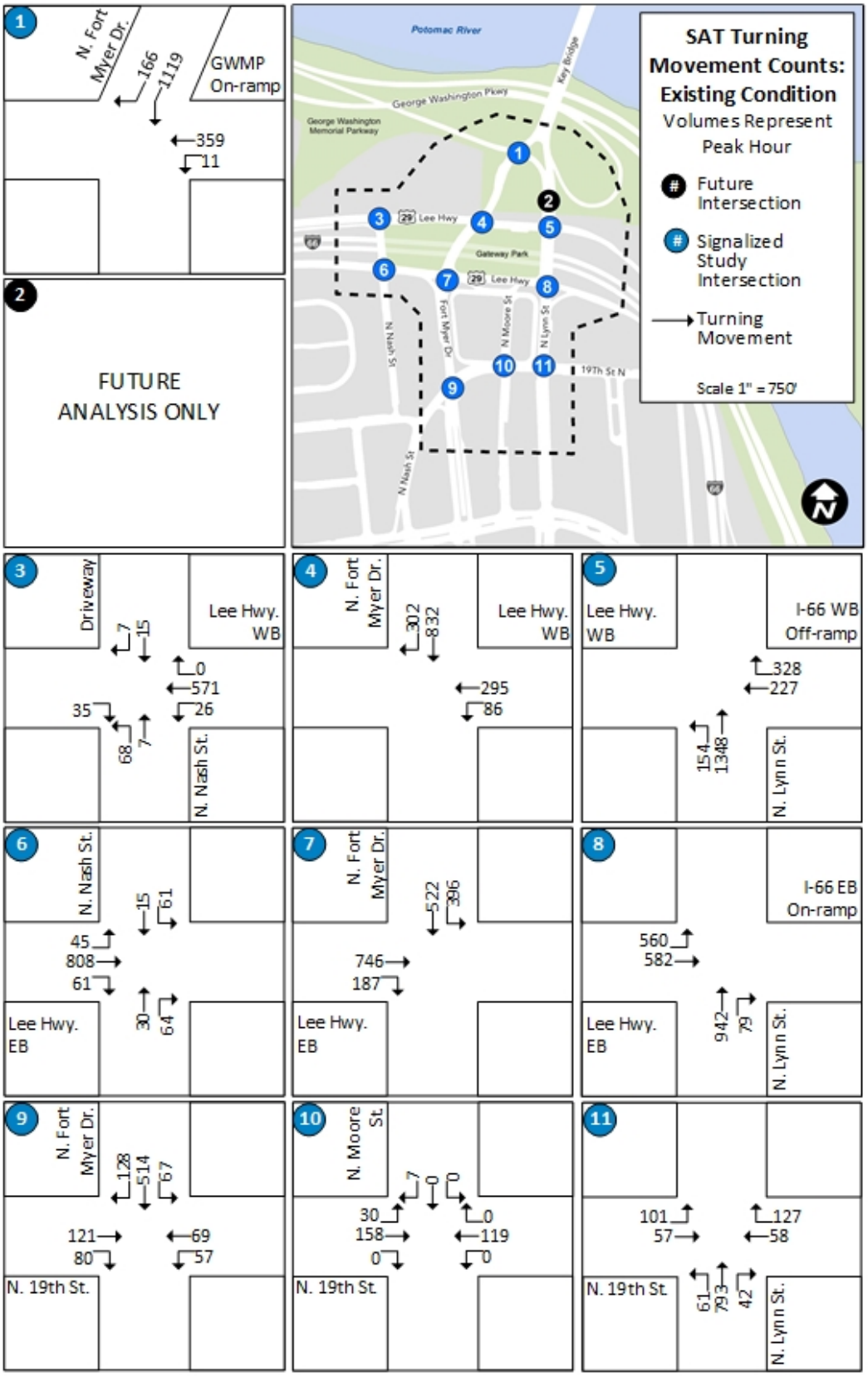


FIGURE 4-3. SATURDAY PEAK HOUR EXISTING TURNING MOVEMENT VOLUMES – ROSSLYN STUDY AREA

4.2.3 GRAVELLY POINT STUDY AREA

The Gravelly Point study area is parkland associated with the GWMP, located along the western bank of the Potomac River between I-395 and Reagan National Airport. The parkland is accessible by car via northbound GWMP or on foot via the Mt. Vernon Trail. Amenities provided at Gravelly Point include a parking lot, boat ramp, picnic facilities (e.g., benches, trashcans), and playing fields. The study relied on the following two data sources:

1. **Louis Berger** performed field counts in July and August 2015.
2. **NPS** permanent count station along the GWMP provided data covering July 2014, 2015, 2016, and 2017.

Louis Berger conducted a field survey in 2015 to count the number of vehicles that entered and exited the Gravelly Point parking lot from the GWMP. The survey was conducted in late July to cover a weekday and in mid-August to cover a Saturday. Tables 4-1, 4-2, and 4-3 contain the survey results for the AM, PM, and Saturday count periods, respectively.

TABLE 4-1. GRAVELLY POINT AM PEAK PERIOD ENTERING AND EXITING VOLUMES

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Gravelly Point AM Period - July 28, 2015			
8:00 a.m. – 8:15 a.m.	5	2	
8:15 a.m. – 8:30 a.m.	6	7	
8:30 a.m. – 8:45 a.m.	7	4	
8:45 a.m. – 9:00 a.m.	4	7	42
9:00 a.m. – 9:15 a.m.	7	3	45
9:15 a.m. – 9:30 a.m.	10	8	50
9:30 a.m. – 9:45 a.m.	15	10	64
9:45 a.m. – 10:00 a.m.	11	8	72
10:00 a.m. – 10:15 a.m.	15	10	87
10:15 a.m. – 10:30 a.m.	11	9	89
10:30 a.m. – 10:45 a.m.	17	20	101
10:45 a.m. – 11:00 a.m.	26	17	125

TABLE 4-2. GRAVELLY POINT PM PEAK PERIOD ENTERING AND EXITING VOLUMES

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Gravelly Point PM Period - July 28t, 2015			
5:00 p.m. – 5:15 p.m.	27	12	
5:15 p.m. – 5:30 p.m.	18	13	
5:30 p.m. – 5:45 p.m.	22	13	
5:45 p.m. – 6:00 p.m.	25	22	152
6:00 p.m. – 6:15 p.m.	24	18	155
6:15 p.m. – 6:30 p.m.	24	20	168
6:30 p.m. – 6:45 p.m.	31	18	182
6:45 p.m. – 7:00 p.m.	27	6	168

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Gravelly Point PM Period - July 28t, 2015			
7:00 p.m. – 7:15 p.m.	34	20	180
7:15 p.m. – 7:30 p.m.	23	20	179
7:30 p.m. – 7:45 p.m.	15	15	160
7:45 p.m. – 8:00 p.m.	18	24	169

TABLE 4-3. GRAVELLY POINT SATURDAY PEAK PERIOD ENTERING AND EXITING VOLUMES

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Gravelly Point Saturday Period - August 15, 2015			
3:00 p.m. – 3:15 p.m.	22	30	
3:15 p.m. – 3:30 p.m.	30	24	
3:30 p.m. – 3:45 p.m.	21	21	
3:45 p.m. – 4:00 p.m.	39	28	215
4:00 p.m. – 4:15 p.m.	25	33	221
4:15 p.m. – 4:30 p.m.	21	24	212
4:30 p.m. – 4:45 p.m.	22	26	218
4:45 p.m. – 5:00 p.m.	34	24	209
5:00 p.m. – 5:15 p.m.	38	38	227
5:15 p.m. – 5:30 p.m.	36	35	253
5:30 p.m. – 5:45 p.m.	39	22	266
5:45 p.m. – 6:00 p.m.	51	30	289

NPS provided traffic data covering the Gravelly Point study area in 2014, 2015, 2016, and 2017 from a permanent count station along the GWMP, just north of Reagan National Airport. The permanent count stations provide 24-hour vehicle volumes by hour, by lane, and by direction. Because the GWMP operates with three lanes through this area, the data provided counts for each of the three lanes along the northbound segment. Additionally, because the Gravelly Point survey data were obtained in 2015, the July 2015 NPS data were used to develop the existing condition. Three weekdays were averaged to develop a typical summer average weekday volume and to determine the peak hour. The same procedure was followed to calculate a typical average Saturday volume during the summer and to determine the peak hour volume. The 2014, 2016, and 2017 data were also extracted from the NPS data to provide a comparison and help to develop a growth rate for alternative A.

Based on the GWMP data obtained, two distinct peak hours occurred during the weekdays, one in the morning between 8:00 a.m. and 9:00 a.m. and another in the afternoon between 5:00 p.m. and 6:00 p.m. Because the data collected covered northbound traffic, the afternoon peak hour reported a much lower volume than the morning, reflecting the morning inbound commute pattern to the 14th Street Bridge and points north. The Saturday pattern reflected an increase of traffic through the morning, followed by a plateau through the late afternoon, and then a decrease into the evening. The pattern did not create a pronounced peak hour, but showed more of a gentle bell curve. Figure 4-4 shows the weekday GWMP traffic flow pattern, and figure 4-5 shows the Saturday traffic flow pattern.

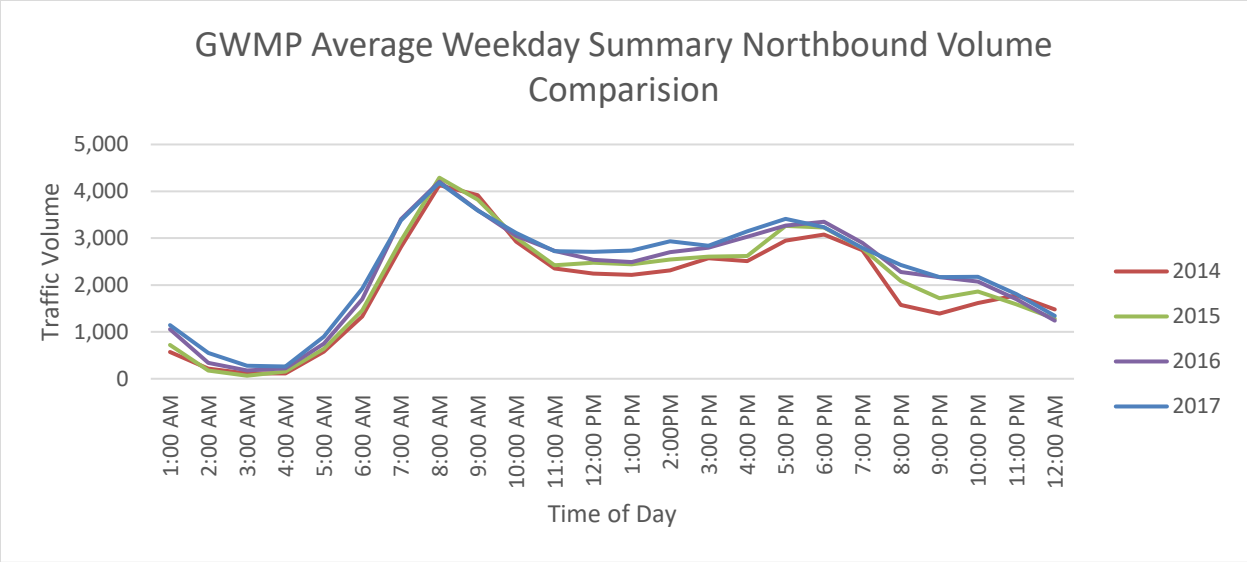


FIGURE 4-4. GWMP WEEKDAY VOLUME COMPARISON

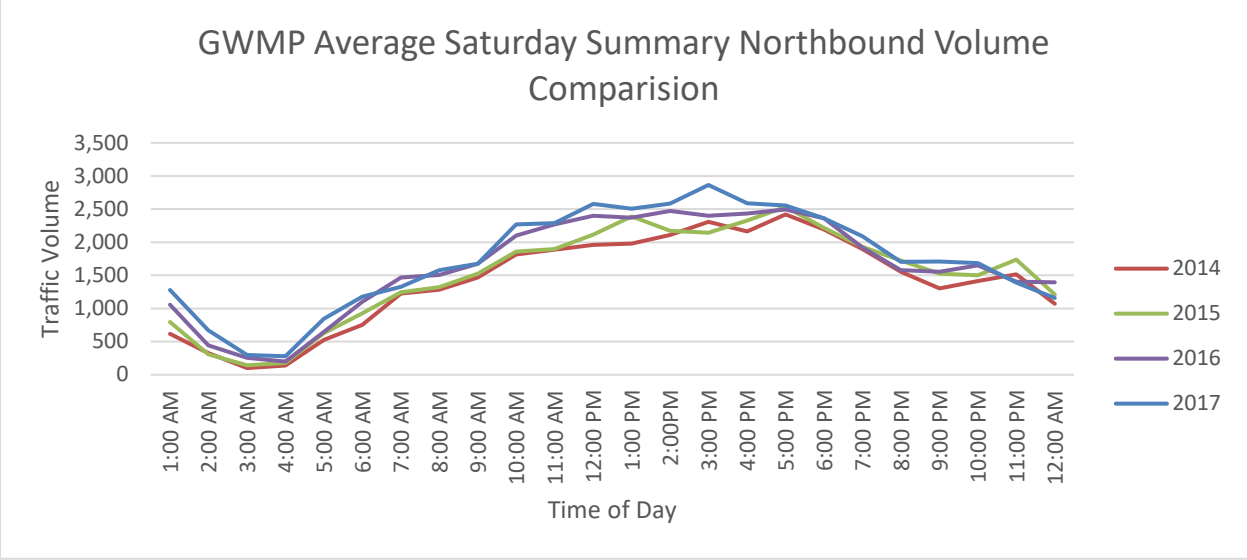


FIGURE 4-5. GWMP SATURDAY VOLUME COMPARISON

Figure 4-6 shows the Gravelly Point study area existing condition lane geometry and turning movement counts covering the AM, PM, and Saturday peak hours. Attachment 4 contains the NPS GWMP counts.

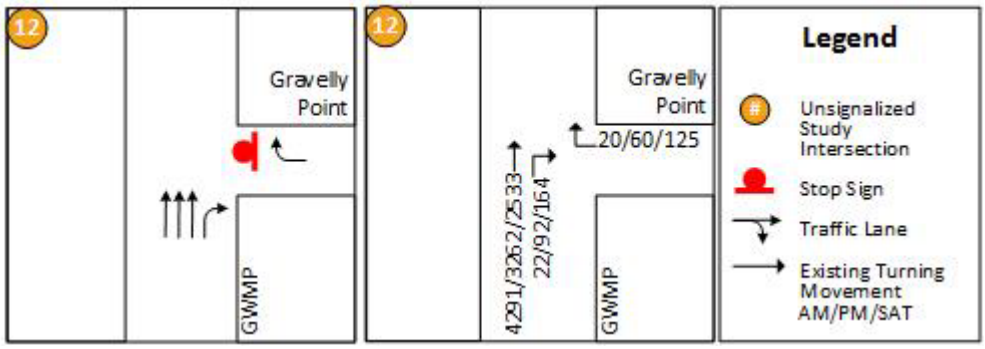


FIGURE 4-6. GRAVELLY POINT EXISTING LANE GEOMETRY AND TURNING MOVEMENT VOLUMES

4.2.4 ROOSEVELT ISLAND

Roosevelt Island is an NPS park located in the middle of the Potomac River between the Key Bridge and Arlington Memorial Bridge, with I-66 traversing the islands' southern tip on the Roosevelt Bridge. The park is accessible by a pedestrian bridge across the Potomac River from a parking lot adjacent to northbound GWMP and Mt. Vernon Trail. Roosevelt Island offers trails and cultural interpretation activities. Louis Berger conducted a survey of the Roosevelt Island parking area entrance and exit ramps on July 28, 2015. Counts were taken between 8:00 a.m. and 11:00 a.m. to cover the AM peak period and between 5:00 p.m. and 8:00 p.m. to cover the PM peak period. Counts were also conducted on Saturday, August 15, 2015, between 4:00 p.m. and 7:00 p.m. Tables 4-4, 4-5, and 4-6 contain the AM, PM, and Saturday counts, respectively.

TABLE 4-4. ROOSEVELT ISLAND AM PEAK PERIOD ENTERING AND EXITING VOLUMES

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Roosevelt Island AM Period - July 28, 2015			
8:00 a.m. – 8:15 a.m.	3	2	
8:15 a.m. – 8:30 a.m.	1	1	
8:30 a.m. – 8:45 a.m.	4	1	
8:45 a.m. – 9:00 a.m.	2	3	17
9:00 a.m. – 9:15 a.m.	2	0	14
9:15 a.m. – 9:30 a.m.	6	6	24
9:30 a.m. – 9:45 a.m.	1	1	21
9:45 a.m. – 10:00 a.m.	12	1	29
10:00 a.m. – 10:15 a.m.	4	4	35
10:15 a.m. – 10:30 a.m.	8	7	38
10:30 a.m. – 10:45 a.m.	5	5	46
10:45 a.m. – 11:00 a.m.	6	5	44

TABLE 4-5. ROOSEVELT ISLAND PM PEAK PERIOD ENTERING AND EXITING VOLUMES

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Roosevelt Island PM Period - July 28, 2015			
5:00 p.m. – 5:15 p.m.	7	6	
5:15 p.m. – 5:30 p.m.	6	5	

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Roosevelt Island PM Period - July 28, 2015			
5:30 p.m. – 5:45 p.m.	2	5	
5:45 p.m. – 6:00 p.m.	5	4	40
6:00 p.m. – 6:15 p.m.	3	5	35
6:15 p.m. – 6:30 p.m.	7	7	38
6:30 p.m. – 6:45 p.m.	9	10	50
6:45 p.m. – 7:00 p.m.	8	7	56
7:00 p.m. – 7: 15 p.m.	5	3	56
7:15 p.m. – 7:30 p.m.	3	1	46
7:30 p.m. – 7:45 p.m.	8	5	40
7:45 p.m. – 8:00 p.m.	3	4	32

TABLE 4-6. ROOSEVELT ISLAND SATURDAY PEAK PERIOD ENTERING AND EXITING VOLUMES

Time Period	Vehicles Entering	Vehicles Exiting	Hourly Count
Roosevelt Island Saturday Period - August 15, 2015			
4:00 p.m. – 4:15 p.m.	14	20	
4:15 p.m. – 4:30 p.m.	19	20	
4:30 p.m. – 4:45 p.m.	10	16	
4:45 p.m. – 5:00 p.m.	12	15	126
5:00 p.m. – 5:15 p.m.	14	17	123
5:15 p.m. – 5:30 p.m.	9	20	113
5:30 p.m. – 5:45 p.m.	18	16	121
5:45 p.m. – 6:00 p.m.	8	14	116
6:00 p.m. – 6:15 p.m.	8	11	104
6:15 p.m. – 6:30 p.m.	14	16	105
6:30 p.m. – 6:45 p.m.	13	9	93
6:45 p.m. – 7:00 p.m.	14	13	98

4.3 Roadway Descriptions

The following section describes the roadways in the study area, including the VDOT roadway functional classification, the number of lanes in each direction, and the latest average annual daily traffic (AADT) and average annual weekday traffic (AAWDT) volumes available from VDOT. Any noteworthy characteristics, such as the roadway's role within the transportation network and if bicycle lanes are present, are included. The information was compiled from VDOT 2014 Approved Functional Classification data (VDOT 2015) for roadway classifications and speed limits, observations in the field, aerial imagery, and VDOT 2016 Average Daily Traffic Volumes data (VDOT 2016) for AADT and AAWDT volumes.

I-66 travels eastbound and westbound through the study area and has a VDOT functional classification of interstate (VDOT 2015). The interstate operates with two lanes in both directions with no street parking and the posted speed limit is 55 miles per hour (mph). The AADT of I-66 is 73,000, and the AAWDT is 77,000 (VDOT 2016). A majority of the road travels underneath the study area through an underpass

beneath Gateway Park. An off-ramp (exit 73A) from westbound I-66 leads up to Lee Hwy. WB at N. Lynn St. This off-ramp begins as one lane, then widens to three lanes as it approaches N. Lynn St. The AADT of this I-66 off-ramp is 11,000 (VDOT 2016). An I-66 eastbound on-ramp from Lee Hwy. EB at N. Lynn St. also begins as two lanes and narrows to one lane before merging onto I-66 eastbound. The AADT of this on-ramp is 16,000 (VDOT 2016).

Lee Hwy. Eastbound and Westbound travels through the study area from east to west, and has a posted speed limit of 30 mph. and a VDOT classification of principal arterial (VDOT 2015). The westbound segment is located north of I-66 and travels from east to west starting at the N. Lynn St. intersection with the I-66 off-ramp. The AADT is 6,600 and the AAWDT is 7,400 (VDOT 2016). The eastbound segment is south of I-66 and travels from west to east, ending as a merge into I-66 eastbound. The AADT is 16,000 and the AAWDT is 18,000 (VDOT 2016). Each direction operates with three lanes, and no on-street parking is provided except for a small cutout area on the westbound side between N. Lynn St. and N. Fort Myer Dr. that is reserved for county vehicles only. The Custis Trail (for bicycles and pedestrians) travels along the north side of Lee Hwy. WB and follows the Mt. Vernon Trail after it passes N. Lynn St.

N. Lynn St. travels south to north through the study area and is classified by VDOT as a minor arterial road south of Lee Hwy. EB and a principal arterial north of Lee Hwy. EB (VDOT 2015). South of N. 19th St., the road is composed of three lanes and offers metered on-street parking. Between N. 19th St. and Lee Hwy. EB, the road widens to five lanes, with a short drop-off area in front of 1919 N. Lynn St. North of Lee Hwy. EB, the road maintains five lanes with no on-street parking and two lanes travel to the GWMP on-ramp and the remaining three lanes travel north onto the Key Bridge. The AADT of N. Lynn St. is 22,000 and the AAWDT is 24,000 (VDOT 2016). The posted speed limit is 25 mph. A bicycle lane is striped south of Lee Hwy. EB and follows the sidewalk north of Lee Hwy. EB and crosses the Key Bridge.

N. Fort Myer Dr. travels north to south through the study area and is classified by VDOT as principal arterial north of Lee Hwy. EB and as a minor arterial south of Lee Hwy. EB (VDOT 2015). The road operates with three lanes. On-street metered parking is available on the right side, and tour-bus parking is permitted on the left side south of Lee Hwy. EB. The AADT is 13,000 and its AAWDT is 14,000 (VDOT 2016). The posted speed limit is 25 mph.

N. 19th St. travels in an east-west orientation through the study area. VDOT classifies it as a major collector road (VDOT 2015). On-street metered parking spaces are available east of N. Lynn St. The road operates with two lanes in each direction. The AADT is 6,900 and the AAWDT is 7,500 (VDOT 2016).

N. Nash St. travels in a north-south orientation through the study area, and VDOT classifies it as a major collector road (VDOT 2015). It operates as one lane in both directions and has metered on-street parking south of East Lee Hwy. The AADT is 2,500 and the AAWDT is 2,600 (VDOT 2016).

N. Moore St. is classified as a major collector road and operates with one lane in the southbound direction (VDOT 2015). Along the east side south of N. 19th St., construction reduces the street to two travel lanes, with no parking and no sidewalk along the east side. The AADT is 4,800 and the AAWDT is 5,100 (VDOT 2016).

GWMP travels in a north-south orientation past Gravelly Point, and VDOT classifies it as a principal arterial (VDOT 2015). The posted speed limit is 40 mph, and the road operates with three lanes in both directions. The AADT of the GWMP is 62,000 (VDOT 2016).

Figures 4-7 and 4-8 show the functional roadway classifications covering the Rosslyn and Gravelly Point study areas, respectively. As part of the field data collected, a detailed inventory of the lane geometry was conducted through field reconnaissance and a study of aerial imagery. Based on this information, the existing lane geometry and traffic control type (signalized or unsignalized) are shown in figure 4-9.

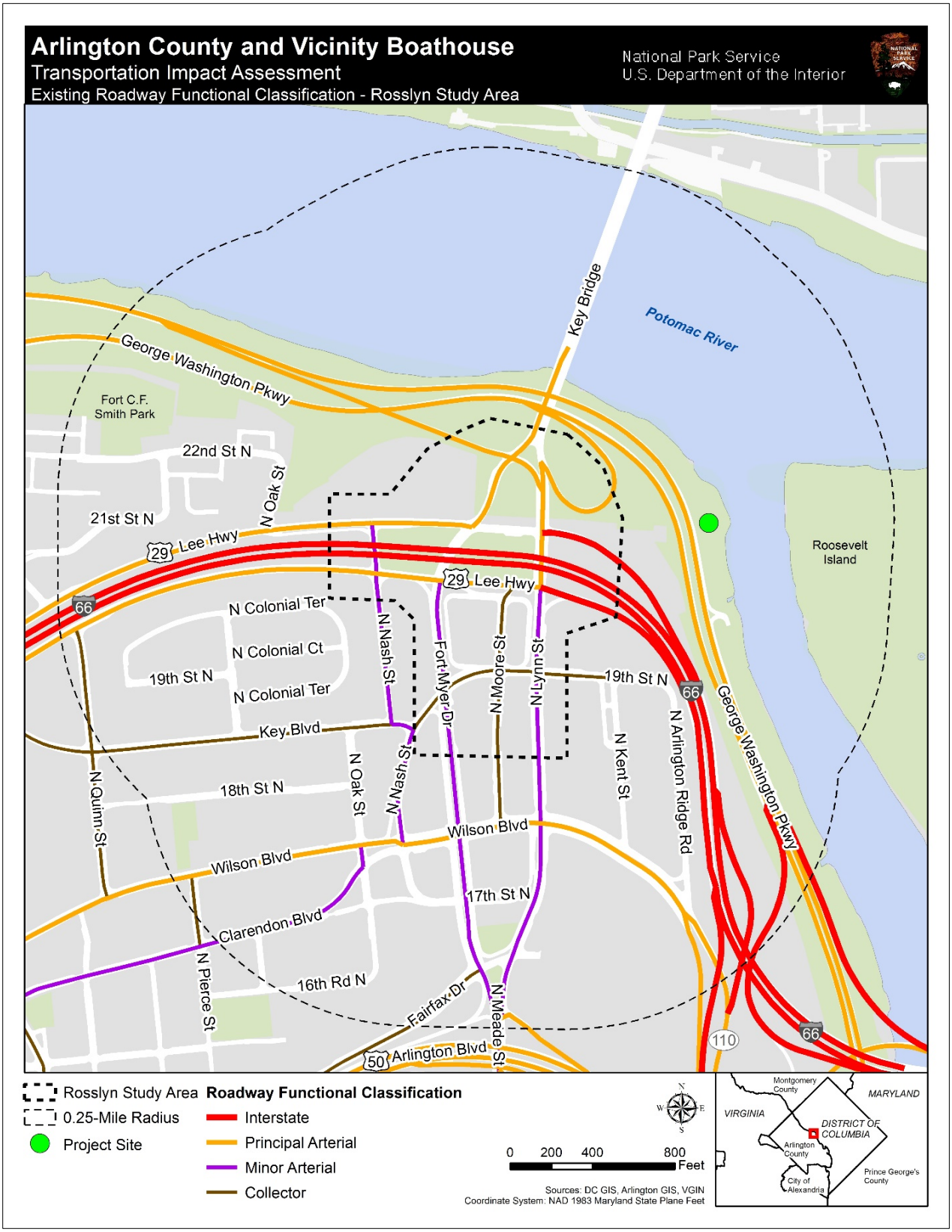


FIGURE 4-7. ROADWAY FUNCTIONAL CLASSIFICATION – ROSSLYN STUDY AREA

FIGURE 4-8. ROADWAY FUNCTIONAL CLASSIFICATION – GRAVELLY POINT STUDY AREA

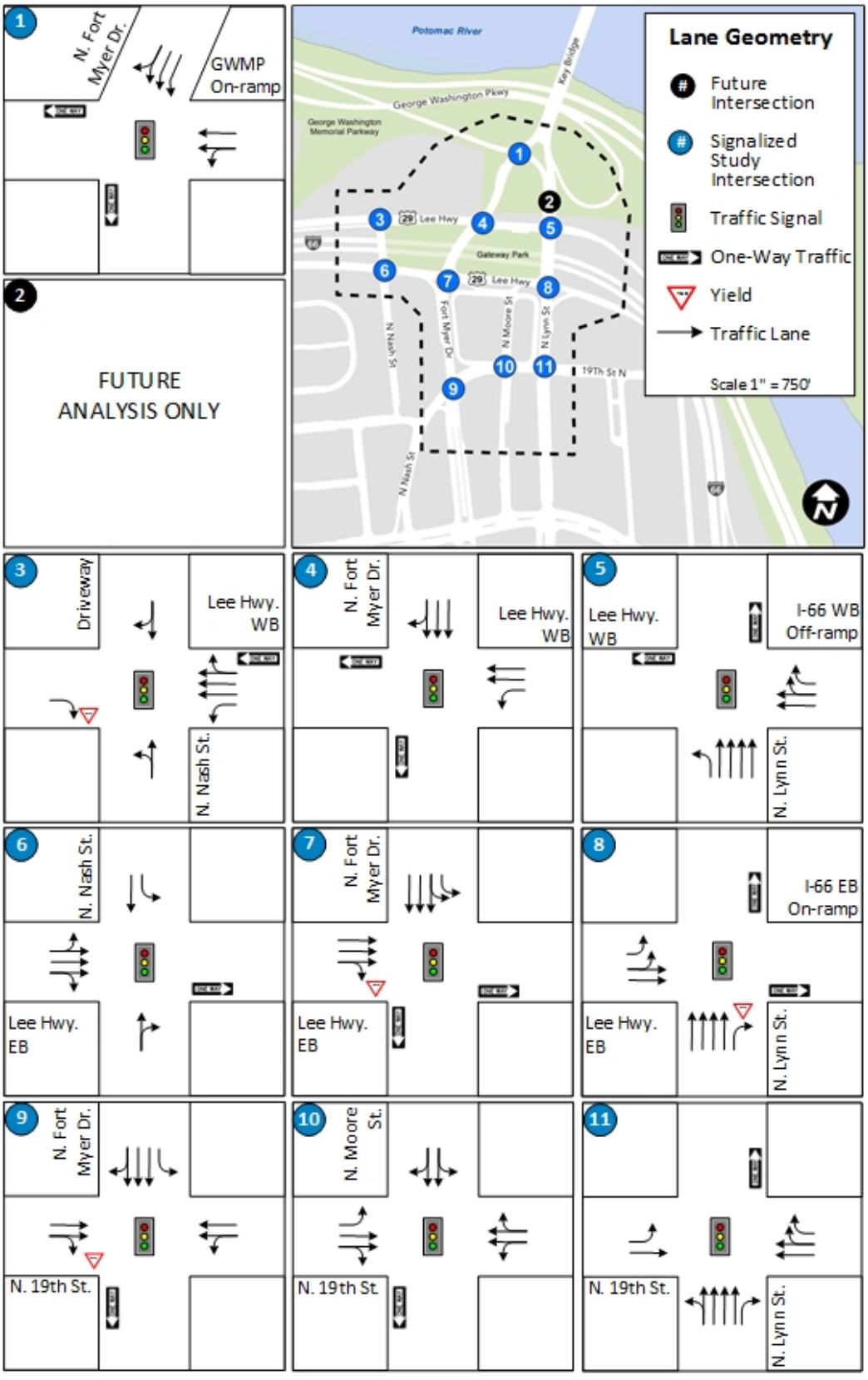


FIGURE 4-9. EXISTING CONDITIONS LANE GEOMETRY – ROSSLYN STUDY AREA

4.4 Pedestrian Network

This section describes the origin and destination points of pedestrians and/or commonly used sidewalks in the study area, as well as disruptions or obstacles in the pedestrian environment.

Starting from the south, sidewalks flank both sides of N. 19th St. in the Rosslyn study area. Construction on the west side of N. Lynn St. blocks off most of the sidewalk; however, many pedestrians still use the east side. Between the two directions of Lee Hwy., there is sidewalk on both sides of N. Lynn St.; however, it switches back to the east side after crossing Lee Hwy. WB. The same holds true for the east side of N. Moore St. south of N. 19th St., where construction blocks the sidewalk. N. Fort Myer Dr. has sidewalks on both sides; however, the sidewalk stops on the east side after N. Fort Myer Dr. crosses over Lee Hwy. WB. Lee Hwy. WB has a sidewalk on the south side until it crosses N. Nash St. to the west, and the Custis Trail (for bicycles and pedestrians) travels along the north side. Lee Hwy. EB has a sidewalk on the north side from N. Lynn St. to N. Fort Myer Dr., then along both sides until N. Nash St., and then only along the south side west of N. Nash St.

Pedestrian activity was monitored on April 18, 2017, during the peak AM and PM peak periods along all sidewalks in the study area. Pedestrian activity during the AM peak period (7:30 a.m.–9:00 a.m.) was observed as mostly occurring in the northeast direction towards the Key Bridge and Georgetown. A majority of pedestrian activity was observed on N. 19th St. heading east and N. Lynn St. heading north. Pedestrians entered and exited the Rosslyn Metro Station on N. Moore St. and on N. Fort Myer Dr. Pedestrians during the PM peak period did not have a particular pattern, but were focused near the Rosslyn Metro Station with pockets of activity on N. 19th St., N. Moore St., N. Fort Myer Dr., and N. Lynn St.

The only pedestrian facility in the Gravelly Point study area is the Mt. Vernon Trail with connections to the north and south.

4.5 Bicycle Network

Existing bicycle facilities and trails within a 1-mile radius of the Rosslyn and Gravelly Point study areas are described in this section and shown in figures 4-10 and 4-11, respectively. Data were collected from DC Geographic Information Systems trail data and local bicycle plans and were verified with aerial imagery and field visits as needed. Gaps or deficiencies in the bicycle network are also identified.

4.5.1 BICYCLE NETWORK DESCRIPTION

Several types of bicycle facilities travel through the Rosslyn and Gravelly Point study areas. These include on-street facilities and regional multiuse trails.

4.5.1.1 On-Street Bicycle Facilities

Bicycle lanes are present on a number of streets within a 1-mile radius of the Rosslyn study area and contribute to the overall bicycle network. Bicycle lanes are marked lanes that allow one-way bicycle travel, typically in the same direction as adjacent vehicle travel lanes. Bicycle lanes may or may not be separated from vehicle travel lanes by physical barriers. A bicycle lane is provided along N. Lynn Street between Fairfax Dr. and Lee Hwy. EB. Bicycle lanes also exist along Wilson, Clarendon, and Key Blvds., Veitch St., and part of Lee Hwy., west of the Rosslyn study area. In addition, there is one cycle track on the service road south of Lee Hwy. EB for a short distance on the curve east of N. Moore St.

Across the river in Georgetown, a pair of one-way bicycle lanes connect M Street NW near the Key Bridge to Wisconsin Avenue NW to the north. The southbound lane is on 34th Street NW and the northbound lane is on 33rd Street NW to match the vehicle direction of travel on these one-way streets. A number of shorter distance trails can also be found in Georgetown, including the Georgetown Waterfront Park Trail and Rose Park Trail.

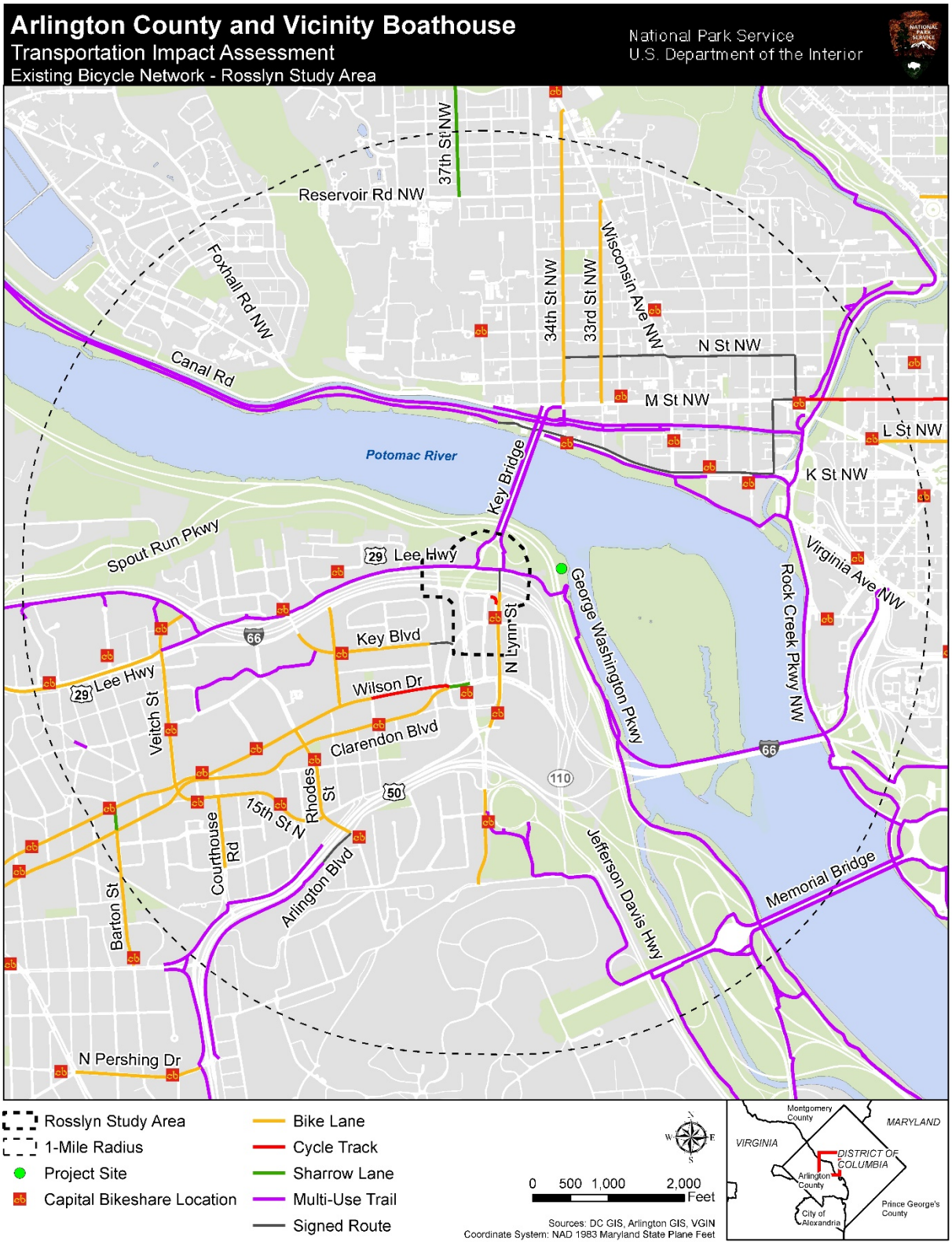


FIGURE 4-10. BICYCLE NETWORK – ROSSLYN STUDY AREA

FIGURE 4-11. BICYCLE NETWORK – GRAVELLY POINT STUDY AREA

The closest bicycle lane to the Gravelly Point study area is located along Crystal Dr. in Crystal City, located approximately 1 mile south and accessible from the Mt. Vernon Trail. Bicycle lanes also exist along S. 15th and 18th Streets with connections to the west.

4.5.1.2 Martha Custis Trail and Mt. Vernon Trail

The Custis Trail provides a multiuse trail link between the Washington and Old Dominion Rail Trail in Fairfax County, Virginia, and the Mt. Vernon Trail and Key Bridge in Rosslyn, which terminates in the Rosslyn study area. The Custis Trail follows the right-of-way of I-66 for its length. It is paved and mostly free of at-grade crossings with roads (BikeWashington.org n.d.a). The Custis Trail is located on the north side of Lee Hwy. WB and changes into the Mt. Vernon Trail after it crosses N. Lynn St.

The Mt. Vernon Trail runs 18 miles in Virginia from George Washington's Mount Vernon Estate to the Key Bridge in Rosslyn along the west bank of the Potomac River. NPS maintains this paved, multiuse trail (NPS n.d.b). This trail also connects to the Roosevelt Bridge crossing and provides access to the Roosevelt Island footbridge. The Mt. Vernon Trail traverses the western edge of the Gravelly Point study area and is the only bicycle facility in a 1-mile radius.

These two trails are part of the Arlington Loop, which is a "premier off-street facility supporting county-wide and regional transportation" (BikeArlington 2016). They connect Rosslyn to areas such as Ballston, the Memorial Bridge, the Tidal Basin, Fairfax, and Potomac Park. Activity along this stretch of the Arlington Loop is largely directed east toward the Key Bridge during the AM rush hour and west during the PM rush hour. Off-street (or shared-use) trails connect to the Custis Trail on N. Fort Myer Dr. and N. Lynn St. to cross the Key Bridge.

The Mt. Vernon Trail traverses the Gravelly Point study area along the eastern edge of the GWMP and connects to the 14th Street Bridge to the north and to Crystal City and Reagan National Airport to the south, as shown in figure 4-11.

4.5.1.3 Francis Scott Key Bridge

The Key Bridge crosses the Potomac River in the Rosslyn study area, and it is equipped with wide multiuse trails on each side that provide connections between Georgetown and Rosslyn, Virginia. On the Virginia side of the river, connections are made directly with the Custis and Mt. Vernon Trails. In Georgetown, the bridge crosses over the Chesapeake and Ohio (C&O) Canal Trail and near the Capital Crescent Trail (CCT) and Georgetown Waterfront Trail, but no direct connections are made. The *Bicycle Master Plan 2014 Update* notes that the trails on the bridge are crowded with pedestrians, making bicycle use difficult (DDOT 2014b).

4.5.1.4 Trails in Georgetown—CCT, Rock Creek Trail, and C&O Canal Towpath

The CCT, a mixed-use trail that runs along the Potomac River and former railroad right-of-way in northwest DC and Montgomery County, Maryland, connects Bethesda, Maryland, to Georgetown and terminates near the Key Bridge at the Alexandria Aqueduct (BikeWashington.org n.d.b). The Rock Creek Trail is a multiuse trail with an 8-foot-wide asphalt surface maintained by NPS. It begins near the National Zoo in Rock Creek Park and follows the Rock Creek and Potomac Parkway south to the Potomac River in Georgetown and ends at the Roosevelt Bridge where it connects to the National Mall Trails. The C&O Canal Towpath or Trail is a NPS-maintained unpaved, hard-packed dirt trail on the towpath of the C&O Canal, extending 184.5 miles from Georgetown to Cumberland, Maryland (NPS 2016c; HNTB 2008). It begins at the Rock Creek Trail and travels west under the Key Bridge. West of the Key Bridge, the towpath closely parallels the CCT as it heads west along the canal.

4.5.1.5 Capital Bikeshare and Bicycle Racks

Capital Bikeshare is an automated bicycle-sharing system serving Washington, DC; Arlington and Alexandria, Virginia; and Montgomery County, Maryland. The study area includes a Capital Bikeshare station at the northwest corner of N. Lynn Street and N. 19th Street. In total, 30 Bikeshare stations exist

within a mile of the study area. Figure 4-9 shows the stations. A bicycle rack at the Rosslyn Metro Station can accommodate 20 bicycles. The Gravelly Point study area contains eight Bikeshare stations within a 1-mile radius west of the GWMP, as shown in figure 4-11.

4.5.2 BICYCLE NETWORK GAPS AND BARRIERS

Limited facilities are available to connect the east-west bicycle lanes through downtown Rosslyn, the Key Bridge, the Custis Trail, and Mt. Vernon Trail. N. Lynn St. has a bicycle lane, but a gap exists between Lee Hwy. EB and the Key Bridge. Cyclists share the road with vehicles along Fort Myer Dr., N. 19th St. and Lee Hwy. EB.

Access to points west of Gravelly Point are limited by the Roaches Run waterbody. The Mt. Vernon Trail, north or south, is used to access connections to Washington, DC, or other points in Arlington County.

4.5.3 CRASH ANALYSIS

The process to identify and rank high bicycle crash locations helps provide insight into traffic and crash patterns and possible safety enhancements. However, determining the true reasons for a high accident rating cannot solely be determined with accident data because each situation has unique circumstances that are not reflected in the accident/crash study reports. However, general trends can be determined or certain causes can be eliminated by examining the available accident-specific information.

High bicycle crash locations are based on a bicycle crash rate that is calculated by dividing the number of bicycle crashes by the average daily traffic volume, expressed as crashes per million vehicles. Crash rates can be reviewed as a whole or categorically by number of lanes, functional class, severity of the crash, or other type as warranted to help identify high bicycle crash locations (Virginia Transportation Research Council 2008).

According to the crash data reports received from VDOT, 4 of the 10 intersections in the study area experienced a crash between a bicycle and car (DDOT 2013–2015). The intersection of Lee Hwy. WB/I-66 off-ramp and N. Lynn. St. (Intersection #5) had the highest crash rate with nine crashes, resulting in a crash rate of 0.28 crashes per million vehicles. The next highest crash rate occurred at Lee Hwy. EB and N. Fort Myer Dr. (Intersection # 7) with three crashes, followed by Lee Hwy. EB/I-66 on-ramp and N. Lynn. St (Intersection #8) with two crashes, followed by Lee Hwy. WB and N. Fort Myer Dr. (Intersection #4) with 1 crash. In addition to the study intersections, five crashes between a bicycle and car occurred at the Key Bridge Marriott Hotel driveway connection to Lee Hwy. WB, where vehicles entering or exiting the hotel traversed the Custis Trail.

4.6 Transit

Transit service in the Rosslyn and Gravelly Point study areas consist of many modes, including Metrorail lines, local and commuter bus service, and carsharing. This section summarizes these transit services, frequencies and headways, and ridership, if available. The analysis includes weekday and weekend service.

4.6.1 METRORAIL SERVICE

The Rosslyn Metro Station serves the Rosslyn study area with service to the Orange, Silver, and Blue lines. The station is located in the block consisting of N. 19th St., N. Wilson Blvd., N. Moore St., and N. Fort Myer Dr. and has multiple entry points, including a bank of escalators between N. Moore St. and N. Fort Myer Dr., south of N. 19th St. and a bank of high speed elevators next to N. Moore St. across the street from the other entrance. The station is a major transfer point for locations to the south (City of Alexandria), west (Fairfax County), and east (Washington, DC). Daily ridership at this station in May 2017 was approximately 12,590 boardings on weekdays and 3,950 boardings on weekends, with a total of

1,675 boardings during the AM peak hour and 1,950 boardings during the PM peak hour (WMATA 2017a). Saturday ridership did not exceed 375 boardings per hour.

The Gravelly Point study area is served by the Reagan National Airport and Crystal City Metro Stations located approximately 1 mile south. The stations provide service to the Blue and Yellow lines that connect Springfield and Alexandria, Virginia, to Washington, DC. The National Airport station can be accessed at two entrances that connect to walkways leading directly into the airport between Terminals B and C. Daily ridership at this station in 2016 was approximately 6,540 boardings on weekdays. The Crystal City station can be accessed at the corner of S. 18th St. and S. Bell St. Daily ridership at this station in 2016 was approximately 11,180 boardings on weekdays (WMATA 2016).

Figure 4-12 shows the Rosslyn study area Metrorail network, and figure 4-13 shows the Gravelly Point study area Metrorail network.

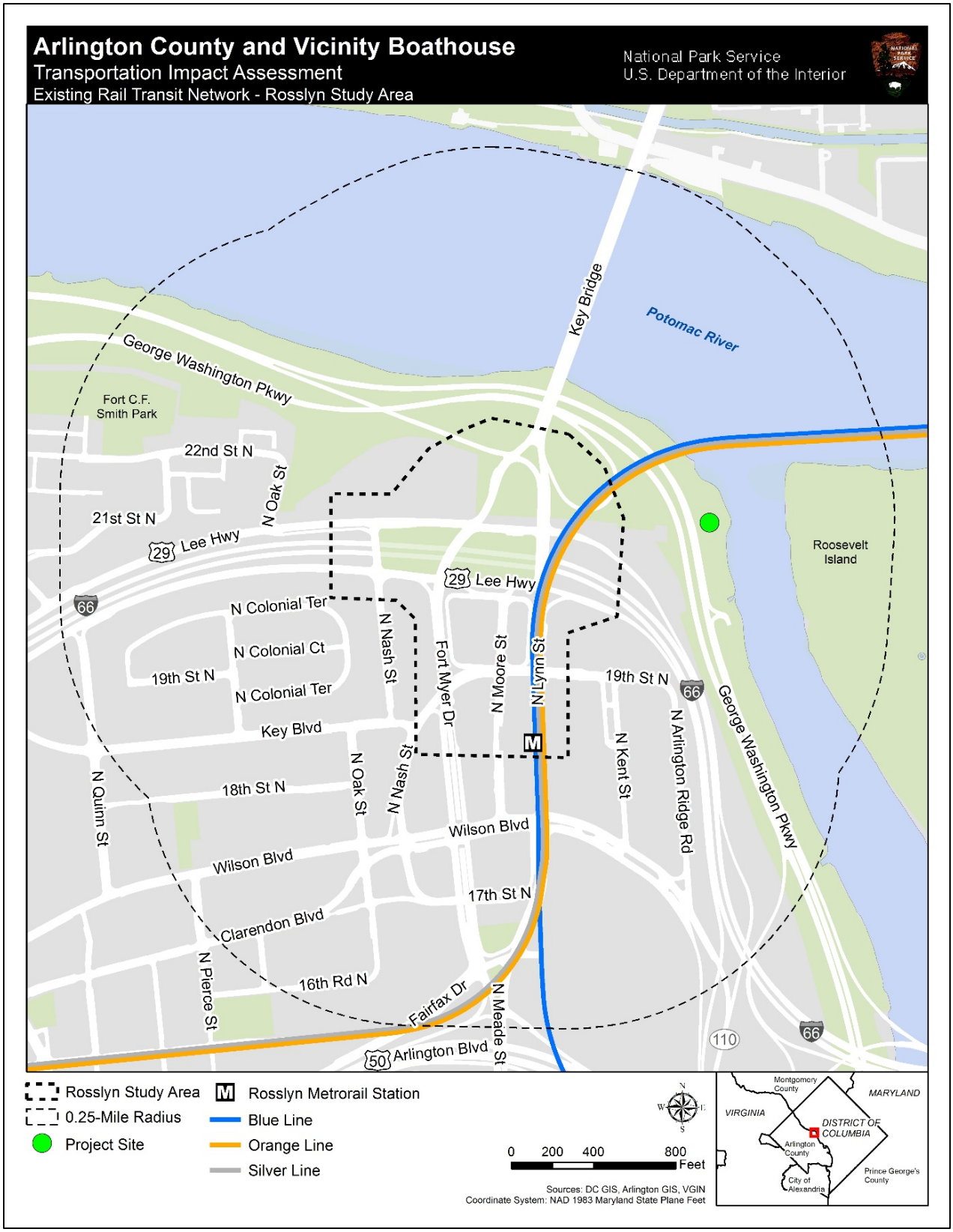


FIGURE 4-12. EXISTING METRORAIL TRANSIT NETWORK – ROSSLYN STUDY AREA

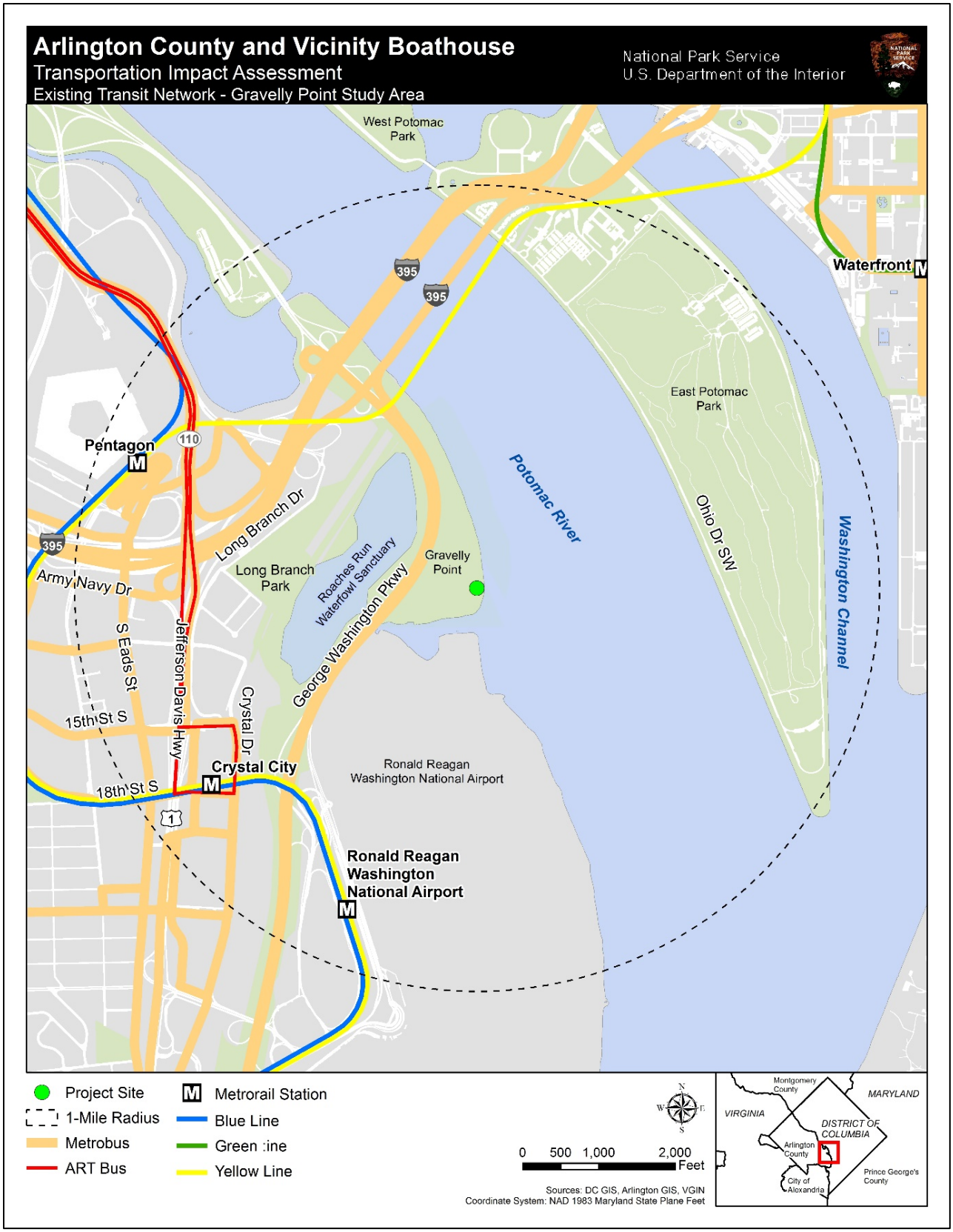


FIGURE 4-13. EXISTING METRORAIL TRANSIT NETWORK – GRAVELLY POINT STUDY AREA

4.6.2 LOCAL AND COMMUTER BUS SERVICE

The Rosslyn Metro Station serves as a major local bus transfer point with connections to 12 bus routes, including routes provided by the Washington Metropolitan Area Transit Authority (WMATA) (Metrobus), Arlington County Transit (ART), and DC Circulator. The majority of the routes are bidirectional and have service throughout the day; however, some of these routes are rush hour only. A list of the routes, frequencies, and destinations are provided in figure 4-14 and table 4-7.

Many local and commuter buses provide service in the Rosslyn study area; no bus service in provided in in the Gravelly Point study area. WMATA Metrobus services connect the Rosslyn study area with other neighborhoods in Arlington County and points in Washington, DC; Arlington County ART services provide supplemental connections in Arlington County; the DC Circulator operates between Rosslyn and Dupont Circle providing connection to Washington, DC; and commuter buses connect farther Virginia destinations to the Rosslyn area.

4.6.2.1 WMATA Metrobus

WMATA provides local Metrobus service throughout the District of Columbia and neighboring jurisdictions, including operating seven bus lines in the Rosslyn study area, as shown in figure 4-14. The seven lines serve destinations primarily in Arlington County while their endpoints provide transfer points to other bus lines and transit options to make farther connections, including Dulles International Airport at the end of the 5A line. Further, these bus lines also serve the Rosslyn Metro Station and include five bus stops along N. Moore St. near the station entrance. Most bus lines operate with weekday peak period headways around 20 minutes, although some bus lines have headways as short as 12 minutes and as long as 60 minutes. Table 4-7 presents Metrobus service by route for lines that serve the study area, including peak and off-peak headways (time between buses), service hours, weekday average ridership, and route type.

WMATA ridership data from spring 2017 for bus routes serving Rosslyn was used to show the daily weekday and weekend ridership. Overall, Metrobus routes that travel through Rosslyn carried approximately 7,300 passengers on an average weekday and 3,380 passengers on an average Saturday. Route 38B carried the highest passenger volumes, exceeding 1,000 during the PM peak hour or three times the other routes, while the other six carried similar volumes between 150 and 300. A similar pattern was present for Saturday service where Route 38B carried more than two times the volume of the other routes. Based on an average bus capacity of 28 seats per bus, the seven bus routes operate on average below their seating capacity. On occasion, Routes 5A during the PM and 38B during the AM, PM, and Saturday operate near their seating capacity (WMATA 2017b).

4.6.2.2 Arlington County ART

Arlington County provides local bus service through its ART program (Arlington Transit) to supplement WMATA Metrobus service. ART operates four bus lines in the Rosslyn study area that each serve the Rosslyn Metro Station. Each bus line operates on an optimized schedule based on its ridership for weekdays and weekends, resulting in headways that vary between 10 and 30 minutes depending on the line, as shown in table 4-7.

