NATIONAL PARK SERVICE

U.S. DEPARTMENT OF THE INTERIOR

ROCK CREEK PARK

INSTALLATION OF REGENERATIVE STORMWATER CONVEYANCES AT BINGHAM RUN AND MILKHOUSE RUN

Environmental Assessment (EA) / Assessment of Effect (AoE)

May 2011

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Note to Reviewers and Respondents

If you wish to comment on this EA, you must do so within 30 days of its publication. Please mail comments to the address below or submit them online at *http://parkplanning.nps.gov/ROCR*. Please be aware that your comments and personal identifying information may be made publicly available at any time. While you may request that the National Park Service withhold your personal information, we cannot guarantee that we will be able to do so.

Superintendent, Rock Creek Park

Regenerative Stormwater Conveyance Environmental Assessment/Assessment of Effect

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Washington, DC 20008

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CHAPTER 1: PURPOSE AND NEED

INTRODUCTION

The National Park Service (NPS) and District Department of the Environment (DDOE) seek to stabilize and rehabilitate two streams within Rock Creek Park (the "park"):

- **Bingham Run –** A tributary of Rock Creek that begins at Oregon Avenue, west of the U.S. Park Police Horse Stables; and
- **Milkhouse Run** – A tributary of Rock Creek that begins as two forks along Oregon Avenue, southwest of the U.S. Park Police Horse Stables, before merging into one tributary.

PURPOSE AND NEED

The purpose of the project is to rehabilitate and stabilize Bingham Run and Milkhouse Run, the headwater stretches of two degraded tributaries of Rock Creek. The project is needed because a significant increase in impervious surfaces in the watershed through the years has produced powerful, high-volume stormwater flows in these tributaries. These flows have damaged the tributaries by causing erosion and sedimentation, which have destabilized the surrounding environment (e.g., trees), reduced infiltration of water into underlying aquifers, and compromised wildlife habitat. Without intervention, stormwater will continue degrading these resources.

PROJECT BACKGROUND

The park's enabling legislation, passed in 1890, continues to guide planning and management. It states that Rock Creek Park is to be "perpetually dedicated and set apart as a public park or pleasure ground for the benefit and enjoyment of the people of the United States." It specifies that the park is to "provide for the preservation from injury or spoliation of all timber, animals, or curiosities within said park, and their retention in their natural condition, as nearly as possible."

In a natural environment, a significant portion of precipitation infiltrates the soil and eventually enters groundwater aquifers. Moved by gravity, water emerges from these aquifers into above-ground waterways, where it is referred to as "base flow." However, in urbanized environments, impervious surfaces, such as roads and parking lots, hamper infiltration and decrease base flow. During precipitation events, water runoff from impervious surfaces discharges directly or indirectly into waterways, often causing erratic and violent storm surges. When waterways are not equipped to handle the energy and volume of these surges, soil erosion occurs, which harms surrounding vegetation and causes sediment deposition downstream, negatively impacting aquatic species. This is shown below in Figures 1 and 3.

Regenerative Stormwater Conveyances (RSCs) utilize a series of shallow aquatic pools, riffle/weir/grade controls, native vegetation, and an underlying sand channel to absorb and control the flow of stormwater. These systems are designed to convey flows associated with extreme floods, such as a 100-year flood event, in a manner that minimizes erosion. There are many benefits of RSCs. They include providing a base-flow channel, trapping sediment and nutrients, recharging groundwater beneath stream beds, and creating wildlife habitat. This is shown in Figures 2 and 3.

Figure 1: Storm water Damage in Fairmount Park, Pennsylvania (before)

Figure 2: Installed RSC in Fairmount Park, Pennsylvania (after)

Figure 3: Mount Vernon, Virginia – before (left) and after (right) installation of a RSC

Rock Creek Park is located in northwest Washington, D.C. Rock Creek is a tributary of the Potomac River, which is part of the Chesapeake Bay watershed (see Figures 4 and 5). Rock Creek Park is managed by the National Park Service (NPS) and is the largest contiguous natural space within the District of Columbia. It covers over 2,000 acres in the Rock Creek Valley, including Rock Creek and many of its tributary streams. Bingham Run and Milkhouse Run are tributaries of Rock Creek. The proposed project area is within U.S. Reservation 339 of Rock Creek Park, along Oregon Avenue, NW, between Military Road and Bingham Drive (see Figure 6).

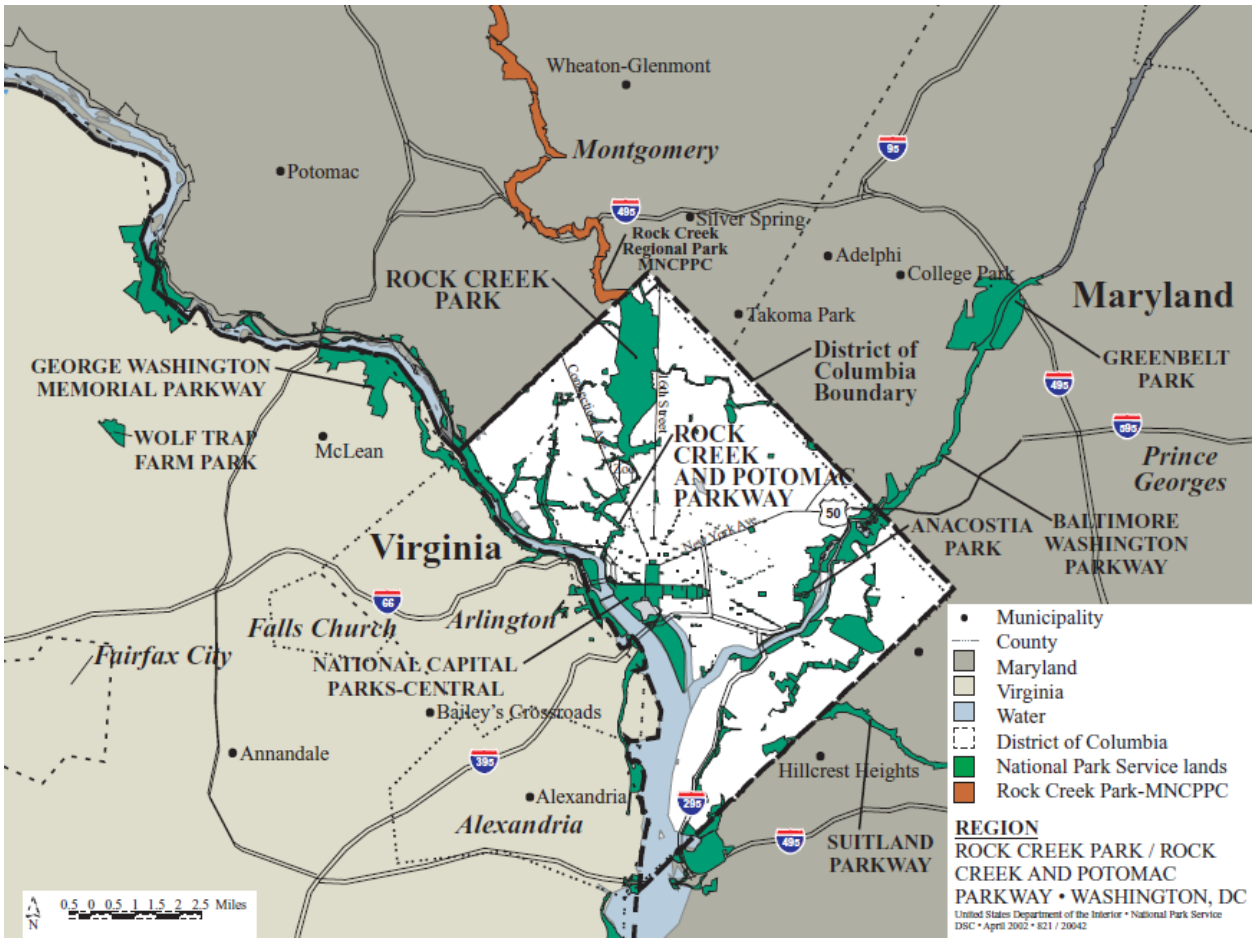
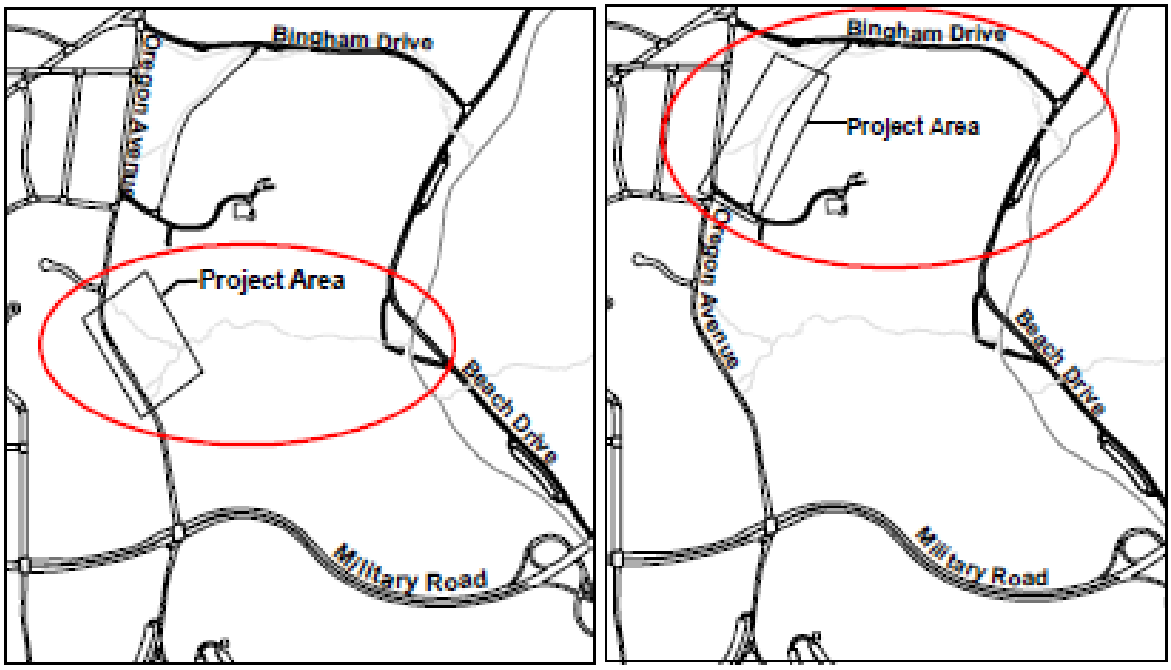


Figure 4: Rock Creek Park and Surrounding Areas

Figure 5: Reservation 339 of Rock Creek Park



Milkhouse Run **Bingham Run**

Figure 6: Project Locations

Bingham Run and Milkhouse Run have been damaged by stormwater, as shown below in Figures 7 & 8. Over time, increasingly powerful and high-volume stormwater flows have scoured the banks of both streams, undercutting surrounding trees and other vegetation, and exposing utility lines, including sanitary sewer pipes. In addition, eroded soil from the banks has been carried downstream, damaging aquatic habitat. Instead of natural waterways characterized by step pools and surrounding vegetation, these tributaries now flow in severely eroded and deepened channels. Without intervention, the health of these tributaries will continue to deteriorate.

Figure 7: Bingham Run (December 2010)

Figure 8: Milkhouse Run (December 2010)

To protect these tributaries, DDOE and the NPS propose to install RSCs. The RSCs would promote infiltration, control stormwater surges, and reduce erosion that causes sedimentation in the tributaries, Rock Creek and the Potomac River. Pursuant to a Memorandum of Understanding (MOU), DDOE and the NPS would work together to plan, build and maintain the RSCs. DDOE would provide funding to install the RSCs, and the park would assume maintenance responsibility of the RSCs after an agreed-upon number of years.

In 2008, DDOE suggested to the NPS that a RSC project might be appropriate in Rock Creek Park. DDOE and NPS surveyed stormwater damage along Oregon Avenue, NW and discussed potential solutions. At Bingham Run, they agreed that the installation of a RSC could be effective, and DDOE offered to include the installation as a part of its EPA 319 (non-point source pollution) grant.

In late 2008, Superintendent Adrienne Coleman sent DDOE a letter of support for the RSC project. The letter stated that NPS staff "see great promise and potential for … the regenerative stormwater conveyance stream restoration strategy" and "look forward to working together … during the planning, design and ultimate implementation of this project." DDOE subsequently secured grant funding for the project and sent it out for bid. After a competitive bidding process, Biohabitats, Inc. was selected as the contractor.

In the spring of 2009, DDOE prepared a list of potential restoration projects to fund under the American Recovery and Reinvestment Act. With NPS consent, DDOE proposed Milkhouse Run, and the proposal was accepted. After a competitive bidding process, Biohabitats was again selected as the contractor.

SCOPING PROCESS

The National Environmental Policy Act (NEPA) requires federal agencies to assess the environmental impacts of federal projects and disclose these impacts to the public. The National Historic Preservation Act (NHPA) requires federal agencies to assess the impact of federal projects on places that are listed on the National Register of Historic Places. Together, NEPA and NHPA require an "early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action." To determine the scope and significance of issues, meetings were held with lead agencies and scoping letters were sent to potentially interested parties.

NPS and DDOE conducted several meetings to investigate the feasibility of installing RSCs at Bingham Run and Milkhouse Run. In addition to the initial field meeting in October 2008, park representatives and DDOE inspected a RSC installed at Donaldson Run, a degraded urban stream in Arlington County, Virginia. On April 27, 2010, park and DDOE staff met at the proposed project sites with staff from Biohabitats, the company contracted by DDOE to perform the proposed RSC work. On August 19, 2010, a park representative attended a tour of RSCs installed by Biohabitats in and around Annapolis, Maryland.

In addition, park staff met frequently in 2009 and 2010 to determine potential issues that might arise in connection with the proposed project. Park staff determined these issues included (1) impacts to environmental and cultural resources; (2) connected, similar, and cumulative actions; and (3) the appropriate compliance documentation. At an internal meeting held on December 8, 2010, the park completed an Environmental Screening Form (ESF), identifying park resources that would be impacted by the proposed project.

Throughout the scoping process, the park examined how best to minimize project impacts, which are discussed in further detail below. Of particular concern were impacts to vegetation, especially those caused by access routes for heavy equipment and project materials delivery. Other noteworthy issues included (1) the health and safety of park visitors, who use the Western Ridge Trail adjacent to Bingham Run and multi-use trail adjacent to Milkhouse Run (hereinafter "Milkhouse Multi-use Trail"); (2) plans by the District Department of Transportation (DDOT) to repave Oregon Avenue, especially its proposals for storm-water mitigation; and (3) potential impacts on cultural resources such as Old Bingham Road and nearby archeological artifacts.

In addition to internal scoping, the park sent outside stakeholders letters requesting comment on the proposed project. Recipients included St. John's College High School; Advisory Neighborhood Commissions (ANC) 3/4G; Friends of Rock Creek's Environment (FORCE); The Army Distaff Foundation, Inc., which operates a nearby facility for seniors; and the Rock Creek Community Garden Association.

After receiving a scoping letter, ANC 3/4G asked DDOE and NPS to speak about RSCs at the ANC's monthly meeting. On February 28, 2011, representatives from DDOE and NPS delivered a short presentation about RSCs and fielded questions. Most of the questions involved project details. One

constituent asked whether DDOE and NPS were coordinating with DDOT, which was planning to repave Oregon Avenue. DDOE and NPS responded that the agencies were collaborating on all aspects of the repaving project, including stormwater management strategies that would be acceptable to the park and surrounding homeowners.

ISSUES AND IMPACT TOPICS

ISSUES

Issues describe problems or concerns associated with impacts from current environmental conditions and operations, as well as problems or concerns that may arise from the implementation of any of the alternatives presented in this Environmental Assessment. Potential issues associated with the proposed actions at Rock Creek Park were identified by NPS staff during internal scoping meetings. Issues and concerns identified include:

Natural Resources

- Stormwater runoff has caused extensive bank erosion, sediment loading and incised channels, affecting the area's natural resources including soils, topography, water quality, hydrology, vegetation, and wildlife.

Cultural Resources

- The degradation of these streams diminishes the integrity of the cultural landscapes.
- Current stormwater damage to resources located near the proposed project areas within the Rock Creek Park Historic District.

Visitor Use

- During construction, park visitors who use the Western Ridge Trail and Milkhouse Multi-use Trail may be disturbed.

IMPACT TOPICS ANALYZED

The following impact topics are discussed in the "Affected Environment" chapter and analyzed in the "Environmental Consequences" chapter. These topics are resources of concern that could be beneficially or adversely affected by the actions proposed under each alternative, and are analyzed to ensure that the alternatives are evaluated and compared based on the most relevant topics.

Cultural Resources

The National Historic Preservation Act (NHPA; 16 USC 470 et seq.), NEPA, the NPS Organic Act, NPS 2006, DO #12 (Conservation Planning, Impact Analysis and Decision-making), and NPS-28 (Cultural Resources Management Guideline) require the consideration of impacts on any cultural resource that might be affected by a proposed federal action. The NHPA specifically requires consideration of impacts on a cultural resource either listed in, or eligible to be listed in, the National Register of Historic Places (NRHP). Cultural resources include archeological resources, cultural landscapes, historic structures and districts, ethnographic resources, and museum objects, collections, and archives. Cultural landscapes and historic structures and districts will be analyzed in this EA.

Cultural Landscapes: The Secretary of the Interior's Standards for the Historic Properties with Guidelines for the Treatment of Cultural Landscapes define a cultural landscape as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person exhibiting other cultural or aesthetic values." (NPS 1995) A preliminary park-wide cultural landscape inventory was initiated, but never completed, in 1997. From this effort, the park as a whole was identified as a cultural landscape, as were Peirce Mill (NPS 2003a) and Linnaean Hill (NPS 2003b). In 2010, NPS began a Cultural Landscape Report on the Historic Trails in the park. This study will include identification and

analysis of all the horse, foot, and multi-use trails located in Rock Creek Park to north of the zoo tunnel that connects Beach Drive to the Rock Creek and Potomac Parkway.

The proposed project, which would alter the damaged landscape, would occur close to a section of the Western Ridge Trail, part of the historic circulation within Rock Creek Park and a contributing component of the park's cultural landscape. Therefore, the impact topic of cultural landscapes will be analyzed.

