

## CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This “Environmental Consequences” chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this EA. This chapter also includes definitions of impact thresholds (e.g., negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by the CEQ regulations implementing NEPA, table 2-1 provides a summary of the environmental consequences for each alternative (“Chapter 2: Alternatives”). The resource topics presented in this chapter and the organization of the topics correspond to the resource discussions in “Chapter 3: Affected Environment.”

### GENERAL METHODOLOGY FOR ESTABLISHING IMPACT THRESHOLDS AND MEASURING EFFECTS BY RESOURCE

The following elements were used in the general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category:

- general analysis methods as described in guiding regulations, including the context and duration of environmental effects
- basic assumptions used to formulate the specific methods used in this analysis
- thresholds used to define the level of impact resulting from each alternative
- methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting park resources

These elements are described in the following sections.

#### GENERAL ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines and Director’s Order 12 procedures (NPS 2011) and is based on the underlying goal of preserving the historic and natural resources that contribute to the significance of the park for the use, inspiration, and benefit of the public. This analysis incorporates the best available scientific literature applicable to the setting and the actions being considered in the alternatives. For each resource topic addressed in this chapter, the applicable analysis methods are discussed, including assumptions and impact intensity thresholds.

#### ASSUMPTIONS

Several guiding assumptions were made to provide context for this analysis. These assumptions are described in the following sections.

##### Analysis Period

The analysis period for this assessment is the expected period needed to construct the proposed alternatives. However, the analysis period for some resource areas may extend beyond the period of construction. The specific analysis period for each impact topic is defined at the beginning of each topic discussion.

##### Geographic Area Evaluated for Impacts (Area of Analysis)

The project area is the area on and adjacent to the Rock Creek and Potomac Parkway southbound lanes at the merge with Waterside Drive, NW, including the land in the median, Rock Creek, and both the east

and west banks of the creek. The riparian revegetation areas consist of at least six sites along Rock Creek between Sherrill Drive, NW and Bingham Drive, NW.

### IMPACT THRESHOLDS

Determining impact thresholds is a key component in applying NPS *Management Policies 2006* and Director's Order 12 (NPS 2006a; 2011). These thresholds provide the reader with an idea of the intensity of a given impact to a specific resource. The impact threshold is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. In all cases, the impact thresholds are defined for adverse impacts. Beneficial impacts are addressed qualitatively.

The potential impacts of all alternatives are described in terms of type (beneficial or adverse); context; duration (short or long-term); and intensity (negligible, minor, moderate, major). Definitions of these descriptors include

**Beneficial.** A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

**Adverse.** A change that declines, degrades, and/or moves the resource away from a desired condition or detracts from its appearance or condition.

**Context.** The affected environment in which an impact would occur, such as local, park wide, regional, global, affected interests, society as whole, or any combination of these. Context is variable and depends on the circumstances involved with each impact topic. As such, the impact analysis determines the context, not vice versa.

**Duration.** The duration of the impact is described as short-term or long-term. Duration is variable with each impact topic; therefore, definitions related to each impact topic are provided in the specific impact analysis narrative.

**Intensity.** Because definitions of impact intensity (negligible, minor, moderate, and major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed.

### CUMULATIVE IMPACTS

The CEQ regulations for implementing NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact to the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7). As stated in the CEQ handbook, *Considering Cumulative Effects* (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected, and the analysis should focus on effects that are truly meaningful. Cumulative impacts are considered for all alternatives, including the no action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at Rock Creek Park and, if applicable, in the surrounding area. Table 4-1 summarizes the actions that could affect the various resources at the park,

along with the plans and policies of the park and surrounding jurisdictions, which were discussed in “Chapter 1: Purpose and Need.”

The analysis of cumulative impacts was accomplished using four steps:

**Step 1:** Identify resources affected. Fully identify resources affected by any of the alternatives. These include the resources addressed as impact topics in chapters 3 and 4 of this document.

**Step 2:** Set boundaries. Identify an appropriate spatial and temporal boundary for each resource. The temporal boundaries are noted in table 4-1, and the spatial boundary for each resource topic is listed under each topic.

**Step 3:** Identify past, present, and reasonably foreseeable future actions. Determine which past, present, and reasonably foreseeable future actions to include with each resource. These are listed in table 4-1 and described below.

**Step 4:** Perform cumulative impact analysis. Summarize impacts of these other actions (x) plus impacts of the proposed action (y), to arrive at the total cumulative impact (z). This analysis is included for each resource.

**TABLE 4-1: CUMULATIVE IMPACT PROJECTS**

Cumulative Impact Project	Description	Status
Rehabilitation of Peirce Mill	The NPS recently completed a major rehabilitation of Peirce Mill, a historic structure located on Tilden Street, NW near Beach Drive, NW. <b>Affected Resources:</b> Floodplains, soils, vegetation, and cultural resources	Past
Rehabilitation and Reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway	The NPS, in coordination with FHWA, will resurface and repair the entire length of Beach Drive, NW. The agencies have rehabilitated and repaved Rock Creek and Potomac Parkway from Virginia Avenue, NW to Shoreham Drive, NW, excluding the southbound parkway and the Waterside Drive, NW area covered in this EA; rehabilitated and repaved Cathedral Avenue, NW at the intersection with Shoreham Drive, NW; rehabilitated and repaved Shoreham Drive, NW to the intersection with Calvert Street, NW; and repaved and spot repaired the Harvard Street, NW ramp from Beach Drive, NW in Rock Creek Park. <b>Affected Resources:</b> Water resources, floodplains, wetlands, soils, vegetation, wildlife, cultural resources, visitor use and experience, transportation, and health and safety	Present
Broad Branch Stream Daylighting	The NPS and the DDOE will restore and daylight approximately 1,600 linear feet of stream that is currently piped beneath NPS and District of Columbia property. <b>Affected Resources:</b> Water resources, floodplains, wetlands, soils, vegetation, and wildlife	Future

Cumulative Impact Project	Description	Status
Installation of Regenerative Stormwater Conveyances at Milkhouse Run and Bingham Run	The District of Columbia Department of the Environment installed regenerative stormwater conveyances to protect and enhance the streambeds of Milkhouse Run and Bingham Run, both of which are on NPS land. An EA was prepared and a finding of no significant impact was signed in 2011. <b>Affected Resources:</b> Water resources, floodplains, wetlands, soils, vegetation, and wildlife	Past
National Zoological Park General Services Building Retaining Wall	The Smithsonian Institution is planning to construct a retaining wall structure between the General Services Building and North Road, NW at the National Zoo. <b>Affected Resources:</b> Water resources, soils, vegetation, and transportation	Future
Klinge Valley Trail	FHWA and DDOT have proposed to construct a multi-use trail on a closed section of Klinge Road, NW and to rehabilitate the adjacent stream, which is on NPS property. The EA has been completed and a decision document is expected from NPS in summer, 2012. <b>Affected Resources:</b> Water resources, floodplains, wetlands, soils, vegetation, wildlife, and visitor use and experience	Future
Oregon Avenue, NW Reconstruction and Improvements	is conducting planning for the reconstruction of Oregon Avenue, NW, including sidewalks, drainage facilities, signs, and pavement markings. <b>Affected Resources:</b> Water resources, soils, vegetation, and transportation	Future
Reconstruction of Broad Branch Road, NW	The DDOT conducting planning for the reconstruction of Broad Branch Road, NW. <b>Affected Resources:</b> Water resources, floodplains, wetlands, soils, vegetation, and wildlife	Future
Rock Creek Park Multi-use Trail Repaving	DDOT has proposed to repave a 3.7-mile section of the Rock Creek Park Multi-use Trail from Broad Branch Road to P Street, NW. The project includes resurfacing, trail widening where environmentally feasible, modifications to the trail alignment and road crossings, and additional modifications to improve safety, erosion control, and connections to and from the trail. <b>Affected Resources:</b> Water resources, floodplains, wetlands, soils, vegetation, wildlife, visitor use and experience, transportation, and health and safety	Future

## WATER RESOURCES

### METHODOLOGY AND ASSUMPTIONS

The *NPS Management Policies 2006* states that the NPS will “take all necessary actions to maintain or restore the quality of surface waters and ground waters in the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations” (NPS 2006a, section 4.6.3).

Another consideration in assessing water quality impacts is the effect on those resources dependent on a certain quality or condition of water. Sensitive aquatic organisms, submerged aquatic vegetation, riparian areas, and wetlands are affected by changes in water quality from direct and indirect sources.

Potential impacts to water quality focused on the expected extent of disturbance to the riverbank and nearshore river bottom/sediments from construction, as well as the potential for soil erosion resulting from disturbance of the banks. The analysis of possible impacts to water quality was based on on-site inspection of the resource in the project area, review of existing literature and water quality standards, information provided by the NPS and other agencies, and professional judgment.

For this project, hydraulic modeling (NPS 2012h) was conducted that looked at water surface elevations and average flow velocity in the main channel of Rock Creek from immediately upstream of the project site to just below the Q Street, NW Bridge. Modeling looked at flow and flood elevation conditions during one-year, two-year, 25-year, 50-year, 100-year, and 500-year flood events. This modeling helped assess impacts to stream flow and erosion potential and associated water quality issues, as well as flood levels and impacts to floodplains, which are discussed later.

## STUDY AREA

The study area for water quality and stream processes includes the stream segment from immediately upstream of the project area, downstream to the confluence with the Potomac River, and the segment of upper Rock Creek that would be revegetated from Sherrill Drive, NW on the north to Bingham Drive, NW on the south. The cumulative impact analysis considers additional projects upstream and downstream of the project area, with focus on the management unit of lower Rock Creek, which extends from Peirce Mill to the confluence of the Potomac River, as well as upstream projects along Rock Creek.

## IMPACT THRESHOLDS

The following impact thresholds were established to describe the relative changes in hydrology (overall, local, short and long-term, cumulative, adverse, and beneficial) under the alternatives.

**Negligible.** Chemical, physical, or biological effects on water quality or streamflows would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions and flows.

**Minor.** Chemical, physical, or biological effects on water quality or streamflows would be detectable and local, but would be well below water quality standards or criteria and within historical or desired water quality conditions and flows.

**Moderate.** Chemical, physical, or biological effects on water quality or streamflows would be detectable over a relatively wide area or stream reach, but would be at or below water quality standards or criteria. However, historical baseline or desired water quality conditions and/or streamflows would be temporarily altered.

**Major.** Chemical, physical, or biological effects on water quality or streamflows would be detectable and would be frequently altered from the historical baseline or desired water quality conditions and flows over a large area in and outside of the study area; and/or chemical, physical, or biological water quality standards or criteria would temporarily be slightly and singularly exceeded.

**Duration.** Impacts would be short-term when changes in water quality and streamflows are temporary, occurring after major storm events or during construction. Long-term impacts would occur when the recovery period is not temporary, resulting in permanent changes to water quality or hydrologic characteristics.

## IMPACTS OF ALTERNATIVE 1: NO ACTION

**Analysis.** Under the no action alternative, no additional impervious surface would be created and the gabion baskets installed to provide emergency stabilization of the erosion that resulted from the back-to-back storms in 2011 would remain in place. The installation of the gabion baskets has stabilized erosion locally, but has also created a vertical and hardened stream bank configuration that would have the potential for long-term effects downstream. The hardening has resulted in a relatively channelized stream system in the study area, which can affect stream hydraulics by increasing the velocity of downstream flow during storm events. Hydraulic modeling confirms that the current configuration with the gabion baskets would not noticeably decrease the velocities in the main channel, which would increase the chances of further downstream scour (NPS 2012h). Several of the modeled storms show both modest increases and decreases in velocity compared to conditions prior to the gabion baskets, indicating a shift in how water is flowing through the channel; the largest increases are between the pedestrian bridge and the Q Street, NW Bridge and are as much as 0.05 feet per second. The gabion baskets would result in short-term benefits to water quality by stabilizing the eroded banks and stopping the immediate downstream flow of associated sediments and sediment-bound pollutants, such as nutrients. The impacts to both stream bank configuration and water quality would be long-term, negligible to minor, and adverse because of the potential for increased velocities downstream during storm events that would amplify the likelihood of increased scour, erosion, and stream channel degradation, as well as associated water quality problems, in the future.

The gabion baskets would have short-term, beneficial impacts to both the stream channel and water quality by preventing continued erosion and downstream transport of large amounts of sediment and soil from this stream reach, but would ultimately have long-term, minor, adverse impacts due to the changes in hydrology. There would be no impacts to water quality from the road, because the alignment and pavement area would remain the same as under current conditions. Riparian areas along Rock Creek would not be revegetated with native vegetation to compensate for impacts that resulted from previous roadway construction, resulting in long-term, minor, adverse impact to the stream channel and to water quality.

**Cumulative Impacts.** There are road projects occurring in the area that are addressing traffic problems but would have long-term, negligible to minor, adverse impacts to Rock Creek by increasing impervious surfaces, resulting in increased runoff into Rock Creek or its tributaries. Conversely, the stream daylighting project at Broad Branch, the installation of regenerative stormwater projects at Milkhouse and Bingham Runs, and the stream restoration associated with the Klingle Road, NW Multi-use Trail would all have long-term, beneficial impacts to Rock Creek by reintroducing a more natural stream profile, restoring habitat, attenuating stormwater runoff, and improving water quality. The conversion of a wide road into a narrower multi-use trail in Klingle Valley would also result in local benefits to Rock Creek through decreasing the amount of impervious surface adjacent to the stream, which would reduce runoff volume, and through reducing pollutants by replacing cars with bicycles and pedestrians. The impacts of these past, present, and reasonably foreseeable future actions on Rock Creek would be generally long-term and beneficial, although largely local. Alternative 1 would have long-term, minor, adverse impacts on the stream channel. When combined with the long-term, beneficial impacts of past, present, and reasonably foreseeable future actions, alternative 1 would have a minimal adverse contribution resulting in overall long-term, beneficial impacts to the stream channel and water quality.

**Conclusion.** The emergency installation of the gabion baskets has stabilized erosion locally and stopped downstream transport of sediment-bound pollutants, but has created a vertical and hardened configuration that would have long-term impacts downstream by increasing the likelihood for scour and erosion in the future. The gabion baskets would therefore result in short-term benefits for water quality by stabilizing the eroded banks and stopping the downstream flow of associated sediments, but would also create the potential for long-term, negligible to minor, adverse impacts to stream channel configuration by encouraging increased downstream flow and flow velocities during storm events, which can result in the

increased likelihood of erosion and associated adverse impacts to water quality. Cumulative impacts would be long-term and beneficial, with the no action alternative contributing minimal adverse impacts.

## **IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS**

**Analysis.** Under this alternative, Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be restored to its pre-July 2011 alignment, which would effectively remove pavement added in 2011 to widen the lane. It also would move the creek-side curb of the parkway a few feet away from Rock Creek, restoring the original 24-foot road width with two 11-foot wide lands and two 1-foot gutters. The existing gabion baskets would be removed and vegetated engineered slopes would be installed along the creek in place of the gabion walls. Additionally, no less than 0.6 acre of riparian plantings would be installed in six areas along upper Rock Creek between Sherrill Drive, NW and Bingham Drive, NW.

Shifting the road away from the creek back to its original conditions would result in long-term, benefits for water quality through moving impervious surfaces away from the stream. However, these benefits would be limited because the alignment would only be moved a relatively short distance. No additional impervious surfaces would result from the implementation of alternative 2. The replacement of the gabion basket walls with approximately 340 linear feet of vegetated reinforced soil slopes (VRSS) along the stream banks would provide long-term benefits for stream channel characteristics, hydraulics, and water quality. The engineered slope would be more natural and less hardened and vertical than the banks currently are with the gabion baskets. The VRSS would ultimately be vegetated, and the slope on the VRSS stream bank would be gradual. This would lessen the likelihood that the stream stabilization measures would exacerbate downstream erosion, and would allow stormwater to filter through the vegetated slope before entering Rock Creek, slowing the flow and allowing some pollutant removal.

Hydraulic modeling indicates that alternative 2 would be effective at attenuating downstream velocities and would provide improvement over the gabion walls. Although the alternative would increase upstream velocities slightly in some of the modeled storms over the baseline (pre-gabion basket conditions), it would be no greater than 0.01 feet per second. Downstream velocities would decrease as much as 0.36 feet per second over baseline conditions for the two-year storm, but would also decrease for other storms, and would decrease by as much as 0.39 feet per second compared to the no action alternative with the gabion baskets. The VRSS would stabilize the slope with vegetation, which would provide greater resistance to water flowing in the channel, thereby reducing the likelihood of local erosion as well as decreasing the downstream velocities and the likelihood of future downstream scour and erosion.

Cofferdams and sediment and erosion control practices would be used during construction to minimize short-term, adverse impacts related to sedimentation in the creek, and would be implemented in accordance with District of Columbia guidelines for in-stream construction and restoration that are in the sediment and erosion control handbook (DDOE 2003). The cofferdams allow work to occur in the stream while allowing the stream to flow around the dam and the project area, and prevent stirring up materials in the stream bed and creating construction-related turbidity in the stream, which can adversely affect aquatic habitat. However, the cofferdams would also constrict the channel, however, which can concentrate stream flow through the project area and increase the potential for scour and erosion downstream, resulting in short-term, negligible to minor, adverse impacts downstream. Upland sediment and erosion control practices consistent with the District's *Soil Erosion and Sediment Control Handbook* (DDOE 2003) would minimize runoff from the upland areas of the project area and limit impacts to water quality during construction to short-term, negligible to minor, and adverse.

Finally, approximately 0.3 acre of degraded riparian area in the project area was impacted by the 2011 road construction activities not specified in the preferred alternative contained in the 2006 EA. To mitigate this impact, no less than 0.6 acre of vegetation in three areas along Rock Creek would be revegetated with native vegetation. Revegetation of riparian areas along Rock Creek would provide long-term, beneficial impacts by helping to stabilize the stream banks and providing additional vegetated

buffers for Rock Creek. This would help attenuate stormwater quantity and quality and enhance habitat along the banks and in the stream by providing shade and sources for woody debris. Additional mitigation measures as outlined in Chapter 2 will be implemented to ensure that impacts are not significant.

There would be no impacts to water quality or stream channel configurations from the inclusion of road striping, rumble strips, or signs.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact water quality and stream channel configuration would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 2 would also have long-term, beneficial impacts (from moving the road away from the creek and from the replacement of the gabion baskets with VRSS) as well as short-term, negligible to minor, adverse impacts (during construction). When combined with the impacts from the cumulative actions, alternative 2 would have a slight contribution resulting in an overall long-term, beneficial impact to the stream channel and to water quality in Rock Creek.

**Conclusion.** The replacement of the gabion baskets with VRSS and moving the road alignment slightly away from the existing stream bank would result in long-term, beneficial impacts to water quality and water resources by reducing stream velocities and the associated risk of local and downstream erosion. The revegetation of riparian areas along Rock Creek would provide long-term, beneficial impacts by helping to stabilize the stream banks and providing additional vegetated buffers for Rock Creek. There would be short-term, negligible to minor, adverse impacts associated with construction activities. Cumulative impacts would be long-term and beneficial with alternative 2 contributing slightly to beneficial impacts.

### **IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Under alternative 3, the alignment of Rock Creek and Potomac Parkway would be moved approximately five feet closer to the stream bank, depending on the specific point on the road. In addition, a 350-foot-long stone retaining wall would need to be constructed to support the new pavement. This alignment and construction of the retaining wall would further narrow the distance between the road and Rock Creek and would limit the width in which VRSS could be placed at the toe of the retaining wall. Revegetation of riparian areas in upper Rock Creek between Sherrill Drive, NW and Bingham Drive, NWs would also take place, similar as proposed under alternative 2.