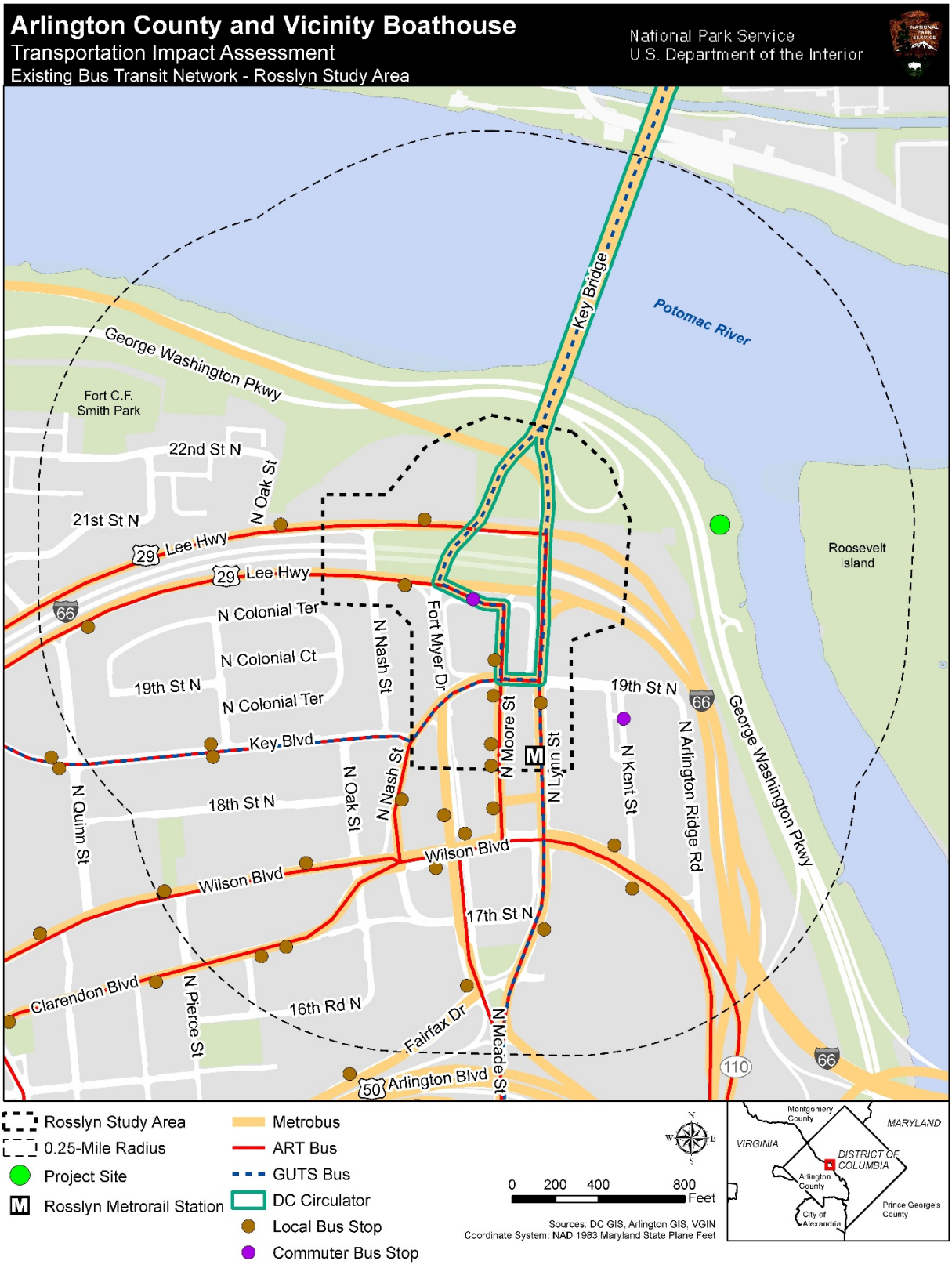


FIGURE 4-14. EXISTING BUS TRANSIT NETWORK – ROSSLYN STUDY AREA

TABLE 4-7. LOCAL AND COMMUTER BUS SERVICE HOURS AND HEADWAYS

Route Name by Provider	Route Endpoints	Headway	Service Hours for Study Area
WMATA			
3Y	East Falls Church Metro Station to McPherson Square Metro Station	Peak: 15–25 minutes	Weekdays: 6:29 a.m. – 9:30 a.m., 4:15 p.m. – 8:00 p.m.
4A	Seven Corners in Falls Church to Rosslyn Metro Station	Peak: 15–30 minutes Off-Peak: 40–60 minutes	Weekdays: 5:30 a.m. – 12:50 a.m. Saturday: 6:15 a.m. – 11:31 p.m. Sunday: 6:19 a.m. – 10:13 p.m.
4B	Seven Corners to Rosslyn Metro Station	Peak: 15–30 minutes Off-Peak: 40–60 minutes	Weekdays: 5:30 a.m. – 12:50 a.m. Saturday: 6:15 a.m. – 11:31 p.m. Sunday: 6:19 a.m. – 10:13 p.m.
5A	L'Enfant Plaza Metro Station to Washington Dulles International Airport	Peak: 30 minutes Off-Peak: 40–60 minutes	Weekdays: 4:50 a.m. – 12:17 p.m. Saturday: 5:30 a.m. – 12:18 p.m. Sunday: 5:30 a.m. – 12:10 p.m.
10E	Hunting Point to Rosslyn Metro Station	PM Peak: 30 minutes	Weekdays: 5:51 a.m. – 8:42 a.m., 4:00 p.m. – 7:29 p.m.
15K	East Falls Church Metro Station to Rosslyn Metro Station	Peak: 30 minutes	Weekdays: 5:40 a.m. – 8:49 a.m., 3:15 p.m. – 7:00 p.m.
38B	Ballston Metro Station to Farragut West Metro Station	Peak: 12–15 minutes Off-Peak: 20–30 minutes	Weekdays: 5:30 a.m. – 1:30 a.m. Saturday: 6:00 a.m. - 1:30 a.m. Sunday: 6:00 a.m. – 12:20 a.m.
Arlington County Transit (ART)			
43	Courthouse Metro Station to Crystal City Metro Station	Peak: 10 minutes Off-Peak: 20 minutes	Monday to Thursday: 6:01 a.m. – 10:56 p.m. Friday: 6:01 a.m. – 11:56 p.m. Saturday: 7:00 a.m. – 11:56 p.m. Sunday: 7:00 a.m. – 9:56 p.m.
45	Columbia Pike (Columbia Pike & South Dinwiddle Street) to Rosslyn Metro Station	Peak: 25 minutes Off-Peak: 30 minutes	Weekdays: 5:40 a.m. – 11:35 p.m. Saturday: 7:30 a.m. – 12:21 a.m. Sunday: 6:50 a.m. – 8:11 p.m.
55	East Falls Church Metro Station to Rosslyn Metro Station	Peak: 15 minutes Off-Peak: 30 minutes	Weekdays: 5:00 a.m. – 1:49 a.m. Saturday: 5:45 a.m. – 1:12 a.m. Sunday: 6:20 a.m. – 12:17 a.m.
61	Loop between Rosslyn and Courthouse Metro Stations	Peak: 25 minutes Off-Peak: 25 minutes	Weekdays: 6:15 a.m. – 6:08 p.m.

Route Name by Provider	Route Endpoints	Headway	Service Hours for Study Area
DC Circulator			
Dupont Circle – Georgetown – Rosslyn	Dupont Circle Metro to Rosslyn Metro Station	10 minutes	Monday to Thursday: 6:00 a.m. – Midnight Friday: 6:00 a.m. – 3:00 a.m. Saturday: 7:00 a.m. – 3:00 a.m. Sunday: 7:00 a.m. – Midnight
Loudoun County Transit (LCT) Commuter Bus			
Ashburn North, Brambleton, Dulles North, Dulles South, Christian Fellowship Church, Harmony (Hamilton), Leesburg, Purcellville, Telos to Arlington/DC	Loudoun County to Washington, DC	Peak: 15–30 minutes	Monday to Friday: 4:38 a.m. – 8:45 a.m., 1:34 p.m. – 7:04 p.m.
Potomac and Rappahannock Transportation Commission (PRTC) Commuter Bus			
Dale City – Pentagon and Rosslyn/Ballston	Dale City to the Pentagon with connecting trips to Rosslyn/Ballston Metro Stations	Peak: 30–40 minutes Monday through Thursday Peak: 60 minutes Friday	To/from connecting trips to Rosslyn/Ballston Metro Stations Monday to Friday: 5:22 a.m. – 7:32 a.m., 3:36 p.m. – 5:51 p.m. (Friday service ends at 5:08 p.m.)
Georgetown University Transportation Shuttle			
Georgetown University – Rosslyn	Georgetown University to Rosslyn Metro Station	Peak: 10–20 minutes	Monday to Friday: 4:45 a.m. – 12:00 a.m. (midnight)
Georgetown University – Arlington County, Virginia	Georgetown University to Arlington County, Virginia	Peak: 50–75 minutes	Monday to Friday: 7:10 a.m. – 10:20 p.m.

Source: WMATA n.d.; Arlington County n.d.; DDOT n.d.b; Loudoun County n.d.; PRTC 2017; Georgetown University n.d.

4.6.2.3 DC Circulator

The DC Circulator Bus system is a unique transit option in the Washington, DC, metro area that provides continuous bus service every 10 minutes on fixed routes connecting major destinations. The Rosslyn study area is served by the Dupont Circle – Georgetown – Rosslyn route. This route begins at the Dupont Circle Metro Station, passes near the Foggy Bottom Metro Station before traversing Georgetown, and ends at the Rosslyn Metro Station after crossing the Potomac River via the Key Bridge. The route has an average daily ridership of 2,000 passengers (DDOT n.d.a) and provides transfer connections to three Metrorail stations and numerous bus lines. DC Circulator bus stops do not include shelters, benches, or curb ramps. Circulator stops that were co-located with the Metrobus stops previously noted share the same features. A summary of DC Circulator route information is presented in table 4-7.

4.6.2.4 Commuter Bus Service

Because of the high concentration of office development in Rosslyn, two commuter bus services from nearby jurisdictions operate in the Rosslyn study area. These commuter buses benefit from the access provided by major thoroughfares such as I-66 and Route 110 and connections to the Roosevelt Bridge.

Loudoun County Transit (LCT) and the Potomac and Rappahannock Transportation Commission (PRTC) operate nine and one commuter bus lines with stops in the Rosslyn study area, respectively. The nine LCT routes operate between multiple park & ride lots throughout Loudoun County and Washington, DC, and provide service to numerous communities, including Ashburn, Brambleton, Leesburg, and Purcellville (Loudoun County n.d.). PRTC (referred to as OmniRide) operates one route between Dale City and the Pentagon, with connecting trips to Rosslyn/Ballston Metro Stations (PRTC 2017). A summary of commuter bus routes is presented in table 4-7.

4.6.2.5 Georgetown University Transportation Shuttle

Georgetown University operates a free shuttle bus (referred to as GUTS) for faculty, staff, students, and others affiliated with Georgetown University and Medstar Georgetown University Hospital, connecting the university's main campus with two Metro stations, the Georgetown University Law Center, Capitol Hill, and Arlington, Virginia. The shuttle operate two routes with stops in the Rosslyn study area. The Rosslyn route operates continually between Georgetown University and the Rosslyn Metro Station, while the Arlington route makes a loop from the university through Arlington County as far west as the Ballston Metro Station (Georgetown University n.d.). A summary of the Georgetown University Transportation Shuttle route information is presented in table 4-7.

4.6.3 CARSHARE AND ON-DEMAND CAR SERVICES

Carsharing is a mobility option that allows individuals to rent a vehicle for short periods (minutes, hours, or days) and has become an increasingly popular way for people to travel around metropolitan Washington, DC. Two carsharing companies currently serve the Rosslyn study area—ZipCar and Car2Go. All services are provided by private companies that offer automobile access to registered users. Zipcar has fixed pick-up/drop-off locations, whereas Car2Go can be picked up/dropped off at any location in its service area. A review of data collected in August 2017 shows that Zipcar has five fixed locations in the Rosslyn study area (ZipCar 2017), including an on-street location at Wilson Blvd. and N. Lynn St. near the Rosslyn Metro Station (figure 4-15).

The Gravelly Point study area is not served by carshare options; however, ZipCar provides pick-up/drop-off locations at Reagan National Airport and Crystal City, approximately 1 mile south.

The two study areas are additionally served by on-demand car-for-hire services, including Uber and Lyft. These car services use a smartphone application to hail a private driver for passenger service between destinations. Hail-taxicabs are also available throughout the Rosslyn study area.

4.7 Trucks and Buses

VDOT has established designated access routes for twin-trailers, triple saddlemount combinations, and automobile/watercraft transporters. Truck restrictions primarily concern vehicle length, although other restrictions and limitations may include weight, width, or height. I-66 crossing the Rosslyn study area has a VDOT truck restriction for vehicles with more than four tires; no other VDOT truck restrictions apply in the Rosslyn study area (VDOT 2008).

Arlington County has established truck prohibitions on certain streets that may not be used for truck use except for the purpose of receiving loads and making deliveries; no streets with truck prohibitions are located in the Rosslyn study area (Arlington County Code 2015). Arlington County also has established eight tour-bus parking zones in the county, including two zones in the Rosslyn study area. Five bus parking spaces are located on the east side of N. Fort Myer Dr. between Lee Hwy. and 19th St. N., and three spaces are located along N. Arlington Ridge Rd. north of Wilson Blvd. (Stay Arlington n.d.a). These designated bus parking spaces are available on a first-come, first-serve basis with no reservations accepted (Arlington County 2017c). The closest designated tour-bus parking zone near the Gravelly Point study area is located approximately 1 mile south in Crystal City along S. 18th St. between S. Bell St. and Crystal Dr. by the Crystal City Metro Station (Stay Arlington n.d.b).

Federal regulations restrict the use of NPS park roads, including the GWMP, by commercial vehicles. Commercial vehicles, defined as trucks or other vehicles used in transporting movable property for a fee or profit, must have a special permit to use the GWMP at all times, including segments traversing both the Rosslyn and Gravelly Point study areas (NPS 2017). In addition, there is a 10-ton load limit restriction on the Arlington Memorial Bridge until rehabilitation is completed.

Figure 4-16 shows the truck restrictions and tour-bus parking zones in the Rosslyn study area.

4.8 Parking

Existing public parking in the Rosslyn study area includes on-street metered and unmetered parking zones, off-street underground garages, and surface lots as shown in figure 4-17. Information about on-street parking was gathered through site visits in April 2017; information about off-street parking used Arlington County online resources in addition to site visits. This section also contains a description of the available parking at Gravelly Point and Roosevelt Island.

4.8.1 On-Street Parking in Rosslyn

The Rosslyn study area includes approximately 41 public on-street parking spaces. The majority of these spaces are metered with limited hour restrictions (i.e., 2 hours) and centralized on Fort Myer Dr. and N. Lynn St. A few spaces have no parking restrictions during rush hour, are reserved for handicapped parking, or are reserved for tour-bus parking.

4.8.2 Off-Street Parking in Rosslyn

Eight public off-street parking options serve the Rosslyn study area, including seven underground garages and one surface lot. The off-street parking option closest to the proposed Rosslyn boathouse sites is the Colonial Parking underground garage located at 1901 N. Moore St. Other off-street parking options accessible to the public in the study area include:

- Atlantic Parking, located at 1812 N. Moore St. at Central Place (garage)
- Atlantic Parking, located at 1901–1911 N. Fort Myer Dr. (garage)
- Atlantic Parking, located at 1801 N. Lynn St. (garage)
- Colonial Parking, located at 1700 N. Moore St. at Rosslyn Center (garage)
- Key Bridge Marriott, located at 1401 Lee Hwy. (garage)
- Holiday Inn Rosslyn at Key Bridge, located at 1900 N. Fort Myer Dr. (garage)

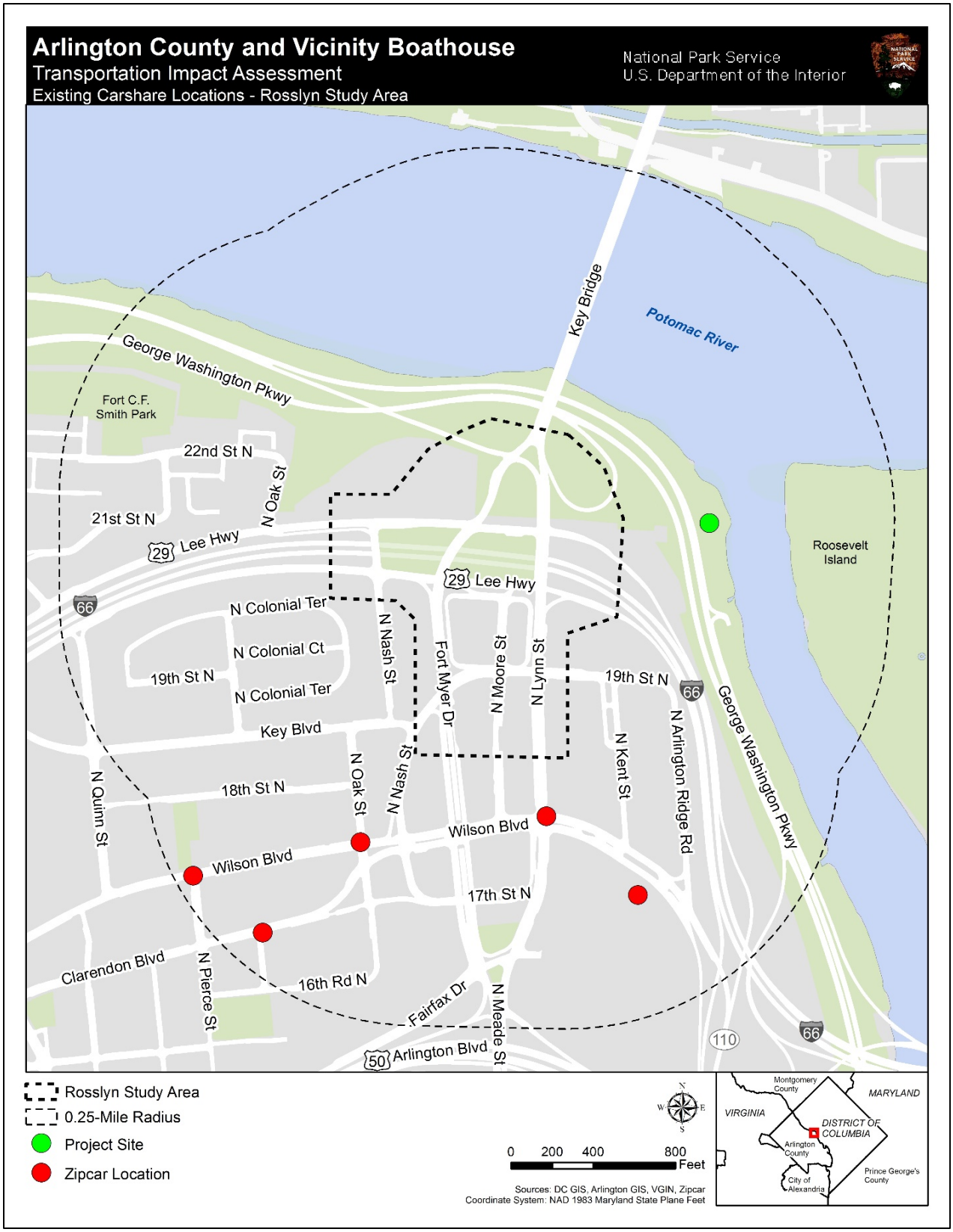


FIGURE 4-15. EXISTING CARSHARE LOCATIONS – ROSSLYN STUDY AREA

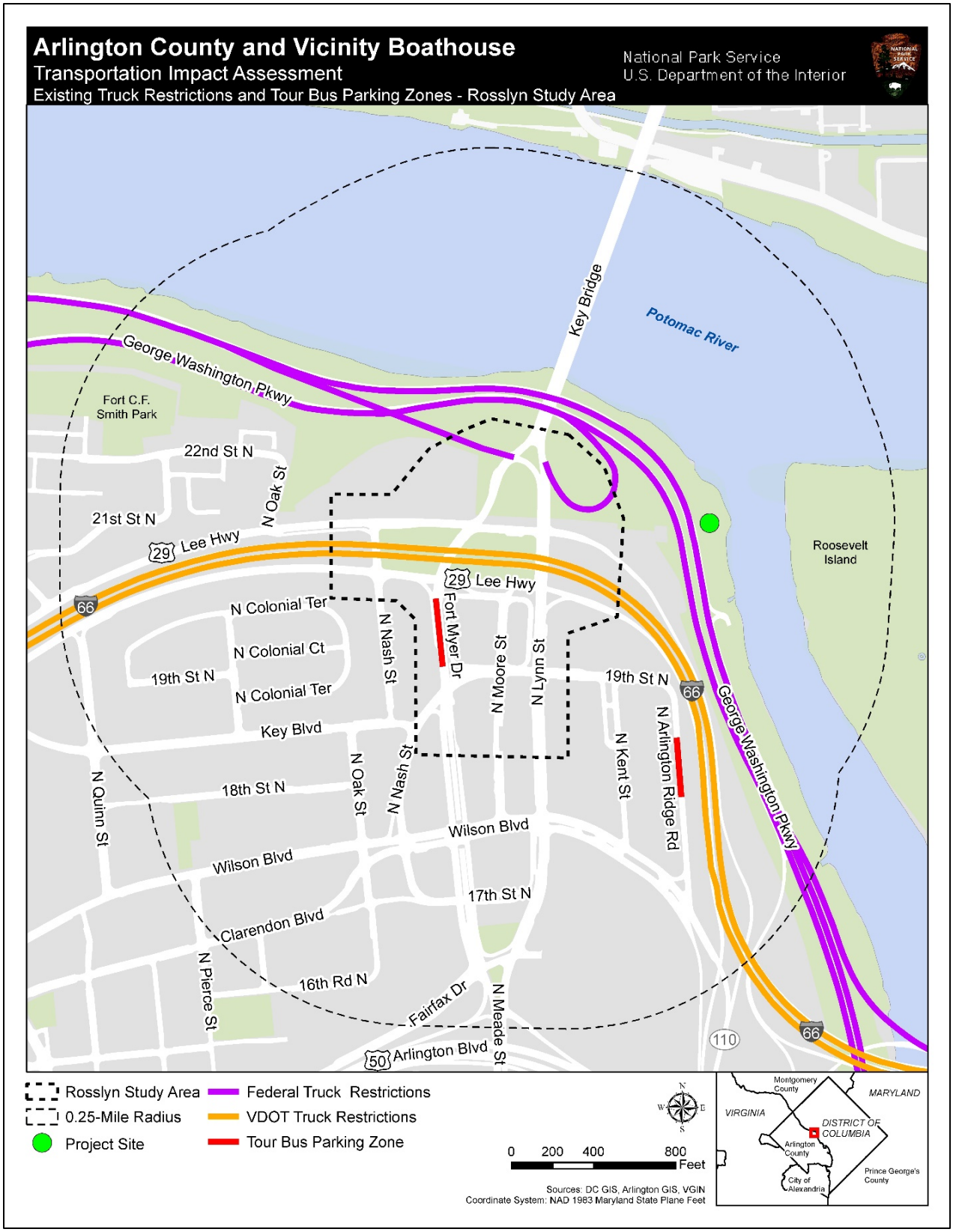


FIGURE 4-16. EXISTING TRUCK RESTRICTIONS AND TOUR-BUS PARKING ZONES – ROSSLYN STUDY AREA

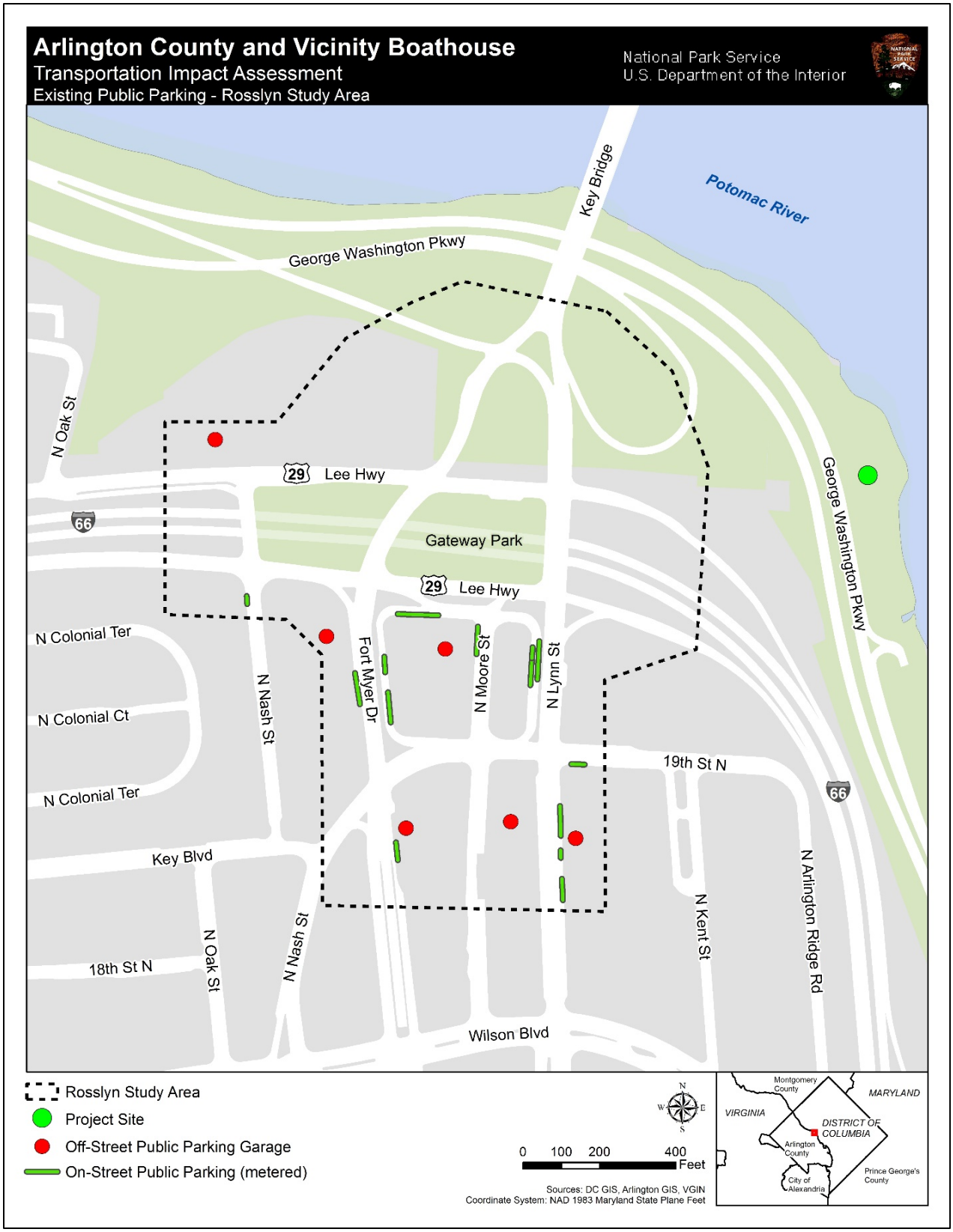


FIGURE 4-17. EXISTING PUBLIC PARKING – ROSSLYN STUDY AREA

4.8.3 ROOSEVELT ISLAND PARKING AREA

Roosevelt Island has a public outdoor surface parking lot containing 97 parking spaces based on a parking occupancy study conducted by Louis Berger on July 28, 2015. This parking lot can only be accessed from the northbound travel lanes of the GWMP and is the primary access point to the pedestrian bridge to Roosevelt Island. The parking lot also provides access to the Mt. Vernon Trail and Rosslyn via a pedestrian bridge over the GWMP. Results of the parking occupancy study are detailed in tables 4-8 and 4-9 for a typical summer weekday (July 28, 2015) and a typical summer Saturday (August 15, 2015), respectively.

TABLE 4-8. ROOSEVELT ISLAND WEEKDAY PARKING USE SUMMARY

Time Period	Time Counted	Occupied Spaces	Total Spaces	Occupancy
Roosevelt Island (BOTH LOTS) - July 28, 2015				
7:00 a.m. – 8:00 a.m.	7:20 a.m.	7	97	7%
8:00 a.m. – 9:00 a.m.	8:05 a.m.	9	97	9%
9:00 a.m. – 10:00 a.m.	9:05 a.m.	8	97	8%
10:00 a.m. – 11:00 a.m.	10:06 a.m.	20	97	21%
11:00 a.m. – 12:00 p.m.	11:25 a.m.	26	97	27%
12:00 p.m. – 1:00 p.m.	12:07 p.m.	22	97	23%
1:00 p.m. – 2:00 p.m.	1:02 p.m.	28	97	29%
2:00 p.m. – 3:00 p.m.	2:06 p.m.	31	97	32%
3:00 p.m. – 4:00 p.m.	3:34 p.m.	22	97	23%
4:00 p.m. – 5:00 p.m.	4:34 p.m.	24	97	25%
5:00 p.m. – 6:00 p.m.	5:02 p.m.	23	97	24%
6:00 p.m. – 7:00 p.m.	6:05 p.m.	24	97	25%

TABLE 4-9. ROOSEVELT ISLAND SATURDAY PARKING USE SUMMARY

Time Period	Time Counted	Occupied Spaces	Total Spaces	Occupancy
Roosevelt Island (BOTH LOTS) - August 15, 2015				
7:00 a.m. – 8:00 a.m.	7:20 a.m.	56	97	58%
8:00 a.m. – 9:00 a.m.	8:05 a.m.	97	97	100%
9:00 a.m. – 10:00 a.m.	9:05 a.m.	96	97	99%
10:00 a.m. – 11:00 a.m.	10:06 a.m.	94	97	97%
11:00 a.m. – 12:00 p.m.	11:25 a.m.	97	97	100%
12:00 p.m. – 1:00 p.m.	12:07 p.m.	88	97	91%
1:00 p.m. – 2:00 p.m.	1:02 p.m.	94	97	97%
2:00 p.m. – 3:00 p.m.	2:06 p.m.	97	97	100%
3:00 p.m. – 4:00 p.m.	3:34 p.m.	97	97	100%
4:00 p.m. – 5:00 p.m.	4:34 p.m.	81	97	84%
5:00 p.m. – 6:00 p.m.	5:02 p.m.	55	97	57%
6:00 p.m. – 7:00 p.m.	6:05 p.m.	50	97	52%

4.8.4 GRAVELLY POINT PARKING AREA

The Gravelly Point study area has a public outdoor surface parking lot containing 78 parking spaces and 18 boat trailer parking spaces based on a parking occupancy study conducted by Louis Berger on July 28, 2015. Grassy areas are routinely utilized for parking once the paved surface lot is full. This parking lot can only be accessed from northbound travel lanes of the GWMP. The parking lot provides access to the parkland and boat launch associated with Gravelly Point, but also access to the Mt. Vernon Trail. Results of the parking occupancy study are detailed in Tables 4-10 and 4-11 regarding a typical summer weekday (July 28, 2015) and a typical summer Saturday (August 15, 2015), respectively.

TABLE 4-10. GRAVELLY POINT WEEKDAY PARKING USE SUMMARY

Time Period	Time Counted	Parking Spaces			Boat Trailer Spaces		
		Occupied Spaces	Total Spaces	Occupancy	Occupied Spaces	Total Spaces	Occupancy
Gravelly Point - July 28, 2015							
7:00 a.m. – 8:00 a.m.	7:10 a.m.	8	78	10%	1	18	6%
8:00 a.m. – 9:00 a.m.	8:35 a.m.	6	78	8%	1	18	6%
9:00 a.m. – 10:00 a.m.	9:21 a.m.	18	78	23%	1	18	6%
10:00 a.m. – 11:00 a.m.	10:23 a.m.	27	78	35%	1	18	6%
11:00 a.m. – 12:00 p.m.	11:25 a.m.	22	78	28%	6	18	33%
12:00 p.m. – 1:00 p.m.	12:24 p.m.	24	78	31%	0	18	0%
1:00 p.m. – 2:00 p.m.	1:18 p.m.	27	78	35%	2	18	11%
2:00 p.m. – 3:00 p.m.	2:24 p.m.	31	78	40%	1	18	6%
3:00 p.m. – 4:00 p.m.	3:10 p.m.	24	78	31%	4	18	22%
4:00 p.m. – 5:00 p.m.	4:08 p.m.	30	78	38%	4	18	22%
5:00 p.m. – 6:00 p.m.	5:21 p.m.	51	78	65%	1	18	6%
6:00 p.m. – 7:00 p.m.	6:24 p.m.	70	78	90%	1	18	6%

TABLE 4-11. GRAVELLY POINT WEEKEND PARKING USE SUMMARY

Time Period	Time Counted	Parking Spaces			Boat Trailer Spaces		
		Occupied Spaces	Total Spaces	Occupancy	Occupied Spaces	Total Spaces	Occupancy
Gravelly Point - August 15th, 2015							
7:00 a.m. – 8:00 a.m.	7:30 a.m.	42	78	54%	8	18	44%
8:00 a.m. – 9:00 a.m.	8:15 a.m.	49	78	63%	8	18	44%
9:00 a.m. – 10:00 a.m.	9:30 a.m.	75	78	96%	9.5	18	53%
10:00 a.m. – 11:00 a.m.	10:10 a.m.	72	78	92%	8.5	18	47%
11:00 a.m. – 12:00 p.m.	11:30 a.m.	79	78	101%	16	18	89%
12:00 p.m. – 1:00 p.m.	12:26 p.m.	75	78	96%	12.5	18	69%
1:00 p.m. – 2:00 p.m.	1:01 p.m.	60	78	77%	11	18	61%
2:00 p.m. – 3:00 p.m.	2:16 p.m.	72	78	92%	13.5	18	75%
3:00 p.m. – 4:00 p.m.	3:35 p.m.	78	78	100%	15	18	83%
4:00 p.m. – 5:00 p.m.	4:40 p.m.	79	78	101%	16.5	18	92%
5:00 p.m. – 6:00 p.m.	5:10 p.m.	79	78	101%	17	18	94%
6:00 p.m. – 7:00 p.m.	6:30 p.m.	79	78	101%	17	18	94%

4.9 Airport Facilities

Reagan National Airport is managed by the Metropolitan Washington Airports Authority and is located in Arlington, Virginia, along the Potomac River approximately 1 mile south of the Gravelly Point study area. The airport provides domestic and international flights and includes 3 terminals, 44 gates, and 3 runways. The airport averages 62 landings and takeoffs per hour. Hourly, daily, and economy public parking is available for more than 9,000 vehicles. A five-level parking garage is connected to Terminal A that also includes a car rental facility served by five car rental companies. Terminals B and C also connect to a parking garage at both ends. Courtesy shuttle buses travel between each terminal and to the economy parking lot. Taxicabs are also available, and approximately 5,000 taxis are dispatched at the airport daily. SuperShuttle also provides roundtrip transportation services to the airport from homes, businesses, or hotels (Metropolitan Washington Airports Authority n.d.).

4.10 Traffic

This section explains the concepts and definitions for analyzing the traffic operations, the process used to analyze the 11 study area intersections, and the results of the traffic analyses. All facilities (intersections and freeways) were evaluated based on a peak hour factor of 0.85 or higher (ratio of the 60-minute volume divided by 4 times the highest 15-minute volume), the lowest accepted by VDOT's *Traffic Impact Analysis Regulations* (VDOT 2012).

4.10.1 Analysis Tools

The study analyzed the study area intersections using Synchro™ Traffic Signal Coordination Software Version 10.0 (Build 1, Revision 26). Two analyses were performed for traffic, including an intersection capacity analysis and an intersection queueing analysis. The intersection capacity analysis used the Synchro™ software tool and various input values as described in the following sections to determine the level of service (LOS) or driver perception of an intersection's operation. The intersection capacity analysis results are presented in section 4.10.3. The intersection queuing analysis used the Synchro™ tool to determine different levels of queuing or the length that vehicles may back up at an intersection. The intersection queuing analysis process and the traffic study area results of the queuing analysis are presented in section 4.10.4

4.10.2 Intersection Operations Analysis Method

LOS is the primary measure of traffic operations for both signalized and unsignalized intersections. LOS is a standard performance measure developed by the transportation profession to quantify driver perception for such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles. LOS provides a scale that is intended to match motorists' perception of how a transportation facility operates and to provide a scale to compare different facilities. Detailed LOS descriptions are presented in figure 4-18.

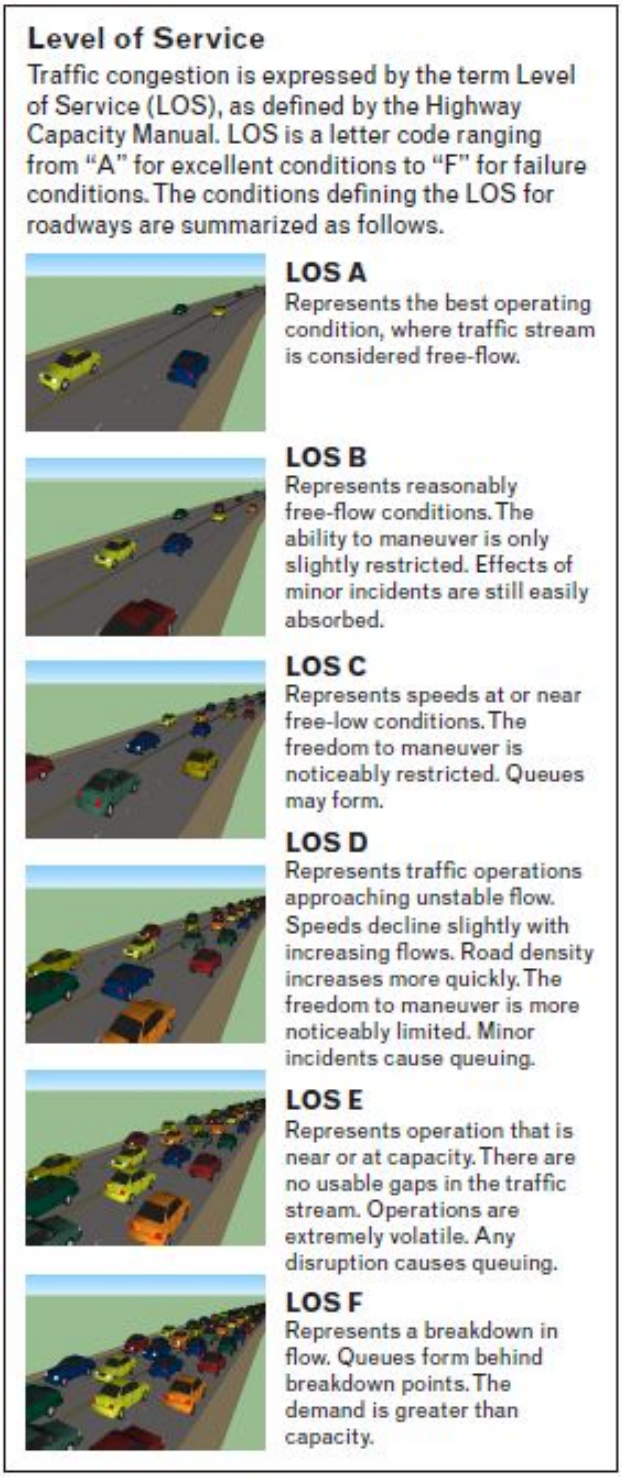


FIGURE 4-18. LEVEL OF SERVICE DIAGRAM

4.10.2.1 Signalized Intersection Level of Service

The LOS for signalized intersections is based on the Highway Capacity Manual (HCM) 2000 method and requires the same inputs to determine an accurate LOS (TRB 2000). HCM 2010 methods were not followed because the signal timings were not HCM 2010 compliant, for example, signal timings included pedestrian lead-time to offer pedestrians a head start ahead of vehicles to enter an intersection. Primary inputs include:

- vehicular volumes
- pedestrian volumes
- traffic signal timings
- roadway geometry
- speed limits
- truck percentages
- peak hour factor (measure of vehicle 15-minute flow rate)

The average vehicle control delay, measured in seconds per vehicle, is calculated using these parameters with the Synchro™ procedures. This represents the average extra delay in seconds per vehicle caused by the presence of a traffic control device or traffic signal and includes the time required to decelerate, stop, and accelerate. The LOS can be characterized for the entire intersection, each intersection approach, and each lane group. Control delay is used to characterize the LOS for the entire intersection or an approach. The control delay and the volume-to-capacity ratio are used to characterize the LOS for a lane group. Delay quantifies the increase in travel time due to a traffic signal control. It is also a surrogate measure for driver discomfort and fuel consumption (TRB 2010). Signalized intersections or approaches that exceed a delay of 50 seconds have LOS E and those with a delay of 80 seconds have LOS F. Table 4-12 shows the average control delay and corresponding LOS for signalized intersections. Using the Synchro™ method, LOS E and LOS F constitute failing operations.

TABLE 4-12. SIGNALIZED INTERSECTION CONTROL DELAY AND LOS THRESHOLDS – HCM 2000 METHOD

LOS	Average Control Delay (seconds/vehicle)	Description
A	Less than or equal to 10	Stable conditions
B	>10-20	
C	>20-35	
D	>35-55	
E	>55-80	Unstable conditions
F	More than 80	Above capacity and unstable conditions

Source: TRB (2000)

To determine the LOS of an intersection, the critical input values were entered into the analysis software (Synchro™), and the average vehicle delay (seconds per vehicle) was calculated. Based on the average vehicle delay, the LOS was determined for all movements (left, through, and right), approaches, and the intersection as a whole.

4.10.2.2 Unsignalized Intersection Levels of Service

The LOS for unsignalized intersections (STOP-controlled intersections) is based on the HCM 2000 method and requires several inputs, including:

- vehicular volumes
- pedestrian volumes
- roadway geometry
- speed limits
- truck percentages
- peak hour factor

The average vehicle control delay, in seconds per vehicle, was calculated using these parameters with the HCM 2000 procedures (TRB 2010). Average vehicle control delay represents the average delay caused by the presence of a stop sign or roundabout and includes the time required to decelerate, stop, and accelerate.

The LOS for a two-way, STOP-controlled (TWSC) intersection (i.e., unsignalized intersection) is determined for each minor-street movement or shared movement and the major-street left turns. LOS F is assigned to the movement if the volume-to-capacity ratio for the movement exceeds 1.0 or if the movement's control delay exceeds 50 seconds. The criteria used to determine LOS for TWSC intersections are different from the criteria used for signalized intersections primarily because user perceptions differ among transportation facility types. The expectation is that a signalized intersection is designed to carry higher traffic volumes and presents greater delay than an unsignalized intersection. Unsignalized intersections are also associated with more uncertainty for users because delays are less predictable than at signals, which can reduce users' delay tolerance. LOS is not defined for the TWSC intersection as a whole or for major-street approaches for three primary reasons: (1) major-street through vehicles are assumed to experience zero delay; (2) the disproportionate number of major-street through vehicles at a typical TWSC intersection skews the weighted average of all movements, resulting in a very low overall average delay for all vehicles; and (3) the resulting low delay can mask important LOS deficiencies for minor movements (TRB 2010).

The capacity of the controlled intersection legs is based primarily on three factors: the conflicting volume, the critical gap time (defined as the number of seconds between vehicles passing the same point along the major street approach), and the follow-up time (defined as the number of seconds between the departure of the first and second vehicle in queue along the minor street approach). The HCM-based capacity analysis procedure assumes that drivers are both consistent and homogeneous and assumes consistency for their critical gap time. Critical gap times are based on many factors, including delay experienced by drivers on the approaches controlled by STOP signs. As delay increases, drivers become less patient and accept shorter gaps, resulting in higher capacities for unsignalized intersections that are operating at LOS D or worse. The unsignalized intersection procedure uses fixed critical gap times. Unless the critical gap times are adjusted, the procedure tends to overestimate the delay at unsignalized intersections that are operating at LOS D or worse. Also, poor operations at an unsignalized intersection encourages some drivers to turn right and make a U-turn on the mainline or accept shorter critical gaps (safety issue) rather than attempt a left turn (TRB 2010).

Given the main use of this procedure is for the Gravelly Point on-ramp connecting to the GWMP, the HCM 2000 method is used in place of the HCM 2010 because the HCM 2000 results better align with the actual existing operation of this specific on-ramp facility. HCM uses a default gap acceptance value of 7.1 seconds. Based on research performed for stop-controlled intersections, a gap acceptance around 6.0 seconds has proven to be accurate (Gaps and Gap Acceptance n.d.; Fitzpatrick n.d.). In this case, the stop-controlled intersection is part of an on-ramp leading to a freeway facility with an acceleration lane; therefore, a gap acceptance of 5.0 seconds was used in the analysis software.

Table 4-13 shows the average control delay and corresponding LOS for unsignalized intersections. It should be noted that the worst LOS at one-way, STOP-controlled, and TWSC intersections represents the

delay for the minor approach only. Using the HCM 2000 method, LOS E and LOS F constitute failing operations.

TABLE 4-13. UNSIGNALIZED INTERSECTION CONTROL DELAY AND LOS THRESHOLDS – HCM 2000 METHOD

LOS	Average Control Delay (seconds/vehicle)	Description
A	Less than or equal to 10	Stable conditions
B	>10-15	
C	>15-25	
D	>25-35	
E	>35-50	Unstable conditions
F	More than 50	Above capacity and unstable conditions

Source: TRB (2010)

4.10.3 EXISTING CONDITION INTERSECTION OPERATIONS ANALYSIS

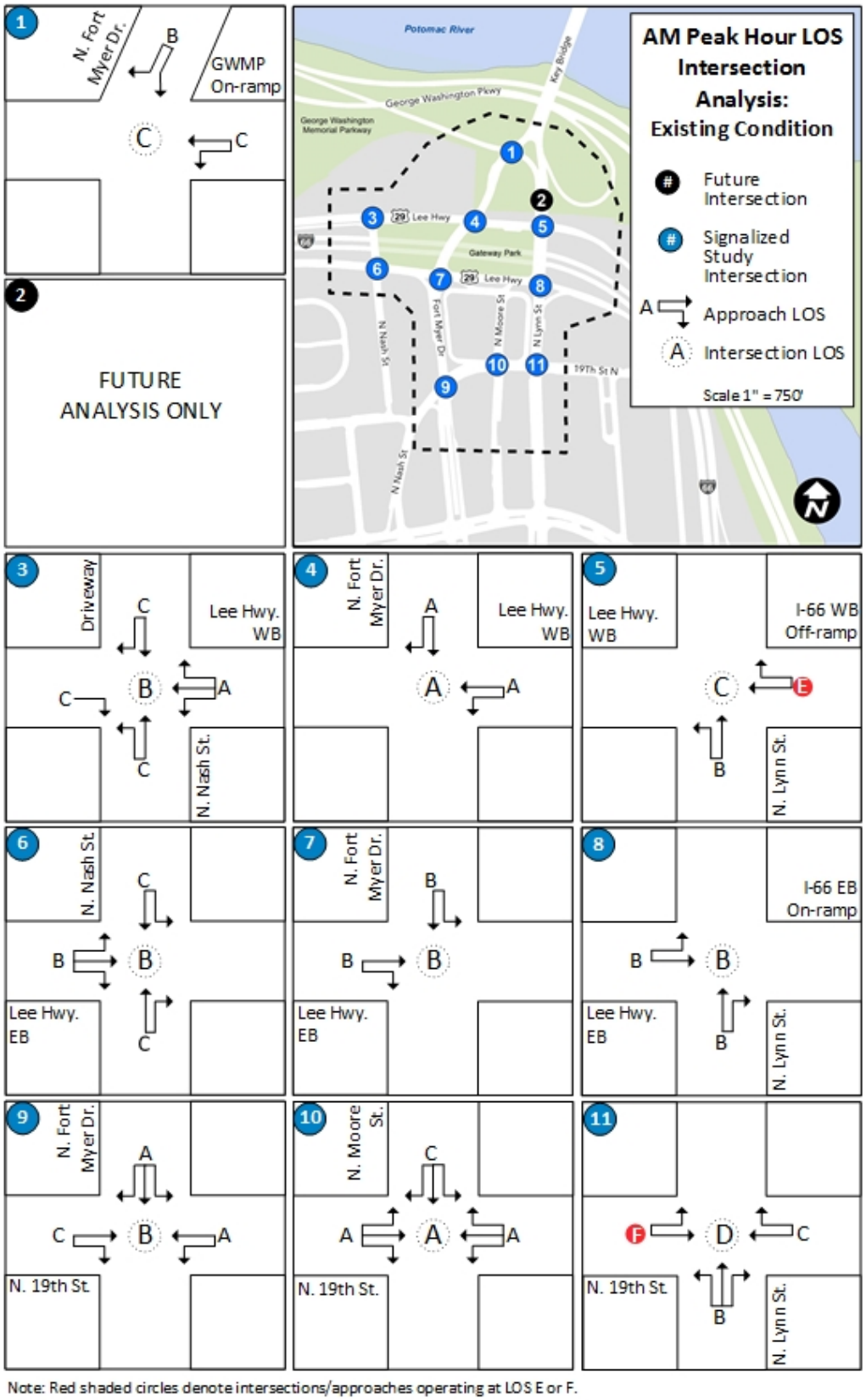
Based on the Synchro™ signalized intersection analysis results, all the Rosslyn study area intersections operate at acceptable overall conditions (LOS D or better is considered an acceptable operating level) during the three evaluated periods.

Based on the Synchro™ signalized intersection analysis results, two Rosslyn study area signalized intersections (Intersection #1 through #11) have overall approaches that operate at unacceptable conditions (LOS E or LOS F) during one or more of the evaluated periods. The following are the individual signalized intersection approaches in the traffic study area that operate under unacceptable conditions during peak hours:

- Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5)
  - Westbound I-66 off-ramp during the AM and PM peak hours
- N. 19th St. and N. Lynn St. (Intersection #11)
  - Eastbound N. 19th St. during the AM and PM peak hours

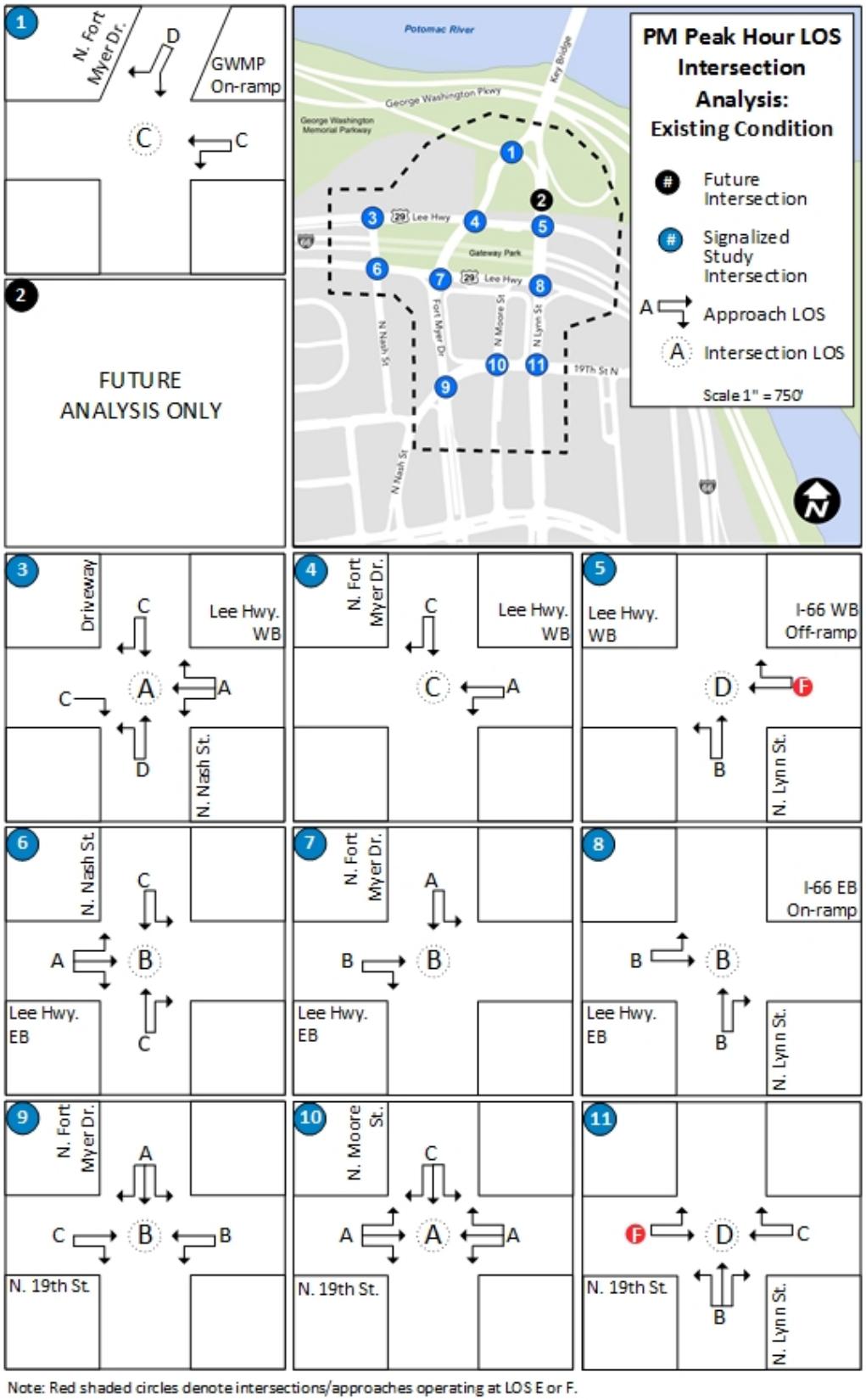
Based on the Synchro™ unsignalized intersection analysis results, the Gravelly Point study area intersection (Intersection #12) operates at acceptable overall conditions (LOS D or better is considered an acceptable operating level) during the three evaluated periods.

The average LOS for the various approaches to the intersection and the overall intersection LOS grades are depicted in figures 4-19, 4-20, and 4-21 for AM, PM, and Saturday peak hours, respectively. Table 4-14 shows the results of the LOS capacity analysis and the intersection vehicle delay for the existing condition during the AM, PM, and Saturday peak hours.



Note: Red shaded circles denote intersections/approaches operating at LOS E or F.

FIGURE 4-19. EXISTING CONDITION INTERSECTION LEVEL OF SERVICE FOR WEEKDAY AM PEAK HOUR



Note: Red shaded circles denote intersections/approaches operating at LOS E or F.

FIGURE 4-20. EXISTING CONDITION INTERSECTION LEVEL OF SERVICE FOR WEEKDAY PM PEAK HOUR

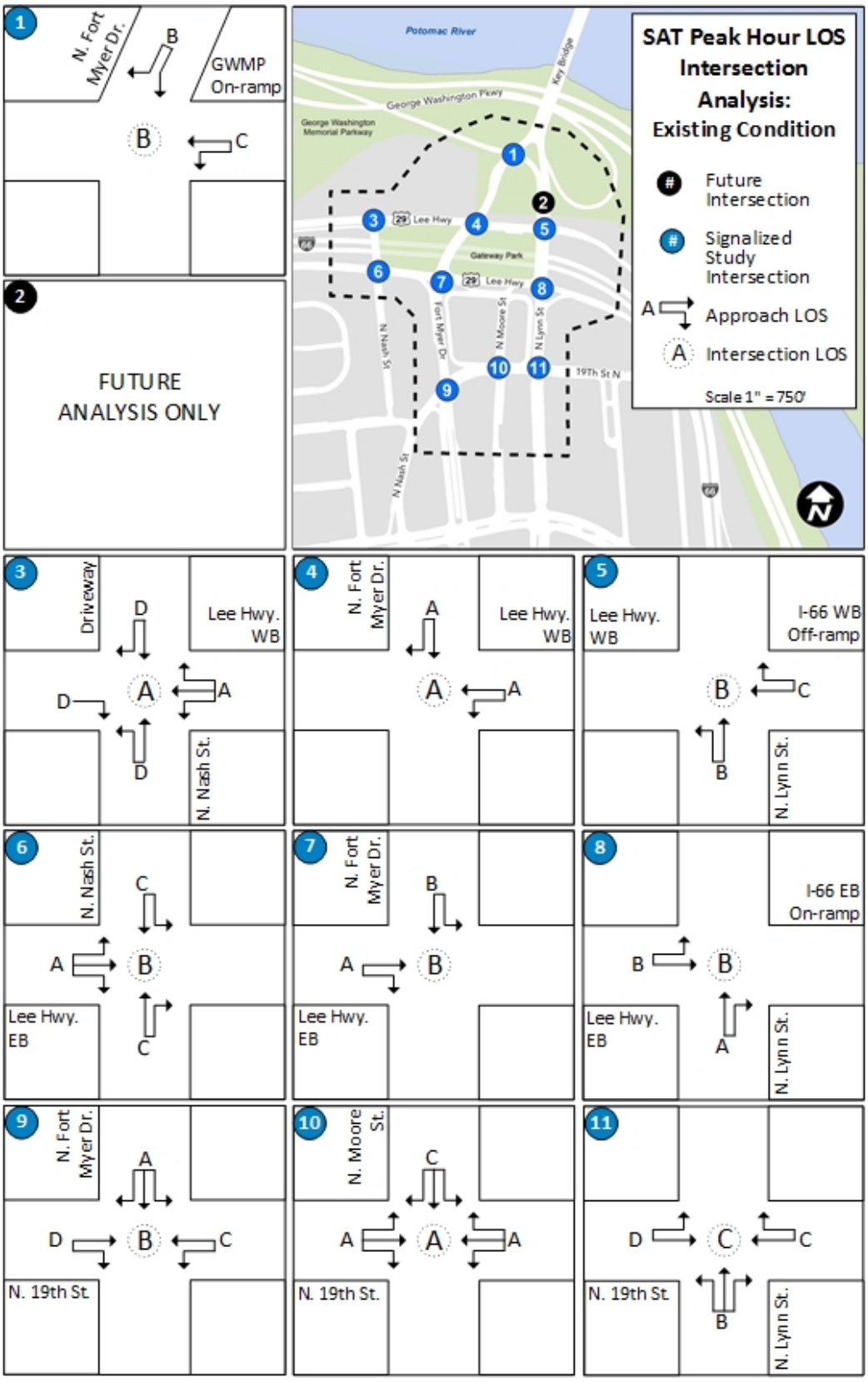


FIGURE 4-21. EXISTING CONDITION INTERSECTION LEVEL OF SERVICE FOR SATURDAY PEAK HOUR

TABLE 4-14. EXISTING CONDITION ALL PEAK HOUR OPERATIONS ANALYSIS

#	Intersection and Approach	Lane Group	AM Peak Hour V/C Ratio	AM Peak Hour Delay (sec/ veh)	AM Peak Hour LOS	AM Peak Hour Check	PM Peak Hour V/C Ratio	PM Peak Hour Delay (sec/ veh)	PM Peak Hour LOS	PM Peak Hour Check	Saturday Peak Hour V/C Ratio	Saturday Peak Hour Delay (sec/ veh)	Saturday Peak Hour LOS	Saturday Peak Hour Check
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized) [a]**													
	WB (GWMP On-ramp)	LT	0.70	32.3	C		0.74	23.4	C		0.33	24.8	C	
	WB Overall (GWMP On-ramp)			**32.3**	**C**	**Pass**		**23.4**	**C**	**Pass**		**24.8**	**C**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.76	15.7	B		1.00	38.7	D		0.49	12.5	B	
	SB Overall (N. Fort Myer Dr.)			**15.7**	**B**	**Pass**		**38.7**	**D**	**Pass**		**12.5**	**B**	**Pass**
	Overall		**0.74**	**20.4**	**C**	**Pass**	**0.91**	**34.8**	**C**	**Pass**	**0.43**	**15.3**	**B**	**Pass**
3	**Lee Hwy. WB & N. Nash St. (Signalized) [a]**													
	EB (Lee Hwy. WB)	R	0.04	25.0	C		0.04	25.0	C		0.03	36.1	D	
	EB Overall (Lee Hwy. WB)			**25.0**	**C**	**Pass**		**25.0**	**C**	**Pass**		**36.1**	**D**	**Pass**
	WB (Lee Hwy. WB)	L	0.03	So	A		0.03	4.1	A		0.02	2.9	A	
	WB (Lee Hwy. WB)	TR	0.16	8.2	A		0.30	4.9	A		0.16	3.0	A	
	WB Overall (Lee Hwy. WB)			**8.1**	**A**	**Pass**		**4.9**	**A**	**Pass**		**3.0**	**A**	**Pass**
	NB (N. Nash St.)	LT	0.19	25.1	C		0.26	40.3	D		0.58	39.9	D	
	NB Overall (N. Nash St.)			**25.1**	**C**	**Pass**		**40.3**	**D**	**Pass**		**39.9**	**D**	**Pass**
	SB (Driveway)	TR	0.03	24.9	C		0.06	25.2	C		0.13	36.7	D	
	SB Overall (Driveway)			**24.9**	**C**	**Pass**		**25.2**	**C**	**Pass**		**36.7**	**D**	**Pass**
	Overall		**0.17**	**11.7**	**B**	**Pass**	**0.29**	**9.4**	**A**	**Pass**	**0.21**	**9.5**	**A**	**Pass**
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized) [a]**													
	WB (Lee Hwy. WB)	L	0.08	7.2	A		0.14	6.4	A		0.05	11.4	B	
	WB (Lee Hwy. WB)	T	0.17	7.7	A		0.49	9.3	A		0.28	8.8	A	
	WB Overall (Lee Hwy. WB)			**7.5**	**A**	**Pass**		**8.9**	**A**	**Pass**		**9.4**	**A**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.48	1.2	A		0.80	29.3	C		0.41	3.2	A	
	SB Overall (N. Fort Myer Dr.)			**1.2**	**A**	**Pass**		**29.3**	**C**	**Pass**		**3.2**	**A**	**Pass**
	Overall		**0.37**	**2.4**	**A**	**Pass**	**0.67**	**23.5**	**C**	**Pass**	**0.37**	**4.8**	**A**	**Pass**
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized) [a]**													
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	0.91dr	37.3	D		0.93	51.5	D		0.49	30.3	C	
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	1.12	125.5	F		1.19	150.8	F		0.53	34.5	C	
	WB Overall (Lee Hwy. WB/I-66 Off-ramp)			**70.6**	**E**	**Fail**		**82.3**	**F**	**Fail**		**31.6**	**C**	**Pass**
	NB (N. Lynn St.)	L	0.07	19.4	B		0.20	41.7	D		0.09	13.7	B	
	NB (N. Lynn St.)	T	0.78	12.9	B		0.61	15.1	B		0.41	10.2	B	
	NB Overall (N. Lynn St.)			**13.1**	**B**	**Pass**		**18.9**	**B**	**Pass**		**10.5**	**B**	**Pass**
	Overall		**0.83**	**25.6**	**C**	**Pass**	**0.75**	**38.2**	**D**	**Pass**	**0.42**	**16.2**	**B**	**Pass**

TABLE 4-14. EXISTING CONDITION ALL PEAK HOUR OPERATIONS ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	AM Peak Hour				PM Peak Hour				Saturday Peak Hour			
			V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check
6	**Lee Hwy. EB & N. Nash St. (Signalized)** [a]													
	EB (Lee Hwy. EB)	LTR	0.73	14.3	B		0.37	9.4	A		0.31	8.9	A	
	EB Overall (Lee Hwy. EB)			**14.3**	**B**	**Pass**		**9.4**	**A**	**Pass**		**8.9**	**A**	**Pass**
	NB (N. Nash St.)	TR	0.31	29.0	C		0.24	27.9	C		0.12	26.3	C	
	NB Overall (N. Nash St.)			**29.0**	**C**	**Pass**		**27.9**	**C**	**Pass**		**26.3**	**C**	**Pass**
	SB (N. Nash St.)	L	0.25	26.5	C		0.13	27.1	C		0.20	29.3	C	
	SB (N. Nash St.)	T	0.06	23.6	C		0.14	27.1	C		0.03	26.9	C	
	SB Overall (N. Nash St.)			**25.7**	**C**	**Pass**		**27.1**	**C**	**Pass**		**28.8**	**C**	**Pass**
	Overall		**0.61**	**15.7**	**B**	**Pass**	**0.33**	**12.9**	**B**	**Pass**	**0.28**	**11.8**	**B**	**Pass**
7	**Lee Hwy. EB. & N. Fort Myer Dr. (Signalized)** [a]													
	EB (Lee Hwy. EB)	TR	0.78	11.0	B		0.61	17.5	B		0.36	8.6	A	
	EB Overall (Lee Hwy. EB)			**11.0**	**B**	**Pass**		**17.5**	**B**	**Pass**		**8.6**	**A**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.48	10.8	B		0.51	2.6	A		0.30	9.7	A	
	SB (N. Fort Myer Dr.)	LT	0.52	14.8	B		0.53	5.8	A		0.43	14.2	B	
	SB Overall (N. Fort Myer Dr.)			**13.8**	**B**	**Pass**		**5.0**	**A**	**Pass**		**13.1**	**B**	**Pass**
	Overall		**0.68**	**12.0**	**B**	**Pass**	**0.56**	**10.1**	**B**	**Pass**	**0.39**	**10.8**	**B**	**Pass**
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized)** [a]													
	EB (Lee Hwy. EB/I-66 On-ramp)	L	0.87	20.3	C		0.74	17.5	B		0.47	14.4	B	
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	0.88	16.3	B		0.75	14.8	B		0.49	13.7	B	
	EB Overall (Lee Hwy. EB/I-66 On-ramp)			**17.6**	**B**	**Pass**		**15.6**	**B**	**Pass**		**13.9**	**B**	**Pass**
	NB (N. Lynn St.)	T	0.63	14.3	B		0.62	14.1	B		0.37	9.7	A	
	NB (N. Lynn St.)	R	0.25	8.4	A		0.59	16.0	B		0.07	2.5	A	
	NB Overall (N. Lynn St.)			**13.8**	**B**	**Pass**		**14.4**	**B**	**Pass**		**9.2**	**A**	**Pass**
	Overall		**0.76**	**15.8**	**B**	**Pass**	**0.69**	**15.0**	**B**	**Pass**	**0.43**	**11.7**	**B**	**Pass**
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)** [a]													
	EB (N. 19th St.)	TR	0.36	22.0	C		0.29	21.0	C		0.45	38.5	D	
	EB Overall (N. 19th St.)			**22.0**	**C**	**Pass**		**21.0**	**C**	**Pass**		**38.5**	**D**	**Pass**
	WB (N. 19th St.)	LT	0.32	9.7	A		0.41	17.8	B		0.46	20.2	C	
	WB Overall (N. 19th St.)			**9.7**	**A**	**Pass**		**17.8**	**B**	**Pass**		**20.2**	**C**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.34	8.7	A		0.15	8.2	A		0.05	1.9	A	
	SB (N. Fort Myer Dr.)	TR	0.45	8.5	A		0.45	9.0	A		0.18	1.8	A	
	SB Overall (N. Fort Myer Dr.)			**8.6**	**A**	**Pass**		**8.9**	**A**	**Pass**		**1.8**	**A**	**Pass**
	Overall		**0.41**	**11.2**	**B**	**Pass**	**0.43**	**12.5**	**B**	**Pass**	**0.22**	**11.1**	**B**	**Pass**

TABLE 4-14. EXISTING CONDITION ALL PEAK HOUR OPERATIONS ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	AM Peak Hour				PM Peak Hour				Saturday Peak Hour			
			V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check
10	**N. 19th St. & N. Moore St. (Signalized)** [a]													
	EB (N. 19th St.)	L	0.09	6.5	A		0.02	9.3	A		0.05	5.8	A	
	EB (N. 19th St.)	TR	0.23	6.9	A		0.14	9.4	A		0.09	6.1	A	
	EB Overall (N. 19th St.)			**6.9**	**A**	**Pass**		**9.3**	**A**	**Pass**		**6.0**	**A**	**Pass**
	WB (N. 19th St.)	LTR	0.19	7.5	A		0.21	3.9	A		0.07	9.0	A	
	WB Overall (N. 19th St.)			**7.5**	**A**	**Pass**		**3.9**	**A**	**Pass**		**9.0**	**A**	**Pass**
	SB (N. Moore St.)	LTR	0.04	21.4	C		0.08	21.7	C		0.00	21.0	C	
	SB Overall (N. Moore St.)			**21.4**	**C**	**Pass**		**21.7**	**C**	**Pass**		**21.0**	**C**	**Pass**
	Overall		**0.16**	**8.0**	**A**	**Pass**	**0.16**	**8.6**	**A**	**Pass**	**0.06**	**7.5**	**A**	**Pass**
11	**N. 19th St. & N. Lynn St. (Signalized)** [a]													
	EB (N. 19th St.)	L	1.43	267.0	F		1.47	305.1	F		0.84	74.9	E	
	EB (N. 19th St.)	T	0.36	10.8	B		0.14	12.3	B		0.08	6.4	A	
	EB Overall (N 19th St.)			**117.4**	**F**	**Fail**		**203.5**	**F**	**Fail**		**50.1**	**D**	**Pass**
	WB (N. 19th St.)	TR	0.51	31.8	C		0.55	32.7	C		0.14	26.7	C	
	WB (N. 19th St.)	R	0.38	32.9	C		0.41	33.9	C		0.06	26.0	C	
	WB Overall (N. 19th St.)			**32.1**	**C**	**Pass**		**33.1**	**C**	**Pass**		**26.5**	**C**	**Pass**
	NB (N. Lynn St.)	LT	0.53	16.8	B		0.52	16.7	B		0.29	14.3	B	
	NB (N. Lynn St.)	R	0.14	14.0	B		0.10	13.3	B		0.06	12.7	B	
	NB Overall (N. Lynn St.)			**16.7**	**B**	**Pass**		**16.5**	**B**	**Pass**		**14.2**	**B**	**Pass**
	Overall		**0.60**	**35.4**	**D**	**Pass**	**0.61**	**39.8**	**D**	**Pass**	**0.30**	**20.6**	**C**	**Pass**
12	**George Washington Memorial Parkway & Gravelly Point (TWSC)** [b]													
	WB (GWMP On-ramp)	R	0.07	19.5	C		0.16	16.3	C		0.26	15.0	C	
	WB Overall (GWMP On-ramp)			**19.5**	**C**	**Pass**		**16.3**	**C**	**Pass**		**15.0**	**C**	**Pass**

Notes:

dr = Defacto Right Lane

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LOS = Level of Service

LTR = left / through / right lanes

TWSC = Two-way STOP-Controlled unsignalized intersection (TWSC intersections do not have an overall LOS)

V/C = Volume-to-Capacity ratio

Delay is Measured in Seconds Per Vehicle.