Historic Structures and Districts: The Rock Creek Park Historic District was listed in the National Register of Historic Places in 1991. The district encompasses all of US Reservation 339, which is a 1,755-acre parcel of Rock Creek Valley, a picturesque, forested valley characterized by sloping hills and meadows and gorge-like scenery.

In order for a structure or building to be listed in or eligible for listing in the NRHP, it must possess historic significance and the integrity to convey that significance with respect to location, setting, design, feeling, association, workmanship, and materials. Contributing structures within the Rock Creek Park Historic District include Peirce Mill, roadways and 11 bridges.

There are at least four contributing resources to the Rock Creek Park Historic District in or around the proposed project site: (1) Old Bingham Road (including its historic lamp post and cobble stone gutter); and (2) the Western Ridge Trail, one of several trails that have played an integral role in park operations since 1890; (3) a culvert adjacent to Bingham Run, underneath the Western Ridge Trail; and (4) a culvert located at the intersection of Bingham Road and Old Bingham Road. During construction of the RSCs, Old Bingham Road would be used to store materials. Therefore, the impact topic of historic structures and districts will be analyzed.

Topography and Soils

The proposed project would occur at the boundary of the Piedmont and Coastal Plain physiographic provinces, where the topography is relatively flat. Although the project would not increase impervious surfaces, it would involve the grading of soils and the addition of soils, rocks and other natural materials used to construct the RSCs. Therefore, the impact topic of topography and soils will be analyzed.

Hydrology

The proposed RSC project will allow Milkhouse Run and Bingham Run to convey stormwater surges in a non-destructive manner, which will alter the hydrology by facilitating groundwater recharge and increase base flow. Also, temporary disruptions of stream flow resulting from erosion and sediment control methods, such as coffer dams, could occur during construction. Therefore, the impact topic of hydrology will be analyzed.

Water Quality

The proposed RSC project would rehabilitate incised banks that contribute to sedimentation and water pollution, use sand beds to raise water levels, and promote the filtering of groundwater into aquifers. However, temporary turbidity increases to surface water could occur during construction activities. Therefore, the impact topic of water quality will be analyzed.

Wetlands

Wetlands include areas inundated or saturated by surface or groundwater for a sufficient length of time during the growing season to develop and support characteristic soils and vegetation. The NPS classifies wetlands based on the Cowardin system, which requires that wetlands possess one or more of the following attributes:

- The habitat at least periodically supports predominately hydrophytic vegetation (wetland vegetation);

- The substrate is predominately undrained, hydric soil; or
- The substrate is non-soil and saturated with water, or covered by shallow water at some time during the growing season. (Cowardin 1979)

The proposed project area contains riverine wetlands. Therefore, the impact topic of wetlands will be analyzed.

Floodplains: Executive Order 11988 (Floodplain Management) requires an examination of impacts to floodplains and the potential risk involved in placing facilities within floodplains (also see NPS 2006, Section 4.6.4, Floodplains; 1993 NPS Floodplain Management Guidelines; DO 77-2; and 1983 General Management Plan). The proposed project would raise the streambed of the existing tributaries, thereby reviving degraded riparian zones, such as plant communities and wildlife habitat, and possibly affecting floodplain environmental processes. Therefore, the impact topic of floodplains will be analyzed.

Wildlife and Wildlife Habitat

The NPS protects the abundance and diversity of all naturally occurring plant and animal communities within its jurisdiction (NPS 2006; DO 77). The proposed project would impact wildlife and wildlife habitat. To install the RSCs, the contractor would remove several tress in the project area and potentially reduce habitat for aquatic and/or non- aquatic species. Once installed, the RSCs would create habitat for aquatic species. Therefore, the impact topic of wildlife and wildlife habitat will be analyzed.

Vegetation

Vegetation would be directly affected by the proposed project. For example, trees and other plants would be removed to access to the worksites and install the RSCs. Therefore, the impact topic of vegetation will be analyzed.

Park Operations and Management

The project involves construction of new infrastructure, which could require ongoing maintenance. RSCs are natural systems that, once established, should require little maintenance. However, pursuant to a Memorandum of Understanding between the park and DDOE, DDOE will maintain the RSCs for an agreed-upon number of years. Thereafter, the park will be responsible for maintenance. Therefore, the impact topic of park operations and management will be analyzed.

Visitor Use and Experience

The Western Ridge Trail and Milkhouse Multi-use Trail, which parallel Oregon Avenue, NW, attract thousands of visitors per year. The proposed project would occur close to these trails, affecting how park visitors use and enjoy the trails and surroundings. Therefore, the impact topic of visitor use and experience will be analyzed.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

Transportation/Traffic

The proposed project is located near a high-traffic area for visitors and commuters. Proposed construction activities would have a negligible impact on the use of nearby roads and parking areas. The vast majority of the project will take place on or under unpaved National Park Service land. Any lane closures or detours along Oregon Avenue caused by the project would be brief and compliant with the Manual of Uniform Traffic Control Devices (MUTCD). Therefore, the impact topic of transportation/traffic is dismissed from further analysis.

Health and Safety

Although construction sites are potentially hazardous, the contractor chosen to perform the work would abide by all applicable health and safety regulations. Further, the work would be performed outdoors, in a

wooded area away from buildings and public gatherings. Therefore, the impact topic of health and safety is dismissed from further analysis.

Air Quality

The Clean Air Act and NPS Management Policies 2006 require decision-makers to consider air quality impacts from NPS projects. The proposed project would have a negligible impact on air quality. Vehicle emissions would have an adverse effect on air quality, but this would be temporary and the contractor would comply with all federal and D.C. regulations regarding construction-related air quality. Further, once installed, the RSCs would have no impact on air quality. Therefore, the impact topic of air quality is dismissed from further analysis.

Cultural Resources

Museum Objects: The NPS defines a museum object as "a material thing possessing functional, aesthetic, cultural, symbolic, and/or scientific value, usually moveable by nature or design. Museum objects include pre-contact Native American and historic objects, artifacts, works of art, archival material, and natural history specimens that are part of a museum collection." (NPS 2002) Within the proposed work area, there are no museum objects. Therefore, the impact topic of museum objects is dismissed from further analysis.

Ethnographic Resources: The NPS defines ethnographic resources as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence or other significance in the cultural system of a group traditionally associated with it." (DO 28, page 181) Ethnographic resources present in Rock Creek Park include the Colored Union Benevolent Cemetery and Quaker Burial Ground. To date, no ethnographic resources have been identified in or around the proposed work area. Therefore, the impact topic of ethnographic resources is dismissed from further analysis.

Archeological Resources: The four-year archeological inventory and evaluation study of Rock Creek Park was completed in 2008 (Bedell, et al. 2008). During this study, more than 1,100 acres of the park were surveyed for archeological sites and 51 sites were identified. Of those sites identified, 11 were archeological components associated with known historic sites, such as Fort Totten and Peirce Mill, and 40 were new discoveries. The sites include Native American camps and quarries, dumps and a barracks area associated with Civil War forts, colonial farms, nineteenth-century tenant dwellings, and remains of the Battle of Fort Stevens in July 1864.

As part of the 2008 study, Site 51NW186 was identified in the vicinity of Bingham Run but outside the limits of disturbance (LOD) for the proposed RSC project. Given this discovery and the potential for archeological resources within this area of Rock Creek Park, a Phase I archeological testing was initiated during the fall of 2010. All testing work was located within the proposed project's LOD. The results indicated that there are no intact archeological resources in proposed areas of ground disturbance along Milkhouse Run and Bingham Run (see a summary of these findings in Appendix C). Therefore, the impact topic of archeological resources is dismissed from further analysis.

Soundscapes

As described in NPS 2006 and DO 47, preservation of natural soundscapes associated with national park units is an important part of the NPS mission. Natural sounds associated with each park administered by the NPS are contextual, depending on factors such as location, surrounding activities, vegetation, and wildlife. Tolerance for the introduction of human-created noise increases as one approaches developed areas and moves away from natural areas.

The proposed project would have a negligible impact on existing soundscapes of Rock Creek Park. In and around the worksites, existing noise from vehicular traffic is noticeable, rivaling any short-term noise

associated with construction. Therefore, the impact topic of soundscapes is dismissed from further analysis.

Rare, Threatened, Endangered, Candidate Species and Species of Special Concern

In addition to NPS policy, the Endangered Species Act of 1973 protects rare, threatened, and endangered species (flora and fauna). The United States Fish and Wildlife Service (USFWS) lists one endangered or threatened species that occurs within Rock Creek Park - the endangered Hay's Amphipod, a small, colorless and eyeless crustacean that lives at natural springs.

The proposed project would occur outside of Hay's Amphipod habitat and would not affect the groundwater flows that create the amphipod's habitat. Therefore, the impact topic of rare, threatened, endangered, candidate species, and species of special concern, is dismissed from further analysis.

Socioeconomic Resources and Adjacent Lands

Surrounding the proposed project are higher-income areas with residences, commercial businesses, schools, and federal installations. The proposed project would not affect the operation or enjoyment of these facilities. It would, however, have a short-term, beneficial impact on them by providing temporary employment for construction workers, whose purchases would stimulate the local economy. Any increase, however, would be temporary and negligible, lasting only as long as construction. Therefore, the impact topic of socioeconomic resources and adjacent lands is dismissed from further analysis.

Environmental Justice

Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The goal is "fair treatment": identifying potentially disproportionately high and adverse effects on populations and alternatives that may mitigate these impacts.

Both minority and low-income populations are present in the vicinity of Rock Creek Park. However, the proposed project would not result in any identifiable adverse, human health effect. Also, the impacts associated with the proposed project would not disproportionately affect any minority or low-income population or community. Therefore, the impact topic of environmental justice is dismissed from further analysis.

IMPAIRMENT

According to NPS 2006, an action constitutes an impairment when an impact "would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS 2006 § 1.4.5). Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts. An impact on any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to the opportunity for enjoyment of the park; or
- Identified as a goal in the park's General Management Plan (GMP) or other relevant NPS planning documents.

Impairment findings relate back to park resources and values. Because the impact topics of visitor use and experience and concession operations are not generally considered to be park resources or values according to the Organic Act, they are omitted from the impairment analysis.

A draft impairment determination for the NPS preferred alternative is provided in Appendix A of this document. Park resources considered in this determination include cultural landscapes, historic structures and districts, topography and soils, hydrology, water quality, wetlands, floodplains, wildlife and wildlife habitat, and vegetation. A final impairment determination will be provided in the decision document developed on the findings of this EA.

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CHAPTER 2: ALTERNATIVES

NEPA requires federal agencies to explore reasonable alternatives aimed at addressing the purpose and need of the proposed project. The alternatives under consideration must include the "no action" alternative (40 CFR § 1502.14). Project alternatives may originate from the proponent agency, local government officials, or members of the public. Alternatives may also originate from coordinating or cooperating agencies.

In accordance with NEPA, the alternatives analyzed herein are the result of internal and external scoping. They satisfy the management objectives of the park while meeting the overall purpose and need of the proposed action. They were selected in lieu of alternatives (also described below) that were considered but rejected because they were not technically feasible, created excessive adverse impacts to cultural and/or natural resources, and/or conflicted with the overall management principles of the park.

The NPS explores and objectively evaluates two alternatives in this EA, including:

- Alternative A: No Action
- Alternative B: Installation of regenerative stormwater conveyances at Bingham Run and Milkhouse Run.

ALTERNATIVE A – NO ACTION

Under alternative A, stormwater from the upper watershed would continue to damage Bingham Run and Milkhouse Run. During precipitation events, water runoff from impervious surfaces outside the park would discharge into these waterways, causing powerful, high-volume stormwater surges. Unequipped to handle the energy of these surges, Bingham Run and Milkhouse Run would continue to suffer soil erosion. This would continue to harm surrounding vegetation and cause sediment deposition downstream, negatively impacting aquatic species. This no action alternative provides a baseline for assessing the effects of alternative B.

ALTERNATIVE B – REGENERATIVE STORMWATER CONVEYANCES

Under alternative B, RSCs would be installed at Milkhouse Run and Bingham Run. The RSCs would utilize a series of shallow aquatic pools, riffle/weir/grade controls, native vegetation, and an underlying sand channel to absorb and control the conveyance of stormwater. Designed to convey flows associated with extreme storms (such as a 100-year event) in a non-erosive manner, the systems would trap sediments and nutrients, recharge groundwater beneath and adjacent to stream beds, and create wildlife habitat.

At Bingham Run, work would occur on approximately 600 linear feet and 6,000 square feet of waterway (see Figure 9). Old Bingham Road would be used to access the worksite and store construction materials. Materials would be brought to and removed from the worksite each day, so only the current day's materials would be stored on Old Bingham Road. The limits of disturbance (LOD) for this site would extend the length of the proposed work within Bingham Run, closely hugging the tributary on the west side and including Old Bingham Road on the east side.

At Milkhouse Run, work would occur on approximately 2,300 linear feet and 23,000 square feet of waterway (see Figure 10), including two forks – the North Fork and South Fork – that merge and continue as one waterway. Given the wooded terrain, accessing the worksite would present a challenge. However, a 15-foot wide access path has been identified that would minimize impacts to vegetation (see Figure 10) and accommodate construction vehicles. A thick layer of mulch would be placed on the access path to minimize soil compaction. The LOD for this site would closely hug the access path and tributaries. The project contractor would store construction materials in a small area next to the North Fork, and materials would be brought to and removed from the worksite each day, so only the current day's materials would be stored there.

Each RSC would be installed in the same way. The contractor would first place a pipe on the bed of the tributary to divert and protect water flow during construction. Using an excavator, the contractor would then fill the tributary with a thick layer of sand, ensuring that the excavator drives only on the sand, not on the streambed. Next, working within each tributary, from the bottom of the project area to the top, the contractor would add layers of soil on top of the sand and then, on the surface layer, use stones and felled trees to created aquatic step pools. The pools would sit just below the top edge of the stream banks. During rain events equal to or less than a 100-year storm, the pools would manage water in a non-erosive manner, while preventing it from overflowing the banks. Finally, the contractor would revegetate areas within the LOD with native, plant species approved by the NPS.

Most of the project would involve minimal grading and/or excavation. However, at two locations along Milkhouse Run – the beginning of the North Fork and the end of the South Fork (near the confluence of the forks), some grading and excavation would occur to shift each tributary approximately 10 to 20 feet from the center of the existing channel to improve the hydrological performance of the RSC.

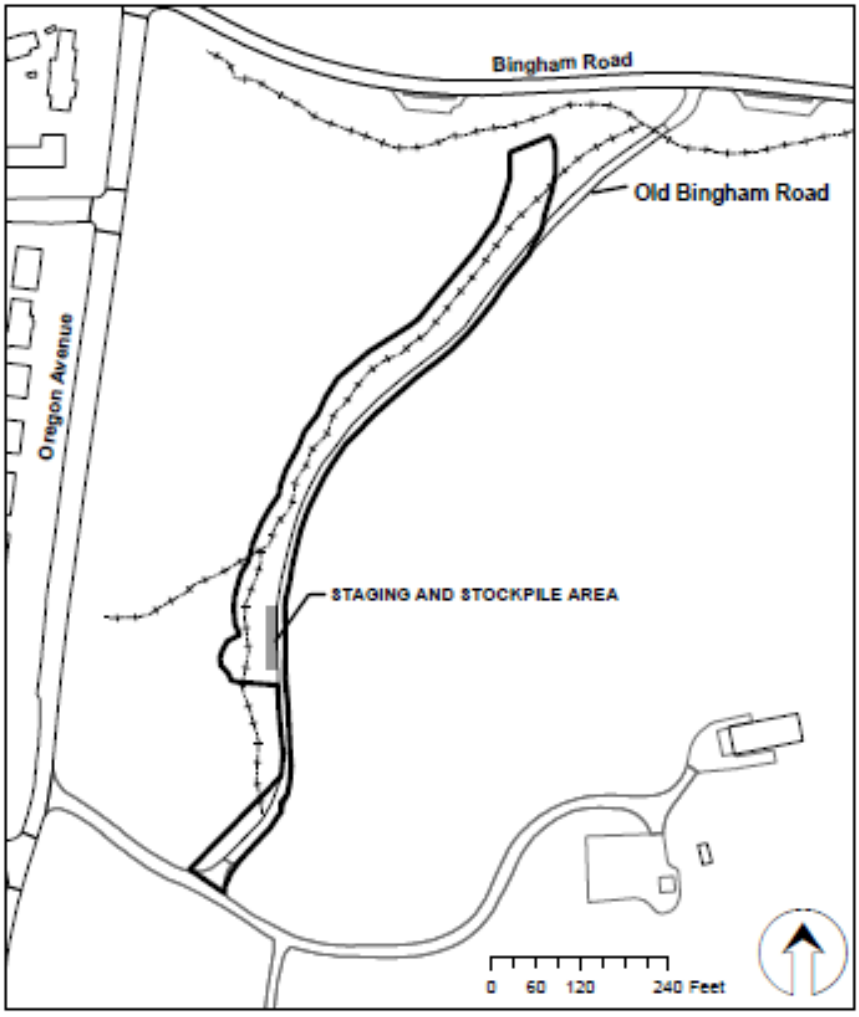

Figure 9 - Limits of Disturbance at Bingham Run

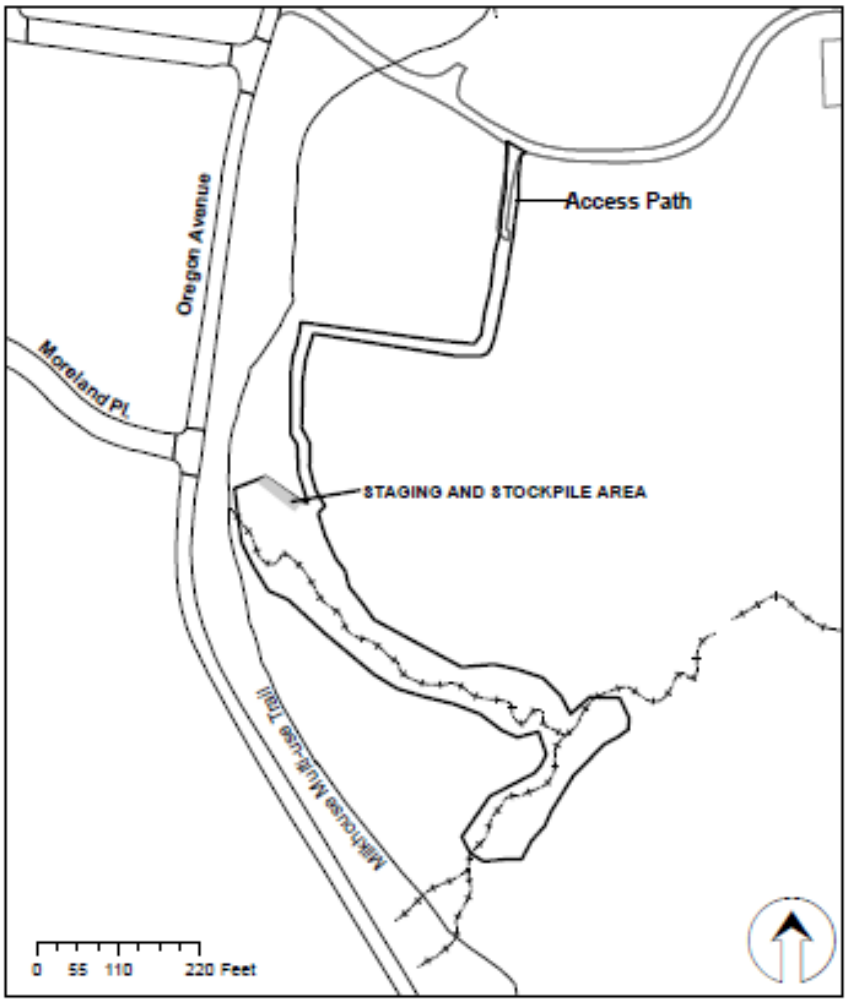

Figure 10 – Limits of Disturbance at Milkhouse Run

MITIGATION MEASURES

The NPS places a strong emphasis on avoiding, minimizing, and mitigating potentially adverse impacts to park resources. To help ensure the protection of natural and cultural resources and the quality of the visitor experience, the following protective measures would be implemented as part of the selected action alternative. The NPS would implement an appropriate level of monitoring throughout the construction process to help ensure that protective measures were properly implemented and achieving their intended results.