Hydraulic modeling indicates that alternative 3 would cause the greatest increase in average main channel velocity compared to other alternatives, increasing flows by as much as 0.61 feet per second for the two-year flood over the conditions prior to the installation of the gabion baskets. This alternative has the largest encroachment into the Rock Creek channel, which would restrict the dimensions of the channel. Less water would be able to flow through that section of Rock Creek, and therefore channel velocities would be concentrated (NPS 2012h), resulting in the likelihood of increased stream bank scour and erosion downstream and associated water quality issues. The likelihood of future local and downstream scour and erosion and associated water quality problems would therefore be greater under alternative 3 than under the other alternatives.

In addition, the new alignment would increase impervious surface by approximately 5,500 square feet. This additional pavement would marginally increase runoff from the road surface, resulting in long-term, minor, adverse impacts to water quality. However, these impacts would not be particularly noticeable once the vegetation on the VRSS has had an opportunity to become established, because the vegetation would act as a filter for pollutants and would slow the sheet flow of water from the road. Because the VRSS would be narrower and the new impervious surface would be closer to the road than under the other alternatives, the impacts from the runoff would be slightly more noticeable than under other alternatives. Long-term impacts to water quality and stream channel integrity from the increased impervious surface and encroachment into the channel would therefore be minor and adverse.

This alternative also includes at least 0.6 acre of riparian revegetation along Rock Creek, which would have the same long-term, beneficial impacts as those under alternative 2. The same construction and sediment and erosion control methods discussed under alternative 2 would be used, resulting in short-term, negligible to minor, adverse impacts to water quality. There would be no impacts to water quality or stream channel configurations from the inclusion of road striping, rumble strips, or signs.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact water quality and stream channel configuration would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 3 would have long-term, minor, adverse impacts (from encroachment into the stream channel and new impervious surfaces), long-term, beneficial impacts (from the replacement of the gabion baskets with VRSS and revegetation of the riparian areas near Sherrill Drive, NW), and short-term, negligible to minor, adverse impacts (during construction). When combined with the impacts from the cumulative actions, alternative 3 would have a noticeable adverse contribution to an overall long-term, beneficial impact to water quality and the stream channel.

**Conclusion.** Alternative 3 would encroach on the streambed and result in 5,500 square feet of new impervious surface, resulting in increased downstream velocities and associated scour that could result in erosion and increased sediment loads in Rock Creek. The local and downstream impacts to the stream channel and water quality would therefore be long-term, minor, and adverse, although there would also be long-term, beneficial impacts from the replacement of the gabion baskets with VRSS. There would also be short-term, negligible to minor, adverse impacts to water quality as a result of construction activity. Revegetation of riparian areas would result in long-term benefits by minimizing the change of scour and erosion downstream. Cumulative impacts would be long-term and beneficial with alternative 3 having a noticeable adverse contribution to overall long-term, beneficial impacts.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Under alternative 4, the road configuration would be moved toward the existing median by approximately 12 feet in places, and construction would take place farther from Rock Creek than in alternatives 2 or 3. This alternative would result in 4,600 square feet of new impervious surface and would not result in encroachment on the stream channel. This additional pavement would marginally increase runoff from the road surface, resulting in long-term, negligible to minor, adverse impacts to water quality

Stream stabilization with VRSS would be the same as under alternative 2, with the same long-term, beneficial effects on downstream hydraulics and water quality. Hydraulic modeling shows results similar to alternative 2 with respect to decreased downstream velocities, and therefore decreased likelihood for future scour, erosion, and associated pollution (NPS 2012h). Once vegetation in the VRSS has been established, impacts from the runoff from the additional impervious surface would be attenuated. There would also be similar short-term, negligible to minor, adverse impacts from construction activities. Short- and long-term impacts to the stream channel and water resources would therefore be similar to the impacts described for alternative 2.

This alternative also includes at least 0.6 acre of riparian revegetation along Rock Creek at Sherrill Drive, NW, which would have the same long-term, beneficial impacts as those under alternatives 2 and 3. Additional mitigation measures, as outlined in Chapter 2 will be implemented to ensure that impacts are not significant.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact water quality and stream channel configuration would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 4 would have long-term, negligible to minor, adverse impacts (from the additional impervious surface), long-term, beneficial impacts (from the replacement of the gabion baskets with VRSS and riparian area revegetation at Sherrill Drive, NW), and short-term,

negligible to minor, adverse impacts (during construction). When combined with the impacts from the cumulative actions, alternative 4 would have a slight contribution to an overall long-term, beneficial impact to water quality and the stream channel.

**Conclusion.** Although there would be an additional 4,600 square feet of new impervious surfaces added in the implementation of this alternative, the new road surface would be added away from the stream bank of Rock Creek, and there would be no encroachment into the channel. The new impervious surface would result in long-term, negligible to minor, adverse impacts from increased runoff. These effects would not be noticeable once the VRSS vegetation becomes established, resulting in long-term, beneficial impacts. The VRSS and riparian area revegetation would result in overall long-term, beneficial impacts to the downstream channel and water quality. There would be short-term, negligible to minor, impacts associated with construction that would be minimized by compliance with sediment and erosion control guidance. Cumulative impacts would be long-term and beneficial with alternative 4 having a slight contribution to overall long-term, beneficial impacts.

## FLOODPLAINS

### METHODOLOGY AND ASSUMPTIONS

The impact analysis is based on the review of floodplain information in relation to the proposed design of the action alternatives. Under NPS Director's Order 77-2: *Floodplain Management* (NPS 2003a), a SOF is required when a proposed action would have an adverse effect on a floodplain (see appendix B). The SOF is intended to provide documentation as to why the proposed action or site was selected and a less flood-prone alternative was rejected. *NPS Management Policies 2006* (NPS 2006a) calls for the protection, preservation, and restoration of natural resources and functions of floodplains, avoidance of long- and short-term environmental effects associated with the modification of the floodplain, and avoidance of floodplain development that would adversely affect natural resources and floodplain processes. Impacts to floodplains have been analyzed with these management objectives in mind.

For this project, hydraulic modeling was conducted that looked at water surface elevations and average flow velocity in the main channel of Rock Creek from immediately upstream of the project site to just below the Q Street, NW Bridge. Modeling looked at flow and flood elevation conditions during one-year, two-year, 10-year, 25-year, 50-year, 100-year, and 500-year flood events (NPS 2012h). This modeling helped assess impacts to streamflow and erosion potential and associated water quality issues, as well as flood levels and impacts to floodplains.

### STUDY AREA

The study area for floodplain impacts is the limit of disturbance required for the construction of the stream restoration project and road realignment and the riparian revegetation areas.

### IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of impacts to floodplains:

**Negligible.** The action would result in a change to floodplains, but the change would be so small it would not be of any measurable or perceptible consequence.

**Minor.** The action would result in impacts to floodplains, but the change would be small and local and of little consequence. Mitigation would be needed to offset adverse impacts. Mitigation would be relatively simple to implement and would likely be successful.

**Moderate.** The action could result in a change to floodplains. The change would be measurable and of consequence. Mitigation measures would be necessary to offset adverse impacts and would likely be successful.

**Major.** The action would result in a noticeable change to floodplains. The change would be measurable and result in a severely adverse impact. Mitigation measures necessary to offset adverse impacts would be needed and would be extensive, and their success would not be guaranteed.

**Duration.** Short-term impacts to floodplains would occur during the construction activities. Long-term impacts to floodplains would extend after completion of the project.

### **IMPACTS OF ALTERNATIVE 1: NO ACTION**

**Analysis.** Under the no action alternative, no additional impervious surfaces would be created and the gabion baskets installed to quickly address erosion that resulted from the back-to-back storms in 2011 would remain in place. The hydraulic modeling shows that the water surface elevation in Rock Creek would remain largely the same compared with the conditions in Rock Creek before the 2011 storms, with the exception of some minor differences at some modeled points for the 10-year and 25-year floods (NPS 2012h). This indicates that there would be no noticeable change in the floodplain itself, nor any noticeable change in threat to human life or property, under the no action alternative. Floodplain values include the ability of the floodplain to absorb increased water flows, to recharge groundwater, and provide floodplain habitat. The area would continue to provide a wildlife corridor for urban wildlife, and opportunities for groundwater recharge. However, the presence of gabion walls in place of natural stream banks would create a long-term, negligible to minor, adverse impact to floodplain functions because the hardened configuration of the gabion baskets would alter the natural configuration of the floodplain. This would reduce the floodplain's ability to recharge groundwater or absorb runoff, as well as limit the quality of the floodplain habitat. Risk to property or life associated with the floodplain would not change, as the extent of the floodplain would remain essentially unchanged. Impacts to floodplain functions and values from the no action alternative would be long-term, negligible, and adverse.

**Cumulative Impacts.** There are road projects occurring in the area that are addressing traffic problems. However, these projects would have long-term, negligible to minor, adverse impacts to the Rock Creek floodplain by potentially increasing impervious surfaces in the floodplain, which would result in decreased capacity for recharge and increased runoff and runoff velocity in the floodplain. Conversely, the stream daylighting project at Broad Branch, the installation of regenerative stormwater projects at Milkhouse and Bingham Runs, and the stream restoration associated with the Klingle Road, NW multi-use trail project would all have long-term, beneficial impacts to the floodplains in the watershed by restoring habitat, and attenuating stormwater runoff, which would positively affect floodplain values and functions. The conversion of a wide road into a narrower multi-use trail at Klingle Road, NW would also result in local benefits for floodplain values and functions by decreasing the amount of impervious surfaces adjacent to the stream, which would reduce runoff volume and increase recharge. The impact of these cumulative actions on the Rock Creek floodplain would be generally long-term and beneficial, although largely local. The no action alternative would have long-term, negligible, adverse impacts on floodplains. When combined with the impacts of past, present, and reasonably foreseeable future actions, the no action alternative would have a negligible contribution to an overall long-term, beneficial impact.

**Conclusion.** The impacts to floodplain functions and values from alternative 1 would be long-term, negligible to minor, and adverse, because the presence of the gabion basket walls would affect natural processes that are part of floodplain function. Cumulative actions would be long-term and beneficial, with the no action having a negligible contribution to overall long-term, beneficial impacts.

## IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS

**Analysis.** Alternative 2 would not increase impervious surfaces, so any alterations to the road configuration would not affect floodplain functions or values. The removal of the gabion baskets and replacement with VRSS and revegetation of riparian areas upstream near the Sherrill Drive, NW would improve floodplain functions and values by restoring a gentle slope to the stream bank and establishing vegetation that can enhance wildlife habitat for floodplain species. Other floodplain values, such as providing groundwater recharge and wildlife corridors would continue to exist. The hydraulic model shows some modest decreases in water surface elevation at several of the cross sections (for example, by 0.01 feet) from the implementation of alternative 2. Impacts to floodplain values and resources would therefore be beneficial over the long-term. Risk to property or life associated with the floodplain would not change. The revegetation project to restore riparian areas along Rock Creek would also provide some long-term benefits to floodplain values.

Construction activities would have short-term, negligible to minor, adverse impacts to floodplain values and function, because the installation of the cofferdams would constrict the stream. This would temporarily affect the ability of water to flow past the project area and slightly increase the risk of flooding upstream.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact floodplain functions and values would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 2 would have long-term, beneficial impacts (from moving the road away from the creek and from the replacement of the gabion baskets with VRSS and riparian area revegetation) and short-term, negligible to minor, adverse impacts (during construction). When combined with the long-term, beneficial impacts from cumulative actions, alternative 2 would have a minor contribution to long-term, beneficial impacts to floodplain functions and values.

**Conclusion.** The implementation of alternative 2 would have long-term, beneficial impacts from the replacement of the gabion walls with the VRSS and riparian revegetation and short-term, negligible to minor, adverse impacts during construction. Cumulative impacts would be long-term and beneficial, with alternative 2 having a minor contribution to an overall long-term, beneficial impact to floodplain functions and values.

## IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK

**Analysis.** Alternative 3 would add 5,500 square feet of impervious surfaces in the 100-year floodplain and widen the parkway toward the creek with construction of a retaining wall. Short-term, negligible to minor, adverse impacts to floodplain functions and values would result from encroachment into the streambed with cofferdams during construction. This alternative would also result in use of VRSS to stabilize the stream bank at the toe of the retaining wall. The additional impervious surface is a relatively small area compared to the amount of impervious surfaces in the area, but the new surface would be close to the creek. The hydraulic modeling indicates that the channel encroachment would force stormwater from smaller storms into the overbank areas of the channel, where it would ultimately spill onto the road and the pedestrian trail (NPS 2012h), possibly affecting property or safety should cars ford high waters and sustain damage or should floodwaters affect the condition of the road.

Changes in water surface elevations in the hydraulic model indicate that this alternative would have the most noticeable change in water surface elevations, with the increases in water surface elevations for the various floods modeled ranging from 0.07 foot (0.84 inch) for the two-year flood (which would remain within the banks) to 0.11 foot (1.32 inches) for the 10-year flood. Increases were also observed for the 50-year, 100-year, and 500-year floods, although the overall increase was smaller (0.05 foot [0.6 inch] for the 500-year flood, for example). The water surface elevation under the 25-year flood scenario was largely the same as the projection for existing conditions. Although there would be long-term benefits from the

replacement of the gabion baskets, as discussed under alternative 2, these benefits would be limited because the realignment toward Rock Creek would limit the area and configuration available for the installation of VRSS. The addition of the retaining wall would also affect floodplain functions and value by encroaching into the floodplain, constricting the channel, and therefore, increasing floodplain elevations upstream of the constriction, resulting in long-term, minor, adverse impacts.

Additionally, revegetation of the riparian areas along Rock Creek near Sherrill Drive, NW would occur. Impacts from the revegetation of these areas would be the same as in alternative 2, and would provide some long-term benefits to floodplain functions and values.

Other floodplain values and functions, such as providing groundwater recharge and a corridor for urban wildlife and floodplain species, would not be affected, and would continue. Impacts to floodplain value and functions as a result of the implementation of alternative 3 would be long-term, minor, and adverse, with long-term benefits from the revegetation project.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact floodplain functions and values would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 3 would have long-term, beneficial impacts (from the revegetation project and replacement of the gabion baskets with VRSS) and short-term, negligible to minor, adverse impacts (from encroachment into the stream channel with cofferdams during construction), and long-term, minor, adverse impacts to floodplain values and functions from the retaining wall. When combined with the long-term, beneficial impacts from cumulative actions, alternative 3 would have a minimal contribution to an overall long-term, beneficial impact to floodplain functions and values.

**Conclusion.** The increase in impervious surfaces and encroachment into the channel under alternative 3 would result in long-term, minor, adverse impacts to Rock Creek floodplain values and functions from encroachment into the stream channel and the use of a retaining wall, with long-term benefits from the VRSS and revegetation project. There would also be short-term, negligible to minor, adverse impacts from constriction of the stream channel by the cofferdams during construction. Cumulative impacts would be mostly local, long-term, and beneficial, with alternative 3 contributing minimally to long-term, beneficial cumulative impacts to floodplain functions and values.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Under alternative 4, an additional 4,600 square feet of impervious surfaces would be added in the floodplain and the additional merge lane and parkway would be widened away from Rock Creek toward the existing median. The gabion basket walls would be removed and replaced with VRSS in the same configuration as discussed under alternative 2. In addition, no less than 0.6 acre of riparian areas along Rock Creek near the Sherrill Drive, NW site would be revegetated (see appendix B).

The addition of new, additional impervious surfaces would have a long-term, negligible to minor, adverse effect on floodplain functions and values by converting a previously vegetated area that infiltrates stormwater and slows the flow volume and velocity of stormwater entering Rock Creek. The additional impervious surfaces would be located farther from the creek than the existing pavement, which would reduce the adverse impacts to some extent. The replacement of the gabion structures with VRSS would result in benefits for floodplain functions and values by replacing a hardened vertical structure that can impact downstream floodplains and prevent infiltration and other floodplain functions. Similar benefits would result from implementation of the revegetation of riparian areas along Rock Creek.

The hydraulic model indicates that the water surface elevation would result in minimal change to water surface elevations when compared to the 2011 conditions before the storms that caused the erosion and required the installation of the emergency gabion baskets. At several of the modeled cross sections, the projected water surface elevations would be local and would occur mostly in the project area. In many

cases, the water surface elevations would remain the same or would actually decrease by a few hundredths of a foot, although some of the projected water surface elevations would increase minimally by no more than 0.02 feet (0.24 inch). Risk to property or life associated with the floodplain would not change.

Impacts from the revegetation of riparian areas along Rock Creek would be the same as in alternative 2, and would provide some long-term benefit for floodplain functions and values. Other floodplain values and functions in the project area, such as providing groundwater recharge and a corridor for urban wildlife and floodplain species, would not be affected, and would continue.

Impacts to floodplain resources, functions, and values would be long-term, beneficial and long-term, negligible, and adverse. VRSS and revegetation of the riparian areas would create benefits for the floodplain and would likely offset the majority of the adverse impacts of the increased impervious surfaces.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact floodplain functions and values would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 4 would have long-term, beneficial impacts (from the revegetation project and replacement of the gabion baskets with VRSS) and long-term, negligible, adverse impacts (from additional impervious surfaces). When combined with the long-term, beneficial impacts from cumulative actions, alternative 4 would have a relatively minimal contribution to a long-term, beneficial impact to floodplain functions and values.

**Conclusion.** The increase in impervious surfaces and encroachment into the channel under alternative 4 would result in long-term, negligible to minor, adverse impacts to Rock Creek floodplain values and functions from increases in impervious surfaces in the floodplain, with long-term benefits from the revegetation project and replacement of the gabion baskets with VRSS. Cumulative impacts would be mostly local, long-term, and beneficial, with alternative 4 contributing minimally to long-term, beneficial impacts to floodplain functions and values.

## WETLANDS

### METHODOLOGY AND ASSUMPTIONS

Executive Order 11990, "Protection of Wetlands," states that federal agencies are to avoid to the extent possible long-term and short-term impacts associated with the destruction or modification of wetlands and avoid direct and indirect support of new construction in wetlands whenever practical alternatives exist. The USACE regulates development in wetland areas pursuant to Section 404 of the Clean Water Act (33 CFR 320–330).

The NPS has adopted a "no net loss" of wetlands policy in agreement with executive Order 11990 in NPS Director's Order 77-1: *Wetland Protection* (NPS 2002). Under NPS Director's Order 77-1, an SOF is required when a proposed action would have an adverse effect on a wetland area. The SOF is intended to provide documentation as to why the proposed action or site was selected and an alternative that avoided wetlands has been rejected.

The impact analysis and the conclusions for possible impacts to wetlands and waters of the United States were based on the field investigations conducted to delineate the extent of wetland habitats in the study area (or corridor). Existing data sources, such as National Wetland Inventory mapping and similar studies, information provided by park staff and other agencies, and best professional judgment were used to delineate the boundaries of wetlands and other waters of the United States. Locations of wetlands and waters of the United States delineated and mapped in the corridor were compared with the location of the existing road. The potential for impacts to wetlands and other waters of the United States was evaluated based on proposed rehabilitation alternatives near and in Rock Creek below the ordinary high water line.

## STUDY AREA

The study area for wetlands is the approximately 600-foot corridor between Rock Creek and Potomac Parkway and the Rock Creek Park Multi-use Trail near Waterside Drive, NW where the southbound ramp from Waterside Drive, NW merges with the parkway. Wetlands that were found within, as well as extending beyond, this boundary were fully delineated. Additionally, the study area includes the proposed riparian revegetation area along Rock Creek located between Bingham Drive, NW and Sherrill Drive, NW. All of the sites identified for revegetation are riparian areas. The six proposed sites differ in area, ranging between 0.005 and 0.279 acre and are immediately adjacent to the banks of Rock Creek. Throughout the proposed revegetation area, the banks of Rock Creek are very steep and practically vertical from the edge of the riparian zone to the creek bed. Scouring of the stream banks is present throughout the revegetation area.

## IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of impacts to wetlands:

**Negligible.** Wetlands would not be impacted or the impacts would be below or at the lower levels of detection.

**Minor.** The impacts to wetlands would be detectable and relatively small in terms of area and the nature of the change. The action would impact a limited number of individuals of plant or wildlife species in the wetland.

**Moderate.** The impacts to wetlands would be readily apparent over a relatively small area but the impacts could be mitigated by restoring previously degraded wetlands. The action would have a measurable impact to plant or wildlife species in the wetland, but all species would remain indefinitely viable.

**Major.** The impacts to wetlands would be readily apparent over a relatively large area. The action would have measurable consequences for the wetland area that could not be mitigated. Wetland species dynamics would be upset, and plant and/or animal species would be at risk of extirpation from the area.

**Duration.** Short-term impacts would occur during all or part of alternative construction; long-term impacts would extend beyond the implementation of the alternative.

## IMPACTS OF ALTERNATIVE 1: NO ACTION

**Analysis.** Under the no action alternative, no additional impervious surfaces would be created and the gabion baskets installed to provide emergency stabilization of the erosion that resulted from the back-to-back storms in 2011 would remain in place. The installation of the gabion baskets has stabilized erosion locally, but has also created a vertical and hardened stream bank configuration that would have the potential for long-term effects downstream. The hardened stream bank in the study area would increase the flow velocity, which would increase stream bank erosion downstream of the study area. Increased stream bank erosion would amplify the amount of sediment entering waters of the United States, thus decreasing the functions and values supported by Rock Creek.

The gabion baskets would have short-term, local, beneficial impacts to stream bank erosion in the study area. However, the downstream stream bank erosion that would result from leaving the gabion baskets in place would have long-term, negligible to minor, impacts to wetlands and waters of the United States due to increased stream bank erosion.

Riparian areas (no less than 0.6 acre) along Rock Creek would not be revegetated with native vegetation to compensate for impacts that resulted from previous roadway construction. This would result in long-term, minor, adverse impacts to the banks of Rock Creek.

**Cumulative Impacts.** There are road projects occurring in the area that are addressing traffic problems but that would have long-term, negligible to minor, adverse impacts to Rock Creek by increasing impervious surfaces. This would result in increased runoff into Rock Creek or its tributaries. Increased runoff, in turn, can result in increased stream bank erosion, contributing to higher sedimentation loads in Rock Creek. Conversely, the stream daylighting project at Broad Branch, the DC Water sewer line project, the regenerative stormwater projects at Milkhouse and Bingham Runs, and the stream restoration associated with the Klingle Road, NW Multi-use Trail project would all have long-term, beneficial impacts to Rock Creek by attenuating stormwater runoff and improving water quality. The conversion of a wide road into a narrower multi-use trail at Klingle Road, NW would also result in local benefits to Rock Creek by decreasing the amount of impervious surface adjacent to the stream, which would reduce runoff volume. The impact of these past, present, and reasonably foreseeable future actions on wetlands in Rock Creek would be generally beneficial, although largely local. The no action alternative would result in long-term, negligible to minor, adverse impacts on waters of the United States. When combined with the long-term, beneficial impacts of past, present, and reasonably foreseeable future actions, the no action alternative would have a negligible adverse contribution to overall long-term, beneficial impacts to wetlands.

**Conclusion.** The emergency installation of the gabion baskets has stabilized erosion locally, but has increased the potential for stream bank erosion to occur downstream of the study area. The gabion baskets would therefore result in short-term benefits for waters of the United States in the study area by stabilizing the eroded banks, but would also create the potential for long-term, negligible to minor, adverse impacts to waters of the United States by increasing stream bank erosion and sediment deposition downstream. Cumulative impacts would be overall long-term and beneficial with the no action having a negligible adverse contribution to these impacts.

## **IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS**

**Analysis.** Under alternative 2, Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be restored to its pre-July 2011 alignment, which would remove pavement added in 2011 to widen the lane. It also would move the creek-side curb of the parkway a few feet away from Rock Creek. Shifting the road back to its original conditions, away from the creek, would result in long-term benefits for waters of the United States by moving impervious surface away from the stream, allowing for a larger buffer to be established between the impervious pavement and Rock Creek. These benefits would be limited because the alignment would only be moved a relatively short distance. There would also be short-term, negligible to minor, adverse impacts associated with construction activities.

The existing gabion baskets that are stabilizing sections of the creek banks would be replaced with a bioengineered slope, using VRSS. The VRSS technique combines the use of woody, living vegetation purposefully embedded into a slope to help stabilize the soil, prevent erosion, and bind together the installed reinforcements. Heavy geotextile material is used as the primary reinforcement to stabilize the slope. A shorter secondary reinforcement wrap with a special mixture of soil and organic materials that helps to promote the establishment of vegetation and growth is used on the face of the overall system.

Under alternative 2, the VRSS technique would be applied to approximately 150 feet of the east bank and approximately 100 feet of the west bank of Rock Creek. Stream bank stabilization would have long-term, beneficial impacts to Rock Creek by reducing the sediment load entering the waterway. To minimize stream impacts during construction, construction activity would follow BMP guidelines described in the District of Columbia sediment and erosion control handbook (DDOE 2003). Appropriate BMPs include placing coffer dams in the stream to minimize erosion to the stream banks and using upland sediment and

erosion measures to reduce the sediment load entering the stream. Additional mitigation measures as outlined in Chapter 2 would be implemented to ensure that impacts are not significant.

Additionally, approximately 0.3 acre of degraded riparian area in the project area was impacted by road construction activities in 2011. To mitigate this impact, no less than 0.6 acre of vegetation along Rock Creek would be revegetated with native vegetation. Revegetation of riparian areas along Rock Creek would provide long-term, beneficial impacts by helping to stabilize the stream banks and providing additional vegetated buffers for Rock Creek. This would help attenuate stormwater quantity and improve stormwater quality, and enhance habitat along the banks and in the stream by providing shade and sources for woody debris.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact wetlands and other waters of the United States would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 2 would result in long-term, beneficial impacts (from moving the road away from the creek and from the replacement of the gabion baskets with VRSS) and short-term, negligible to minor, adverse impacts (during construction). When combined with the impacts from cumulative actions, alternative 2 would have a minimal contribution to overall long-term, beneficial impacts to Rock Creek.

**Conclusion.** The implementation of alternative 2 would result in long-term, benefits for waters of the United States by stabilizing approximately 150 feet of the east bank and approximately 100 feet of the west bank and decreasing the sediment load entering waters of the United States, both in the study area and downstream. Additionally, riparian revegetation along Rock Creek would have long-term, beneficial impacts by improving the riparian area, decreasing erosion potential, limiting the amount of sediment entering waters of the United States, and mitigating for the impacts to 0.3 acre of riparian area impacts from previous construction activities. There would be short-term, negligible to minor, adverse impacts associated with construction activities. Cumulative impacts would be long-term and beneficial with alternative 2 having a minimal contribution to these impacts.

### **IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Under alternative 3, the alignment of Rock Creek and Potomac Parkway would be moved approximately five feet closer to the stream bank of Rock Creek, depending on the specific point on the road. This alignment would further narrow the buffer distance between the road and Rock Creek and would limit the width in which VRSS could be placed. In addition, a 350-foot-long stone retaining wall would need to be constructed to support the new pavement. The VRSS approach described in alternative 2 would be used to recreate the natural stream bank conditions in the previously impacted bank areas. Although the VRSS would be narrower under alternative 3 than under alternative 2, it would also be longer. Approximately 540 feet of the east bank and 100 feet of the west bank would receive this treatment. There would also be short-term, negligible to minor, adverse impacts associated with construction activities.

Alternative 3 would cause the greatest increase in channel velocity compared to the other alternatives and would result in the greatest potential for downstream stream bank erosion. The increased stream bank erosion would lead to a greater rate of sediment being deposited into waters of the United States. Long-term, minor, adverse impacts to waters of the United States would result from the increased sediment load.

Construction activity would use BMPs to minimize impacts to waters of the United States during construction. BMPs would follow guidelines for in-stream construction described in the District of Columbia sediment and erosion control handbook (DDOE 2003). These practices would include proper placement of cofferdams in the stream as well as applying sediment and erosion control measures in upland areas to minimize sediment runoff into Rock Creek.

This alternative also includes no less than 0.6 acre of riparian revegetation along Rock Creek, which would have the same long-term, beneficial impacts as those under alternative 2

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact wetlands and waters of the United States would be the same as under alternative 1, resulting in long-term, beneficial, impacts. Alternative 3 would result in long-term, minor, adverse impacts (from encroachment into the stream channel), long-term, beneficial impacts (from the replacement of the gabion baskets with VRSS), and short-term, negligible to minor, adverse impacts (during construction). When combined with the impacts from the cumulative actions, alternative 3 would have a minimal contribution to overall long-term, beneficial impacts to Rock Creek.

**Conclusion.** Alternative 3 would decrease the buffer distance between Rock Creek and the road which would result in more unfiltered runoff entering waters of the United States. Increased flow velocity under alternative 3 would lead to downstream bank erosion and increased sediment loads in waters of the United States, which would result in long-term, minor, adverse impacts. However, there would be long-term, beneficial impacts from the replacement of the gabion baskets with VRSS on approximately 540 feet of the east bank and 100 feet of the west bank. There would be short-term, negligible to minor, impacts from construction activity. Additionally, riparian revegetation along Rock Creek would have long-term, beneficial impacts by improving the riparian area, decreasing erosion potential and limiting the amount of sediment entering waters of the United States, and mitigating for the impacts to approximately 0.3 acre of riparian area from previous construction activities. Cumulative impacts would be long-term and beneficial but local, with alternative 3 having a minimal contribution to these impacts.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Under alternative 4, the changes to the road configuration would be moved toward the existing median by approximately 12 feet in places, and construction would take place farther from Rock Creek than in alternatives 2 or 3, resulting in long-term, beneficial impacts. Further, the eroded sections of the stream bank would be permanently restored. The VRSS approach described in alternative 2 would be used to recreate the natural stream bank conditions in the previously impacted bank areas with the same linear footage as described under alternative 2. There would also be short-term, negligible to minor, adverse impacts associated with construction activities.

Construction activity would use BMPs to minimize impacts to waters of the United States during construction. BMPs would follow guidelines for in-stream construction described in the District of Columbia sediment and erosion control handbook (DDOE 2003). These practices would include proper placement of cofferdams in the stream as well as applying sediment and erosion control measures in upland areas to minimize sediment runoff into Rock Creek. Successful stream bank stabilization would have long-term, beneficial impacts to Rock Creek by reducing the sediment load entering the waterway.

This alternative also includes no less than 0.6 acre of riparian revegetation along Rock Creek, which would have the same long-term, beneficial impacts as those under alternative 2.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future actions with the potential to impact wetlands and other waters of the United States would be the same as under alternative 1, resulting in long-term, beneficial impacts. Alternative 4 would result in long-term, beneficial impacts (from moving the road away from the creek and from the replacement of the gabion baskets with VRSS) and short-term, negligible to minor, adverse impacts (during construction). When combined with the impacts from the cumulative actions, alternative 4 would have a minimal contribution to overall long-term, beneficial impacts to Rock Creek.

**Conclusion.** Implementation of alternative 4 would lead to the stabilization of approximately 150 feet of the east bank and approximately 100 feet of the west bank of Rock Creek, thus decreasing the sediment

load entering waters of the United States, resulting in long-term, beneficial impacts. Additionally, a riparian revegetation along Rock Creek would have long-term, beneficial impacts by improving the riparian area, decreasing erosion potential and limiting the amount of sediment entering waters of the United States, and mitigating for the impacts to approximately 0.3 acre of riparian area from previous construction activities. There would be short-term, negligible to minor, adverse impacts associated with construction activities. Cumulative impacts would be long-term and beneficial with alternative 4 having a minimal contribution to these impacts.

## SOILS

### METHODOLOGY AND ASSUMPTIONS

Under NPS Management Policies 2006 the NPS actively seeks to understand and preserve the soil resources of its parks and properties, and prevent unnatural erosion, physical removal, or contamination of the soil to the extent possible (NPS 2006a). Analysis of possible impacts to soil resources was based on a review of existing literature and maps, information provided by the NPS and other agencies, and professional judgment. The majority of soils in the project area and in the riparian revegetation areas are highly disturbed in nature, especially along the portion of Rock Creek where construction activities took place in July 2011.

### STUDY AREA

The study area for soil resource impacts is the limit of disturbance required for stream bank restoration, construction of the road expansion project, and any necessary staging areas for stockpiling material and construction equipment. This study area includes the project area for the reconstruction and rehabilitation of Rock Creek and Potomac Parkway at Waterside Drive, NW and the riparian revegetation areas near Sherrill Drive, NW.

### IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of impacts to soils:

**Negligible.** The action would result in a change to soil resources, but the change would be so small it would not be of any measurable or perceptible consequence.

**Minor.** The action would result in impacts to soil resources, but the change would be small and local and of little consequence. Mitigation would be needed to offset adverse impacts. The mitigation would be relatively simple to implement and would likely be successful.

**Moderate.** The action could result in a change to soil resources. The change would be measurable and of consequence. Mitigation measures would be necessary to offset adverse impacts and would likely be successful.

**Major.** The action would result in a noticeable change to soil resources. The change would be measurable and would result in a severely adverse impact. Mitigation measures necessary to offset adverse impacts would be needed and would be extensive, and their success would not be guaranteed.

**Duration.** Short-term impacts to soils would occur during the construction activities. Long-term impacts to soils would extend after completion of the project.

## IMPACTS OF ALTERNATIVE 1: NO ACTION

**Analysis.** Alternative 1 represents the current conditions at the proposed site. There would be no excavation of soils or removal of vegetation as a result of this alternative. Routine maintenance, consisting of mowing and debris removal, would not impact soils. Bank stabilization measures in the form of gabion walls would remain in place under the no action alternative. There would be no revegetation of riparian areas along Rock Creek to mitigate for impacts that resulted from construction activities in 2011. The implementation of alternative 1 would result in long-term, minor, adverse impacts to soils due to potential for continued erosion and bank and slope sloughing along the south side of the Parkway near Waterside Drive, NW.

**Cumulative Impacts.** Past, present, and future actions have contributed to impacts to soils in the project area and the proposed riparian revegetation areas. The reconstruction of Oregon Avenue, NW and Broad Branch Road, NW, the Klingle Valley Multi-use Trail construction and stream restoration, the repaving of the Rock Creek Park Multi-use Trail, the daylighting of Broad Branch Stream, the construction of a retaining wall at the National Zoo, and the installation of regenerative stormwater conveyances at Bingham Run and Milkhouse Run have disturbed or would disturb and potentially displace soils, creating short-term, minor, adverse impacts. However, these projects have resulted or would result in long-term, beneficial impacts to soils through the implementation of various BMPs. Overall, long-term, beneficial impacts to soils would result from past, present, and reasonably foreseeable future actions. The no action alternative would have long-term, minor, adverse impacts to soils. When combined with impacts from cumulative actions, the no action would have a minimal contribution to overall long-term, beneficial impacts.

**Conclusion.** Soil conditions and bank stability would not be improved and may continue to deteriorate under alternative 1. Soil supporting Rock Creek Park Multi-use Trail near Waterside Drive, NW would continue to be unstable and subject to erosion. Soils would not be stabilized in the riparian revegetation areas along Rock Creek. The implementation of alternative 1 would result in long-term, minor, adverse impacts to soils due to continued erosion and bank/slope sloughing along Rock Creek near Waterside Drive, NW. Cumulative impacts would be long-term and beneficial with the no action having a minimal contribution to these impacts.

## IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS

**Analysis.** Under alternative 2, soils along approximately 350 feet of road would be impacted by the restoration of the road alignment to the pre-July 2011 conditions. The restoration of the road to its previous alignment would restore the currently disturbed soils along this portion of the road because the road width would be reduced compared to present conditions. Approximately 7,400 square feet (0.17 acre) of existing asphalt would be removed under this alternative.

The eroded sections of the east and west stream banks would be permanently restored under this alternative. A VRSS would be installed to lock existing soils in place and prevent future erosion of soils. As a part of the VRSS, an additional amount of soil in the form of a wrap with a special mixture of soil and organic materials would be added to the site to promote the establishment of vegetation. Approximately 250 feet of soil along the east bank of Rock Creek and 100 feet of soil along the west bank would be stabilized by VRSS under this alternative. During restoration it may be necessary to detour pedestrian traffic on the multi-use trail adjacent to the west bank of the creek. However, this traffic would be detoured to an area of previously disturbed soil so as to minimize the impacts to soils. Impacts to soil during the construction period would be short-term, minor, and adverse, while over the long-term, impacts to soils would be beneficial.

Although construction equipment would be staged in previously disturbed and/or paved areas, some impacts to undisturbed soils may occur. In preparation for construction activities, heavy machinery would be used to remove top layers of soil (i.e., grading and leveling). As a result of construction activities, soils

in the area of construction would be compacted, the soil layer structure would be disturbed and modified, and soils would be exposed, increasing the overall potential for erosion. However, many of the soils in this area have already been compacted as a result of previous construction on the site.

Areas of soil along the stream bank where the VRSS would be implemented would be planted with vegetation immediately following the construction of the VRSS to stabilize the soil. Other areas of disturbed soil that are not to be covered by asphalt or VRSS would be reseeded to stabilize the exposed soil. This would result in long-term, beneficial impacts to soil resources. No additional adverse impacts to soil along multi-use trail would be anticipated as a result of this alternative.

The revegetation of the no less than 0.6 acre of riparian areas along Rock Creek Park would also be implemented under this alternative. Site preparation would include minor grading to prepare the area for planting, which would be done by hand. Soil samples may be taken during this revegetation process, and, if deemed necessary, soil amendments may be applied to revegetation areas. The revegetation of riparian areas would have short-term, negligible, adverse impacts to soil during the period when this area is being revegetated. However, long-term, beneficial impacts to soil are anticipated to occur as a result of increased soil stabilization in the revegetated areas.

**Cumulative Impacts.** The effects on soil resources from past, present, and reasonably foreseeable future actions would be similar to those identified under alternative 1, resulting in overall long-term, beneficial impacts to soils. Alternative 2 would result in short-term, minor, and adverse impacts from construction, short-term, negligible impacts from revegetation activities, as well as long-term, beneficial impacts from the stabilization of the bank slopes and the revegetation in riparian areas along Rock Creek. When combined with the impacts from cumulative actions, alternative 2 would have a slight contribution to overall long-term, beneficial impacts soil resources.

**Conclusion.** Under alternative 2, realigning Rock Creek and Potomac Parkway and implementing VRSS measures and the revegetation of riparian areas would have long-term, beneficial impacts to soils. During the construction period, restoration of eroding stream banks and restoring the alignment of the road to pre-July 2011 conditions would have short-term, minor, adverse impact to soils. The revegetation of riparian areas would have short-term, negligible, and adverse impacts to soil during revegetation activities. However, long-term, beneficial impacts to soils, as a result of increased stream bank stabilization and soil stabilization in the riparian revegetation areas would occur. Cumulative impacts would be long-term and beneficial with alternative 3 having a slight contribution to these impacts.