Red cells denote intersections or approaches operating at unacceptable conditions.

[a] Highway Capacity Manual 2000 results (Signalized intersections)

[b] Highway Capacity Manual 2000 results (Unsignalized intersections)

4.10.4 EXISTING CONDITIONS ROSSLYN STUDY AREA INTERSECTION QUEUING ANALYSIS

In addition to analyzing the vehicle delay, the vehicle queue lengths were calculated for each approach. The 50th percentile queue length is the average queue length, calculated as the queue expected during 50% of the analysis period. The 95th percentile queue length is the worst-case scenario, calculated as the queue that has a 5% probability of being exceeded. A failing queue length is determined by a queue length exceeding the intersection approach storage capacity. Because the available storage for each intersection approach differs, these values reflect whether the existing storage provides enough space for vehicles waiting to pass through the intersection without blocking another lane or another intersection. Additionally, because failing queues might occur along the same approach as a failing LOS, these values are calculated independently and might result in one approach receiving a failing LOS score, while another approach has a failing queue length. The study used Synchro™ to calculate both the 50th and 95th percentile queue lengths for the seven signalized intersections and the 95th percentile queue lengths for the six unsignalized intersections (50th percentile not reported in Synchro for unsignalized intersections).

4.10.4.1 Signalized Intersection Queuing Analysis

Based on the Synchro™ signalized intersection analysis results, the seven signalized intersections listed below experience queuing lengths that exceed the available storage capacity. The remaining signalized intersections in the traffic study area provide sufficient storage for the anticipated demand. The lane group in the approach that is operating under unacceptable conditions is noted in parentheses.

N. Fort Myer Dr. and GWMP on-ramp (Intersection #1)

- Westbound GWMP on-ramp (all movements) during the AM peak hour

- Lee Hwy. WB and N. Fort Myer Dr. (Intersection #4)
  - Southbound N. Fort Myer Dr. (all movements) during the PM peak hour

- Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5)
  - Westbound I-66 off-ramp (right turns) during the AM and PM peak hours
  - Northbound N. Lynn St. (through movements) during the AM peak hour

Lee Hwy. EB/I-66 on-ramp and N. Lynn St. (Intersection #8)

- Eastbound Lee Hwy. EB (all movements) during the AM peak hour

N. 19th St. and N. Fort Myer Dr. (Intersection #9)

- Eastbound Lee Hwy. EB (all movements) during the AM peak hour

N. 19th St. and N. Lynn St. (Intersection #11)

- Eastbound N. 19th St. (left turns) during the AM, PM, and Saturday peak hours
- Eastbound N. 19th St. (through movements) during the AM peak hour

The remaining intersections in the study area have acceptable queue lengths or experience low levels of queuing. Table 4-15 contains the queuing results. Note that the percentile values are expressed in feet, and a car occupies about 25 linear feet of roadway, including the space between cars.

TABLE 4-15. EXISTING CONDITION ALL PEAK HOUR QUEUING ANALYSIS

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized)**								
	WB (GWMP On-ramp)	LT	350	~294	m#401	~340	m277	80	143
	SB (N. Fort Myer Dr.)	TR	1,860	243	304	~458	608	145	180
3	**Lee Hwy. WB & N. Nash St. (Signalized)**								
	EB (Lee Hwy. WB)	R	410	0	0	0	0	0	0
	WB (Lee Hwy. WB)	L	125	6	m15	5	m8	3	m11
	WB (Lee Hwy. WB)	TR	400	38	50	53	59	23	45
	NB (N. Nash St.)	LT	120	31	m51	50	100	47	91
	SB (Driveway)	TR	40	7	23	11	31	13	34
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized)**								
	WB (Lee Hwy. WB)	L	230	5	m9	15	m18	1	4
	WB (Lee Hwy. WB)	T	230	18	m31	77	m70	37	48
	SB (N. Fort Myer Dr.)	TR	310	0	0	318	m#318	0	0
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized)**								
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	670	132	192	218	330	102	150
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	250	~207	#376	~251	#421	95	170
	NB (N. Lynn St.)	L	210	0	m27	14	69	0	27
	NB (N. Lynn St.)	T	210	213	#288	180	195	98	131
6	**Lee Hwy. EB & N. Nash St. (Signalized)**								
	EB (Lee Hwy. EB)	LTR	2,500	280	338	108	135	86	109
	NB (N. Nash St.)	TR	640	56	107	36	89	14	53
	SB (N. Nash St.)	L	120	35	74	17	44	33	70
	SB (N. Nash St.)	T	120	13	35	32	66	8	25
7	**Lee Hwy. EB. & N. Fort Myer Dr. (Signalized)**								
	EB (Lee Hwy. EB)	TR	210	134	174	103	124	62	79
	SB (N. Fort Myer Dr.)	L	220	67	118	0	m0	50	87
	SB (N. Fort Myer Dr.)	LT	220	111	131	42	50	103	124
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized)**								
	EB (Lee Hwy. EB/I-66 On-ramp)	L	380	101	#584	190	259	96	138
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	380	169	#385	204	248	108	134
	NB (N. Lynn St.)	T	330	230	m210	99	m111	42	54
	NB (N. Lynn St.)	R	330	12	m29	60	m90	1	m3

TABLE 4-15. EXISTING CONDITION ALL PEAK HOUR QUEUING ANALYSIS (CONTINUED)

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)**								
	EB (N. 19th St.)	TR	100	69	#109	52	88	38	73
	WB (N. 19th St.)	LT	180	31	46	42	60	29	47
	SB (N. Fort Myer Dr.)	L	125	52	m77	21	m36	6	11
	SB (N. Fort Myer Dr.)	TR	440	67	83	60	72	0	9
10	**N. 19th St. & N. Moore St. (Signalized)**								
	EB (N. 19th St.)	L	75	9	21	3	m10	4	10
	EB (N. 19th St.)	TR	180	40	55	17	39	11	17
	WB (N. 19th St.)	LTR	60	27	42	10	16	18	30
	SB (N. Moore St.)	LTR	260	8	21	13	32	0	0
11	**N. 19th St. & N. Lynn St. (Signalized)**								
	EB (N. 19th St.)	L	60	~132	#253	~130	#259	61	#158
	EB (N. 19th St.)	T	60	88	#149	21	42	16	33
	WB (N. 19th St.)	TR	220	89	135	92	140	22	46
	WB (N. 19th St.)	R	175	29	100	32	106	0	12
	NB (N. Lynn St.)	LT	610	172	206	165	197	84	106
	NB (N. Lynn St.)	R	100	0	18	0	3	0	0

Notes:

~ 50th percentile volume exceeds capacity, queue is theoretically infinite.

95th percentile volume exceeds capacity, queue may be longer.

m Volume for 95th percentile queue is metered by upstream signal. Due to upstream metering, the 95th percentile queue may be less than the 50th percentile queue.

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LTR = left / through / right lanes

Intersection #2 is not displayed because it is a placeholder for a future condition intersection.

Red cells denote approaches and lane groups whose queuing length exceeds capacity.

4.10.5 EXISTING CONDITIONS GRAVELLY POINT STUDY AREA FREEWAY ANALYSIS

The Highway Capacity Software (HCS™) Version 6.90 was used to determine the freeway operations for the mainline operations along the GWMP north of Reagan National Airport in the Gravelly Point study area. Freeway facilities are evaluated based on the density of vehicles. The higher the density, the slower the vehicles travel, and the worse the operations. Based on the vehicle density, the HCM provides LOS equivalents to represent the driver's perception of the facility operation. Table 4-16 contains the HCM freeway LOS.

TABLE 4-16. FREEWAY DENSITY AND LOS THRESHOLDS – HCM 2010 METHOD

LOS	Density (passenger cars/mile/lane)	Description
A	0-10	Stable conditions
B	>10-20	
C	>20-28	
D	>28-35	
E	>35	Unstable conditions
F	Demand Exceeds Capacity	Above capacity and unstable conditions

Source: TRB (2010)

Traffic volumes along the GWMP were obtained from NPS covering July 2015, the same period when the volume of vehicles entering and exiting the Gravelly Point parking area were obtained. Based on the HCS™ analysis, the GWMP did not exceed capacity for all periods studied covering the segment between Reagan National Airport and Gravelly Point. Table 4-17 contains the existing condition results.

TABLE 4-17. EXISTING CONDITION GWMP NORTHBOUND OPERATIONS ANALYSIS

Freeway Segment	Facility Type	Time period	Density (pc/mi/ln)	LOS
GWMP northbound between Reagan National Airport and Gravelly Point	Mainline	AM Peak Hour	26.0	C
		PM Peak Hour	19.8	C
		Saturday Peak Hour	15.3	B

Notes: LOS= level of service; Density = passengers cars per mile per lane (pc/mi/ln)

4.10.6 CRASH ANALYSIS

Accident ratings are used in transportation analyses to help determine where additional attention or examination of safety should be undertaken. Accident ratings are evaluated based on recorded accident information collected by jurisdiction, in this case three years of data from VDOT (2013–2015), and calculated using the accident information and daily volume of vehicles that travel through the intersection. Accident and injury ratings are calculated based on the number of accidents or injuries that would occur per million entering vehicles (MEV) using the following formula:

$$\text{Rate} = \frac{C * 1{,}000{,}000}{n * 365 * V}$$

In this formula, C is the total number of intersection-related accidents or injuries in the study period, *n* is the number of years of data (i.e., study period), and *V* are the traffic volumes entering the intersection daily. Daily traffic volumes were calculated from an average of the AM and PM peak hour traffic volumes (due to the large differences between AM and PM volumes for some intersections) and adjusted based on the percent of daily traffic that would likely use the intersection during the peak hour. Based on common assumptions that peak hour traffic volumes account for 8%–12% of daily traffic depending on the surrounding land use pattern, as noted in a recent Washington, DC, transportation study, the *Maryland Avenue SW Transportation Study*, it was assumed the peak hour accounted for 11% of the daily volumes, the same percentage used in the *Maryland Avenue SW Transportation Study* (DDOT 2013). The 11% factor was used because Rosslyn matches a similar office-focused downtown area such as the L'Enfant Plaza area studied in the *Maryland Avenue SW Transportation Study*.

Accident ratings for the intersections in the study area are presented in table 4-18 using crash data reports received from VDOT (DDOT 2013–2015). The intersections that have the highest accident rating are Lee Hwy. EB at N. Nash St., N. Fort Myer Dr., and N. Lynn St.; Lee Hwy. WB at N. Lynn St.; and N. 19th St. at N. Moore St. These locations had accident rates of 1.25, 1.31, 1.17, 1.58, and 1.81 accidents per MEV, respectively. The N. 19th St. at N. Moore St. intersection was the only study area intersection with an injury rate greater than 1.00; the intersection had an injury rate of 1.36 injuries per MEV.

Intersections that have an accident rating of greater than 1.0 typically warrant further examination to determine if one or more particular causes can be gleaned from the detailed intersection accident data, and if mitigation is advisable, what mitigation measures would help to improve the safety of the intersection. Of the intersections for which sufficient data are available for analysis (a minimum of three years of data), five of the intersections have an accident rating of greater than 1.0, as shown in orange in table 3-9.

These high accident rating intersections are shown in more detail in table 4-19, which helps to examine whether there is a high percentage of a particular type of accident. Determining the true reasons for a high accident rating cannot solely be determined with accident data because each situation has unique circumstances that are not reflected in the accident/crash study reports. However, general trends can be determined or certain causes can be eliminated by examining the available accident-specific information. Accident data that may provide clues about accident trends have been highlighted in orange.

TABLE 4-18. INTERSECTION ACCIDENT SUMMARY

Intersection #	Intersection Name (Cross Streets)	Crash Rate crashes/MEV	Injury Rate crashes/MEV
1	N. Fort Myer Dr. & GWMP On-ramp	0.40	0.36
2	Lee Hwy. WB & N. Nash St.	0.59	0.23
3	Lee Hwy. WB & N. Fort Myer Dr.	0.93	0.34
4	Lee Hwy. WB/I-66 Off-ramp & N. Lynn St.	1.58	0.85
5	Lee Hwy. EB & N. Nash St.	1.25	0.79
6	Lee Hwy. EB & N. Fort Myer Dr. &	1.31	0.79
7	Lee Hwy. EB/I-66 On-ramp & N. Lynn St.	1.17	0.36
8	N. 19th St. & N. Fort Meyer Dr.	0.54	0.18
9	N. 19th St. & N. Moore St.	1.81	1.36
10	N. 19th St. & N. Lynn St.	0.76	0.09

Sources: VDOT crash data from 2013-2015, received July 14, 2017.

Notes:

MEV = Million entering vehicles

NA = Crash data not available because the intersection was built within last three years or planned for the future

Intersections depicted in orange may warrant further examination because they have a crash rating over 1.0.

TABLE 4-19. DETAILED INTERSECTION CRASH ANALYSIS

Intersection #	Intersection Name (Cross Streets)	Crash Rate crashes/MEV	Rear End	Angle	Head On	Side Swipe - Same Direction	Fixed Object in Road	Fixed Object Off Road	Pedestrian Involved	Other	Total
4	Lee Hwy. WB/I-66 Off-ramp & N. Lynn St.	1.58	6	26	0	8	0	1	8	1	50
5	Lee Hwy. EB & N. Nash St.	1.25	3	14	0	2	0	1	1	1	22
6	Lee Hwy. EB & N. Fort Myer Dr. &	1.31	4	18	0	4	0	1	11	0	38
7	Lee Hwy. EB/I-66 On-ramp & N. Lynn St.	1.17	2	27	1	6	0	1	3	2	42
9	N. 19th St. & N. Moore St.	1.81	2	6	0	0	0	0	4	0	12

Sources: VDOT crash data from 2013-2015, received July 14, 2017.

Notes:

MEV = Million entering vehicles

Crash data that may provide clues about crash trends have been highlighted in orange

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5.0 ALTERNATIVES ANALYSIS

5.1 Goals and Objectives

Three action alternatives were assessed, two in Rosslyn and one at Gravelly Point. See section 3.0 for a general description of each alternative with a supporting graphic. The goals and analysis objectives for the three alternatives are:

- **Alternative B**: develop a riverfront boat storage and launching facility. Site access would be predominantly by transit, bicycle, and foot. The objective of the assessment is to evaluate the transit, bicycle, and foot access, as well as vehicle accessibility for drop-off/pick-up and parking in downtown Rosslyn.
- **Alternative C**: develop a riverfront boat storage and launching facility with ancillary facilities located on an upland site accessible by trail. Site access would be predominantly by transit, bicycle, and foot. The objective of the assessment is to evaluate the transit, bicycle, and foot access, as well as vehicle accessibility for drop-off/pick-up and parking in downtown Rosslyn.
- **Alternative D**: develop a large, full-service riverfront community rowing/paddling facility with storage, launching, and support spaces. Access would be predominantly by vehicle. The objective of the assessment is to evaluate the vehicle accessibility for drop-off/pick-up and parking at Gravelly Point, as well as transit, bicycle, and foot access to be consistent with the other two alternatives.

5.2 Assessment

Prior to evaluating each alternative based on Measure of Effectiveness (MOE), infrastructure improvements expected to be in place under each alternative were defined. This includes the alternative A or no-action alternative planned development and transportation improvements plus the additional transportation infrastructure likely to be added based on each alternative. The MOE analysis for each alternative covered five transportation topics—traffic operations, pedestrian and bicycle safety, pedestrian and bicycle accessibility, transit accessibility, and vehicle travel time. Traffic operations evaluated congested corridors that a boathouse patron would need to travel through to access the parking areas serving the proposed sites. Pedestrian and bicycle safety identified conflicts along the trails serving the proposed sites and the safety of the trail. Because access to the proposed sites would occur via specific multiuse trails and not the Arlington street grid, the pedestrian and bicycle accessibility assessed the proximity of the proposed sites to the nearest access point to the Arlington County pedestrian and bicycle network. The transit accessibility analysis evaluated the proposed site's proximity to the nearest Metrorail station or major bus route. Travel time focused on the vehicle drive time and compared the drive times between the proposed sites to identify which site had a greater number of Arlington County residents and households with a shorter drive time.

5.2.1 ALTERNATIVE A ASSUMPTIONS

Alternative A assumptions include planned developments and improvements in the Rosslyn and Gravelly Point study areas, as described in section 6.2. Planned developments in Rosslyn would be expected to improve existing sidewalks adjacent to the new developments (i.e., Central Place, West Rosslyn, and 1401 Wilson Blvd.). Planned improvements in Rosslyn would entail various pedestrian and bicyclist improvements by Arlington County and VDOT, including (1) installing a bicycle lane on N. Lynn St. between Lee Hwy. EB and WB, (2) widening the Custis Trail to 16 feet between N. Lynn St. and N. Oak St., (3) improving access between the Mt. Vernon and Custis Trails by enhancing intersection crossings to provide safer pedestrian and bicycle queueing locations and better sight distances, (4) creating a connection from the Mt. Vernon Trail to the south side of the I-66 Roosevelt Bridge, and (5) increasing trail separation from vehicular traffic. Planned improvements in Gravelly Point would include improving access to the Mt. Vernon Trail from the Airport Access Road overpass at Reagan National

Airport/Aviation Circle. TBC in Washington, DC, located at the intersection of Rock Creek Parkway and Virginia Avenue NW, would continue to serve as the closest boathouse facility for Arlington County residents and schools.

5.2.2 ALTERNATIVE B ASSUMPTIONS

Alternative B assumes the same planned developments and improvements described under alternative A in Rosslyn. In addition, a pedestrian connection would be provided from the Roosevelt Island parking lot to the lower Rosslyn site and bicycle racks would be provided near the boathouse facility.

5.2.3 ALTERNATIVE C ASSUMPTIONS

Alternative C assumes the same planned developments and improvements described under alternative A in Rosslyn. In addition, a pedestrian connection would link the Roosevelt Island parking lot to the lower Rosslyn site, bicycle racks would be provided near the boathouse facility, a proposed driveway connecting to N. Lynn St. would provide access to the upper Rosslyn site, and bicycle racks would be provided near the upper Rosslyn facility.

5.2.4 ALTERNATIVE D ASSUMPTIONS

Alternative D assumes the same planned improvements described under alternative A in Gravelly Point. In addition, pedestrians and bicyclists would access the Gravelly Point site from the Mt. Vernon Trail and bicycle racks would be provided near the boathouse facility.

5.2.5 TRAFFIC OPERATIONS

Under alternative A, the boathouse facility would not be constructed, and TBC would continue to be the closest boathouse to Arlington County. Patrons could use I-66 during High Occupancy Vehicle (HOV) and High Occupancy Toll (HOT) operation for part of the trip during the morning rush as far east as Rosslyn as long as they have one or more passengers. This would bypass other parallel routes such as US Route 50 (Route 50) eastbound and the GWMP southbound, both of which are heavily congested during the morning rush. The same would be true during the evening rush where I-66 westbound could be used to access central and western Arlington County and bypass Route 50 westbound, Lee Hwy. westbound, and Wilson Blvd. westbound, which are typically congested while I-66 westbound operates well west of Rosslyn. However, patrons would experience traffic delays on the non-HOV Arlington County roadways and bridges crossing the Potomac River for both HOV and single occupancy vehicles during the morning and evening rush as well as the change in the weekday peak hour direction of traffic flow along Rock Creek Parkway to access TBC (i.e., southbound only during the morning rush and northbound during the evening rush).

Under alternative B, patrons could use I-66 during HOV operation during the morning rush to access downtown Rosslyn as long as they have one or more passengers. This would bypass other parallel routes such as Route 50 eastbound and the GWMP southbound, both of which are heavily congested during the morning rush. The same would be true during the evening rush where travel along routes west of downtown Rosslyn, such as Route 50 westbound, Lee Hwy. westbound, and Wilson Blvd. westbound are typically congested, while I-66 westbound operates well. Another benefit would be the number of routes available to avoid congested areas to access downtown Rosslyn from Arlington County. However, single occupancy vehicle patrons who access the boathouse during the morning rush would experience traffic congestion along the GWMP southbound, north of the Roosevelt Bridge, Route 50 west of Rosslyn, and on N. Lynn St. and N. Fort Myer Dr. in downtown Rosslyn. During the evening rush, Route 50 westbound, Lee Hwy. westbound, and Wilson Blvd. westbound would be congested. Patrons who travel in the reverse commute direction during the morning or evening rush would mainly experience congested conditions in downtown Rosslyn.

Effects on traffic operations under alternative C would be the same as those described under alternative B.

Under alternative D, patrons could use the I-395 northbound HOV/HOT lanes to bypass most of the traffic during the morning rush to access Gravelly Point as long as they are carrying two or more passengers. This would bypass the I-395 northbound general purpose lanes, Route 50 eastbound, and Columbia Pike eastbound, all of which are heavily congested during the morning rush. The same would be true during the evening rush where travel routes such as the I-395 southbound general purpose lanes, Route 50 westbound, and Columbia Pike westbound are typically congested while the I-395 HOV/HOT lanes operate well. Single occupancy vehicle patrons who access the boathouse during the morning rush would experience traffic congestion along the GWMP northbound past Gravelly Point, the only road that accesses Gravelly Point, as well as the I-395 northbound general purpose lanes, Route 50 eastbound, and Columbia Pike eastbound. During the evening rush, the only travel route from Gravelly Point (the GWMP northbound approaching the 14th Street Bridge) would be congested in addition to the I-395 southbound general purpose lanes, Route 50 westbound, and Columbia Pike westbound. GWMP northbound is the only road that services Gravelly Point; therefore, any congestion along this segment between Reagan National Airport and the 14th Street Bridge would delay access to and from Gravelly Point.

5.2.6 PEDESTRIAN AND BICYCLE SAFETY

Under alternative A, the boathouse facility would not be constructed, and TBC would continue to be the closest boathouse to Arlington County. Users could access TBC via the Rock Creek Park Trail, a multiuse trail separated from vehicular traffic. There would be an extensive number of roadway crossings required to connect to the closest point in the Arlington County bicycle and pedestrian network by crossing either the Roosevelt Bridge or the Key Bridge.

Under alternative B, access to the lower Rosslyn site would be limited to a multiuse trail with no motorized vehicles; however, the trail is steep, which could present safety concerns for conflicting trail users and for patrons with difficulties traversing steep slopes on foot or by bicycle.

Under alternative C, advantages and disadvantages for pedestrian and bicycle safety would be similar to those described under alternative B. Additional advantages for the upper Rosslyn site would include a separate multiuse trail to access the upper Rosslyn site that would use the proposed driveway. Disadvantages would include possible pedestrian/bicycle/vehicle conflicts on the upper Rosslyn site driveway; although vehicular traffic would be limited to NPS service vehicles and vehicles using the designated ADA parking spaces.

Under alternative D, the advantages would include establishing the boathouse adjacent to a multiuse trail designed for commuter and recreational use. Disadvantages would include multiple trail crossings because the trail intersects the internal Gravelly Point roadway network, which could result in safety concerns around pedestrian/bicycle/vehicular conflicts.

5.2.7 PEDESTRIAN AND BICYCLE ACCESSIBILITY

Under alternative A, the boathouse facility would not be constructed, and TBC would continue to be the closest boathouse to Arlington County. Users could access TBC from multiple points from the north, east, or south. However, the distance between TBC and the closest access points to the Arlington County bicycle and pedestrian network would be more than a mile on foot or 1.5 miles by bicycle.

Under alternative B, establishing the boathouse adjacent to the heavily used commuter and recreational multiuse trail and Capital Bikeshare station and providing bicycle racks would encourage the use of bicycles to access the boathouse. In addition, the boathouse would be close to Rosslyn, a destination with multiple pedestrian and bicycle connections. An alternative route to access the lower Rosslyn site along the Mt. Vernon Trail would be the S. Washington Blvd. Trail that connects to the Pentagon Metro Station. This trail intersects the Mt. Vernon Trail over a mile south of the lower Rosslyn site. The best access point to the lower Rosslyn site would be limited to the Mt. Vernon trailhead located at the intersection of N. Lynn St and Lee Hwy. WB.

Under alternative C, advantages and disadvantages for pedestrian and bicycle accessibility would include those described under alternative B covering the lower Rosslyn site. For the upper Rosslyn site, providing bicycle racks to encourage the use of bicycles to access the facility and connecting the site directly to the sidewalk along N. Lynn St. would benefit patrons. There would be no additional disadvantages with respect the to the upper Rosslyn site.

Under alternative D, establishing the boathouse adjacent to the heavily used commuter and recreational multiuse trail and Capital Bikeshare station and providing bicycle racks to encourage the use of bicycles to access the facility would benefit patrons. The isolated location of Gravelly Point (i.e., more than 1 mile north from a trail connection to Crystal City, Arlington, and more than 1.5 miles south from a trail connection to the Pentagon Metro Station) would be a disadvantage.

5.2.8 TRANSIT ACCESSIBILITY

Under alternative A, the boathouse facility would not be constructed, and TBC would continue to be the closest boathouse to Arlington County. Users would access TBC from the Foggy Bottom Metro Station and multiple bus lines that travel through Georgetown, including the DC Connector to/from the Rosslyn Metro Station. However, there would be an extra transfer distance between TBC and the closest point to access the Arlington County bicycle and pedestrian network.

Under alternative B, the Mt. Vernon trailhead would be connect to multiple transit options in Rosslyn, including the Rosslyn Metro Station, a multimodal hub serving three subway lines, six WMATA Metrobus lines, four Arlington County ART bus lines, and one DC Circulator bus route. Users would need to cross multiple major roads to access the Mt. Vernon trailhead from the Rosslyn Metro Station, the shortest route to access the lower Rosslyn site, which could negatively affect transit users. The proposed Rosslyn bicycle and pedestrian improvements would greatly diminish these issues.

Under alternative C, transit accessibility would be similar to alternative B; the upper Rosslyn site would be located closer to the Rosslyn Metro Station and all transit services that serve the station. The number of major street crossings between the Rosslyn Metro Station and upper Rosslyn site would remain the same as the lower Rosslyn site.

Under alternative D, there would be at least one transit option to reach the site. However, transit accessibility would be limited to the Reagan National Airport or Crystal City Metro Stations—both approximately 1 mile south of the Gravelly Point site. From either of these stations, patrons would be required to walk on the Mt. Vernon Trail to access Gravelly Point.

5.2.9 VEHICLE TRAVEL TIME

Travel time analysis was performed for the alternatives using two methods: the Metropolitan Washington Council of Governments (MWCOG) travel demand model and the Google Maps real-time feature. The travel timetables from the 2020 version of the MWCOG Travel Demand Model Version 2.3.66, based on Round 9 demographics and projects in the *Constrained Long-Range Plan and Transportation Improvement Plan*, were used to analyze travel times between the alternative sites and the model's traffic analysis zones (TAZs) in Arlington County. TAZs are model-defined zones that are similar in size to census tracts and represent a unique piece of the county in terms of demographics and roads. The MWCOG model data helped determine the percentage of Arlington County households and overall population that would have a shorter travel time to either the Rosslyn or Gravelly Point sites based on the 2020 roadway network and 2020 demographic forecasts. The average and median travel times between all Arlington TAZs and the two sites were calculated for both inbound and outbound trips during the AM peak period and inbound and outbound trips during the midday period. Each TAZ was flagged as having a lower travel time to one of the sites and summed together to determine the percentage of the population and households that would be closest to a particular site. Table 5-1 presents the MWCOG travel-demand model results.

Drive time directions used the Google Maps real-time feature and analyzed travel times between the Rosslyn and Gravelly Point sites and four high schools in Arlington County that have crew teams and two universities, one in Arlington County and one in Fairfax Count with crews teams that could use the boathouse facility. High schools and universities analyzed were Wakefield High School, Washington Lee High School, Yorktown High School, Bishop O'Connell High School, Marymount University, and George Mason University. Drive time directions were collected on two weekdays (August 17, 2017, and August 24, 2017) covering the following three periods:

1. Morning at 8:00 a.m. at the conclusion of crew practice from the two alternative sites to the six schools;
2. Afternoon at 3:00 p.m. at the beginning of crew practice from the six schools to the two alternative sites; and
3. Early evening at 7:00 p.m. at the end of crew practice from the two alternative sites to the six schools.

Early morning travel times were not recorded because the crew practice begins before the AM peak period begins. Table 5-2 presents the averaged Google Maps real time feature results. Attachment 5 presents all data collected from Google Maps for each school, weekday, and time.

To be consistent between the two travel time analysis methods, the alternative destination for the Rosslyn study area is defined as the intersection of N. Moore St. and the service road south of Lee Hwy. EB, and the destination for the Gravelly Point study area is defined as the intersection of the GWMP and the Gravelly Point on/off ramps.

Under alternative A, the boathouse facility would not be constructed, and TBC would continue to be the closest boathouse to Arlington County. Drive times to TBC would add 5 to 10 more minutes to access than the proposed Arlington County sites because users would need to cross the Potomac River to access Washington, DC.

Under alternative B, based on the MWCOG model, 61%–64% of Arlington County households and overall population would likely have a shorter travel time to reach the Rosslyn site than the Gravelly Point site under 2020 travel conditions. Further, average drive times would likely be 9.2 and 6.4 minutes for inbound trips during AM peak and midday periods, respectively, and 6.5 and 6.3 minutes for outbound trips during AM peak and midday periods, respectively. Based on the Google Maps real-time feature, the average weekday drive time for schools accessing the site would likely be 14.7 minutes in the morning from the Rosslyn site, 14.3 minutes in the afternoon to the site, and 15.2 minutes in the evening from the site.

Under alternative C, travel time analysis would be identical to alternative B because personal vehicles would be stored in Rosslyn on- or off-street parking options and school buses would drop the crew teams at N. Moore St.

Under alternative D, based on the MWCOG model, 36%–39% of Arlington County households and overall population would likely have a shorter travel time to reach the Gravelly Point site than the Rosslyn site under 2020 travel conditions. Further, average travel times would likely be 10 and 7.7 minutes for inbound trips during AM peak and midday periods, respectively, and 8.9 and 7.7 minutes for outbound trips during AM peak and midday periods, respectively. Based on the Google Maps real-time feature, the average weekday drive time for schools accessing the site would likely be 16.7 minutes in the morning from the Gravelly Point site, 21.7 minutes in the afternoon to the site, and 16.6 minutes in the evening from the site.

TABLE 5-1. 2020 TRAVEL TIME FORECASTS FOR THE ROSSLYN AND GRAVELLY POINT SITES USING MWCOG MODEL

Time Period	Site	Projected Percentage of Arlington County Households with Shortest Drive Time to Rosslyn or Gravelly Point Site in 2020	Projected Percentage of Arlington County Population with Shortest Drive Time to Rosslyn or Gravelly Point Site in 2020	Average Travel Time (Minutes)	Median Travel Time (Minutes)
Inbound during AM Peak Period	Rosslyn	61%	62%	9.2	9.06
	Gravelly Point	39%	38%	10	9.69
Outbound during AM Peak Period	Rosslyn	62%	64%	6.54	6.61
	Gravelly Point	38%	36	8.86	8.74
Inbound during Midday	Rosslyn	62%	63%	6.39	6.5
	Gravelly Point	38%	37%	7.74	7.57
Outbound during Midday	Rosslyn	62%	63%	6.28	6.37
	Gravelly Point	38%	37%	7.67	7.55

TABLE 5-2. EXISTING AVERAGE WEEKDAY DRIVE TIMES FOR THE ROSSLYN AND GRAVELLY POINT SITES USING GOOGLE MAPS

School	Site	AM Outbound minutes	PM Inbound minutes	Evening Outbound minutes
Bishop O'Connell High School	Rosslyn	15	12.5	15.5
	Gravelly Point	18.5	22	17.5
Wakefield High School	Rosslyn	14.5	16	13
	Gravelly Point	10.5	17.5	14
Washington Lee High School	Rosslyn	7	6.5	9.5
	Gravelly Point	13	16	11.5
Yorktown High School	Rosslyn	12	12	12
	Gravelly Point	15	21	14
George Mason University	Rosslyn	29.5	29	31.5
	Gravelly Point	30.5	33.5	30.5
Marymount University	Rosslyn	10	10	10
	Gravelly Point	13	20.5	12

5.3 Summary

A Stop Light chart was created to summarize the alternatives analysis. The chart covers each alternative, including alternative A (i.e., Arlington County residents continuing to use TBC to access the water on non-motorized boats). Each MOE analysis is summarized and assigned a light to reflect the positive, neutral, or negative rating of the assessment. In most cases, each MOE for each alternative has both positive and negative aspects; therefore, the light color reflected an overall positive, neutral, or negative rating. Table 5-3 contains the alternatives analysis summary chart.

TABLE 5-3. ALTERNATIVES COMPARISON CHART

Criterion		Alternative A		Alternative B		Alternative C		Alternative D
Traffic Operations		AM inbound congestion, PM outbound congestion, I-66 HOV alternative available to access TBC, multiple access points		AM inbound congestion, PM outbound congestion, nearby I-66 HOV alternative available to access Rosslyn, multiple access points		Same as alternative B		AM inbound congestion, PM outbound congestion, I-395 HOV alternative available to access GWMP, only one access point
Pedestrian and Bicycle Safety		Numerous vehicle crossings required to access Arlington County pedestrian and bicycle network		Steep trail grade to access the lower Rosslyn site; bicycle-pedestrian conflicts possible on trail		Steep trail grade to access the lower Rosslyn site; bicycle-pedestrian conflicts possible on trail; part of operations accessible via driveway		Vehicle-pedestrian/bicycle conflicts limited to Gravelly Point area only
Pedestrian and Bicycle Accessibility		Commuter-based multiuse trail serves TBC, long distance to access Arlington County pedestrian and bicycle network		Commuter-based multiuse trail serves site, short distance to access Arlington County street network from multiuse trail		Two commuter-based multiuse trails intersect at site with direct access to Arlington County street network		Commuter-based multiuse trail serves site, long distance to access Arlington County from multiuse trail
Transit Accessibility		Foggy Bottom Metro Station is more than a 10-minute walk to TBC		Rosslyn Metro Station, a multimodal transit hub, less than 10-minute walk from the lower Rosslyn site		Rosslyn Metro Station, a multimodal transit hub, less than 5-minute walk from the upper Rosslyn site		Closest Metrorail station over 1 mile
Travel Time		Arlington County residents continue to drive into Washington, DC, to access TBC		More than 60% of Arlington County residents and households have a shorter travel time to this site compared to Gravelly Point		Same as alternative B		Less than 40% of Arlington County residents and households have a shorter travel time to this site compared to downtown Rosslyn

Notes: HOV = High Occupancy Vehicle; TBC = Thompson Boat Center

6.0 NO-ACTION ALTERNATIVE BY MODE

6.1 Alternative A: No-Action Alternative

This chapter describes alternative A, or the baseline condition if the associated planned development were not implemented. This condition is the basis for examining impacts on the transportation network for the action alternatives. Analysis of alternative A assumes background development and growth through 2020, the full implementation year of the zone.

Under alternative A, no changes are proposed in the project areas. Therefore, this chapter describes changes that are planned or reasonably foreseeable outside the project area but within the two study areas defined in the "Existing Conditions" chapter.

6.2 Alternative A Planned Developments and Improvements

The following section describes the alternative A planned developments in the study areas that include reasonably foreseeable planned developments and planned pedestrian and bicycle improvements estimated to be completed by 2020 by Arlington County, VDOT, and NPS.

Based on discussions with Arlington County, three planned developments are included as part of alternative A (Arlington County 2017d). All developments are located adjacent to or within the Rosslyn study area.

- **Central Place (1801 N. Moore St.)** is composed of 350 residential units, 44,554 SF of retail use, and 570,549 SF of office (Wells + Associates 2015). The site is located between N. Lynn St., N. Moore St., N. Wilson Blvd., and N. 19th St. in the Rosslyn study area.
- **1401 Wilson Blvd.** would redevelop 195,472 SF of office use into a 40,000 SF grocery store, 18,000 SF of retail use, and 288 multi-family residential units (Wells + Associates 2015). The site is located between N. Fort Myer Dr., N. Oak St., Key Blvd., and N. 19th St. in the Rosslyn study area.
- **West Rosslyn** would redevelop a fire station, Rosslyn Highlands Park, retail, and office use into 912 units of residential use, a new fire station, and 25,000 SF retail use (Gorove/Slade 2017). The site is located between N. Wilson Blvd. and N. 18th St., west of the Rosslyn study area.

VDOT, Arlington County, and NPS have plans for pedestrian and bicycle improvements in the future.

- **N. Lynn St. Esplanade Improvements** would improve the pedestrian and bicycle network along N. Lynn St. between Lee Hwy. EB and WB by providing the following improvements/changes (Arlington County and VDOT 2017):
    - Adding a new bicycle lane
    - Widening the existing sidewalk and increasing the separation from vehicular traffic
    - Enhancing intersection crossings to provide safer pedestrian and bicycle queueing locations and better sight distances
    - Narrowing the travel lanes from 12-foot to 11-foot lanes to create space for a new bicycle lane
    - Upgrading the traffic signals at both Lee Hwy. intersections along N. Lynn St.
- **Custis Trail Improvements** would improve the pedestrian and bicycle network along Lee Hwy. WB between N. Lynn St. and N. Oak St. by providing the following improvements/changes (Arlington County and VDOT 2017):
    - Widening the existing multiuse Custis Trail to 16-feet wide

- Increasing trail separation from traffic and enhancing intersection crossings to provide safer pedestrian and bicycle queuing locations
- Reducing the number of travel lanes from three to two to create space for the Custis Trail improvements between N. Fort Myer Dr. and N. Oak St.
- Creating a new curb extension or bulb-out at the northwest corner of N. Lynn St. at Lee Hwy. WB to reduce the length of the Custis Trail crossing
- Upgrading the traffic signals at N. Fort Myer Dr. and N. Nash St.

- **NPS Mt. Vernon Trail Improvements** would connect the Mt. Vernon Trail to the south side of the I-66 Roosevelt Bridge, improve access from the Airport Access Road overpass at Reagan National Airport/Aviation Circle to the Mt. Vernon Trail, and improve access at the intersection of the Mt. Vernon Trail and the Custis Trail in Rosslyn (NPS 2016a). The third improvement coincides with the Custis Trail improvements described above.
- **Capital Bikeshare Expansion** by Arlington County would install a bikeshare station at Roosevelt Island and Gravelly Point.

Figure 6-1 illustrates the locations of the planned developments and roadway improvements. Figure 6-2 shows the alternative A lane geometry and contains the changes in the number of lanes based on the proposed bicycle and pedestrian improvements in Rosslyn.

6.3 Pedestrian Network

Alternative A includes planned development projects and multiple pedestrian improvement projects that are reasonably foreseeable to be completed by 2020 in the Rosslyn study area. Improvements by planned development projects would include replacing existing sidewalks torn-up or damaged during construction and improving and providing new access to the overall pedestrian network. Arlington County and VDOT joint improvements would include widening sidewalks, increasing separation from vehicular traffic, and enhancing intersection crossings to improve pedestrian safety along two corridors (N. Lynn St. between Lee Hwy. EB and WB and the Custis Trail [Lee Hwy. WB between N. Lynn St. and N. Oak St.]). NPS improvements would include improving access between the Mt. Vernon and Custis Trails and connecting the Mt. Vernon Trail to the south side of the I-66 Roosevelt Bridge.

NPS improvements in the Gravelly Point study area would improve access to the Mt. Vernon Trail from the Airport Access Road overpass at Reagan National Airport/Aviation Circle.

Under alternative A, these planned developments and improvements and other area pedestrian growth through 2020 would provide additional sidewalk capacity and safer intersection crossings and would result in a small increase in the volume of pedestrian activity in the Rosslyn study area. Other than minor growth along the Mt. Vernon Trail through the Gravelly Point study area, no increase in pedestrians is anticipated.

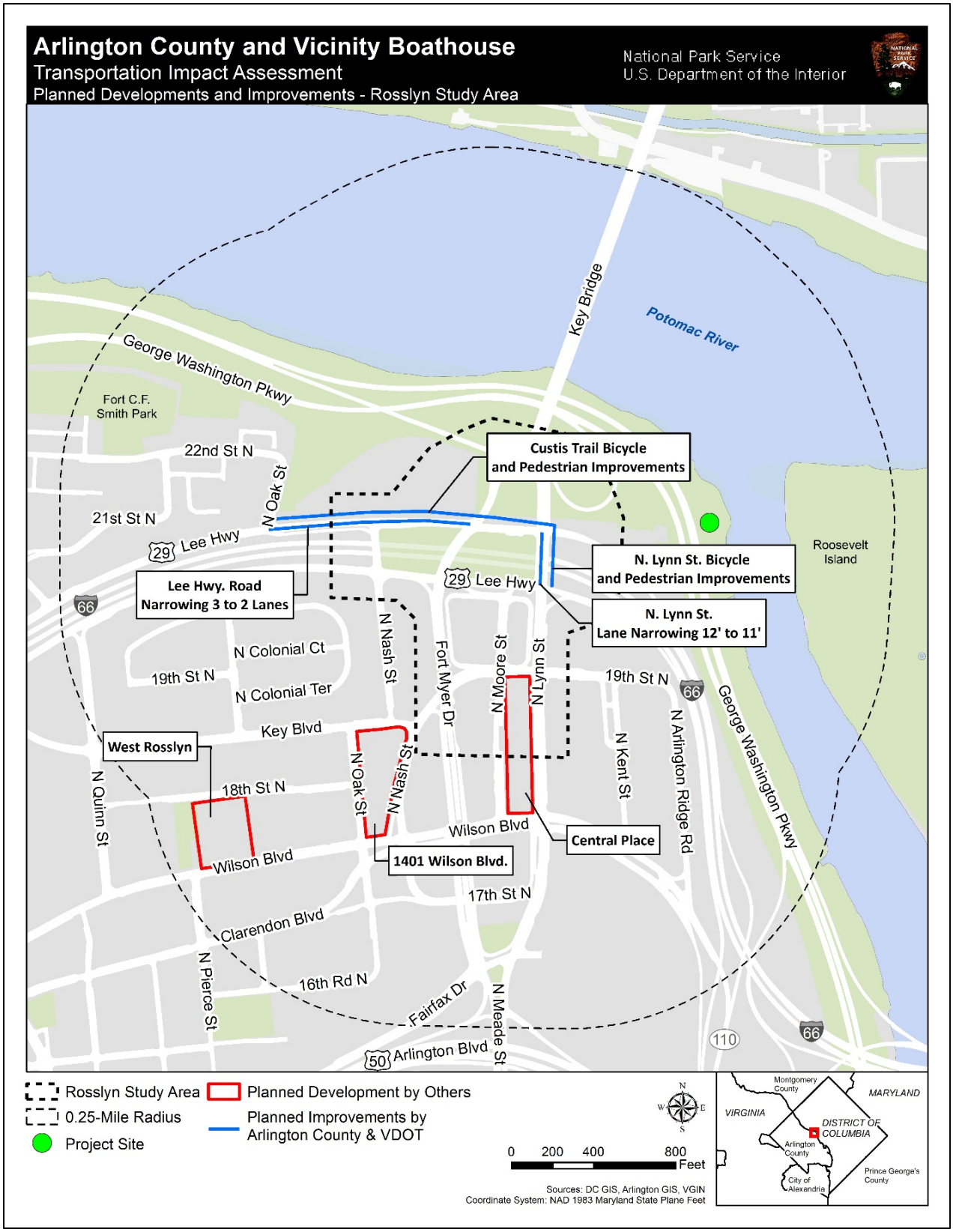


FIGURE 6-1. PLANNED DEVELOPMENTS AND IMPROVEMENTS – ROSSLYN STUDY AREA

FIGURE 6-2. ALTERNATIVE A LANE GEOMETRY – ROSSLYN STUDY AREA

6.4 Bicycle Network

Arlington County plans to construct a number of bicycle facilities throughout the county, including bicycle lanes, multiuse trails, marked street bicycle routes, sharrows, and bicycle boulevards. According to the Bicycle Element in the county's *Master Transportation Plan*, bicycle use has steadily grown over the last few decades in the Washington, DC, metropolitan core area and completing the bicycle network in Arlington County would help accommodate future growth. The Bicycle Element lists 12 funded bicycle improvement projects, many of which have been implemented since its publication in 2008, such as constructing a new bicycle trail on the south side of Arlington Blvd. between Pershing Dr. and N. Rolfe St. The plan lists 37 future projects for multiuse trail improvements, ranging from improving trail conditions to improving trail access by resolving gaps and barriers in the existing network. The plan also lists 57 future projects for on-street bicycle improvements, ranging from installing pavement markings for signed routes to establishing bicycle boulevards (Arlington County 2008).

Arlington County and VDOT have planned two bicycle improvement projects that are reasonably foreseeable to be completed by 2020 in the Rosslyn study area. These projects would improve bicycle safety and connections by installing a bicycle lane along N. Lynn St. between Lee Hwy. EB and WB and widening the Custis Trail to 16-feet wide along Lee Hwy. WB between N. Lynn St. and N. Oak St.

The *Rosslyn Sector Plan*, published in 2015, provides an updated overview of bicycle improvements planned for the Rosslyn area, including:

- Implement cycle tracks/protected bike lanes along the priority bicycle routes of N. Nash St., Wilson Blvd., Fort Myer Dr., and N. Lynn St.
- Improve access to nearby riverfront park amenities, including the Mt. Vernon Trail and Roosevelt Island through and iconic and attractive pedestrian/bicycle bridge over I-66.
- Continue to expand the Capital Bikeshare system through the addition of new stations at selected Rosslyn locations and elsewhere throughout Arlington (Arlington County 2015).

The District Department of Transportation (DDOT) also plans to construct a number of bicycle facilities throughout the District within a 1-mile radius of the Rosslyn study area, including new cycle tracks, bicycle lanes, and multiuse trails. According to the moveDC plan, 230,000 additional annual bicycle trips are expected in the District by 2040, and the planned improvements to the bicycle network would accommodate them (DDOT 2014b). Further, the 2012 *Arlington County Capital Bikeshare Transit Development Plan* and 2015 *District of Columbia Capital Bikeshare Development Plan* recommends expanding the Capital Bikeshare station network through fiscal years 2018 and 2021, respectively. Arlington County recommends stations at Roosevelt Island, Gravelly Point, Reagan National Airport, and four additional stations within a 1-mile radius of the Rosslyn study area (Arlington County 2012b). On the Washington, DC, side of the river within a 1-mile radius of the Rosslyn study area, DDOT recommends a station near the Georgetown Waterfront Park (DDOT 2015).

Under alternative A, these bicycle improvements, coupled with the planned developments and improvements described above and other area bicyclist growth through 2020 are not expected to result in a substantial change to the volume of bicycle activity in the Rosslyn or Gravelly Point study areas. Because alternative A does not include additional development in the project area, no increase in bicyclists traveling through the study areas is anticipated other than normal annual growth.

6.5 Transit

The 2014 *DC Circulator Transit Development Plan Update* identifies several opportunities to improve and expand the DC Circulator system in the future. Improvements were identified based on performance data and/or input from stakeholders and the community. These improvements include deploying additional vehicles to meet service commitments, improving reliability through priority treatments along routes (transit signal priority, bus only lanes, queue jumping, and re-timing of intersections), evaluating

modifications to routes and stop consolidation, evaluating changes to schedule and span, and considering options to adapt to underutilization. DDOT is likely to implement these improvements as needed along the current routes. For example, an analysis of actual running times shows that service on the Dupont Circle – Georgetown – Rosslyn route has an average headway of 11 minutes and up to 13 minutes in the PM peak period, rather than the advertised 10 minutes, so the report recommends that DDOT consider deploying additional vehicles to achieve 10-minute headways (DDOT 2014a).

Ongoing WMATA initiatives are planned that would result in local bus changes, including quarterly Metrobus Service Changes and the Momentum strategic plan for the Metro system 2013–2025. Further, the Momentum strategic plan recommends offering more eight-car trains during peak periods to increase the system's ability to move more passengers. These types of changes would directly affect Metrobus and Metrorail routes that currently serve the transit study area (WMATA 2013). Ongoing bus changes are also expected in the Arlington County ART program based on the county's *Transit Development Plan*. The plan recommends broad strategies and specific improvements to improve the overall bus system. Expected improvements include increasing service frequency of Route #45 to every 20 minutes and discontinuing service on Columbia Pike in conjunction with implementing the Premium Transit Network on Columbia Pike (Arlington County 2016).

Alternative A includes three planned developments in the Rosslyn study area; therefore, a moderate increase in transit trips is anticipated from the planned developments in addition to annual background growth. It is likely that office and residential developments would increase Metrorail ridership to and from the Rosslyn Metro Station during morning and afternoon peak periods.

Additionally, no change to regional commuter bus service is anticipated beyond routine route and schedule adjustments under alternative A. Carsharing options may change over time depending on decisions made by the individual vendors.

6.6 Trucks and Buses

No changes to truck and bus operations are expected in the Rosslyn or Gravelly Point study areas.

6.7 Parking

Parking at Roosevelt Island would be reduced by two to three spaces from installation of the Capital Bikeshare station (Capital Bikeshare, 2017). No additional parking changes are expected in the Rosslyn or Gravelly Point study areas. However, planned developments may introduce new underground garage parking options in the Rosslyn study area.

6.8 Traffic

Alternative A includes various programmed transportation improvements in the study area, growth in existing traffic volumes through the same horizon year (2020) as alternatives B, C, and D, and trips generated by approved and unbuilt development projects. Volumes are then used as an input, along with delay, signal timing, and geometrics to evaluate traffic operations and queuing at signalized and unsignalized intersections to determine the impacts of traffic growth.

The following section describes the process for analyzing traffic for alternative A and the results of the analysis. Note that the procedures to forecast future traffic volumes throughout the study include rounding; therefore, values may not add up to the precise value indicated. All facilities (intersections and freeways) were evaluated based on a peak hour factor of 0.92 or higher (ratio of the 60-minute volume divided by 4 times the highest 15-minute volume), the lowest peak hour factor accepted by VDOT's *Traffic Impact Analysis Regulations* (VDOT 2012).

6.8.1 Background Growth – Rosslyn Study Area

Background growth was added to the roadway network to account for vehicle trips traveling through the study area during the AM and PM peak hours. These trips are important to include because they account

for vehicle volume growth resulting from land use changes outside the study area. Following the scoping agreement, AADTs were used to develop background growth rates. The AADT volumes provide a historical reference. VDOT recommends five years of historical data to determine a historical average growth. The data available when the study began were compared from 2010–2014 to provide an average annual growth rate to apply to the study area roadways (VDOT 2010–2014).

The comparison separated roadways into arterials, other principal arterials, and minor arterials. Most roadways examined in the study area had negative average growth trends. Arterials had a 0.3 positive growth rate, other principal arterials had no growth, and major collectors had a 0.3 negative growth rate. VDOT agreed for study purposes to apply a 0.3% growth for all roadways in the Rosslyn study area to be conservative. The existing condition values were calculated for three years out from 2017 to 2020 for the AM and PM peak hours covering the 2017 weekday counts and five years out from 2015 to 2020 for the Saturday peak hour covering the 2015 weekend counts.

6.8.2 BACKGROUND GROWTH – GRAVELLY POINT STUDY AREA

Traffic volumes along the GWMP were increased to reflect 2020 future volumes under alternative A. Existing condition values were calculated five years out from the July 2015 existing conditions. Based on a review of historical GWMP volumes from July from 2014 to 2017, the study developed average yearly weekday and Saturday peak hour growth rates of 2.75% and 1.8%, respectively.

6.8.3 ALTERNATIVE A TRIP GENERATION – ROSSLYN STUDY AREA

The development of trip generation relied on existing transportation studies, which rely on the Institute of Transportation Engineers (ITE) 9th edition of the *Trip Generation Manual* (ITE 2012). Some of the planned developments incorporated internal capture reductions and pass-by reductions. Internal capture reductions account for existing trips that would choose to walk between nearby land uses rather than drive. Pass-by trip reductions represent existing trips that include a new stop at a retail use along their route and then continue on their way following the stop. Vehicle trips published by existing transportation studies were used. Saturday vehicle trips were not provided in the existing transportation studies with the exception of the West Rosslyn Plaza study and were calculated following the same assumptions as the AM and PM peak hour. This included using the ITE 9th edition of the *Trip Generation Manual* to derive the Saturday peak hour estimated vehicle trips. The estimated vehicle trips reported in the West Rosslyn Plaza study covering all time periods (AM, PM, and Saturday peak hour) double counted the pass-by reduction value; therefore, the values were corrected and report a slightly higher value than published in that report. A total of 423 trips are forecasted during the AM peak hour, 694 trips during the PM peak hour, and 549 trips during the Saturday peak hour.