Cultural Resources

- Archeological investigations were conducted to determine whether resources are present in the proposed project area. These investigations were carried out by the NPS in coordination with the State Archeologist. No archeological resources were found. If unknown archeological resources are discovered, all work in the immediate vicinity of the discovery would be halted until the resources could be evaluated and an appropriate mitigation strategy developed, if necessary. This strategy would be developed in consultation with the District of Columbia Historic Preservation Office (SHPO), following the procedures for post-review discoveries found in the Advisory Council on Historic Preservation's Protection of Historic Properties (36 CFR 800.13). 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.

- Construction materials would be brought to and removed from the Bingham Run worksite each day, so only the current day's materials would be stored on Old Bingham Road.
- Protection of features along Old Bingham Road, including the historic lamp post and cobble stone gutter, would be implemented. This would include matting to protect historic surfaces, such as the road and cobbles, and fencing to protect the lamp post. Also, the historic culvert that abuts the LOD would be flagged and covered with matting.

Vegetation

- Revegetate disturbed areas using native species determined by the NPS.
- Within the project's limits of disturbance (LOD), use flagging or snow fencing to protect the root zones of trees not slated for removal and root prune any trees whose roots may be adversely impacted.
- Use a 15-foot wide raised access path to Milkhouse Run, covered with woodchips, that minimizes impacts to vegetation.

Visitor Use and Experience

- The Western Ridge Trail and Milkhouse Multi-use Trail would remain open at all times and made safe by warning signs, barricades and/or other measures.

Topography and Soils

- Approved erosion and sediment control plan, including use of silt fences and hay bales.
- Mitigate any soil compaction caused by construction equipment through soil aeration and other measures, if necessary.
- Revegetate disturbed areas using native species.

Water Quality

- Install a pipe on the bed of each tributary receiving a RSC to divert and protect water flow during construction.
- To prevent spills of fuels, lubricants, or other contaminants from entering waterways or wetlands, a NPS-approved Spill Response Kit must be present at all times, and any personnel working at the site shall be trained in the use of the kit. Also, all vehicle refueling or maintenance must occur on an asphalt surface.

Wetlands

- No storage of materials in wetlands will be permitted. Construction materials must be stabilized with straw bales, filter cloth, or other appropriate means to prevent contamination of waterways or wetlands.
- No work will occur during rain events.

ALTERNATIVES CONSIDERED BUT DISMISSED

Several alternatives or alternative elements were identified during the design process and scoping. After consulting with scientific and administrative personnel from NPS and DDOE, some of these were determined to be unreasonable, or much less desirable than other alternatives, and were therefore not

carried forward for analysis in this EA. Justification for eliminating alternatives from further analysis was based on factors relating to:

- Technical or economic infeasibility;
- Conflicts with already-established park uses;
- Duplication with other less environmentally damaging alternatives;
- Conflict with the statement of purpose and need, or other policy; and/or
- Severe impact on environmental or cultural resources.

Hard engineering alternatives such as lining the existing channel with concrete piping, gabion baskets, rip-rap, or similar hard armoring was dismissed as inconsistent with NPS policies, project goals, and fiscal constraints. Furthermore, erosion would be exacerbated wherever these hard armoring approaches ended and discharged into unprotected sections of the tributaries.

Another stream restoration technique considered but dismissed was the natural channel approach. This approach reshapes the stream channel using natural materials and some grading to meet existing flow conditions and convey water in a non-erosive way without significant infiltration or treatment. The natural stream channel technique can be used in different ways depending on site conditions. To generalize, there are two approaches that define the ends of a spectrum of natural stream channel design:

a) When space exists, grade back the banks of the stream to reduce erosive forces and reconnect the stream with its existing floodplain (if present); and
b) When space is limited, use structures, natural materials, and plantings to keep water flow in the center of the channel to reduce erosive forces.

These alternatives were dismissed for several reasons. The natural stream channel approach described in a) above would require significant grading and the removal of many trees, an unacceptable adverse impact on the existing forest ecosystem. Additionally, although this approach would dissipate some stream energy, it would infiltrate far less stormwater than a RSC.

The impact of the natural stream channel approach described in b) above on the stream and surrounding forest ecosystem would be similar to that of the proposed project. However, this approach would not dissipate significant amounts of energy from rushing stormwater, nor would it replenish underlying aquifers with infiltrated water or protect downstream segments of the tributaries from damage.

Finally, the NPS and DDOE considered the prospect of treating stormwater in the upper watershed, before it reaches Bingham Run and Milkhouse Run. Stormwater from impervious surfaces such as roofs, driveways and roads can sometimes be treated at or near its source with bioretention ponds or swales, shade trees, rain barrels and pervious surfaces. RiverSmart Homes, a program offered by DDOE, helps homeowners install such stormwater controls on their properties. However, the effort to convince homeowners to install and use these controls voluntarily in large enough numbers to curtail significant amounts of stormwater in Bingham Run and Milkhouse Run would be expensive and time consuming. In addition, while the stormwater controls were being implemented over the course of several years, the tributaries in question would continue to degrade.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Criteria for selecting the environmentally preferable alternative include:

- Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations;

- Assuring for all generations safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserving important historic, cultural and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieving a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities; and
- Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources (NEPA, Section 101).

The NPS is required to identify the environmentally preferable alternative in its NEPA documents for public review and comment. The NPS, in accordance with the Department of the Interior policies contained in the Departmental Manual (516 DM 4.10) and the Council on Environmental Quality's (CEQ) *NEPA's Forty Most Asked Questions*, defines the environmentally preferable alternative (or alternatives) as the alternative that best promotes the national environmental policy expressed in NEPA (Section 101(b) (516 DM 4.10). In their *Forty Most Asked Questions*, CEQ further clarifies the identification of the environmentally preferable alternative, stating "[o]rdinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."

After completing the environmental analysis contained herein, the NPS identifies alternative B as the environmentally preferable alternative because it best meets the definition established by the CEQ. Alternative A would lead to the further degradation of Milkhouse Run and Bingham Run, including erosion that jeopardizes large trees and possibly cultural resources like Old Bingham Road, alternative B would use natural materials to prevent erosion, provide a base-flow channel, trap sediment and nutrients, recharge groundwater beneath stream beds, and create wildlife habitat. Consequently, alternative B best protects, preserves, and enhances historic, cultural, and natural resources.

A summary of environmental consequences associated with each alternative is shown below in Table 1.

Table 1: Summary of Environmental Consequences

Impact Topic	Alternative A: No action Alternative	Alternative B: Installation of RSCs
Cultural Landscapes	**Direct/Indirect Impacts**: The Western Ridge Trail is a character-defining feature of the park's cultural landscape of historic trails. The resulting adverse impacts from the continued degradation of the Bingham Run, and it's potential to affect the trail, would be minor and of long duration. **Cumulative Impacts**: Improvements at Peirce Mill and the continued implementation of the park's GMP, in combination with the impacts associated with alternative A, would result in a park-wide, long-term beneficial impact (due to protection of cultural resources located inside and outside the project area). Depending on erosion patterns, there is potential for a finding of adverse effect under the NHPA.	**Direct/Indirect Impacts**: RSCs would modify the existing landscape features and also be a departure from historic conditions, a local, long-term, minor adverse impact. However, the RSCs would protect features that contribute to the historic landscape of Rock Creek Park, such as the Western Ridge Trail, from damage caused by erosion, a local, long-term, beneficial impact. Also, the installation of RSCs (and associated construction) would constitute a local, short-term, minor, adverse impact. **Cumulative Impacts**: Improvements at Peirce Mill and the continued implementation of the park's GMP, along with alternative B, would result in park-wide, long-term beneficial impacts (due to protection of cultural resources located inside and outside the project area). There would be no adverse effect under the NHPA.
Historic Structures and Districts	**Direct/Indirect Impacts**: Storm flows would cause continued stream bank erosion, threatening to undermine sections of the Western Ridge Trail and Old Bingham Road (including its historic lamp post and cobble stone gutter), which are contributing resources to the Rock Creek Park Historic District, resulting in potential long-term minor to moderate adverse impacts. **Cumulative Impacts**: Improvements at Peirce Mill and the continued implementation of the park's GMP, in combination with the impacts associated with alternative A, would result in a park-wide, long-term beneficial impact (due to protection of cultural resources located inside and outside the project area). Depending on erosion patterns, there is potential for a finding of adverse effect under the NHPA.	**Direct/Indirect Impacts**: During construction at Bingham Run, Old Bingham Road would be used for material storage and as an access path for equipment, a local, short-term, minor, adverse impact. Over the long term, installation of the RSC at Bingham Run would protect the Western Ridge Trail and Old Bingham Road and would dissipate the energy, and thereby reduce the damaging effects, of stormwater flowing down Bingham Run to culverts located along Bingham Road (below the project area), resulting in long-term, beneficial impacts. **Cumulative Impacts**: Improvements at Peirce Mill and the continued implementation of the park's GMP, in combination with the impacts associated with alternative B, would result in a park-wide, long-term beneficial impact (due to protection of cultural resources located inside and outside the project area).

		There would be no adverse effect under the NHPA.
Topography and Soils	**Direct/Indirect Impacts**: Bingham Run and Milkhouse Run would continue to degrade. In particular, powerful stormwater flows would continue to scour the banks of each tributary, causing sedimentation and channel incising and resulting in long-term moderate adverse impacts. **Cumulative Impacts**: Improvements at Peirce Mill, road/trail paving projects in or adjacent to the park, and the continued implementation of the park's GMP, in combination with the impacts associated with alternative A, would result in long-term, minor to moderate adverse impacts.	**Direct/Indirect Impacts**: Construction equipment would damage soils (i.e., disturbance, compaction), and the installation of RSCs would require limited soil grading and excavation, resulting in short-term, minor, adverse impacts. Upon completion, the RSCs would stabilize surrounding soils and topography, preventing erosion and sedimentation, resulting in long-term beneficial impacts. **Cumulative Impacts**: Improvements at Peirce Mill, road/trail paving projects in or adjacent to the park, and the continued implementation of the park's GMP, in combination with the impacts associated with alternative B, would result in short-term and long-term minor adverse cumulative impacts, as well as long-term beneficial impacts.
Hydrology	**Direct/Indirect Impacts**: Unnatural stream flows within Bingham Run and Milkhouse Run would continue as uncontrolled stormwater flows from surrounding roads and properties, resulting in long-term moderate adverse impacts to the hydrology of these tributaries. **Cumulative Impacts**: The rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) would have a local, long-term, beneficial impact on the hydrology of Rock Creek, and the repaving of Oregon Road would have beneficial impacts on stormwater runoff entering the park. In addition, the overall urbanization of the watershed would continue to adversely impact the hydrology of the streams within the region. These impacts, in combination with the impacts from the alternative A, would have long-term moderate adverse cumulative impacts on hydrology within the watershed.	**Direct/Indirect Impacts**: RSCs would help control the stormwater runoff entering these streams by slowing the flows within the channels, and allowing more of the water to infiltrate into groundwater, a long-term beneficial impact. During construction conducted along approximately 2,900 feet of stream channel, water would be diverted through a pipe installed along each stream bed, which would result in short-term, negligible adverse impacts. **Cumulative Impacts**: The rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) would have a local, long-term, beneficial impact on the hydrology of Rock Creek, and the repaving of Oregon Road would have beneficial impacts on stormwater runoff entering the park. In addition, the overall urbanization of the watershed would continue to adversely impact the hydrology of the streams within the region. These impacts, in combination with the impacts from the alternative B, would have long-term moderate adverse cumulative impacts on hydrology within the watershed.

Water Quality	**Direct/Indirect Impacts**: Uncontrolled stormwater flows within Milkhouse Run and Bingham Run would continue to convey sediments (caused by the erosion), and small amounts of pollutants originating from area roads and neighboring properties, into Rock Creek, resulting in minor adverse impacts to water quality. **Cumulative Impacts**: The rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), in combination with impacts from alternative A, will have local and park-wide, long-term, beneficial impacts on water quality.	**Direct/Indirect Impacts**: RSCs would improve water quality within the Rock Creek Watershed by slowing stormwater flows in a non-erosive manner so as to limit sedimentation and help filter pollutants through groundwater infiltration, resulting in long-term beneficial impacts to water quality. During construction, the proposed project could cause sedimentation, a local, short-term, minor, adverse impact. **Cumulative Impacts**: The rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), in combination with impacts from alternative B, will have local and park-wide, long-term, beneficial impacts on water quality.
Wetlands	**Direct/Indirect Impacts**: Storm water would continue to degrade the tributary riverine wetlands of Milkhouse Run and Bingham Run, causing local, long-term, moderate, adverse impacts throughout the lengths of these tributaries. **Cumulative Impacts**: The rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), in combination with impacts from alternative A, will have local and park-wide, long-term, beneficial impacts, and local, long-term, moderate, adverse impacts, on wetlands.	**Direct/Indirect Impacts**: Installing RSCs would help restore the overall function and value of degraded riparian wetlands associated with Milkhouse Run and Bingham Run, a local, long-term, beneficial impact. During construction conducted along approximately 2,900 feet of stream channel, the proposed project could cause local, short-term, minor, adverse impacts. **Cumulative Impacts**: The rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), in combination with impacts from alternative B, will have local and park-wide, long-term, beneficial impacts on wetlands.
Floodplains	**Direct/Indirect Impacts**: There is a small, raised "island" floodplain located at the confluence of the North Fork and South Fork within Milkhouse Run. This floodplain gets inundated with water during large storm events, causing erosion and degrading the overall function of the floodplain, resulting in long-term minor adverse impacts to the overall function of this floodplain. **Cumulative Impacts**: Renovation of a	**Direct/Indirect Impacts**: RSCs will greatly slow stormwater flows and help protect the floodplain located at the confluence of the North Fork and South Fork at Milkhouse Run, resulting in long-term beneficial impacts. **Cumulative Impacts**: Renovation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the rehabilitation of Peirce Mill, in combination with alternative B, will have

	stream in Klingle Valley (part of a DDOT multi-use trail project) and the rehabilitation of Peirce Mill, in combination with alternative A, will have long-term minor adverse impacts on floodplains within the watershed.	long-term minor adverse impacts to floodplains within the watershed.
Wildlife and Wildlife Habitat	**Direct/Indirect Impacts**: Stormwater flows would continue destabilizing nearby trees and reducing aquatic and non-aquatic habitat and biodiversity, resulting in long-term minor adverse impacts. Along Bingham Run and Milkhouse Run, downstream populations of amphibians and macroinvertebrates would also be threatened and may result in long-term minor, adverse impacts. **Cumulative Impacts**: Rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), in combination with alternative A, will have local and park-wide, long-term, beneficial impacts on wildlife and wildlife habitat.	**Direct/Indirect Impacts**: RSCs would restore aquatic and non-aquatic habitat by stabilizing channel beds and slopes, a local, long-term beneficial impact. RSCs would also protect downstream populations of amphibians and macroinvertebrates. However, during construction, approximately 22 trees would be removed, resulting in a loss of habitat, a short-term minor adverse impact. **Cumulative Impacts**: Rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), in combination with alternative B, will have local and park-wide, long-term, beneficial impacts on wildlife and wildlife habitat.
Vegetation	**Direct/Indirect Impacts**: Strong storm flows, which have denuded the banks of the streams, would continue to incise and undercut the channels, destabilizing nearby vegetation and resulting in long-term minor adverse impacts. **Cumulative Impacts**: The rehabilitation of Peirce Mill, which might result in the loss of some grasses, shrubs, and trees, and the GMP's charge to remove invasive species and plant naturally occurring species, in combination with alternative A, would result in long-term negligible to minor adverse impacts on vegetation within the park.	**Direct/Indirect Impacts**: After installation, existing vegetation surrounding the RSCs would be protected against erosion damage caused by stormwater, a local, long-term, beneficial impact. However, construction activities would adversely impact vegetation (but no species of special concern), as 22 large trees would be removed – 10 from Milkhouse Run and 12 from Bingham Run, a local, long-term, minor, adverse impact. **Cumulative Impacts**: The rehabilitation of Peirce Mill, which might result in the loss of some grasses, shrubs, and trees, and the GMP's charge to remove invasive species and plant naturally occurring species, in combination with alternative B, would result in long-term negligible to minor adverse impacts on vegetation within the park.
Park Operations and Management	**Direct/Indirect Impacts**: During precipitation events, water runoff from impervious surfaces would flow unimpeded down Bingham Run and Milkhouse Run, eroding soil and	**Direct/Indirect Impacts**: RSCs at Milkhouse Run and Bingham Run would convey stormwater flows in a non-erosive manner, a local, long-term, beneficial impact. However, during planning and

	compromising vegetation. When the culverts along Milkhouse Run and Bingham Run became clogged, the NPS would clear them, a long-term minor adverse impact on park operations and management. **Cumulative Impacts**: It is anticipated that demand for park resources would escalate due to increased use of the park by visitors. This demand would have a detectable but not noticeable effect on park operations and management. The impact, in combination with the impacts associated with alternative A, would result in long-term minor adverse impacts on park operations and management.	construction of the RSCs, park operations would be impacted as park staff divert their energies to provide input, oversight and compliance assistance, a park-wide, short-term, minor, adverse impact. Also, under an agreement with DDOE, the park would assume maintenance responsibilities for the RSCs after an agreed-upon number of years, a park-wide, long-term, minor, adverse impact. **Cumulative Impacts**: It is anticipated that demand for park resources would escalate due to increased use of the park by visitors. This demand would have a detectable but not noticeable effect on park operations and management. The impact, in combination with the impacts associated with alternative B, would result in long-term minor adverse impacts on park operations and management.
Visitor Use and Experience	**Direct/Indirect Impacts**: Storm flows would threaten to undermine sections of the Milkhouse Multi-use Trail and Western Ridge Trail, located near Milkhouse Run and Bingham Run, which could result in long-term minor adverse impacts. **Cumulative Impacts**: Renovations of public buildings and trails throughout the park would have local, short-term, minor, adverse impacts (due to construction) and local, long-term, beneficial impacts. These impacts, in combination with the impacts associated with alternative A would result in long-term beneficial cumulative impacts.	**Direct/Indirect Impacts**: Project work would occur close to the Milkhouse Multi-use Trail, the Western Ridge Trail at Bingham Run, and the Rock Creek Park Community Garden. While these facilities would remain open during construction, users of them would experience the noise and visual intrusions of a construction site; resulting in short-term minor adverse impacts. Once the RSCs were completed, the visual quality of the streams would be improved and the erosion caused by stormwater (that threatens to undermine the trails) would be slowed. As a result, over the long term, the RSCs would have beneficial impacts. **Cumulative Impacts**: Renovations of public buildings and trails throughout the park would have local, short-term, minor, adverse impacts (due to construction) and local, long-term, beneficial impacts. These impacts, in combination with the impacts associated with alternative B would result in long-term beneficial cumulative impacts.