### **IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Impacts to soils as a result of the stream bank restoration, construction staging, and construction operations would be similar to those described under alternative 2. However, as a merge lane would be added and the road would be widened towards Rock Creek under this alternative, an additional 330 feet of VRSS along the east bank of the creek would be added under alternative 3 compared to alternative 2, resulting in short-term, moderate, adverse impacts to soils that would be mitigated by using BMPs. Long-term impacts to soils as a result of the installation of the VRSS would be beneficial. A 350-foot retaining wall would also be constructed between the road and the creek. The construction of this retaining wall would require the installation of drilled shafts in the roadside soil in order to support the structure. The retaining wall would be constructed of natural stone veneer with a concrete, steel-reinforced core. Approximately 16,800 square feet (0.39 acre) of soil would be disturbed under this alternative; approximately 9,600 square feet (0.22 acre) of this soil is currently undisturbed. Approximately 5,500 square feet (0.12 acre) of new compacted soils would be added as a result of the construction of the retaining wall and the asphalt added for the road realignment and merge lane. This would result in long-term, moderate, adverse impacts to soils resources.

Under this alternative, impacts to soils resulting from the revegetation of riparian areas along Rock Creek would be the same as those identified under Alternative 2.

**Cumulative Impacts.** The effects on soil resources from cumulative actions would be similar to those identified under alternative 1, resulting in overall long-term, beneficial impacts to soils. Alternative 3 would result in short-term, moderate, adverse impacts from construction, long-term, moderate, adverse impacts from the realigned road, short-term, negligible impacts from revegetation activities, as well as long-term, beneficial impacts from the stabilization of the bank slopes, the reduction in the total amount of compacted soils, and the revegetation in riparian areas along Rock Creek. When combined with the impacts from cumulative actions, alternative 3 would have a slightly greater contribution than alternative 2 to overall long-term, beneficial impacts soil resources.

**Conclusion.** Under alternative 3, adding a merge lane by widening the road towards Rock Creek would have short-term, moderate, adverse impacts to soil resources as a result of construction activities; however, this impact would be mitigated by using construction BMPs. Impacts to soils resulting from the implementation the revegetation of riparian areas along Rock Creek would be similar those impacts identified under alternative 2. Long-term, moderate, adverse impacts to soil resources would result from the additional compaction of approximately 5,500 square feet (0.12 acre) of new soil and the installation of shafts into the soil to support the retaining wall, whereas, long-term, beneficial impacts would result from the stabilization of currently eroding soils along the creek bank. Cumulative impacts would be long-term and beneficial with alternative 3 having a slight contribution to these impacts.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Impacts to soils as a result of the stream bank restoration and construction staging under alternative 4 would be similar to those described under alternative 2. However, as a merge lane would be added and the road would be widened towards median under this alternative a total of approximately 17,500 square feet (0.40 acre) of soils, approximately 10,100 square feet (0.23 acre) of which is currently undisturbed, would be disturbed as a result of construction, road realignment, and bank stabilization activities. Approximately 4,600 square feet (0.11 acre) of new compacted soils would be created as a result of alternative 4, resulting in long-term, minor to moderate, adverse impacts to soil resources. Construction would result in the removal or impact of up to seven trees (five with large diameter) which would have a short-term, minor, adverse impact to soil resources. Two light poles in the median would be relocated, which would require the removal of approximately 233 cubic yards of soil. An additional four cubic yards of soil would be removed in order to accommodate the installation of new inlets and a pipe.

Impacts to soils under this alternative resulting from the revegetation of riparian areas along Rock Creek would be the same as those identified under Alternative 2.

**Cumulative Impacts.** The effects on soil resources from cumulative actions would be similar to those identified under Alternative 1, resulting in overall long-term, beneficial impacts. Alternative 4 would result in short-term, moderate, adverse impacts from construction, long-term, minor to moderate, adverse impacts from the realigned road, short-term, negligible impacts from revegetation activities, as well as long-term, beneficial impacts from the stabilization of the bank slopes, the reduction in the total amount of compacted soils, and the revegetation in riparian areas along Rock Creek. When combined with the impacts from cumulative actions, alternative 4 would have a slight contribution to overall long-term, beneficial impacts soil resources.

**Conclusion.** Under alternative 4, adding a merge lane by widening the road toward the median would have short-term, moderate, adverse impacts to soil resources as a result of construction activities. However, these impacts would be mitigated by using construction BMPs. Impacts to soils resulting from the revegetation of riparian areas along Rock Creek would be similar those impacts identified under alternative 2. Alternative 4 would have long-term, minor to moderate, adverse impacts as well as long-

term, beneficial impacts to soil resources. Long-term, minor to moderate, adverse impacts to soil resources would result from the additional compaction of approximately 4,600 square feet (0.12 acre) of new soil, while impacts to up seven trees (five with large diameter) from construction, and the installation light poles, inlets and a pipe. Long-term, beneficial impacts would result from the stabilization of presently eroding soils along the creek bank. Cumulative impacts would be long-term and beneficial, with alternative 4 having a slight contribution to these impacts.

## VEGETATION

### METHODOLOGY AND ASSUMPTIONS

Under NPS Director's Order 77: *Natural Resources Management* (NPS n.d.), the NPS is responsible for managing, conserving, and protecting the natural resources found in National Park System units. Information on vegetation and vegetation communities potentially impacted in the project area was compiled based on information gathered for the previous 2006 EA, which included vegetation classification and mapping of Rock Creek Park prepared by The Nature Conservancy (1998), and on reconnaissance of the project corridor conducted in July 2004, December 2004, and January 2005. The location where the proposed road rehabilitation could extend outside the existing road's footprint was assessed in the field to determine the potential for damage or loss of trees.

### STUDY AREA

The study area for vegetation includes the area of the parkway just south of Waterside Drive, NW – specifically the area within the limit of disturbance required for stream bank restoration, construction of the road expansion project, and any necessary on-site staging areas for stockpiling material and construction equipment – as well as the riparian revegetation areas along Rock Creek between Sherrill and Bingham Drive, NW.

### IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of effects on vegetation:

**Negligible.** Individual native plants may occasionally be affected, but measurable or perceptible changes in plant community size, integrity, or continuity would not occur. No species of special concern would be affected.

**Minor.** Effects on native plants would be measurable or perceptible, but would affect a small area. The viability of the plant community would not be affected and the community, if left alone, would recover. Special measures to avoid affecting species of special concern could be required and would be effective.

**Moderate.** A change would occur over a relatively large area in the native plant community that would be readily measurable in terms of abundance, distribution, quantity, or quality. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful. Some species of special concern could also be affected.

**Major.** Effects on native plant communities, including species of special concern, would be readily apparent, and would substantially change vegetation community types over a large area in and out of the park. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

**Duration.** Short-term impacts would occur during all or part of alternative implementation; long-term impacts would extend beyond the implementation of the alternative.

### **IMPACTS OF ALTERNATIVE 1: NO ACTION**

**Analysis.** Under the no action alternative, there would be no road realignment of the southbound parkway at Waterside Drive, NW, resulting in no removal of trees or other vegetation. Erosion from the storm events in 2011 would continue to be addressed with the current gabion baskets and no further erosion control measures would be implemented. As a result, alternative 1 would not result in any construction or disturbance to vegetation in the project area. However, the no action alternative would not include revegetation of riparian areas along Rock Creek to compensate for impacts that resulted from construction activities in 2011; specifically the removal of 14 trees. This would result in long-term, moderate, adverse impacts to vegetation in the project area by permanently affecting the native plant community in terms of abundance and quantity.

**Cumulative Impacts.** Several past, present and reasonably foreseeable future plans, projects, and actions have affected or have the potential to impact vegetation in Rock Creek Park. The rehabilitation of Peirce Mill and the rehabilitation and reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway likely disturbed vegetated areas, resulting in the loss of trees, shrubs, and herbaceous vegetation. Similarly, current and proposed DDOT projects and actions could result in similar disturbance to vegetated areas in the park, including the reconstruction of Oregon Avenue, NW and Broad Branch Road, NW, the restoration of Klingle Valley Multi-use Trail and stream, and the repaving of Rock Creek Park Multi-use Trail. The Smithsonian Institution is currently planning for the construction of a retaining wall structure between the General Services Building and North Road, NW at the National Zoo. The construction of this retaining wall would result in minimal adverse impacts from the removal of 1.25 acres of vegetation in that area. However, revegetation with native species would be provided for mitigation. The installation of regenerative stormwater conveyances at Bingham Run and Milkhouse Run by the NPS and DDOE would potentially result in long-term, minor, adverse impacts from the removal of individual trees due to construction activities. However, the installation of regenerative stormwater conveyances would help protect vegetation against erosion damage caused by stormwater, resulting in long-term, beneficial impacts. The NPS and DDOE have also proposed to restore daylight to approximately 1,600 linear feet of stream that is currently piped beneath NPS and District of Columbia property. Although short-term, moderate, adverse impacts could result from construction staging requiring tree clearing and root removal, there would be overall long-term, benefits for vegetation from stabilizing surrounding vegetation, especially along the stream banks.

Overall, these projects would create long-term, negligible to minor, adverse impacts. However, using BMPs and replanting native vegetation where applicable would create beneficial impacts. Additionally, several projects that address erosion control (e.g., the repaving of Rock Creek Park Multi-use Trail, construction of Klingle Valley Multi-use Trail, installation of regenerative stormwater conveyances, and reconstruction of roads in the park) would benefit native vegetation over the long-term. The no action would result in long-term, moderate, adverse impacts to vegetation. When combined with the impacts of the cumulative actions, the no action would have a minimal adverse contribution to overall beneficial impacts.

**Conclusion.** Under alternative 1 no trees or other vegetation would be removed and erosion would continue to be addressed with the current gabion basket, resulting in no effect on vegetation. However, lack of mitigation for trees removed during pre-July 2011 construction would result in long-term, moderate, adverse impacts to vegetation in the project area. Cumulative impacts would be long-term and beneficial with the no action having a slight adverse contribution to these impacts.

## **IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS**

**Analysis.** Under alternative 2, Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be restored to its pre-July 2011 realignment. Although 7,400 square feet (0.17 acre) total area would be disturbed, no trees would be removed under this alternative, resulting in long-term, negligible, adverse impacts to native vegetation in the project area. To ensure that vegetation beyond the areas necessary for construction would not be adversely impacted, mitigation measures would be implemented, including fencing to clearly delineate the project disturbance limits before starting work

Under alternative 2, the NPS would plant no less than 0.6 acre of riparian areas in need of revegetation to mitigate for impacts to vegetation that resulted from construction activities in 2011. A 2:1 ratio will be used to offset the temporal loss of mature riparian vegetation, resulting in long-term benefits for vegetation through reestablishing native plant communities in the project area. Monitoring the revegetation would be conducted for five years by a NPS contractor, which could result in short-term, negligible adverse impacts to vegetation from limited disturbance to habitat in the project area.

Mitigation measures would be implemented to prevent the spread of nonnative, invasive plant species during construction and implantation. All fill and aggregate material would be treated or certified free of all nonnative invasive plants before entering the park, and vegetation would be monitored in areas replanted following road rehabilitation to ensure successful establishment of native species and to ensure that any nonnative, invasive species that appear in the replanted areas are removed.

**Cumulative Impacts.** The same past, present, and reasonably foreseeable future plans, projects, and actions described for alternative 1 would also occur under alternative 2, resulting in overall long-term, benefits for vegetation from stabilizing surrounding vegetation, especially along the stream banks. Alternative 2 would result in long-term, negligible, adverse impacts to native vegetation in the project area as well as long-term, beneficial impacts from riparian area revegetation. When combined with the impacts from cumulative actions, alternative 2 would have a minimal contribution to overall beneficial impacts.

**Conclusion.** Under alternative 2, no trees or other vegetation would be removed, resulting in long-term, negligible, adverse impacts to vegetation in the project area. Long-term, beneficial impacts would also result from the VRSS, which would replace the current gabion baskets for erosion control, and from riparian revegetation. Cumulative impacts would be long-term and beneficial with alternative 2 having a slight contribution to these impacts.

## **IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Under alternative 3, approximately 350 feet (107 meters) of Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be realigned approximately five feet (1.5 meters) toward Rock Creek, which would necessitate the construction of a retaining wall between the road and the creek. Widening the road toward the creek would disturb approximately 16,800 square feet (0.39 acre), 9,600 square feet (0.22) of which would be in previously undisturbed areas. However, as described in chapter 3, many of the areas along Rock Creek and Potomac Parkway are characterized by maintained and mowed habitat, and three trees would be removed under this alternative, resulting in long-term, negligible to minor, adverse impacts to native vegetation in the project area. To ensure that vegetation beyond the areas necessary for construction would not be adversely impacted, mitigation measures would be implemented, including fencing to clearly delineate the project disturbance limits prior to starting work. Additionally, the NPS would plant no less than 0.6 acre of riparian areas in need of revegetation to mitigate for impacts to vegetation that resulted from construction activities in 2011. A 2:1 ratio will be used to off-set the temporal loss of mature riparian vegetation, resulting in long-term benefits for vegetation through reestablishing vegetation in the project area.

Similar to alternative 2, under alternative 3 the gabion baskets that are currently stabilizing sections of Rock Creek would be replaced with a bioengineered slope, as described in chapter 2. Because much of the vegetation along the stream bank in the project area was destroyed during the storm events in 2011 and during prior construction, the construction of a new bioengineered slope would likely result in short-term, negligible, adverse impacts to vegetation along Rock Creek. The construction of a VRSS would result in beneficial impacts to vegetation in the project area, because native vegetation along the stream bank would reestablish over the long-term.

Similar to alternative 2, the NPS would revegetate no less than 0.6 acre of riparian areas along Rock Creek under alternative 3, resulting in long-term benefits for vegetation through reestablishing native plant communities along Rock Creek. Monitoring for revegetation would be conducted for five years by a contractor, which could result in short-term, negligible, adverse impacts to vegetation from limited disturbance to habitat in the project area.

As described for alternative 2, mitigation measures would be implemented under alternative 3 to prevent the spread of nonnative, invasive plant species. All fill and aggregate material would be treated or certified free of all nonnative plants before entering the park, and vegetation would be monitored in areas replanted following road rehabilitation to ensure the successful establishment of native species and ensure that any nonnative, invasive species that appear in the replanted areas are removed.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future plans, projects, and actions would be the same as for alternative 1. Alternative 3 would result in long-term, negligible to minor, adverse impacts to native vegetation from the construction of a retaining wall and realignment of the road, as well as long-term, beneficial impacts from the implementation of VRSS to permanently stabilize the creek banks and the revegetation of riparian areas. When combined with the impacts from cumulative actions, alternative 3 would have a minimal contribution to an overall long-term, beneficial impact.

**Conclusion.** Approximately 9,600 square feet of previously undisturbed areas would be disturbed under alternative 3 and three trees would be removed, resulting in long-term, negligible to minor, adverse impacts to vegetation in the project area because the vegetation that would be disturbed is primarily maintained and mowed habitat. VRSS would replace the current gabion baskets for erosion control and riparian areas would be revegetated, resulting in long-term, beneficial impacts to vegetation in the project area by allowing vegetation to reestablish along the stream bank. Cumulative impacts would be long-term and beneficial with alternative 3 having a minimal contribution to these impacts.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Under alternative 4, approximately 350 feet (107 meters) of Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be realigned 12 feet (from the original pre-July 2011 alignment) toward the median between northbound and southbound Rock Creek and Potomac Parkway. Widening the road toward the median side would result in the disturbance of approximately 17,500 square feet (0.40 acre), approximately 10,100 square feet (0.23 acre) of which would be on previously undisturbed areas. As a result of the road realignment, up to seven trees would be removed, resulting in long-term, minor, adverse impacts to vegetation in the project area. Trenching in the area, required to relocate two light poles, would disturb an area approximately 2.5 feet long by 2.5 feet wide by seven feet deep, resulting in short-term, minor, adverse impacts to vegetation in the project area. Excavated soils would be removed from the site. To ensure that vegetation beyond the areas necessary for construction would not be adversely impacted, mitigation measures would be implemented, including fencing to clearly delineate the project disturbance limits before starting work.

Similar to alternative 2, under alternative 4 the gabion baskets that are currently stabilizing sections of Rock Creek would be replaced with a bioengineered slope, as described in chapter 2. Because much of

the vegetation along the stream bank in the project area was destroyed during the storm events in 2011 and during prior construction, the construction of a new bioengineered slope would likely result in short-term, negligible, adverse impacts to vegetation along Rock Creek. The construction of a VRSS would result in beneficial impacts to vegetation in the project area, because native vegetation along the stream bank would reestablish over the long-term.

Similar to alternatives 2 and 3, the NPS would revegetate no less than 0.6 acre of riparian areas along Rock Creek under alternative 3, resulting in long-term benefits for vegetation through reestablishing native plant communities along Rock Creek. Monitoring for revegetation would be conducted for five years by a contractor, which could result in short-term, negligible, adverse impacts to vegetation from limited disturbance to habitat in the project area.

As described for alternative 2, mitigation measures including the following would be implemented under alternative 4 to prevent the spread of nonnative, invasive plant species: all fill and aggregate material would be treated or certified free of all nonnative, invasive plants before entering the park and vegetation would be monitored in areas replanted following road rehabilitation to ensure the successful establishment of native species and ensure that any nonnative, invasive species that appear in the replanted areas are removed.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future plans, projects, and actions would be the same as for alternative 1. Alternative 4 would result in long-term, minor, adverse impacts to vegetation as a result of the removal of up to seven trees in the median, as well as, long-term, beneficial impacts to vegetation through the implementation of VRSS to permanently stabilize the creek banks and the revegetation of riparian areas. When combined with the impacts from cumulative actions, alternative 4 would have a slight contribution to an overall long-term, beneficial impact.

**Conclusion.** Under alternative 4, approximately 10,100 square feet of previously undisturbed areas would be disturbed and up to seven trees (five with large diameters) would either be removed or impacted by construction, resulting in long-term, minor, adverse impacts to vegetation in the project area. VRSS would replace the current gabion baskets for erosion control and riparian areas would be revegetated, resulting in long-term, beneficial impacts to vegetation in the project area through allowing vegetation to reestablish along the stream bank. Cumulative impacts would be long-term and beneficial with alternative 4 having a slight contribution to these impacts.

## WILDLIFE

### METHODOLOGY AND ASSUMPTIONS

The NPS Organic Act, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities. According to *NPS Management Policies 2006*, the restoration of native species is a high priority (NPS 2006a, section 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals.

Information on Rock Creek Park wildlife and fisheries was based on information gathered for the previous EA in 2006, which included information from the *Rock Creek Park and the Rock Creek and Potomac Parkway Final General Management Plan / Environmental Impact Statement* (NPS 2005) and field observations made during site reconnaissance conducted in July and December 2004 and January 2005. The park's natural resource management staff and the USFWS also provided wildlife information.

## STUDY AREA

The study area for aquatic wildlife includes the reach of Rock Creek from the District of Columbia and Maryland border downstream to its confluence with the Potomac River. The study area for terrestrial wildlife includes the area of Rock Creek and Potomac Parkway just south of Waterside Drive, NW, specifically the area within the limit of disturbance required for stream bank restoration, construction of the road expansion project, any necessary staging areas for stockpiling material and construction equipment, and the riparian revegetation areas along Rock Creek between Sherrill and Bingham Drives.

## IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of effects on wildlife:

**Negligible.** Individual species may occasionally be affected, but measurable or perceptible changes in the size, integrity, or continuity of wildlife populations would not occur.

**Minor.** Effects on wildlife and habitats would be measurable or perceptible, but would affect a small area. Although the mortality of individuals might occur, the viability of wildlife populations would not be affected and the community, if left alone, would recover.

**Moderate.** A change to wildlife and habitats would occur over a relatively large area. The change would be readily measurable in terms of abundance, distribution, quantity, or quality of populations. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

**Major.** Effects on wildlife and habitats would be readily apparent, and would substantially change wildlife populations over a large area in and out of the park. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

**Duration.** Short-term impacts would occur during all or part of alternative implementation; long-term impacts would extend beyond the implementation of the alternative.