6.8.4 ALTERNATIVE A MODAL SPLIT – ROSSLYN STUDY AREA

Modal splits were developed by using the modal splits provided in existing transportation reports. These reports relied on the Rosslyn Multi-Modal Transportation Study, Residential Site Plans Aggregate Study, Arlington County Household Survey, and Arlington County Resident Survey Study. In addition, the number of pedestrians in the immediate area also contributed to the modal split (Wells + Associates 2015). Table 6-1 contains the AM and PM alternative A trip generation summary, and table 6-2 contains alternative A Saturday peak hour trip generation summary. Both tables include the modal splits for the planned development projects.

TABLE 6-1. SUMMARY OF ALTERNATIVE A WEEKDAY TRIP GENERATION – ROSSLYN STUDY AREA

Project	Units/Size/ Credits	AM PEAK HOUR TRIPS			PM PEAK HOUR TRIPS		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Central Place (1801 North Moore Street)							
Condominium (ITE 230)	350 Units	24	117	141	113	55	168
Alternative Travel Mode Reduction	60%	-14	-70	-85	-68	-33	-101
Subtotal		10	47	56	45	22	67
Retail (ITE 820)	44,554 SF	59	37	96	181	189	370
Alternative Travel Mode Reduction	90%	-53	-33	-86	-163	-170	-333
Subtotal		6	4	10	18	19	37
Office (ITE 710)	570,549 SF	664	91	755	122	596	718
Alternative Travel Mode Reduction	50%	-332	-46	-378	-61	-298	-359
Subtotal		332	46	378	61	298	359
Net Vehicle Trips		**348**	**96**	**444**	**124**	**339**	**463**
1401 Wilson Boulevard							
Grocery (ITE 850)	40,000 SF	88	56	144	251	242	493
Internal Capture Reduction		-14	-6	-20	-18	-16	-34
Alternative Travel Mode Reduction	52%	-38	-26	-64	-121	-118	-239
Pass-by Reduction	25%	-9	-6	-15	-28	-27	-55
Subtotal		27	18	45	84	81	165
Retail (ITE 820)	18,000 SF	34	22	56	97	105	202
Internal Capture Reduction		-7	-2	-9	-8	-7	-15
Alternative Travel Mode Reduction	52%	-14	-10	-24	-46	-51	-97
Pass-by Reduction	25%	-3	-2	-6	-11	-12	-22
Subtotal		10	7	17	32	35	67
Residential (ITE 220)	288 Units	29	116	145	114	62	176
Internal Capture Reduction		-8	-34	-42	-34	-18	-52
Alternative Travel Mode Reduction	42%	-9	-34	-43	-34	-18	-52
Subtotal		12	48	103	46	26	124
Existing Office (ITE 710)	195,472 sf	63	15	78	33	51	84
Net Vehicle Trips		**-14**	**58**	**43**	**129**	**91**	**220**
West Rosslyn							
High-Rise Apartment (ITE 222)	912 Units	68	204	272	185	119	304
Internal Capture Reduction		-1	-4	-5	-7	-5	-12
Alternative Travel Mode Reduction	60%	-41	-122	-163	-111	-71	-182
Subtotal		26	78	104	67	43	110
Specialty Retail (ITE 826)	25,000 SF	21	20	41	36	45	81
Alternative Travel Mode Reduction	50%	-10	-10	-20	-18	-23	-41
Pass-by Reduction	25%	-3	-2	-5	-5	-5	-10
Subtotal		8	8	16	14	18	31
Existing Trips (office, Retail, City Park)		-178	-6	-184	-19	-111	-130
Net Vehicle Trips		**-144**	**80**	**-64**	**62**	**-51**	**11**

Notes: ITE – Institute of Transportation Engineers; SF – square feet

TABLE 6-2. SUMMARY OF ALTERNATIVE A SATURDAY TRIP GENERATION – ROSSLYN STUDY AREA

Project	Units/Size/ Credits	SATURDAY PEAK HOUR		
		IN	OUT	TOTAL
Central Place (1801 North Moore Street)				
Condominium (ITE 230)	350 Units	78	66	144
Alternative Travel Mode Reduction	60%	-47	-40	-86
Subtotal		31	26	58
Retail (ITE 820)	44,554 SF	112	103	215
Alternative Travel Mode Reduction	90%	-101	-93	-194
Subtotal		11	10	22
Office (ITE 710)	570,549 SF	132	113	245
Alternative Travel Mode Reduction	50%	-66	-57	-123
Subtotal		66	57	123
Net Vehicle Trips		**108**	**93**	**202**
1401 Wilson Boulevard				
Grocery (ITE 850)	40,000 SF	217	209	426
Internal Capture Reduction		-24	-5	-29
Alternative Travel Mode Reduction	52%	-100	-106	-206
Pass-by Reduction	25%	-23	-24	-48
Subtotal		69	73	143
Retail (ITE 820)	18,000 SF	45	42	87
Internal Capture Reduction		-5	-1	-6
Alternative Travel Mode Reduction	52%	-21	-21	-42
Pass-by Reduction	25%	-5	-5	-10
Subtotal		14	15	29
Residential (ITE 220)	288 Units	75	75	150
Internal Capture Reduction		-2	-2	-4
Alternative Travel Mode Reduction	42%	-31	-31	-61
Subtotal		42	42	146
Existing Office (ITE 710)	195,472 sf	26	23	49
Net Vehicle Trips		**100**	**108**	**208**
West Rosslyn				
High-Rise Apartment (ITE 222)	912 Units	188	142	330
Internal Capture Reduction		-8	-5	-13
Alternative Travel Mode Reduction	60%	-113	-85	-198
Subtotal		67	52	119
Specialty Retail (ITE 826)	25,000 SF	63	63	126
Alternative Travel Mode Reduction	50%	-32	-31	-63
Pass-by Reduction	25%	-8	-8	-16
Subtotal		23	24	47
Existing Trips (office, Retail, City Park)		-2	-24	-26
Net Vehicle Trips		**88**	**52**	**140**

Notes: ITE – Institute of Transportation Engineers; SF – square feet

6.8.5 ALTERNATIVE A TRIP DISTRIBUTION – ROSSLYN STUDY AREA

The trip distributions for each planned development followed the patterns provided in existing transportation reports. The percentage were based on input from Arlington County and VDOT staff as well as engineering judgement. In cases where planned developments were located outside the study area, the routes crossing the study area were included in the alternative A analysis. Table 6-3 shows the trip distribution percentages by proposed development.

TABLE 6-3. ALTERNATIVE A PLANNED DEVELOPMENT TRIP DISTRIBUTION

	Roadways						
Planned Development	**West on Lee Hwy./I-66**	**N. on Lynn/ South on Fort Myer / Key Bridge**	**East on I-66**	**South on Route 110**	**South on Route 50/ N. Meade St.**	**West on Wilson Blvd.**	**East on N. 19th St.**
Central Place (1801 N. Moore St.)	25%	15%	10%	15%	25%	10%	0%
1401 Wilson Blvd.	25%	15%	10%	15%	25%	10%	0%
West Rosslyn	5% IN 20% OUT	20% IN 10% OUT	0%	30% IN 10% OUT	0%	0%	5%

Figure 6-3 shows AM and PM peak hour vehicle trips generated by alternative A that reflect the background development and background growth, and figure 6-4 shows Saturday peak hour vehicle trips generated by Alternative A that reflects the background development and background growth. Figure 6-5 shows the future alternative A weekday AM and PM peak hour turning movement volumes, and figure 6-6 shows the future alternative A Saturday peak hour turning movement volumes.

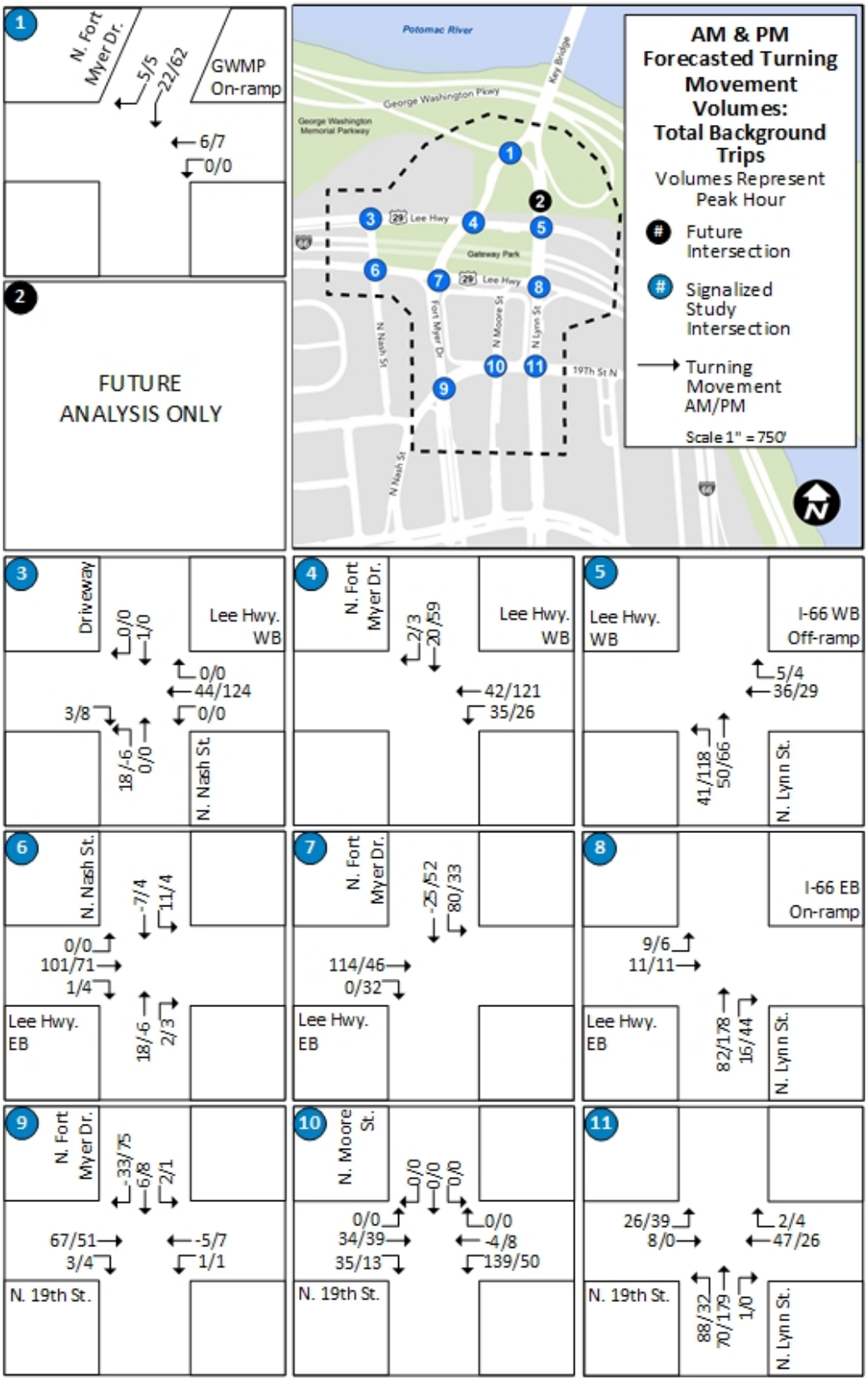


FIGURE 6-3. ALTERNATIVE A BACKGROUND AM AND PM PEAK HOUR TRIPS GENERATED – ROSSLYN

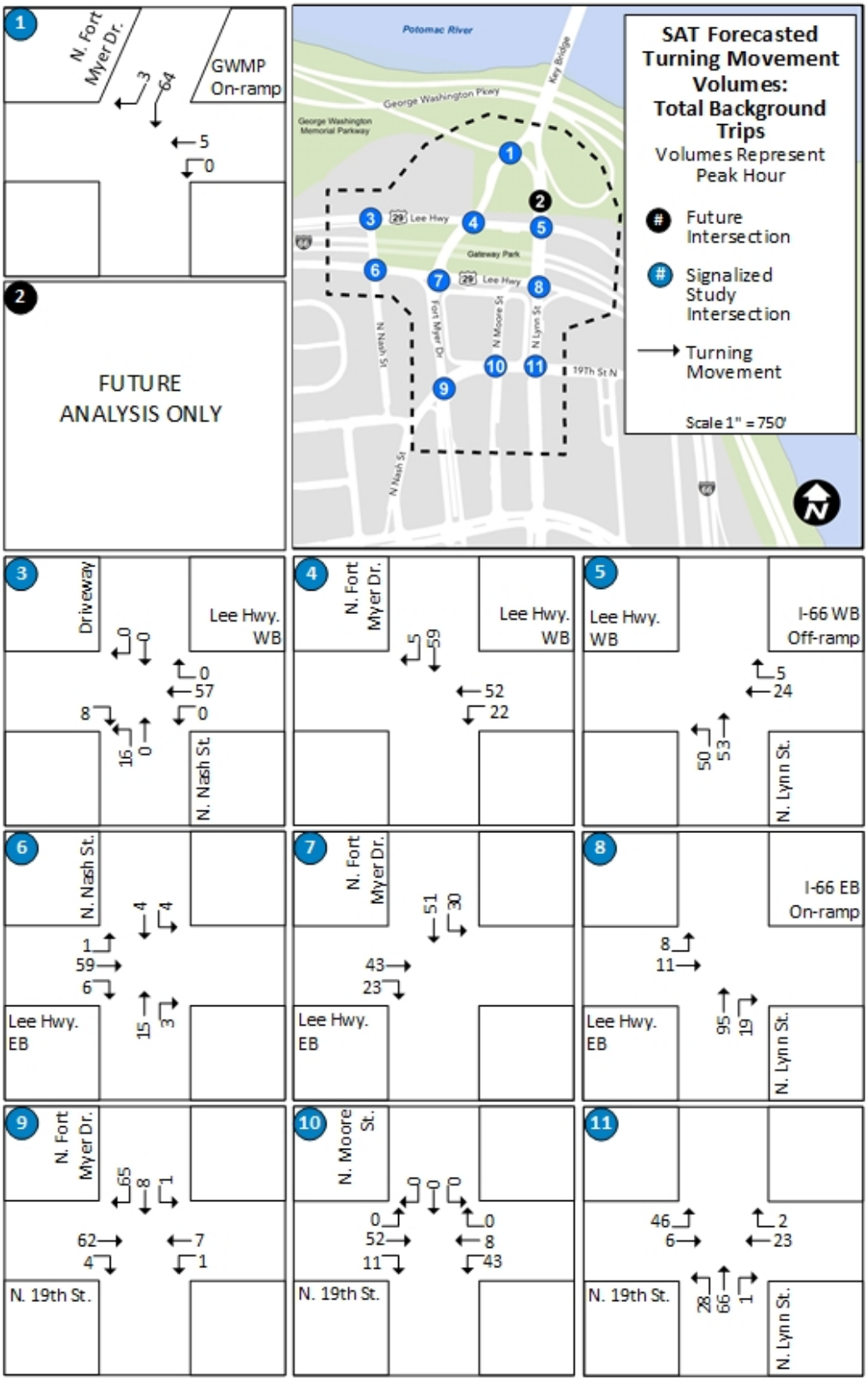


FIGURE 6-4. ALTERNATIVE A BACKGROUND SATURDAY PEAK HOUR TRIPS GENERATED – ROSSLYN

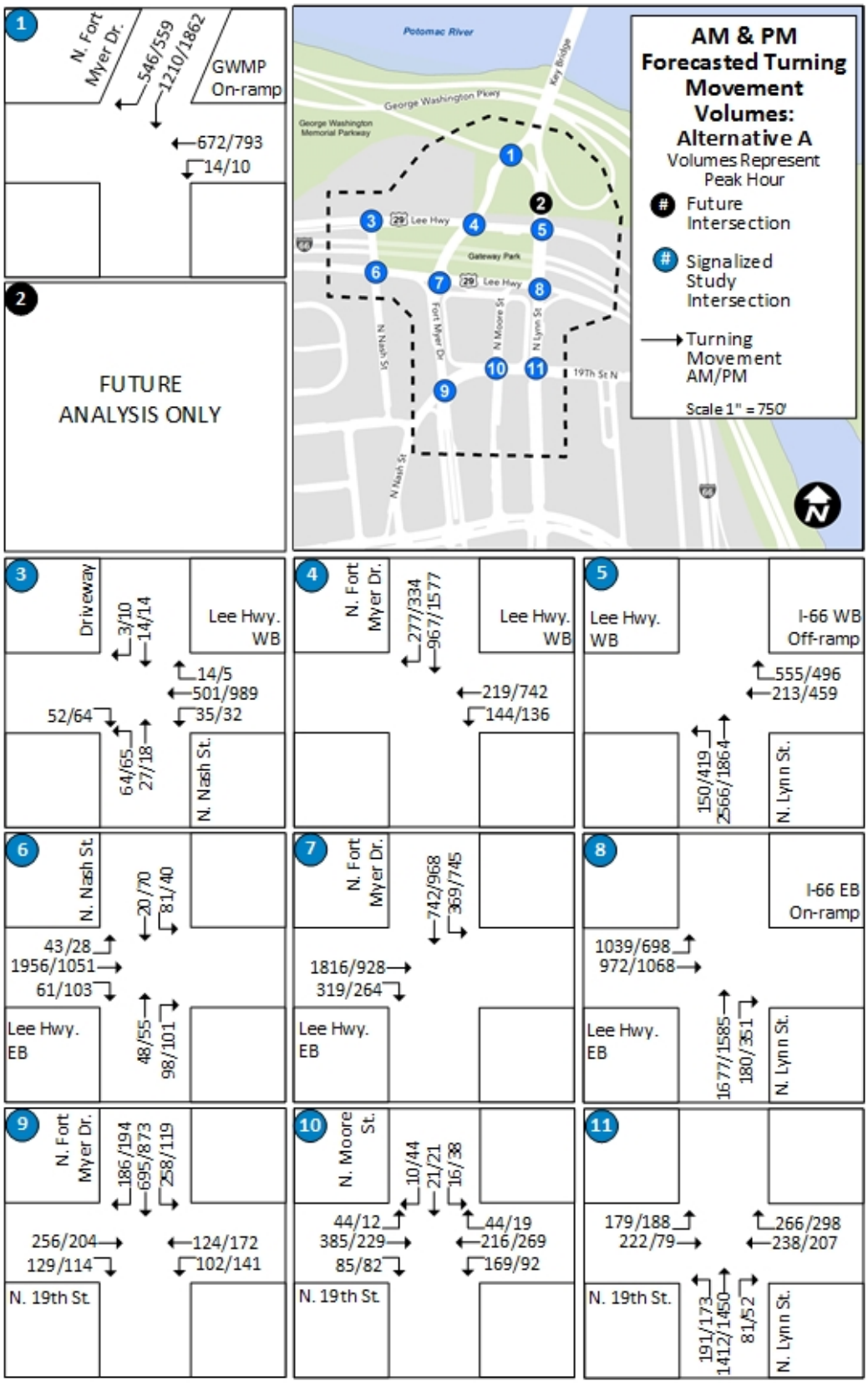


FIGURE 6-5. ALTERNATIVE A WEEKDAY AM AND PM PEAK HOUR TURNING MOVEMENT VOLUMES – ROSSLYN

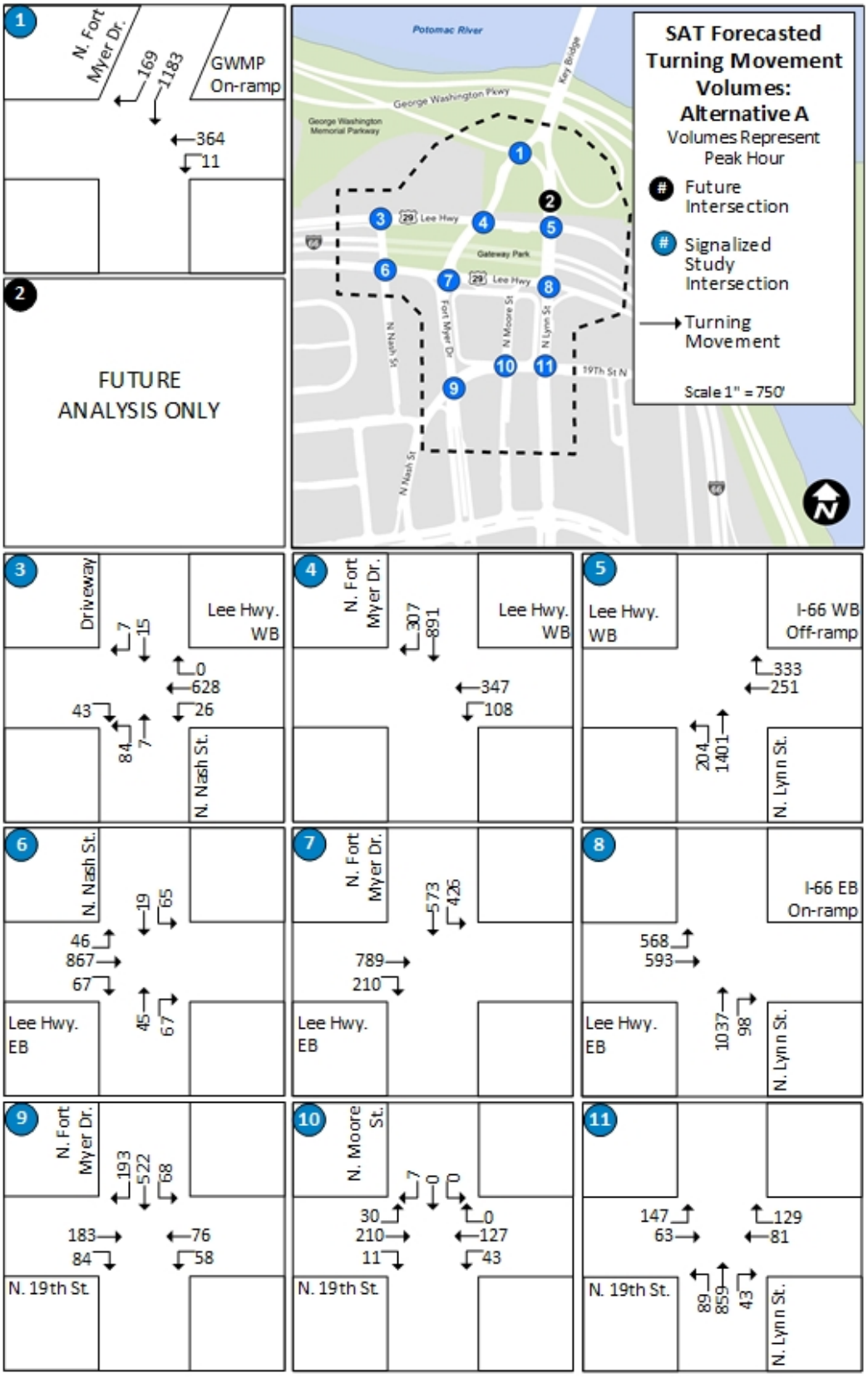


FIGURE 6-6. ALTERNATIVE A SATURDAY PEAK HOUR TURNING MOVEMENT VOLUMES – ROSSLYN

Figure 6-7 shows the future alternative A Gravelly Point AM, PM, and Saturday peak hour background trips generated and turning movement volumes.

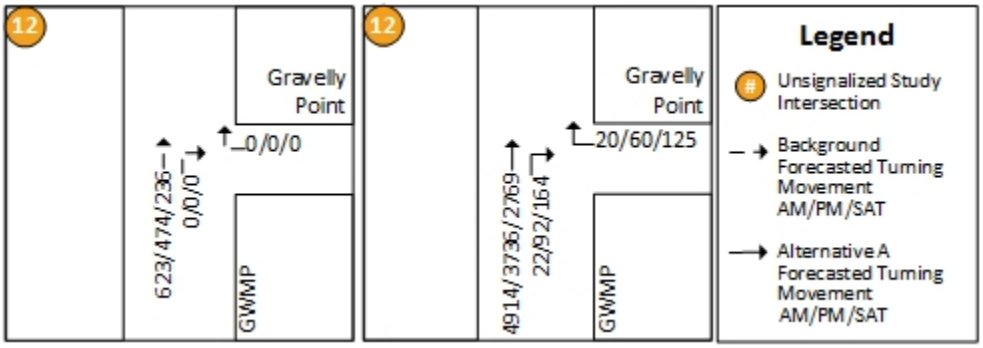


FIGURE 6-7. ALTERNATIVE A PEAK HOUR TURNING MOVEMENT VOLUMES – GRAVELLY POINT

6.8.6 ALTERNATIVE A INTERSECTION OPERATIONS ANALYSIS

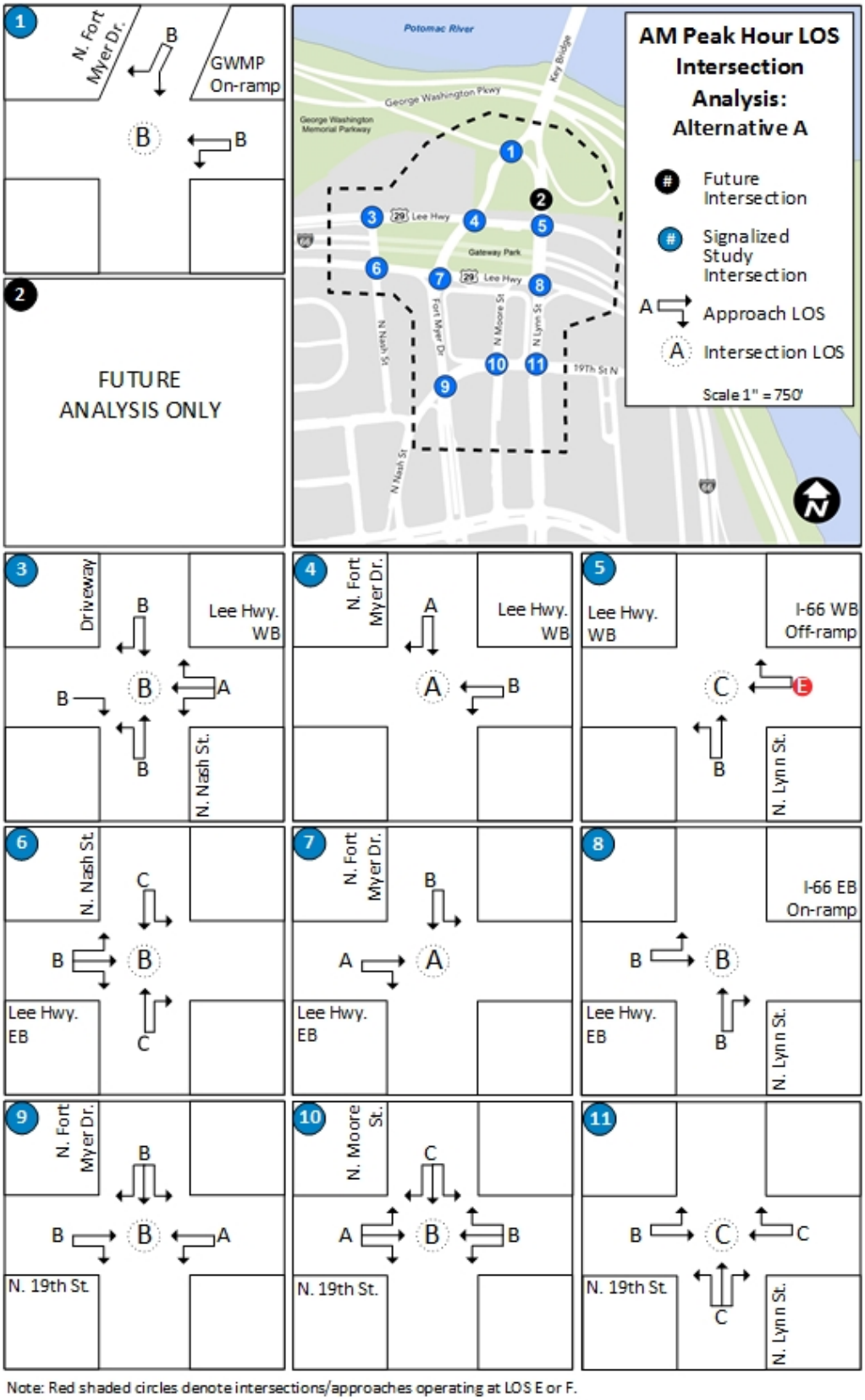
Based on the Synchro™ signalized intersection analysis results, all the Rosslyn study area intersections (Intersection #1 through #11) would operate at overall acceptable conditions (LOS D or better) during the peak hours analyzed (weekday AM and PM peak hours, Saturday peak hour). The following individual signalized intersection approach would operate at unacceptable conditions (LOS E or LOS F) during the noted peak hour:

Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5)

- Westbound on I-66 off-ramp during the weekday AM peak hour

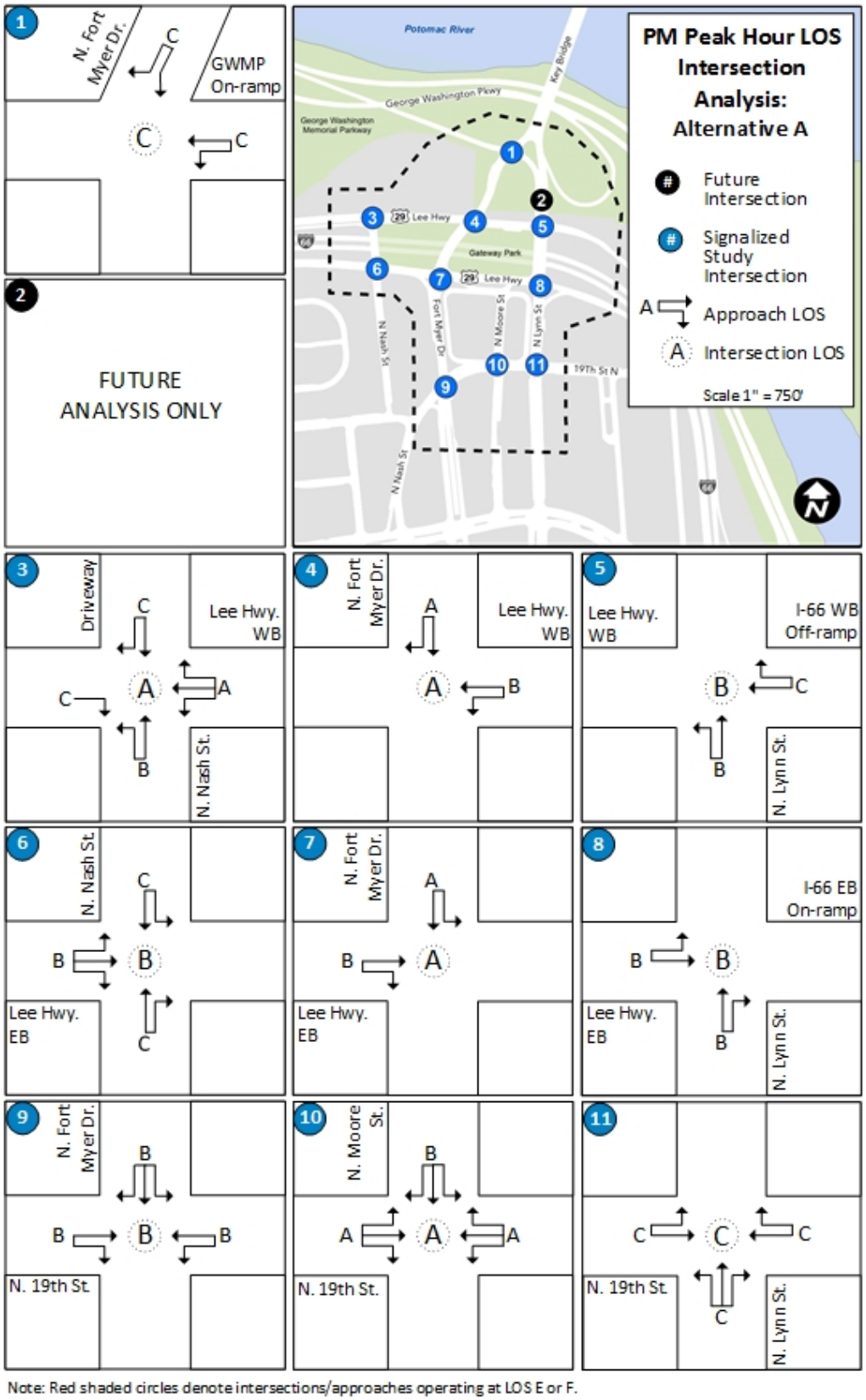
Based on the Synchro™ unsignalized intersection analysis, the Gravelly Point study area intersection (Intersection #12) would operate at overall acceptable conditions during the peak hours.

The average LOS for the various approaches to the intersection and the overall intersection LOS grades are depicted in figures 6-8 and 6-9 for weekday AM and PM peak hours, respectively, and in figure 6-10 for the Saturday peak hour at the end of this section. Table 6-4 shows the results of the LOS capacity analysis and the intersection vehicle delay under alternative A during all peak hours (weekday AM and PM peak hours and Saturday peak hour).



Note: Red shaded circles denote intersections/approaches operating at LOS E or F.

FIGURE 6-8. ALTERNATIVE A INTERSECTION LEVEL OF SERVICE FOR WEEKDAY AM PEAK HOUR



Note: Red shaded circles denote intersections/approaches operating at LOS E or F.

FIGURE 6-9. ALTERNATIVE A INTERSECTION LEVEL OF SERVICE FOR WEEKDAY PM PEAK HOUR

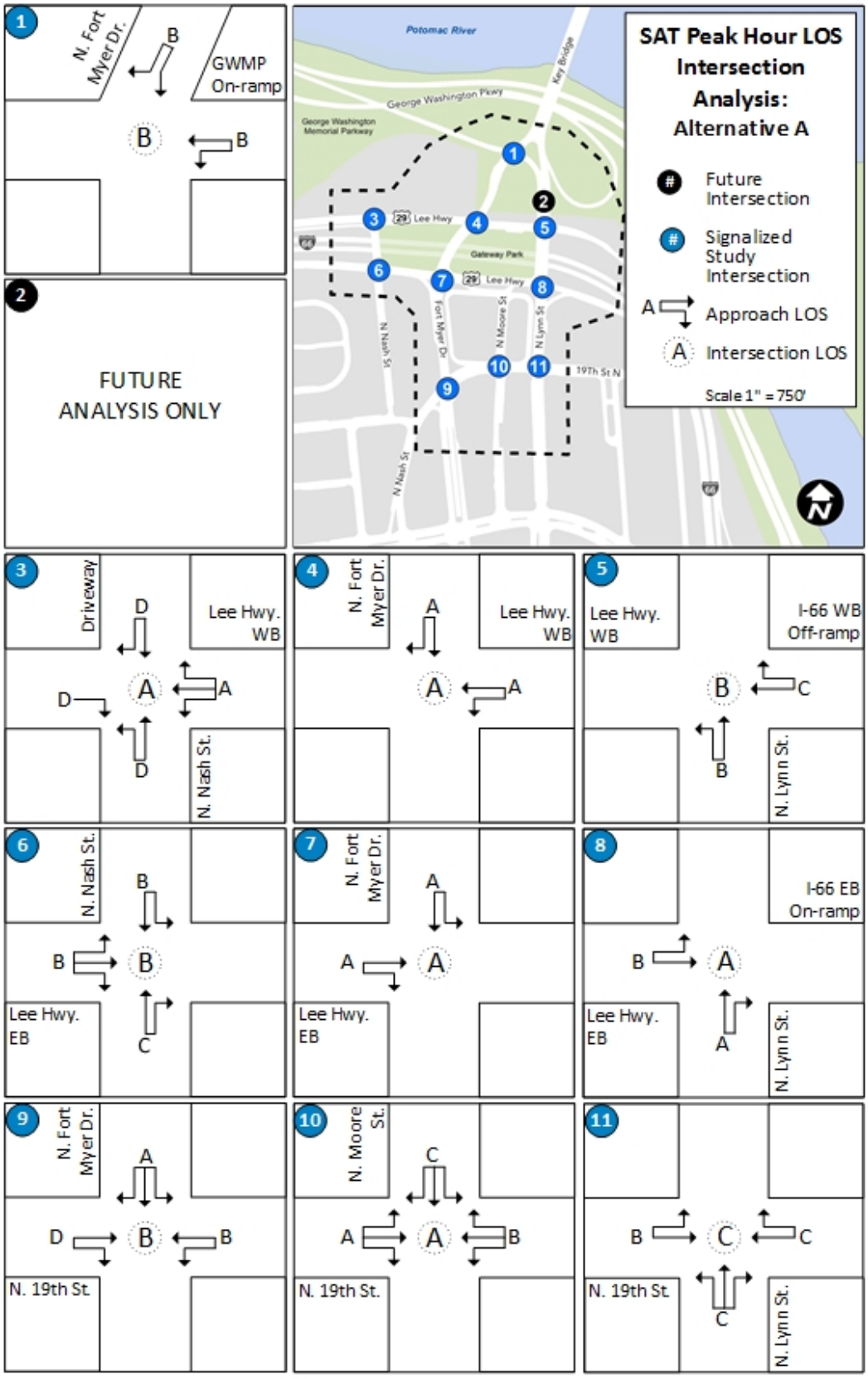


FIGURE 6-10. ALTERNATIVE A INTERSECTION LEVEL OF SERVICE FOR SATURDAY PEAK HOUR

TABLE 6-4. ALTERNATIVE A ALL PEAK HOUR OPERATIONS ANALYSIS

#	Intersection and Approach	Lane Group	AM Peak Hour				PM Peak Hour				Saturday Peak Hour			
			V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized)** [a]													
	WB (GWMP On-ramp)	LT	0.71	18.3	B		0.96	33.5	C		0.36	16.2	B	
	WB Overall (GWMP On-ramp)			**18.3**	**B**	**Pass**		**33.5**	**C**	**Pass**		**16.2**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.77	16	B		0.92	21	C		0.49	11.6	B	
	SB Overall (N. Fort Myer Dr.)			**16**	**B**	**Pass**		**21**	**C**	**Pass**		**11.6**	**B**	**Pass**
	Overall		**0.75**	**16.7**	**B**	**Pass**	**0.93**	**24.1**	**C**	**Pass**	**0.45**	**12.6**	**B**	**Pass**
3	**Lee Hwy. WB & N. Nash St. (Signalized)** [a]													
	EB (Lee Hwy. WB)	R	0.04	17.5	B		0.04	22.2	C		0.03	35.3	D	
	EB Overall (Lee Hwy. WB)			**17.5**	**B**	**Pass**		**22.2**	**C**	**Pass**		**35.3**	**D**	**Pass**
	WB (Lee Hwy. WB)	L	0.04	8.5	A		0.03	5.6	A		0.02	1.0	A	
	WB (Lee Hwy. WB)	TR	0.31	9.8	A		0.53	7.3	A		0.25	1.3	A	
	WB Overall (Lee Hwy. WB)			**9.7**	**A**	**Pass**		**7.2**	**A**	**Pass**		**1.3**	**A**	**Pass**
	NB (N. Nash St.)	LT	0.17	18.3	B		0.20	19.2	B		0.62	45.7	D	
	NB Overall (N. Nash St.)			**18.3**	**B**	**Pass**		**19.2**	**B**	**Pass**		**45.7**	**D**	**Pass**
	SB (Driveway)	TR	0.02	17.3	B		0.05	22.2	C		0.11	35.8	D	
	SB Overall (Driveway)			**17.3**	**B**	**Pass**		**22.2**	**C**	**Pass**		**35.8**	**D**	**Pass**
	Overall		**0.25**	**11.6**	**B**	**Pass**	**0.42**	**9.2**	**A**	**Pass**	**0.30**	**9.0**	**A**	**Pass**
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized)** [a]													
	WB (Lee Hwy. WB)	L	0.16	11.6	B		0.20	9.9	A		0.10	8.4	A	
	WB (Lee Hwy. WB)	T	0.17	11.9	B		0.64	15.3	B		0.26	6.7	A	
	WB Overall (Lee Hwy. WB)			**11.8**	**B**	**Pass**		**14.5**	**B**	**Pass**		**7.1**	**A**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.54	8.0	A		0.78	4.8	A		0.51	5.1	A	
	SB Overall (N. Fort Myer Dr.)			**8.0**	**A**	**Pass**		**4.8**	**A**	**Pass**		**5.1**	**A**	**Pass**
	Overall		**0.38**	**8.9**	**A**	**Pass**	**0.72**	**7.9**	**A**	**Pass**	**0.40**	**5.6**	**A**	**Pass**
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized)** [a]													
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	0.87dr	37.7	D		0.58	23.2	C		0.37	22.5	C	
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	1.10	119.7	F		0.70	30.8	C		0.40	24.3	C	
	WB Overall (Lee Hwy. WB/I-66 Off-ramp)			**67.3**	**E**	**Fail**		**25.5**	**C**	**Pass**		**23.0**	**C**	**Pass**
	NB (N. Lynn St.)	L	0.09	0.1	A		0.44	5.0	A		0.13	0.8	A	
	NB (N. Lynn St.)	T	0.83	11.1	B		0.85	17.7	B		0.54	13.4	B	
	NB Overall (N. Lynn St.)			**10.5**	**B**	**Pass**		**15.4**	**B**	**Pass**		**11.8**	**B**	**Pass**
	Overall		**0.86**	**23.1**	**C**	**Pass**	**0.72**	**18.4**	**B**	**Pass**	**0.44**	**14.8**	**B**	**Pass**

TABLE 6-4. ALTERNATIVE A ALL PEAK HOUR OPERATIONS ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	AM Peak Hour				PM Peak Hour				Saturday Peak Hour			
			V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check
6	**Lee Hwy. EB & N. Nash St. (Signalized)** [a]													
	EB (Lee Hwy. EB)	LTR	0.76	14.3	B		0.46	13.8	B		0.39	13.6	B	
	EB Overall (Lee Hwy. EB)			**14.3**	**B**	**Pass**		**13.8**	**B**	**Pass**		**13.6**	**B**	**Pass**
	NB (N. Nash St.)	TR	0.37	30.9	C		0.22	22.5	C		0.12	20.6	C	
	NB Overall (N. Nash St.)			**30.9**	**C**	**Pass**		**22.5**	**C**	**Pass**		**20.6**	**C**	**Pass**
	SB (N. Nash St.)	L	0.31	29.3	C		0.11	22.9	C		0.16	20.0	C	
	SB (N. Nash St.)	T	0.05	25.5	C		0.12	22.7	C		0.03	18.4	B	
	SB Overall (N. Nash St.)			**28.5**	**C**	**Pass**		**22.8**	**C**	**Pass**		**19.7**	**B**	**Pass**
	Overall		**0.65**	**16.0**	**B**	**Pass**	**0.37**	**15.4**	**B**	**Pass**	**0.30**	**14.7**	**B**	**Pass**
7	**Lee Hwy. EB & N. Fort Myer Dr. (Signalized)** [a]													
	EB (Lee Hwy. EB)	TR	0.77	6.8	A		0.61	14.6	B		0.45	7.6	A	
	EB Overall (Lee Hwy. EB)			**6.8**	**A**	**Pass**		**14.6**	**B**	**Pass**		**7.6**	**A**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.56	8.3	A		0.58	3.5	A		0.34	2.2	A	
	SB (N. Fort Myer Dr.)	LT	0.61	13.6	B		0.59	6.9	A		0.38	10.3	B	
	SB Overall (N. Fort Myer Dr.)			**12.3**	**B**	**Pass**		**6.1**	**A**	**Pass**		**8.3**	**A**	**Pass**
	Overall		**0.72**	**8.7**	**A**	**Pass**	**0.60**	**9.6**	**A**	**Pass**	**0.42**	**7.9**	**A**	**Pass**
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized)** [a]													
	EB (Lee Hwy. EB/I-66 On-ramp)	L	0.75	11.7	B		0.73	18.5	B		0.43	10.6	B	
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	0.76	9.7	A		0.74	16.3	B		0.44	10.2	B	
	EB Overall (Lee Hwy. EB/I-66 On-ramp)			**10.4**	**B**	**Pass**		**17.0**	**B**	**Pass**		**10.3**	**B**	**Pass**
	NB (N. Lynn St.)	T	0.82	14.9	B		0.71	9.8	A		0.48	8.3	A	
	NB (N. Lynn St.)	R	0.33	7.2	A		0.69	12.5	B		0.09	2.4	A	
	NB Overall (N. Lynn St.)			**14.2**	**B**	**Pass**		**10.3**	**B**	**Pass**		**7.8**	**A**	**Pass**
	Overall		**0.78**	**12.2**	**B**	**Pass**	**0.73**	**13.5**	**B**	**Pass**	**0.45**	**9.1**	**A**	**Pass**
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)** [a]													
	EB (N. 19th St.)	TR	0.40	19.9	B		0.31	18.1	B		0.56	38.6	D	
	EB Overall (N. 19th St.)			**19.9**	**B**	**Pass**		**18.1**	**B**	**Pass**		**38.6**	**D**	**Pass**
	WB (N. 19th St.)	LT	0.29	8.7	A		0.37	16.0	B		0.43	15.8	B	
	WB Overall (N. 19th St.)			**8.7**	**A**	**Pass**		**16.0**	**B**	**Pass**		**15.8**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.38	10.4	B		0.17	12.5	B		0.06	2.4	A	
	SB (N. Fort Myer Dr.)	TR	0.47	10.0	A		0.56	13.6	B		0.21	2.4	A	
	SB Overall (N. Fort Myer Dr.)			**10.1**	**B**	**Pass**		**13.4**	**B**	**Pass**		**2.4**	**A**	**Pass**
	Overall		**0.44**	**12.1**	**B**	**Pass**	**0.46**	**14.7**	**B**	**Pass**	**0.27**	**12.1**	**B**	**Pass**

TABLE 6-4. ALTERNATIVE A ALL PEAK HOUR OPERATIONS ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	AM Peak Hour				PM Peak Hour				Saturday Peak Hour			
			V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check	V/C Ratio	Delay (sec/ veh)	LOS	Check
10	**N. 19th St. & N. Moore St. (Signalized)** [a]													
	EB (N. 19th St.)	L	0.10	6.6	A		0.03	10.7	B		0.05	3.3	A	
	EB (N. 19th St.)	TR	0.27	6.9	A		0.18	9.3	A		0.12	3.5	A	
	EB Overall (N. 19th St.)			**6.9**	**A**	**Pass**		**9.3**	**A**	**Pass**		**3.4**	**A**	**Pass**
	WB (N. 19th St.)	LTR	0.39	13.5	B		0.30	4.8	A		0.12	12.2	B	
	WB Overall (N. 19th St.)			**13.5**	**B**	**Pass**		**4.8**	**A**	**Pass**		**12.2**	**B**	**Pass**
	SB (N. Moore St.)	LTR	0.04	21.4	C		0.07	19.6	B		0.00	21.7	C	
	SB Overall (N. Moore St.)			**21.4**	**C**	**Pass**		**19.6**	**B**	**Pass**		**21.7**	**C**	**Pass**
	Overall		**0.26**	**10.4**	**B**	**Pass**	**0.21**	**8.5**	**A**	**Pass**	**0.08**	**7.2**	**A**	**Pass**
11	**N. 19th St. & N. Lynn St. (Signalized)** [a]													
	EB (N. 19th St.)	L	0.66	37.4	D		0.69	41.4	D		0.43	19.4	B	
	EB (N. 19th St.)	T	0.29	5.0	A		0.11	8.0	A		0.07	1.2	A	
	EB Overall (N 19th St.)			**19.5**	**B**	**Pass**		**31.5**	**C**	**Pass**		**13.9**	**B**	**Pass**
	WB (N. 19th St.)	TR	0.47	31.0	C		0.47	31.1	C		0.14	26.6	C	
	WB (N. 19th St.)	R	0.45	35.2	D		0.41	33.9	C		0.06	26.1	C	
	WB Overall (N. 19th St.)			**32.3**	**C**	**Pass**		**32.0**	**C**	**Pass**		**26.5**	**C**	**Pass**
	NB (N. Lynn St.)	LT	0.78	27.7	C		0.79	28.8	C		0.45	23.3	C	
	NB (N. Lynn St.)	R	0.15	20.2	C		0.10	20.0	B		0.06	19.9	B	
	NB Overall (N. Lynn St.)			**27.3**	**C**	**Pass**		**28.5**	**C**	**Pass**		**23.1**	**C**	**Pass**
	Overall		**0.65**	**27.1**	**C**	**Pass**	**0.67**	**29.6**	**C**	**Pass**	**0.35**	**22.3**	**C**	**Pass**
12	**George Washington Memorial Parkway & Gravelly Point (TWSC)** [b]													
	WB (GWMP On-ramp)	R	0.09	23.4	C		0.19	18.6	C		0.28	16.2	C	
	WB Overall (GWMP On-ramp)			**23.4**	**C**	**Pass**		**18.6**	**C**	**Pass**		**16.2**	**C**	**Pass**

Notes:

dr = Defacto Right Lane

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LOS = Level of Service

LTR = left / through / right lanes

V/C = Volume-to-Capacity ratio

Delay is Measured in Seconds Per Vehicle.

Intersection #2 is not displayed because it is a placeholder for a future condition intersection.

Red cells denote intersections or approaches operating at unacceptable conditions.

[a] Highway Capacity Manual 2000 results (Signalized intersections)

[b] Highway Capacity Manual 2010 results (Unsignalized intersections)

6.8.7 ALTERNATIVE A QUEUING ANALYSIS – ROSSLYN STUDY AREA

Based on the Synchro™ signalized intersection analysis results, four signalized intersections experience queuing lengths that would exceed the available storage capacity. The remaining signalized intersections in the traffic study area would provide sufficient storage for the anticipated demand. The lane group within the approach that would operate under unacceptable conditions is noted in parentheses.

- Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5)
  - Westbound I-66 off-ramp (right turns) during the AM and PM peak hours
- N. 19th St. and N. Fort Myer Dr. (Intersection #9)
  - Eastbound N. 19th St. (all movements) during the AM peak hour
- N. 19th St. and N. Moore St. (Intersection #10)
  - Westbound N. 19th St. (all movements) during the AM peak hour
- N. 19th St. and N. Lynn St. (Intersection #11)
  - Eastbound N. 19th St. (left turns) during the AM, PM, and Saturday peak hours

There are no unsignalized intersections in the Rosslyn study area under alternative A.

Table 6-5 contains the results of alternative A queuing analysis for both signalized and unsignalized intersections for all periods.

TABLE 6-5. ALTERNATIVE A ALL PEAK HOUR QUEUING ANALYSIS

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized)**								
	WB (GWMP On-ramp)	LT	350	163	m198	234	m324	75	122
	SB (N. Fort Myer Dr.)	TR	1,860	250	312	393	497	147	181
3	**Lee Hwy. WB & N. Nash St. (Signalized)**								
	EB (Lee Hwy. WB)	R	410	0	0	0	0	0	0
	WB (Lee Hwy. WB)	L	125	7	m17	5	m7	1	m3
	WB (Lee Hwy. WB)	TR	400	61	93	90	112	16	28
	NB (N. Nash St.)	LT	120	37	m66	30	53	56	104
	SB (Driveway)	TR	40	6	19	10	29	12	33
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized)**								
	WB (Lee Hwy. WB)	L	230	20	m44	28	54	14	36
	WB (Lee Hwy. WB)	T	230	32	m54	135	173	47	67
	SB (N. Fort Myer Dr.)	TR	310	169	161	128	m130	16	14
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized)**								
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	670	144	207	170	231	93	134
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	250	~205	#375	163	#278	86	151
	NB (N. Lynn St.)	L	210	0	m0	0	15	0	3
	NB (N. Lynn St.)	T	210	189	208	146	179	114	132
6	**Lee Hwy. EB & N. Nash St. (Signalized)**								
	EB (Lee Hwy. EB)	LTR	2,500	297	358	147	182	121	152
	NB (N. Nash St.)	TR	640	69	126	40	88	18	55
	SB (N. Nash St.)	L	120	40	81	17	45	29	60
	SB (N. Nash St.)	T	120	9	28	31	66	8	24
7	**Lee Hwy. EB & N. Fort Myer Dr. (Signalized)**								
	EB (Lee Hwy. EB)	TR	210	84	92	95	113	39	52
	SB (N. Fort Myer Dr.)	L	220	0	0	1	m0	0	0
	SB (N. Fort Myer Dr.)	LT	220	93	113	81	100	40	51
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized)**								
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	380	112	175	193	352	83	121
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	380	121	170	206	243	92	117
	NB (N. Lynn St.)	T	330	109	142	68	88	46	56
	NB (N. Lynn St.)	R	330	6	m22	39	m57	0	3

TABLE 6-5. ALTERNATIVE A ALL PEAK HOUR QUEUING ANALYSIS (CONTINUED)

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)**								
	EB (N. 19th St.)	TR	100	83	#126	61	97	59	98
	WB (N. 19th St.)	LT	180	41	60	77	114	33	50
	SB (N. Fort Myer Dr.)	L	125	59	m83	28	m53	5	16
	SB (N. Fort Myer Dr.)	TR	440	69	83	97	132	8	24
10	**N. 19th St. & N. Moore St. (Signalized)**								
	EB (N. 19th St.)	L	75	9	20	2	m11	3	6
	EB (N. 19th St.)	TR	180	43	60	12	39	10	13
	WB (N. 19th St.)	LTR	60	73	m#94	39	m43	34	52
	SB (N. Moore St.)	LTR	260	8	21	12	30	0	0
11	**N. 19th St. & N. Lynn St. (Signalized)**								
	EB (N. 19th St.)	L	60	59	#187	114	#207	81	#140
	EB (N. 19th St.)	T	60	17	37	19	51	1	1
	WB (N. 19th St.)	TR	220	81	128	73	120	20	45
	WB (N. 19th St.)	R	175	38	116	30	106	0	14
	NB (N. Lynn St.)	LT	610	250	295	254	301	123	153
	NB (N. Lynn St.)	R	100	0	23	0	0	0	0

Notes:

~ 50th percentile volume exceeds capacity, queue is theoretically infinite.

95th percentile volume exceeds capacity, queue may be longer.

m Volume for 95th percentile queue is metered by upstream signal. Due to upstream metering, the 95th percentile queue may be less than the 50th percentile queue.

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LTR = left / through / right lanes

Intersection #2 is not displayed because it is a placeholder for a future condition intersection.

Red cells denote approaches and lane groups whose queuing length exceeds capacity.

6.8.8 ALTERNATIVE A FREEWAY ANALYSIS – GRAVELLY POINT STUDY AREA

Based on the HCS™ analysis, the GWMP did not exceed capacity for all periods studied for the segment between Reagan National Airport and Gravelly Point. Table 6-6 contains the alternative A results.

TABLE 6-6. ALTERNATIVE A GWMP NORTHBOUND OPERATIONS ANALYSIS

Freeway Segment	Facility Type	Time period	Density (pc/mi/ln)	LOS
GWMP Northbound between Reagan National Airport and Gravelly Point	Mainline	AM Peak Hour	29.8	D
		PM Peak Hour	22.6	C
		Saturday Peak Hour	16.8	B

Notes: LOS = level of service; Density = passengers cars per mile per lane (pc/mi/ln)

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7.0 ACTION ALTERNATIVES BY MODE

7.1 Description of Alternatives

Three action alternatives were assessed, two in Rosslyn and one at Gravelly Point. See section 3.0 for a general description of each alternative with a supporting graphic.

7.2 Alternative B: Lower Rosslyn Sites Alternative

This alternative would include a 14,000 SF building providing boat storage and boat repair on the river just north of the Roosevelt Island parking lot. Site access would only be available on foot, by bicycle, or transit (a 10–15 minute walk from Rosslyn Metro Station). School buses and Kiss & Rides (including taxis) would drop-off/pick-up in downtown Rosslyn at the closest safe location to be determined. For the purposes of this study, the intersection of N. Moore St. and Lee Hwy. EB was designated as the drop-off/pick-up location.

7.2.1 PEDESTRIANS

Under alternative B, a new trail would be provided between the Roosevelt Island parking lot and the boathouse. Wayfinding signs would also be provided throughout the area. Pedestrian activity in the Rosslyn study area would likely increase as a result of the lower boathouse facility, and pedestrian congestion could increase slightly at times, particularly traversing the Mt. Vernon Trail between N. Lynn St. and the Roosevelt Island parking lot, including the bridge over the GWMP. No other pedestrian impacts are anticipated from alternative B.

7.2.2 BICYCLES

Bicycle improvements proposed under alternative B would include wayfinding signs throughout the area and bicycle racks at the boathouse facility. Similar to the description for pedestrians in section 7.2.1, bicyclist activity in the Rosslyn study area and vicinity would likely increase, and bicycle congestion could slightly increase at times along the Mt. Vernon Trail between N. Lynn St. and the Roosevelt Island parking lot, including traversing the bridge over the GWMP.

7.2.3 TRANSIT

Under alternative B, transit use would increase slightly as a result of patrons destined to the boathouse facility; however, transit should not be adversely affected. Alternative B would have a minimal increase in traffic in the area, resulting in minimal delays to Metrobus, ART, and DC Circulator bus service. However, it is likely that bus routes, scheduling, and stop locations would be planned and updated, as conditions require, which could result in potential new bus routes and changes in existing bus routes as operators periodically adjust them (e.g., WMATA's Metrobus Service Change program).

Additionally, no change to regional commuter bus service is anticipated beyond routine route and schedule adjustments. Carsharing options may change over time, depending on decisions made by the individual vendors.

7.2.4 TRUCKS AND BUSES

This section discusses project area access for emergency vehicles and buses and loading within the project area.

7.2.4.1 Project Area Access – Emergency Vehicles

Under alternative B, fire trucks and ambulances would need to park on the GWMP just west of the lower boat facility to access to the facility. The site plan also proposes a possible emergency vehicle route that would connect the Roosevelt Island parking lot to the lower boat facility. The route would create a corridor along the river edge, east of the existing pedestrian bridge that carries the Mt. Vernon Trail over the GWMP to avoid affecting the bridge. The upper support facility would be accessible by the proposed driveway along N. Lynn St. between Lee Hwy. WB and the Key Bridge.

7.2.4.2 Project Area Access – Buses

Under alternative B, buses would not be able to directly access the lower boat facility but would be directed in the near-term to use a general loading/unloading area along a Lee Hwy. EB service road between N. Fort Myer Dr. and N. Lynn St. In the long-term, once these roadways are eliminated as a result of proposed future development, buses would be directed to 1701 N. Kent St., the existing LCT commuter bus stop. Discussions between NPS and Arlington County regarding the best place for a boathouse pick-up/drop-off location should occur. The details of using these areas are further described in section 7.3.6.5.

7.2.4.3 Project Area Loading

Under alternative B, boats would be launched from several other locations, including Riverside Park, Collingwood picnic area, and Roaches Run in Virginia but would not unload/load in Rosslyn. Loading and unloading boats from trailers would be prohibited along the GWMP and at the Roosevelt Island parking area.

7.2.5 PARKING

No new parking would be provided under alternative B; however, a few spaces in the northern part of the Roosevelt Island parking lot would need to be converted for ADA and NPS service vehicle parking. These spaces would serve the proposed new boathouse. All other parking needs would need to use downtown Rosslyn options. No other parking impacts are anticipated as a result of alternative B.

7.2.6 TRAFFIC

Both alternatives B and C are almost identical in their traffic evaluation; therefore, the full traffic evaluation is described under alternative C because that alternative would represent a slightly worse condition.

The traffic impacts assessed under alternative C (section 7.2.6) would follow the same analysis process and contain very similar results as this alternative. There would be a minor difference in the operations analysis because the boathouse driveway is not included in this alternative. The removal of the driveway would improve vehicle operations at the intersection of N. Fort Myer Dr. and the GWMP on-ramp (intersection #1) by 1 second per vehicle.

7.2.7 DISCUSSION OF ALTERNATIVE B

Alternative B is evaluated for pedestrian, bicycle, transit, truck, parking, and traffic impacts. Under alternative B, the proposed boathouse facility would introduce a new pedestrian connection between the Roosevelt Island parking lot and the boathouse. This action, in addition to attracting new person trips to the area by the boathouse facilities, would slightly increase pedestrian and bicycle volumes along the Mt. Vernon Trail. Based on the forecasted boathouse person trip generation covering both alternatives B and C, AM, PM, and Saturday peak hour new person trips (bicycle and pedestrian combined) would be 196, 305, and 272, respectively, added to the existing Mt. Vernon Trail bicycle and pedestrian volumes.