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CHAPTER 3: AFFECTED ENVIRONMENT

Under NEPA, the term "affected environment" is defined as the resources expected to experience environmental impacts from a proposed project. For each of the Analyzed Impact Topics identified above, this chapter provides a detailed description of the resources that might be affected by the project alternatives. Potential impacts on these resources are discussed later in the Environmental Consequences chapter.

CULTURAL RESOURCES

The CEQ regulations that implement NEPA require assessment of impacts on cultural resources as well as natural resources. In accordance with the Advisory Council's regulations for implementing Section 106 of the NHPA (36 CFR Part 800 Protection of Historic Properties), before determining impacts on cultural resources, planners must determine the area of potential effects (APE) and identify cultural resources present in the APE that are either listed in or eligible for listing in the National Register of Historic Places. For the proposed project, two APEs were delineated after consultation with the SHPO and NPS Regional Archeologist Dr. Stephen Potter. As shown in Figure 11, the APE for Archeology resembles the proposed project's limits of disturbance, whereas the APE for Historic Resources is slightly larger.

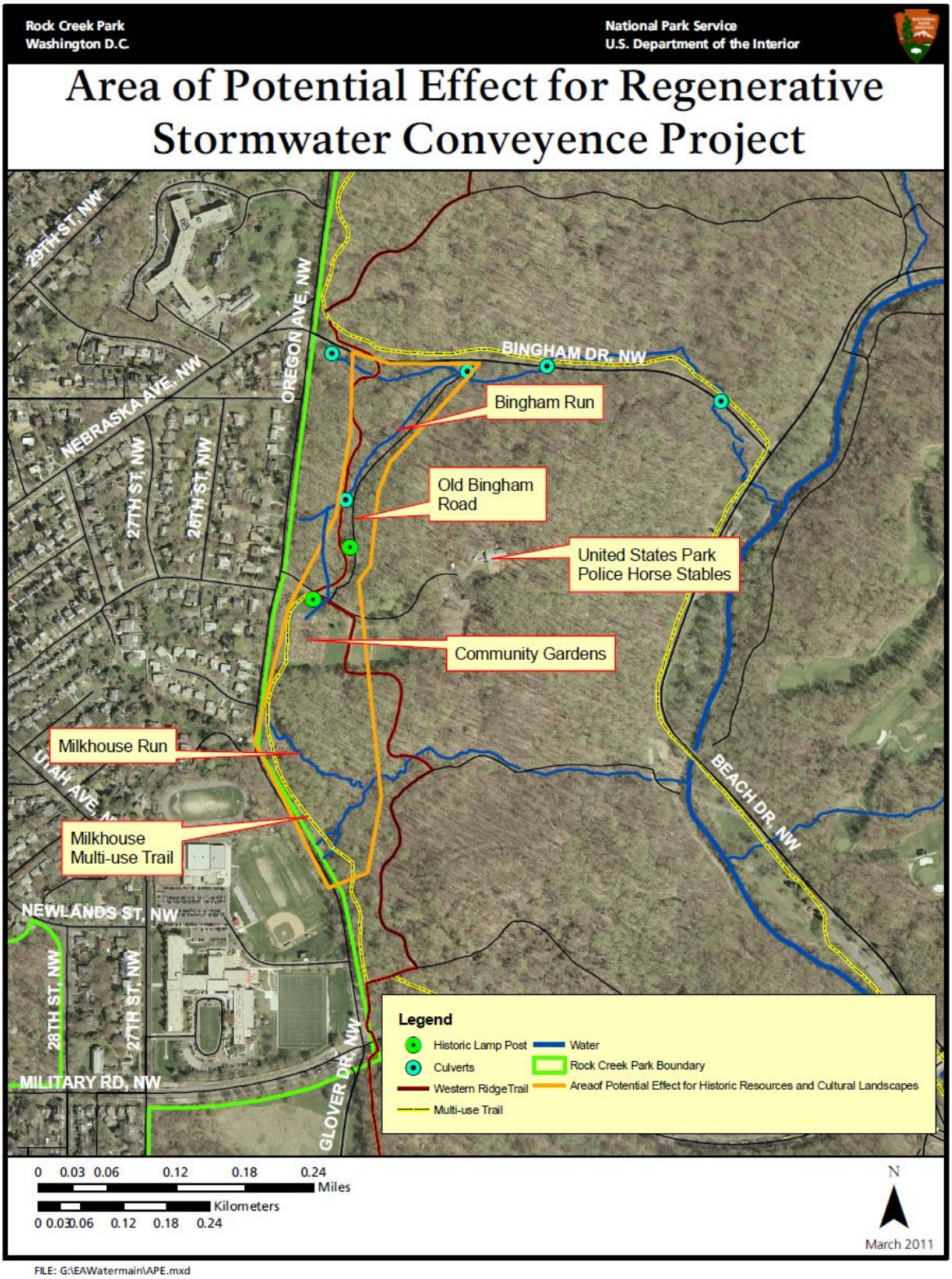

Figure 11: APE for RSC Project

CULTURAL LANDSCAPES

Cultural landscapes, as defined by The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes, consist of "a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (NPS 1996b). The NPS uses 13 features to determine if a landscape is significant. There are four general types of cultural landscapes: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

The most common cultural landscapes within Rock Creek Park are historic sites, historic designed landscapes, and historic vernacular landscapes. A historic site is a landscape significant for its association with a historic event, activity, or person. A historic designed landscape includes parks, large gardens and estates, and is a landscape that was consciously designed or planned, generally by a landscape architect, architect, or horticulturist. A historic vernacular landscape is a landscape that has evolved over time through use by the people whose activities and occupancy shaped it.

Created by an act of Congress in 1890, Rock Creek Park encompasses the last major natural landscape in the District of Columbia. Many areas in the park were little modified prior to the park's creation. Since that time, most of these natural areas have remained intact, as the park has balanced the preservation and maintenance of its natural and cultural resources with the recreational and transportation requirements of modern Washington, D.C. Taken together, Rock Creek Park is a significant cultural and historic landscape.

In 1997, the NPS began a cultural landscape inventory of Rock Creek Park. A cultural landscape inventory (CLI) identifies and documents the characteristics of a cultural landscape that make it significant and worthy of preservation. The CLIs permit the NPS to collate and evaluate information on the location, historical development, and features of the cultural landscapes that will assist park managers in their planning, programming, treatment, and management decisions. The cultural landscape of Rock Creek Park (US Reservation 339) has not been fully inventoried or evaluated for the National Register of Historic Places. However, the results of the inventory started in 1997 show that Rock Creek Park satisfies the criteria for listing in the National Register as a historic designed landscape.

In 2010, NPS began a Cultural Landscape Report on the Historic Trails in the park. This study will include an identification and analysis of all the horse, foot, and multi-use trails located in Rock Creek Park north of the zoo tunnel that connects Beach Drive to the Rock Creek and Potomac Parkway. This includes the Western Ridge Trail, which runs along Oregon Avenue, NW, close to Bingham Run.

HISTORIC STRUCTURES AND DISTRICTS ("HISTORIC RESOURCES")

The Rock Creek Park Historic District covers approximately 1,755 acres. Its boundaries are the same as those for Reservation 339, roughly defined as 16th Street to the east, Oregon Avenue to the west, Klingle Road to the south, and the Maryland boundary and Parkside Drive to the north. The district satisfies National Register Criteria A, B, and C under the themes of architecture, community planning and development, conservation, entertainment and recreation, industry, landscape architecture, military, and horticulture. Contributing structures include Peirce Mill, roadways, trails and bridges. Three such structures -- Old Bingham Road (including its historic lamp post and cobble stone gutter), the Western Ridge Trail, and historic culverts -- are located in or around the proposed projects.

Old Bingham Road

The roads and trails of Rock Creek Park form a historically significant circulation system built and improved between 1831 and 1941. Bingham Road, which was built in 1921, was the first major road construction conducted under the direction of the Office of Public Buildings and Grounds to provide east-west access from Daniel Road (present day Oregon Avenue) to Beach Drive. According to the Olmsted

Brothers' report, Bingham Road was "a more or less urgent construction project" and the conceptual design for the road was to serve as a model for the construction of additional roadways within the park (Davis 1996, 89; Olmsted Brothers Report 1918, 46). The curving design of the road incorporated decorative lamp posts and a cobble stone gutter along the length of the road. Bingham Road now incorporates the active roadway from Oregon Avenue to Beach Drive and a spur that is unofficially known as Old Bingham Road, which was abandoned in the 1950s. At Old Bingham Road, which passes through the project area, a single decorative lamp post remains along the west edge of the roadway, immediately to the east of Bingham Run (see Figure 12). A cobble stone gutter is extant on the east side of the roadway, but it has been heavily damaged by water and lack of maintenance (see Figure 13).

Figure 12: Historic Lamp Post on Old Bingham Road

Figure 13: Historic Cobble Stone Gutter

Western Ridge Trail

The hiking and equestrian trails of Rock Creek Park are part of the historic circulation system designed, built, and improved between 1830 and 1941. Running along the western boundary of Rock Creek Park, constructed and modified in sections over several decades, the Western Ridge Trail is one of the main north-south trails in U.S. Reservation 339 (see Figure 14). Certain sections are associated with older circulation routes that predate the park's establishment in 1890.

The section of trail at issue is immediately to the west of Bingham Run. Research being conducted for the Rock Creek Park Historic Trails Cultural Landscape Report is investigating whether this trail section was the main thoroughfare within this area of the park. The Western Ridge Trail was part of a circulation system that connected Oregon Avenue to Riley Spring.

Culverts

There are several culverts along Bingham Run that contribute to the Rock Creek Park Historic District. The National Register nomination for the district states that "the historic characteristics of this system of landscape elements can be defined as native stone material laid in a variety of sizes in mortar or in a few cases dry designed to appear informal and inconspicuous." Examples that the nomination identifies are the historic culverts constructed in the 1920s along Bingham Road. One such culvert abuts the LOD of

the proposed work on Bingham Run (see Figure 14). A second culvert is near the project area, at the intersection of Old Bingham Road and Bingham Road.

Figure 14: Western Ridge Trail and Historic Culvert

TOPOGRAPHY AND SOILS

Manor Loam and Glenelg Variant Silt Loam are the two most prevalent soil types found within and adjacent to Bingham Run and Milkhouse Run. Manor Loam, a moderately sloping and well drained to somewhat excessively drained soil, appears on ridge tops and side slopes of strongly dissected areas of the Piedmont Plateau. Glenelg is a nearly level to gently sloping, moderately well drained soil located on flat areas, in depressions, at the foot of hillsides, and around the heads of drainage ways. It is found in the Piedmont Plateau. (Soil Survey of the District of Columbia, 1975)

The topography of the Bingham Run site slopes downhill to the north, while the Milkhouse Run site slopes downhill to the east. Elevations range from approximately 270 feet above sea level at the upper end of the Milkhouse site to about 240 feet above sea level at the end of the project site. At the Bingham site, the project starts at about 270 feet above sea level and ends at about 210 feet above sea level. The slopes within the Milkhouse site are gentle, while the Bingham site has moderate slopes.

Powerful high-volume stormwater flows have scoured the banks of Bingham Run and Milkhouse Run, undercutting surrounding vegetation and exposing utility lines, including sanitary sewer pipes. In some spots, the channels are 12 feet deep. In addition, eroded soil from the banks has been carried downstream, resulting in sedimentation that damages aquatic habitat.

HYDROLOGY

Milkhouse Run begins as two perennial, first-order streams that originate directly east of Oregon Avenue. The streams eventually join and continue as one stream to Rock Creek. The southernmost stream (the South Fork) is approximately 340 feet in length. The northernmost stream (the North Fork) is approximately 600 feet in length. After the two tributaries merge, Milkhouse Run flows an additional 1500 feet before it enters Rock Creek. Stormwater enters Milkhouse Run as sheet flow from impervious surfaces and from a single stormwater outfall that empties into the run. Spring-fed water enters the South Fork after passing through a culvert under the Milkhouse Multi-use Trail. On the North Fork, spring-fed water enters from a seep located near the tributary's headwaters.

Bingham Run is a first-order, intermittent tributary located on the east side of Oregon Avenue. After flowing adjacent to Old Bingham Drive past the project site, Bingham Run joins the main stream of Bingham Run and flows approximately 2500 feet before entering Rock Creek. Water enters Bingham Run as sheet flow from impervious surfaces such as roadways and the Western Ridge Trail.

As predicted by hydrologic, computer-aided design software, the peak discharges for Milkhouse Run range from 72.8 cubic feet per second (cfs) for the two-year storm event to 248 cfs for the 100-year storm event. The predicted peak discharges for Bingham Run range from 7.46 cfs for the two-year storm event to 41.47 cfs for the 100-year storm event. The base flow in Milkhouse Run is negligible, averaging only 0.002 cfs. There is no base flow in Bingham Run.

WATER QUALITY

Milkhouse Run and Bingham Run are tributaries of Rock Creek. Currently, these tributaries are being degraded by storm flows and non-point source pollution from developed areas in the upper watershed, resulting in stream bank erosion, incised channels, and reduced water quality from sedimentation. Also, during storm events, the water in Milkhouse Run and Bingham Run contains small amounts of pollutants commonly found in urban streams. During dry conditions, Bingham Run doesn't convey water, and Milkhouse Run conveys a small amount (0.002 cfs) of spring-fed water.

WETLANDS

Milkhouse Run and Bingham Run are riverine wetlands under the NPS-recognized U.S. Fish and Wildlife Service (FWS) Cowardin Classification System. Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. The dominant water source at these runs is uncontrolled stormwater that enters the tributaries during storm events and damages the wetlands. Additional water sources include perennial springs, which provide a small base flow to Milkhouse Run.

FLOODPLAINS

According to the National Park Service, floodplains are "the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands and (including at a minimum), that area subject to temporary inundation by a regulatory flood" (DO 77-2). There is one floodplain located within the project area. It is a small plot of elevated land that sits at the confluence of the two tributaries of Milkhouse Run, where the tributaries merge and continue as one stream to Rock Creek. During large storm events, this plot becomes inundated with water. However, due to the sloped topography of the area, there are no other floodplains located in or around the proposed project sites.

WILDLIFE AND WILDLIFE HABITAT

The project area is rich with wildlife and wildlife habitat. It is part of a flyway, visited by migratory birds during the spring and fall. Bird species commonly seen in the project area include the Northern Cardinal (*Cardinalis cardinalis*), American Robin (*Turdus migratorius*), Carolina Chickadee (*Poecile carolinensis*), Red-bellied Woodpecker (*Melanerpes carolinus*), and Downy Woodpecker (*Picoides pubescens*). Mammals present include, but are not limited to, the eastern chipmunk (*Tamias striatus*), gray squirrels (*Sciurus caolinensis*), house mice (*Mus musculus*), white footed mouse (*Peromyscus leucopus*), and raccoon (*Procyon lotor*). Natural resources specialists from the NPS did not find aquatic species in the project areas,. However, downstream from the project areas, NPS staff found populations of Northern Two-lined Salamanders (*Eurycea bislineata*) and macroinvertebrates such as chironomids, crayfish and caddisflies.

VEGETATION

In general, vegetation types found throughout the District of Columbia are the same as those found in Rock Creek Park. However, Rock Creek Park is unique in terms of preserving the largest urban forest in the area, providing habitat for much of the city's wildlife and acting as an important contributor to the region's biodiversity. Approximately 80 percent (1,662 acres) of Reservation 339 is covered with mature

second-growth forest that is approximately 120 years old. Woodlands in the park are a mixture of deciduous species typical of eastern forests in the later stages of succession (NPS 2005). Inventories of park vegetation have found 238 non-native plant species within the park, 42 of which are classified as invasive, non-native species that, unless controlled, are likely to spread and adversely affect native plant populations.

A vegetation survey of the proposed project area was conducted on May 20, 2010, by Biohabitats, and later confirmed by Rock Creek Park natural resource specialists. The results are shown in Tables 2 and 3.