## IMPACTS OF ALTERNATIVE 1: NO ACTION

**Analysis.** Under the no action alternative, there would be no road realignment on Rock Creek and Potomac Parkway southbound at Waterside Drive, NW and the erosion from the storm events in 2011 would continue to be addressed with the current gabion baskets, resulting in no new disturbance to wildlife in or near Rock Creek. The gabion baskets would have short-term benefits for water quality through stabilizing the eroded banks and stopping the immediate downstream flow of associated sediments and sediment-bound pollutants, such as nutrients. However, the impacts to both stream bank configuration and water quality would be long-term, minor, and adverse, because of the potential for increased flow velocities downstream during storm events that would amplify the likelihood of increased scour, erosion, and stream channel degradation, as well as associated water quality problems in the future. The no action alternative would not include revegetation of riparian areas to compensate for trees removed during pre-July 2011 construction, resulting in long-term, moderate, adverse impacts to wildlife by permanently removing native habitat. Therefore, alternative 1 would result in long-term, minor to moderate, adverse impacts to wildlife and aquatic in the project area.

**Cumulative Impacts.** Several past, present, and reasonably foreseeable future plans, projects, and actions have affected or have the potential to impact wildlife in Rock Creek Park. The reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway may have disturbed and would likely disturb individual species, resulting in the temporary or permanent loss of habitat, noise-related impacts from construction, and potential habitat avoidance. Similar disturbance to wildlife in the park could result from

current and proposed DDOT projects and actions, including the reconstruction of Broad Branch Road, NW, the repaving of Rock Creek Park Multi-use Trail, and the restoration of Klingle Valley Multi-use Trail and stream. However, the rehabilitation of the stream adjacent to Klingle Road, NW would result in long-term benefits for aquatic wildlife in the area through protecting and restoring suitable habitat.

The installation of regenerative stormwater conveyances at Bingham Run and Milkhouse Run by the NPS and DDOE would potentially result in wildlife and habitat disturbance, especially for aquatic species. However, the purpose of the plan is to protect and enhance the streambeds, which could result in long-term benefits for aquatic wildlife and habitat along the streams. The NPS and DDOE have also proposed to restore daylight to approximately 1,600 linear feet of stream that is currently piped beneath NPS and District of Columbia property. Short-term, minor, adverse impacts would be expected from temporary stream diversions, as well as long-term, minor, adverse impacts from the permanent removal of trees in the area, which provide habitat for wildlife species. However, the restoration of the streambed would ultimately result in overall long-term, beneficial impacts to wildlife.

Overall, these projects would create long-term, negligible to minor, adverse impacts to wildlife. However, BMPs and the replanting of native vegetation where applicable would create long-term, beneficial impacts. Additionally, several projects that address erosion control (e.g., the repaving of Rock Creek Park Multi-use Trail, construction of Klingle Valley Multi-use Trail, installation of regenerative stormwater conveyances, and reconstruction of roads in the park) would benefit aquatic wildlife over the long-term.

The no action would result in long-term, minor to moderate, adverse impacts to wildlife and aquatic wildlife. When combined with the impacts of the cumulative actions, the no action would have a slight contribution to an overall long-term, beneficial impact.

**Conclusion.** No trees (i.e., habitat) would be removed under alternative 1, resulting in no impacts on wildlife and wildlife habitat. However, erosion would continue to be addressed with the current gabion baskets, and trees removed during construction activities in 2011 would not be replaced, resulting in long-term, minor to moderate, adverse impacts to wildlife in the project area. Cumulative impacts would be long-term and beneficial with the no action having a noticeable adverse contribution to these impacts.

## **IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS**

**Analysis.** Under alternative 2, Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be restored to its pre-July 2011 realignment. A total area of 7,400 square feet (0.17 acre) would be disturbed, resulting in short-term, minor, adverse impacts to wildlife in the project area from unnatural noise due to construction activities. To ensure that habitat beyond the areas necessary for construction would not be adversely impacted, mitigation measures would be implemented, including fencing to clearly delineate the project disturbance limits before starting work. Additionally, wildlife species observed in the construction areas would be provided the opportunity to move out of harm's way.

Under alternative 2, the gabion baskets that are currently stabilizing sections of Rock Creek would be replaced with a bioengineered slope, as described in chapter 2. Much of the habitat along the stream bank was destroyed during the storm events in 2011 and from previous construction activities. The construction of a new bioengineered slope would likely result in short-term, negligible to minor, adverse impacts to the remaining habitat along Rock Creek and to species occurring in Rock Creek. However, long-term, beneficial impacts would result for wildlife in the project area, because native habitat along the stream bank would reestablish and a more permanent form of erosion control would be in place.

Under alternative 2, the NPS would revegetate no less than 0.6 acre of degraded riparian areas along Rock Creek to off-set the temporal loss of mature riparian vegetation due to past road construction. This would result in long-term benefits for wildlife (particularly riparian species) by reestablishing native habitat in the project area. Monitoring for revegetation would be conducted for five years by a contractor, which

could result in short-term, negligible, adverse impacts from limited disturbance to wildlife habitat in the area.

Mitigation measures would be implemented to prevent erosion and sediment buildup, and stormwater BMPs would be implemented to minimize potential impacts to aquatic species and their habitats both in and downstream of the project area.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future plans, projects, and actions would be the same as described for alternative 1. Alternative 2 would result in short-term, negligible to minor, adverse impacts from construction activities. However, long-term, beneficial impacts are expected from the implementation of VRSS and the revegetation of riparian habitat. When combined with the impacts of cumulative actions, alternative 2 would have a slight contribution to overall long-term, beneficial impacts.

**Conclusion.** Although no trees would be removed under alternative 2, noise-related impacts from construction activities would affect wildlife in the area, resulting in short-term, negligible to minor, adverse impacts to the remaining habitat along Rock Creek and to species occurring in Rock Creek. Additionally, long-term, beneficial impacts would result for wildlife in the project area, because native habitat along the stream bank would reestablish and a more permanent form of erosion control would be in place. Cumulative impacts would be long-term and beneficial with alternative 2 having a slight contribution to these impacts.

### **IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Under alternative 3, approximately 350 feet (107 meters) of Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be realigned approximately five feet (1.5 meters) toward Rock Creek, which would necessitate the construction of a retaining wall between the road and the creek. Widening the road toward the creek would disturb approximately 16,800 square feet (0.39 acre), 9,600 square feet (0.22) of which would be in previously undisturbed areas, resulting in short-term, minor, adverse impacts to wildlife in the project area from unnatural noise due to construction activities. However, as described in chapter 3, many of the areas along Rock Creek and Potomac Parkway are characterized by maintained and mowed habitat, which would limit long-term, adverse impacts to wildlife habitat in the project area. To ensure that habitat beyond the areas necessary for construction would not be adversely impacted, mitigation measures would be implemented, including fencing to clearly delineate the project disturbance limits before starting work. Additionally, wildlife species observed in the construction areas would be provided the opportunity to move out of harm's way.

Similar to alternative 2, under alternative 3 the gabion baskets that are currently stabilizing sections of Rock Creek would be replaced with a bioengineered slope, as described in chapter 2. Much of the habitat along the stream bank was destroyed during the storm events in 2011 and from previous construction activities. The construction of a new bioengineered slope would likely result in short-term, negligible to minor, adverse impacts to the remaining habitat along Rock Creek and to species occurring in Rock Creek. However, long-term, beneficial impacts would result for wildlife in the project area, because native habitat along the stream bank would reestablish over the long-term and a more permanent form of erosion control would be in place. As described for alternative 2, mitigation measures would be implemented to prevent erosion and sediment buildup, and stormwater BMPs would be implemented to minimize potential impacts to aquatic species and their habitats both in and downstream of the project area.

Like alternative 2, under alternative 3 the revegetation of no less than 0.6 acre of degraded riparian area along Rock Creek would be undertaken to mitigate for the 0.3 acre of riparian areas adversely impacted by past road construction. The restoration of riparian areas along Rock Creek would result in long-term, benefits for wildlife (particularly riparian species) by reestablishing native habitat in the project area.

Monitoring for revegetation would be conducted for five years by a NPS contractor, which could result in short-term, negligible, adverse impacts from limited disturbance to wildlife habitat in the project area.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future plans, projects, and actions would be the same as described for alternative 1. Alternative 3 would result in short-term, negligible to minor, adverse impacts to wildlife and wildlife habitat. However, long-term, beneficial impacts are expected from the implementation of VRSS and the revegetation of riparian habitat. When combined with the impacts of cumulative actions, alternative 3 would have a minimal contribution to overall long-term, beneficial impacts.

**Conclusion.** Noise-related impacts from construction activities would affect wildlife in the area, resulting in short-term, minor, adverse impacts. Short-term, negligible to minor, adverse impacts would also result from the construction of the VRSS, which would replace the current gabion baskets for erosion control; however, beneficial impacts to aquatic wildlife would result over the long-term from the VRSS and the restoration of riparian areas along the creek. Cumulative impacts would be long-term and beneficial with alternative 3 having a minimal contribution to these impacts.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Under alternative 4, approximately 350 feet (107 meters) of Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be realigned 12 feet (from the original pre-July 2011 alignment) toward the median between northbound and southbound Rock Creek and Potomac Parkway. Widening the road toward the median side would result in the disturbance of approximately 17,500 square feet (0.40 acre), approximately 10,100 square feet (0.23 acre) of which would be on previously undisturbed areas. As a result of the road realignment, up to seven trees (five with large diameter) would be removed or impacted by construction, resulting in short-term and long-term, minor, adverse impacts to wildlife in the area that use habitat provided by the trees. Trenching in the area, required to relocate two light poles, would disturb an area approximately 2.5 feet long by 2.5 feet wide by seven feet deep. Trenching and other construction-related activities would result in short-term, minor, adverse impacts to wildlife from noise disturbance. To ensure that habitat beyond the areas necessary for construction would not be adversely impacted, mitigation measures would be implemented, including fencing to clearly delineate the project disturbance limits before starting work. Additionally, wildlife species observed in the construction areas would be provided the opportunity to move out of harm's way.

Similar to alternative 2, under alternative 4 the gabion baskets that are currently stabilizing sections of Rock Creek would be replaced with a bioengineered slope, as described in chapter 2. Because the majority of the habitat along the stream bank was destroyed during the storm events in 2011 and by previous construction activities, the construction of a new bioengineered slope would likely result in short-term, negligible adverse impacts to habitat along Rock Creek. The construction of a VRSS would result in short-term, minor, adverse impacts to species occurring in Rock Creek. However, long-term, beneficial impacts would result for wildlife in the project area, because native habitat along the stream bank would reestablish over the long-term and a more permanent form of erosion control would be in place. As described for alternative 2, mitigation measures would be implemented to prevent erosion and sediment buildup, and stormwater BMPs would be implemented to minimize potential impacts to aquatic species and their habitats both in and downstream of the project area.

Like for alternative 3, under alternative 4 the NPS would revegetate no less than 0.6 acre of degraded riparian area along Rock Creek to mitigate for the approximately 0.3 acre of riparian areas that were adversely impacted by past road construction. The restoration of riparian areas along Rock Creek would result in long-term benefits to wildlife (particularly riparian species) by reestablishing native habitat in the project area. Monitoring for revegetation would be conducted for five years by a contractor, which could

result in short-term, negligible, adverse impacts from limited disturbance to wildlife habitat in the project area.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future plans, projects, and actions would be the same as described for alternative 1. Alternative 4 would result in short-term, negligible to minor, adverse impacts to wildlife and wildlife habitat. However, long-term, beneficial impacts are expected from the implementation of VRSS and the revegetation of riparian habitat. When combined with the impacts of cumulative actions, alternative 4 would have a slight contribution to overall long-term, beneficial impacts.

**Conclusion.** Under alternative 4, approximately 10,100 square feet of previously undisturbed areas would be disturbed and up to seven trees (including five with large diameter) would be removed or impacted by construction, resulting in short- and long-term, minor, adverse impacts to wildlife in the project area. Short-term, negligible to minor, adverse impacts would also result from the construction of the VRSS, which would replace the current gabion baskets for erosion control. However, beneficial impacts would result over the long-term for aquatic wildlife from the VRSS and restoration of riparian areas along the creek. Cumulative impacts would be long-term and beneficial with alternative 4 having a slight contribution to these impacts.

## CULTURAL RESOURCES

### HISTORIC STRUCTURES AND DISTRICTS

#### Methodology and Assumptions

Historic structures are classified as buildings, structures, sites, objects, or districts (i.e. all the various types of historic property, except for archeological sites) that are potentially eligible for the NRHP. Impacts to historic structures, like other environmental impacts, are described in NEPA documents such as this EA. However, these impact analyses are intended, however, to comply not only with the requirements of NEPA, but also with Section 106 of the NHPA, as Amended. In accordance with the ACHP's regulations implementing Section 106 (36 CFR 800, "Protection of Historic Properties"), impacts to cultural resources are identified and evaluated by (1) determining the area of potential effects, (2) identifying historic properties present in the area of potential effect that are listed in or eligible for listing in the NRHP, (3) applying the criteria of adverse effect to these historic properties, and (4) identifying methods to avoid, minimize, or mitigate any adverse effects, if they exist.

Under the ACHP's regulations, a determination of either *adverse effect* or *no adverse effect* must be made for affected cultural resources eligible for or listed in the NRHP. An *adverse effect* occurs whenever an impact alters, either directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion on the NRHP (e.g., diminishes the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects that could occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, "Assessment of Adverse Effects"). A determination of *no adverse effect* means the proposed action would not diminish the historic property's integrity in a manner that alters any characteristics of the property that qualify it for the NRHP.

CEQ regulations and Director's Order 12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). However, any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation only under NEPA. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Although *adverse effects* under Section 106 may be mitigated, the effect remains adverse.

## Study Area

The study area for historic structures and districts is the same as the Section 106 APEs described in for the historic districts and cultural landscapes in (a) the project area at Waterside Drive, NW and (b) the riparian revegetation area.

## Impact Thresholds

The following thresholds were used to determine the magnitude of effects on historic structures under NEPA and their equivalent determination of effect under Section 106 of NHPA:

**Negligible.** The impact would be at the lowest level of detection or barely perceptible and not measurable. For the purposes of Section 106, the determination of effect would be *no adverse effect*.

**Minor.** Alteration of a character-defining feature(s) would not diminish the overall integrity of the resource. The determination of effect for Section 106 would be *no adverse effect*.

**Moderate.** Alteration of a character-defining feature(s) would diminish the overall integrity of the resource. The determination of effect for Section 106 would be an *adverse effect*. A memorandum of agreement would be executed between the NPS and applicable SHPO and, if necessary, the ACHP in accordance with 36 CFR 800.6(b). Measures identified in the memorandum of agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate.

**Major.** Alteration of a character-defining feature(s) would diminish the overall integrity of the resource. The determination of effect for Section 106 would be an *adverse effect*. Measures to minimize or mitigate adverse impacts cannot be agreed on and the NPS and applicable SHPO and/or the ACHP are unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

**Beneficial.** No levels of intensity for beneficial impacts are defined. Beneficial impacts can occur under the following scenarios: when character-defining features of the historic district or structure would be stabilized/preserved in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties* (Weeks and Grimmer 1995), to maintain its existing integrity; when the historic district or structure would be rehabilitated in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties* to make possible a compatible use of the property while preserving its character defining features; or when a historic district or structure would be restored in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties* to accurately depict its form, features, and character as it appeared during its period of significance. For purposes of Section 106, a beneficial effect is equivalent to *no adverse effect*.

**Duration.** Short-term impacts would occur during all or part of alternative implementation; long-term impacts would extend beyond the implementation of the alternative.

## Impacts of Alternative 1: No Action

**Analysis.** Long-term, moderate, adverse impacts would result from the no action alternative, specifically to Rock Creek and the trail network as contributing features of the RCPP Historic District. The eroded stream banks of Rock Creek would continue to be protected by stone gabion baskets, intended as temporary remediation. The segment of the Rock Creek Park Multi-use Trail along the western shore

could continue to be threatened by erosion. The integrity of the bucolic setting of the historic district would continue to be adversely impacted. However, there would be no impact to the Lyons Mill footbridge, the stone retaining walls, the road, or the culverts. There would also be no impact to the median, another RCPP Historic District contributing feature. In summary, the no action alternative would have a long-term, moderate, adverse impact to the RCPP Historic District.

Both the Massachusetts Avenue Historic District and the Georgetown Historic District along with its component historic properties, the Oak Hill Cemetery and Mount Zion Cemetery would experience long-term, negligible, adverse impacts to historic structures. The setting and other character-defining aspects of the Massachusetts Avenue district would not be affected because the primary historic quality of this district is the linear parade of grand houses facing toward the avenue from both sides, not the intermittent views from the backyards and rear elevations of individual houses on the southern side. The Georgetown district does extend to the western stream bank of Rock Creek, but the existing condition of the stream bank (i.e. gabions as a temporary fix for erosion) is negligible in the context of the scale and historic context of Georgetown. Lastly, the current graceful transition from the natural riparian, wooded appearance of the west bank of Rock Creek to the picturesque landscape design of the two cemeteries would not be impacted by the no action alternative.

Under the no action alternative, revegetation of riparian areas would not occur. Therefore, there would be no impacts to any of the historic structures along the upper reach of Rock Creek that are contributing features of the RCP Historic District.

**Cumulative Impacts.** There are two past projects that have the capability of generating cumulative impacts to historic structures. The rehabilitation of Peirce Mill, located on Tilden Avenue, NW at Beach Drive, NW in the historic district, has had a long-term, beneficial impact to historic structures. The rehabilitation and reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway is impacting the historic structures of both the RCP Historic District (north of the Zoo Tunnel) and the RCPP Historic District (south of the Zoo Tunnel). The impacts were considered long-term and beneficial, for these resources. However, the rehabilitation of the segment of the southbound parkway at the intersection of Waterside Drive, NW was not completed and is the subject of this EA. Long-term, moderate, adverse impacts to historic structures would result from the no action alternative. In combination with the long-term, beneficial impacts from the cumulative actions, the no action would have a noticeable adverse contribution to overall long-term, beneficial impacts to historic structures.

**Conclusion.** The no action alternative would result in long-term, moderate, adverse impacts to historic structures due to the threat of continued erosion of Rock Creek and the trail network and the related degradation of the bucolic setting, all important elements of the RCPP Historic District. It would have no impacts to all other historic structures within the two APEs. Cumulative impacts would long-term and beneficial with the no action alternative having a noticeable adverse contribution to these impacts.

**Assessment of Effect for Section 106.** The no action alternative does not constitute an “undertaking” under Section 106 of the National Historic Preservation Act. Therefore, there is no Section 106 equivalent for an evaluation of effects under NEPA.

### **Impacts of Alternative 2: Restore to Original Conditions**

**Analysis.** The restoration of the section of Rock Creek and Potomac Parkway to its original pre-2011 alignment in conjunction with the restoration of the stream bank by means of the VRSS and restoration of riparian areas would have a long-term, beneficial impact to the RCPP Historic District. The original dimensions of the road, particularly the southbound lanes of Rock Creek and Potomac Parkway and Waterside Drive, NW would be retained. The Lyons Mill Footbridge would not be impacted, nor would the stone retaining walls.

The installation of the VRSS would protect the stream banks of Rock Creek and the segment of the trail network along the western shore from further erosion. Installation of the VRSS would be a long-term, beneficial impact. The masonry-faced culvert on the eastern stream bank is upstream from the area where the VRSS would be installed so it would not be impacted. Alternative 2 would have a long-term, beneficial effect on the RCPP Historic District.