Similar to alternative C, transit and vehicle use would increase slightly. Based on the AM, PM, and Saturday peak hour traffic assessment under alternative C, the same for alternative B, there would be no impacts to the Rosslyn area study intersections. Parking demand in downtown Rosslyn would increase to serve the vehicle trips, but plenty of on- and off-street parking options would be available.

7.3 Alternative C: Upper and Lower Rosslyn Sites Alternative

This alternative would include a 14,000 SF building to provide boat storage and boat repair on the river just north of the Roosevelt Island parking lot. Site access would be provided on foot or by bicycle only. Emergency vehicle access would be provided only from Roosevelt Island parking lot.

A second 8,000 SF building, on the west side of the GWMP, would contain amenities to support the boathouse. A driveway would connect the building to N. Lynn St. and would only allow access for ADA spaces and NPS service vehicles. All other vehicles would be prohibited from using the driveway. The driveway would connect to N. Lynn St. between Lee Hwy. WB and the ramp to GWMP northbound. Site access would be primarily on foot, by bicycle, or transit (a 10-minute walk from the Rosslyn Metro Station). Parking would be available on-street in Rosslyn or off-street through existing Rosslyn garages. Figure 7-1 shows the alternative C lane geometry.

7.3.1 PEDESTRIANS

Under alternative C, the upper support facility would be accessible from N. Lynn St. via an existing unmaintained driveway between Lee Hwy. WB and the ramp to GWMP northbound that would be improved to provide shared pedestrian, bicycles, and motor vehicle use in conjunction with development of the support facility. The driveway would accommodate ADA parking and NPS service vehicles only, thus limiting the volume of vehicles entering and existing the driveway and providing safe access for pedestrians and bicyclists. A new trail would be provided between the Roosevelt Island parking lot and boathouse. Wayfinding signs would also be provided throughout the area. Access points between the Mt. Vernon Trail and upper support facility would be provided to connect the upper support site to the boathouse along the river.

The new multimodal driveway serving the upper boat facility would have a minimal impact on pedestrians using the sidewalk along the east side of N. Lynn St. Pedestrian activity in the Rosslyn study area would likely increase as a result of the lower boathouse facility, and pedestrian congestion could increase slightly at times, particularly traversing the Mt. Vernon Trail between N. Lynn St. and the Roosevelt Island parking lot, including the bridge over the GWMP. No other pedestrian impacts are anticipated as a result of alternative C.

7.3.2 BICYCLES

Bicycle improvements proposed under alternative C would include wayfinding signs throughout the area and bicycle racks at the boathouse facilities. Similar to the description for pedestrians in section 7.3.1, bicyclist activity in the Rosslyn study area and vicinity would likely increase because of the boathouse facilities, and bicycle congestion along the Mt. Vernon Trail between N. Lynn St. and Roosevelt Island parking lot, including traversing the bridge over the GWMP.

FIGURE 7-1. ALTERNATIVE C LANE GEOMETRY

7.3.3 TRANSIT

Transit conditions would be the same as those described under alternative B.

7.3.4 TRUCKS AND BUSES

This section discusses project area access for emergency vehicles and buses and loading in the project area.

7.3.4.1 Project Area Access – Emergency Vehicles

Similar to alternative B, fire trucks and ambulances would need to park on the GWMP just west of the lower boat facility to access the facility. The upper support facility would be accessible by the proposed driveway along N. Lynn St. between Lee Hwy. WB and the Key Bridge.

7.3.4.2 Project Area Access – Buses

Under alternative C, buses would not be able to access either the upper support or lower boat facility directly, but would be directed in the near-term to use a general loading/unloading area along a Lee Hwy. EB service road between N. Fort Myer Dr. and N. Lynn St. In the long-term, once these roadways are eliminated as a result of proposed future development, buses would be directed to 1701 N. Kent St., the existing LCT commuter bus stop. Discussions between NPS and Arlington County regarding the best place for a boathouse pick-up/drop-off location should occur. The details of using this area are further described in section 7.3.6.5.

7.3.4.3 Project Area Loading

Boat loading would be the same as described under alternative B.

7.3.5 PARKING

Under alternative C, a minimal number of parking spaces would be provided at the upper support facility to serve ADA and NPS service vehicles. No other new parking is proposed under alternative C. Patrons of the boat facility using personal vehicles would be prohibited from using the parking lot at Roosevelt Island and encouraged to use public parking options in downtown Rosslyn. Roosevelt Island is a popular outdoor attraction and the parking lot is consistently at or near full capacity during the weekend; therefore, any increase in traffic would have a negative impact and exacerbate existing congestion. During weekdays, however, the parking lot is less used (see section 4.8.3), although vehicles would still be prohibited from using the parking lot and encouraged to use public parking options in downtown Rosslyn. Moreover, existing public parking options in downtown Rosslyn would likely be able to accommodate an increase in parking demand by patrons of the boat facility. No other parking impacts are anticipated as a result of alternative C.

7.3.6 TRAFFIC

The following section describes the process for analyzing traffic under alternative C and the results of the analysis. Note that the procedures to forecast future traffic volumes throughout the study include rounding; therefore, values may not add up to the precise value indicated. All facilities (intersections and freeways) were evaluated based on a peak hour factor of 0.92 or higher (ratio of the 60-minute volume divided by 4 times the highest 15-minute volume), the lowest accepted peak hour factor by VDOT's *Traffic Impact Analysis Regulations* (VDOT 2012).

The process to evaluate traffic impacts first covers trip generation, followed by modal split, trip distribution, and trip assignment. The section concludes with the results of the traffic analysis.

7.3.6.1 Proposed Alternative C Traffic Network

The proposed boathouse would be situated along the Mt. Vernon Trail and include two facilities, both accessible from the trail. A planned boathouse driveway would connect N. Lynn St. to the upper boathouse but would be restricted to NPS service vehicles and users requiring ADA parking spaces. All

other users accessing the boathouse facilities by vehicle would need to park in downtown Rosslyn on the street or in one of the off-street parking facilities. Because most of the on-street parking spaces near the access point to the Mt. Vernon Trail have a two-hour parking limit, most boathouse users would likely choose to the park their vehicles in an off-street parking garage along N. Moore St. and walk along Lee Hwy. EB to N. Lynn St. to access the boathouse driveway entrance. Given the proposed location of the boathouse driveway along N. Lynn St., signs would be posted in the immediate area near the proposed driveway to alert motorists that no loading or unloading of passengers would be permitted.

7.3.6.2 Trip Generation

Custom trip generations were calculated for the different proposed boathouse users. These include athletes from the area high schools in Virginia and universities (George Mason and Marymount Universities), public use (users with their own boats and privately stored at a future boathouse), and recreational public rentals. A separate analysis covered the AM peak hour and PM weekday peak hour to represent early morning and late afternoon rowing demand, as well as a Saturday peak hour analysis to represent the private use and recreational rental demand.

Alternative C boathouse trip generation would be composed of 14,000 SF of boathouse development. The primary assumption is that the available space would be divided evenly between athletic use, rental use, and private (storage and personal boats) or one-third of the total square footage divided among the three user groups. Table 7-1 lists the user groups.

TABLE 7-1. ALTERNATIVE C USER GROUPS

Users	Description
Athletic	4,667 SF
Rental	4,667 SF
Private	4,666 SF
Total	14,000 SF

Rental User Group. The primary source for trip generation is a customer turnover summary table provided by Key Bridge Boathouse (table 7-2), an existing boat rental facility located on Water Street NW in Georgetown across the Potomac River from Rosslyn. The customer use summary contains the percentage of customer turnover by hour and grouped by weekday and weekends/holidays between April 1, 2015, and July 31, 2015. Based on the data, the AM peak hour maximum percentage of turnover was 5% (representing those arriving at the tail end of the AM rush), the PM peak hour maximum percentage was 12% (representing those arriving at the tail end of the PM rush), and the Saturday peak hour maximum percentage was 13%. Table 7-2 contains the customer turnover summary.

Based on the average total number of weekday and weekend customers equating to 391 and 1,842, respectively, and the total area of the Key Bridge Boathouse parcel (no building within project area) listed as 9,391 SF in the DC parcel Geographic Information Systems layer, the AM, PM, and Saturday peak trip generation rates were calculated as follows:

AM Trip Rate: (391 [customers] * 5% [peak customer turnover]) / 9,391 SF = 0.00208/SF

PM Trip Rate: (391 [customers] * 12% [peak customer turnover]) / 9,391 SF = 0.005/SF

Saturday Trip Rate: (1,842 [customers] * 13% [peak customer turnover]) / 9,391 SF = 0.0255/SF

The total trips were calculated by multiplying the trip rates by the proposed future rental user square feet or 4,667 SF (one-third of 14,000). This resulted in 10 AM peak hour, 23 PM peak hour, and 119 Saturday peak hour trips. To be conservative, these trips were considered the total inbound trips and the same

number of trips were applied for outbound trips. Therefore, there would be a total of 20 AM peak hour, 46 PM peak hour, and 238 Saturday peak hour trips; all would have a 50/50 entering and exiting split.

TABLE 7-2. KEY BRIDGE BOATHOUSE CUSTOMER TURNOVER APRIL THROUGH JULY 2015

Time of Day	All Days	Weekdays	Weekends/Holidays
8:00 a.m. – 8:59 a.m.	1%	0%	1%
9:00 a.m. – 9:59 a.m.	3%	1%	3%
10:00 a.m. – 10:59 a.m.	6%	**5%**	6%
11:00 a.m. – 11:59 a.m.	9%	9%	9%
12:00 PM – 12:59 PM	11%	10%	11%
1:00 p.m. – 1:59 p.m.	12%	11%	12%
2:00 p.m. – 2:59 p.m.	12%	11%	13%
3:00 p.m. – 3:59 p.m.	13%	12%	**13%**
4:00 p.m. – 4:59 p.m.	11%	10%	12%
5:00 p.m. – 5:59 p.m.	9%	11%	9%
6:00 p.m. – 6:59 p.m.	8%	**12%**	6%
7:00 p.m. – 7:59 p.m.	5%	8%	3%
8:00 p.m. – 8:59 p.m.	0%	1%	0%
Number of Days Counted:	98	67	31

Athlete User Group. TBC, a multi-purpose boathouse facility serving athletic and private use at the western end of Georgetown near Rock Creek Parkway, currently serves the majority of athletes. Approximately 1,210 athletes use TBC on a daily basis during the week, 930 high school athletes and 280 university athletes. Twelve high schools use the 17,410 SF facility, resulting in an average of 78 athletes per high school. Only two universities use TBC, resulting in an average of 140 athletes per university. A representative from TBC indicated that 45% of athletic users use the facility during the morning and 55% use the facility during the afternoon. Therefore, the AM peak hour and PM peak hour trip generation rates were calculated as follows:

AM Trip Rate: (1,210 [athletes] * 45% [AM percent of users]) / 17,410 SF = 0.031275/SF

PM Trip Rate: (1,210 [athletes] * 55% [PM percent of users]) / 17,410 SF = 0.038225/SF

The total trips were calculated by multiplying the trip rates by the proposed future athletic user square feet or 4,667 SF (one-third of 14,000). Since the average number of athletes per high school is 78 athletes, the initial trips were adjusted to equate to the next highest number divisible by 78 (to reflect the need to have the whole school program participate). This calculation resulted in 156 AM peak hour and 234 PM peak hour trips, respectively. To be conservative, all AM trips were assumed to be departing (athletes arrive early in the morning to practice) and PM trips were arriving (athletes arrive around 4:00 PM each day).

Private User Group (Store Boat at Boathouse). The ITE *Trip Generation Manual* land use code 420 (marina) was used to calculate trips because this code most closely aligns with a person who owns a boat and stores it at a boat storage facility (ITE 2012). The ITE 420 unit of measure is berths; therefore, the number of racks capable of storing a kayak was used. According to the *Georgetown Non-Motorized Boathouse Zone Transportation Study*, a 2,700 SF site was planned to store 64 kayaks resulting in 42 SF per boat (Louis Berger 2016). This measure equates to 111 racks based on 42 SF per boat divided into the future private user space or 4,667 total SF (one-third of the total 14,000 SF). The ITE value was adjusted to person trips by multiplying the average vehicle occupancy from the National Household Travel Survey

or 2.20 (Federal Highway Administration 2011). Table 7-3 provides a summary of the ITE-based vehicle trips and person trips.

TABLE 7-3. PRIVATE USERS STORE AT BOATHOUSE: ITE FORECASTED TRIPS

Source	Independent Variable	Trip Type	Time Period	IN	OUT	Total Trips
ITE Land Use Code 420	111 racks (berths)	**ITE vehicle trips**	AM Peak Hour	12	7	19
			PM Peak Hour	12	11	23
			Saturday Peak	13	17	30
		Person trips (2.20 average vehicle occupancy)*	AM Peak Hour	13	8	21
			PM Peak Hour	13	13	26
			Saturday Peak	15	19	34

*Average vehicle occupancy obtained from the 2009 National Household Travel Survey (Federal Highway Administration 2011)

Private User Group (Bring Own Boat). The proposed boathouse location would not include a place to load or unload boat trailers; therefore, all private users who wish to store their boats in the facility would be required to launch their boat from another location and paddle to the boathouse to store it. The details regarding storage duration would need to be worked out between the operator and NPS.

Summary of all User Groups. All user groups were combined to develop a total forecasted trip generation. Based on the assumptions, 196 and 305 total AM and PM peak hour person trips, respectively, would be generated. On a typical Saturday, 272 person trips would be generated during the afternoon peak hour. Table 7-4 contains a weekday peak hour summary of all user groups' trip generation results. Table 7-5 contains a Saturday peak hour summary of all trip generation results by user group.

TABLE 7-4. WEEKDAY AM AND PM PEAK HOUR TRIP GENERATION BY USER GROUP

User	Independent Variable	Time Period	IN	OUT	TOTAL
Rental	Square footage of facility (4,667 SF)	**AM Peak**	10	10	20
		PM Peak	23	23	46
Athlete	Number of athletes	**AM Peak**	0	156	156
		PM Peak	234	0	234
Private User (Store at Boathouse)	Number of boat storage racks (ITE 420)	**AM Peak**	13	8	21
		PM Peak	13	13	26
Private User (Bring own Boat)	Parking spaces and temporary storage lockers	**AM Peak**			
		PM Peak			
TOTAL		**AM Peak**	23	173	196
		PM Peak	269	36	305

TABLE 7-5. SATURDAY PEAK HOUR TRIP GENERATION BY USER GROUP

Source	Independent Variable	IN	OUT	TOTAL
Rental	Square footage of facility (4,667 SF)	119	119	238
Athlete	Number of athletes	N/A	N/A	N/A
Private User (Store at Boathouse)	Number of boat storage racks (ITE 420)	15	19	34
Private User (Bring own Boat)	Parking spaces and temporary storage lockers			
TOTAL		134	138	272

7.3.6.3 Modal Split

Key Bridge Boathouse conducted modal split surveys on a weekday and weekend day as customers arrived at the facility. These surveys provided the modal split for the rental user group. Because weekday and weekend modal splits differed, the two periods were assigned different modal splits. As a comparison, the WMATA *2005 Development-Related Ridership Survey* provides a modal split for an entertainment destination (closest land use to proposed facilities) located approximately half mile from the nearest Metrorail station (the Rosslyn Metro Station is approximately 0.75 mile from the Georgetown Waterfront) (WMATA 2005). Other sources of modal split data, such as the census, were not relevant to recreational activities.

A representative from TBC indicated that 75% of athletic user trips were by school bus, 20% were by vehicle (mostly upperclassmen with drivers' licenses), and the remaining were by bicycle. TBC reached out to 18 of its private members to inquire about modal split; more than 89% indicated that they drove to TBC to access their boat. The remaining 10% was split between walking and bicycling. Table 7-6 summarizes the modal split research.

TABLE 7-6. MODAL SPLIT SUMMARY FOR ALL USER GROUPS – ALTERNATIVE C

Mode Share	Boat Rentals		Athletes				Private Use: Store at Boathouse		
	Weekday		Saturday		Weekday		All Times	Weekday	Saturday
	Percent	Trips (AM/PM)	Percent	Trips	Percent	Trips (AM/PM)	Percent	Trips (AM/PM)	
Vehicle	2.7%	1/1	2.1%	5	20%	31/47	90%	19/23	31
Carpool	79.2%	16/36	62.9%	150	0%	0/0	0%	0/0	0
Taxi	0.0%	0/0	7.3%	17	0%	0/0	0%	0/0	0
Bicycle	2.7%	1/1	6.0%	14	5%	8/12	5%	1/1	2
Walk	9.9%	2/5	10.7%	25	0%	0/0	5%	1/1	2
Metro	2.2%	0/1	3.9%	9	0%	0/0	0%	0/0	0
Bus	3.3%	1/2	7.1%	17	75%	117/176	0%	0/0	0
TOTAL	100%	20/46	100%	238	100%	156/234	100%	21/26	34

After applying the modal split results to the person trip generation, the number of vehicle trips were calculated by user group. Sixty vehicle trips would be generated during the AM peak hour and 93 vehicle trips during the PM peak hour. Table 7-7 contains the weekday forecasted vehicle trips generated by user

group. On a typical Saturday, 92 vehicles trips would be generated during the afternoon peak hour. Table 7-8 contains the Saturday forecasted vehicle trips by user group.

TABLE 7-7. WEEKDAY VEHICLE TRIPS BY USER GROUP – ALTERNATIVE C

User	Independent Variable	Time Period	IN	OUT	TOTAL
Rental	Square footage of facility (4,667 SF)	**AM Peak**	3	3	6
		PM Peak	8	8	16
Athlete	Number of athletes	**AM Peak**	0	36	89
		PM Peak	53	0	106
Private User (Store at Boathouse)	Number of boat storage racks (ITE 420)	**AM Peak**	12	7	19
		PM Peak	12	12	24
Private User (Bring own Boat)	Parking spaces and temporary storage lockers	**AM Peak**			
		PM Peak			
TOTAL		**AM Peak**	15	45	60
		PM Peak	73	20	93

TABLE 7-8. SATURDAY VEHICLE TRIPS BY USER GROUP – ALTERNATIVE C

Source	Independent Variable	IN	OUT	TOTAL
Rental	Square footage of facility (4,667 SF)	31	31	62
Athlete	Number of athletes	N/A	N/A	N/A
Private User (Store at Boathouse)	Number of boat storage racks (ITE 420)	13	17	30
Private User (Bring own Boat)	Parking spaces and temporary storage lockers			
TOTAL		44	48	92

7.3.6.4 Trip Distribution

Trip distribution represents the origin-destination pattern by percentage for trips generated by each user group to/from points beyond the study area boundary (e.g., 39% of trips destined to Georgetown or 30% of trips destined to Lee Hwy. WB). This process totals 100%. Vehicle trips were assigned routes to and from the study area boundary to N. Moore St., the location of the closest off-street parking garages to the boathouse.

Trip distribution was developed differently for each user group. For the rental use group, an 18,000 plus log file was obtained from Key Bridge Boathouse that contained all the zip codes for each group renting a boat at the facility. Each log represented an individual or group of individuals boating together. Zip codes covering an area similar to the MWCOG travel demand model were selected to develop distribution zones based on geographic relation to the primary roadway network access from downtown Rosslyn and the MWCOG travel demand model boundary (approximately an 80-mile range). The total number of rental groups were totaled by the distribution zone to create a list of the total number of rental groups by distribution zone. Because I-66 has restrictions on who can use the roadway depending on the number of people per vehicle by time of day, AM, PM, and Saturday distribution patterns were developed separately. No data were available describing the origins of the private user group; therefore, the private user group was assumed to have the same distribution as the rental user group. Tables 7-9, 7-10, and 7-11 provide a rental/private use group trip distribution summary for the AM, PM, and Saturday peak hours,

respectively. Figures 7-2, 7-3, and 7-4 show the rental/private user group AM, PM, and Saturday trip distributions, respectively.

TABLE 7-9. RENTAL/PRIVATE USER GROUP AM PEAK HOUR TRIP DISTRIBUTION

	Inbound		Outbound	
Destination	Route	Percent	Route	Percent
DC and Points East	Lee Hwy. EB	18%	Lee Hwy. EB	18%
Virginia Points West	Lee Hwy. WB	15%	Lee Hwy. WB	30%
Georgetown	Key Bridge	39%	Key Bridge	39%
US Route 50	N. Lynn St.	28%	N. Fort Myer Dr.	0%
GWMP			GWMP On-ramp	13%
		100%		100%

TABLE 7-10. RENTAL/PRIVATE USER GROUP PM PEAK HOUR TRIP DISTRIBUTION

	Inbound		Outbound	
Destination	Route	Percent	Route	Percent
DC and Points East	Lee Hwy. EB	18%	Lee Hwy. EB	18%
Virginia Points West	Lee Hwy. WB	30%	Lee Hwy. WB	15%
Georgetown	Key Bridge	39%	Key Bridge	39%
US Route 50	N. Lynn St.	13%	N. Fort Myer Dr.	15%
GWMP			GWMP On-ramp	13%
		100%		100%

TABLE 7-11. RENTAL/PRIVATE USER GROUP SATURDAY PEAK HOUR TRIP DISTRIBUTION

	Inbound		Outbound	
Destination	Route	Percent	Route	Percent
DC and Points East	Lee Hwy. EB	18%	Lee Hwy. EB	18%
Virginia Points West	Lee Hwy. WB	30%	Lee Hwy. WB	30%
Georgetown	Key Bridge	39%	Key Bridge	39%
US Route 50	N. Lynn St.	13%	N. Fort Myer Dr.	0%
GWMP			GWMP On-ramp	13%
		100%		100%

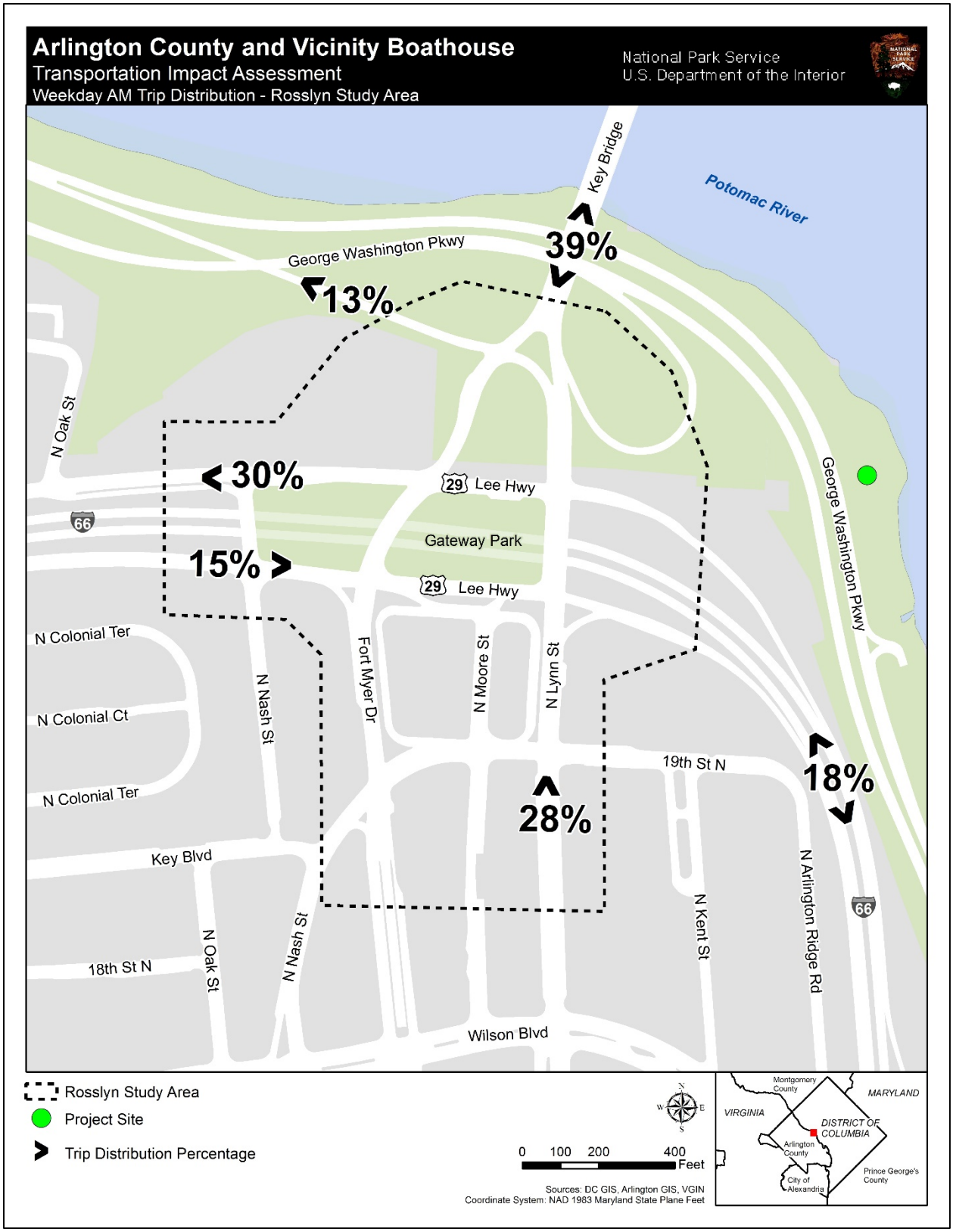


FIGURE 7-2. ALTERNATIVE C WEEKDAY AM TRIP DISTRIBUTION

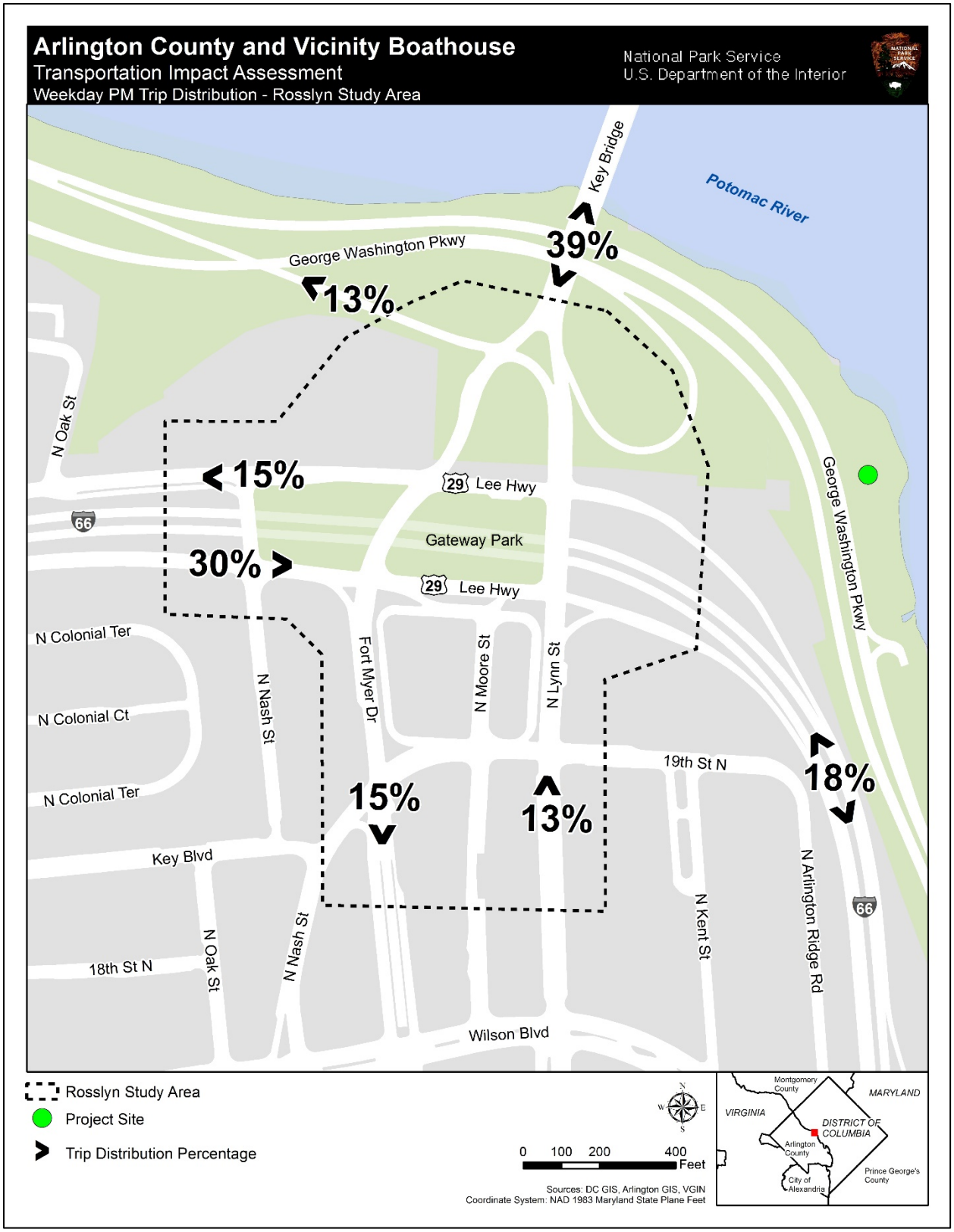


FIGURE 7-3. ALTERNATIVE C WEEKDAY PM TRIP DISTRIBUTION

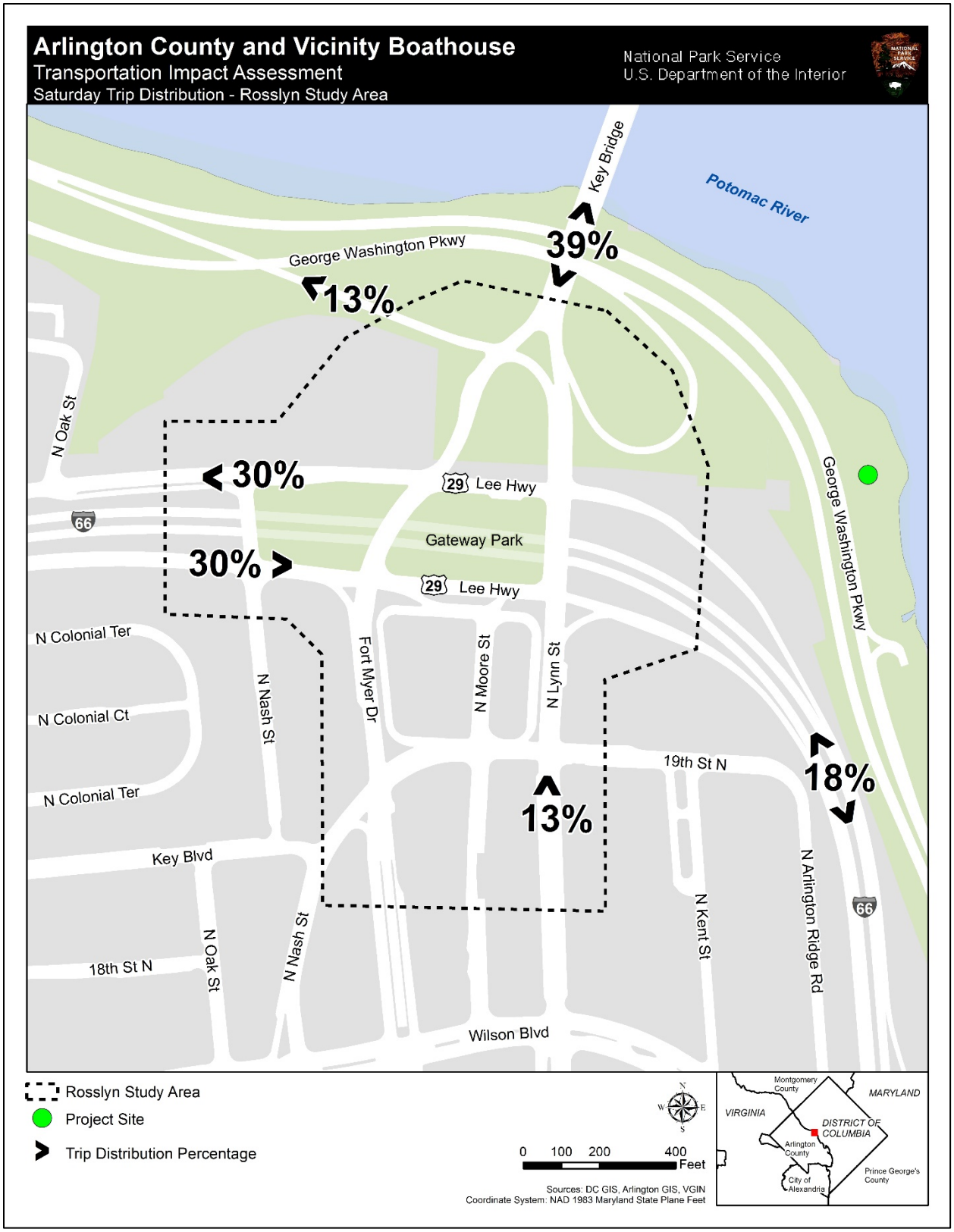


FIGURE 7-4. ALTERNATIVE C SATURDAY TRIP DISTRIBUTION

Based on the location of the three Arlington County public high schools, all with crew teams, and one private school in Arlington with a crew team, three of the four schools are situated near Lee Hwy. The other school is near Route 50. Therefore, 75% of the trips were assigned to Lee Hwy. from the west and 25% were assigned to US Route 50 from the west. The Route 50 trips were assigned to N. Lynn St. from the south and N. Fort Myer Dr. to the south. N. Lynn St. and N. Fort Myer Dr. are north-south one-way street pairs that connect to Route 50.

7.3.6.5 Trip Assignment

Vehicle trips whether by person vehicle, school bus, or taxi would not be permitted to park along the proposed driveway connecting to N. Lynn St. Signs and information provided through the boathouse website would direct personal vehicle trips to park in downtown Rosslyn at on-street metered spaces or at a Rosslyn garage. Because the closest public parking garage is located on N. Moore St. between N. 19th St. and Lee Hwy. EB, the traffic modeling assigned this location as the personal vehicle destination. A service roadway parallels Lee Hwy. EB between N. Fort Myer Dr. and N. Lynn St. that offers about 190 feet of parking spaces for taxi pick-up/drop-off on a portion of the service roadway west of N. Moore St.

In the near-term, school buses carrying Arlington high school teams could also use this parallel service roadway to pick-up/drop-off crew teams. There is a bus stop along this parallel roadway at the northwest corner of N. Moore St. If this area would conflict with other buses already serving this stop, about 120 feet of parking spaces along the same roadway but around the corner past the cycle track parallel to N. Lynn St. along the right side could provide an alternative location. Because the buses would only be present early in the morning or late in the afternoon, these metered parking spaces could be open for public use at all other times and restricted during peak hours. In the long-term, once the parallel roadway to Lee Hwy. EB is removed as a result of future planned development, 1401 N. Kent St, (an existing commuter bus stop) could be used as a pick-up/drop-off location. Discussions regarding the best place for a boathouse pick-up/drop-off location should occur between NPS and Arlington County.

The proposed driveway connecting to N. Lynn St. would be used by person vehicles seeking ADA spaces and NPS service vehicles. To account for a small limited use, the traffic model incorporated five trips entering and five trips exiting during each peak hour modeled. This provides an indication of how the unsignalized intersection would operate given its limited vehicle attraction.

Figure 7-5 illustrates the proposed bus and taxi pick-up/drop-off locations as well as the modeled person vehicle destinations along N. Moore St.

Figures 7-6 and 7-7 show all alternative C vehicle trips for all user groups (rental/private and athletic users) for weekday AM and PM peak hours and Saturday peak hours, respectively. Figures 7-8 and 7-9 show the full alternative C turning movement volumes for weekday AM and PM peak hours and Saturday peak hours, respectively.

FIGURE 7-5. PROPOSED PICK-UP/DROP-OFF AREAS IN DOWNTOWN ROSSLYN AND PERSONAL VEHICLE DESTINATION

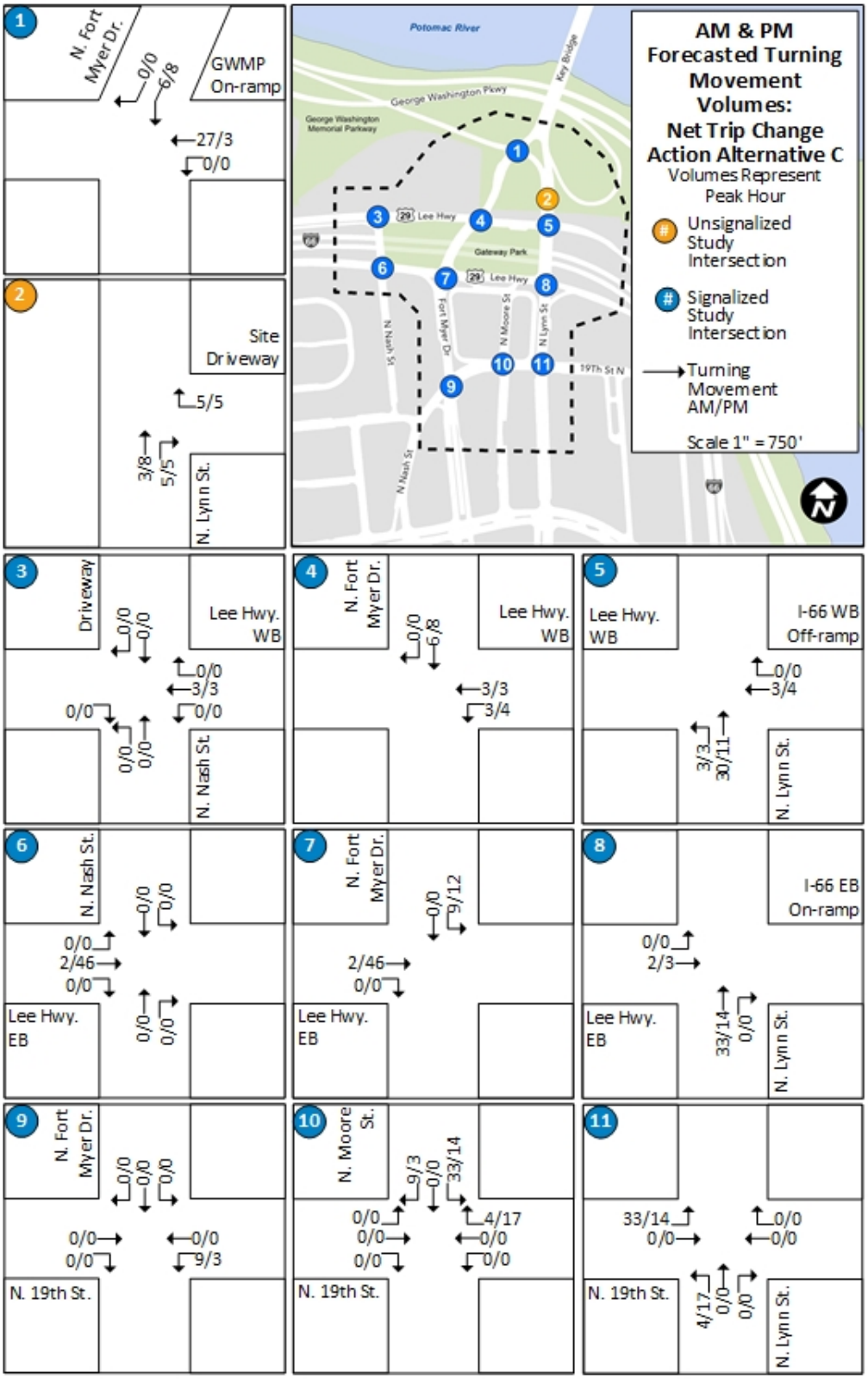


FIGURE 7-6. ALTERNATIVE C WEEKDAY AM AND PM VEHICLE TRIPS GENERATED

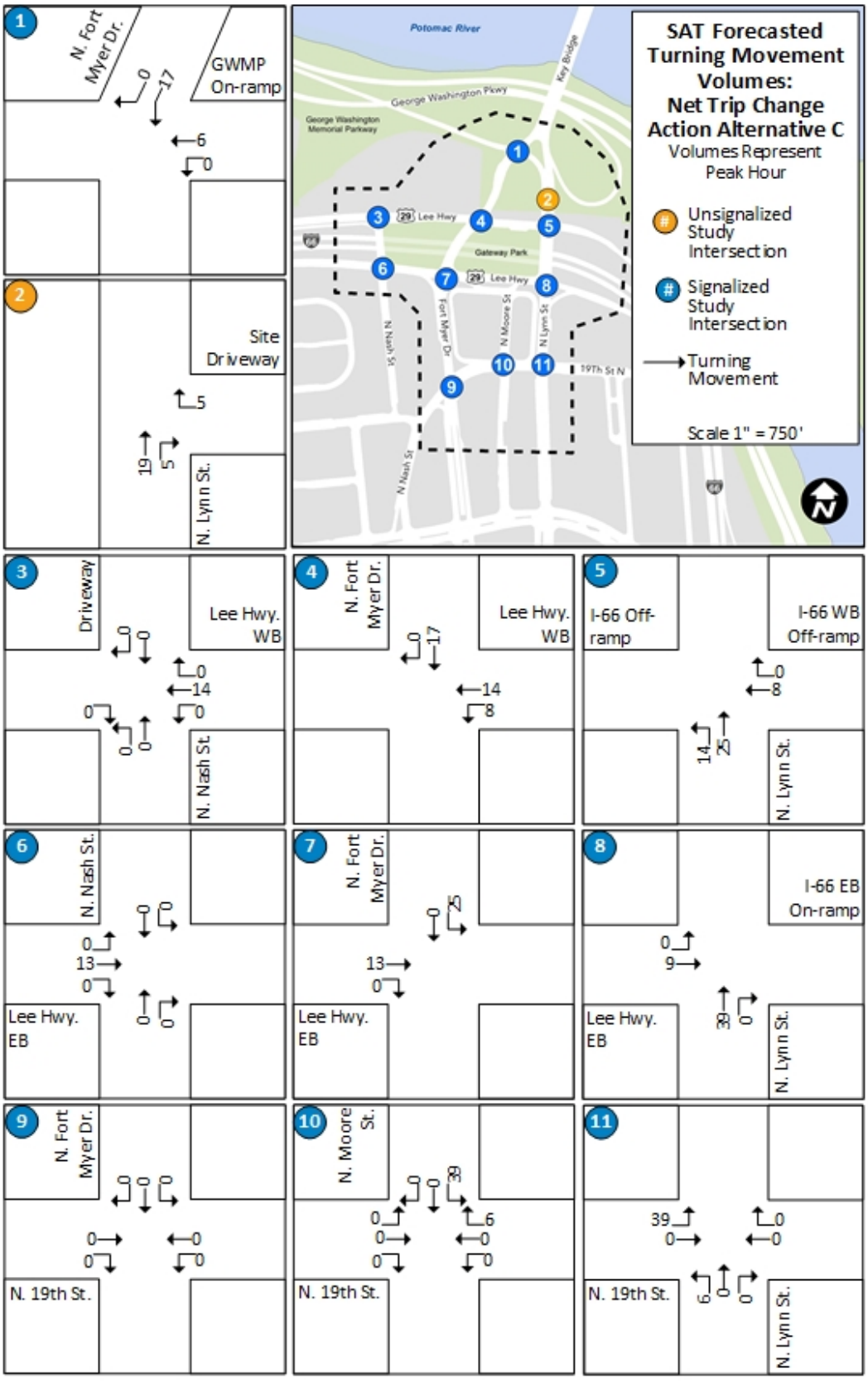


FIGURE 7-7. ALTERNATIVE C SATURDAY VEHICLE TRIPS GENERATED

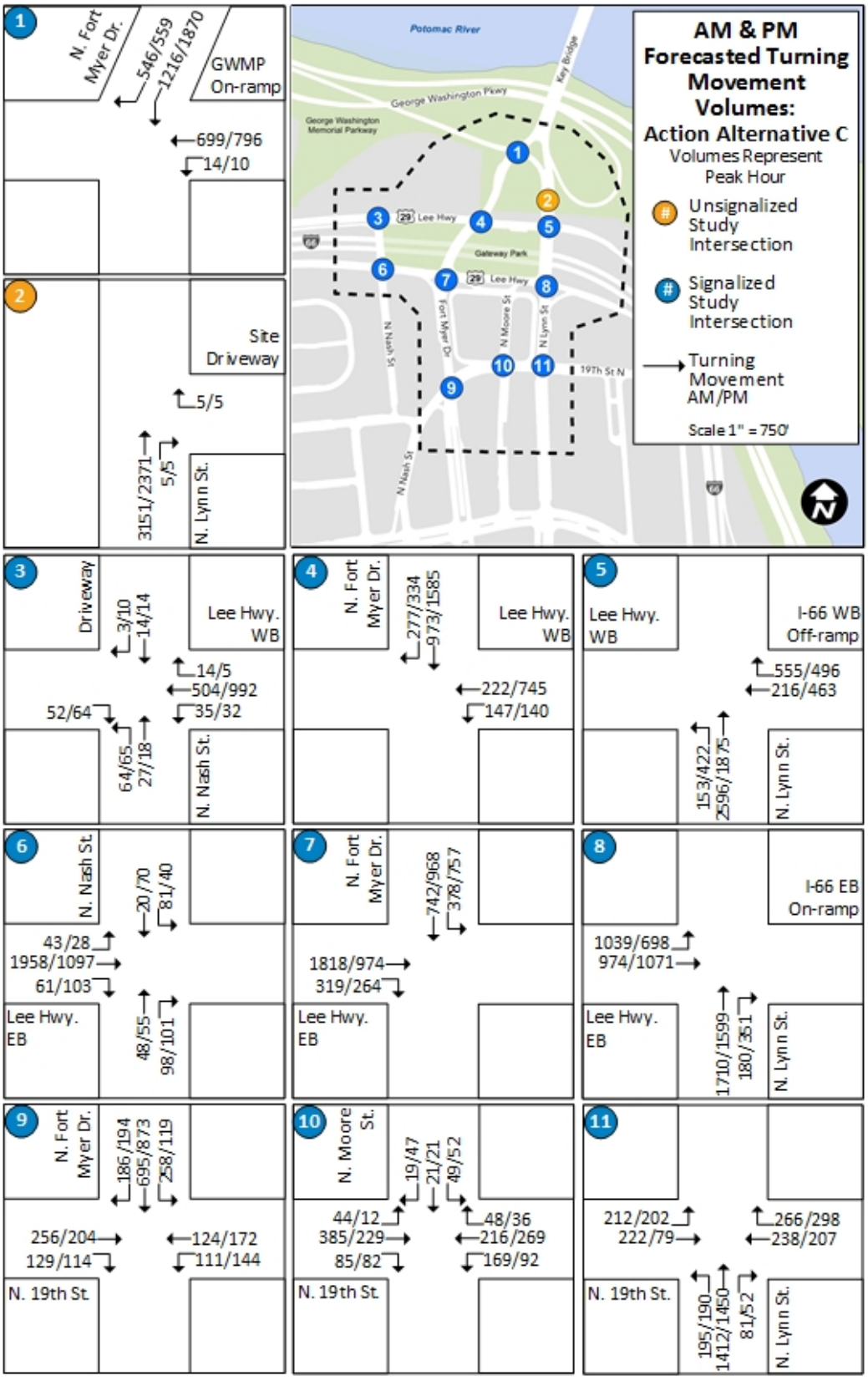


FIGURE 7-8. ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR TURNING MOVEMENT VOLUMES

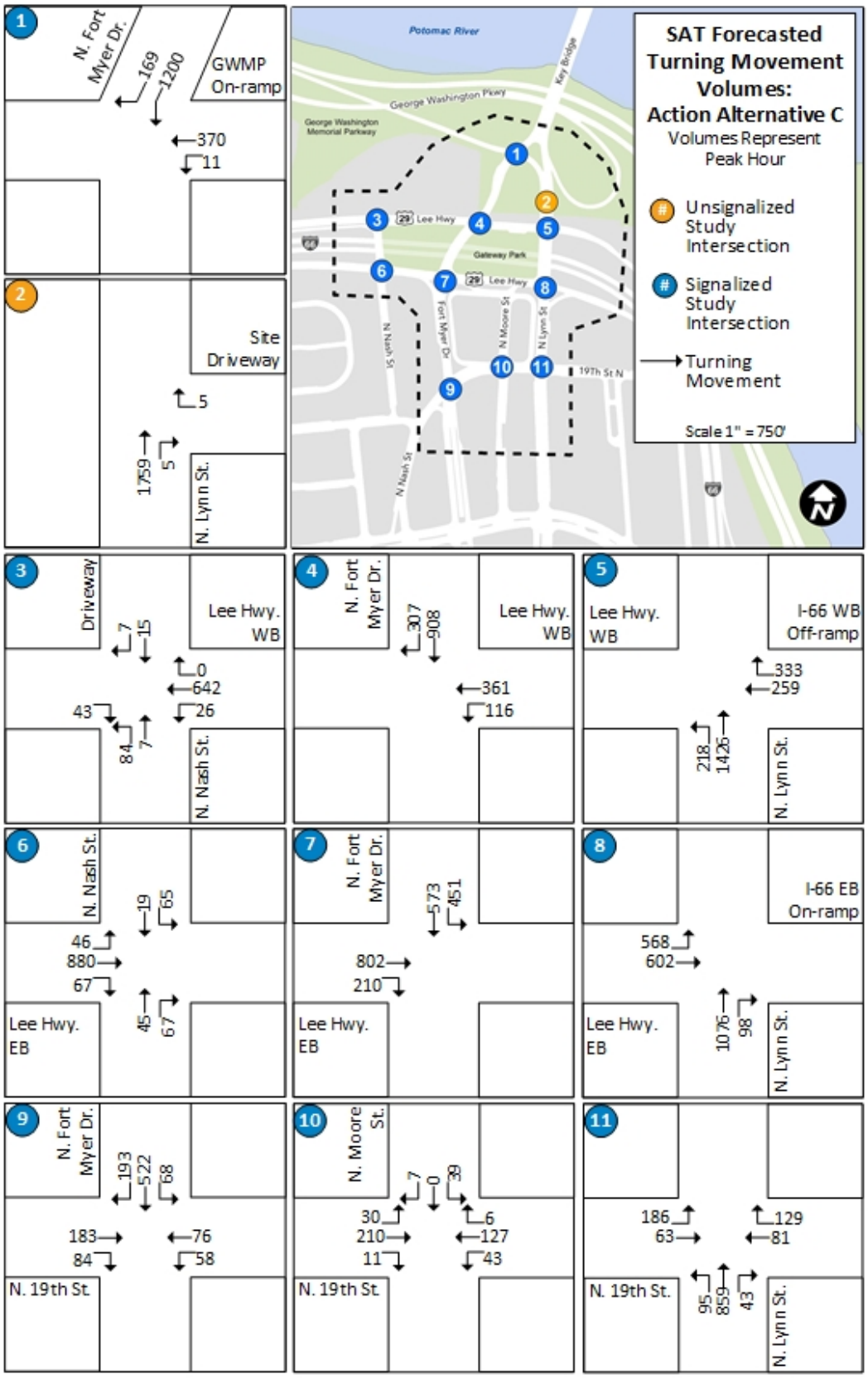


FIGURE 7-9. ALTERNATIVE C SATURDAY PEAK HOUR TURNING MOVEMENT VOLUMES

7.3.6.6 Alternative C Operations Analysis

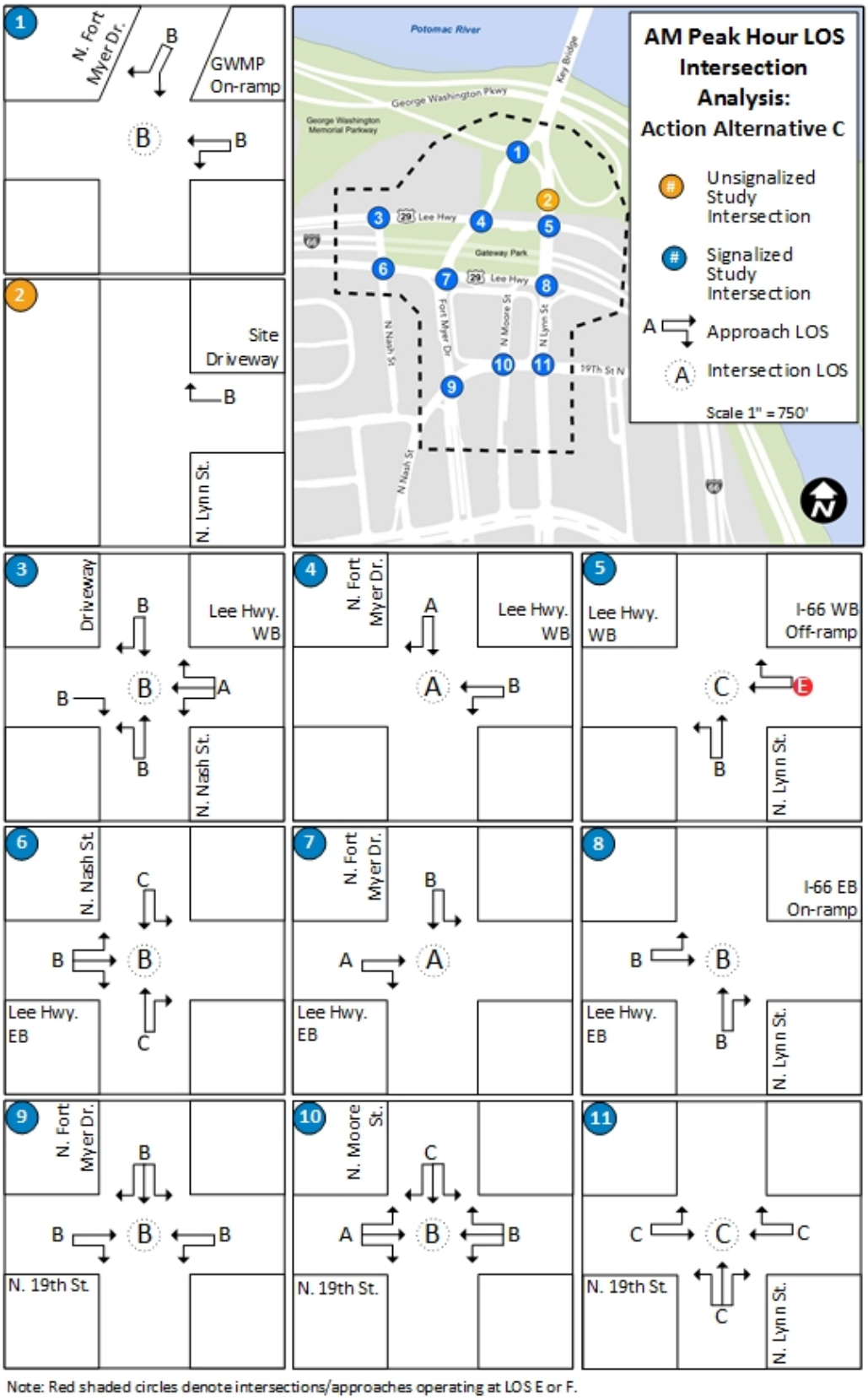
Based on the Synchro™ signalized intersection analysis results, all the Rosslyn study area intersections (Intersections #1 through #11) would operate at acceptable conditions (LOS D or better) during the peak hours analyzed (weekday AM and PM peak hours, Saturday peak hour). The following individual signalized intersection approach would operate at unacceptable conditions (LOS E or LOS F) during the noted peak hour:

Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5)

- Westbound on the I-66 off-ramp during the weekday AM peak hour (same failure as alternative A)

Based on the Synchro™ unsignalized intersection analysis, the Gravelly Point study area intersection (Intersection #12) would operate at overall acceptable conditions during the peak hours.

The average LOS for the various approaches to the intersection and the overall intersection LOS grades are depicted in figures 7-10 and 7-11 for weekday AM and PM peak hours, respectively, and in figure 7-12 for the Saturday peak hour at the end of this section. Table 7-12 compares alternative A and alternative C LOS capacity analysis and the intersection vehicle delay results during the AM and PM peak hours. Table 7-13 shows the same comparison during the Saturday peak hour.



Note: Red shaded circles denote intersections/approaches operating at LOS E or F.