Table 2 – Milkhouse Run Vegetation

Common Name	Scientific Name
American beech	*Fagus grandifolia*
American holly	*Ilex opaca*
American sycamore	*Platanus occidentalis*
Black locust	*Robinia pseudoacacia*
Blackgum	*Nyssa sylvatica*
Boxelder	*Acer negundo*
Broadleaf enchanter's nightshade	*Circaea lutetiana*
Cherry sp.	*Prunus* sp.
Christmas fern	*Polystichum acrostichoides*
Devil's walking stick	*Aralia spinosa*
Dogwood sp.	*Cornus* sp.
English ivy*	*Hedera helix*
Garlic mustard*	*Alliaria petiolata*
Grape sp.	*Vitis* sp.
Jack-in-the-pulpit	*Arisaema triphyllum*
Japanese barberry*	*Berberis thunbergii*
Japanese honeysuckle*	*Lonicera japonica*
Japanese pachysandra*	*Pachysandra terminalis*
Multiflora rose*	*Rosa multiflora*
Nepalese browntop*	*Microstegium vimineum*
Northern spicebush	*Lindera benzoin*
Norway maple*	*Acer platanoides*
Poison ivy	*Toxicodendron radicans*
Red maple	*Acer rubrum*
Roundleaf greenbrier	*Smilax rotundifolia*
Sedge sp.	*Carex* sp.
Slippery elm	*Ulmus rubra*
Tuliptree	*Liriodendron tulipifera*
Virginia creeper	*Parthenocissus quinquefolia*
White mulberry*	*Morus alba*
Wild lettuce	*Lactuca canadensis*
Wild onion	*Allium sp.*
Wine raspberry*	*Rubus phoenicolasius*
Winter creeper*	*Euonymus fortunei*
* Non-Native Species	

Table 3 – Bingham Run Vegetation

Common Name	Scientific Name
American basswood	*Tilia americana*
Black walnut	*Juglans nigra*
Boxelder	*Acer negundo*
Broadleaf enchanter's nightshade	*Circaea lutetiana*
Dock sp.	*Rumex* sp.
Dogwood sp.	*Cornus* sp.
English ivy*	*Hedera helix*
Exotic bush honeysuckle*	*Lonicera* sp.

Garlic mustard*	*Alliaria petiolata*
Grape sp.	*Vitis* sp.
Green ash	*Fraxinus pennsylvanica*
Indian strawberry*	*Duchesnea indica*
Japanese barberry*	*Berberis thunbergii*
Japanese honeysuckle*	*Lonicera japonica*
Japanese pachysandra*	*Pachysandra terminalis*
Lettuce sp.	*Lactuca* sp.
Mockernut hickory	*Carya alba*
Nepalese browntop*	*Microstegium vimineum*
Northern red oak	*Quercus rubra*
Northern spicebush	*Lindera benzoin*
Norway maple*	*Acer platanoides*
Poison ivy	*Toxicodendron radicans*
Royal Paulownia*	*Paulownia tomentosa*
Red maple	*Acer rubrum*
Sawtooth oak*	*Quercus acutissima*
Slippery elm	*Ulmus rubra*
Smartweed sp.	*Polygonum* sp.
Tuliptree	*Liriodendron tulipifera*
Virginia creeper	*Parthenocissus quinquefolia*
White oak	*Quercus alba*
Wine raspberry*	*Rubus phoenicolasius*
Winter creeper*	*Euonymus fortunei*
* Non-Native Species	

PARK OPERATIONS AND MANAGEMENT

The staff of Rock Creek Park is currently organized into four operating divisions: Park Management, Administration, Resource Management and Visitor Services, and Maintenance. There are approximately 48 full-time employees. The permanent staff is augmented by a seasonal/temporary workforce, which changes annually based on available funding.

MAINTENANCE

The Maintenance Division is responsible for the upkeep and maintenance of all park facilities, infrastructure and designed landscapes. This includes 30 picnic groves, approximately 50 miles of foot, horse, and bike trails, 20 miles of park roadways, and numerous buildings, some of which are historic. Park maintenance is also responsible for maintaining all utilities that service park buildings and other park facilities.

VISITOR USE AND EXPERIENCE

Visitors use two trails near the proposed project areas. The Western Ridge Trail stretches from the Maryland/DC border at Beach Drive to its southern terminus below Peirce Mill at Bluff Bridge. It crosses Bingham Road and passes the Bingham Run project site. There is also the Milkhouse Multi-use Trail that runs along Oregon Avenue, from Horse Stables Road to Military Avenue, NW, passing Milkhouse Run. Each year, thousands of people use these trails to exercise and commute, and during the work week, when all of Beach Drive is open to vehicular traffic, paved sections of the Western Ridge Trail and Milkhouse Multi-use Trail provide a north-south transportation alternative for cyclists and pedestrians.

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CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter analyzes both beneficial and adverse impacts that would result from implementing each 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 Council on Environmental Quality (CEQ) regulations implementing NEPA, a summary of the environmental consequences for each alternative is provided in Table 2, which can be found in the Alternatives chapter above. The resource topics presented in this chapter, and their organization, correspond to the resource discussions provided above in the Affected Environment chapter.

GENERAL METHODOLOGY

The following elements were used to establish impact thresholds and measure the impacts of the alternatives within each resource category:

- General analysis methods as described in guiding regulations, including the context and duration of environmental effects;
- 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; and
- Methods and thresholds used to determine if impairment of specific resources would occur under any alternative.

These elements are described in the following sections.

ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines and Director's Order 12 procedures (NPS 2001) and is based on the underlying goal of providing for long-term protection, conservation, and restoration of native species and cultural landscapes at Rock Creek Park. This analysis incorporates the best-available scientific literature applicable to the region and setting, the species being evaluated, and the actions being considered in the alternatives.

As described in the Purpose and Need chapter, the NPS created a team of resource specialists to provide input for the impact analysis. For each impact topic addressed in this chapter, the applicable methods of analysis are discussed, including assumptions and impact intensity thresholds.

IMPACT THRESHOLDS

Determining impact thresholds is a key component of NPS Management Policies and Director's Order 12. These thresholds provide the reader with an understanding about the intensity of a given impact on 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, and/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. Impact thresholds are provided for all adverse impacts, whereas beneficial impacts are addressed qualitatively.

Potential impacts of the 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 within 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 varies with each impact topic. Therefore, duration definitions are provided in each 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

CEQ regulations implementing NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on 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 should focus on effects that are truly meaningful. Cumulative impacts are considered for all alternatives, including the no action alternative.

For the proposed project, these are relevant past, present, and reasonably foreseeable future actions:

- The NPS is rehabilitating Peirce Mill, a historic structure located near the intersection of Tilden Street, NW, and Beach Drive.
- In 2009, pursuant to a consent decree with EPA, DC Water began modifying combined sewer outflows (CSOs) in Rock Creek Park, in order to reduce the amount of sewage discharged into Rock Creek.
- DDOT plans to repave Oregon Avenue,[1] a section of the Rock Creek Multi-use Trail (located along Beach Drive) and Broad Branch Avenue. It also plans to install a multi-use trail on a closed section of Klingle Road and rehabilitate the adjacent stream.

CULTURAL RESOURCES

CEQ regulations that implement NEPA require assessment of impacts on cultural resources as well as natural resources. In this EA/AoE, impacts on cultural resources are described in terms of type, context, duration, and intensity, as defined above, which is consistent with CEQ regulations. These impact analyses are intended, however, to comply with the requirements of both NEPA and Section 106 of the NHPA. In accordance with the Advisory Council's regulations for implementing Section 106 of the NHPA (36 CFR Part 800 Protection of Historic Properties), impacts on cultural resources also were identified and evaluated by (1) determining the area of potential effect (see Figure 11), (2) identifying cultural resources present in the area of potential effects that were either listed in or eligible for listing in the National Register, (3) applying the criteria of adverse effect to affected cultural resources either listed

[1] Oregon Avenue contributes stormwater to Milkhouse Run and Bingham Run. DDOT faces engineering constraints that necessitate the use of these runs for stormwater mitigation. DDOT's repaving plans would not affect the design or installation of the RSCs, which are engineered to handle flows coming from Oregon Avenue during a 100-year storm.

in or eligible for listing in the National Register, and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under Advisory Council regulations, a determination of either adverse effect or no adverse effect must be made for affected, National Register-listed or -eligible cultural resources. An adverse effect occurs whenever an impact directly or indirectly alters any characteristic of a cultural resource that qualifies it for inclusion in the National Register. This includes diminishing the integrity (or the extent to which a resource retains its historic appearance) of the resource's location, setting, design, feeling, association, workmanship, or materials. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR Part 800.5 Assessment of Adverse Effects). A determination of no adverse effect means that there is an effect, but the effect would not diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register of Historic Places.

CEQ regulations and NPS DO 12: Conservation Planning, Environmental Impact Analysis, and Decision-making also call for a discussion of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact – for example, reducing the intensity of an impact from major to moderate or minor. However, any resulting reduction in the intensity of impact due to mitigation is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Cultural resources are non-renewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resources that can never be recovered. Therefore, although actions determined to have an adverse effect under Section 106 may be mitigated, the effect remains adverse.

A Section 106 summary is included in the impact analysis sections for cultural resources. The Section 106 summary is intended to meet the requirements of Section 106 and is an assessment of the effect of the undertaking (implementation of the alternative) on cultural resources, based upon the criteria of effect and the criteria of adverse effect found in the Advisory Council regulations.

ANALYSIS OF IMPACTS TO RESOURCES

CULTURAL LANDSCAPES

Methodology and Assumptions

Impacts were determined by considering the effects of existing conditions on, and proposed changes to, cultural landscapes or potentially eligible cultural landscapes.

Study Area

The study area for cultural landscapes is the APE set forth above (see Figure 11).

Impact Thresholds

For purposes of analyzing potential impacts to cultural landscapes, the thresholds for the intensity of an impact are as follows:

> **Negligible:** Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. An assessment of effect according to Section 106 of the NHPA would result in a determination of no adverse effect.
>
> **Minor:** Alteration of a pattern(s) or feature(s) of the landscape would not diminish the overall integrity of the landscape. An assessment of effect according to Section 106 of the NHPA would result in a determination of no adverse effect.

Moderate: Alteration of a pattern(s) or feature (s) of the landscape would diminish the overall integrity of the cultural landscape. An assessment of effect according to Section 106 of the NHPA would result in a determination of adverse effect. A memorandum of agreement (MOA) is executed among the NPS and applicable state or tribal historic preservation officer and, if necessary, the Advisory Council in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts reduce the intensity of impact under NEPA from major to moderate.

Major: Alteration of a pattern(s) or feature(s) of the landscape would diminish the overall integrity of the landscape. An assessment of effect according to Section 106 of the NHPA would result in a determination of adverse effect. Measures to minimize or mitigate adverse impacts cannot be agreed upon, and the NPS and applicable state historic or tribal preservation officer and/or Advisory Council are unable to negotiate and execute an MOA in accordance with 36 CFR 800.6(b).

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, stream degradation would continue. Storm flows would cause significant stream bank erosion, sediment loading, and bank incision, threatening to undermine a section of the Western Ridge Trail located a short distance (15 feet) from Bingham Run and natural resources that contribute to the historic landscape of Rock Creek Park. Because the Western Ridge Trail is a character-defining feature of the park's cultural landscape of historic trails, the resulting adverse impacts from the continued degradation of the stream, and it's potential to affect the trail, would be minor and of long duration.

Cumulative: The NPS is rehabilitating Peirce Mill, and implementation of the GMP would result in greater protection and interpretation of the park's other historic landscapes. Such improvements, in combination with the impacts associated with alternative A, would result in a park-wide, long-term beneficial impact (due to protection of cultural resources located inside and outside the project area). The overall contribution of the no action alternative would be negligible.

Section 106 Summary: Alternative A threatens to diminish the integrity of a section of the Western Ridge Trail and natural resources that contribute to the historic landscape of Rock Creek Park. After applying the Advisory Council's regulations 36 CFR 800, the NPS finds that alternative A may eventually result in a determination of adverse effect on cultural landscapes.

Conclusion: The cultural landscapes of Rock Creek Park, which include areas in and around Bingham Run and Milkhouse Run, and the historic trails in the park are eligible for listing in the National Register. Under alternative A, the continued erosion and degradation of Bingham Run and Milkhouse Run from unmitigated stormwater flows would continue, threatening the integrity of these landscapes, a local, long-term, minor, adverse impact. In addition, park-wide, long-term beneficial cumulative impacts would occur from the protection of cultural resources located inside and outside the project area. Over the long-term there may be an adverse effect, as determined under Section 106 of the NHPA, to the park's cultural landscapes from the continued degradation of the streams.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Installing RSCs at Bingham Run and Milkhouse Run would modify the existing landscape features (i.e., the current condition of each stream) and also be a departure from historic conditions (i.e., those existing prior to urbanization of the watershed), a local, long-term, minor adverse impact. These changes, however, would not alter a character-defining feature of the landscape because the proposed project would utilize natural materials such as vegetation and stones that are consistent with surrounding natural areas. In addition, the step pools and native vegetation characteristic of a RSC would be a much more accurate representation of historic conditions than the incised channels that currently exist in the two streams. The RSCs would also protect features that contribute to the historic landscape of

Rock Creek Park, such as the Western Ridge Trail, from damage caused by erosion, a local, long-term, beneficial impact. Nevertheless, the installation of RSCs (and associated construction) would constitute a local, short-term, minor, adverse impact.

Cumulative: The NPS is rehabilitating Peirce Mill, and implementation of the GMP would result in greater protection and interpretation of the park's other historic landscapes. Such improvements, along with alternative B, would result in park-wide, long-term beneficial impacts (due to protection of cultural resources located inside and outside the project area).

Section 106 Summary: Although short-term construction-related impacts would occur, alternative B would protect Bingham Run and Milkhouse Run, as well as nearby resources such as the Western Ridge Trail, from continuing erosion. Moreover, the introduction of new landscape features would not diminish the integrity of a cultural landscape. Therefore after applying the Advisory Council's regulations 36 CFR 800, the NPS finds that alternative B would have no adverse effect on cultural landscapes.

Conclusion: The cultural landscapes of Rock Creek Park and the historic trails are eligible for listing in the National Register. Alternative B would result in local, short-term and long-term, minor, adverse impacts to cultural landscapes from the overall modification of the landscape. This alternative would also result in local, long-term, beneficial impacts to cultural landscapes from the enhanced protection against erosion and degradation at these two runs. Overall cumulative impacts would be long-term and beneficial due to protection of cultural resources located inside and outside the project area. There would be no adverse effect to cultural landscapes as determined under Section 106 of the NHPA.

HISTORIC STRUCTURES AND DISTRICTS

Methodology and Assumptions

Impact analyses under NEPA and Section 106 examine the manner and degree to which the proposed alternatives impact or affect the qualities and integrity of the individual historic resource's character-defining features, significance, and National Register eligibility. Impacts were determined by considering the effects of existing conditions on, and proposed changes to, historic resources or potentially eligible historic resources within the Rock Creek Park Historic District.

Study Area

The study area for cultural landscapes is the APE set forth above (see Figure 11).

Impact Thresholds

For purposes of analyzing potential impacts on historic resources, the thresholds of change for the intensity of an impact are defined as follows:

> **Negligible:** Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. An assessment of effect according to Section 106 of the NHPA would result in a determination of no adverse effect.
>
> **Minor:** Alteration of a character-defining feature(s) would not diminish the overall integrity of the resource. An assessment of effect according to Section 106 of the NHPA would result in a determination of no adverse effect.
>
> **Moderate:** Alteration of a character-defining feature(s) would diminish the overall integrity of the resource. An assessment of effect according to Section 106 of the NHPA would result in a determination of adverse effect. An MOA is executed among the NPS and applicable state or tribal historic preservation officer and, if necessary, the Advisory Council in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts 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. An assessment of effect according to Section 106 of the NHPA would result in a determination of adverse effect. Measures to minimize or mitigate adverse impacts cannot be agreed upon, and the NPS and applicable state or tribal historic preservation officer and/or Advisory Council are unable to negotiate and execute an MOA in accordance with 36 CFR 800.6(b).

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, stream degradation would continue. Storm flows would cause continued stream bank erosion, sediment loading, and bank incision at Bingham Run, threatening to undermine sections of the Western Ridge Trail and Old Bingham Road (including its historic lamp post and cobble stone gutter), which are contributing resources to the Rock Creek Park Historic District, resulting in potential long-term minor to moderate adverse impacts.

Cumulative: The NPS is rehabilitating Peirce Mill, and implementation of the GMP would result in greater protection and interpretation of the park's other historic resources. Such improvements, along with alternative A, would result in a park-wide, long-term beneficial impact (due to protection of cultural resources located inside and outside the project area), the overall contribution of the no action alternative would be negligible.

Section 106 Summary: Alternative A threatens to diminish the integrity of sections of Bingham Road and the Western Ridge Trail. After applying the Advisory Council's regulations 36 CFR 800, the NPS finds that alternative A may eventually have an adverse effect on historic structures.

Conclusion: The Western Ridge Trail and Old Bingham Road (and its features) are contributing resources to the Rock Creek Park Historic District. Under alternative A, the continued erosion and degradation of Bingham Run from stormwater flows would continue, threatening the integrity of these resources, a local, long-term, moderate, adverse impact. In addition, alternative A would result in a park-wide, long-term beneficial cumulative impact (due to protection of cultural resources located inside and outside the project area). In the future, due to the continued degradation of the streams, and the potential to impact historic resources, there is the potential for a determination of adverse effect under Section 106 of the NHPA.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Construction activities associated with the RSCs at Bingham Run would occur on or near historic resources. During construction at Bingham Run, Old Bingham Road would be used for material storage and as an access path for equipment, a local, short-term, minor, adverse impact. To mitigate this impact, pads would protect the roadway and cobble stone gutter, and a fence would protect the lamp post. Pads would also protect the culvert that abuts the LOD. Over the long term, installation of the RSC at Bingham Run would protect the Western Ridge Trail and Old Bingham Road and would dissipate the energy and reduce the damaging effects of stormwater flowing down Bingham Run to culverts located along Bingham Road (below the project area), resulting in long-term, beneficial impacts.