The Massachusetts Avenue Historic District would experience negligible effects to historic structures. The setting and other character-defining aspects of the Massachusetts Avenue district would not be affected because the primary historic quality of this district is the linear parade of mansions with imposing front elevations facing toward the avenue from both sides, not the intermittent views from the backyards and rear elevations of houses on the southern side. The Georgetown Historic District, which extends to the western stream bank of Rock Creek, and its component historic properties (the Oak Hill Cemetery and Mount Zion Cemetery) would experience long-term, beneficial impacts to historic structures. This would occur due to the replacement of the visually disruptive gabion erosion control fix by the VRSS which would enhance the graceful transition from the natural riparian, wooded appearance of the west bank of Rock Creek to the picturesque landscape design of the two cemeteries.

In the riparian revegetation area, coterminous with an additional APE for historic structures and cultural landscapes, several areas would be planted with native species appropriate to the natural riparian environment of Rock Creek. The contributing elements of the RCP Historic District within the APE (which are all structures associated with park infrastructure) – an outdoor fireplace, pedestrian bridge, stream gauge, and historic trails/roads – would be avoided or protected during revegetation activities. This component of the project would be the same for all action alternatives. There would no impacts to historic structures.

**Cumulative Impacts.** The impacts from cumulative actions with the capacity to affect historic structures would be the same as under the no action (alternative 1), resulting in long-term, beneficial impacts. The impacts of alternative 2 would also be long-term and beneficial. Therefore, in combination with impacts from cumulative actions, alternative 2 would have a slight contribution to overall long-term, beneficial impacts to historic structures.

**Conclusion.** Alternative 2 would result in long-term, beneficial effects on historic structures in the RCPP Historic District due to the avoidance of the threat of continued erosion of Rock Creek and the trail network and the related degradation of the bucolic setting. This alternative would have no impacts to all other historic structures within the two APEs. Cumulative impacts would be overall long-term and beneficial with alternative 2 having a slight contribution to these impacts.

**Assessment of Effect for Section 106.** Alternative 2 would have long-term, beneficial effects on all historic properties – the RCPP Historic District, the RCP Historic District, the Massachusetts Avenue Historic District, the Georgetown Historic District, the Oak Hill Cemetery, and the Mount Zion Cemetery. The assessment of effect under Section 106 would be “*no adverse effect.*”

### **Impacts of Alternative 3: Add Merge Lane by Widening the Road toward the Creek**

**Analysis.** The road as a contributing element of the RCPP Historic District represents not only the main road, Rock Creek and Potomac Parkway in this location, but two specifically identified subcomponents: North Waterside Drive, NW and what is termed in the NRHP nomination the “South Waterside Drive Overpass.” The description in the NRHP nomination emphasizes the architectural character, materials, and picturesque character of the bridge structure. It is not clear whether the “at grade” segments of South Waterside Drive, NW at either end of the overpass are included. In general, the history of conflicts between the aesthetic goal of maintaining the configuration of the roads as winding, scenic, low-speed parkways and their later function as commuter arteries is a major theme in the narrative of the NRHP nomination (Barsoum 2005). For the road as a contributing feature to the historic district, adding the

merge lane would have a long-term, negligible impact on one contributing feature due to the change to southbound Waterside Drive, NW and southbound Rock Creek and Potomac Parkway at their confluence.

No other contributing features of the historic district on the east side of Rock Creek would be impacted. The addition of a natural stone-faced concrete retaining wall and steel-backed timber guardrails is in keeping with the existing palette of hardscape features in the historic district. The installation of the VRSS would protect all stream banks of Rock Creek and the segment of the trail network along the western shore from further erosion. This would be a beneficial long-term impact. The masonry-faced culvert on the eastern stream bank is upstream from the area where the VRSS would be installed so it would not be impacted. Alternative 3 would have a long-term, beneficial impact to the RCPP Historic District.

The Massachusetts Avenue Historic District would experience negligible impacts to historic structures. The setting and other character-defining aspects of the Massachusetts Avenue district would not be affected because the primary historic quality of this district is the linear parade of mansions with imposing front elevations facing toward the avenue from both sides, not the intermittent views from the backyards and rear elevations of houses on the southern side. The Georgetown Historic District, which extends to the western stream bank of Rock Creek, along with its component historic properties (the Oak Hill Cemetery and Mount Zion Cemetery) would experience long-term, beneficial impacts to historic structures due to the replacement of the visually disruptive gabion erosion control fix by the VRSS. The VRSS would enhance the graceful transition from the natural riparian, wooded appearance of the west bank of Rock Creek to the picturesque landscape design of the two cemeteries.

In the riparian revegetation area, coterminous with an additional APE for historic structures, several areas would be planted with native species appropriate to the natural riparian environment of Rock Creek. The contributing elements of the RCP Historic District within the APE (which are all structures associated with park infrastructure) – an outdoor fireplace, pedestrian bridge, stream gauge, and historic trails/roads – would be avoided or protected during revegetation activities. This component of the project would be the same for all action alternatives. There would not have impacts to historic structures.

**Cumulative Impacts.** The cumulative actions with the capacity to affect historic structures would be the same as for the no action alternative and would have the same long-term, beneficial impacts. The impacts of alternative 3 would also be long-term and beneficial. Therefore, in combination with impacts from cumulative actions, alternative 3 would have a slight contribution to overall long-term, beneficial impacts to historic structures.

**Conclusion.** Alternative 3 would result in long-term, beneficial impacts on historic structures to the RCPP Historic District due to the avoidance of the threat of continued erosion of Rock Creek and the trail network and the related degradation of the bucolic setting. This alternative would have no impacts to all other historic structures within the two APEs. Cumulative impacts would be overall long-term and beneficial with alternative 3 having a slight contribution to these impacts.

**Assessment of Effect for Section 106.** Alternative 3 would have beneficial effects on all historic properties – the RCPP Historic District, the RCP Historic District, the Massachusetts Avenue Historic District, the Georgetown Historic District, the Oak Hill Cemetery, and the Mount Zion Cemetery. The assessment of effect under Section 106 would be “*no adverse effect.*”

#### **Impacts of Alternative 4: Add Merge Lane by Widening the Road toward the Median**

**Analysis.** The analysis of the impact to the road as a contributing feature of the RCPP Historic District, as well as the characterization of altering the configuration of Waterside Drive, NW and southbound Rock Creek and Potomac Parkway as a long-term, negligible impact in alternative 3, applies to alternative 4 as well. However, alternative 4 would also widen the roadway into the median by 12 feet (from the original

pre-July 2011 alignment). The combination of impacts to the road and the median would create a long-term, minor, adverse impact.

No other contributing features of the historic district on the east side of Rock Creek would be impacted. The addition of steel-backed timber guardrails is in keeping with the existing palette of hardscape features in the historic district. The installation of the VRSS would protect all stream banks of Rock Creek and the segment of the trail network along the western shore from further erosion. This would be a beneficial long-term impact. The masonry-faced culvert on the eastern stream bank is upstream from the area where the VRSS would be installed so it would not be impacted. Alternative 4 would have a long-term, negligible impact to the RCPP Historic District.

The Massachusetts Avenue Historic District would experience negligible adverse effects to historic structures. The setting and other character defining aspects of the Massachusetts Avenue district would not be affected because the primary historic quality of this district is the linear parade of mansions with imposing front elevations facing toward the avenue from both sides, not the intermittent views from the backyards and rear elevations of houses on the southern side. The Georgetown Historic District, which extends to the western stream bank of Rock Creek, along with its component historic properties (the Oak Hill Cemetery and Mount Zion Cemetery) would experience long-term, beneficial impacts to historic resources due to the replacement of the visually disruptive gabion erosion control fix by the VRSS. The VRSS would enhance the graceful transition from the natural riparian, wooded appearance of the west bank of Rock Creek to the picturesque landscape design of the two cemeteries.

In the riparian revegetation area, coterminous with an additional APE for historic structures, several sites would be planted with native species appropriate to the natural riparian environment of Rock Creek. The contributing elements of the RCP Historic District within the APE (which are all structures associated with park infrastructure) – an outdoor fireplace, pedestrian bridge, stream gauge, and historic trails/roads – would be avoided or protected during revegetation activities. This component of the project would be the same for all action alternatives. There would no impacts to historic structures.

**Cumulative Impacts.** The cumulative actions with the capacity to affect historic structures would be the same as for the no action alternative and would have the same long-term, beneficial impacts. The impacts of alternative 4 would be negligible. Therefore, in combination, in combination with impacts from cumulative actions, alternative 4 would have a minimal contribution to overall long-term, beneficial impacts to historic structures.

**Conclusion.** Alternative 4 would result in negligible effects to the RCPP Historic District due to its impacts to the median and roadway, as well as long-term, beneficial impacts on historic structures to the RCPP Historic District due to the avoidance of the threat of continued erosion of Rock Creek and the trail network and the related degradation of the bucolic setting. This alternative would have no impacts to all other historic structures within the two APEs. Cumulative impacts would be overall long-term and beneficial with alternative 4 having a minimal contribution to these impacts.

**Assessment of Effect for Section 106.** Under NEPA, alternative 4 would have negligible to beneficial effects to all historic properties. The assessment of effect under Section 106 would be “*no adverse effect.*”

## CULTURAL LANDSCAPES

### Methodology and Assumptions

Cultural landscapes are composed of two principal organizational elements, spatial organization and land patterns, and several character-defining landscape features. These character-defining features include topography, vegetation, circulation, water features, structures, site furnishings, and objects. The paramount attribute of the organizational elements and the character-defining features is their interrelationships in space. Individual features of the landscape are never examined alone but only in

relationship to the overall landscape. The arrangement and interrelationship of the Rock Creek and Potomac Parkway cultural landscape's organizational elements and character-defining features provides the key to determining the potential impacts and effects of the proposed improvements on the cultural landscape (Birnbaum 1996).

In this EA, impacts to cultural landscapes are described in terms of type, context, duration, and intensity, which is consistent with the CEQ regulations. As described in the "Historic Structures" section above, these impact analyses are intended to comply with the requirements of both NEPA and Section 106 of the National Historic Preservation Act of 1966, as Amended. In addition, under the ACHP's regulations, a determination of either adverse effect or no adverse effect must be made for affected cultural resources eligible for or listed in the NRHP.

CEQ regulations and Director's Order 12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). However, any resultant reduction in intensity of impact due to mitigation is an estimate of the effectiveness of mitigation only under NEPA. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Although adverse effects under Section 106 may be mitigated, the effect remains adverse.

### **Study Area**

The study area for historic structures and districts is the same as the Section 106 APE described for the historic districts and cultural landscapes in (a) the project area at Waterside Drive, NW and (b) the riparian revegetation area.

The territory of the parkway, documented in 2002 and listed in the NRHP, has also been recognized as a historic designed landscape, i.e., a type of cultural landscape. The parkway's cultural landscape is related to but differs somewhat from the Rock Creek Park cultural landscape to the north, also nominated as a historic district and cultural landscape. The parkway's cultural landscape is primarily based on the parkway and its intended design as a picturesque American parkway linking the formal zone of the Lincoln Memorial on the Mall to the wooded, naturalistic environment of Rock Creek Park. Only in its more northerly half, between the P Street, NW Bridge and the south entrance of the Zoo Tunnel, is it surrounded by lush and seemingly randomly spaced trees and vegetation as it snakes along the valley of Rock Creek. At this northern stretch of the parkway, the corridor of surrounding parkland is comparatively narrow, at least in comparison with the wider Rock Creek Park further north. The wild aspect of the landscape of the upper Rock Creek and Potomac Parkway is somewhat contrived because it depends on the historical removal of row houses and industrial facilities not deemed in accordance with the plan, as well as the sunken topography. Rock Creek Park has these elements too, but it contains more authentically natural woodland.

Rustic-appearing stone bridges (vehicular and pedestrian), retaining walls, and culverts are the structural and hardscape features that are associated with the American parkway movement. Because the impacts of the project alternatives to these features have already been analyzed in the "Historic Structures" section above, the discussion here will focus on the landscape design aspects, also documented in the 2002 nomination of the RCPP Historic District to the NRHP.

The only specific discussion in the NRHP nomination's landscape section about an area corresponding roughly to the project's APE indicates, "In the median south of Waterside Drive Overpass is the site of the historic Lyons Mill. Adjacent to the site are three large sycamores that appear to predate the parkway construction. Today numerous mature deciduous trees, probably indigenous specimens dating before parkway construction, are scattered across the median and along the western side of the parkway in the area of the par course. Trees standing on extensive lawns give this section the appearance of a picturesque landscape. However, it should not be assumed that the mature trees described constitute only a natural

resource, as the parkway designers made the conscious choice to expand the median around them and preserve the Lyons Mill site.

The NPS has identified five significant trees within the median that would be impacted within the APE. These trees have been documented to the HALS standards (Kuhn and Plakorus 2012).

### **Impact Thresholds**

The following thresholds were used to determine the magnitude of effects on cultural landscapes:

**Negligible.** The impact would be at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for Section 106 would be *no adverse effect*.

**Minor.** The alteration of a pattern(s) or feature(s) of the landscape would not diminish the overall integrity of the landscape. The determination of effect for Section 106 would be *no adverse effect*.

**Moderate.** Alteration of a pattern(s) or feature(s) of the landscape would diminish the overall integrity of the landscape. The determination of effect for Section 106 would be an *adverse effect*. A memorandum of agreement would be executed between the NPS and applicable SHPO and, if necessary, the ACHP in accordance with 36 CFR 800.6(b). Measures identified in the memorandum of agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate.

**Major.** Alteration of a pattern(s) or feature(s) of the cultural landscape would diminish the overall integrity of the landscape. The determination of effect for Section 106 would be an *adverse effect*. Measures to minimize or mitigate adverse impacts cannot be agreed on and the NPS and applicable SHPO and/or the ACHP are unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

**Beneficial.** Restoration of a cultural landscape or its patterns and features in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. The determination of effect for Section 106 would be *no adverse effect*.

**Duration.** Short-term impacts would occur during all or part of alternative implementation; long-term impacts would extend beyond the implementation of the alternative.

### **Impacts of Alternative 1: No Action**

**Analysis.** Long-term, moderate, adverse impacts would result from the no action alternative, specifically for Rock Creek. The eroded stream banks of Rock Creek would continue to be protected by stone gabion baskets, intended as a temporary remediation and visually incompatible with the surrounding green slopes and the natural stone abutments. The integrity of the bucolic setting of the parkway's cultural landscape would continue to be adversely impacted. The no action alternative would have a long-term, moderate, adverse impact to the parkway's cultural landscape.

Under the no action alternative, the revegetation of riparian areas along Rock Creek would not occur. Therefore there would be no impacts to the cultural landscape of upper Rock Creek.

**Cumulative Impacts.** There are two past projects that have the capability of generating cumulative impacts to cultural landscapes. The rehabilitation of Peirce Mill, located on Tilden Avenue, NW at Beach Drive, NW has had a long-term, beneficial impact to the Peirce Mill cultural landscape, a designated subcomponent of the Rock Creek Park cultural landscape. The rehabilitation and reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway is impacting the cultural landscapes of both Rock

Creek Park and Rock Creek and Potomac Parkway. The impacts were considered moderate, beneficial, and long-term for these resources. However, the rehabilitation of the segment of the southbound parkway at the intersection of Waterside Drive, NW was not completed and is the subject of this EA. Long-term, moderate, adverse impacts to cultural landscapes would result from the no action alternative. In combination with the impacts that have resulted from the cumulative actions, the no action would have noticeable adverse contribution to overall long-term, beneficial impacts.

**Conclusion.** The no action alternative would result in long-term, moderate, adverse impacts to cultural landscapes due to the threat of continued erosion of Rock Creek and negative visual impact to the bucolic setting of the parkway's cultural landscape. Cumulative impacts would be long-term and beneficial with the no action having a noticeable adverse contribution to these impacts.

**Assessment of Effect for Section 106.** The no action alternative does not constitute an "undertaking" under Section 106 of the NHPA. Therefore, there is no Section 106 equivalent for an evaluation of effects under NEPA.

### **Impacts of Alternative 2: Restore to Original Conditions**

**Analysis.** The retention of the section of the southbound parkway in its original pre-construction alignment, in conjunction with the restoration of the stream bank by means of the VRSS and restoration of riparian areas along the creek, would have a long-term, beneficial impact to the parkway's cultural landscape. The median and its mature specimen trees are an important cultural landscape resource. The installation of the VRSS would protect the stream banks of Rock Creek from further erosion and create a visually appropriate vegetated slope down to the creek, which would be a beneficial long-term impact. In summary, alternative 2 would have a long-term, beneficial impact to the parkway's cultural landscape.

In the riparian revegetation area, coterminous with an additional APE for historic structures and cultural landscapes, several areas would be planted with native species appropriate to the natural riparian environment of Rock Creek. There would be long-term, beneficial effects to cultural landscapes.

**Cumulative Impacts.** The cumulative actions with the capacity to affect cultural landscapes would be the same as for the no action alternative and would have long-term, beneficial impacts. The impacts of alternative 2 would also be long-term and beneficial. In combination with the impacts that have resulted from the cumulative actions, alternative 2 would have slight contribution to overall long-term, beneficial impacts.

**Conclusion.** Under alternative 2, the restoration of the parkway to its original conditions in conjunction with the stabilization of the Rock Creek stream banks and the trail and the revegetation of riparian areas would have long-term, beneficial impacts to cultural landscapes. Cumulative impacts would be long-term and beneficial with alternative 2 having a slight contribution to these impacts.

**Assessment of Effect for Section 106.** As alternative 2 would have beneficial effects to the cultural landscapes associated with Rock Creek Park and the Rock Creek and Potomac Parkway. The assessment of effect under Section 106 would be "*no adverse effect.*"

In addition, the NPS has written to the DCHPO to propose the following measures to avoid any potential adverse effects to cultural landscapes:

- While the loss of vegetation resulting from the proposed undertaking, including within the median, would be limited relative to the size of the Rock Creek and Potomac Parkway (approximately 173 acres) and its extensive landscaping throughout the valley, the replanting of native tree species and vegetation following construction would eliminate potential adverse effects on the setting of the parkway. Planting within the median will focus on replanting within close proximity to the original location of the current trees to continue the visual demarcation of

the former Lyons Mill site. This will be planned in consultation with the NPS Regional Archeologist to avoid potential archeological resources associated with the Lyons Mill.

- Historic American Landscape Survey (HALS) documentation of five trees (three sycamores and two white ashes) within the median has been undertaken by the NPS. This documentation will be submitted to the Library of Congress for inclusion in the Historic American Building Survey/Historic American Engineering Record/HALS collection.
- As part of the NPS's on-going Section 110 responsibilities, documentation and an inventory of the cultural landscape for the RCPP will be conducted within the next five years.

### **Impacts of Alternative 3: Add Merge Lane by Widening the Road toward the Creek**

**Analysis.** The installation of the VRSS would protect all stream banks of Rock Creek from further erosion and would restore the appearance of a vegetated natural slope down to the creek. The addition of a natural stone-faced concrete retaining wall and steel-backed timber guardrails is in keeping with the existing palette of hardscape features in the cultural landscape. This alternative might lessen stress on the significant specimen trees in the median. In summary, alternative 3 would have a long-term, beneficial impact to the parkway's cultural landscape.

**Cumulative Impacts.** The cumulative actions with the capacity to affect cultural landscapes would be the same as for the no action alternative and would have beneficial long-term impacts. The impacts of alternative 3 would be long-term and beneficial. In combination with the impacts that have resulted from the cumulative actions, alternative 3 would have slight contribution to overall long-term, beneficial impacts.

**Conclusion.** Under alternative 3, the stabilization of the Rock Creek stream banks would have long-term, beneficial long-term impacts to cultural landscapes. Cumulative impacts would be long-term and, beneficial with alternative 3 having a slight contribution to these impacts.