FIGURE 7-10. ALTERNATIVE C INTERSECTION LEVEL OF SERVICE FOR WEEKDAY AM PEAK HOUR

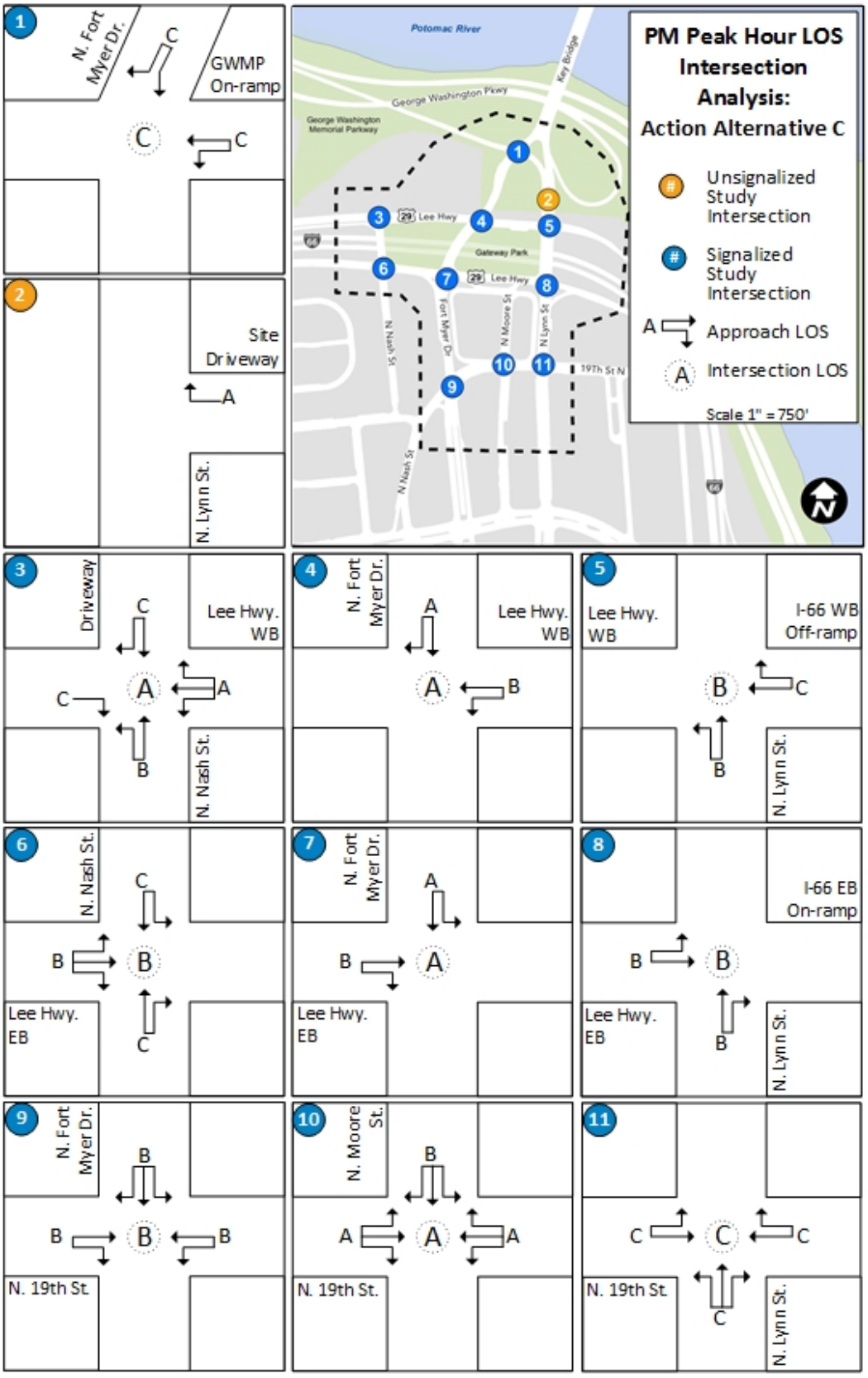


FIGURE 7-11. ALTERNATIVE C INTERSECTION LEVEL OF SERVICE FOR WEEKDAY PM PEAK HOUR

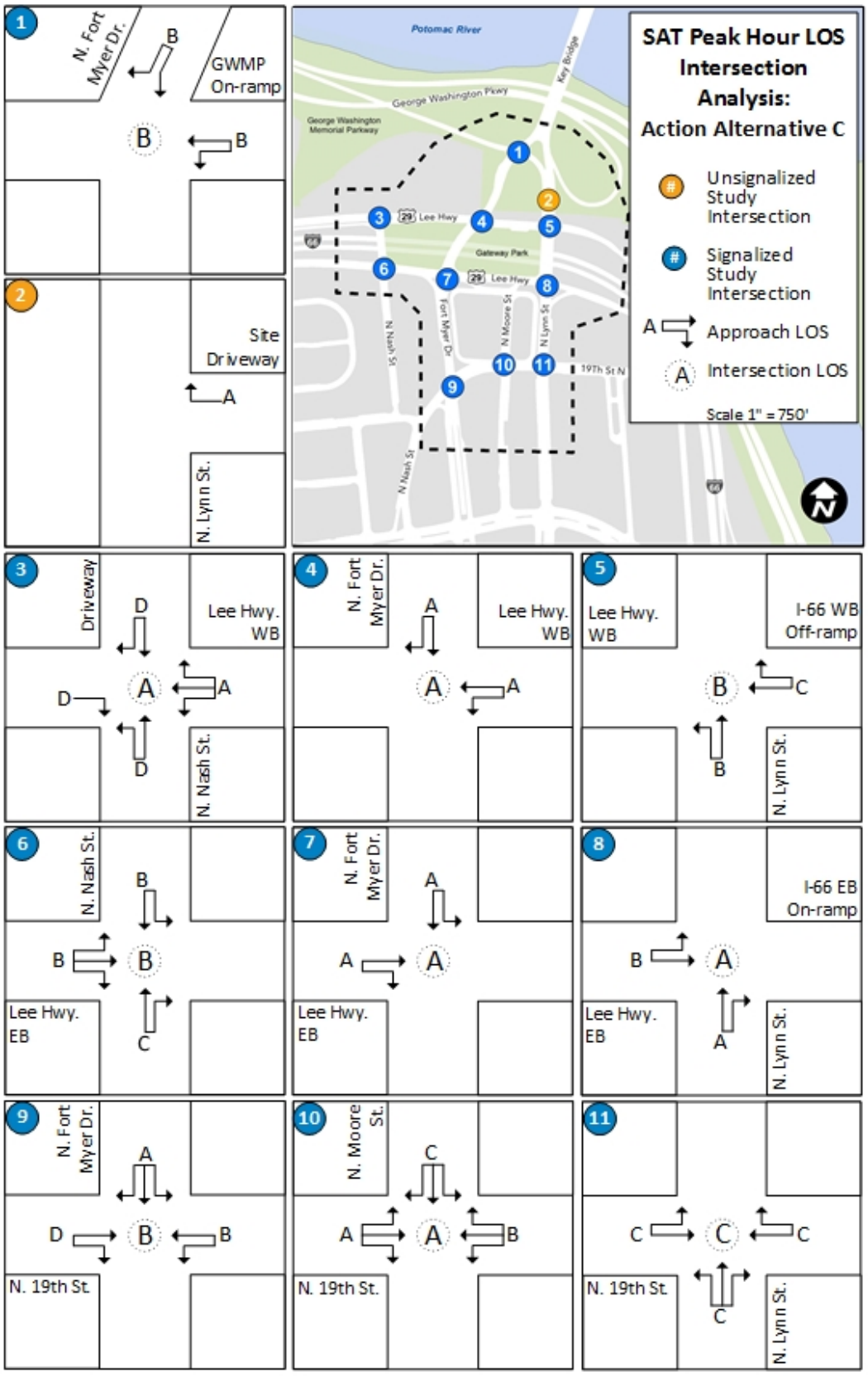


FIGURE 7-12. ALTERNATIVE C INTERSECTION LEVEL OF SERVICE FOR SATURDAY PEAK HOUR

TABLE 7-12. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR CAPACITY ANALYSIS

#	Intersection and Approach	Lane Group	Alternative A								Alternative C							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized)** [a]																	
	WB (GWMP On-ramp	LT	0.71	18.3	B		0.96	33.5	C		0.74	19.9	B		0.96	33.9	C	
	WB Overall (GWMP On-ramp)			**18.3**	**B**	**Pass**		**33.5**	**C**	**Pass**		**19.9**	**B**	**Pass**		**33.9**	**C**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.77	16	B		0.92	21	C		0.77	16.1	B		0.93	21.2	C	
	SB Overall (N. Fort Myer Dr.)			**16**	**B**	**Pass**		**21**	**C**	**Pass**		**16.1**	**B**	**Pass**		**21.2**	**C**	**Pass**
	Overall		**0.75**	**16.7**	**B**	**Pass**	**0.93**	**24.1**	**C**	**Pass**	**0.76**	**17.2**	**B**	**Pass**	**0.93**	**24.4**	**C**	**Pass**
2	**Site Driveway & N. Lynn St. (TWSC)** [b]																	
	WB (Site Driveway)	R	-	-	-		-	-	-		0.01	10.3	B		0.01	9.8	A	
	WB Overall (Site Driveway)			**-**	**-**	**-**		**-**	**-**	**-**		**10.3**	**B**	**Pass**		**9.8**	**A**	**Pass**
3	**Lee Hwy. WB & N. Nash St. (Signalized)** [a]																	
	EB (Lee Hwy. WB)	R	0.04	17.5	B		0.04	22.2	C		0.04	17.5	B		0.04	22.2	C	
	EB Overall (Lee Hwy. WB)			**17.5**	**B**	**Pass**		**22.2**	**C**	**Pass**		**17.5**	**B**	**Pass**		**22.2**	**C**	**Pass**
	WB (Lee Hwy. WB)	L	0.04	8.5	A		0.03	5.6	A		0.04	8.5	A		0.03	5.5	A	
	WB (Lee Hwy. WB)	TR	0.31	9.8	A		0.53	7.3	A		0.32	9.9	A		0.54	7.3	A	
	WB Overall (Lee Hwy. WB)			**9.7**	**A**	**Pass**		**7.2**	**A**	**Pass**		**9.8**	**A**	**Pass**		**7.2**	**A**	**Pass**
	NB (N. Nash St.)	LT	0.17	18.3	B		0.20	19.2	B		0.17	18.3	B		0.20	18.8	B	
	NB Overall (N. Nash St.)			**18.3**	**B**	**Pass**		**19.2**	**B**	**Pass**		**18.3**	**B**	**Pass**		**18.8**	**B**	**Pass**
	SB (Driveway)	TR	0.02	17.3	B		0.05	22.2	C		0.02	17.3	B		0.05	22.2	C	
	SB Overall (Driveway)			**17.3**	**B**	**Pass**		**22.2**	**C**	**Pass**		**17.3**	**B**	**Pass**		**22.2**	**C**	**Pass**
	Overall		**0.25**	**11.6**	**B**	**Pass**	**0.42**	**9.2**	**A**	**Pass**	**0.25**	**11.6**	**B**	**Pass**	**0.42**	**9.1**	**A**	**Pass**

TABLE 7-12. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A								Alternative C							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized)** [a]																	
	WB (Lee Hwy. WB)	L	0.16	11.6	B		0.20	9.9	A		0.17	11.5	B		0.21	10.0	B	
	WB (Lee Hwy. WB)	T	0.17	11.9	B		0.64	15.3	B		0.18	11.9	B		0.64	15.4	B	
	WB Overall (Lee Hwy. WB)			**11.8**	**B**	**Pass**		**14.5**	**B**	**Pass**		**11.7**	**B**	**Pass**		**14.5**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.54	8.0	A		0.78	4.8	A		0.55	8.0	A		0.78	4.8	A	
	SB Overall (N. Fort Myer Dr.)			**8.0**	**A**	**Pass**		**4.8**	**A**	**Pass**		**8.0**	**A**	**Pass**		**4.8**	**A**	**Pass**
	Overall		**0.38**	**8.9**	**A**	**Pass**	**0.72**	**7.9**	**A**	**Pass**	**0.39**	**8.9**	**A**	**Pass**	**0.73**	**7.9**	**A**	**Pass**
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized)** [a]																	
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	0.87dr	37.7	D		0.58	23.2	C		0.87dr	37.9	D		0.59	23.2	C	
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	1.10	119.7	F		0.70	30.8	C		1.10	119.7	F		0.70	30.8	C	
	WB Overall (Lee Hwy. WB/I-66 Off-ramp)			**67.3**	**E**	**Fail**		**25.5**	**C**	**Pass**		**67.3**	**E**	**Fail**		**25.6**	**C**	**Pass**
	NB (N. Lynn St.)	L	0.09	0.1	A		0.44	5.0	A		0.10	0.1	A		0.45	5.2	A	
	NB (N. Lynn St.)	T	0.83	11.1	B		0.85	17.7	B		0.84	11.1	B		0.86	17.8	B	
	NB Overall (N. Lynn St.)			**10.5**	**B**	**Pass**		**15.4**	**B**	**Pass**		**10.5**	**B**	**Pass**		**15.5**	**B**	**Pass**
	Overall		**0.86**	**23.1**	**C**	**Pass**	**0.72**	**18.4**	**B**	**Pass**	**0.87**	**22.9**	**C**	**Pass**	**0.72**	**18.4**	**B**	**Pass**

TABLE 7-12. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A								Alternative C							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
6	**Lee Hwy. EB & N. Nash St. (Signalized)** [a]																	
	EB (Lee Hwy. EB)	LTR	0.76	14.3	B		0.46	13.8	B		0.76	14.3	B		0.48	14.0	B	
	EB Overall (Lee Hwy. EB)			**14.3**	**B**	**Pass**		**13.8**	**B**	**Pass**		**14.3**	**B**	**Pass**		**14.0**	**B**	**Pass**
	NB (N. Nash St.)	TR	0.37	30.9	C		0.22	22.5	C		0.37	30.9	C		0.23	22.6	C	
	NB Overall (N. Nash St.)			**30.9**	**C**	**Pass**		**22.5**	**C**	**Pass**		**30.9**	**C**	**Pass**		**22.6**	**C**	**Pass**
	SB (N. Nash St.)	L	0.31	29.3	C		0.11	22.9	C		0.31	29.3	C		0.11	23.0	C	
	SB (N. Nash St.)	T	0.05	25.5	C		0.12	22.7	C		0.05	25.5	C		0.12	22.8	C	
	SB Overall (N. Nash St.)			**28.5**	**C**	**Pass**		**22.8**	**C**	**Pass**		**28.5**	**C**	**Pass**		**22.9**	**C**	**Pass**
	Overall		**0.65**	**16.0**	**B**	**Pass**	**0.37**	**15.4**	**B**	**Pass**	**0.65**	**16.0**	**B**	**Pass**	**0.38**	**15.6**	**B**	**Pass**
7	**Lee Hwy. EB & N. Fort Myer Dr. (Signalized)** [a]																	
	EB (Lee Hwy. EB)	TR	0.77	6.8	A		0.61	14.6	B		0.77	6.9	A		0.63	14.7	B	
	EB Overall (Lee Hwy. EB)			**6.8**	**A**	**Pass**		**14.6**	**B**	**Pass**		**6.9**	**A**	**Pass**		**14.7**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.56	8.3	A		0.58	3.5	A		0.57	8.5	A		0.57	3.5	A	
	SB (N. Fort Myer Dr.)	LT	0.61	13.6	B		0.59	6.9	A		0.61	13.7	B		0.60	7.1	A	
	SB Overall (N. Fort Myer Dr.)			**12.3**	**B**	**Pass**		**6.1**	**A**	**Pass**		**12.4**	**B**	**Pass**		**6.2**	**A**	**Pass**
	Overall		**0.72**	**8.7**	**A**	**Pass**	**0.60**	**9.6**	**A**	**Pass**	**0.72**	**8.8**	**A**	**Pass**	**0.61**	**9.8**	**A**	**Pass**

TABLE 7-12. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A								Alternative C							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized)** [a]																	
	EB (Lee Hwy. EB/I-66 On-ramp)	L	0.75	11.7	B		0.73	18.5	B		0.75	11.7	B		0.73	18.1	B	
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	0.76	9.7	A		0.74	16.3	B		0.76	9.8	A		0.74	16.0	B	
	EB Overall (Lee Hwy. EB/I-66 On-ramp)			**10.4**	**B**	**Pass**		**17.0**	**B**	**Pass**		**10.4**	**B**	**Pass**		**16.7**	**B**	**Pass**
	NB (N. Lynn St.)	T	0.82	14.9	B		0.71	9.8	A		0.84	16.0	B		0.72	10.0	A	
	NB (N. Lynn St.)	R	0.33	7.2	A		0.69	12.5	B		0.33	7.9	A		0.69	12.5	B	
	NB Overall (N. Lynn St.)			**14.2**	**B**	**Pass**		**10.3**	**B**	**Pass**		**15.3**	**B**	**Pass**		**10.4**	**B**	**Pass**
	Overall		**0.78**	**12.2**	**B**	**Pass**	**0.73**	**13.5**	**B**	**Pass**	**0.79**	**12.8**	**B**	**Pass**	**0.73**	**13.4**	**B**	**Pass**
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)** [a]																	
	EB (N. 19th St.)	TR		19.9	B		0.31	18.1	B		0.40	19.9	B		0.31	18.1	B	
	EB Overall (N. 19th St.)			**19.9**	**B**	**Pass**		**18.1**	**B**	**Pass**		**19.9**	**B**	**Pass**		**18.1**	**B**	**Pass**
	WB (N. 19th St.)	LT	0.29	8.7	A		0.37	16.0	B		0.31	10.1	B		0.37	16.1	B	
	WB Overall (N. 19th St.)			**8.7**	**A**	**Pass**		**16.0**	**B**	**Pass**		**10.1**	**B**	**Pass**		**16.1**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.38	10.4	B		0.17	12.5	B		0.38	10.4	B		0.17	12.4	B	
	SB (N. Fort Myer Dr.)	TR	0.47	10.0	A		0.56	13.6	B		0.47	10.0	A		0.56	13.5	B	
	SB Overall (N. Fort Myer Dr.)			**10.1**	**B**	**Pass**		**13.4**	**B**	**Pass**		**10.1**	**B**	**Pass**		**13.4**	**B**	**Pass**
	Overall		**0.44**	**12.1**	**B**	**Pass**	**0.46**	**14.7**	**B**	**Pass**	**0.44**	**12.2**	**B**	**Pass**	**0.47**	**14.7**	**B**	**Pass**

TABLE 7-12. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A								Alternative C							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
10	**N. 19th St. & N. Moore St. (Signalized)** [a]																	
	EB (N. 19th St.)	L	0.10	6.6	A		0.03	10.7	B		0.10	6.6	A		0.03	10.6	B	
	EB (N. 19th St.)	TR	0.27	6.9	A		0.18	9.3	A		0.27	6.9	A		0.18	9.3	A	
	EB Overall (N. 19th St.)			**6.9**	**A**	**Pass**		**9.3**	**A**	**Pass**		**6.9**	**A**	**Pass**		**9.3**	**A**	**Pass**
	WB (N. 19th St.)	LTR	0.39	13.5	B		0.30	4.8	A		0.39	13.6	B		0.32	4.6	A	
	WB Overall (N. 19th St.)			**13.5**	**B**	**Pass**		**4.8**	**A**	**Pass**		**13.6**	**B**	**Pass**		**4.6**	**A**	**Pass**
	SB (N. Moore St.)	LTR	0.04	21.4	C		0.07	19.6	B		0.08	21.7	C		0.09	19.8	B	
	SB Overall (N. Moore St.)			**21.4**	**C**	**Pass**		**19.6**	**B**	**Pass**		**21.7**	**C**	**Pass**		**19.8**	**B**	**Pass**
	Overall		**0.26**	**10.4**	**B**	**Pass**	**0.21**	**8.5**	**A**	**Pass**	**0.28**	**11.0**	**B**	**Pass**	**0.22**	**8.6**	**A**	**Pass**

TABLE 7-12. COMPARISON ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A								Alternative C							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
11	**N. 19th St. & N. Lynn St. (Signalized)** [a]																	
	EB (N. 19th St.)	L	0.66	37.4	D		0.69	41.4	D		0.78	45.4	D		0.74	44.1	D	
	EB (N. 19th St.)	T	0.29	5.0	A		0.11	8.0	A		0.29	6.5	A		0.11	8.0	A	
	EB Overall (N 19th St.)			**19.5**	**B**	**Pass**		**31.5**	**C**	**Pass**		**25.5**	**C**	**Pass**		**34.0**	**C**	**Pass**
	WB (N. 19th St.)	TR	0.47	31.0	C		0.47	31.1	C		0.47	31.0	C		0.48	31.3	C	
	WB (N. 19th St.)	R	0.45	35.2	D		0.41	33.9	C		0.45	35.2	D		0.41	33.9	C	
	WB Overall (N. 19th St.)			**32.3**	**C**	**Pass**		**32.0**	**C**	**Pass**		**32.3**	**C**	**Pass**		**32.1**	**C**	**Pass**
	NB (N. Lynn St.)	LT	0.78	27.7	C		0.79	28.8	C		0.78	27.7	C		0.80	29.2	C	
	NB (N. Lynn St.)	R	0.15	20.2	C		0.10	20.0	B		0.15	20.2	C		0.10	20.0	B	
	NB Overall (N. Lynn St.)			**27.3**	**C**	**Pass**		**28.5**	**C**	**Pass**		**27.4**	**C**	**Pass**		**28.9**	**C**	**Pass**
	Overall		**0.65**	**27.1**	**C**	**Pass**	**0.67**	**29.6**	**C**	**Pass**	**0.68**	**28.0**	**C**	**Pass**	**0.69**	**30.1**	**C**	**Pass**

Notes:

dr = Defacto Right Lane

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LOS = Level of Service

LTR = left / through / right lanes

TWSC = Two-way STOP-Controlled unsignalized intersection (TWSC intersections do not have an overall LOS)

V/C = Volume-to-Capacity ratio

Delay is Measured in Seconds Per Vehicle.

Red cells denote intersections or approaches operating at unacceptable conditions.

[a] Highway Capacity Manual 2000 results (Signalized intersections)

[b] Highway Capacity Manual 2000 results (Unsignalized intersections)

TABLE 7-13. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C SATURDAY PEAK HOUR CAPACITY ANALYSIS

#	Intersection and Approach	Lane Group	Alternative A SAT Peak Hour				Alternative C SAT Peak Hour			
			V/C Ratio	Delay (sec/veh)	LOS	Check	V/C Ratio	Delay (sec/veh)	LOS	Check
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized)** [a]									
	WB (GWMP On-ramp)	LT	0.36	16.2	B		0.36	16.2	B	
	WB Overall (GWMP On-ramp)			**16.2**	**B**	**Pass**		**16.2**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.49	11.6	B		0.50	11.6	B	
	SB Overall (N. Fort Myer Dr.)			**11.6**	**B**	**Pass**		**11.6**	**B**	**Pass**
	Overall		**0.45**	**12.6**	**B**	**Pass**	**0.45**	**12.6**	**B**	**Pass**
2	**Site Driveway & N. Lynn St. (TWSC)** [b]									
	WB (Site Driveway)	R	-	-	-		0.01	9.0	A	
	WB Overall (Site Driveway)			**-**	**-**	**-**		**9.0**	**A**	**Pass**
3	**Lee Hwy. WB & N. Nash St. (Signalized)** [a]									
	EB (Lee Hwy. WB)	R	0.03	35.3	D		0.03	35.3	D	
	EB Overall (Lee Hwy. WB)			**35.3**	**D**	**Pass**		**35.3**	**D**	**Pass**
	WB (Lee Hwy. WB)	L	0.02	1.0	A		0.02	1.0	A	
	WB (Lee Hwy. WB)	TR	0.25	1.3	A		0.26	1.3	A	
	WB Overall (Lee Hwy. WB)			**1.3**	**A**	**Pass**		**1.3**	**A**	**Pass**
	NB (N. Nash St.)	LT	0.62	45.7	D		0.62	45.7	D	
	NB Overall (N. Nash St.)			**45.7**	**D**	**Pass**		**45.7**	**D**	**Pass**
	SB (Driveway)	TR	0.11	35.8	D		0.11	35.8	D	
	SB Overall (Driveway)			**35.8**	**D**	**Pass**		**35.8**	**D**	**Pass**
	Overall		**0.30**	**9.0**	**A**	**Pass**	**0.31**	**8.9**	**A**	**Pass**
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized)** [a]									
	WB (Lee Hwy. WB)	L	0.10	8.4	A		0.12	8.1	A	
	WB (Lee Hwy. WB)	T	0.26	6.7	A		0.27	6.9	A	
	WB Overall (Lee Hwy. WB)			**7.1**	**A**	**Pass**		**7.2**	**A**	**Pass**
	SB (N. Fort Myer Dr.)	TR	0.51	5.1	A		0.52	5.1	A	
	SB Overall (N. Fort Myer Dr.)			**5.1**	**A**	**Pass**		**5.1**	**A**	**Pass**
	Overall		**0.40**	**5.6**	**A**	**Pass**	**0.41**	**5.7**	**A**	**Pass**

TABLE 7-13. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C SATURDAY PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A SAT Peak Hour				Alternative C SAT Peak Hour			
			V/C Ratio	Delay (sec/veh)	LOS	Check	V/C Ratio	Delay (sec/veh)	LOS	Check
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized) [a]**									
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	0.37	22.5	C		0.38	22.5	C	
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	0.40	24.3	C		0.40	24.3	C	
	WB Overall (Lee Hwy. WB/I-66 Off-ramp)			**23.0**	**C**	**Pass**		**23.1**	**C**	**Pass**
	NB (N. Lynn St.)	L	0.13	0.8	A		0.14	0.7	A	
	NB (N. Lynn St.)	T	0.54	13.4	B		0.55	13.3	B	
	NB Overall (N. Lynn St.)			**11.8**	**B**	**Pass**		**11.6**	**B**	**Pass**
	Overall		**0.44**	**14.8**	**B**	**Pass**	**14.60**	**14.6**	**B**	**Pass**
6	**Lee Hwy. EB & N. Nash St. (Signalized) [a]**									
	EB (Lee Hwy. EB)	LTR	0.39	13.6	B		0.40	13.7	B	
	EB Overall (Lee Hwy. EB)			**13.6**	**B**	**Pass**		**13.7**	**B**	**Pass**
	NB (N. Nash St.)	TR	0.12	20.6	C		0.12	20.6	C	
	NB Overall (N. Nash St.)			**20.6**	**C**	**Pass**		**20.6**	**C**	**Pass**
	SB (N. Nash St.)	L	0.16	20.0	C		0.16	20.0	C	
	SB (N. Nash St.)	T	0.03	18.4	B		0.03	18.6	B	
	SB Overall (N. Nash St.)			**19.7**	**B**	**Pass**		**19.7**	**B**	**Pass**
	Overall		**0.30**	**14.7**	**B**	**Pass**	**0.30**	**14.7**	**B**	**Pass**
7	**Lee Hwy. EB & N. Fort Myer Dr. (Signalized) [a]**									
	EB (Lee Hwy. EB)	TR	0.45	7.6	A		0.46	7.6	A	
	EB Overall (Lee Hwy. EB)			**7.6**	**A**	**Pass**		**7.6**	**A**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.34	2.2	A		0.35	2.3	A	
	SB (N. Fort Myer Dr.)	LT	0.38	10.3	B		0.39	10.9	B	
	SB Overall (N. Fort Myer Dr.)			**8.3**	**A**	**Pass**		**8.8**	**A**	**Pass**
	Overall		**0.42**	**7.9**	**A**	**Pass**	**0.43**	**8.2**	**A**	**Pass**
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized) [a]**									
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	0.43	10.6	B		0.43	10.9	B	
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	0.44	10.2	B		0.44	10.4	B	
	EB Overall (Lee Hwy. EB/I-66 On-ramp)			**10.3**	**B**	**Pass**		**10.6**	**B**	**Pass**
	NB (N. Lynn St.)	T	0.48	8.3	A		0.50	8.8	A	
	NB (N. Lynn St.)	R	0.09	2.4	A		0.09	3.1	A	
	NB Overall (N. Lynn St.)			**7.8**	**A**	**Pass**		**8.4**	**A**	**Pass**
	Overall		**0.45**	**9.1**	**A**	**Pass**	**0.46**	**9.5**	**A**	**Pass**

TABLE 7-13. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C SATURDAY PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A SAT Peak Hour				Alternative C SAT Peak Hour			
			V/C Ratio	Delay (sec/veh)	LOS	Check	V/C Ratio	Delay (sec/veh)	LOS	Check
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)** [a]									
	EB (N. 19th St.)	TR	0.56	38.6	D		0.56	38.6	D	
	EB Overall (N. 19th St.)			**38.6**	**D**	**Pass**		**38.6**	**D**	**Pass**
	WB (N. 19th St.)	LT	0.43	15.8	B		0.43	16.1	B	
	WB Overall (N. 19th St.)			**15.8**	**B**	**Pass**		**16.1**	**B**	**Pass**
	SB (N. Fort Myer Dr.)	L	0.06	2.4	A		0.06	2.3	A	
	SB (N. Fort Myer Dr.)	TR	0.21	2.4	A		0.21	2.3	A	
	SB Overall (N. Fort Myer Dr.)			**2.4**	**A**	**Pass**		**2.3**	**A**	**Pass**
	Overall		**0.27**	**12.1**	**B**	**Pass**	**0.27**	**12.1**	**B**	**Pass**
10	**N. 19th St. & N. Moore St. (Signalized)** [a]									
	EB (N. 19th St.)	L	0.05	3.3	A		0.05	3.3	A	
	EB (N. 19th St.)	TR	0.12	3.5	A		0.12	3.5	A	
	EB Overall (N. 19th St.)			**3.4**	**A**	**Pass**		**3.4**	**A**	**Pass**
	WB (N. 19th St.)	LTR	0.12	12.2	B		0.12	12.6	B	
	WB Overall (N. 19th St.)			**12.2**	**B**	**Pass**		**12.6**	**B**	**Pass**
	SB (N. Moore St.)	LTR	0.00	21.7	C		0.03	21.9	C	
	SB Overall (N. Moore St.)			**21.7**	**C**	**Pass**		**21.9**	**C**	**Pass**
	Overall		**0.08**	**7.2**	**A**	**Pass**	**0.09**	**8.6**	**A**	**Pass**

TABLE 7-13. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C SATURDAY PEAK HOUR CAPACITY ANALYSIS (CONTINUED)

#	Intersection and Approach	Lane Group	Alternative A SAT Peak Hour				Alternative C SAT Peak Hour			
			V/C Ratio	Delay (sec/veh)	LOS	Check	V/C Ratio	Delay (sec/veh)	LOS	Check
11	**N. 19th St. & N. Lynn St. (Signalized) [a]**									
	EB (N. 19th St.)	L	0.43	19.4	B		0.54	26.8	C	
	EB (N. 19th St.)	T	0.07	1.2	A		0.07	4.2	A	
	EB Overall (N 19th St.)			**13.9**	**B**	**Pass**		**21.1**	**C**	**Pass**
	WB (N. 19th St.)	TR	0.14	26.6	C		0.14	26.6	C	
	WB (N. 19th St.)	R	0.06	26.1	C		0.06	26.1	C	
	WB Overall (N. 19th St.)			**26.5**	**C**	**Pass**		**26.5**	**C**	**Pass**
	NB (N. Lynn St.)	LT	0.45	23.3	C		0.46	23.3	C	
	NB (N. Lynn St.)	R	0.06	19.9	B		0.06	19.9	B	
	NB Overall (N. Lynn St.)			**23.1**	**C**	**Pass**		**23.2**	**C**	**Pass**
	Overall		**0.35**	**22.3**	**C**	**Pass**	**0.38**	**23.3**	**C**	**Pass**

Notes:

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LOS = Level of Service

LTR = left / through / right lanes

TWSC = Two-way STOP-Controlled unsignalized intersection (TWSC intersections do not have an overall LOS)

V/C = Volume-to-Capacity ratio

Delay is Measured in Seconds Per Vehicle.

[a] Highway Capacity Manual 2000 results (Signalized intersections)

[b] Highway Capacity Manual 2000 results (Unsignalized intersections)

7.3.6.7 Alternative C Queuing Analysis

The results of alternative C queuing analysis for both signalized and unsignalized intersections are discussed in this section. Note that the percentile values are expressed in feet, and a car occupies about 25 linear feet of roadway, including the space between cars.

Based on the Synchro™ signalized intersection analysis results, five signalized intersections would experience queuing lengths that exceed the available storage capacity. The remaining signalized intersections in the traffic study area would provide sufficient storage for the anticipated demand. The lane group within the approach that would operate under unacceptable conditions is noted in parentheses.

- Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5)
  - Westbound I-66 off-ramp (right turns) during the AM and PM peak hours (same failure as alternative A)
- N. 19th St. and N. Fort Myer Dr. (Intersection #9)
  - Eastbound N. 19th St. (all movements) during the AM peak hour (same failure as alternative A)
- N. 19th St. and N. Moore St. (Intersection #10)
  - Westbound N. 19th St. (all movements) during the AM peak hour (same failure as alternative A)
- N. 19th St. and N. Lynn St. (Intersection #11)
  - Eastbound N. 19th St. (left turns) during the AM, PM, and Saturday peak hours (compared to alternative A, the queue lengths would increase 53 feet during the AM peak hour, 23 feet during the PM peak hour, and 35 feet during the Saturday peak hour, respectively, or a maximum of two car lengths)

Based on the Synchro™ unsignalized intersection analysis, the new proposed driveway that would operate as an unsignalized intersection would operate with overall acceptable operations, with no failing minor street approaches during the three evaluated periods and would provide sufficient storage for the anticipated demand.

Table 7-14 compares alternative A to alternative C queuing analysis results for both signalized and unsignalized intersections for all periods.

TABLE 7-14. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR QUEUING ANALYSIS

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	Alternative A						Alternative C					
				AM Peak Hour		PM Peak Hour		SAT Peak Hour		AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
1	**N. Fort Myer Dr. & GWMP On-ramp (Signalized)**														
	WB (GWMP On-ramp)	LT	350	163	m198	234	m324	75	122	173	m212	233	m322	75	122
	SB (N. Fort Myer Dr.)	TR	1,860	250	312	393	497	147	181	251	314	396	506	150	184
2	**Site Driveway & North Lynn Street**														
	WB (Site Driveway)	R	200	-	-	-	-	-	-	-	25	-	0	-	0
3	**Lee Highway WB & North Nash Street (Signalized)**														
	EB (Lee Hwy. WB)	R	410	0	0	0	0	0	0	0	0	0	0	0	0
	WB (Lee Hwy. WB)	L	125	7	m17	5	m7	1	m3	7	m16	5	m7	1	m3
	WB (Lee Hwy. WB)	TR	400	61	93	90	112	16	28	61	95	90	112	16	28
	NB (N. Nash St.)	LT	120	37	m66	30	53	56	104	37	m66	29	53	56	104
	SB (Driveway)	TR	40	6	19	10	29	12	33	6	19	10	29	12	33
4	**Lee Hwy. WB & N. Fort Myer Dr. (Signalized)**														
	WB (Lee Hwy. WB)	L	230	20	m44	28	54	14	36	21	m44	29	56	15	45
	WB (Lee Hwy. WB)	T	230	32	m54	135	173	47	67	32	m55	136	174	51	71
	SB (N. Fort Myer Dr.)	TR	310	169	161	128	m130	16	14	172	164	129	m131	18	16
5	**Lee Hwy. WB/I-66 Off-ramp & N. Lynn St. (Signalized)**														
	WB (Lee Hwy. WB/I-66 Off-ramp)	TR	670	144	207	170	231	93	134	145	208	171	232	95	137
	WB (Lee Hwy. WB/I-66 Off-ramp)	R	250	~205	#375	163	#278	86	151	~205	#375	163	#278	86	151
	NB (N. Lynn St.)	L	210	0	m0	0	15	0	3	0	m0	0	16	0	2
	NB (N. Lynn St.)	T	210	189	208	146	179	114	132	189	207	146	184	114	131
6	**Lee Hwy. EB & N. Nash St. (Signalized)**														
	EB (Lee Hwy. EB)	LTR	2,500	297	358	147	182	121	152	298	359	155	191	123	154
	NB (N. Nash St.)	TR	640	69	126	40	88	18	55	69	126	43	91	18	55
	SB (N. Nash St.)	L	120	40	81	17	45	29	60	40	81	17	45	29	60
	SB (N. Nash St.)	T	120	9	28	31	66	8	24	9	28	31	66	8	25

TABLE 7-14. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR QUEUING ANALYSIS (CONTINUED)

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	Alternative A						Alternative C					
				AM Peak Hour		PM Peak Hour		SAT Peak Hour		AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
7	**Lee Hwy. EB & N. Fort Myer Dr. (Signalized)**														
	EB (Lee Hwy. EB)	TR	210	84	92	95	113	39	52	84	92	98	117	41	52
	SB (N. Fort Myer Dr.)	L	220	0	0	1	m0	0	0	0	0	1	m0	0	0
	SB (N. Fort Myer Dr.)	LT	220	93	113	81	100	40	51	94	113	85	105	44	55
8	**Lee Hwy. EB/I-66 On-ramp & N. Lynn St. (Signalized)**														
	EB (Lee Hwy. EB/I-66 On-ramp)	L	380	112	175	193	352	83	121	113	178	187	346	86	127
	EB (Lee Hwy. EB/I-66 On-ramp)	LT	380	121	170	206	243	92	117	123	172	202	243	96	121
	NB (N. Lynn St.)	T	330	109	142	68	88	46	56	131	160	71	96	52	64
	NB (N. Lynn St.)	R	330	6	m22	39	m57	0	3	10	m23	41	m58	1	5
9	**N. 19th St. & N. Fort Myer Dr. (Signalized)**														
	EB (N. 19th St.)	TR	100	83	#126	61	97	59	98	83	#126	61	97	59	98
	WB (N. 19th St.)	LT	180	41	60	77	114	33	50	44	65	76	114	34	52
	SB (N. Fort Myer Dr.)	L	125	59	m83	28	m53	5	16	59	m83	28	m53	5	16
	SB (N. Fort Myer Dr.)	TR	440	69	83	97	132	8	24	69	83	97	131	8	23
10	**N. 19th St. & N. Moore St. (Signalized)**														
	EB (N. 19th St.)	L	75	9	20	2	m11	3	6	9	20	2	m11	3	6
	EB (N. 19th St.)	TR	180	43	60	12	39	10	13	43	60	12	65	10	13
	WB (N. 19th St.)	LTR	60	73	m#94	39	m43	34	52	74	m#95	40	m43	35	54
	SB (N. Moore St.)	LTR	260	8	21	12	30	0	0	15	33	15	35	3	16

TABLE 7-14. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE C WEEKDAY AM AND PM PEAK HOUR QUEUING ANALYSIS (CONTINUED)

#	Intersection	Lane Group	Turning Bay/Link Length (feet)	Alternative A						Alternative C					
				AM Peak Hour		PM Peak Hour		SAT Peak Hour		AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)	50th Percentile (feet)	95th Percentile (feet)
11	**N. 19th St. & N. Lynn St. (Signalized)**														
	EB (N. 19th St.)	L	60	59	#187	114	#207	81	#140	74	#240	119	#230	105	#174
	EB (N. 19th St.)	T	60	17	37	19	51	1	1	25	50	19	50	4	12
	WB (N. 19th St.)	TR	220	81	128	73	120	20	45	81	128	76	124	20	45
	WB (N. 19th St.)	R	175	38	116	30	106	0	14	38	116	30	106	0	14
	NB (N. Lynn St.)	LT	610	250	295	254	301	123	153	250	297	258	305	124	154
	NB (N. Lynn St.)	R	100	0	23	0	0	0	0	0	23	0	0	0	0

Notes:

~ 50th percentile volume exceeds capacity, queue is theoretically infinite.

95th percentile volume exceeds capacity, queue may be longer.

m Volume for 95th percentile queue is metered by upstream signal. Due to upstream metering, the 95th percentile queue may be less than the 50th percentile queue.

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LTR = left / through / right lanes

Red cells denote approaches and lane groups whose queuing length exceeds capacity.

7.3.7 DISCUSSION OF ALTERNATIVE C

Alternative C is evaluated for pedestrian, bicycle, transit, truck, parking, and traffic impacts. Under the alternative, the proposed boathouse facilities would introduce a new curb cut to the sidewalk along N. Lynn St. in Rosslyn that would create an unsignalized right-in/right-out driveway and a new pedestrian connection between the Roosevelt Island parking lot and boathouse. These actions, in addition to attracting new person trips to the area by the boathouse facilities, would slightly increase pedestrian and bicycle volumes along the Mt. Vernon Trail. Based on the forecasted boathouse person trip generation, 196, 305, and 272 AM, PM, and Saturday peak hour new person trips (bicycle and pedestrian combined), respectively, would be added to the Mt. Vernon Trail.

In terms of the other travel modes, transit and vehicle use would increase slightly. Based on the AM, PM, and Saturday peak hour traffic assessment, there would be no impacts on the Rosslyn area study intersections. Demand for parking in downtown Rosslyn would increase to serve the vehicle trips, but plenty of on- and off-street parking options are available.

7.4 Alternative D: Gravelly Point Site

This alternative would include a 28,000 SF building to provide boat storage, boat repair, and amenities that support the boathouse. A 14,000 SF building would provide boat storage and boat repair. The facility would be located on the Potomac River in the southeastern part of the park and connected by driveway to existing Gravelly Point parking lot. Site access would be by vehicle, foot, bicycle, or transit (a 30-minute walk from Crystal City Metro Station). Enough parking is expected to be provided to handle the demand for the new boathouse.

7.4.1 PEDESTRIANS

The facility would be accessible by pedestrians from the Mt. Vernon Trail, with the closest Arlington County trail connection point located approximately 1 mile south at National Airport that connects to Crystal City. The Mt. Vernon Trail alignment would be slightly adjusted to the west to accommodate the new boathouse building and circular driveway and to avoid crossing the ball fields to the north.

Patrons of the boathouse facility by personal vehicle would access the facility in the same manner as existing patrons of Gravelly Point from the northbound GWMP using the existing ramps. Minimal impacts on Mt. Vernon trail users are anticipated because the trail would be shifted away from the boathouse; however, the trail would still cross the boathouse exit driveway. Overall, vehicular traffic crossing the trail would increase slightly to access the new boathouse facility. Visitors accessing the boathouse on foot or by bicycle would increase use of the Mt. Vernon Trail.

7.4.2 BICYCLES

It is likely that both bicycle racks and new wayfinding signs would be incorporated into the new boathouse facility. Impacts on bicyclists would be similar to those on pedestrians—with a slight increase in vehicle volumes crossing the Mt. Vernon Trail. Visitors accessing the boathouse on foot or by bicycle would also increase use of the Mt. Vernon Trail.

7.4.3 TRANSIT

Under alternative D, Metrorail use would increase slightly as a result of patrons destined to the boathouse facility, but this increase should not have any adverse impact on transit. Because the distance to the nearest metro station at Reagan National Airport is approximately 1.3 miles, the number of new transit trips would be minimal. The second nearest Metrorail station is Crystal City, which is even farther.

7.4.4 TRUCKS AND BUSES

This section discusses project area access for trucks and emergency vehicles, project area access for buses and off-site parking, loading within the project area, and the ability of rowing shell trailers to travel between the nearest interstate and the project area and to access to the project area.

7.4.4.1 Project Area Access –Emergency Vehicles

Under alternative D, fire trucks and ambulances would access the boat facility from northbound GWMP using the existing off-ramp.

7.4.4.2 Project Area Access – Buses

Under alternative D, buses would access the boat facility from northbound GWMP using the existing off-ramp. Buses traveling southbound along the GWMP would be able to access northbound GWMP via National Airport or by making a U-turn at the Daingerfield Island marina.

7.4.4.3 Project Area Loading

Under alternative D, all boats would be loaded and unloaded at the boathouse facility using the existing or new boat ramps constructed as part of the boathouse facility. They would also be launched from several other locations, including Riverside Park, Collingwood picnic area, and Roaches Run in Virginia.

7.4.4.4 Rowing Shell Trailer Access

Under alternative D, rowing shell trailers would need access to Gravelly Point. These trailers are usually pulled by a Ford-150 or equivalent with an average trailer length of approximately 72 feet from the front of the truck to the end overhang point of the boats. They would access the boathouse facility from northbound GWMP using the existing off-ramp. Trailers traveling southbound along the GWMP would be required to make a U-turn at the Daingerfield Island marina to access the boathouse facility. These trailers may require additional coordination with NPS to travel along the GWMP.

An AutoTurn analysis was performed to assess if the on- and off-ramps serving Gravelly Point from the GWMP and U-turn between GWMP southbound and northbound at Daingerfield Island could handle rowing shell trailers. Based on a 72-foot total length between the front of the truck and back of the trailer and a pivot point where the trailer is connected to the truck, these three locations would not be able to handle these trailers without the trailer driving off the paved surface. If alternative D is chosen for a boathouse, the pavement would need to be slightly widened at all three locations to accommodate the trailer vehicle. Attachment 6 provides the illustrations showing the turning movements required to handle these vehicles.

7.4.5 PARKING

Under alternative D, patrons of the boathouse facility would use the existing parking lot at Gravelly Point. Based on the exiting Gravelly Point parking use survey described in section 4.8.4, there would be little room to accommodate future boathouse demand in the existing parking area; therefore, a new parking facility would need to be constructed to for boathouse users. The addition of a new parking facility would reduce the potential parking impact caused by the increase in patrons at Gravelly Point.

7.4.6 TRAFFIC

The following section describes the process for analyzing traffic under alternative D and the results of the analysis. Note that the procedures to forecast future traffic volumes throughout the study include rounding; therefore, values may not add up to the precise value indicated. Following the same process as alternative C, all facilities (intersections and freeways) were evaluated based on a peak hour factor of 0.92 or higher (ratio of the 60-minute volume divided by 4 times the highest 15-minute volume), the lowest accepted by VDOT's *Traffic Impact Analysis Regulations* (VDOT 2012).

The process to evaluate the traffic impacts covers trip generation, modal split, and trip distribution. The section concludes with the results of the traffic analysis.

7.4.6.1 Proposed Alternative D Traffic Network

The proposed boathouse would be situated along the Mt. Vernon Trail at Gravelly Point. A planned boathouse driveway would connect to the existing Gravelly Point internal roadway network. The ramps

connecting Gravelly Point to the GWMP would provide the primary access to and from the regional highway network. Based the parking occupancy counts in section 4.8.4, the parking lot is 90% filled during the weekdays and more than 100% filled (cars parked illegally) during the weekends. These parking lots serve the ball fields, boat launch, and Mt. Vernon Trail access and provide a place to watch airplanes land or take off at Reagan National Airport. Therefore, additional parking facilities would need to be constructed to accommodate the boathouse users.

7.4.6.2 Trip Generation

The trip generation process and results would be the same as those described under alternative C (see section 7.3.6.2).

7.4.6.3 Modal Split

Key Bridge Boathouse conducted modal split surveys on a weekday and weekend day as customers arrived at the facility. These surveys were described above (under section 7.3.6.3) and served as a starting point for the rental user category. However, alternative D is not transit accessible and far from residential land uses. Therefore, the transit and walk shares were assigned to vehicles. The carpool/taxi categories were assumed to remain the same.

The athlete user category mode share would remain the same as the other alternatives, reflecting bus as the primary mode and vehicle as the secondary mode for upper classmen with drivers' licenses. The private user category was assumed to have a higher vehicle mode share (5% higher) than the other alternatives due to the location. Table 7-15 summarizes the modal split research.

TABLE 7-15. MODAL SPLIT SUMMARY FOR ALL USER GROUPS – ALTERNATIVE D

Mode Share	Boat Rentals				Athletes		Private Use: Store at Boathouse		
	Weekday		Saturday		Weekday		All Times	Weekday	Saturday
	Percent	Trips (AM/PM)	Percent	Trips	Percent	Trips (AM/PM)	Percent	Trips (AM/PM)	
Vehicle	18.1%	4/8	23.8%	57	20%	31/47	95%	20/25	32
Carpool	79.2%	16/36	62.9%	150	0%	0/0	0%	0/0	0
Taxi	0.0%	0/0	7.3%	17	0%	0/0	0%	0/0	0
Bicycle	2.7%	1/1	6.0%	14	5%	8/12	5%	1/1	2
Walk	0.0%	0/0	0.0%	0	0%	0/0	0%	0/0	0
Metro	0.0%	0/0	0.0%	0	0%	0/0	0%	0/0	0
Bus	0.0%	0/0	0.0%	0	75%	117/176	0%	0/0	0
Total	100%	20/46	100%	238	100%	156/234	100%	21/26	34

After applying the modal split results to the person trip generation, the number of vehicle trips were calculated by user group. Sixty-five vehicles trips would be generated during the AM peak hour and 100 vehicles during the PM peak hour. Table 7-16 contains the weekday forecasted vehicle trips produced by user group. On a typical Saturday, 146 vehicles trips would be generated during the afternoon peak hour. Table 7-17 contains the Saturday forecasted vehicle trips produced by user group.

TABLE 7-16. WEEKDAY VEHICLE TRIPS BY USER GROUP – ALTERNATIVE D

User	Independent Variable	Time Period	IN	OUT	TOTAL
Rental	Square footage of facility (4,667 SF)	**AM Peak**	5	5	10
		PM Peak	11	11	22
Athlete	Number of athletes	**AM Peak**	0	35	35
		PM Peak	53	0	53
Private User (Store at Boathouse)	Number of boat storage racks (ITE 420)	**AM Peak**	13	7	20
		PM Peak	13	12	25
Private User (Bring own Boat)	Parking spaces and temporary storage lockers	**AM Peak**			
		PM Peak			
TOTAL		**AM Peak**	18	47	65
		PM Peak	77	23	100

TABLE 7-17. SATURDAY VEHICLE TRIPS BY USER GROUP – ALTERNATIVE D

Source	Independent Variable	IN	OUT	TOTAL
Rental	Square footage of facility (4,667 SF)	57	57	114
Athlete	Number of athletes	N/A	N/A	N/A
Private User (Store at Boathouse)	Number of boat storage racks (ITE 420)	14	18	32
Private User (Bring own Boat)	Parking spaces and temporary storage lockers			
TOTAL		71	75	146

7.4.6.4 Trip Distribution

The trip distribution assigned all inbound trips along northbound GWMP, south of Gravelly Point. All outbound trips were assigned to northbound GWMP, north of Gravelly Point. Figure 7-13 illustrates alternative D trip distribution.

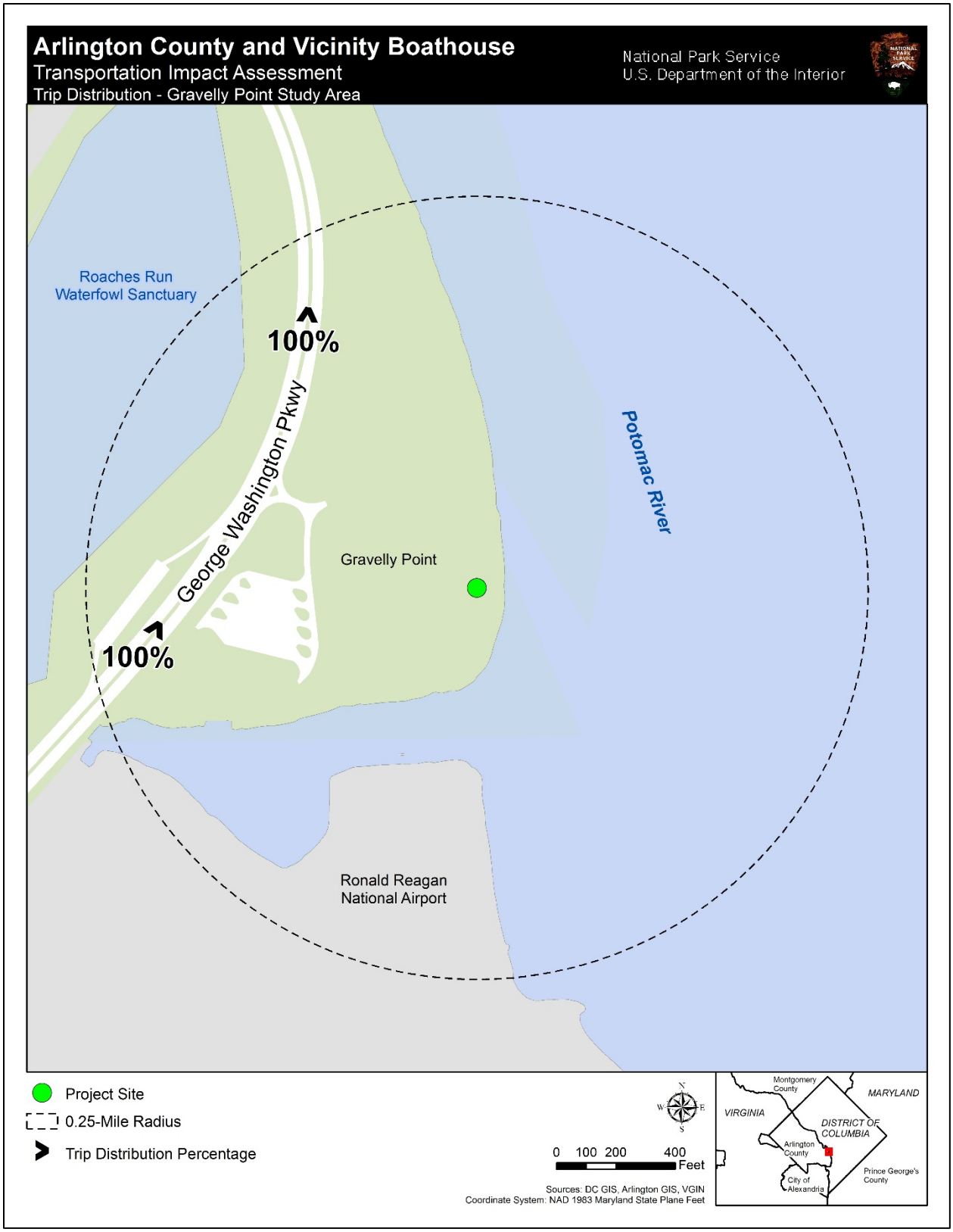


FIGURE 7-13. ALTERNATIVE D TRIP DISTRIBUTION

Figures 7-14 shows the alternative D vehicle trips for all user groups (rental/private and athletic users) for weekday AM and PM peak hours and Saturday peak hours, respectively, and the full alternative D turning movement volumes for weekday AM and PM peak hours and Saturday peak hours, respectively. These figures combine alternative A turning movement volumes with the alternative D vehicle trips.

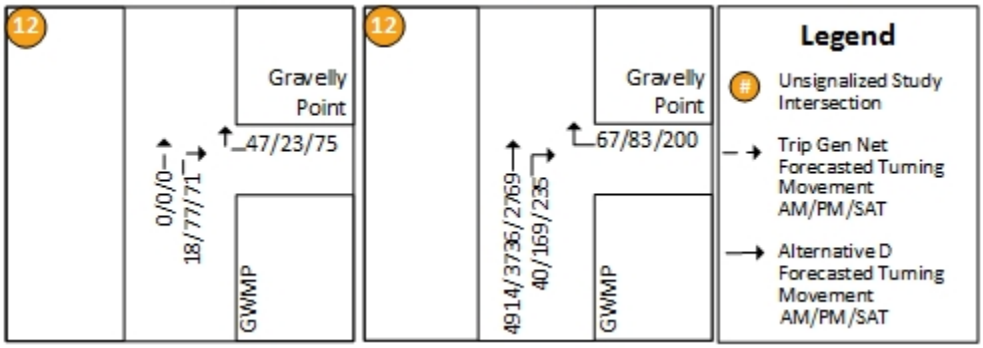


FIGURE 7-14. ALTERNATIVE D VEHICLE TRIPS GENERATED AND PEAK HOUR TURNING MOVEMENT VOLUMES

7.4.6.5 Alternative D Operations Analysis

Based on the Synchro™ unsignalized intersection analysis, the Gravelly Point study area intersection (Intersection #12) would operate at overall acceptable conditions during the peak hours. Table 7-18 shows the results of the LOS capacity analysis and the intersection vehicle delay under alternative D during weekday AM and PM peak hours. Table 7-19 shows the results of the LOS capacity analysis and the intersection vehicle delay under alternative D during the Saturday peak hour.

TABLE 7-18. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE D WEEKDAY PEAK HOUR CAPACITY ANALYSIS

#	Intersection and Approach	Lane Group	Alternative A								Alternative D							
			AM Peak Hour				PM Peak Hour				AM Peak Hour				PM Peak Hour			
			V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check	V/C Ratio	Delay (sec /veh)	LOS	Check
12	**George Washington Memorial Parkway & Gravelly Point (TWSC)** [a]																	
	WB (GWMP On-ramp	R	0.09	23.4	C		0.19	18.6	C		0.31	29	D		0.26	19.9	C	
	WB Overall (GWMP On-ramp)			**23.4**	**C**	**Pass**		**18.6**	**C**	**Pass**		**29**	**D**	**Pass**		**19.9**	**C**	**Pass**

Notes:

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LOS = Level of Service

LTR = left / through / right lanes

TWSC = Two-way STOP-Controlled unsignalized intersection (TWSC intersections do not have an overall LOS)

V/C = Volume-to-Capacity ratio

Delay is Measured in Seconds Per Vehicle.

[a] Highway Capacity Manual 2000 results (Unsignalized intersections)

TABLE 7-19. COMPARISON OF ALTERNATIVE A AND ALTERNATIVE D SATURDAY PEAK HOUR CAPACITY ANALYSIS

#	Intersection and Approach	Lane Group	Alternative A SAT Peak Hour V/C Ratio	Alternative A SAT Peak Hour Delay (sec/veh)	Alternative A SAT Peak Hour LOS	Alternative A SAT Peak Hour Check	Alternative C SAT Peak Hour V/C Ratio	Alternative C SAT Peak Hour Delay (sec/veh)	Alternative C SAT Peak Hour LOS	Alternative C SAT Peak Hour Check
12	**George Washington Memorial Parkway & Gravelly Point (TWSC)** [a]									
	WB (GWMP On-ramp)	R	0.28	16.2	C		0.45	19.4	C	
	WB Overall (GWMP On-ramp)			**16.2**	**C**	**Pass**		**19.4**	**C**	**Pass**

Notes:

EB = Eastbound, WB = Westbound, NB= Northbound, SB = Southbound

LOS = Level of Service

LTR = left / through / right lanes

TWSC = Two-way STOP-Controlled unsignalized intersection (TWSC intersections do not have an overall LOS)

V/C = Volume-to-Capacity ratio

Delay is Measured in Seconds Per Vehicle.

[a] Highway Capacity Manual 2000 results (Unsignalized intersections)

7.4.7 ALTERNATIVE D FREEWAY ANALYSIS

In addition to analyzing the GWMP ramps using unsignalized intersection analysis, the mainline of the GWMP was also analyzed to determine if the added vehicle trips destined to Gravelly Point would affect the GWMP mainline traffic flows. Based on the HCS™ analysis, the GWMP did not exceed capacity for all time periods studied covering the segment between Reagan National Airport and Gravelly Point. Table 7-20 contains the alternative D results.

TABLE 7-20. ALTERNATIVE D GWMP NORTHBOUND OPERATIONS ANALYSIS

Freeway Segment	Facility Type	Time period	Density (pc/mi/ln)	LOS
GWMP Northbound between Reagan National Airport and Gravelly Point	Mainline	AM Peak Hour	30.1	D
		PM Peak Hour	23.1	C
		Saturday Peak Hour	17.2	B

Notes: LOS= level of service; Density = passengers cars per mile per lane (pc/mi/ln)

7.4.8 DISCUSSION OF ALTERNATIVE D

Alternative D is evaluated for pedestrian, bicycle, transit, truck, parking, and traffic impacts. Under the alternative, the proposed boathouse facility would introduce a new circular driveway serving the boathouse and revised Mt. Vernon Trail alignment to avoid the boathouse and minimize the number of vehicle crossings. These actions in addition to the attraction of new person trips to the area by the boathouse facilities would minimally increase pedestrian and bicycle volumes along the Mt. Vernon Trail. Based on the forecasted boathouse vehicle trip generation covering alternative D, there would be 65, 100, and 146 AM, PM, and Saturday peak hour new vehicle trips (person vehicles, school buses, and taxis combined), respectively added to Gravelly Point.

There would be a minor increase in transit, pedestrian, and bicycle use. Based on the AM, PM, and Saturday peak hour traffic assessment, there would be no impacts to the GWMP ramps serving Gravelly Point or the GWMP mainline flows. There would be an increased parking demand at Gravelly Point to serve the vehicle trips.

8.0 PROPOSED MITIGATION BY MODE

To reduce impacts on the transportation system from the action alternatives, mitigation measures are recommended in this section for each mode of transportation analyzed (if they are warranted).

8.1 Pedestrians

The action alternatives would generate an increase in pedestrian traffic in both the Rosslyn and Gravelly Point study areas. Each action alternative would include new sidewalk connections to connect the proposed boathouse with the regional pedestrian network or Mt. Vernon Trail. Under alternatives B or C, installing signs would help boathouse users, especially tourists, find their way between the Rosslyn Metro Station and the boathouse facilities. At Gravelly Point, installing speed humps along the Gravelly Point internal roadway network, including the new proposed circular driveway serving the boathouse and at each Mt. Vernon Trail vehicular crossing is recommended. Given the additional traffic forecasted, these trail crossings would require additional safety measures to ensure they would continue to operate in a safe manner.

8.2 Bicycles

The action alternatives would generate an increase in bicycle traffic in both the Rosslyn and Gravelly Point study areas. Each action alternative would include new bicycle racks at the proposed boathouse. Under alternatives B or C, requiring bicyclists to walk their bicycles between N. Lynn St. and the boathouse along the Mt. Vernon Trail could reduce potential bicycle-pedestrian safety issues. In addition, this section of the Mt. Vernon Trail has a steep grade, making it more difficult for bicyclists to control their speed, especially going downhill toward the boathouse. There are no recommendations for the Gravelly Point site in terms of bicycle improvements.

8.3 Transit

Under alternatives B and C, NPS should work with WMATA and DDOT to install signs directing boathouse patrons from the key transit locations to the boathouse, including the Rosslyn Metro Station and DC Circulator stop at N. Moore St. at N.19th St.

8.4 School Buses/ Taxis/ Other Vehicles

Under alternatives B and C, Arlington County should work with NPS to designate locations where school buses, taxis, and other vehicles can safely drop-off/pick-up boathouse users. The study provides a few suggested near-term and long-term locations (see section 7.3.6.5), but these locations need to be formalized before a new boathouse opens to prevent vehicles from attempting the drop-off/pick-up at the corner of Lee Hwy. WB and N. Lynn St. The study suggests the following near-term locations:

- **School Buses**: along the N. Lynn St. service road west side using the four general-purpose parking spaces during peak hours (red arrow in figure 8-1). The parking spaces could be available for parking between 9:00 a.m. and 3:00 p.m., evenings after 7:00 p.m., and weekends.
- **Taxis and Personal Vehicle Drop-off/Pick-up**: along Lee Hwy. EB service road using the existing designated bus stops (see the white signs in figure 8-2). These stops are used by LCT between 6:00 a.m. and 8:40 a.m. during the weekdays.
- **Taxis and Personal Vehicle Drop-off/Pick-up**: along N. Moore St. just south of Lee Hwy. EB service road along the west side using the existing on-street parking (figure 8-3). These are metered, on-street parking spaces that could be restricted to no parking during the peak hours between 6:00 a.m. and 9:00 a.m. and 3:00 p.m. and 7:00 p.m. during the weekdays.
- **All Drop-off/Pick-up**: along N. Moore St. just south of Lee Hwy. EB service road along the west side using the existing on-street parking (figure 8-3). These metered on-street parking spaces would be converted to an official drop-off/pick-up for all boathouse traffic.

In the long-term, the study suggests using 1401 N. Kent St., an existing commuter bus stop for 13 LCT outbound commuter buses destined to Loudoun County (figure 8-4). There is 100-foot section of curb that is signed to prohibit parking.