Cumulative: Past, present, and reasonably foreseeable future actions, including the continued implementation of the park's GMP and the rehabilitation of Peirce Mill, have impacted, and would continue to impact, historic resources in the northern portion of U.S. Reservation 339. Such improvements, along with alternative B, would result in a park-wide, long-term, beneficial impact (due to greater protection of historic resources located inside and outside the project area). The overall contribution of the alternative B would be negligible.

Section 106 Summary: Although short-term construction-related impacts would occur, alternative B would protect Bingham Run and Milkhouse Run (and nearby historic structures) from continuing erosion.

Therefore, after applying the Advisory Council's regulations 36 CFR 800, the NPS finds that alternative B would result in a determination of adverse effect to historic resources under section 106 of the NHPA.

Conclusion: Old Bingham Road (and its historic features) and the Western Ridge Trail are contributing resources to the Rock Creek Park Historic District. Alternative B would result in a local, short-term, minor, adverse impact during construction because Old Bingham Road would be used as a storage and staging area. However, mitigation measures will be implemented to protect the roadway and its features, and the RSC would protect the Western Ridge Trail and Old Bingham Road from erosion. This alternative would also result in a park-wide, long-term beneficial impact due to protection of cultural resources located inside and outside the project area. There would be no adverse effect under the NHPA.

TOPOGRAPHY AND SOILS

Methodology and Assumptions

Available information on soil and topographic resources potentially impacted in the study area was compiled. Predictions about short- and long-term site impacts were based on a review of existing literature, soil and topographic mapping, and information provided by the NPS and other agencies.

Study Area

The geographic study area for topography and soils includes the project area, as construction activities would not occur outside this area.

Impact Thresholds

The thresholds of change for the intensity of an adverse impact are defined as follows:

> **Negligible**: Impacts on soil and topographical resources would be below or at the lower levels of detection.
>
> **Minor**: Impacts on soil and topographical resources would be detectable and small. Mitigation may be needed to offset adverse impacts and would be relatively simple to implement and likely be successful.
>
> **Moderate**: Impacts on soil and topographical resources would be readily apparent and result in a change to soils and/or topography over a relatively wide area. Mitigation measures would be necessary to offset adverse impacts and likely be successful.
>
> **Major**: Impacts on soil and topographical resources would be readily apparent and would substantially change the character of the soils and/or topography over a large area in and out of the park. Mitigation measures to offset adverse impacts would be needed and extensive, and their success could not be guaranteed.

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, Bingham Run and Milkhouse Run would continue to degrade. In particular, powerful stormwater flows would continue to scour the banks of each tributary, causing sedimentation and channel incising. Soils would erode (particularly from the bottoms and lower reaches of the stream beds) and the topography within the streams would become more extreme as water continues to deepen the channels, resulting in long-term moderate adverse impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on soils and topography in and around the project area. These actions include the rehabilitation of Peirce Mill and road/trail paving projects in or adjacent to the park, which will displace soils and will result in, long-term, minor, adverse impacts. Also, the continued implementation of the park's GMP would result in new development that could lead to grading and soil displacement, causing local, long-term, minor, adverse impacts. These impacts, in combination with the

impacts associated with the no action alternative would result in long-term, minor to moderate adverse cumulative impacts to soils and topography.

Conclusion: In terms of topography and soils, alternative A would have long-term, moderate adverse impacts from the continued erosion, sedimentation and incising. Cumulative adverse impacts would be minor to moderate and of long duration.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, the use of construction equipment would damage soils (i.e., disturbance, compaction), resulting in short-term, minor, adverse impacts. These impacts would be mitigated by placing woodchips along access trails, utilizing an approved erosion and sediment control plan, aerating compacted soils, and revegetating disturbed areas using NPS approved native plant species. The installation of RSCs would require limited soil grading and excavation, as banks would be widened in certain locations to accommodate RSC pools and shifted in others to improve hydrology. This modification in the soils and topography of the streams would result in short-term minor adverse impacts. Upon completion, the RSCs would stabilize surrounding soils and topography, preventing erosion and sedimentation, resulting in long-term beneficial impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on soils and topography in and around the project area. These actions include the rehabilitation of Peirce Mill and trail/road paving projects in or adjacent to the park, which will displace soils, a local, long-term, minor adverse impact. Also, the continued implementation of the park's GMP would result in new development that could lead to grading and soil displacement, causing local, long-term, minor, adverse impacts. Therefore, these projects, along with alternative B, would have short-term and long-term minor adverse cumulative impacts, as well as long-term beneficial impacts.

Conclusion: In terms of topography and soils, alternative B would have a local, long-term, beneficial impact on Milkhouse Run and Bingham Run by stabilizing surrounding soils and improving topography. During construction, there would be local short-term minor adverse impacts. Overall, there would be short-term and long-term minor adverse cumulative impacts.

HYDROLOGY

The U.S. Army Corps of Engineers has approved a Clean Water Act Section 404 permit as well as a Section 401 Water Quality Certification for the proposed work at Milkhouse Run and Bingham Run.

Methodology and Assumptions

Available information on hydrology within the project area was compiled and reviewed. Predictions about short- and long-term project impacts on hydrology were based on general characteristics and proposed actions associated with alternatives affecting the hydrology of Bingham Run and Milkhouse Run.

Study Area

The geographic study area for hydrology is the Rock Creek watershed.

Impact Thresholds

The following thresholds were defined:

Negligible: Impacts on hydrology would be below or at the lower levels of detection.

Minor: Impacts on hydrology would be detectable and small. Mitigation may be needed to offset adverse impacts and would be relatively simple to implement and likely be successful.

Moderate: Impacts on hydrology would be readily apparent and result in a change to hydrology over a relatively wide area. Mitigation measures would be necessary to offset adverse impacts and likely be successful.

Major: Impacts on hydrology would be readily apparent and would substantially change the character of the hydrology over a large area in and out of the park. Mitigation measures to offset adverse impacts would be needed and extensive, and their success could not be guaranteed.

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, unnatural stream flows within Bingham Run and Milkhouse Run would continue as uncontrolled stormwater flows from surrounding roads and properties. The flows caused by this stormwater runoff are generally fast with high volumes of water, followed shortly by relatively low or nonexistent base flows. This pattern of fast powerful flows followed by extreme low flows is one of the main contributors to erosion within these tributaries. In a natural state, stormwater flows would not be concentrated by stormwater sewers and outfalls, and flows within streams would be naturally slower and less powerful, and ultimately less erosive. Continuation of these unnatural flows in Bingham Run and Milkhouse Run would result long-term moderate adverse impacts to the hydrology of these tributaries.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on hydrology in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) which would have a local, long-term, beneficial impact on the hydrology of Rock Creek, and the repaving of Oregon Road, which would have beneficial impacts on stormwater runoff entering the park. In addition, the overall urbanization of the watershed would continue to adversely impact the hydrology of the streams within the region. These impacts, in combination with the impacts from the no action alternative would have long-term moderate adverse cumulative impacts on hydrology within the watershed.

Conclusion: In terms of hydrology, implementation of alternative A would have long-term moderate adverse impacts due to receiving uncontrolled stormwater runoff from surrounding roads and properties. Overall adverse cumulative impacts would be moderate and of long duration.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, RSCs would help control the stormwater runoff entering these streams by slowing the flows within the channels, and allowing more of the water to infiltrate into the groundwater. While the proposed RSCs would not restore the natural hydrology of Milkhouse Run and Bingham Run and the amount of stormwater runoff entering these tributaries would not change, by enhancing these streams ability to slow the flow, and allowing a larger percentage of the runoff to infiltrate the groundwater, the overall hydrology within the watershed would be enhanced, resulting in long-term beneficial impacts. During construction conducted along approximately 2,900 feet of stream channel, water would be diverted through a pipe installed along each stream bed, which would result in short-term, negligible adverse impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on hydrology in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) which would have a local, long-term, beneficial impact on the hydrology of Rock Creek, and the repaving of Oregon Road, which would have beneficial impacts on stormwater runoff entering the park. In addition, the overall urbanization of the watershed would continue to adversely impact the hydrology of the streams within the region. These impacts, in combination with the impacts from alternative B would have long-term moderate adverse cumulative impacts on hydrology within the watershed. The beneficial contribution of alternative B would be negligible, when compared to the impacts associated with urbanization within the watershed.

Conclusion: In terms of hydrology, alternative B would have long-term beneficial impacts to the overall watershed by slowing stormwater flows and allowing increased infiltration into the groundwater. Overall adverse cumulative impacts to hydrology within the watershed would be long-term and moderate.

WATER QUALITY

Methodology and Assumptions

Available information on water quality within the project area was compiled and reviewed. Predictions about short- and long-term project impacts on water quality were based on general characteristics and proposed actions associated with alternatives affecting the water quality of Bingham Run and Milkhouse Run.

Study Area

The geographic study area for water quality includes Bingham Run and Milkhouse Run, where the proposed work would occur, as well as Rock Creek, their terminus waterway.

Impact Thresholds

The following thresholds were defined:

> **Negligible:** Impacts are chemical, physical, or biological effects would not be detectable, would be well within acceptable water quality standards or criteria, and would be within historical or desired water quality conditions.
>
> **Minor:** Impacts (chemical, physical, or biological effects) would be detectable but would be well within acceptable water quality standards or criteria and within historical or desired water quality conditions.
>
> **Moderate:** Impacts (chemical, physical, or biological effects) would be detectable but would be at or within acceptable water quality standards or criteria; however, historical baseline or desired water quality conditions would be altered on a short-term basis.
>
> **Major:** Impacts (chemical, physical, or biological effects) would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would be slightly and singularly exceeded on a short-term basis.

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, uncontrolled stormwater flows within Milkhouse Run and Bingham Run would continue to convey sediments (caused by the erosion), and small amounts of pollutants originating from area roads and neighboring properties, into Rock Creek, resulting in minor adverse impacts to water quality. While this problem would be of long duration, the impacts to Rock Creek's water quality would only occur during storm events, when there were measurable flows within Milkhouse Run and Bingham Run.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on water quality in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), which will have local and park-wide, long-term, beneficial impacts on water quality. The contribution of adverse impacts from the no action alternative would not likely be measurable.

Conclusion: In terms of water quality, the no action alternative would have long-term minor adverse impacts due to continued conveyance of pollutants through uncontrolled stormwater runoff. Overall cumulative impacts to water quality would be beneficial.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, RSCs would rehabilitate Milkhouse Run and Bingham Run. They would improve water quality within the Rock Creek Watershed by slowing stormwater flows in a non-

erosive manner so as to limit sedimentation and help filter pollutants being conveyed by runoff through groundwater infiltration, resulting in long-term beneficial impacts to water quality. During construction, the proposed project could cause sedimentation, a local, short-term, minor, adverse impact. Diversion pipes installed along the streambeds of the runs would mitigate this impact.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on water quality in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT's trail project) and the closing of combined sewer outflows (CSOs), which will have local and park-wide, long-term, beneficial impacts on water quality. The contribution of adverse impacts from alternative B would not likely be measurable.

Conclusion: In terms of water quality, alternative B would have a local, long-term, beneficial impact by slowing stormwater flows in a non-erosive manner so as to limit sedimentation and help filter pollutants being conveyed by runoff through groundwater infiltration. Overall cumulative impacts to water quality would be beneficial.

WETLANDS

This project involves the restoration of degraded riverine wetland stream channels which have lost much of their wetland function due to uncontrolled stormwater flows coming from residential development and impervious surfaces in the upper watersheds. The NPS protects and preserves wetlands under Executive Order 11990, Director's Order #77-1, 2002, and NPS Procedural Manual #77-1:Wetland Protection, 2008. According to NPS DO #77-1: Wetland Protection, a statement of findings (SOF) is required when a proposed action is to occur within a wetland, unless the action qualifies for an exemption. The proposed project qualifies for an exemption under Section 4.2.1(h) of DO 77-1 because the project is designed specifically for the purpose of *restoring* degraded (or completely lost) natural wetland, stream, riparian, or other aquatic habitats or ecological processes. Therefore, a SOF would not be written for this project.[2]

Methodology and Assumptions

Available information on wetlands within the project area was compiled and reviewed. Predictions about short- and long-term project impacts on wetlands were based on general characteristics and proposed actions associated with alternatives affecting the wetlands of Bingham Run and Milkhouse Run.

Study Area

The geographic study area for wetlands includes Bingham Run and Milkhouse Run.

Impact Thresholds

The following thresholds were defined:

Negligible: Impacts on wetlands would be below or at the lower levels of detection.

Minor: Impacts on wetlands would be detectable and small. Mitigation may be needed to offset adverse impacts and would be relatively simple to implement and likely be successful.

Moderate: Impacts on wetlands would be readily apparent and result in a change to wetlands over a relatively wide area. Mitigation measures would be necessary to offset adverse impacts and likely be successful.

Major: Impacts on wetlands would be readily apparent and would substantially change the character of the wetlands over a large area in and out of the park. Mitigation measures to offset adverse impacts would be needed and extensive, and their success could not be guaranteed.

[2] This determination was made after consulting Kevin Noon, a NPS scientist and wetland compliance specialist.

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, storm water would continue to degrade the tributary riverine wetlands of Milkhouse Run and Bingham Run. In particular, these wetlands would suffer from bank erosion, sedimentation, loss of aquatic habitat and biodiversity, and reduced groundwater infiltration, causing local, long-term, moderate, adverse impacts throughout the lengths of these tributaries.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on wetlands in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), which will have local and park-wide, long-term, beneficial impacts on wetlands. Therefore, these projects, along with alternative A, would have a local, long-term, moderate, adverse impact, as well as long-term, beneficial impacts.

Conclusion: In terms of wetlands, alternative A would have a local, long-term, moderate, adverse impact due to continued erosion, sedimentation, and loss of habitat and groundwater infiltration, and long-term, beneficial impacts due to current and proposed construction projects.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Installing RSCs would help restore the overall function and value of degraded riparian wetlands associated with Milkhouse Run and Bingham Run. These changes would stabilize and rehabilitate the tributary riverine wetlands of Milkhouse Run and Bingham Run and associated aquatic habitat and biodiversity, a local, long-term, beneficial impact. During construction conducted along approximately 2,900 feet of stream channel, the proposed project could cause local, short-term, minor, adverse impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on wetlands in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT trail project) and the closing of combined sewer outflows (CSOs), which will have local and park-wide, long-term, beneficial impacts on wetlands. Therefore, these projects, along with alternative B, would have long-term beneficial cumulative impacts on wetlands within the watershed.

Conclusion: In terms of wetlands, implementation of alternative B would have long-term beneficial impacts to wetlands by helping to restore some of the values and function of those riparian wetlands lost through erosion. Overall cumulative impacts to wetlands would be long-term and beneficial.

FLOODPLAINS

According to NPS DO #77-2: Floodplain Management, a statement of findings (SOF) is required when an action will have an adverse effect on a floodplain. The SOF is intended to provide reasoning as to why the proposed site was selected and why less flood-prone alternative sites were rejected. For the proposed project, a SOF would not be required because impacts to floodplains would be beneficial, not adverse.[3]

Methodology and Assumptions

The project planning team based the impact analysis and conclusions for possible impacts to the floodplains at Bingham Run and Milkhouse Run on the review of existing literature and studies, information provided by experts in the NPS and other agencies.

[3] This determination was made after consulting Gary Smillie, a NPS scientist and floodplain compliance specialist.

Study Area

The geographic study area for floodplains includes the portions of Bingham Run and Milkhouse Run where proposed work would occur.

Impact Thresholds

The following thresholds were defined:

> **Negligible**: There would be no change in the ability of a floodplain to convey floodwaters, or its values and functions. Projects would not contribute to enhancing flood events.
>
> **Minor**: Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local. Project would not contribute to a flood event. No mitigation would be needed.
>
> **Moderate**: Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local. Project could contribute to the flood event. The impact could be mitigated by modification of proposed facilities in floodplains.
>
> **Major**: Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and regional. Project would contribute to the flood event. The impact could not be mitigated by modification of proposed facilities in the floodplains.

Impacts of Alternative A: No action Alternative

Direct/Indirect: There are no known floodplains that exist in areas adjacent to Milkhouse Run or Bingham Run. However, there is a small, raised "island" floodplain located at the confluence of the North Fork and South Fork within Milkhouse Run. This floodplain gets inundated with water during large storm events. During these larger storm events, powerful, erratic flows impact the floodplain, causing erosion, and degrading the overall functions of the floodplain, resulting in long-term minor adverse impacts to the overall function of this floodplain.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on floodplains in and around the project area. These actions are the renovation of a stream in Klingle Valley (part of a DDOT multi-use trail project), which will have a local, long-term, beneficial impact on floodplains, and the rehabilitation of Peirce Mill, which will have local, short-term and long-term, minor adverse impacts, and a local, long-term, beneficial impact, on floodplains (Preserve Peirce Mill Environmental Assessment, pages 67-71). These projects, in combination with the no action alternative, would have long-term minor adverse cumulative impacts to floodplains within the watershed. The overall contribution of the no action alternative would be negligible.

Conclusion: In terms of floodplains, the no action alternative would have long-term minor adverse impacts due to the impacts to the overall functionality of the floodplain sitting at the confluence of the North Fork and South Fork at Milkhouse Run. Overall adverse cumulative impacts to floodplains would be adverse and of long duration.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: The proposed RSCs will rehabilitate and stabilize Milkhouse Run and Bingham Run and greatly slow stormwater flows. By slowing these flows, the RSCs would help protect the floodplain located at the confluence of the North Fork and South Fork at Milkhouse Run from erosion by dissipating the energy of stormwater flows and allowing these flood waters to move more slowly through the system, which would result in long-term beneficial impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on floodplains in and around the project area. These actions are the renovation of a stream in Klingle Valley (part of a DDOT trail project), which will have a local, long-

term, beneficial impact on floodplains, and the rehabilitation of Peirce Mill, which will have local, short-term and long-term, minor adverse impacts, and a local, long-term, beneficial impact, on floodplains. These projects, in combination with the alternative B, would have long-term minor adverse cumulative impacts to floodplains within the watershed. The overall contribution of the no action alternative would be negligible.

Conclusion: In terms of floodplains, alternative B would have a local, long-term, beneficial impact by protecting the floodplain located at the confluence of the North Fork and South Fork at Milkhouse Run. Overall adverse cumulative impacts to floodplains would be adverse and of long duration.