**Assessment of Effect for Section 106.** As alternative 3 would have beneficial effects to the cultural landscapes associated with Rock Creek Park and the Rock Creek and Potomac Parkway. The assessment of effect under Section 106 would be "*no adverse effect.*"

In addition, the NPS has written to the DCHPO to propose the following measures to avoid any potential adverse effects to cultural landscapes:

- While the loss of vegetation resulting from the proposed undertaking, including within the median, would be limited relative to the size of the Rock Creek and Potomac Parkway (approximately 173 acres) and its extensive landscaping throughout the valley, the replanting of native tree species and vegetation following construction would eliminate potential adverse effects on the setting of the parkway. Planting within the median will focus on replanting within close proximity to the original location of the current trees to continue the visual demarcation of the former Lyons Mill site. This will be planned in consultation with the NPS Regional Archeologist to avoid potential archeological resources associated with the Lyons Mill.
- Historic American Landscape Survey (HALS) documentation of five trees (three sycamores and two white ashes) within the median has been undertaken by the NPS. This documentation will be submitted to the Library of Congress for inclusion in the Historic American Building Survey/Historic American Engineering Record/HALS collection.
- As part of the NPS's on-going Section 110 responsibilities, documentation and an inventory of the cultural landscape for the RCPP will be conducted within the next five years.

**Impacts of Alternative 4: Add Merge Lane by Widening the Road toward the Median**

**Analysis.** Alternative 4 would widen the roadway into the median by 12 feet from its original pre-2011 alignment in order to accommodate a safe access to the southbound parkway and would require the removal of up to seven mature trees. The NRHP nomination's description of the median as a contributing feature begins, "At the northern end of the 1935 stone retaining wall, the road separates and becomes more curvilinear, establishing a grassy, irregular shaped median planted with specimen trees." It mentions the role of the remains of Lyons Mill, built in 1780 and collapsed in 1913, as a picturesque ruin in the median and that it was valued by park designer Frederick Law Olmsted, Jr. The description ends, "Three majestic sycamores mark the mill site" (Barsoum 2002). The combination of impacts to the median; to the open, picturesque, bucolic setting; and to the trees would create a long-term, minor, adverse impact. However, it might be partially mitigated by a tree replanting plan designed to restore the picturesque landscape and lessen the perception of loss of open space in the median. It will also be mitigated by the photographic recordation of significant trees by the HALS recordation (Kuhn and Plakorus 2012). The resulting mitigated impact would then be long-term, minor, and adverse. The addition of steel-backed timber guardrails is in keeping with the existing palette of hardscape features in the cultural landscape. The installation of the VRSS would protect all stream banks of Rock Creek from further erosion and would restore the appearance of a vegetated natural slope down to the creek. This would be a beneficial long-term impact. In summary, alternative 4 would have a long-term, minor to moderate, impact to the parkway's cultural landscape.

In the riparian revegetation area, coterminous with an additional APE for historic structures and cultural landscapes, several areas would be planted with native species appropriate to the natural riparian environment of Rock Creek. There would be long-term, beneficial impacts to cultural landscapes.

**Cumulative Impacts.** The cumulative actions with the capacity to affect historic resources would be the same as for the no action alternative and would have beneficial long-term impacts. The impacts of alternative 4 would be long-term, negligible and adverse. In combination with the impacts that have resulted from the cumulative actions, alternative 4 would have slight adverse contribution to overall long-term, beneficial impacts.

**Conclusion.** Under alternative 4, the addition of a merge lane onto the southbound parkway and the realignment of the road toward the median, in conjunction with the stabilization of the Rock Creek stream banks and the trail, would have long-term, minor, adverse impacts to cultural landscapes. This is due to the balancing of adverse impacts to the median and its trees with long-term, beneficial impacts to the Rock Creek stream banks at the project site at Waterside Drive, NW and with riparian revegetation along upper Rock Creek. Cumulative impacts would be long-term and beneficial with alternative 4 having a slight contribution to these impacts.

**Assessment of Effect for Section 106.** Alternative 4 would have minor to moderate, adverse impacts to the cultural landscapes associated with Rock Creek Park and the Rock Creek and Potomac Parkway. The assessment of effect under Section 106 would be "*no adverse effect*" according to the NPS impact thresholds.

In addition, the NPS has written to the DCHPO to propose the following measures to avoid any potential adverse effects to cultural landscapes:

- While the loss of vegetation resulting from the proposed undertaking, including within the median, would be limited relative to the size of the Rock Creek and Potomac Parkway (approximately 173 acres) and its extensive landscaping throughout the valley, the replanting of native tree species and vegetation following construction would eliminate potential adverse effects on the setting of the parkway. Planting within the median will focus on replanting within close proximity to the original location of the current trees to continue the visual demarcation of

the former Lyons Mill site. This will be planned in consultation with the NPS Regional Archeologist to avoid potential archeological resources associated with the Lyons Mill.

- Historic American Landscape Survey (HALS) documentation of five trees (three sycamores and two white ashes) within the median has been undertaken by the NPS. This documentation will be submitted to the Library of Congress for inclusion in the Historic American Building Survey/Historic American Engineering Record/HALS collection.

As part of the NPS's on-going Section 110 responsibilities, documentation and an inventory of the cultural landscape for the RCPP will be conducted within the next five years.

## ARCHEOLOGICAL RESOURCES

### Methodology and Assumptions

Because archeological resources exist essentially in subsurface contexts, potential impacts to archeological resources are assessed according to the extent to which the proposed alternatives would involve ground-disturbing activities such as excavation or grading. The analysis of possible impacts to archeological resources was based on a review of previous archeological studies, consideration of the proposed design concepts, and other information provided by the NPS.

### Study Area

The study area for archeological resources is the project's defined limits of disturbance for the construction of all action alternatives combined. It is the same as the Section 106 APE for archeological resources.

As indicated in the affected environment for Archeological Resources (chapter 3), one potentially significant historic archeological resource is presumed to lie in and just beyond the APE. It is believed that the ruins of the 1700s Lyons Mill may be preserved in the median area, although archeological remains of the mill have not yet been formally identified. It is also possible that resources associated with the mill may exist in the area between Rock Creek and Potomac Parkway roads and the creek, particularly in the direction of the Lyons Mill Footbridge. During the planning and design for the Rock Creek and Potomac Parkway, the road was purposefully designed to avoid the mill by the creation of an enlarged median between the inbound and outbound traffic lanes in the Waterside Drive, NW vicinity.

### Impact Thresholds

For potential impacts to archeological resources, the magnitudes of effect are as follows:

**Negligible.** Impact is at the lowest levels of detection, and a determination of *no adverse effect* under Section 106 of the National Historic Preservation Act of 1966, as Amended.

**Minor.** Impact results in little, if any, loss or gain of integrity, and a determination of *no adverse effect* under Section 106 of the National Historic Preservation Act of 1966, as Amended.

**Moderate.** Impact results in loss or gain of integrity, and if detrimental, a determination of *adverse effect* under Section 106 of the National Historic Preservation Act of 1966, as Amended.

**Major.** Impact results in a significant loss or gain of integrity, and if detrimental, a determination of *adverse effect* under Section 106 of the National Historic Preservation Act of 1966, as Amended.

**Impacts of Alternative 1: No Action**

**Analysis.** Because there would be no ground disturbance under the no action alternative, there would be no impacts to archeological resources. The no action alternative would not have any impact to archeological resources.

**Cumulative Impacts.** Because there are no direct or indirect impacts to archeological resources under the no action alternative, no cumulative impacts would occur.

**Conclusion.** There would be no adverse or beneficial direct, indirect, or cumulative impacts associated with the implementation of the no action alternative.

**Assessment of Effect for Section 106.** The no action alternative does not constitute an "undertaking" under Section 106 of the NHPA. Therefore, there is no Section 106 equivalent for an evaluation of effects under NEPA.

**Impacts of Alternative 2: Restore to Original Conditions**

**Analysis.** Under alternative 2, the roadway would be restored to its original alignment, and the potential archeological resources associated with Lyons Mill found within the median would remain untouched. The restoration of the parkway at Waterside Drive, NW would only impact land that has already been extensively disturbed for the construction of Rock Creek and Potomac Parkway and is not considered sensitive for prehistoric archeological resources. As a result, there would be no impacts to archeological resources under alternative 2.

If archeological resources are discovered during construction, all work in the immediate vicinity of the discovery would be halted until the resources can be identified and documented and an appropriate mitigation strategy can be developed. Consultation with the DCSHPO, the NPS, and/or the NPS regional archeologist will be coordinated to ensure that the protection of resources is addressed. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (25 USC 3001) of 1990 would be followed.

**Cumulative Impacts.** Because there are no direct or indirect impacts to archeological resources under the no action alternative, no cumulative impacts would occur.

**Conclusion.** No adverse or beneficial direct, indirect, or cumulative impacts to archeological resources would occur as a result of this alternative.

**Assessment of Effect for Section 106.** Alternative 2 would have no adverse impacts to archeological resources. The assessment of effect under Section 106 would be "*no adverse effect.*"

To ensure the avoidance of adverse effects to archeology at the project area, the NPS has written to the DCHPO to propose the following measures:

- As a result of the findings of the Phase 1A archeological investigation of the median in the vicinity of Waterside Drive, there is the potential for intact archeological resources related to Lyons Mill. The mill, which collapsed in 1913, occupied the area that now includes the median in the vicinity of Waterside Drive at the RCPP. A Phase 1B archeological investigation to determine if archeological resources are extant within the Limits of Disturbance at the median will be undertaken prior to ground-disturbing activities. Ground-disturbing activities are limited to what is required for the installation of lamp poles and inlets within the median. Such an investigation would be used to determine if intact archeological resources are extant and will provide the FHWA and the NPS information that will guide any design changes necessary to avoid such resources. Consultation will continue with the DCHPO on measures to avoid potential adverse effects to these resources.

**Impacts of Alternative 3: Add Merge Lane by Widening the Road toward the Creek**

**Analysis.** Under alternative 3, the roadway would be shifted towards Rock Creek. Because disturbance within the median would be avoided, and the realignment of the parkway at Waterside Drive, NW would only impact land that has already been extensively disturbed for the construction of Rock Creek and Potomac Parkway, and is not considered sensitive for prehistoric archeological resources, alternative 3 would not likely impact archeological resources.

If archeological resources are discovered during construction, all work in the immediate vicinity of the discovery would be halted until the resources can be identified and documented and an appropriate mitigation strategy can be developed. Consultation with the DC SHPO, the NPS, and/or the NPS regional archeologist will be coordinated to ensure that the protection of resources is addressed. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (25 USC 3001) of 1990 would be followed.

**Cumulative Impacts.** Because there are no direct or indirect impacts to archeological resources under the no action alternative, no cumulative impacts would occur.

**Conclusion.** No adverse or beneficial direct, indirect, or cumulative impacts to archeological resources would occur as a result of this alternative.

**Assessment of Effect for Section 106.** Alternative 3 would have no adverse impacts to archeological resources. The assessment of effect under Section 106 would be “*no adverse effect.*”

To ensure the avoidance of adverse effects to archeology at the project area, the NPS has written to the DCHPO to propose the following measures:

- As a result of the findings of the Phase 1A archeological investigation of the median in the vicinity of Waterside Drive, there is the potential for intact archeological resources related to Lyons Mill. The mill, which collapsed in 1913, occupied the area that now includes the median in the vicinity of Waterside Drive at the RCPP. A Phase 1B archeological investigation to determine if archeological resources are extant within the Limits of Disturbance at the median will be undertaken prior to ground-disturbing activities. Ground-disturbing activities are limited to what is required for the installation of lamp poles and inlets within the median. Such an investigation would be used to determine if intact archeological resources are extant and will provide the FHWA and the NPS information that will guide any design changes necessary to avoid such resources. Consultation will continue with the DCHPO on measures to avoid potential adverse effects to these resources.

**Impacts of Alternative 4: Add Merge Lane by Widening the Road toward the Median**

**Analysis.** At the current time, impacts on archeological resources cannot be fully evaluated because the existence of any physical remains of the Lyon’s Mill Site within the APE for the project is unknown. The Phase 1A study of the median at Waterside Drive, NW indicated that based on the best available information, including historic maps, “the site of Lyons Mill is in the roadway median at the intersection of Rock Creek and Potomac Parkway and Waterside Drive.” (LeeDecker, et al. 2012)

Subsurface archeological investigations (Phase 1B) designed to identify, evaluate, and document archeological resources have been deferred, primarily because of the logistical challenges posed by opening excavations in a public park or a public roadway. The Phase 1B would, however, be completed prior to the initiation of construction. Possible adverse impacts to archeological resources could occur from the excavations needed for the light pole or inlets, or the potential encapsulation of a portion of the building foundation from the proposed new road alignment. Impacts to archeological resources would be avoided because NPS has some flexibility to relocate the light poles and inlets as

needed. If impacts could not be avoided, minimization and/or mitigation of adverse effects would be accomplished by design revision, archeological documentation and in-place preservation, followed by publication of the results to the scientific community and the public. Overall, possible adverse impacts could range from negligible to moderate and would be direct and long-term. The NPS is continuing Section 106 consultations to evaluate and mitigate adverse effects on historic properties, including archeological resources, through consultation that would include stipulations/conditions to insure an appropriate level of archeological documentation. Archeological documentation would occur immediately prior to project construction, when subsurface access would be more readily facilitated.

**Cumulative Impacts.** The only past, present, or future projects identified at the beginning of this chapter with a potential to affect archeological resources are the segments of the rehabilitation and reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway project that are immediately adjacent to the study area, or APEs. Because there have been no impacts to archeological resources from the construction of those segments of the Beach Drive, NW and Rock Creek and Potomac Parkway project, there would be no cumulative impacts possible in combination with this alternative.

**Conclusion.** Impacts to archeological resources would be negligible to minor as the NPS has the flexibility to relocate revise design prior to construction, if necessary. There are no adverse or beneficial cumulative impacts associated with this alternative.

**Assessment of Effect for Section 106.** Alternative 4 would have negligible to minor, adverse impacts to archeological resources and the assessment of effect under Section 106 would be “*no adverse effect*” according to the NPS’s impact thresholds.

To ensure the avoidance of adverse effects to archeology at the project area, the NPS has written to the DCHPO to propose the following measures:

- As a result of the findings of the Phase 1A archeological investigation of the median in the vicinity of Waterside Drive, there is the potential for intact archeological resources related to Lyons Mill. The mill, which collapsed in 1913, occupied the area that now includes the median in the vicinity of Waterside Drive at the RCPP. A Phase 1B archeological investigation to determine if archeological resources are extant within the Limits of Disturbance at the median will be undertaken prior to ground-disturbing activities. Ground-disturbing activities are limited to what is required for the installation of lamp poles and inlets within the median. Such an investigation would be used to determine if intact archeological resources are extant and will provide the FHWA and the NPS information that will guide any design changes necessary to avoid such resources. Consultation will continue with the DCHPO on measures to avoid potential adverse effects to these resources.

## VISITOR USE AND EXPERIENCE

### METHODOLOGY AND ASSUMPTIONS

Impacts to visitor use and experience were determined by considering the effect of the existing conditions and the proposed reconstruction and rehabilitation of Rock Creek and Potomac Parkway and stream bank restoration.

The determination of impacts to visitor use and experience considered the road as a means to access other park resources and recreational sites, as a source for vehicular recreation, and as a commuter road. Impacts to immediate visitor amenities, such as the Rock Creek Park Multi-use Trail, and to visitor experience, including the aesthetics and noise environment of the area, were considered.

## STUDY AREA

The study area for visitor experience includes Rock Creek and Potomac Parkway, visitor sites accessed from this road, and immediately adjacent visitor amenities such as the Rock Creek Park Multi-use Trail.

## IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of effects to visitor use and experience:

**Negligible.** Visitors would likely be unaware of any effects associated with the implementation of the alternative. There would be no noticeable change in visitor use and experience or in any defined indicators of visitor satisfaction or behavior.

**Minor.** Changes in visitor use and/or experience would be slight and detectable, but would not appreciably limit or enhance critical characteristics of the visitor experience. Visitor satisfaction would remain stable.

**Moderate.** Few critical characteristics of the desired visitor experience would change. The number of participants engaging in a specified activity would be altered. Some visitors who desire their continued use and enjoyment of the activity/visitor experience might be required to pursue their choices in other available local or regional areas. Visitor satisfaction would begin to decline.

**Major.** Multiple critical characteristics of the desired visitor experience would change and/or the number of participants engaging in an activity would be greatly reduced. Visitors who desire their continued use and enjoyment of the activity/visitor experience would be required to pursue their choices in other available local or regional areas. Visitor satisfaction would markedly decline.

**Duration.** Short-term effects on visitor use and experience would be immediate and could occur during alternative implementation. Long-term effects would persist beyond the implementation of the alternative.

## IMPACTS OF ALTERNATIVE 1: NO ACTION

**Analysis.** Alternative 1 represents the current conditions at the proposed site. There would be no rehabilitation or reconstruction of Rock Creek and Potomac Parkway southbound at the merge with Waterside Drive. The Rock Creek Park Multi-use Trail would remain open to public use and in its original conditions.

Under alternative 1, visitors to the park would continue to experience delays as they attempt to enter the parkway southbound from Waterside Drive, NW resulting in long-term, negligible, adverse impacts to visitor use because there would be no noticeable change in behavior or use. Visitors would continue to have access to the Rock Creek Park Multi-use Trail in its original condition. However, the presence of the gabion baskets in the stream bank would detract from the aesthetics of the stream and result in long-term, minor, adverse impacts to visitor experience.

**Cumulative Impacts.** Current and planned projects in Rock Creek Park near the project area, such as the rehabilitation and reconstruction of Beach Drive, NW and Rock Creek and Potomac Parkway, the Rock Creek Park Multi-use Trail repaving, and the Klingle Valley Multi-use Trail project, would have long-term, beneficial impacts to visitor use and experience by improving park facilities, including roads and trails, and offering new recreational opportunities. These actions would also result in short-term, minor, adverse impacts to visitor use and experience during construction due to restricted recreation activities.

When combined with the impacts from cumulative actions, the no action would have a minor, adverse contribution to an overall long-term, beneficial impact to visitor use and experience.

**Conclusion.** The implementation of alternative 1 would result in long-term, minor, adverse impacts to visitor use and experience from the continued delays while attempting to enter the parkway from Waterside Drive, NW continued access to trails in the area in its current condition, and the continued degraded and unstable stream bank. Cumulative impacts to visitor use and experience would be long-term and beneficial with the no action having a minor, adverse contribution to these impacts.

### **IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS**

**Analysis.** Under alternative 2, the parkway would be returned to pre-July 2011 conditions. No improvements to sight lines would be made and no merge area would be added. The stream bank would be restored using VRSS. During the stream bank construction, one lane of the parkway would remain closed to vehicular traffic and the multi-use trail would be detoured from the pedestrian footbridge to P Street, NW, possibly using the parkway lane closest to the creek.

The implementation of alternative 2 would result in long-term, negligible, adverse impacts from the continued delay when attempting to enter the parkway. Short-term, minor, adverse impacts would result from the lane closure during stream bank restoration construction as a result of the one-lane closure on the parkway, which would cause increased delays to visitors, including both recreational and commuter traffic. In addition, the multi-use trail detour would result in short-term, minor, adverse impacts to visitor use and experience because the detour would reroute visitors from the natural setting where the trail was originally aligned with the road. However, upon completion of the stream bank restoration, the trail would be restored to its original conditions and long-term, beneficial impacts would result from improved stream bank aesthetics and trail stability.

**Cumulative Impacts.** The impacts to visitor use and experience from cumulative actions would be similar to those under alternative 1, resulting in short-term, minor, adverse impacts to visitor use and experience during construction and long-term, beneficial impacts upon completion of construction. Alternative 2 would result in short-term, minor, adverse impacts to visitor use and experience because the trail detour but also long-term, beneficial impacts would result from improved stream bank aesthetics and trail stability. When combined with the impacts from cumulative actions, alternative 2 would have a minor contribution to overall long-term, beneficial impacts to visitor use and experience.