FIGURE 8-1. N. LYNN ST. SERVICE ROAD

FIGURE 8-2. LEE HWY. EB SERVICE ROAD

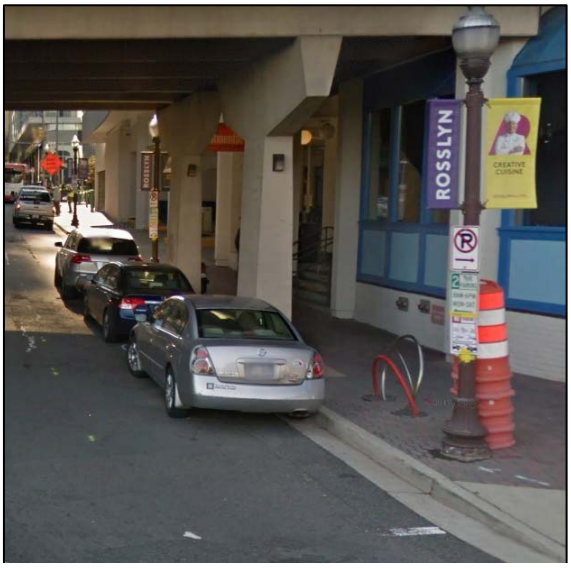


FIGURE 8-3. N. MOORE ST.

FIGURE 8-4. 1701 N. KENT ST. (NORMANDY HOUSE)

8.5 Parking

Under both alternatives B and C, the Rosslyn study area would not require any additional parking options. A number of on- and off-street parking options are available in downtown Rosslyn. Therefore, there are no recommended mitigation required for these action alternatives.

Alternative D in the Gravelly Point study area would require additional parking to accommodate the boathouse demand because the existing parking is fully occupied and alternative travel options would be limited because of the lack of transit serving the site. One option is to provide parking inside of the loop driveway with access points provided along the driveway. This would avoid affecting the ball fields and Mt. Vernon Trail. NPS should investigate other options to determine the best location. A parking demand study should be included as part of any future traffic study that would be required if this site is selected as the preferred alternative. An option to consider is to implement a shuttle bus to the most convenient Metrorail station to avoid the need to construct a large parking area to serve the boathouse.

8.6 Traffic

Based on the traffic analysis conducted for all three action alternatives in the Rosslyn and Gravelly Point study areas, no mitigation required would be required.

The proposed right-in/right-out driveway proposed under alternative C would operate at an acceptable LOS. The existing traffic signal timing at the Lee Hwy. WB at N. Lynn St. intersection provides a green light for pedestrians and bicyclists to cross N. Lynn St. During this time, all vehicular traffic is stopped under a red light. This would provide an opportunity for vehicles attempting to exit the boathouse driveway and enter N. Lynn St. to proceed without any traffic conflicts. VDOT and Arlington County should consider coordinating with NPS to install a single traffic signal connected to the Lee Hwy. WB at N. Lynn St. intersection traffic signal to be posted at the driveway exit to provide a clear indication when it is safe to exit the driveway. The traffic signal would indicate a green light at the same time the pedestrian and bicyclists receive a green light to cross N. Lynn St. at the Lee Hwy. WB at the N. Lynn St. intersection.

9.0 SUMMARY OF ANALYSIS

The following section summarizes the conclusions of the transportation evaluation.

A proposed new boathouse in either Rosslyn or Gravelly Point would generate a total of 196 AM peak hour, 305 PM peak hour, and 272 Saturday peak hour person trips from all modes of transportation. Projected vehicle trips would total 60 during the AM peak hour, 93 during the PM peak hour, and 92 during the Saturday peak hour. The remaining trips would be transit, bicycle, or walking trips. Alternative A background developments in the Rosslyn study area would generate 423 AM peak hour, 694 PM peak hour, and 549 Saturday peak hour vehicle trips.

The pedestrian network would be improved and enhanced under alternative A with the inclusion of the N. Lynn St. and Custis Trail planned sidewalk improvements, providing safer connections between Lee Hwy. EW and WB and between N. Lynn St. and N. Oak St. in Rosslyn. The inclusion of the boathouse under alternatives B and C would increase pedestrian traffic along the Custis and Mt. Vernon Trails where access would be provided to the boathouse. Under alternative D, there would be minimal to no increase in pedestrian traffic along the Mt. Vernon Trail near Gravelly Point.

The bicycle network would be improved and enhanced under alternative A with the inclusion of the N. Lynn St. bicycle lane and Custis Trail planned improvements, providing safer connections between Lee Hwy. EW and WB and between N. Lynn St. and N. Oak St. in Rosslyn. The inclusion of the boathouse under alternatives B and C would increase bicycle traffic along the Custis and Mt. Vernon Trails where access would be provided to the boathouse. Under alternative D, there would be a minor increase in bicycle traffic along the Mt. Vernon Trail near Gravelly Point.

The transit network (Metrorail, Metrobus, ART, and DC Connector) would be minimally affected by a new boathouse in Rosslyn under alternatives B and C. Approximately 5% to 10% of users would travel by transit to Rosslyn to access the boathouse. Instead, most users would opt to either carpool or take a taxi. Under alternative D, it unlikely that anyone would opt to use transit given the 1-mile walk from the nearest Metrorail station.

Parking availability would not be a problem in Rosslyn under alternatives B and C; a number of on- and off-street parking options would be available. Under alternative D, new parking would be necessary to accommodate the boathouse because the existing Gravelly Point parking is fully occupied on most summer days.

Boat trailer access would not be an issue under alternatives B and C because the boats would be floated from another location along the Potomac River and not unloaded/loaded in Rosslyn. Under alternative D, improvements would be needed at three locations (ramps between GWMP and Gravelly Point and a U-turn along GWMP at Daingerfield Island) to enable the boat trailers to access Gravelly Point safely.

Under alternatives B and C, traffic operations at two intersections, Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5) and N. 19th St. and N. Lynn St. (Intersection #11), each have an approach that is currently failing. Once the background growth, three planned developments, and planned roadway narrowing from bicycle/pedestrian improvements are added (alternative A), only one intersection would continue to fail—Lee Hwy. WB/I-66 off-ramp and N. Lynn St. (Intersection #5). The addition of the boathouse would not affect roadway operations and would add minor (about two car lengths) queuing. Given the overall urban environment of downtown Rosslyn, the roadway network would operate well under all alternatives.

Under alternative D, traffic operations along the GWMP mainline and ramps serving Gravelly Point would operate at acceptable levels. The addition of the background growth and proposed boathouse would continue to result in the GWMP mainline and ramps serving Gravelly Point operating at acceptable conditions.

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10.0 REFERENCES

Arlington County

2008 *Arlington Master Transportation Plan—Bicycle Element*. https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2014/02/DES-MTP-Bicycle-Element.pdf. Accessed August 8, 2017.

2012a *Rosslyn Multimodal Transportation Study*. https://projects.arlingtonva.us/plans-studies/transportation/rosslyn-multimodal-transportation-study/. Accessed August 7, 2017.

2012b *Capital Bikeshare Transit Development Plan*. http://nabsa.net/wp-content/uploads/2015/04/Arlington_County_Capital_Bikeshare_TDP_FY2013-2018_Nov2012.pdf. Accessed December 26, 2017.

2015 *Rosslyn Sector Plan. A Plan for the Rosslyn Coordinated Redevelopment District*. https://projects.arlingtonva.us/wp-content/uploads/sites/31/2015/07/Final-draft-Rosslyn_Sector_Plan-Posted_07-17-2015.pdf. Accessed August 4 and 8, 2017.

2016 *FY 2017-2026 Transit Development Plan*. https://projects.arlingtonva.us/plans-studies/transportation/transit-development-plan/. Accessed August 8, 2017.

2017a "Projects and Planning. Comprehensive Plan." https://projects.arlingtonva.us/plans-studies/comprehensive-plan/. Accessed August 4, 2017.

2017b *Projects and Planning. Master Transportation Plan*. https://projects.arlingtonva.us/plans-studies/transportation/master-transportation-plan/. Accessed August 4, 2017.

2017c "Transportation. Tour Buses." https://transportation.arlingtonva.us/parking/public-parking/tour-buses/. Accessed August 17, 2017.

2017d Personal communication via email between R. Gibson, Arlington County, and M. Berger, Louis Berger. August 14, 2017.

n.d. "Arlington County Transit." http://www.arlingtontransit.com/. Accessed August 30, 2017.

Arlington County and Virginia Department of Transportation (Arlington County and VDOT)

2017 *Capital Projects Update: North Lynn Street Esplanade and Custis Trail Improvements*. https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/31/2017/07/Lynn-Street-Esplanade-Presentation-for-web-July-2017.pdf. Accessed August 17, 2017.

Arlington County Code

2015 Chapter 14.2, Motor Vehicles and Traffic. https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/22/2014/01/County-Code-14-2-Motor-Vehicles-and-Traffic.pdf. Accessed August 15, 2017.

BikeArlington

2016 "Arlington Bike Map." http://www.bikearlington.com/tasks/sites/bike/assets/File/Bikemap_front.pdf. Accessed February 8, 2016.

BikeWashington.org

n.d.a "Capital Crescent Trail." http://bikewashington.org/trails/cct/cct.htm. Accessed January 8, 2016.

n.d.b "Martha Custis Trail." http://www.bikewashington.org/trails/wad/custis.htm. Accessed January 8, 2016.

Capital Bikeshare

2017 *Capital Bikeshare FY 2017 Planned Station*s. https://docs.google.com/presentation/d/1F2VkmaA-DwaGh9amWk7-DIpbHuRdtdoC4XyauOnUZ3g/edit#slide=id.p3. Accessed January 2, 2018.

District Department of Transportation (DDOT)

2009–2013

"2009–2013 Traffic Volumes." http://ddot.dc.gov/page/traffic-volume-maps. Accessed July 31, 2015.

2013 *Maryland Avenue SW Transportation Study*, Data Collection Report.

2014a *DC Circulator 2014 Transit Development Plan Update*; Draft: September 2014. http://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/2014%20DC%20Circulator%20Transit%20Development%20Plan%20Update%20Report.pdf. Accessed August 4 and 8, 2017.

2014b *moveDC: Bicycle Element. From: moveDC: the District of Columbia's Multimodal Long-Range Transportation Plan*. http://www.wemovedc.org/resources/Final/Part%202_Plan_Elements/Bicycle.pdf. Accessed January 8, 2016.

2015 *The District of Columbia's Capital Bikeshare Development Plan (Draft)*. Prepared by: Foursquare Integrated Transportation Planning. September 2015. https://ddot.dc.gov/sites/default/files/dc/sites/ddot/page_content/attachments/Draft%20DDOT%20Bikeshare%20Development%20FINAL%20reduced.pdf. Accessed August 8, 2017.

n.d.a "DC Circulator. DC Circulator Data Dashboard." http://circulatordashboard.dc.gov/cirdashboard/#Home. Accessed January 8, 2016.

n.d.b "DC Circulator Buses, Rider Tools." http://www.dccirculator.com/ride/rider-tools/schedule/. Accessed August 31, 2017.

Federal Highway Administration

2011 *Summary of Travel Trends: 2009 National Household Travel Survey*. http://nhts.ornl.gov/2009/pub/stt.pdf. Accessed January 8, 2016.

Fitzpatrick, K.

n.d. "Gaps Accepted at Stop-Controlled Intersections." *Transportation Research Record 1303*. http://onlinepubs.trb.org/Onlinepubs/trr/1991/1303/1303-011.pdf. Accessed August 21, 2017.

Gaps and Gap Acceptance

n.d. *Gaps and Gap Acceptance*. http://mysite.dlsu.edu.ph/faculty/fillonea/documents%5Ctretraf%5Cnotes_gap_and_gap_acceptance.doc. Accessed August 21, 2017.

Georgetown University

n.d. "Georgetown University Transportation Shuttle." https://transportation.georgetown.edu/guts. Accessed January 2, 2018.

Gorove/Slade

2017 *West Rosslyn Development Traffic Impact Study and Transportation Management Plan*. January 11, 2017. http://landtrx.vdot.virginia.gov/page/SubmissionRead.aspx?MastId=32340. Accessed August 31, 2017.

HNTB

2008 *Georgetown Transportation Study: Final Report, October 2008*. Washington, DC. Prepared for: District Department of Transportation. http://ddot.dc.gov/page/georgetown-transportation-study. Accessed November 3, 2015.

Institute of Transportation Engineers (ITE)

2012 *Trip Generation Manual*, Ninth Edition. Washington, DC.

Loudoun County

n.d. "Commuter Bus Service." https://www.loudoun.gov/bus. Accessed August 15, 2017.

Louis Berger

2016 *Georgetown Non-Motorized Boathouse Zone Transportation Study*. https://parkplanning.nps.gov/document.cfm?documentID=77607. Accessed August 31, 2017.

Metropolitan Washington Airports Authority

n.d. "Reagan National." http://www.flyreagan.com/dca/reagan-national-airport. Accessed August 8, 2017.

National Park Service (NPS)

2002 *Facility and Site Analysis for a Boathouse on the Potomac River at Arlington County and Vicinity*. https://parkplanning.nps.gov/document.cfm?parkID=186&projectID=13418&documentID=13527. Accessed August 31, 2017.

2016a *Paved Trails Study, National Capital Region*. Final. https://parkplanning.nps.gov/document.cfm?documentID=74623. Accessed August 4, 2017.

2016b "NPS Visitor Stats. National Park Service Visitor Use Statistics." George Washington Memorial Parkway. https://irma.nps.gov/Stats/Reports/Park/GWMP. Accessed August 21, 2017.

2016c "Chesapeake & Ohio Canal." http://www.nps.gov/choh/planyourvisit/hikingandbiking.htm. Accessed January 8, 2016.

2017 "George Washington Memorial Parkway. Commercial Vehicle Use and Parking." https://www.nps.gov/gwmp/planyourvisit/vehicles.htm. Accessed August 15, 2017.

n.d.a "George Washington Memorial Parkway." https://www.nps.gov/nr/travel/presidents/george_washington_parkway.html. Accessed August 31, 2017.

n.d.b "Mount Vernon Trail." http://www.nps.gov/gwmp/planyourvisit/mtvernontrail.htm. Accessed January 8, 2016.

Potomac and Rappahannock Transportation Commission (PRTC)

2017 "Commuter Bus." http://www.prtctransit.org/commuter-bus/index.html. Accessed August 15, 2017.

Stay Arlington

n.d.a "Tour bus parking in Arlington, Virginia. Rosslyn neighborhood." https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/19/2016/09/Rosslyn-Tour-Bus-Parking-Map-2016.pdf. Accessed August 17, 2017.

n.d.b "Tour bus parking in Arlington, Virginia. Crystal City neighborhood." https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/19/2016/09/Crystal-City-Tour-Bus-Parking-Map-2016.pdf. Accessed August 17, 2017.

Transportation Research Board (TRB)

2000 *Highway Capacity Manual (HCM)*. Transportation Research Board for the National Academies of Science, Washington, DC.

2010 *Highway Capacity Manual (HCM)*. Transportation Research Board for the National Academies of Science, Washington, DC.

Virginia Department of Transportation (VDOT)

2008 "STAA Truck Routes and Restrictions." http://gis.vdot.virginia.gov/VATruckWeb/VaTruckRestrictions.aspx. Accessed August 15, 2017.

2010–2014

"2010, 2011, 2012, 2013, 2014 Jurisdiction Report. Daily Traffic Volume Estimates, including Vehicle Classification Estimates." http://www.virginiadot.org/info/ct-trafficcounts.asp. Accessed August 30, 2017.

2012 *Traffic Impact Analysis Regulations*. 24VAC30-155. http://www.vdot.virginia.gov/info/traffic_impact_analysis_regulations.asp. Accessed August 21, 2017.

2015 "VDOT Functional Classification." http://www.virginiadot.org/projects/fxn_class/maps.asp. Accessed August 8, 2017.

2016 "Average Daily Traffic Volumes with Vehicle Classification Data on Interstate, Arterial and Primary Routes." http://www.virginiadot.org/info/resources/Traffic_2016/AADT_PrimaryInterstate_2016.pdf. Accessed August 8, 2017.

Virginia Transportation Research Council

2008 *Framework for Selection and Evaluations of Bicycle and Pedestrian Safety Projects in Virginia*. http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-r8.pdf. Accessed December 26, 2017.

Washington Metropolitan Area Transit Authority (WMATA)

2005 *Development-Related Ridership Survey Final Report*. https://www.wmata.com/pdfs/planning/2005_Development-Related_Ridership_Survey.pdf. Accessed April 14, 2014.

2013 *Metro Momentum. The Next Generation of Metro*. https://www.wmata.com/initiatives/strategic-plans/2025.cfm. Accessed August 8, 2017.

2016 "Historical Rail Ridership." https://www.wmata.com/initiatives/plans/upload/2016_historical_rail_ridership.pdf. Accessed August 31, 2017.

2017a Personal communication via email from G. McFarland, WMATA, to M. Berger, Louis Berger, regarding Rosslyn rail ridership data. August 8, 2017.

2017b Personal communication via email from G. McFarland, WMATA, to M. Berger, Louis Berger, regarding WMATA bus data. August 22, 2017.

n.d. "District of Columbia [Bus] Timetables." www.wmata.com/bus/timetables/timetables-state.cfm?State=DC. Accessed November 11, 2015.

Wells + Associates

2015 *Rosslyn Plaza Traffic Impact Study*. December 24, 2015. http://landtrx.vdot.virginia.gov/page/SubmissionRead.aspx?MastId=24346. Accessed August 31, 2017.

ZGF Architects LLP

2016 *Georgetown – Rosslyn Gondola Feasibility Study*. https://static1.squarespace.com/static/56be0bf0f85082283a801769/t/581b3129be6594f54cc7a225/1478177085024/GR-Gondola-TechSummary-110316.compressed.pdf. Accessed August 4, 2017.

Zipcar

2017 "Car Sharing Washington, DC." http://www.zipcar.com/dc/find-cars. Accessed August 8, 2017.

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APPENDIX B: WETLAND STATEMENT OF FINDINGS

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STATEMENT OF FINDINGS

FOR

EXECUTIVE ORDER 11990, "PROTECTION OF WETLANDS"

ARLINGTON COUNTY AND VICINITY BOATHOUSE
George Washington Memorial Parkway
Virginia

June 2018

RECOMMENDED: _____

Alexcy Romero Date

Superintendent, George Washington Memorial Parkway

CERTIFICATION OF TECHNICAL ADEQUACY AND SERVICEWIDE CONSISTANCY:

_____

Kevin Noon

Chief, Water Resources Division Date

APPROVED: _____

Robert Vogel Date
Regional Director, National Capital Region

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INTRODUCTION

Executive Order 11990, "Protection of Wetlands," requires the National Park Service (NPS) and other federal agencies to evaluate the likely impacts of actions in wetlands. NPS Director's Order 77-1: *Wetland Protection* and Procedural Manual 77-1 provide NPS procedures for complying with Executive Order 11990. This Statement of Findings (SOF) documents compliance with these NPS wetland protection procedures.

NPS, in cooperation with the National Capital Planning Commission and Arlington County, Virginia, is proposing to develop a boathouse and related facilities on the Virginia side of the Potomac River south and west of Washington, DC, on land administered by the George Washington Memorial Parkway. The purpose of the project is to identify a preferred site for an environmentally sustainable public rowing and paddling facility along the Virginia shoreline, while ensuring the protection of park natural and cultural resources.

Previous studies have demonstrated a steadily increasing demand for nonmotorized boating, including rowing, paddling, and standup paddle boarding within the region, and within Arlington County. Currently, Arlington County residents and the three public high schools use area boathouses located in Washington, DC. The preferred alternative would establish boathouse facilities that would help meet this demand and be designed appropriate to the constraints of the site.

PROJECT DESCRIPTION

Currently, Arlington County residents and the three public high schools use area boathouses located in Washington, DC. Wakefield High School rows out of the Capitol Rowing Club on the Anacostia River; Washington-Lee High School rows out of the Potomac Boat Club and Yorktown High School out of Thompson Boat Center, both on the Potomac River. The rowing conditions, potential conflicts with motorized watercraft, and travel times between Arlington County and the boat clubs make some of these locations less than ideal for the high school rowing programs, as well as for other community users. Other area schools have generated additional demand for rowing programs and associated storage spaces.

The selection of a preferred site and construction of a boathouse is needed to meet the direction of Congress to provide enhanced public waterfront access near Arlington County. The construction of a boathouse facility is also needed to increase access along the Virginia shoreline for nonmotorized water-based recreational activities on the Potomac River and to alleviate pressure on other area boathouses, which are currently at maximum capacity. Access to the Potomac River along the George Washington Memorial Parkway has been an issue for Northern Virginia citizens since the 1930s, when a wharf was planned below the Francis Scott Key Bridge (Key Bridge) to serve primarily as an industrial port. Since the late 1980s, Arlington County residents involved in rowing have expressed a desire for the construction of a boathouse facility along the George Washington Memorial Parkway, and more recently, residents involved in other paddling and nonmotorized activities have expressed a desire for more access to the water on the Virginia side of the river.

Under the preferred alternative, NPS and Arlington County would develop a riverfront boat storage facility and launching site at lower Rosslyn, including a boathouse facility and floating docks for nonmotorized boats. The boathouse facility would be located along the Potomac River shoreline in Virginia south of the Key Bridge, east of the parkway, and north of the existing Theodore Roosevelt Island parking lot. Site access would be predominantly by Metrorail, bus, bicycle, and on foot. This alternative would provide approximately 14,000 square feet (SF) of boat storage and additional space for a rigging area/apron. The storage facility would be designed to be light on the land and flood-resistant with flow-through and tear-away walls. No support facilities (e.g., offices or locker rooms) would be available at this location. A path would link the rigging area/apron to a 300-foot-long floating dock for launching rowing shells and other paddlecraft. Approximately 58,000 SF of excavation and dredging would be required to achieve at least 3.3-foot depth in this location to accommodate depth required for

coaching launch boats and rowers to avoid underwater obstructions. The outboard motors on the coaching launches have shafts that extend up to 22 inches below the surface; there needs to be enough depth below them at low tide so they do not come into contact with the river bottom and stir up sediments or hit objects on the river bottom. In addition, enough depth below the dock should be included so that waves refracting from the shore do not cause the dock to bounce and make it difficult to get into and out of rowing shells safely. Figure B-1 provides the proposed components and configuration for alternative B, figure B-2 shows where dredging would be required, figures B-3 and B-4 show photos of the site, and table B-1 provides details on facility architecture, site access, and floodplain adaptions. The exact location of the floating dock and the depth and frequency of dredging activities would be formalized during the design and permitting phase of the proposed project and in consultation with the US Army Corps of Engineers (USACE). A USACE permit would be required for all in-water work. Construction equipment would be staged on a portion of the existing parking area for Theodore Roosevelt Island. A dredge boat would be required to complete dredging activities, and a barge may be required to deliver large equipment or materials for construction of the boathouse on the lower Rosslyn site because site access is constrained by the elevated pedestrian walkway located south of the proposed boathouse location. Vegetation cleared during the construction period would be replanted with native vegetation where possible.

The boathouse would be low-impact, resilient, and flood resistant. Design of the boathouse has not started, but it would be designed to minimize impacts, including flow-through and tear-away walls. Best management practices for siting and construction would include limiting impervious surfaces and maximizing building-integrated stormwater management.

Additional support facilities would be provided at the upper Rosslyn site, which is closer to the Rosslyn neighborhood and transit. The support facility would include office space, locker rooms, restrooms, and space for education and outreach. A small parking area would provide access for visitors with disabilities and service vehicles, and an access road would be associated with the support facility. The upper Rosslyn site would be accessible by trail to the lower Rosslyn site. Site access would be predominantly by transit, bicycle, and on foot. No wetlands are present at the upper Rosslyn site.

In addition to the boathouse and supporting facilities at the Rosslyn sites, the project would also include the potential for development of two soft launch sites for paddlers elsewhere in George Washington Memorial Parkway, at Riverside Park on the Potomac River, and at Roaches Run. These sites would be convenient to existing parking and would include some changes to the shoreline to allow users to launch from the shore. Short, floating docks would be placed in both locations. Existing riprap would be removed from Roaches Run, and an existing road would be used for pedestrian access to minimize disturbance. Armor stone (boulders) currently on the steep riverbank, would be removed at Riverside Park and potentially replaced with stairs. In addition, NPS would close an unofficial soft launch point at Riverside Park and the associated social trail used to access it. The Roaches Run site is shown in figure B-5; Riverside Park is shown in figure B-6.

FIGURE B-1. UPPER AND LOWER ROSSLYN SITES

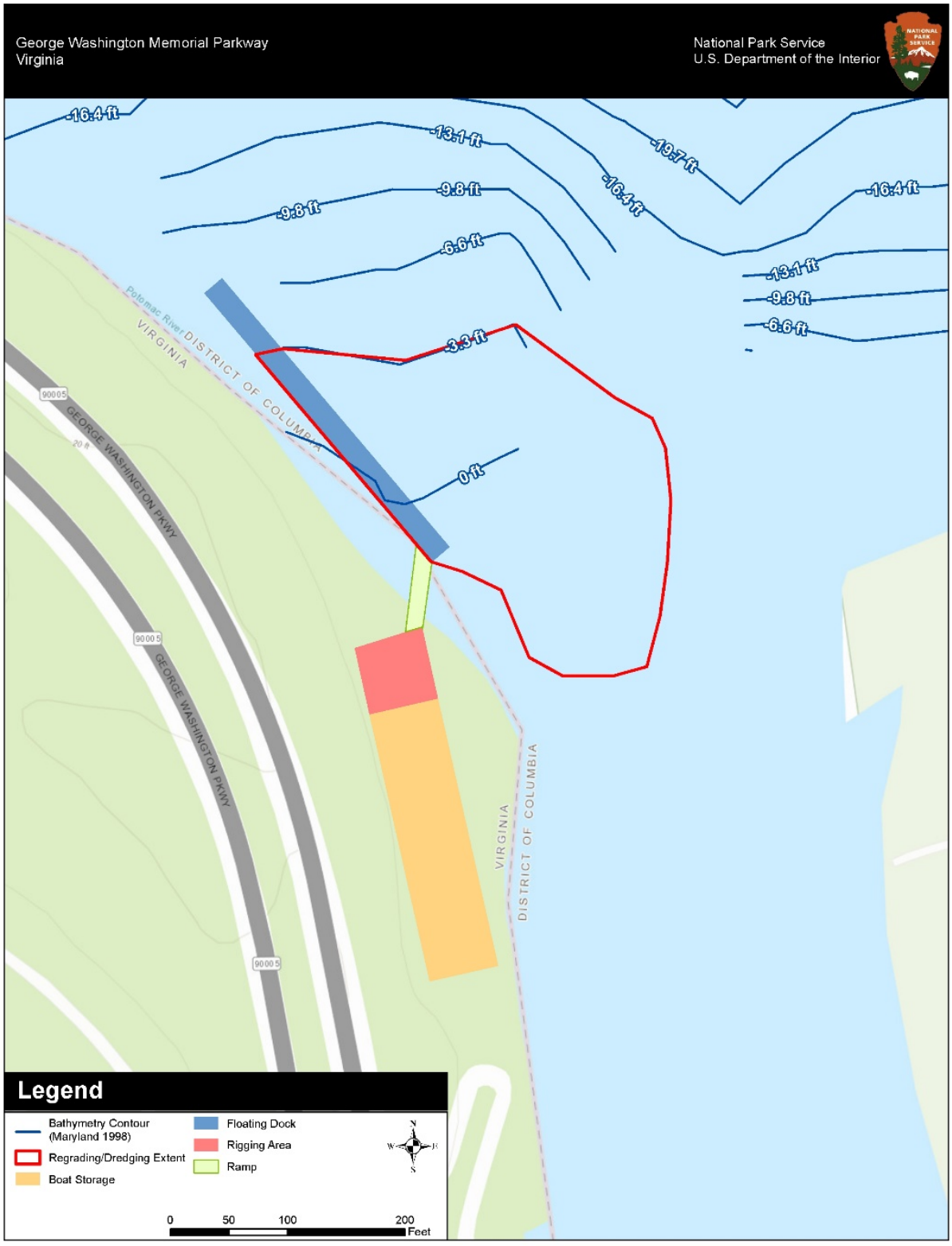

FIGURE B-2. AREA PROPOSED FOR REGRADING/DREDGING TO 3 FEET DEEP AT MEAN LOW WATER

TABLE B-1. SUMMARY OF THE PREFERRED ALTERNATIVE

Feature	Development of the Upper and Lower Rosslyn Site
Summary	This alternative focuses on developing a low-impact, flood resistant riverfront boat storage and launching facility with ancillary functions provided in facilities located on an upland site accessible by a trail. Site access would be predominantly by transit, bicycle, and on foot.
Operational Restrictions and Requirements	• Stored boats to be moved to a location above base flood elevation during potential flood events • Boats delivered to storage facility by water only • No storage or fueling of motorized coach launches, gasoline, or motors
User Experience/Access	• Minimum 5-minute walk from nearby parking and bus drop-off; 100-foot grade change limits accessibility. • Accessible parking and access for emergency vehicles only • No vehicular access / car-top launch for users; alternative launch points for kayaks/canoes to be developed at Riverside Park and Roaches Run • Vehicular access at upper site limited to emergency vehicles and accessible parking
Building Footprint and Program	• Lower site (14,000 SF structure) – 14,000 SF boat storage for scholastic and community use – Rigging space/apron • Upper site – Boathouse support – Office space – Locker rooms and restrooms – Other user amenities that support transit access to the site (e.g., changing rooms, lockers, showers, education and outreach)
New Dock	• 300-foot-long low-profile floating dock for rowing and canoe/kayak launch • Wheelchair transfer point • Regrading/dredging required to achieve minimum 3.3-foot clearance to bottom at mean low water
Visitor Access	• Enhanced wayfinding signage identifying the route to the river by way of the existing trail and pedestrian bridge over parkway • Bicycle and pedestrian access via Martha Custis Trail rerouted around building to minimize bicycle, boat, and pedestrian conflicts • Potomac Heritage Trail would be rerouted around the boathouse • Shower and changing rooms, lockers for bulky equipment storage and other amenities on the upper site that support transit as a viable and comfortable access option

Feature	Development of the Upper and Lower Rosslyn Site
Motorized Access	• Vehicular access to building limited to park or county maintenance vehicles via driveway extended from the Theodore Roosevelt Island parking lot • Paid parking in nearby parking garages • Storage of motorized launches not permitted on site; coach launches berthed offsite at nearest motorboat marina (Pentagon Lagoon) or at other marinas
Boathouse Architecture	• Narrow footprint allows for some vegetative screening on long façades facing river and parkway • Maximum height above existing grade limited to minimize intrusion into views from parkway and other vantage points • Alternative construction methods such as modular construction and installation from waterside to minimize construction impacts
Resilience/Flood Hazard Adaptation	• Critical systems (electrical and communication) would be provided by alternative means to establish an "off the grid" facility. These critical systems would be located above base flood elevation (+19, approximately 9 feet above existing grade). • Resilient structure resists flood damage and allows easy renovation post-flood (e.g., structural frame withstands flood/debris and ice dam impact, interior and exterior finish materials are eliminated to reduce post-flood waste; structure and finishes of durable materials that dry out and clean off easily). • Simple, passive and flexible design features such as natural daylighting, operable windows, passive heating and cooling allow usable conditions to be restored more easily. Same as alternative B, except critical systems would be located above base flood elevation (+19, approximately 9 feet above existing grade).

FIGURE B-3. LOWER ROSSLYN SITE, FACING THE POTOMAC RIVER

FIGURE B-4. THE SHORELINE AT THE LOWER ROSSLYN SITE

SITE DESCRIPTION

For the purposes of this SOF, only the lower Rosslyn site and the two proposed soft launch sites are described because the upper Rosslyn site does not contain any wetlands or submerged aquatic vegetation (SAV). Under Director's Order 77-1: *Wetland Protection* (NPS 2008a), and NPS Procedural Manual 77, NPS considers water up to 2 meters (about 6 feet) deep to be riparian wetlands.

LOWER ROSSLYN

The site extends north of the parking lot for Theodore Roosevelt Island and is approximately 600 feet (from the parking lot to the top of the apron/rigging area) by 120 to 190 feet wide, or 2 acres, and is located between the parkway and the Potomac River. A grassy clearing occupies the center, vine-covered trees and shrubs surround the perimeter (figure B-2), including a vegetated bank up to the parkway. The apron and 300-foot dock would extend to the north of the site where the water is deeper and the river is more accessible for rowing shells.

Wetlands on the lower Rosslyn site are shallow water riverine wetlands in the Potomac River, where the dock would be placed, and dredging is proposed to allow access to the docks. Although precise bathymetry for the area is not available, navigational charts and observational data show the river along the Virginia bank at the lower Rosslyn site being relatively shallow, in the 1- to 5-foot range (NMFS 2017; MD DNR 1998; EA Engineering 2005). From approximately two-thirds of the way down the dock moving south into the mouth of the channel between the Virginia shoreline and Theodore Roosevelt Island, the depth at mean low water ranges from 0 to 3 feet, as demonstrated in figure B-5. Under the northernmost third of the dock, the water is deeper, between 3 and 6 feet. The riverbed in this area is composed of sands and sediments, and SAV historically has occurred in the Potomac River along the shoreline. The Virginia Institute of Marine Sciences maps SAV beds in the Chesapeake Bay region annually. Based on inspection of historic and recent SAV maps, historical SAV beds along the shoreline of the proposed lower Rosslyn site and along the shore of Theodore Roosevelt Island just across from the site include mostly hydrilla *(Hydrilla verticillata),* along with hornwort *(Ceratophyllum demersum),* Brazilian waterweed *(Egeria densa),* stargrass (*Heteranthera dubia),* nodding waternymph (*Najas flexilis),* brittle naiad *(Najas minor),* sago pondweed *(Stuckenia pectinata),* and wild celery *(Vallisneria americana).* SAV was recorded in the zone in 2014, 2015, and 2016 (VIMS 2017; DOEE 2017) (figure B-5). Functions of this wetland include nursery habitat in the SAV and providing shallow water and benthic habitat for aquatic species, including fish and macroinvertebrates found in the Potomac River.

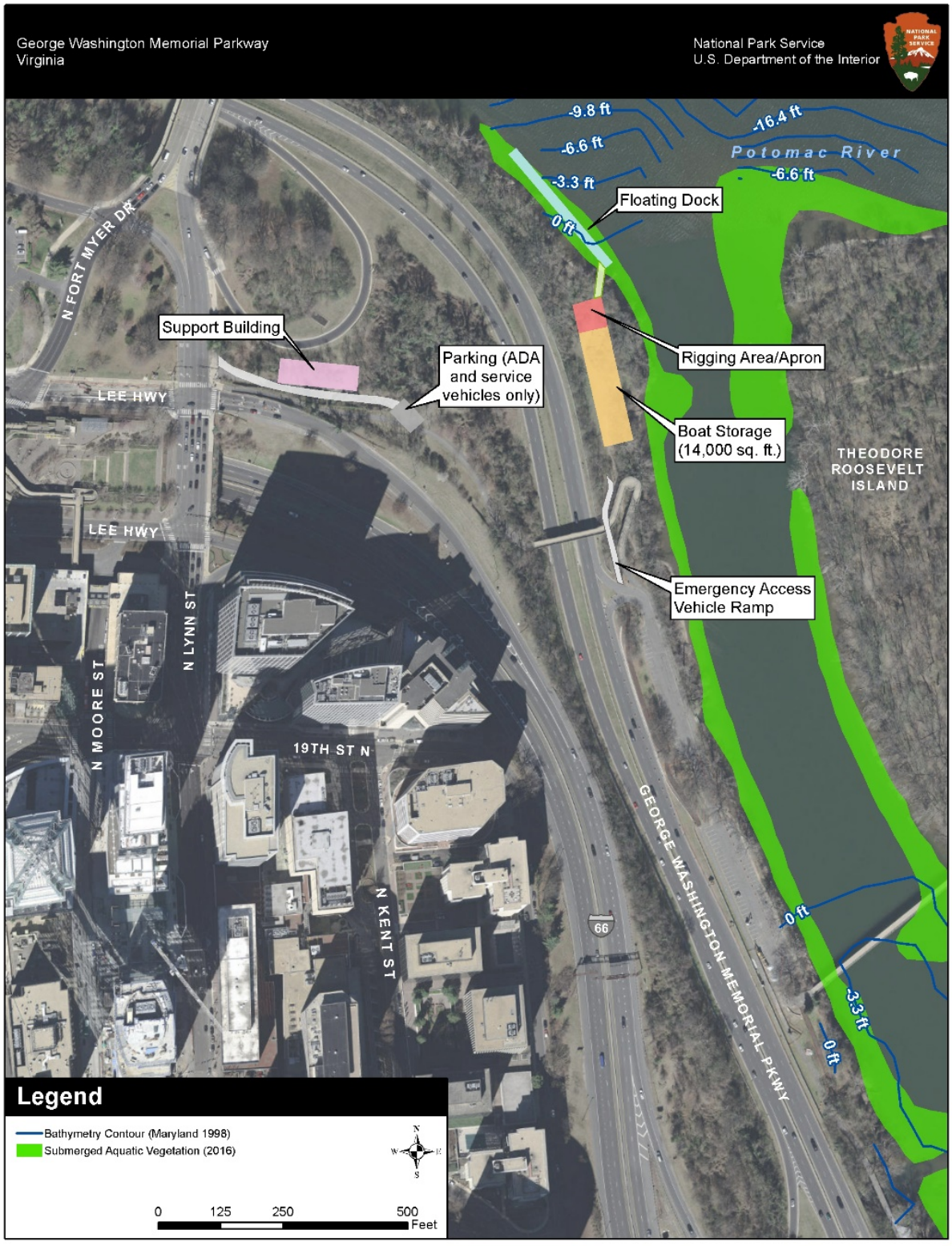

FIGURE B-5. BATHYMETRY AT MEAN LOW WATER AND EXTENT OF SAV IN THE POTOMAC RIVER AT THE LOWER ROSSLYN SITE

ROACHES RUN SOFT LAUNCH SITE

The Roaches Run site is adjacent to the parking lot/cell phone waiting area for Reagan National Airport, and has a gravel shore with vegetation shrubs and trees between the shore and the parking lot. An old roadbed would be used for access. The National Wetlands Inventory wetlands mapper indicates the presence of a 0.5-acre freshwater forested/shrub wetland at the southern end of the parking lot at Roaches Rune. A formal delineation has not been performed. This site also contains shallow water riparian wetlands, over which a floating dock would be placed. Roaches Run (under the State of Virginia's jurisdiction) also has a large SAV bed of nearly all hydrilla that was recorded in 2015. The bed covers most of the inlet and is in front of the area for the proposed launch spot (VIMS 2017).

Functions for this wetland includes providing riparian habitat for macroinvertebrates, avian species, and flora. This wetland protects the shoreline from erosion, although Roaches Run is a relatively well-protected inlet. Another value is flood protection. Evapotranspiration and carbon sequestration are minor values, whereby the wetland minimally reduces water quantity and carbon emissions respectively (USACE 1999).

RIVERSIDE PARK SOFT LAUNCH SITE

The water immediately offshore of the soft launch site at Riverside Park ranges from 1 to 3 feet (NMFS 2017), so it is classified as riparian riverine wetlands. Functions for this wetland include providing riparian and shallow water habitat for aquatic species.

JUSTIFICATION FOR THE USE OF WETLANDS

Providing increased access to the water and increasing user amenities through the development of the boathouse and access for paddlers at the soft launch sites depends on the proximity of the site to the Potomac River and associated inlets, such as Roaches Run. Placing docks at lower Rosslyn is required to allow access for the rowing shells. At the soft launch sites, the docks are needed to protect resources and to provide access to the river for rowers and paddlers. The Rosslyn site is a more appropriate site than Gravelly Point for accommodating rowing because of the open conditions on the Potomac River, which is and prone to choppy water, and for community access.

INVESTIGATION OF ALTERNATIVE SITES AND DESIGNS

The environmental assessment (EA) prepared this project considers four alternatives, the proposed combined upper and lower Rosslyn sites evaluated in this SOF (alternative C in the EA), the lower Rosslyn site only (alternative B), the Gravelly Point site (alternative D), and the no-action alternative (alternative A). NPS also considered and dismissed other alternatives because of land access issues, the potential for unacceptable impacts to other resources, or dangerous on-water user conflicts.

ALTERNATIVE A – NO ACTION

Under the no-action alternative, no boathouse or soft launch sites would be constructed in the park. Arlington County public high school rowing programs and the general public would continue to use area boathouses located in Washington, DC, as described in chapter 1 of the EA. Existing and future public demand for rowing programs and related boat storage space would be accommodated by these existing facilities, other planned rowing facilities, or would remain unmet.

ALTERNATIVE B – LOWER ROSSLYN SITE ONLY

Under alternative B, NPS and Arlington County would develop a low-impact, flood-resistant riverfront boat storage facility and launching site at the lower Rosslyn site, which would include a boathouse facility

and floating docks for nonmotorized boats, as described under the preferred alternative above for the boathouse.

Boats would be delivered to the Rosslyn storage facility by water only. Stored boats would be moved to a location above base flood elevation when potential flood events are expected. No on-site storage of motorized coach launches, gasoline, or motors would occur and no filling of gasoline tanks would be allowed on-site.

Alternative B includes the same options to create soft launch access points for paddlecraft at Roaches Run and Riverside Park as described for the preferred alternative.

ALTERNATIVE D – GRAVELLY POINT SITE

Under alternative D the boathouse facility and docks for nonmotorized boats would be located in the Gravelly Point area located east of the parkway, adjacent to the existing parking lots and recreational fields. Gravelly Point was proposed to avoid potentially sensitive resources and reduce the amount of road infrastructure needed to access the site, compared to other locations along this part of the Potomac River. This alternative would include one larger 28,000 SF two-story boathouse facility, with 14,000 SF of storage space and 14,000 SF for restrooms, locker rooms, exercise equipment, team meeting space, and a community room above. Because of its proximity to the Reagan National Airport, the height of the proposed boathouse would be restricted to be less than 25 feet. Similar to alternatives B and C, the site would contain an associated rigging area/apron and 300-foot-long floating dock. A driveway would be constructed to provide drop-off access to the boathouse facility. Two playing fields that exist on the site would be relocated slightly to the north. Access would be predominantly by car.

Alternative D includes the same options to create soft launch access points for paddlecraft at Roaches Run and Riverside Park as described for the preferred alternative.

WETLAND MITIGATION

Placement of the dock at lower Rosslyn would be optimized to avoid the SAV and minimize the area that would need to be dredged during the design process. SAV would be protected to the extent possible. SAV that is removed through the dredging process or shaded by the dock would be replanted outside the project area, but within the watershed, as close to the site as possible using native species of SAV. Additional mitigation, to be determined during the permitting process, would occur as necessary.

COMPLIANCE

CLEAN WATER ACT SECTION 404

The preferred alternative affects waters of the United States as defined by the Clean Water Act and is therefore subject to review by USACE. The Clean Water Act Section 404 regulates the discharge of dredged or fill material into waters of the United States.

NATIONAL ENVIRONMENTAL POLICY ACT

The EA, section 106 compliance review, this SOF for Executive Order 11990, and the decision document, anticipated to be a finding of no significant impact will complete the requirements for the National Environmental Policy Act for this project.

CONCLUSION

The preferred alternative would require changes within riparian riverine wetlands and areas that include SAV beds at lower Rosslyn, including regrading or dredging up to 58,000 SF of wetlands to a depth of 3.3 feet at mean low water. The dredged area would extend into the existing SAV beds, requiring the

dredging of approximately 3,200 SF of SAV and the dock would also shade the SAV. Although efforts have been and would be made to minimize disturbance of SAV and the extent of dredging, the boathouse would not be functional at this location without the dredging. Possible locations for this facility on the Virginia shoreline are limited because of access issues from land, on-the-water conditions, and other resource constraints.

Although the wetlands at lower Rosslyn would be disturbed, they would remain wetlands because the water would remain less than 2 meters deep. However, the wetland functions would change. The existing SAV bed would be decreased in size, which would decrease the quality of the habitat in the wetlands. Dredging adjacent to the SAV bed would not change the substrate, which is a combination of clay and sand, but would change the depth. Both dredging and disturbance of SAV would be mitigated by continued efforts to minimize disturbance through the design process, planting SAV elsewhere on the Potomac River, as close to the project area as possible, and committing to other mitigation measures that may be stipulated during the permitting process.

Although there is a nontidal freshwater forested/shrub wetland present at the Roaches Run soft launch site, it would not be disturbed, and the dock at both Roaches Run and Riverside Park would shade the bottom but would not fundamentally alter ecological function of the shallow water wetlands near the docks.

REFERENCES

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe

1979 C*lassification of Wetlands and Deepwater Habitats of the United States.* Prepared for the Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, DC.

District of Columbia Department of Energy and Environment (DOEE)

2017 "Project Performance Report F15AF01137: DC F-2-R-28 Fisheries Management Studies—Job 3.1: Aquatic Vegetation Monitoring." Prepared by Sam Doyle, Fisheries Management Branch. March.

EA Engineering, Science, and Technology (EA Engineering)

2005 "Arlington County and Vicinity Rowing Facility: Benthic and Freshwater Mussel Survey of the Lower Potomac River Technical Report." Prepared for the National Park Service. January.

Maryland Department of Natural Resources

1998 "Maryland Bathymetry – Chesapeake Bay Contours." Updated in 1999.

National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS)

2017b *Potomac River, Mattawoman Creek to Georgetown Navigational Chart 12289.*

National Park Service

2008 Directors Order 77-1: *Wetland Protection*. http://www.nps.gov/policy/DOrders/DO77-1-Reissue.htm.

2008 NPS Procedural Manual #77-1: *Wetland Protection Procedural Manual*. http://www.nps.gov/water/wetlands/Wetlands_Protection_Manuals.cfm.

Virginia Institute of Marine Sciences (VIMS)

2017 Submerged Aquatic Vegetation in "Chesapeake Bay and Coastal Bays" interactive map website. Accessed August 21, 2017. http://web.vims.edu/bio/sav/maps.html.

US Army Corps of Engineers (USACE)

1999 *Highway Methodology Workbook Supplement: Wetland Function and Values, A Descriptive Approach.* September 1999.

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APPENDIX C: FLOODPLAIN STATEMENT OF FINDINGS

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STATEMENT OF FINDINGS

FOR

EXECUTIVE ORDER 11988, "FLOODPLAIN MANAGEMENT"

ARLINGTON COUNTY AND VICINITY BOATHOUSE
George Washington Memorial Parkway
Virginia

June 2018

RECOMMENDED: _____

Alexcy Romero Date

Superintendent, George Washington Memorial Parkway

CERTIFICATION OF TECHNICAL ADEQUACY AND SERVICEWIDE CONSISTANCY:

_____

Kevin Noon

Chief, Water Resources Division Date

APPROVED: _____

Robert Vogel Date
Regional Director, National Capital Region

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INTRODUCTION

Executive Order 11988, "Floodplain Management," requires the National Park Service (NPS) and other federal agencies to evaluate the potential impacts of their actions to floodplains. The evaluation is intended to (1) minimize the risk of flood damage to the park resources, including capital investments, (2) preserve and restore natural and beneficial floodplain values, and (3) protect human safety, health and welfare. This floodplain statement of findings (FSOF) has been prepared according to National Park Service Procedural Manual 77-2 to comply with Executive Order 11988.

NPS, in cooperation with the National Capital Planning Commission and Arlington County, is proposing to develop a boathouse and related facilities on the Virginia side of the Potomac River south and west of Washington, DC, on land administered by the George Washington Memorial Parkway. The purpose of the project is to identify a preferred site for an environmentally sustainable public rowing and paddling facility along the Virginia shoreline, while ensuring the protection of park natural and cultural resources.

Previous studies have demonstrated a steadily increasing demand for nonmotorized boating, including rowing, paddling, and standup paddle boarding within the region and within Arlington County. Currently, Arlington County residents and the three public high schools use area boathouses located in Washington, DC. The proposed action would establish boathouse facilities that would help meet this demand and be designed appropriate to the constraints of the site.

PROJECT DESCRIPTION

Currently, Arlington County residents and the three public high schools use area boathouses located in Washington, DC. Wakefield High School rows out of the Capitol Rowing Club on the Anacostia River; Washington-Lee High School rows out of the Potomac Boat Club and Yorktown High School out of Thompson Boat Center, both on the Potomac River. The rowing conditions, potential conflicts with motorized watercraft, and travel times between Arlington County and the boat clubs make some of these locations less than ideal for the high school rowing programs, as well as for other community users. Other area schools have generated additional demand for rowing programs and associated storage spaces.

The selection of a preferred site and construction of a boathouse is needed to meet the direction of Congress to provide enhanced public waterfront access near Arlington County. The construction of a boathouse facility is also needed to increase access along the Virginia shoreline for nonmotorized water-based recreational activities on the Potomac River and to alleviate pressure on other area boathouses, which are currently at maximum capacity. Access to the Potomac River along the George Washington Memorial Parkway has been an issue for Northern Virginia citizens since the 1930s, when a wharf was planned below the Francis Scott Key Bridge (Key Bridge) to serve primarily as an industrial port. Since the late 1980s, Arlington County residents involved in rowing have expressed a desire for the construction of a boathouse facility along the George Washington Memorial Parkway, and more recently, residents involved in other paddling and nonmotorized activities have expressed a desire for more access to the water on the Virginia side of the river.

Under the preferred alternative, NPS and Arlington County would develop a riverfront boat storage facility and launching site at lower Rosslyn, including a boathouse facility and floating docks for nonmotorized boats. The boathouse facility would be located along the Potomac River shoreline in Virginia south of the Key Bridge, east of the parkway, and north of the existing Theodore Roosevelt Island parking lot. Site access would be predominantly by Metrorail, bus, bicycle, and on foot. This alternative would provide approximately 14,000 square feet (SF) of boat storage and additional space for a rigging area/apron. No support facilities (e.g., offices or locker rooms) would be available at this location. A path would link the rigging area/apron to a 300-foot-long floating dock for launching rowing shells and other paddlecraft. Approximately 58,000 SF of regrading or dredging would be required to achieve a minimum 3.3-foot depth in this location.

The boathouse would be low-impact, resilient, and flood resistant. Best management practices for siting and construction would include limiting impervious surfaces and maximizing building-integrated stormwater management. As possible, alternative energy systems would be incorporated into the design. In compliance with Executive Order 11988, "Floodplain Management," any new construction of structures or facilities approved to be located within the 100-year floodplain would require accepted flood-proofing and other flood protection measures to the facilities designed to be applied and would conform to the National Flood Insurance Program.

In addition, Arlington County's Floodplain Management Ordinance (Chapter 48 of the Arlington County Code), stipulates that all new construction and substantial improvements of non-residential structures have the lowest floor, including basement, elevated to or above the flood depth specified on the flood insurance rate maps (FIRM), above the highest adjacent grade at least as high as the depth number specified in feet on the FIRM. If no flood depth number is specified, the lowest floor, including basement, will be elevated at least 2 feet above the highest adjacent grade; or together with attendant utility and sanitary facilities be completely flood-proofed to the specified flood level so that any space below that level is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. For this project, the proposed boat storage area would not be considered habitable.

Additional support facilities would be provided at the upper Rosslyn site, which is closer to the Rosslyn neighborhood and transit. The support facility would include office space, locker rooms, restrooms, and space for education and outreach. A small parking area would be available for visitors with disabilities and service vehicles, and an access road would be associated with the support facility. The upper Rosslyn site would be accessible by trail to the lower Rosslyn site. Site access would be predominantly by transit, bicycle, and on foot. The upper Rosslyn site is not within a regulated floodplain.

Figure C-1 provides the proposed components and configuration for the preferred alternative, figure C-2 shows a photo of the site, and table C-1 provides details on facility architecture, site access, and resilience/floodplain adaptions. Figure C-3 shows conceptual elevations for the lower Rosslyn site.

In addition to the boathouse and supporting facilities at the Rosslyn sites, the project would also include the potential for development of two soft launch sites for paddlers elsewhere in George Washington Memorial Parkway, at Riverside Park on the Potomac River, and at Roaches Run. These sites would be located convenient to existing parking and would include some changes to the shoreline to allow users to launch from the shore. Short, floating docks would be placed in both locations. Existing riprap would be removed from Roaches Run, and an existing road would be used for pedestrian access to minimize disturbance. Armor stone (boulders) currently on the steep riverbank would be removed at Riverside Park and potentially replaced with stairs. In addition, NPS would close an unofficial soft launch point at Riverside Park and the associated social trail used to access it.

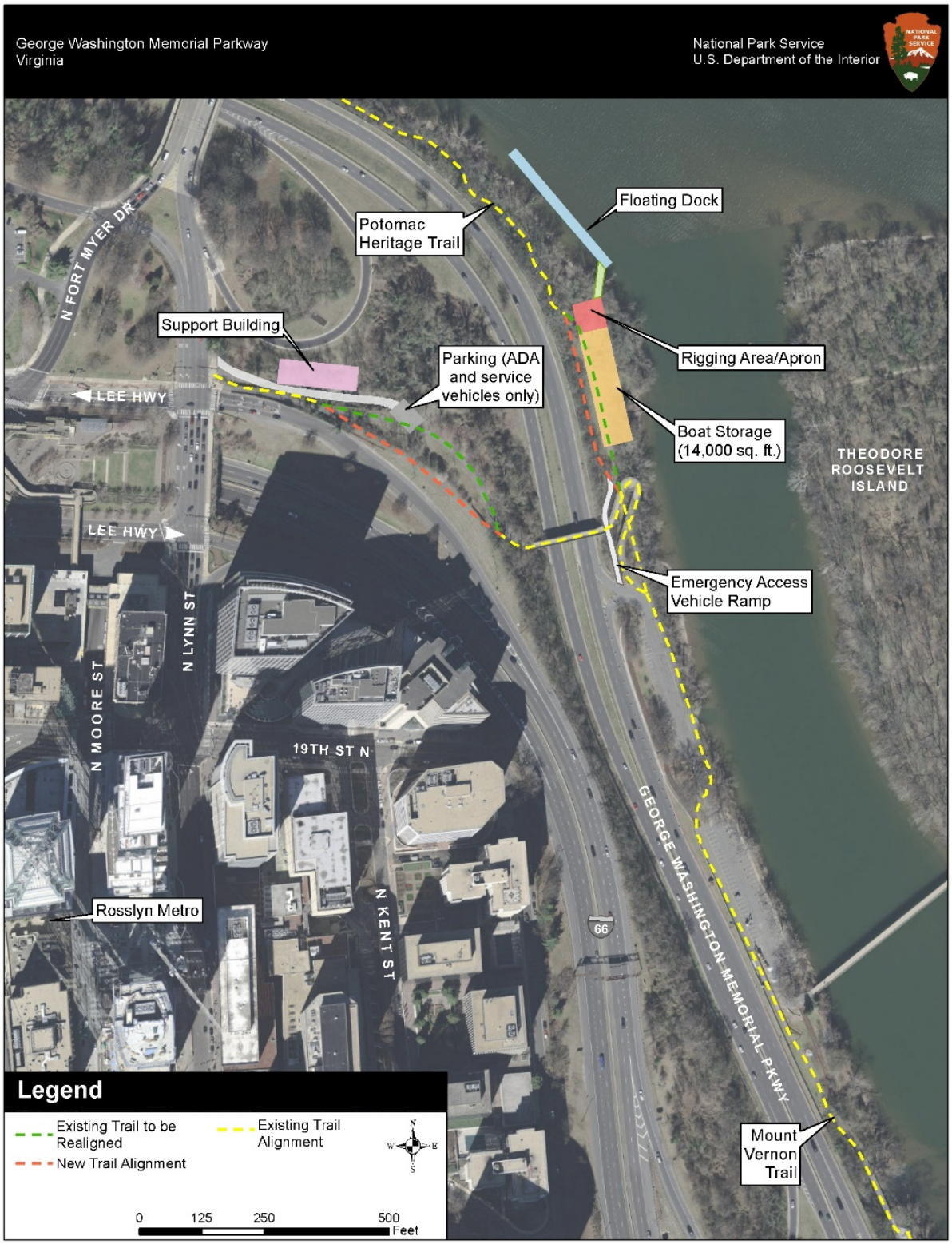

FIGURE C-1. UPPER AND LOWER ROSSLYN SITES

TABLE C-1. SUMMARY OF THE PROPOSED ACTION

Feature	Development of the Upper and Lower Rosslyn Site
Summary	This alternative focuses on developing a low-impact, flood resistant riverfront boat storage and launching facility with ancillary functions provided in facilities located on an upland site accessible by a trail. Site access would be predominantly by transit, bicycle, and on foot.
Operational Restrictions and Requirements	• Stored boats to be moved to a location above base flood elevation during potential flood events • Boats delivered to storage facility by water only • No storage or fueling of motorized coach launches, gasoline, or motors
User Experience/Access	• Minimum 5-minute walk from nearby parking and bus drop-off; 100-foot grade change limits accessibility • Accessible parking and access for emergency vehicles only at the lower Rosslyn site • No vehicular access / car-top launch for users; alternative launch points for kayaks/canoes to be developed at Riverside Park and Roaches Run • Vehicular access at upper site limited to emergency vehicles and accessible parking at the upper Rosslyn site
Building Footprint and Program	• Lower site (14,000 SF structure) – 14,000 SF boat storage for scholastic and community users – Rigging space/apron • Upper site – Boat house support – Office space – Locker rooms and restrooms – Other user amenities that support transit access to the site (e.g., changing rooms, lockers, showers, education and outreach)
New Dock	• 300-foot-long low-profile floating dock for rowing and canoe/kayak launch • Wheelchair transfer point • Regrading/dredging required to achieve minimum 3.3-foot clearance to bottom at mean low water
Visitor Access	• Enhanced wayfinding signage identifying the route to the river by way of the existing trail and pedestrian bridge over parkway • Bicycle and pedestrian access via Martha Custis Trail rerouted around building to minimize bicycle, boat, and pedestrian conflicts • Potomac Heritage Trail would be rerouted around the boathouse.

Feature	Development of the Upper and Lower Rosslyn Site
	• Shower and changing rooms, lockers for bulky equipment storage and other amenities on the upper site that support transit as a viable and comfortable access option
Motorized Access	• Vehicular access to building limited to park or county maintenance vehicles via driveway extended from the Theodore Roosevelt Island parking lot • Paid parking in nearby parking garages • Storage of motorized launches not permitted on site; coach launches berthed offsite at nearest motorboat marina (Pentagon Lagoon) or at other marinas
Boathouse Architecture	• Narrow footprint allows for some vegetative screening on long façades facing river and parkway • Maximum height above existing grade limited to minimize intrusion into views from parkway and other vantage points • Alternative construction methods such as modular construction and installation from waterside to minimize construction impacts
Resilience/Flood Hazard Adaptation	• Critical systems (electrical and communication) would be provided by alternative means to establish an “off the grid” facility. These critical systems would be located above base flood elevation (+19, approximately 9 feet above existing grade). • Resilient structure resists flood damage and allows easy renovation post-flood (e.g., structural frame withstands flood/debris and ice dam impact, interior and exterior finish materials are eliminated to reduce post-flood waste; structure and finishes of durable materials that dry out and clean off easily). • Simple, passive and flexible design features such as natural daylighting, operable windows, passive heating and cooling allow usable conditions to be restored more easily. Same as alternative B, except critical systems would be located above base flood elevation (+19, approximately 9 feet above existing grade).