WILDLIFE AND WILDLIFE HABITAT

Methodology and Assumptions

The planning team based the impact analysis and conclusions for possible impacts to wildlife and wildlife habitat at Bingham Run and Milkhouse Run on a review of existing literature and studies, information provided by experts in the NPS and other agencies.

Study Area

The geographic study area for wildlife and wildlife habitat is the project area.

Impact Thresholds

The following thresholds were defined:

> **Negligible**: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be of short duration and well within natural fluctuations.
>
> **Minor***:* Impacts would be detectable, but they would not be expected to be outside the natural range of variability and would not be expected to have any long-term effects on native species, their habitats, or the natural processes sustaining them.
>
> **Moderate***:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be outside the natural range of variability for short periods of time. Population numbers, population structure, genetic variability, and other demographic factors for species might have short-term changes, but would be expected to rebound to pre-impact numbers and to remain stable and viable in the long term. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors affecting short-term population levels.
>
> **Major***:* Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for long periods of time or be permanent.

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, stream damage would persist. Preexisting habitat for amphibians and macroinvertebrates would continue to be degraded. Stormwater flows would continue causing erosion, sedimentation, and channel incising, destabilizing nearby trees and reducing aquatic and non-aquatic habitat and biodiversity, resulting in long-term minor adverse impacts. Along Bingham Run and Milkhouse Run, downstream populations of amphibians and macroinvertebrates would also be threatened and may result in long-term minor, adverse impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on wildlife and wildlife habitat in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project)

and the closing of combined sewer outflows (CSOs), which will have local and park-wide, long-term, beneficial impacts on wildlife and wildlife habitat. These projects, in combination with the no action alternative would have long-term beneficial cumulative impacts. Overall, the no action alternative would have a negligible contribution to these cumulative impacts.

Conclusion: In terms of wildlife and wildlife habitat, implementation of alternative A would have a local, long-term, minor, adverse impact due to continued erosion, sedimentation, and bank destabilization. Cumulative impacts to wildlife and wildlife habitat would be long-term and beneficial.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, RSC systems would be installed to convey flows in a non-erosive manner during storm events, promoting the conversion of stormwater to groundwater through infiltration, and restoring aquatic and non-aquatic habitat by stabilizing channel beds and slopes, a local, long-term beneficial impact. It would also protect downstream populations of amphibians and macroinvertebrates. However, during construction, approximately 22 trees would be removed, resulting in a loss of habitat. This is considered a short-term minor adverse impact since there is sufficient adjacent habitat that could be utilized by any displaced wildlife. After construction, trees lost would be replaced with NPS-approved native tree species on a one-to-one diameter at breast height (dbh) basis, pursuant to the project planting plan.

Cumulative:

Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on wildlife and wildlife habitat in and around the project area. These actions include the rehabilitation of a stream in Klingle Valley (part of a DDOT multi-use trail project) and the closing of combined sewer outflows (CSOs), which will have local and park-wide, long-term, beneficial impacts on wildlife and wildlife habitat. These projects, in combination with alternative B would have long-term beneficial cumulative impacts. Overall, the no action alternative would have a negligible contribution to these cumulative impacts.

Conclusion: In terms of wildlife and wildlife habitat, implementation of alternative B would have long-term beneficial impacts by conveying storm flows in a non-erosive manner, promoting the conversion of stormwater to groundwater through infiltration, and stabilizing channel beds and slopes. Alternative B would also have long-term minor adverse impacts due to tree removal and loss of habitat. Cumulative impacts to wildlife and wildlife habitat would be long-term and beneficial.

VEGETATION

Methodology and Assumptions

Available information on vegetation and vegetative communities occurring within the project area was compiled and reviewed by NPS staff. Predictions about short- and long-term project impacts on vegetation were based on general characteristics of the local plant community and proposed actions affecting vegetated areas associated with the alternatives.

Study Area

The geographic study area for vegetation includes the project area, as activities would not occur outside this area.

Impact Thresholds

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

> **Negligible:** Individual native plants might be affected, but there would be no overall effect on a species population. Effects would occur on a small scale and no species of special concern would be affected.

Minor: Individual native plants would be affected, as would a relatively small portion of a species population. If detrimental, mitigation to offset adverse effects, including special measures to avoid species of concern, would be required and would be effective.

Moderate: Individual native plants would be affected, as would a sizable segment of a species population, over a relatively large area. Even if detrimental, mitigation to offset adverse effects could be extensive, but would likely be successful. Some species of special concern could be affected.

Major: The action would have a considerable effect on native plant populations, including species of special concern, and could affect a relatively large area in and around the park. If detrimental, mitigation measures would be required and extensive, and the success of those measures would not be guaranteed.

Impacts of Alternative A: No action Alternative

Direct: Under alternative A, stream degradation would persist. Storm flows would continue causing erosion and sedimentation. Strong storm flows, which have denuded the banks of the streams, would continue to incise and undercut the channels, destabilizing nearby vegetation, resulting in long-term minor adverse impacts.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on vegetation in and around the project area. These actions include the rehabilitation of Peirce Mill, which might result in the loss of some grasses, shrubs, and trees, long-term negligible adverse impacts. The GMP instructs the park to remove invasive species and plant naturally occurring species, which would result in park-wide long-term beneficial impacts. These impacts, in combination with the impacts resulting from the no action alternative would result in long-term negligible to minor adverse cumulative impacts on vegetation within the park.

Conclusion: In terms of vegetation, alternative A would have a local, long-term, minor, adverse impact due to continued erosion and sedimentation. Adverse cumulative impacts to vegetation would negligible to minor and of long duration.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, denuded banks and deep channels would be filled and replaced with step pools and riparian zones, and planted with native vegetation. After installation, existing vegetation surrounding the RSCs would be protected against erosion damage caused by stormwater, a local, long-term, beneficial impact. However, construction activities would adversely impact vegetation (but no species of special concern), as 22 large trees would be removed – 10 from Milkhouse Run and 12 from Bingham Run, a local, long-term, minor, adverse impact. The sizes of these trees range from 10 to 30 inches diameter at breast height (dbh). All removed trees would used as project materials (for example, wood chips to prevent soil compaction and logs for step dams), and replanted with native species approved by the NPS on a one-to-one dbh basis, pursuant to the project planting plan.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on vegetation in and around the project area. These actions include the rehabilitation of Peirce Mill, which might result in the loss of some grasses, shrubs, and trees, local, long-term, minor, adverse impacts. The GMP instructs the park to remove invasive species and plant naturally occurring species, a park-wide, long-term, beneficial impact. These impacts, in combination with the impacts resulting from alternative B would result in long-term negligible to minor adverse cumulative impacts on vegetation within the park.

Conclusion: In terms of vegetation, alternative B would have a long-term beneficial impacts due to erosion protection, and short-term, minor, adverse impacts due to construction activities. Adverse cumulative impacts to vegetation would be negligible to minor and of long duration.

PARK OPERATIONS AND MANAGEMENT

Methodology and Assumptions

Available information on park operations and management occurring within the project area was compiled and reviewed. Predictions about short- and long-term project impacts on park operations and management were based on general characteristics and proposed actions affecting park operations and management associated with the alternatives.

Study Area

The geographic study area for park operations and management is within the boundaries of the park.

Impact Thresholds

The thresholds of change for the intensity of this impact are defined as follows:

> **Negligible**: Park operations and management would not be affected, or the impacts would be at low levels of detection and would not have a noticeable impact on operations.
>
> **Minor**: The impact would be detectable but would be of a magnitude that would not have a noticeable impact on park operations and management. If mitigation was needed to offset adverse impacts, it would be simple and likely successful.
>
> **Moderate**: The impacts would be readily apparent and would result in a substantial change in park operations and management in a manner noticeable to staff and the public. Mitigation measures would be necessary to offset adverse impacts and would likely be successful.
>
> **Major**: The impacts would be readily apparent, would result in a substantial change in park operations and management in a manner noticeable to staff and the public, and be markedly different from existing park operations and management. Mitigation measures to offset adverse impacts would be needed and extensive, and their success could not be guaranteed.

Impacts of Alternative A: No Action Alternative

Direct/Indirect: Under alternative A, existing park operations would continue. During precipitation events, water runoff from impervious surfaces would flow unimpeded down Bingham Run and Milkhouse Run, eroding soil and compromising vegetation. When large stormwater events cause nearby culverts to clog or trees to fall across these waterways, park staff would intervene on a case-by-case basis, expending time and money to correct the problem. While dealing with these types of situations is within the purview of normal maintenance operations, it does provide an added level of maintenance responsibilities when these events occur. As a result, during storm events, when the culverts along Milkhouse Run and Bingham Run became clogged, there would be long-term minor adverse impacts on park operations and management.

Cumulative: Under alternative A, park operations and maintenance have been, and would continue to be affected by the implementation of park plans and resource programs. It is anticipated that demand for park resources would escalate due to increased use of the park by visitors. This demand would have a detectable but not noticeable effect on park operations and management. The impact, in combination with the impacts associated with the no action alternative would result in long-term minor adverse impacts on park operations and management.

Conclusion: Impacts to park operations and maintenance under alternative A would be park-wide, long-term, minor and adverse. Cumulative impacts would be long-term minor and adverse.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, RSCs at Milkhouse Run and Bingham Run would convey stormwater flows in a non-erosive manner. Stream banks and adjacent vegetation would be stabilized and

protected from erosion, a local, long-term, beneficial impact. However, during planning and construction of the RSCs, park operations would be impacted as park staff divert their energies to provide input, oversight and compliance assistance, a park-wide, short-term, minor, adverse impact. Also, under an agreement with DDOE, the park would assume maintenance responsibilities for the RSCs after an agreed-upon number of years, a park-wide, long-term, minor, adverse impact.

Cumulative: Under alternative B, park operations and maintenance have been, and would continue to be, affected by the implementation of park plans and resource programs. It is anticipated that demand for park resources would escalate due to increased use of the park by visitors. This demand would have a detectable but not noticeable effect on park operations and management. The impact, in combination with the impacts associated with the alternative B would result in long-term minor adverse impacts on park operations and management.

Conclusion: In terms of park operations and maintenance, alternative B would have long-term beneficial impacts by rehabilitating and stabilizing Milkhouse Run and Bingham Run. Short-term and long-term, minor adverse impacts would occur due to oversight and maintenance of the RSCs. Cumulative impacts would be long-term minor and adverse.

VISITOR USE AND EXPERIENCE

Methodology and Assumptions

Available information on visitor use and experience within the project area was compiled and reviewed. Predictions about short- and long-term project impacts on visitor use and experience were based on general characteristics and proposed actions associated with alternatives affecting visitor use and experience at the Rock Creek Park Community Garden and along the Western Ridge Trail and Milkhouse Multi-use Trail.

Study Area

The geographic study area for visitor use and experience consists of the Milkhouse Multi-use Trail and portions of the Western Ridge Trail adjacent to the project area.

Impact Thresholds

The following thresholds were defined:

> **Negligible**: Changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the impacts associated with the alternative.
>
> **Minor**: Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be slightly aware of the impacts associated with the alternative.
>
> **Moderate**: Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.
>
> **Major**: Changes in visitor use and/or experience would be readily apparent and would be severely adverse or exceptionally beneficial. The visitor would be aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.

Impacts of Alternative A: No action Alternative

Direct/Indirect: Under alternative A, stream degradation would continue. Storm flows would cause stream bank erosion, sediment loading, and bank incision, threatening to undermine sections of the Milkhouse Multi-use Trail and Western Ridge Trail, located near Milkhouse Run and Bingham Run, which could result in long-term minor adverse impacts to user visitor and experience.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on visitor use and experience in and around the project area. These actions include renovations of public buildings and trails throughout the park, each having local, short-term, minor, adverse impacts (due to construction) and local, long-term, beneficial impacts on visitor use and experience. These impacts, in combination with the impacts associated with the no action alternative would result in long-term beneficial cumulative impacts.

Conclusion: In terms of visitor use and experience, alternative A could have long-term minor adverse impacts on visitor use of the Milkhouse Multi-use Trail and Western Ridge Trail if the trail becomes damaged by the erosion caused by uncontrolled stormwater flows through Milkhouse Run and Bingham Run. Overall cumulative impacts would be long-term and beneficial.

Impacts of Alternative B: Installation of RSCs at Bingham Run and Milkhouse Run

Direct/Indirect: Under alternative B, project work would occur close to the Milkhouse Multi-use Trail, the Western Ridge Trail at Bingham Run, and the Rock Creek Park Community Garden. While these facilities would remain open during construction, users of them would experience the noise and visual intrusions of a construction site; resulting in short-term minor adverse impacts to visitor use and experience. To mitigate these impacts, signage would be placed informing the public of what is occurring and how long the construction is expected to last. Also, to ensure public safety, barricades and/or other control measures would be installed to keep the general public out of the construction site. Once the RSCs are completed, the visual quality of the streams would be improved and the erosion caused by stormwater (that threatens to undermine the trails) would be slowed. As a result, over the long term, implementation of the RSCs would have beneficial impacts to visitor use and experience.

Cumulative: Past, present and reasonably foreseeable future actions have contributed and continue to contribute to the cumulative impact on visitor use and experience in and around the project area. These actions include renovations of public buildings and trails throughout the park, each having local, short-term, minor, adverse impacts (due to construction) and local, long-term, beneficial impacts on visitor use and experience. Therefore, these impacts, in combination with alternative B, would have long-term beneficial cumulative impacts on visitor use and experience.

Conclusion: In terms of visitor use and experience, alternative B would have a local, short-term, minor, adverse impact by creating a temporary construction site. Over the long-term, however, there would be overall beneficial impacts by improving the overall visual quality and protecting the Milkhouse Multi-use Trail and Western Ridge Trail. Cumulative impacts would be long-term and beneficial.

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CHAPTER 5: CONSULTATION AND COORDINATION

NPS guidance implementing the provisions of NEPA and CEQ regulations requires the NPS to make "diligent" efforts to involve the interested and affected public and government agencies in the NEPA process. This chapter documents the involvement of other agencies in the proposed action and identifies future compliance needs and permits.

Agency Consultation

On January 25, 2011, the NPS sent letters to USFWS (initiating consultation under Section 7 of the Endangered Species Act), the District of Columbia SHPO and ACHP (initiating consultation under Section 106 of the NHPA), NCPC, CFA, DDOT, D.C. Office of Planning, and DC Water.

In a letter dated February 18, 2011, the SHPO stated that "this project will have 'no adverse effect' on historic properties provided that the NPS will consult further with our office if any potential adverse effects are identified through review of the forthcoming Environmental Assessment."

Shane Dettman of the NCPC replied via email on February 23, 2011, requesting that the NPS and DDOE submit a formal request for NCPC review. Likewise, on February 24, 2011, Frederick Lindstrom requested by phone that the NPS submit a formal request for CFA review. In March 2011, DDOE submitted those requests (including required materials) to the NCPC and CFA. On March 18, 2011, the CFA stated by letter that it had "[n]o objection to the final plans for the installation of a regenerative stormwater conveyance" in Milkhouse Run and Bingham Run. On March 31, 2011, DDOE and NPS met with the NCPC to discuss this project and NCPC's approval process. The parties anticipated that the NCPC would perform its final review in June or July 2011.

In July 2010, NPS and DDOE filed a wetland alteration application with the Army Corps of Engineers. In April 2011, the Corps concluded via letter that the proposed work was authorized "by Nationwide Permit(s) for purposes of Section 404 of the Clean Water Act."

Appendix B contains an exemplary scoping letter sent by NPS to potentially interested parties and all responsive correspondence from state and federal agencies.

Future Compliance Needs/Permits

Prior to the implementation of the proposed action, the NPS would obtain appropriate land disturbance permits and abide by local and state erosion and sediment control standards. Additional approvals and reviews would be required prior to construction. These include a review by the NCPC.

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CHAPTER 6: REFERENCES

ACRONYMS

ACHP	Advisory Council on Historic Preservation
ANC	Advisory Neighborhood Commission
APE	Area of Potential Effect
ARPA	Archaeological Resources Protection Act
CEQ	Council on Environmental Quality
CFA	Commission of Fine Arts
CFR	Code of Federal Regulations
DDOE	District Department of the Environment
DDOT	District Department of Transportation
DO	Director's Order
DOI	Department of the Interior
EA	Environmental Assessment
ESF	Environmental Screening Form
FORCE	Friends of Rock Creek's Environment
GMP	General Management Plan
LOD	Limits of Disturbance
NCPC	National Capital Planning Commission
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NPS	National Park Service
RM	Reference Manual
SHPO	State Historic Preservation Officer
SOF	Statement of Findings
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United State Fish and Wildlife Service
USCGS	United States Coast and Geodetic Survey
USGS	United States Geological Service

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CHAPTER 7: APPLICABLE LAWS, EXECUTIVE ORDERS, POLICIES AND OTHER PLANS

ARCHEOLOGICAL INVENTORY AND EVALUATION STUDY, ROCK CREEK PARK (2004-2008)

The four-year archeological inventory and evaluation study of Rock Creek Park was completed in 2008. During this study, more than 1,100 acres of the park were surveyed for archeological remains, leading to the identification of 51 new sites. Of these, 11 were associated with known historic sites, such as Fort Totten and the Peirce Mill, and 40 were associated with new sites. Sites include Native American camps and quarries, trash dumps and a barracks area associated with Civil War forts, colonial farms, 19th-century tenant dwellings, and remnants of the Battle of Fort Stevens.

CODE OF FEDERAL REGULATIONS, TITLE 36, CHAPTER 1

This chapter provides regulations "for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the NPS."

DIRECTOR'S ORDER 12 (2001)

This policy document (known as DO 12) is entitled "Conservation Planning, Environmental Impact Analysis, and Decision Making." Along with an accompanying handbook, it guides parks through the NEPA compliance process.

DIRECTOR'S ORDER 28 (1998)

This policy document, and its accompanying guideline (known as DO 28), guide parks in their management of cultural resources.

EXECUTIVE ORDER 11593 – PROTECTION AND ENHANCEMENT OF THE CULTURAL ENVIRONMENT

This executive order directs the NPS to support the preservation of cultural properties, identify and nominate appropriate cultural properties within parks to the National Register, and "exercise caution . . . to assure that any NPS-owned property that might qualify for nomination is not inadvertently transferred, sold, demolished, or substantially altered."