**Conclusion.** The implementation of alternative 2 would result in long-term, negligible, adverse impacts to visitor use and experience from the continued delays for visitors attempting to enter the parkway from Waterside Drive. Short-term, minor, adverse impacts would result from the one-lane closure and trail detour; however, upon completion of construction, long-term, beneficial impacts would occur as a result of stream bank stabilization. Cumulative impacts to visitor use and experience would be long-term and beneficial with alternative 2 having a minor contribution to these impacts.

### **IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Under alternative 3, the parkway would be realigned toward the creek and a 350-foot retaining wall would be constructed between the road and the creek. In addition, the stream bank would be restored using VRSS. During stream bank restoration construction, one lane of the parkway would be closed and the multi-use trail would be detoured from the pedestrian footbridge to P Street, NW, possibly using the parkway lane closest to the creek.

The implementation of alternative 3 would result in long-term, beneficial impacts to visitor use and experience as a result of the improved merge area between Waterside Drive, NW and the parkway. However, short-term, minor, adverse impacts would result during stream bank restoration construction

due to the single lane closure. In addition, short-term, minor, adverse impacts would occur as a result of the multi-use trail detour, because the detour would reroute visitors from the natural setting where the trail was originally aligned with the road. However, upon completion of the stream bank restoration, the trail would be restored to its original alignment and long-term, beneficial impacts would result from improved trail stability. The addition of the 350-foot retaining wall could detract from the natural aesthetics of the area and result in long-term, minor, adverse impacts to visitor experience. However, the retaining wall would have a natural stone face in keeping with the existing palette of hardscape features of Rock Creek Park.

**Cumulative Impacts.** The impacts to visitor use and experience from cumulative actions would be similar to those under alternative 1, resulting in short-term, minor, adverse impacts to visitor use and experience during construction and long-term, beneficial, impacts. Alternative 3 would result in short-term, minor, adverse impacts and long-term, beneficial, impacts to visitor use and experience. When combined with the impacts of the cumulative actions, alternative 3 would have a minor contribution to overall long-term, beneficial impacts to visitor use and experience.

**Conclusion.** The implementation of alternative 3 would result in long-term, beneficial impacts to visitor use and experience from the improved merge area between Waterside Drive, NW and the parkway. Short-term, minor, adverse impacts would result from the one-lane closure and trail detour. However, upon completion of construction, long-term, beneficial impacts would occur from stream bank restoration. Cumulative impacts to visitor use and experience would be long-term and beneficial with alternative 3 having a minor contribution to these impacts.

#### **IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Under alternative 4, the parkway would be realigned 12 feet from the pre-July 2011 alignment towards the median. In addition, the stream bank would be restored using VRSS. During stream bank restoration construction, one lane of the parkway would be closed and the multi-use trail would be detoured from the pedestrian footbridge to P Street, NW, possibly using the parkway lane closest to the creek.

The implementation of alternative 4 would result in impacts to visitor use and experience similar to those under alternative 3. Long-term, beneficial impacts to visitor use and experience would occur as a result of the improved merge area between Waterside Drive, NW and the parkway. Short-term, minor, adverse impacts would occur during stream bank restoration construction due to the single lane closure, which would cause increased parkway travel delays. In addition, short-term, minor, adverse impacts would occur as a result of the multi-use trail detour, because the detour would reroute visitors from the natural setting where the trail was originally aligned with the road. However, upon completion of the stream bank restoration, the trail would be restored to its original conditions and long-term, beneficial impacts would result from improved stream bank aesthetics and trail stability.

**Cumulative Impacts.** Impacts to visitor use and experience from past, present, and reasonably foreseeable actions would be similar to those under alternative 1, resulting in short-term, minor, adverse impacts to visitor use and experience during construction and long-term, beneficial impacts upon completion of construction. Alternative 4 would result in short-term, minor, adverse impacts and long-term, beneficial impacts. When combined with the impacts of the cumulative actions, alternative 4 would have a minor contribution to overall long-term, beneficial impacts to visitor use and experience.

**Conclusion.** The implementation of alternative 4 would result in long-term, beneficial impacts to visitor use and experience from the improved merge area between Waterside Drive, NW and the parkway. Short-term, minor, adverse impacts would result from the one-lane closure and trail detour; however, upon completion of construction, long-term, beneficial impacts would occur from stream bank restoration.

Cumulative impacts to visitor use and experience would be long-term and beneficial with alternative 4 having a minor contribution to these impacts.

## TRANSPORTATION AND SAFETY

### METHODOLOGY AND ASSUMPTIONS

Potential impacts to transportation systems and local traffic patterns were derived from data gathered from various sources, including the DDOT and NPS. The data included historical traffic volumes; previous reports; accident data; completed, ongoing, and reasonably foreseeable transportation and resource management projects at Rock Creek Park and in the surrounding region; physical road characteristics; and operational road characteristics. All four alternatives were qualitatively evaluated in detail based on the data provided. Each alternative was also evaluated considering the cumulative effects of the proposed action plus other past, present, and reasonably foreseeable future actions. The impacts to the ability of emergency service vehicles (police and fire) to maintain current operational status and response times were also examined.

### STUDY AREA

The study area for transportation is focused at the parkway's southbound merge area at the Waterside Drive, NW onramp, where road realignments and improvements were proposed for the action alternatives.

### IMPACT THRESHOLDS

The following thresholds were used to determine the magnitude of effects on local traffic and transportation networks:

**Negligible.** The impact would be a change that would not be perceptible or would be barely perceptible by most motorists.

**Minor.** The impact would have an adverse or beneficial change to congestion levels, travel patterns, safety, or travel times. The effect would be noticeable, but would result in little inconvenience to motorists.

**Moderate.** The impact would affect the travel time of a large number of motorists and would result in a noticeable change in congestion levels, travel patterns, travel time, inconvenience or safety.

**Major.** The impact would have a substantial effect on the travel time of a large number of motorists, and would be highly noticeable and have a considerable effect on congestion levels, travel patterns, safety, or travel times to the extent that the use of park roads or arterial roads near the park would be undesirable to motorists.

**Duration.** Short-term impacts would occur during all or part of alternative implementation; long-term impacts would extend beyond the implementation of the alternative.

### IMPACTS OF ALTERNATIVE 1: NO ACTION

**Analysis.** The no action alternative serves as the baseline against which to compare all other alternatives. Under the no action alternative, there would be no road realignment of the parkway southbound at Waterside Drive. This alternative would have no effect on traffic volumes on the parkway. Emergency vehicle access would remain the same as under current conditions. Other major transportation corridors,

such as Massachusetts Avenue, NW and Connecticut Avenue, NW, would still exist for both police and fire response. If needed, the parkway would be available for emergency response use. Because alternate transportation routes for emergency services exist, impacts to these services from the no action alternative would be negligible and adverse in both the short and the long-term.

As shown in table 3-4 (chapter 3), a total of 37 accidents were reported for this parkway southbound merge area over a three-year period from 2009 to 2011. The road environment accounted for 8 percent of the reported accidents. Citations of contributing factors were not issued for nine (24 percent) of the 37 accidents, indicating that driver error was not a factor for these accidents. This suggests that these accidents occurred because of unsafe road conditions rather than because of driver error. Thus, unsafe road conditions accounted for approximately 32 percent of the accidents. Even though driver error was the primary factor for most of these accidents (driver inattention, following too closely, exceeding the posted speed limit, and failing to yield the right of way at the merge area), no acceleration lane and limited sight distance could also be key factors in these accidents. This trend suggests that accidents occurred more often because of both driver error and unsafe road conditions.

Under the no action alternative, the current conditions at the merge area of the parkway southbound and the Waterside Drive, NW onramp would remain. There is no acceleration lane, and a limited sight distance of 180 feet is provided for vehicles merging onto the parkway. Vehicles merging onto the parkway from Waterside Drive, NW would continue to have to come to a full stop before merging from the left. The lack of an acceleration lane and the limited sight distance at the parkway's southbound merge area would remain and would continue to be traffic safety concerns, all resulting in long-term, minor, adverse impacts.

Overall, impacts under the no action alternative would be long-term, minor, and adverse when considering accident rates, road deficiencies, and emergency vehicle access.

**Cumulative Impacts.** In general, all projects identified in the cumulative impact study area would have beneficial impacts to traffic and transportation through the improvement of area roads and trails. There would be short-term, adverse impacts associated with road closures and detours during construction periods. However, long-term benefits would result from projects such as the rehabilitation of Broad Branch Road, NW, Oregon Avenue, NW, and the Rock Creek Park Multi-use Trail; the construction of the Klinge Valley Multi-use Trail; and the National Zoo General Services Building retaining wall project. The rehabilitation of the existing Rock Creek Park Multi-use Trail and the construction of the Klinge Valley Multi-use Trail would improve visitor safety and access to the multi-use trail system from other pedestrian and bicycle facilities, as well as the surrounding neighborhoods.

Initially, the effect of the no action alternative would be negligible and adverse because the current road use or conditions would not change as a result of the proposed action. However, the lack of an acceleration lane and a limited sight distance of 180 feet for merging vehicles could result in long-term, minor, adverse impacts to motorists. When added to the beneficial impacts of other area transportation studies or projects, the no action would have a noticeable adverse contribution to overall long-term, beneficial impacts to transportation and safety.

**Conclusion.** This alternative would have no impact to traffic volumes on the parkway. Impacts to emergency services, including U.S. Park Police, emergency medical services, and fire services would be long-term and negligible. Due to the lack of an acceleration lane and a limited sight distance of 180 feet for merging vehicles, traffic accidents would continue at an equivalent or higher rate at this segment of the parkway southbound resulting in long-term, minor, adverse impacts to motorists and their safety. Cumulative impacts would be long-term and beneficial with the no action having a noticeable adverse contribution to these impacts.

**IMPACTS OF ALTERNATIVE 2: RESTORE TO ORIGINAL CONDITIONS**

**Analysis.** The construction of alternative 2 would be expected to last approximately three months. During the stream bank restoration work, the parkway's southbound travel lane closest to the creek would be closed. The pedestrian traffic on the multi-use trail adjacent to the west bank of the creek could be detoured during stream bank restoration. The detoured trail would be placed on previously disturbed soil (possibly using the closed creek-side southbound lane of the parkway). Posted advisory messages would be provided two weeks prior to closure and during the closure to warn drivers of expected delays and advise them of viable alternative routes. Police and fire response time would be increased because only one travel lane would be available in the southbound direction during the construction period. However, other major transportation corridors, such as Massachusetts Avenue, NW and Connecticut Avenue, NW, would still exist and would provide viable alternative routes to the parkway. There would be short-term, minor, adverse impacts associated with road closures and detours during the three-month construction period.

Under alternative 2, the parkway southbound at Waterside Drive, NW would be restored to its original pre-July 2011 alignment. The road width of the southbound lanes would be restored to two 11-foot lanes plus two 1-foot gutters, for a total of 24 feet. Traffic calming measures, including signs, solid striping, and rumble strips, would also be implemented on this segment of the parkway. However, these measures would have minimal effect in reducing accidents attributed to vehicles on the Waterside Drive, NW ramp following too closely to vehicles that have to come to a full stop to merge onto the parkway southbound.

Following construction, emergency vehicle access would remain the same as under current conditions. Other major transportation corridors, such as Massachusetts Avenue, NW and Connecticut Avenue, NW, would still exist for both police and fire response. If needed, the parkway would be available for emergency response use. Because alternate transportation routes for emergency services exist, impacts to these services under this alternative would be short- and long-term, negligible and adverse.

This alternative would have no effect on traffic volumes on the parkway. Because the road would be restored to its original conditions, the unsafe conditions at the merge of Waterside Drive, NW onto the parkway southbound would continue. Sight distance would remain at approximately 180 feet for vehicles merging from Waterside Drive. Proposed traffic calming measures could slightly minimize the unsafe conditions. Alternative 2 could result in long-term, minor, adverse impacts to motorists.

**Cumulative Impacts.** Impacts from cumulative actions would be similar to those under alternative 1, resulting in short-term, minor, adverse impacts and long-term, beneficial impacts. Alternative 2 would result in long-term, minor, adverse impacts to motorists. When combined with the impacts from cumulative actions, alternative 2 would have a slight adverse contribution to overall long-term, beneficial impacts.

**Conclusion.** This alternative would have no impact to traffic volumes on the parkway. Impacts to emergency services, including U.S. Park Police, emergency medical services, and fire services would be negligible and long-term. The unsafe conditions at the merge of Waterside Drive, NW onto the parkway southbound would continue under this alternative because the road would be restored to its original conditions. Sight distance would remain at approximately 180 feet for vehicles merging from Waterside Drive. Proposed traffic calming measures could slightly minimize the unsafe conditions. However, alternative 2 could still result in long-term, minor, adverse impacts to motorists. Cumulative impacts would be long-term and beneficial with alternative 2 having a slight adverse contribution to these impacts.

**IMPACTS OF ALTERNATIVE 3: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE CREEK**

**Analysis.** Similar to alternative 2, the construction under alternative 3 would be expected to last approximately three months. During the stream bank restoration work, the southbound parkway travel

lane closest to the creek would be closed. Additionally, the pedestrian traffic on the multi-use trail adjacent to the west bank of the creek could be detoured during stream bank restoration. The detoured trail would be placed on previously disturbed soil. Police and fire response time would be increased due to the lane closure on the parkway southbound. However, other major transportation corridors, such as Massachusetts Avenue, NW and Connecticut Avenue, NW, would still exist and would provide viable alternate routes to the parkway. There would be short-term, adverse impacts associated with road closures and detours during the three-month construction period.

Under alternative 3, approximately 350 feet of the parkway southbound at Waterside Drive, NW would be realigned 12 feet toward Rock Creek and a merge lane of approximately 150 feet would be added. A 350-foot retaining wall would also be constructed between the road and the creek to support the newly widened pavement and embankment as a result of the new acceleration lane. In addition to retaining the road, the wall would serve as a roadside barrier. (The ends of the retaining wall would also have steel-backed timber guardrail attached to them to ensure the safety of motorists). Traffic calming measures, including signs, solid striping, and rumble strips, would also be implemented on this segment of the parkway. This alternative would have no effect on traffic volumes on the parkway.

Safety would be improved by the addition of an acceleration lane and taper for merging traffic from Waterside Drive, NW. The merging vehicles would have a dedicated merging lane where they would be able to accelerate to minimize accidents with through traffic and on Waterside Drive, NW. As a result of the new acceleration lane and road realignment, the sight distance for merging traffic from Waterside Drive, NW would be increased from 180 feet to 420 feet, a 240-foot increase. The through traffic on the parkway southbound would be able to see the merging traffic from farther away and would potentially have enough time to switch lanes or stop to avoid merging vehicles. The merging traffic would be better able to see the through traffic from farther away and would have enough time to find a sufficient gap to safely merge. Accidents attributed to vehicles from Waterside Drive, NW following too closely to vehicles that have to come to a full stop to merge onto the parkway southbound would be reduced at this segment of the parkway southbound, as would accidents attributed to vision obstruction due to limited sight distance. The improved road would also create better access for emergency vehicles. This alternative would result in long-term, benefits for motorists using the parkway.

**Cumulative Impacts.** Similar to alternatives 1 and 2, identified cumulative actions would have short-term, minor, adverse impacts associated with road closures and detours during construction periods. However, these projects would have long-term, beneficial impacts to traffic and transportation through the improvement of area roads and trails. Under alternative 3, the realignment of the parkway southbound at Waterside Drive, NW toward Rock Creek and the addition of an approximately 150-foot acceleration lane under alternative 3 would improve road safety and create better access for emergency vehicles for this segment of the parkway. These improvements would have beneficial long-term impacts for park visitors and other motorists. Construction activities, such as temporary staging, would have adverse effects, but there would be no long-term impacts. When combined with the impacts from the cumulative actions, alternative 3 would have a noticeable contribution to overall long-term, beneficial impacts.

**Conclusion.** This alternative would have no effect on traffic volumes on the parkway. The improvements proposed as part of alternative 3 would have a long-term, beneficial effect on motorists because a 150-foot acceleration lane would be added for the Waterside Drive, NW onramp, and traffic calming measures would be implemented to improve safety at this segment of the parkway. These improvements would also create better access for emergency services, including U.S. Park Police, emergency medical services, and fire services. Cumulative impacts would be long-term and beneficial with alternative 3 having a noticeable contribution to these impacts.

**IMPACTS OF ALTERNATIVE 4: ADD MERGE LANE BY WIDENING THE ROAD TOWARD THE MEDIAN**

**Analysis.** Similar to alternatives 2 and 3, construction under alternative 4 would be expected to last approximately three months. During the stream bank restoration work, the parkway's southbound travel lane closest to the creek would be closed. Additionally, the pedestrian traffic on the multi-use trail adjacent to the west bank of the creek could be detoured during stream bank restoration. The detoured trail would be placed on previously disturbed soil. Police and fire response time would be increased due to the lane closure on the parkway southbound. However, other major transportation corridors, such as Massachusetts Avenue, NW and Connecticut Avenue, NW, would still exist and would provide viable alternative routes to the parkway. There would be short-term, adverse impacts associated with road closures and detours during the three-month construction period.

Under alternative 4, approximately 350 feet of Rock Creek and Potomac Parkway southbound at Waterside Drive, NW would be realigned 12 feet (from the original pre-July 2011 alignment) toward the median between northbound and southbound Rock Creek and Potomac Parkway and a merge lane of approximately 150 feet would be added. As a result of the road realignment, a steel-backed timber guardrail the length of the newly realigned road would be constructed between the road and the creek to serve as a roadside barrier. The improved road would also create better access for emergency vehicles. Similar to other alternatives, this alternative would have no effect on traffic volumes on the parkway.

Safety under alternative 4 would be improved by the addition of an acceleration lane and taper for merging traffic from Waterside Drive. The merging vehicles would have a dedicated merging lane and be able to sufficiently accelerate and potentially avoid accidents with through traffic. As a result of the new acceleration lane and road realignment, the sight distance for merging traffic from Waterside Drive, NW would be increased from 180 feet to 410 feet, a 230-foot increase. The through traffic on the parkway southbound would be able to see the merging traffic from farther away and would potentially have enough time to switch lanes or stop to avoid merging vehicles. The merging traffic would be better able to see the through traffic from farther away and would have enough time to find a sufficient gap to safely merge. Therefore, traffic accidents would be reduced at this segment of the parkway southbound. This alternative would result in long-term benefits for motorists using the parkway.

**Cumulative Impacts.** Similar to alternative 3, identified cumulative actions would have short-term, minor, adverse impacts associated with road closures and detours during construction periods. However, these projects would have long-term, beneficial impacts to traffic and transportation through the improvement of area roads and trails.

Under alternative 4, the realignment of approximately 350 feet of Rock Creek and Potomac Parkway southbound at Waterside Drive, NW toward the median and the addition of a 150-foot acceleration lane would have long-term safety benefits. Under this alternative, construction activities such as temporary staging would have adverse effects, but there would be no long-term impacts. When combined with the impacts from the cumulative actions, alternative 4 would have a noticeable contribution to overall long-term, beneficial impacts.

**Conclusion.** This alternative would have no effect on traffic volumes on the parkway. The improvements proposed as part of alternative 4 would have a beneficial effect on motorists because a 150-foot acceleration lane would be added for the Waterside Drive, NW onramp and traffic calming measures would be implemented to improve safety at this segment of the parkway. These improvements would also create better access for emergency services, including U.S. Park Police, emergency medical services, and fire services. Cumulative impacts would be long-term and beneficial with alternative 4 having a noticeable contribution to these impacts.