FIGURE C-2. LOWER ROSSLYN SITE, FACING NORTH TOWARD THE POTOMAC RIVER

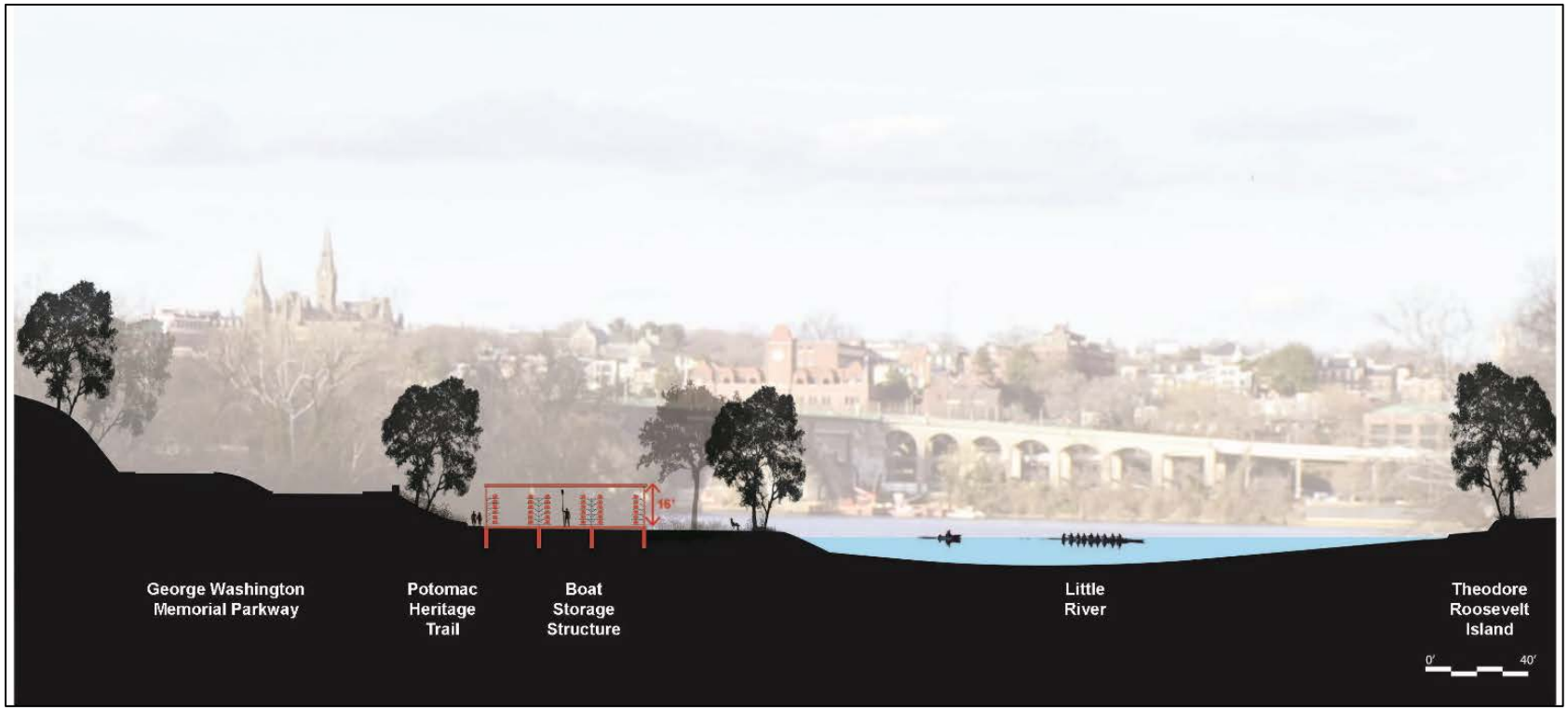

FIGURE C-3. CONCEPTUAL ELEVATION OF BOATHOUSE FACILITY AT LOWER ROSSLYN

SITE DESCRIPTION

For the purposes of this statement of findings, only the lower Rosslyn site and the two proposed soft launch sites are described; the upper Rosslyn site is not within a regulated floodplain.

LOWER ROSSLYN

The site extends north of the parking lot for Theodore Roosevelt Island and is approximately 600 feet (from the parking lot to the top of the apron/rigging area) by 120 to 190 feet wide, or 2 acres, and is located between the parkway and the Potomac River. A grassy clearing occupies the center, and vine-covered trees and shrubs surround the perimeter (figure C-2), including a vegetated bank up to the parkway. The apron and 300-foot dock would extend to the north of the site where the water is deeper and the river is more accessible for rowing shells.

ROACHES RUN SOFT LAUNCH SITE

The Roaches Run site is adjacent to the parking lot/cell phone waiting area for Reagan National Airport and has a gravel shore with vegetation shrubs and trees between the shore and the parking lot. An old roadbed would be used to provide access. The entire site is within the 100-year floodplain.

RIVERSIDE PARK SOFT LAUNCH SITE

At the Riverside Park site, a steep bank lined with armor stones (boulders), separates the river from the upland by about 10 feet. The floodplain is therefore limited to the area immediately along the bank. Some armor stone that lines the bank would be removed, and access to the water and a small floating dock would be provided with a staircase or other improvement.

GENERAL FLOODPLAIN CHARACTERISTICS

FLOODPLAIN DESCRIPTION

Floodplains are defined by the NPS Floodplain Management Guideline as “the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, and including, at a minimum, that area subject to temporary inundation by a regulatory flood.” The entire lower Rosslyn site is within a 100-year floodplain, in which there is a 1% chance of flooding in a given year (see figure C-4). The project area is in the Federal Emergency Management Agency’s Flood Hazard Zone AE with a 100-year flood elevation of +19.00 feet (FEMA 2017). The highest tide of the year (the spring tide) is approximately +8.00 feet and lower areas at the western end of the zone are prone to periodic inundation.

Floodplain values include the ability of the floodplain to absorb increased water flows, recharge groundwater, and provide floodplain habitat. Floodplain values at the lower Rosslyn site include area for the floodplain to absorb increased flows and recharge groundwater. The floodplain provides habitat value, but because nonnative vines cover the woody vegetation, other nonnative plant species, and turfgrass, the quality of that habitat on the site is more limited than it could be. The floodplain value at Roaches Run is of mixed quality. The site provides area that can absorb or accommodate increased water flows, but with the parking area, the habitat values and groundwater recharge potential is restricted to the narrow area of vegetation between the parking lot and the gravel beach. The floodplain at Riverside Park is small, and values are limited to some habitat value in the armor stone along the steep bank, which can provide refuge for some species.

FIGURE C-4. FLOODPLAIN AT THE LOWER ROSSLYN SITE

JUSTIFICATION OF USE OF FLOODPLAIN

While the site sits entirely within the 100-year floodplain of the Potomac River, providing increased access to the water and increasing user amenities through the development of the boathouse and access for paddlers at the soft launch sites depends on the site's proximity to the Potomac River and appropriate use of the floodplain.

ALTERNATIVES

The environmental assessment (EA) prepared for this project considers four alternatives, the proposed combined upper and Rosslyn sites evaluated in this FSOF (alternative C in the EA), the lower Rosslyn site only (alternative B), the Gravelly Point site (alternative D), and the no-action alternative (alternative A).

ALTERNATIVE A – NO ACTION

Under the no-action alternative, no boathouse or soft launch sites would be constructed in the park. Arlington County public high school rowing programs and the general public would continue to use area boathouses located in Washington, DC, as described in chapter 1 of the EA. Existing and future public demand for rowing programs and related boat storage space would be accommodated by these existing facilities, other planned rowing facilities, or would remain unmet.

ALTERNATIVE B – LOWER ROSSLYN SITE ONLY

Under alternative B, NPS and Arlington County would develop a low-impact, flood-resistant riverfront boat storage facility and launching site, at the lower Rosslyn site, including a boathouse facility and floating docks for nonmotorized boats, as described under the preferred alternative above for the boathouse.

Boats would be delivered to the Rosslyn storage facility by water only. Stored boats would be moved to a location above base flood elevation when potential flood events are expected. No on-site storage of motorized coach launches, gasoline, or motors would occur, and no filling of gasoline tanks would be allowed on-site.

Alternative B includes the same options to create soft launch points for paddlecraft at Roaches Run and Riverside Park as described for the preferred alternative.

ALTERNATIVE D – GRAVELLY POINT SITE

Under alternative D the boathouse facility and docks for nonmotorized boats would be located in the Gravelly Point area located east of the parkway, adjacent to existing parking lots and recreational fields. Gravelly Point was proposed to avoid potentially sensitive resources and reduce the amount of road infrastructure needed to access the site, compared to other locations along this part of the Potomac River. This alternative would include one larger 28,000 SF two-story boathouse facility, with 14,000 SF of storage space and 14,000 SF for restrooms, locker rooms, exercise equipment, team meeting space, and a community room above. Because of the proximity to the Reagan National Airport, the height of the proposed boathouse would be restricted to be less than 25 feet. Similar to alternatives B and C, the site would contain an associated rigging area/apron and 300-foot-long floating dock. A driveway would be constructed to provide drop-off access to the boathouse facility. Two playing fields that exist on the site would be relocated slightly to the north. Access would be predominantly by car.

Alternative C includes the same options to create soft launch access points for paddlecraft at Roaches Run and Riverside Park as described for the preferred alternative.

SITE-SPECIFIC FLOOD RISK

The preferred alternative includes development that would be located in the 100-year floodplain (the floodplain that has a one 1% chance of being equaled or exceeded in any given year).

The entire lower Rosslyn project site is located within the 100-year floodplain. Approximately 14,000 SF of new structures would be within the zone under the proposal, in addition to the rigging area and apron, which includes approximately 3,600 SF of impervious surfaces, and a new 300-foot-long access drive for emergency vehicles, which would be installed with pervious pavement, to the extent feasible. Boathouse facilities are water-dependent, and therefore appropriate for placement in the floodplain. The ground floor of the boathouse would be designed with flow-through construction and tear-away walls, so that floodwaters could flow through the structures and not impede floodplain function. Because of the conceptual nature of the plan for the zone at this time, a more specific study will be completed at the time of design for the boathouse. A 2004 study of the opposite river bank examined the effect of a large boathouse structure proposed at the time in the floodplain in the Chesapeake and Ohio National Historical Park north of Key Bridge. The study concludes that the proposed structure would have no impact on the floodplain and would not increase the water surface level, velocity, or shear stress appreciably during floods (Patton, Harris, Rust and Associates 2004). Because of the proximity of the lower Rosslyn site to the 2004 study area, it is assumed the proposed boathouse would not affect the floodplain.

MITIGATION

The preferred alternative is not expected to significantly alter the natural and beneficial functions of the floodplain.

COMPLIANCE WITH DEVELOPMENT REQUIREMENTS

Communities that participate in the National Flood Insurance Program, such as Arlington County, Virginia, are required to enforce floodplain management regulations that meet the requirements of the National Flood Insurance Program. Furthermore, in order to comply with Executive Order 11988, federal agencies must demonstrate there are no reasonable alternatives outside the floodplain and study ways to reduce the flood risk associated with the proposed action. Therefore, guidelines for regulated development in the 100-year floodplain to minimize impacts to the floodplain and adherence to general building and development requirements as outlined in the National Flood Insurance Program requirements will be followed.

Development in the floodway is also an issue to consider for compliance purposes. Development is generally not permitted in the floodway, and fill is prohibited in the floodway. The floodplain consists of two types of flood areas: the floodway and the flood fringe. The floodway is the area that encompasses the stream channel and is where floodwaters generally flow the fastest. By definition, the floodway is the area where fill cannot be placed without resulting in a cumulative 1-foot rise in the 100-year floodwater elevation. The flood fringe comprises the remainder of the floodplain that extends beyond the floodway area. No floodway is designated on the FIRM panels for the area. However, given the location of the proposed development, the lower Rosslyn site is likely located in the flood fringe, away from the floodway. Therefore, the preferred alternative meets compliance requirements for floodway development. The preferred alternative would be able to comply with these requirements.

CONCLUSION

The preferred alternative would include activities located within the regulatory 100-year floodplain of the Potomac River. Additionally, as a federally funded project, the additional Federal Flood Risk Management Standard applies to the proposed project. The proposed development would create additional obstructions within the floodplain; however, the obstructions would not noticeably affect the water surface level during a flood event. A slight decrease in the capacity of the floodplain to store

floodwaters would occur, as well as a slight decrease in infiltration. However, because of the limited capacity of the floodplain in its current condition, these alterations would not result in a measureable adverse impact. Based on the relative magnitude of the Potomac River, the preferred alternative would not have appreciable effects that would increase the risk of flooding or hazards to human life or property.

Floodplain values would be somewhat affected on the site, with the placement of the 14,000 SF boat storage facility and additional impervious surface for the apron. The emergency access driveway would be constructed of pervious pavement to the extent feasible, so it would not add noticeable amounts of impervious surfaces and would allow the groundwater to recharge. Similarly, the boathouse could be constructed on piles and slightly elevated, so water can flow beneath the structure, and groundwater recharge can occur to some extent. The structure is planned to incorporate green stormwater infrastructure, which can also help minimize adverse effects on floodplain values. Development in the flood zone would not improve wildlife habitat, although replanting cleared vegetation with native species and clearing nonnative vines from the site could improve the habitat around the edges of the site. Changes to the soft launch sites would not noticeably adversely affect floodplain values and would not affect floodplain function.

The proposed boathouse structure would not be permanently inhabited, and the area would be evacuated should it be known that flooding is to occur. The project would not increase the risk associated with flooding for the 100-year event. Therefore, NPS has determined the preferred alternative would be consistent with Executive Order 11988.

REFERENCES

Federal Emergency Management Agency (FEMA)

2017 "FEMA's National Flood Hazard Layer (Official). Flood Panel 51059C0190E." Accessed August 22, 2017. http://fema.maps.arcgis.com/home/webmap/viewer.html.

Patton, Harris, Rust and Associates

2004 *Georgetown University Boathouse Hydraulic Impact Analysis*. Project Number 12710-1-0, 18). February 18, 2004.

APPENDIX D: VISUAL IMPACT ASSESSMENT

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George Washington Memorial Parkway
Virginia

U.S. Department of the Interior
National Park Service

Arlington County and Vicinity Boathouse Visual Impact Assessment

FINAL

March 2018

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INTRODUCTION

The National Park Service (NPS), in cooperation with the National Capital Planning Commission and Arlington County, is evaluating the proposed development of a boathouse and related facilities on the Virginia side of the Potomac River, south and west of Washington, DC, on land administered by the George Washington Memorial Parkway. NPS retained Louis Berger to prepare a Visual Impact Assessment (VIA) as part of the environmental assessment (EA) of a nonmotorized boathouse and supporting facilities. The purpose of this VIA is to evaluate potential visual impacts by:

1) determining potential project visibility within the study area, and
2) identifying key views for visual assessment.

Three alternatives are under consideration for the development of a boathouse and related facilities at two proposed project sites, Rosslyn and Gravelly Point, in Arlington County. All three alternatives would also include the option to create soft launch points for paddlecraft along the Virginia shoreline of the Potomac River at Riverside Park and Roaches Run. Figure 1 provides the location for each alternative and soft launch locations.

Alternative B (lower Rosslyn) would include a boathouse at the lower Rosslyn site. Facilities at the lower Rosslyn site would include a one-story, 14,000 square-foot (SF) boat storage structure, rigging apron, and floating dock. The facility would be located along the Potomac River shoreline in Virginia south of the Francis Scott Key Bridge (Key Bridge), east of the parkway and north of the existing Theodore Roosevelt Island parking lot (see figure 2).

Under alternative C (upper and lower Rosslyn), additional support facilities would be located on the upper Rosslyn site. The two Rosslyn sites are located on either end of the Mount Vernon Trail, a pedestrian/bicycle bridge that crosses the parkway (in this document “the park” refers to the park unit and “the parkway” refers to the roadway). Alternative C would include the same facility and configuration on the lower Rosslyn site as described for alternative B but would also provide additional support facilities on the upper Rosslyn site. The upper Rosslyn site includes two possible locations for the 8,000 SF support facility, which would include office space, locker rooms, bathrooms, and space for education and outreach. There would be a small parking area for access for visitors with disabilities and service vehicles and an access road associated with the support facility (see figure 3).

Under alternative D (Gravelly Point), the boathouse facility and docks for nonmotorized boats would be located in the recreational area located east of the parkway, adjacent to the existing parking lots and Mount Vernon Trail. This alternative would include one larger 28,000 SF two-story boathouse facility, with 14,000 SF of storage space and 14,000 for bathrooms, locker rooms, exercise equipment, team meeting space, and a community room above. Similar to alternatives B and C, the site would contain an associated rigging area/apron and 300-foot-long floating dock. A driveway would be constructed to provide drop-off access to the boathouse facility (see figure 4).

The VIA also examines the visibility of soft launch sites located at Riverside Park and Roaches Run, which are included in all action alternatives. In the EA, alternative A is the required no-action alternative and represents the continuation of existing conditions. Because the no action alternative would not alter existing landscape, alternative A is not included in this VIA.

LANDSCAPE CONTEXT

Within the study area for visual impacts, the landscape type is primarily parkland with lawns, individual trees, forested slopes and shoreline, roadways, trails, and other recreational facilities with views of the Potomac River. The park is the primary NPS unit in the study area and is distinguished by the character of movement through the landscape—defined by gentle curving roadways and trails and carefully composed

vistas of the Potomac River and landmarks within the Monumental Core, including important gateways designated in the Urban Design element of the Comprehensive Plan for the National Capital (District of Columbia Office of Planning 2006). The parkway is also a major commuter route. Visitors may view the landscape in a variety of different ways:

- **Motorists** view the landscape while traveling on the parkway to destinations within the metropolitan region and within the park, or from parking areas within the park.
- **Pedestrians** such as bicyclists, picnickers, casual walkers, hikers, photographers, and anglers see the landscape from multiple vantage points from trails, recreational areas, waterfront areas, and established scenic overlooks.

The original 1932 landscape design of the parkway by Wilbur Simonson included essential design components for each of several distinct zones (EDAW 1985). The proposed alternative sites fall within Zone 2, Gravelly Point Airport, and within a later addition north of Memorial Bridge that is not covered by the Cultural Landscape Report.

The essential design components of Zone 2, Gravelly Point Airport include:

- plantings that do not provide a constant canopy but break at intervals to frame views of monumental Washington, and
- a dramatic vista of the Washington Monument from the south (one of two such vistas designated in the 1930 development plan).

The wildlife sanctuary and parking lot at Roaches Run and the active recreational area at Gravelly Point are later additions that are not essential design components of the parkway. Relocation of the original highway alignment inland, development of the airport, the urban skyline of Crystal City, development of the 14th Street Bridge, widening and other alterations in the alignment of the highway to include a median that limit views of the capital and the river make Gravelly Point the parkway's "least historic, sylvan, or riparian" in character.

Maintaining the overall memorial effect of the parkway is the critical criterion for maintaining the integrity of the parkway. Alignment, topography, the species and distribution of plantings, the long vistas, and significant structures contribute to this memorial character. The visual impact analysis describes the visual changes from the proposed project in the context of these features.

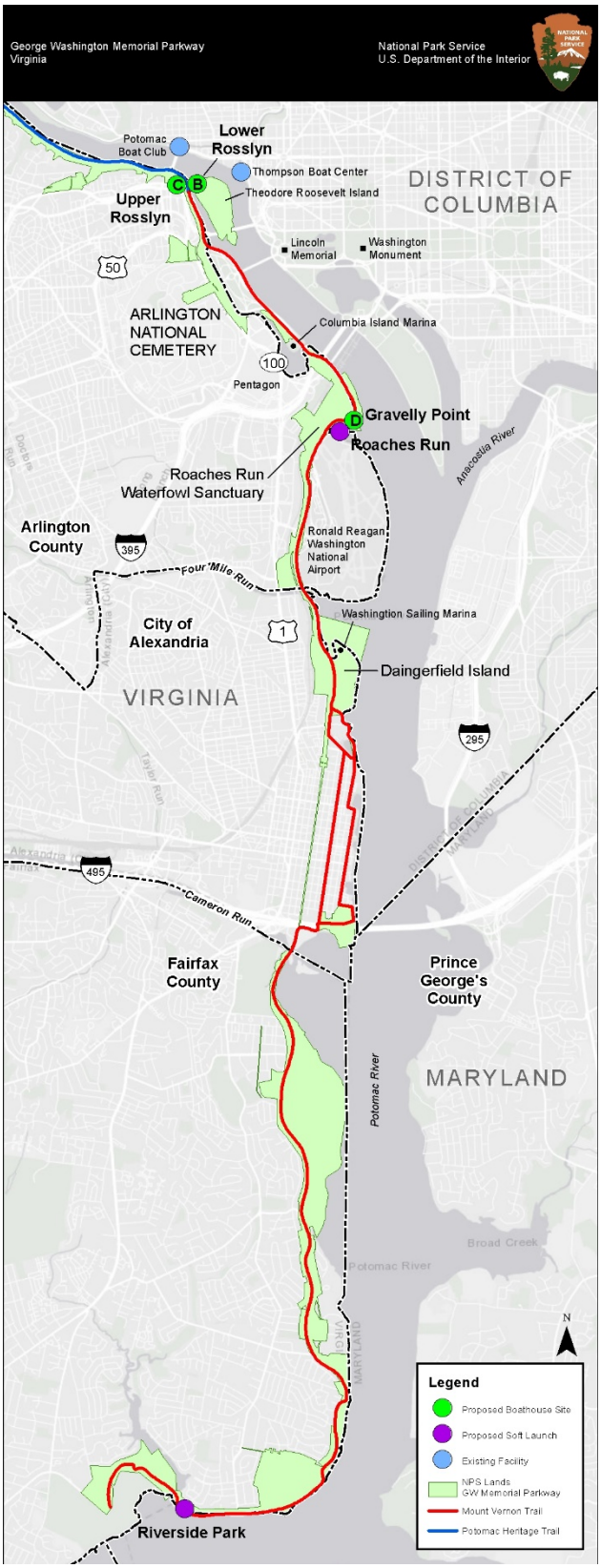


FIGURE 1. PROPOSED ALTERNATIVE SITE LOCATIONS

FIGURE 2. ALTERNATIVE B: LOWER ROSSLYN

FIGURE 3. ALTERNATIVE C: COMBINATION OF UPPER AND LOWER ROSSLYN SITES

FIGURE 4. ALTERNATIVE D: GRAVELLY POINT SITE

PROJECT VISIBILITY

A project visibility analysis was completed to identify locations within the study area where the proposed boathouse and support facilities could be seen from ground-level vantage points, including from sensitive historic and cultural resources for which the integrity of the visual setting could be adversely affected. This analysis included geographic information system (GIS)-based viewshed analysis to establish areas from which structures are potentially visible, cross-section analysis to assess the screening effect of topography and vegetation, and field reviews to confirm visibility from important vantage points. The methodology employed for each of these techniques is described below. In the context of this analysis, a viewshed is an area that includes all locations from which a structure is visible. A "view" is a scene that includes all that is visible from a position or "vantage point," while a "vista" is a scene that is designed to be observed from one or more vantage points, such as a framed view of the Washington Monument from the parkway.

VIEWSHED ANALYSIS

The viewshed analysis is a two-fold process that includes desktop and background research and a GIS-based review of the study area to determine the visibility of a proposed structure. The locations from which each alternative would be visible were determined based on the results of the computer-generated viewshed analysis in the ArcMap software.

The viewshed calculation was performed using a 10-meter digital elevation model from the US Geological Survey's Earth Explorer online, which provides an estimate of the ground surface elevation for every 10 x 10-meter area surrounding the alternative sites. Using this information, the effects of terrain on line-of-sight visibility of an area can be modeled to identify those areas that can and cannot be seen because of intervening topography, vegetation, and buildings. Forest cover data in Arlington County (2017) was downloaded from the Arlington County GIS Open Data Portal, while the forest cover in Washington, DC, was digitized into a GIS layer using Bing Maps Aerial and ESRI World Imagery base maps. Building footprint data for Arlington County was downloaded from the Arlington County GIS Open Data Portal and building footprint data for Washington, DC, was downloaded from the Washington, DC, GIS Open Data Portal. Vegetation and buildings were modeled by overlaying forest cover and building data on top of the elevation data layer.

The analysis assumed an average tree canopy height of 40 feet across the study area and an average building height of 200 feet in Arlington County and 40 feet in Washington, DC. Because the approximate location and heights of the boathouse alternatives are known, the viewshed model was developed from the perspective of the top of the boathouse structure in relation to the terrain visible. The resulting topographic viewshed maps define the maximum area from which the proposed project could potentially be seen and defines the study area for the VIA.

Figures 7, 8, and 9 document the results of the viewshed analysis for the lower Rosslyn site, the upper and lower Rosslyn site, and the Gravelly Point site. The area highlighted in yellow identifies the viewshed or maximum area from which the project is potentially visible. The viewshed analysis examined only the structure in each alternative and not the apron and dock.

The area of potential visibility defined by the viewshed analysis establishes the study area for the other visibility analysis techniques. Many factors can influence project visibility and being in the viewshed does not guarantee actual views of the project. Several historic resources are located within the study area defined by the viewshed analysis. Further analysis of the views from these important vantage points was conducted to confirm if the project would be visible and if an assessment of effect on these historic resources would be required.

CROSS-SECTION ANALYSIS

To analyze the screening effect of topography and vegetation within the study area, representative line-of-sight cross sections were cut through the study area. Cross section locations were chosen such that they pass through visually sensitive areas to provide representative cross sections through major axes of the project area. The cross section for the lower Rosslyn site includes adjacent visually sensitive resources, including the parkway, the Potomac River, and Theodore Roosevelt Island (figure 5). The cross section for Gravelly Point includes the boathouse, the Potomac River, and Gravelly Point Park (figure 6).

Cross-section analysis revealed that along selected lines of sight, vegetation and structures decrease project visibility, when compared to the results of the viewshed analysis. The screening effect of topography, the stone wall bordering the parkway, and vegetation is illustrated in the cross section at the lower Rosslyn site, which indicates there would be no visibility from the parkway.

FIELD REVIEW

Actual visibility of the proposed structures was evaluated in the field on December 15 and 20, 2017, during leaf-off conditions. The evaluation was conducted during leaf-off conditions to ensure that the seasonal conditions during which vegetation screening would have the least impact were considered. A field crew drove public roads and visited public vantage points within the study area to document points from which the alternative sites could or could not be seen. The field crew took photos from representative viewpoints within the study area and documented visibility at each viewpoint with photos and field notes.

Field review indicated that actual project visibility would be more limited than suggested by viewshed mapping for several key sites, including the upper Rosslyn site, the lower Rosslyn site, and the soft launch points at Riverside Park and Roaches Run. These sites, where potential visibility was indicated by viewshed mapping, were actually well screened from views of the proposed project. Because of flat topography and the lack of vegetation on the Gravelly Point site, no field review was required.

At the upper Rosslyn site, field review revealed that mature forested slopes that would remain would limit any long-distance views to the support structure and conceal the structure from surrounding roadways.

Field review also confirmed the cross-section analysis of the proposed boathouse on the lower Rosslyn site. The cross-section analysis indicated that the site would not be visible from the parkway either northbound or southbound, and the field review confirmed this. The top of the structure would be lower than the stone wall that borders the project site, and vegetation on the slope between the site and the parkway would remain in place and screen the site from passing motorists, including those on the downhill southbound curve, which is several feet higher than the northbound lanes bordering the site.

The evaluation of the soft launch sites at Riverside Park and Roaches Run included field review from positions easily accessible to the public. The soft launch sites were determined to be inconspicuous from these vantage points because of their small size and the distance from available viewing positions.

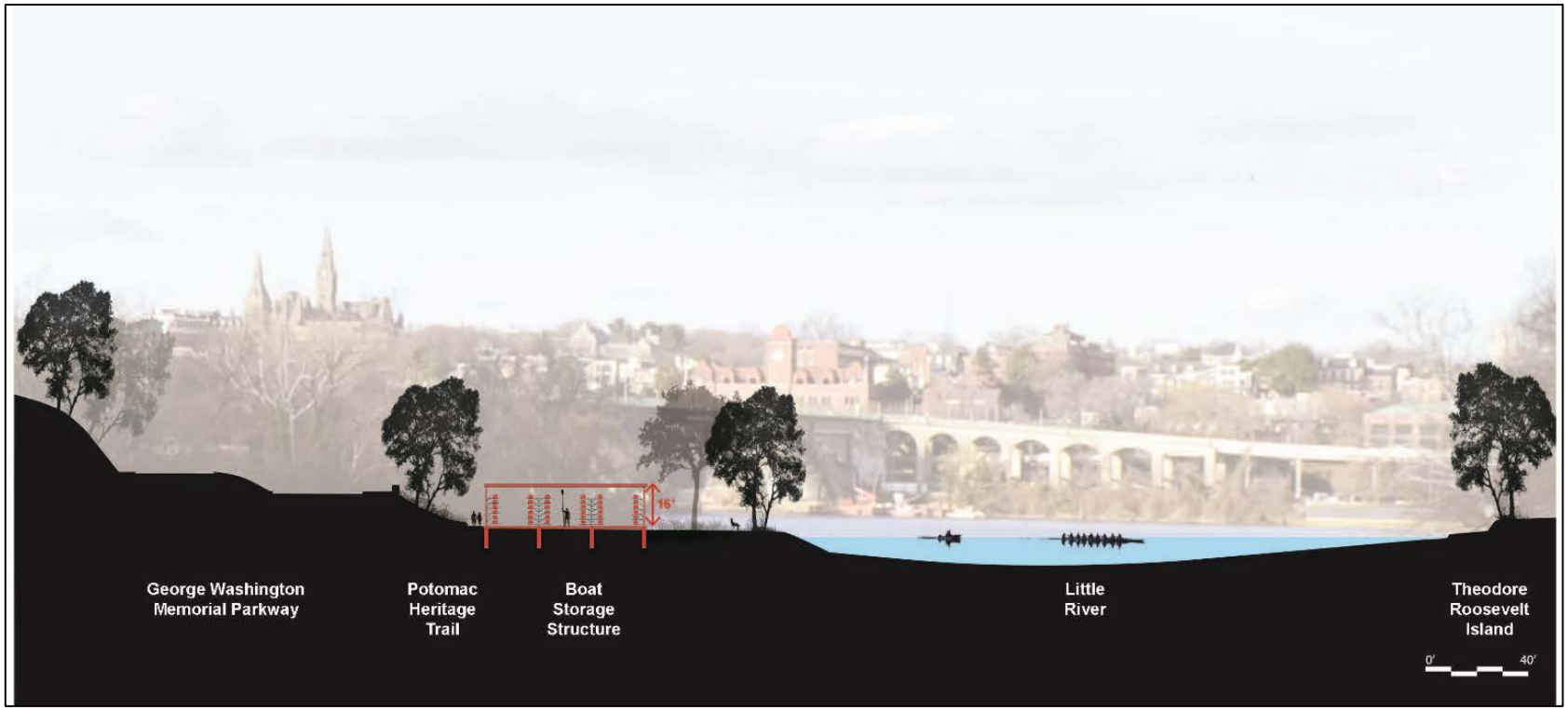


FIGURE 5. SITE CROSS SECTION – LOWER ROSSLYN BOATHOUSE

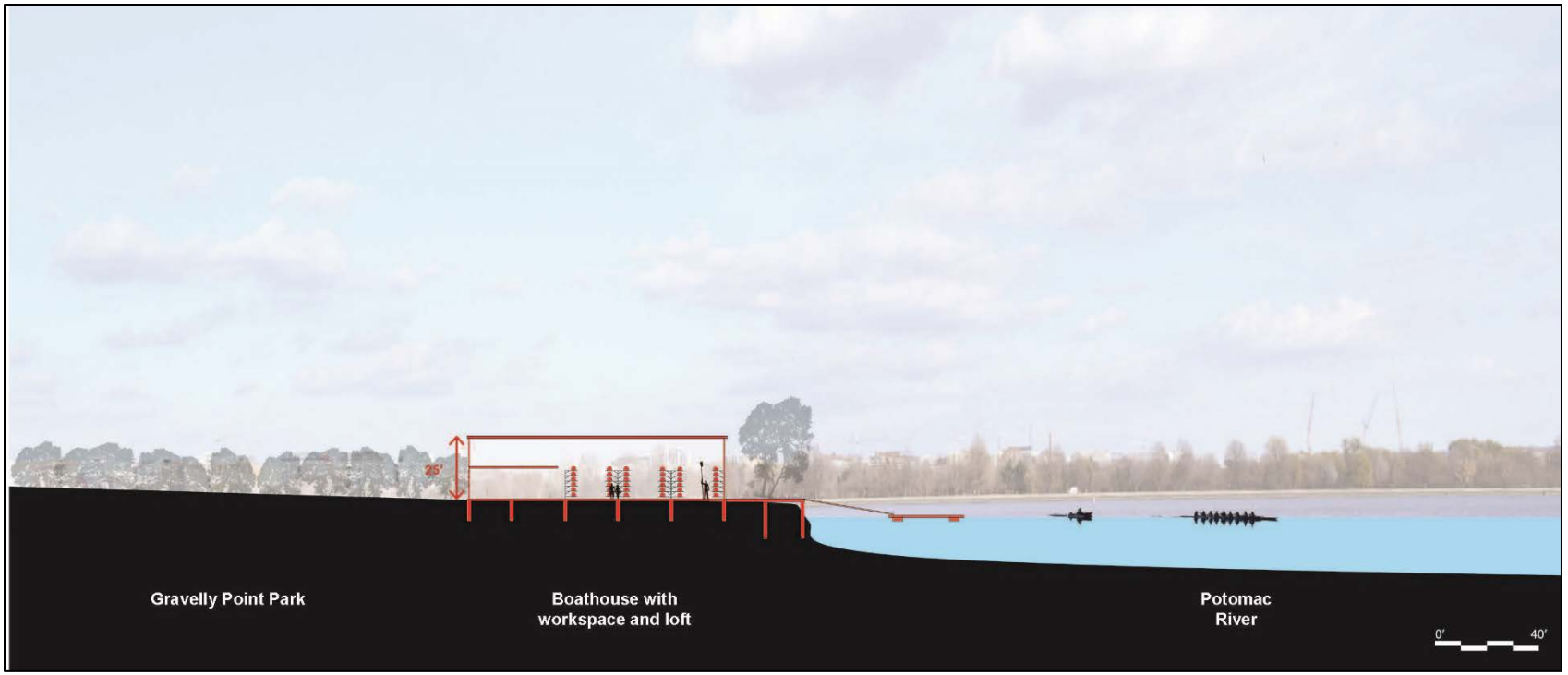


FIGURE 6. SITE CROSS SECTION – GRAVELLY POINT BOATHOUSE

VISIBILITY ANALYSIS RESULTS

As demonstrated in figures 7 through 9 and confirmed through cross section analysis and field review, the proposed boathouse and support structures would be visible from several vantage points within the study area, including from historic resources. Table 1 identifies the historic resources within the viewshed where the proposed facilities would be visible. The "Visual Changes" section, below, provides the specific visual changes that would be anticipated from these important vantage points.

TABLE 1: HISTORIC STRUCTURES AND DISTRICTS LOCATED IN THE VIEWSHED

HISTORIC RESOURCE
George Washington Memorial Parkway
Key Bridge
Theodore Roosevelt Island
George Washington Memorial Parkway
Washington Canoe Club
Potomac Boat Club
Potomac Aqueduct Bridge Abutment & Pier
Georgetown Waterfront Park
Chesapeake and Ohio Canal (National Historic District)
Georgetown Historic District
East and West Potomac Parks Historic District

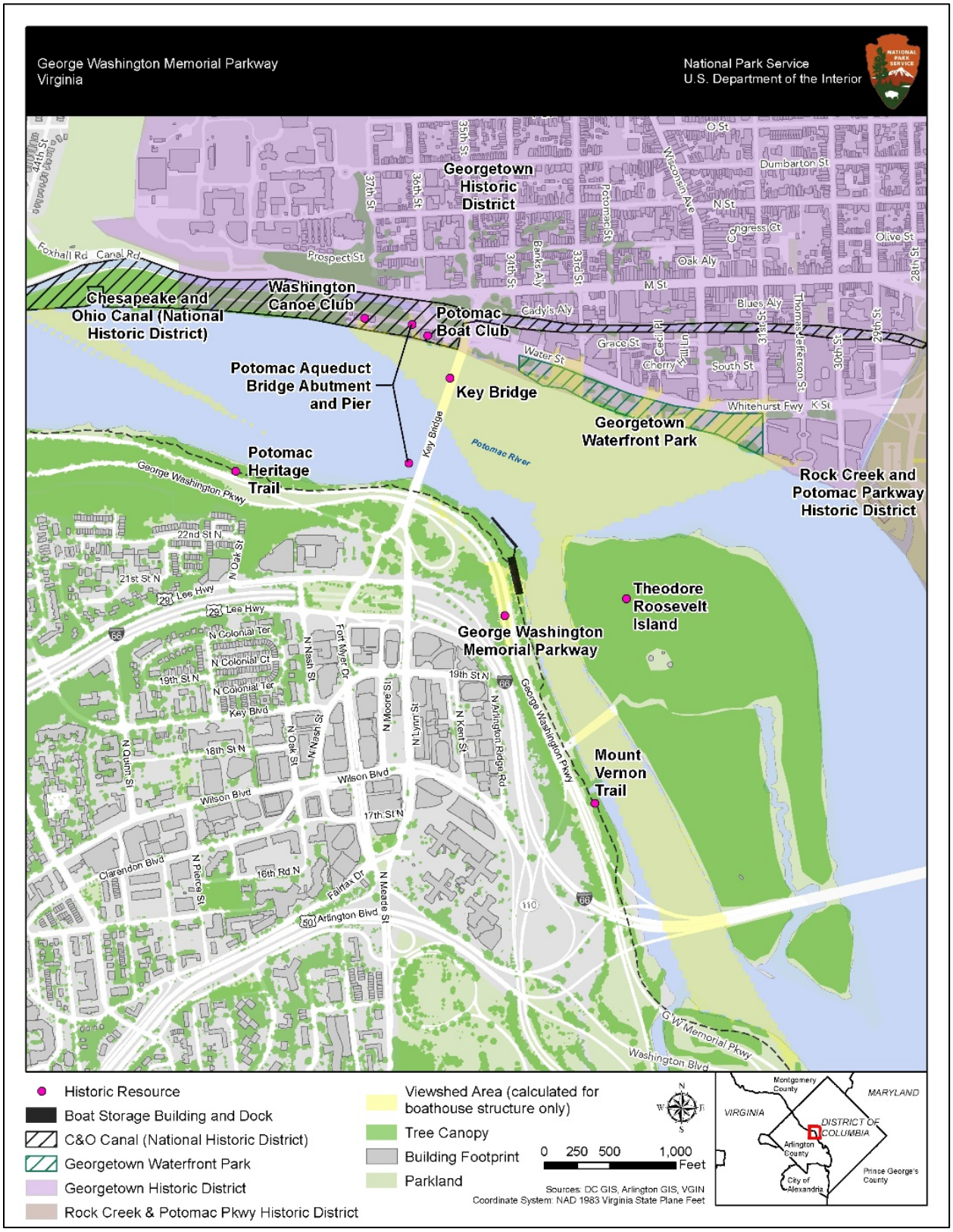


FIGURE 7. LOWER ROSSLYN VIEWSHED AND HISTORIC RESOURCES

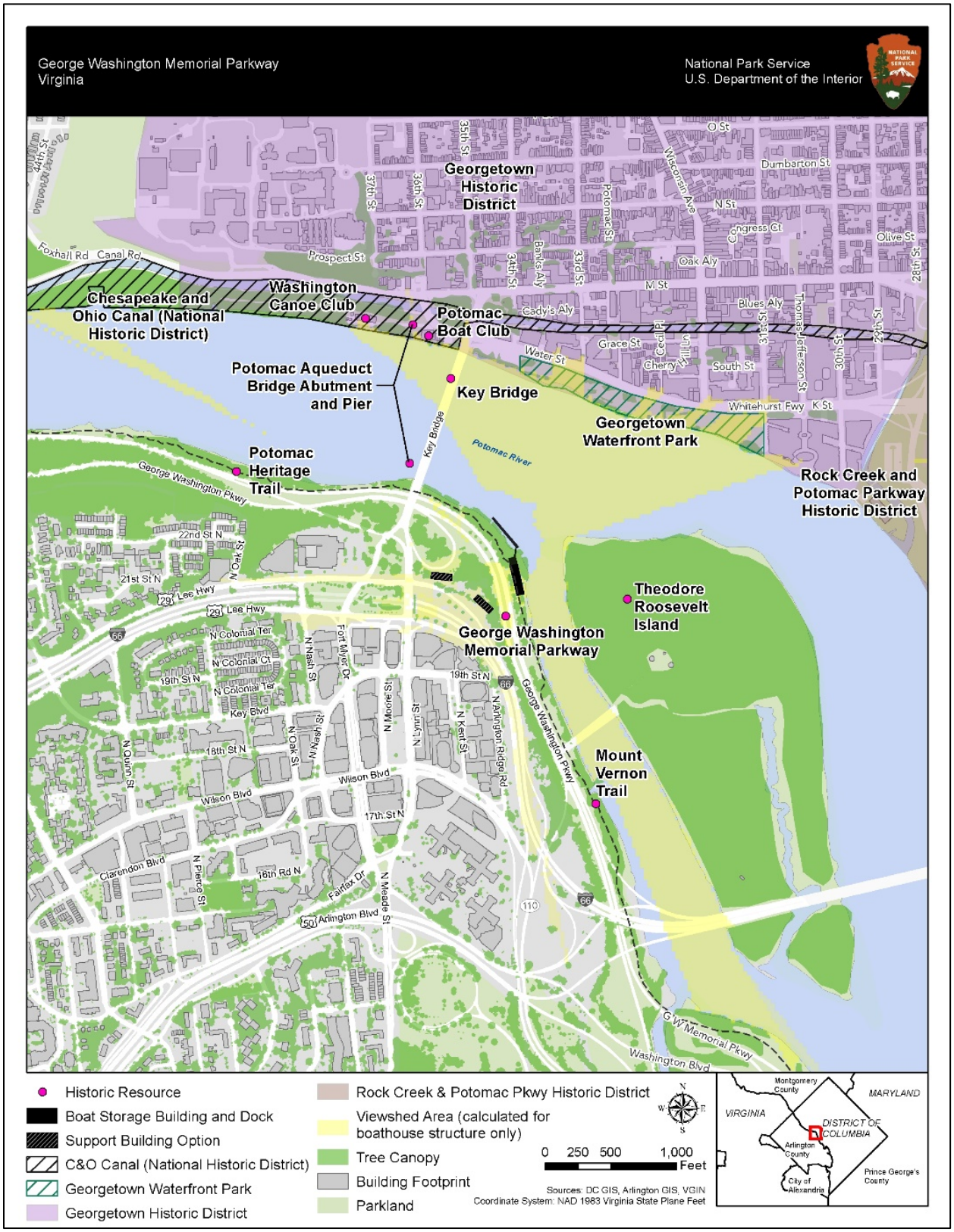


FIGURE 8. UPPER AND LOWER ROSSLYN VIEWSHED AND HISTORIC RESOURCES

FIGURE 9. GRAVELLY POINT VIEWSHED AND HISTORIC RESOURCES

VISUAL CHANGES

In addition to potential visibility, the VIA also examines anticipated visual changes associated with the proposed project. Visual simulations illustrate the visual changes that are anticipated from important vantage points. Several views were selected in consultation with NPS staff for the development of visual simulations. The Assessment of Effects provides the detailed description and potential impacts of project visibility on the historic resources listed in table 1.

VISUAL SIMULATION

This assessment involved selecting representative vantage points within the study area and preparing visual simulations of the proposed project. To show anticipated visual changes associated with the proposed project, photographic simulations/renderings were developed by constructing a three-dimensional (3D) computer model in Sketch-up and overlaying the model on a photograph of the site. Site photographs used a surveyor's rod to establish the roof height of each proposed structure in site context. Once context was established, the 3D model was overlaid and scaled to correspond to the reference height located in the field.

VIEW SELECTION

Photographic simulations were developed for nine views from historic resources where the integrity of the visual setting could be affected by the introduction of the proposed facilities into the views. The visual simulations show the scale and position of the proposed structure and the visual setting both with and without the proposed modifications.

The location of the key views for each alternative site are provided in figures 10 and 11. The views selected for the lower Rosslyn site include:

1) **THEODORE ROOSEVELT ISLAND SHORELINE (FIGURE 12)**. This view is from a vantage point at the location of the island's former causeway on the shoreline trail directly across the Little River channel from the proposed structure. This vantage point would provide a view of the entire structure from a position where visitors are encouraged to stop and examine the setting.

2) **THEODORE ROOSEVELT ISLAND FOOTBRIDGE (FIGURE 13)**. This vantage point is from the main access onto Theodore Roosevelt Island where visitors on foot would have a distant, oblique view of the proposed structure from the footbridge as they enter or leave the island.

3) **KEY BRIDGE (FIGURE 14)**. This vantage point enables pedestrians crossing Key Bridge to view the boathouse and dock from an elevated point of view. This view would not be available to motorists crossing the bridge.

4) **GEORGETOWN WATERFRONT PARK (FIGURE 15)**. This vantage point provides a view of the facility from a position directly across the Potomac River from the project. Park visitors would be able to see the proposed structure from multiple vantage points along the shoreline walkway and from various locations within the park designed to offer views of the Potomac River, the distant Virginia shoreline, and the Rosslyn skyline. The view from this vantage point is typical of river views available at the park, although from most vantage points, the view is more oblique and screened with vegetation.

The vantage points selected for the Gravelly Point site include:

1) **EAST POTOMAC PARK (FIGURE 16)**. This vantage point enables pedestrians, bicyclists, picnickers, and motorists to view the proposed boathouse across the Potomac River. Park visitors would be able to see the proposed structures from multiple vantage points along Ohio Drive, which is

designed to offer views of the Potomac River, the distant Virginia shoreline, the Arlington skyline, and landmarks including the parkway, the Air Force Memorial, and the Pentagon. The view from this vantage point is typical of river views available at the park, although from most vantage points, the view is more oblique and screened with vegetation.

2) **GEORGE WASHINGTON MEMORIAL PARKWAY SOUTHBOUND (PEDESTRIANS) (FIGURE 17).** This vantage point enables pedestrians and park users to view the proposed structure across the park's open lawn area.

3) **GEORGE WASHINGTON MEMORIAL PARKWAY NORTHBOUND (PEDESTRIANS) (FIGURE 18).** This vantage point offers pedestrians (and motorists entering Gravelly Point Park at reduced speed from the northbound parkway) a direct frontal view of the proposed structure from a position directly opposite the structure.

4) **GEORGE WASHINGTON MEMORIAL PARKWAY SOUTHBOUND (MOTORISTS) (FIGURE 19).** The view from this vantage point is typical of views available to motorists travelling along the parkway.

5) **GEORGE WASHINGTON MEMORIAL PARKWAY NORTHBOUND (MOTORISTS) (FIGURE 20).** The view from this vantage point is typical of views available to motorists travelling along the parkway.

CONCLUSIONS

This VIA is intended to examine the potential visibility of all three alternative site locations and identify key cultural resources or visitor use locations that the proposed boathouse development could affect. For a detailed discussion on the anticipated impacts under each alternative, please see the associated EA for this project.

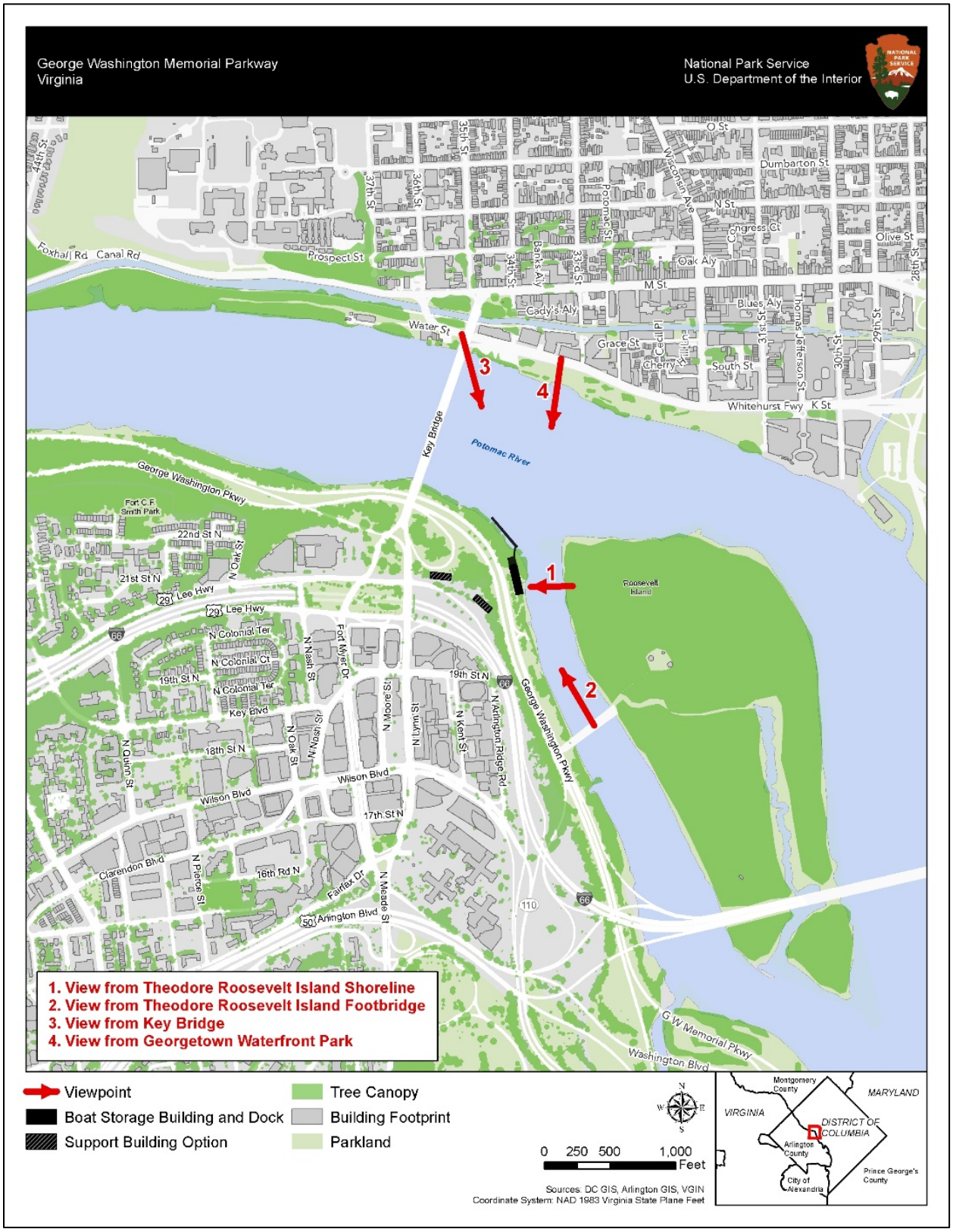


FIGURE 10. ROSSLYN VANTAGE POINTS

FIGURE 11. GRAVELLY POINT VANTAGE POINTS

Visual Simulation of Proposed Structure in Site Context

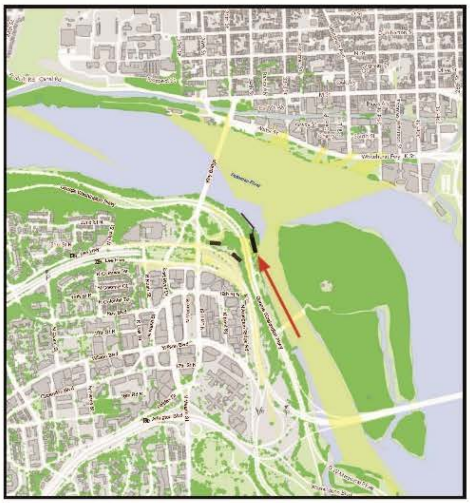
Existing Condition

Vantage Point Location

FIGURE 12. LOWER ROSSLYN SITE – THEODORE ROOSEVELT ISLAND SHORELINE

Visual Simulation of Proposed Structure in Site Context

Existing Condition



Vantage Point Location

FIGURE 13. LOWER ROSSLYN SITE – THEODORE ROOSEVELT ISLAND SHORELINE

Visual Simulation of Proposed Structure in Site Context

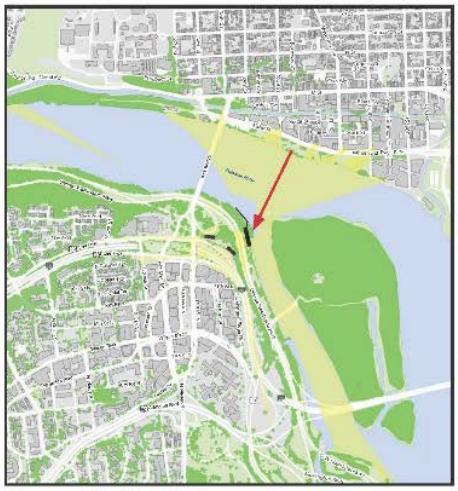
Existing Condition

Vantage Point Location

FIGURE 14. LOWER ROSSLYN SITE – KEY BRIDGE

Visual Simulation of Proposed Structure in Site Context

Existing Condition

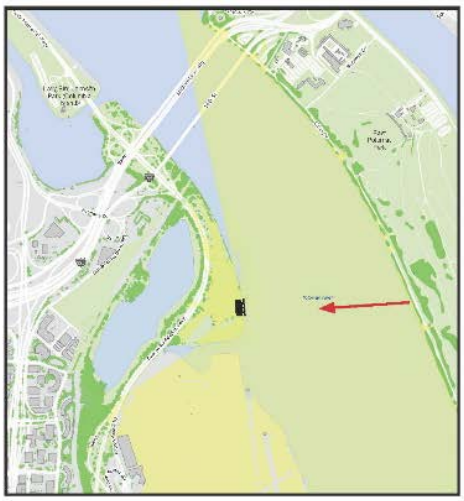


Vantage Point Location

FIGURE 15. LOWER ROSSLYN SITE – GEORGETOWN WATERFRONT PARK

Visual Simulation of Proposed Structure in Site Context

Existing Condition

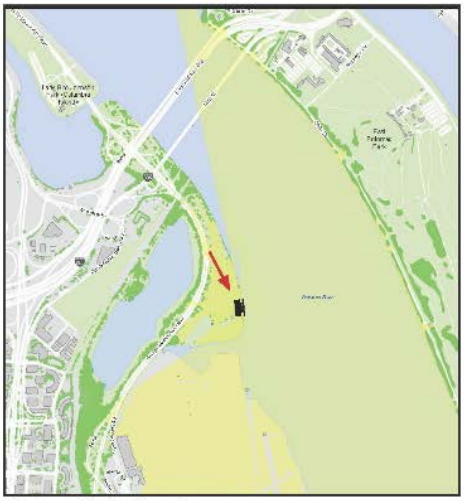


Vantage Point Location

FIGURE 16. GRAVELLY POINT SITE – EAST POTOMAC PARK

Visual Simulation of Proposed Structure in Site Context

Existing Condition

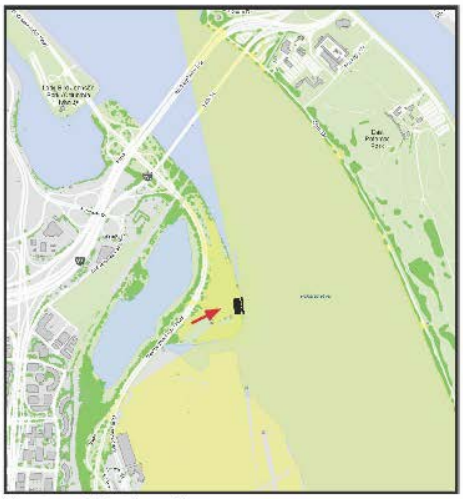


Vantage Point Location

FIGURE 17. GRAVELLY POINT SITE – PARKWAY – SOUTHBOUND (PEDESTRIANS)

Visual Simulation of Proposed Structure in Site Context

Existing Condition



Vantage Point Location

FIGURE 18. GRAVELLY POINT SITE – PARKWAY – NORTHBOUND (PEDESTRIANS)

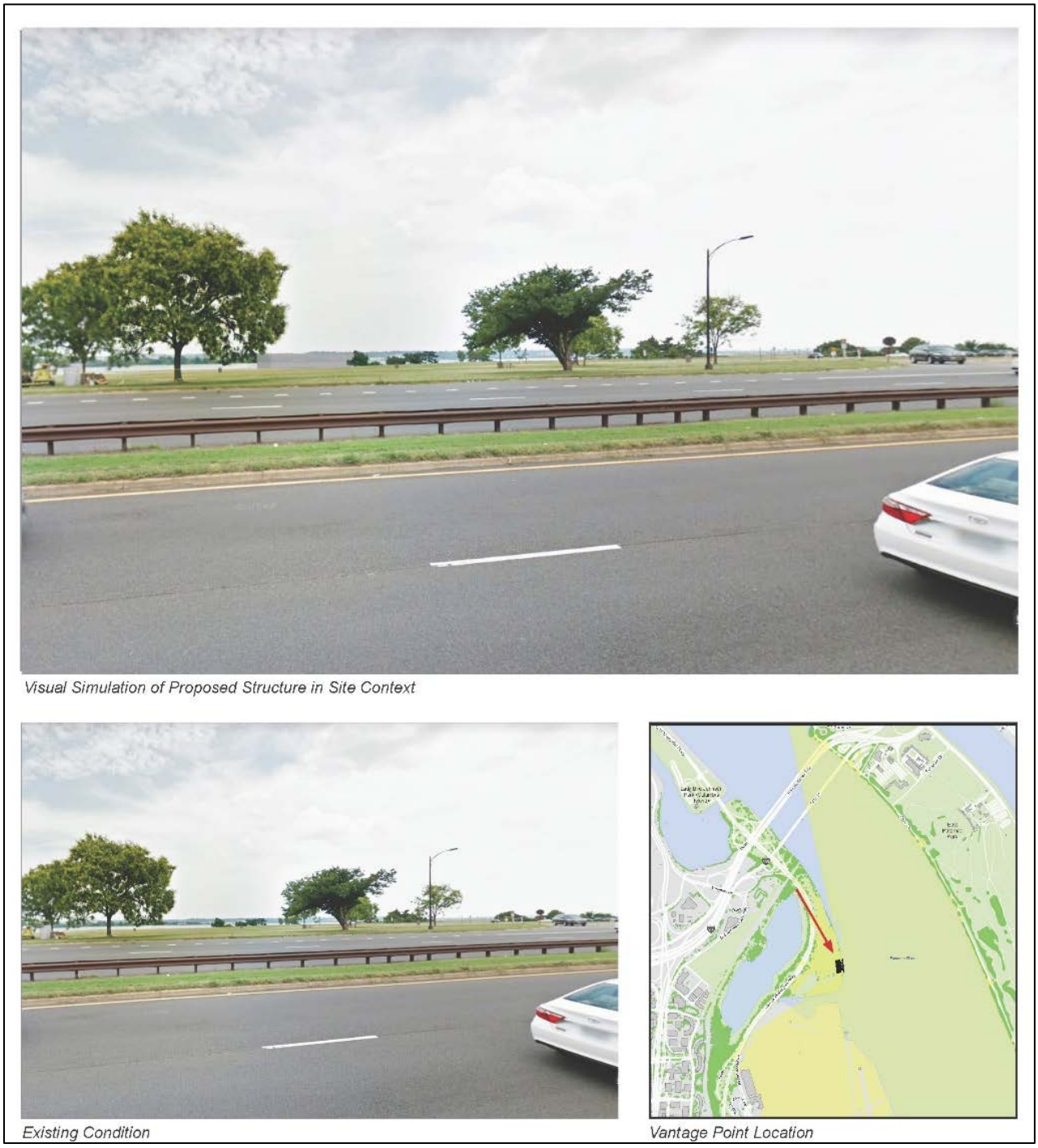


FIGURE 19. GRAVELLY POINT SITE – PARKWAY – SOUTHBOUND (MOTORISTS)

FIGURE 20. GRAVELLY POINT SITE – PARKWAY – NORTHBOUND (MOTORISTS)

ACRONYMS AND ABBREVIATIONS

3D	three-dimensional
EA	environmental assessment
GIS	geographic information system
Key Bridge	Francis Scott Key Bridge
NPS	National Park Service
Parkway	George Washington Memorial Parkway
SF	square feet
VIA	Visual Impact Assessment

REFERENCES

Arlington County

2017 Official GIS Open Data Portal. http://gisdata-arlgis.opendata.arcgis.com/datasets/tree-canopy-2011.

District of Columbia Office of Planning

2006 *Growing an Inclusive City: From Vision to Reality. The Comprehensive Plan for the National Capital: District Elements*. https://planning.dc.gov/page/comprehensive-plan.

EDAW

1985 *Cultural Landscape Report Mount Vernon Memorial Highway*. Volume Two: Documentation.