HISTORIC RESOURCE STUDY: ROCK CREEK PARK, DISTRICT OF COLUMBIA (1990)

The Historic Resource Study for Rock Creek Park surveyed, identified, and evaluated Rock Creek Park's above-ground historic resources. In advance of the park's centennial celebration, the study documented sites and structures potentially eligible for listing in the NRHP.

HISTORIC SITES ACT OF 1935

This act declares as national policy the preservation for public use of historic sites, buildings, objects, and properties of national significance. 16 U.S.C. § 461-67. It authorizes the Secretary of the Interior and the NPS to restore, reconstruct, rehabilitate, preserve, and maintain historic or prehistoric sites, buildings, objects, and properties of national historical or archeological significance.

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. 42 U.S.C. § 4321. It is implemented through regulations of the Council on Environmental Quality (CEQ). 40 CFR § 1500-08.

NATIONAL HISTORIC PRESERVATION ACT OF 1966

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of their undertakings on properties listed or potentially eligible for listing on the National Register

of Historic Places (NRHP). 16 U.S.C. § 470. All actions affecting the park's cultural/historical resources must comply with this legislation.

NPS MANAGEMENT POLICIES 2006

NPS Management Policies 2006 (NPS 2006) recognizes that resource conservation takes precedence over visitor recreation. The policy dictates that "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant." NPS 2006 § 1.4.3. Still, the NPS has discretion to allow a negative impact on park resources when necessary and appropriate to fulfill park purposes, as long as the impact does not constitute "impairment." *Id.* § 1.4.3.

NPS ORGANIC ACT OF 1916

In the National Park Service Organic Act of 1916 (the "Organic Act"), Congress directed the U.S. Department of the Interior and the NPS to manage park units "to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations." 16 U.S.C. § 1. Although the Organic Act affords the NPS latitude when making decisions about visitor recreation and resource preservation, actions that permanently "impair" park resources are prohibited unless otherwise specifically allowed by law. *Id.* § 1a-1.

REDWOOD NATIONAL PARK ACT OF 1978

All NPS units are to be managed and protected as parks, whether established as a recreation area, historic site, or any other designation. This act states that the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress." 16 U.S.C. § 1a-1.

RESOURCES MANAGEMENT PLAN – ROCK CREEK PARK (1996)

The Resources Management Plan for Rock Creek Park provides specific management objectives. Those that pertain to this project include:

- Work cooperatively with other federal agencies, agencies in Maryland and the District of Columbia, private organizations, and members of the public in developing programs to reduce flooding and pollution in the Rock Creek watershed and to prevent or repair damage to park resources caused by human activities;
- Improve the quality of the visitor experience by better protecting natural resources;
- Preserve and perpetuate the park's plant and wildlife resources in as natural a condition as possible, and reduce the adverse effects of human activities and exotic species on the natural environment;
- Identify, protect, and perpetuate the park's historic resources, including its mills, Civil War fortifications, and archeological sites;
- Monitor and evaluate current recreational uses of the park's lands and redirect these activities in order to reduce adverse impacts;
- Foster understanding and appreciation of the park's natural and cultural values through interpretive and educational programs focusing on Rock Creek Park's biological, geological, historic, and prehistoric resources; and
- Establish contact and cooperation with citizen associations, governmental agencies, and other groups or individuals that surround, or have direct effects on or interests in the welfare of, the park.

ROCK CREEK PARK AND ROCK CREEK AND POTOMAC PARKWAY FINAL GENERAL MANAGEMENT PLAN/ENVIRONMENTAL IMPACT STATEMENT (2005)

This document, known as the GMP, is a comprehensive management plan for the park. The purpose of the GMP is to specify resource conditions and visitor experiences to be achieved in the park and Rock Creek and Potomac Parkway, and to provide a foundation for decision-making and the preparation of more specific resource plans. In addition to articulating goals for natural and cultural resource management, the GMP describes the following potential projects:

- Rehabilitate the Peirce Mill complex to focus on the history of milling and land use in the area. This would expand on the already completed rehabilitation of the Peirce Mill Barn;
- Move the park administrative offices out of the Peirce-Klingle Mansion at Linnaean Hill to commercial office space outside the park, or to a new office facility that would be constructed at an already disturbed area within the park, such as at the Maintenance Yard;
- Rehabilitate the Linnaean Hill complex for adaptive use compatible with park values;
- Move the U.S. Park Police substation out of the Lodge House on Beach Drive at Joyce Road to commercial space outside the park, or to a new park police substation that would be constructed within an already disturbed area in the park, such as near the existing U.S. Park Police H-3 stables;
- Convert the Lodge House to a visitor contact station to provide park orientation, information, and interpretation; and
- Rehabilitate and expand the Nature Center and upgrade its planetarium to improve effectiveness of public programs.

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CHAPTER 8: LIST OF PREPARERS

The following people helped write and/or revise this EA.

NPS – Rock Creek Park

Nick Bartolomeo, Chief Ranger

Michael Buckler, Environmental Protection Specialist

Cindy Cox, Deputy Superintendent

Ken Ferebee, Natural Resource Specialist

Joe Kish, Natural Resource Specialist

Simone Monteleone, Cultural Resources Program Manager

Bill Yeaman, Natural Resource Specialist

NPS – National Capital Region

Joel Gorder, Regional Environmental Coordinator and Lands Liaison

Stephen Potter, Regional Archeologist

DDOE

Steve Saari, Watershed Protection Specialist

Stephen Reiling, Environmental Protection Specialist

Biohabitats

Joe Berg, Senior Ecologist

Jennifer Rauhofer, Water Resource Engineer

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APPENDICES

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APPENDIX A – DRAFT IMPAIRMENT DETERMINATION

DRAFT IMPAIRMENT DETERMINATION: The NPS has determined that the implementation of the NPS preferred alternative ***will not*** constitute an impairment. It ***will not*** harm the integrity of park resources and values, including opportunities that would otherwise be present for the enjoyment of those resources and values. It will not cause a major, adverse impact on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified in the park's General Management Plan or other relevant NPS planning documents as being of significance. This determination is based on the thorough analysis of environmental impacts described in the EA, relevant scientific studies, the comments provided by the public and others, and the professional judgment of decision makers guided by NPS management policies.

As required by federal law, for the preferred alternative, below are impairment findings for the analyzed impact topics. Note that such findings are not necessary for park operations and management because under the Organic Act, these resources cannot be impaired in the same way as the other resources potentially impacted by the proposed project, namely cultural resources, topography and soils, hydrology, water quality, wetlands, floodplains, wildlife and wildlife habitat, and vegetation.

Cultural Landscapes

In 1997, the NPS began a cultural landscape inventory of Rock Creek Park. A cultural landscape inventory (CLI) identifies and documents the characteristics of a cultural landscape that make it significant and worthy of preservation. The CLIs permit the NPS to collate and evaluate information on the location, historical development, and features of the cultural landscapes that will assist park managers in their planning, programming, treatment, and management decisions. The cultural landscape of Rock Creek Park (US Reservation 339) has not been fully inventoried or evaluated for the National Register of Historic Places. However, the results of the inventory started in 1997 show that Rock Creek Park satisfies the criteria for listing in the National Register as a historic designed landscape.

In 2010, NPS began a Cultural Landscape Report on the Historic Trails in the park. This study will include an identification and analysis of all the horse, foot, and multi-use trails located in Rock Creek Park north of the zoo tunnel that connects Beach Drive to the Rock Creek and Potomac Parkway. This includes the Western Ridge Trail, which runs along Oregon Avenue, NW, close to Bingham Run.

Under the preferred alternative, cultural landscapes will not be impaired. Although components of the Rock Creek Park cultural landscape, and the Western Ridge Trail, are located in or around the proposed project area, and these resources are necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on the cultural landscapes in question are minor or less.

Historic Structures and Districts

Old Bingham Road (and its historic cobble stone gutter and lamp post), the culverts along Bingham Road, and the Western Ridge Trail are located in or around the project area.

Old Bingham Road: The roads and trails of Rock Creek Park form a historically significant circulation system built and improved between 1831 and 1941. Bingham Road, which was built in 1921, was the first major road construction conducted under the direction of the Office of Public Buildings and Grounds to provide east-west access from Daniel Road (present day Oregon Avenue) to Beach Drive. According to the Olmsted Brothers' report, Bingham Road was "a more or less urgent construction project" and the conceptual design for the road was to serve as a model for the construction of additional roadways within the park (Davis 1996, 89; Olmsted Brothers Report 1918, 46). The curving design of the road incorporated decorative lamp posts and a cobble stone gutter along the length of the road. Bingham Road now incorporates the active roadway from Oregon Avenue to Beach Drive and a spur that is unofficially

known as Old Bingham Road, which was abandoned in the 1950s. At Old Bingham Road, which passes through the project area, a single decorative lamp post remains along the west edge of the roadway, immediately to the east of Bingham Run (see Figure 12). A cobble stone gutter is extant on the east side of the roadway, but it has been heavily damaged by water and lack of maintenance (see Figure 13).

Western Ridge Trail: The hiking and equestrian trails of Rock Creek Park are part of the historic circulation system designed, built, and improved between 1830 and 1941. Running along the western boundary of Rock Creek Park, constructed and modified in sections over several decades, the Western Ridge Trail is one of the main north-south trails in U.S. Reservation 339 (see Figure 14). Certain sections are associated with older circulation routes that predate the park's establishment in 1890.

The section of trail at issue is immediately to the west of Bingham Run. Research being conducted for the Rock Creek Park Historic Trails Cultural Landscape Report is investigating whether this trail section was the main thoroughfare within this area of the park. The Western Ridge Trail was part of a circulation system that connected Oregon Avenue to Riley Spring.

Culverts

There are several culverts along Bingham Run that contribute to the Rock Creek Park Historic District. The National Register nomination for the district states that "the historic characteristics of this system of landscape elements can be defined as native stone material laid in a variety of sizes in mortar or in a few cases dry designed to appear informal and inconspicuous." Examples that the nomination identifies are the historic culverts constructed in the 1920s along Bingham Road. One such culvert abuts the LOD of the proposed work on Bingham Run (see Figure 14). A second culvert is near the project area, at the intersection of Old Bingham Road and Bingham Road.

Under the preferred alternative, historic structures and districts will not be impaired. Although they are necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on the historic structures and districts in question are minor.

Topography and Soils

Manor Loam and Glenelg Variant Silt Loam are the two most prevalent soil types found within and adjacent to Bingham Run and Milkhouse Run. Manor Loam, a moderately sloping and well drained to somewhat excessively drained soil, appears on ridge tops and side slopes of strongly dissected areas of the Piedmont Plateau. Glenelg is a nearly level to gently sloping, moderately well drained soil located on flat areas, in depressions, at the foot of hillsides, and around the heads of drainage ways. It is found in the Piedmont Plateau. (Soil Survey of the District of Columbia, 1975)

The topography of the Bingham Run site slopes downhill to the north, while the Milkhouse Run site slopes downhill to the east. Elevations range from approximately 270 feet above sea level at the upper end of the Milkhouse site to about 240 feet above sea level at the end of the project site. At the Bingham site, the project starts at about 270 feet above sea level and ends at about 210 feet above sea level. The slopes within the Milkhouse site are gentle, while the Bingham site has moderate slopes.

Under the preferred alternative, topography and soils will not be impaired. Although healthy soils and topography are necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on topography and soils within the project area are minor or less.

Hydrology

Milkhouse Run begins as two perennial, first-order streams that originate directly east of Oregon Avenue. The streams eventually join and continue as one stream to Rock Creek. The southernmost stream (the South Fork) is approximately 340 feet in length. The northernmost stream (the North Fork) is approximately 600 feet in length. After the two tributaries merge, Milkhouse Run flows an additional 1500 feet before it enters Rock Creek. Stormwater enters Milkhouse Run as sheet flow from impervious surfaces and from a single stormwater outfall that empties into the run. Spring-fed water enters the South Fork after passing through a culvert under the Milkhouse Multi-use Trail. On the North Fork, spring-fed water enters from a seep located near the tributary's headwaters.

Bingham Run is a first-order, intermittent tributary located on the east side of Oregon Avenue. After flowing adjacent to Old Bingham Drive past the project site, Bingham Run joins the main stream of Bingham Run and flows approximately 2500 feet before entering Rock Creek. Water enters Bingham Run as sheet flow from impervious surfaces such as roadways and the Western Ridge Trail.

As predicted by hydrologic, computer-aided design software, the peak discharges for Milkhouse Run range from 72.8 cubic feet per second (cfs) for the two-year storm event to 248 cfs for the 100-year storm event. The predicted peak discharges for Bingham Run range from 7.46 cfs for the two-year storm event to 41.47 cfs for the 100-year storm event. The base flow in Milkhouse Run is negligible, averaging only 0.002 cfs. There is no base flow in Bingham Run.

Under the preferred alternative, hydrology at Milkhouse Run and Bingham Run will not be impaired. Although it is necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources.

Water Quality

Milkhouse Run and Bingham Run are tributaries of Rock Creek. Currently, these tributaries are being degraded by storm flows and non-point source pollution from developed areas in the upper watershed, resulting in stream bank erosion, incised channels, and reduced water quality from sedimentation. Also, during storm events, the water in Milkhouse Run and Bingham Run contains small amounts of pollutants commonly found in urban streams. During dry conditions, Bingham Run doesn't convey water, and Milkhouse Run conveys a small amount (0.002 cfs) of spring-fed water.

Under the preferred alternative, water quality at Bingham Run and Milkhouse Run will not be impaired. Although it is necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as a significant resource in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on water quality are minor or less.

Wetlands

Milkhouse Run and Bingham Run are riverine wetlands under the NPS-recognized U.S. Fish and Wildlife Service (FWS) Cowardin Classification System. Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. The dominant water source at these runs is uncontrolled stormwater that enters the tributaries during storm events and damages the wetlands. Additional water sources include perennial springs, which provide a small base flow to Milkhouse Run.

Under the preferred alternative, wetlands at Bingham Run and Milkhouse Run will not be impaired. Although they are necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause

a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on wetlands are minor or less.

Floodplains

According to the National Park Service, floodplains are "the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands and (including at a minimum), that area subject to temporary inundation by a regulatory flood" (DO 77-2). There is one floodplain located within the project area. It is a small plot of elevated land that sits at the confluence of the two tributaries of Milkhouse Run, where the tributaries merge and continue as one stream to Rock Creek. During large storm events, this plot becomes inundated with water. However, due to the sloped topography of the area, there are no other floodplains located in or around the proposed project sites.

Under the preferred alternative, floodplains at Bingham Run and Milkhouse Run will not be impaired. Although they are necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on floodplains are minor or less.

Wildlife and Wildlife Habitat

The project area is rich with wildlife and wildlife habitat. It is part of a flyway, visited by migratory birds during the spring and fall. Bird species commonly seen in the project area include the Northern Cardinal (*Cardinalis cardinalis*), American Robin (*Turdus migratorius*), Carolina Chickadee (*Poecile carolinensis*), Red-bellied Woodpecker (*Melanerpes carolinus*), and Downy Woodpecker (*Picoides pubescens*). Mammals present include, but are not limited to, the eastern chipmunk (*Tamias striatus*), gray squirrels (*Sciurus caolinensis*), house mice (*Mus musculus*), white footed mouse (*Peromyscus leucopus*), and raccoon (*Procyon lotor*). Natural resources specialists from the NPS did not find aquatic species in the project areas,. However, downstream from the project areas, NPS staff found populations of Northern Two-lined Salamanders (*Eurycea bislineata*) and macroinvertebrates such as chironomids, crayfish and caddisflies.

Under the preferred alternative, wildlife and wildlife habitat will not be impaired. Although both are necessary to fulfill the purposes for which the park was established, key to opportunities for enjoyment within the park, and/or identified as significant resources in the park's planning documents, the preferred alternative does not constitute an impairment because it does not cause a major, adverse impact to these resources. Indeed, all adverse impacts of the preferred alternative on wildlife and wildlife habitat are minor or less.

Vegetation

In general, vegetation types found throughout the District of Columbia are the same as those found in Rock Creek Park. However, Rock Creek Park is unique in terms of preserving the largest urban forest in the area, providing habitat for much of the city's wildlife and acting as an important contributor to the region's biodiversity. Approximately 80 percent (1,662 acres) of Reservation 339 is covered with mature second-growth forest that is approximately 120 years old. Woodlands in the park are a mixture of deciduous species typical of eastern forests in the later stages of succession (NPS 2005). Inventories of park vegetation have found 238 non-native plant species within the park, 42 of which are classified as invasive, non-native species that, unless controlled, are likely to spread and adversely affect native plant populations.

Under the preferred alternative, vegetation will not be impaired. Although vegetation is necessary to fulfill specific purposes identified in the park's establishing legislation and is key to the natural integrity of the park and to opportunities for enjoyment of the park, the preferred alternative does not constitute an

impairment because it does not cause a major, adverse impact on vegetation. Indeed, all adverse impacts of the preferred alternative on vegetation are minor or less.

APPENDIX B – THIRD-PARTY LETTERS

United States Department of the Interior

NATIONAL PARK SERVICE
National Capital Region
Rock Creek Park
3545 Williamsburg Lane, N.W.
Washington, D.C. 20008-1207

IN REPLY REFER TO:

L76 (NCR-ROCR)

JAN 2 5 2011

Thomas Luebke, Secretary
U. S. Commission of Fine Arts
401 F Street NW, Suite 312
Washington, DC 20001-2728

Dear Mr. Luebke:

The National Park Service (NPS) and the District Department of the Environment (DDOE) propose to install Regenerative Stormwater Conveyances (RSCs) in two locations within Rock Creek Park – Bingham Run and Milkhouse Run, along Oregon Avenue, NW, within U.S. Reservation 339. At both of these locations, stormwater has caused significant damage to the runs and overall degradation of the landscape.

RSCs utilize a series of shallow aquatic pools, riffle/weir/grade controls, native vegetation, and an underlying sand channel to absorb and control the conveyance of stormwater. These systems are designed to convey flows associated with extreme floods (i.e., 100-year flood event) in a manner that minimizes erosion. The benefits of RSCs are many. They include providing a base-flow channel, trapping sediments and nutrients, recharging groundwater beneath and adjacent to stream beds, and creating wildlife habitat.

In order to comply with the National Environmental Policy Act (NEPA), the National Park Service will write an Environmental Assessment/Assessment of Effect (EA/AoE) for this project. The process and documentation required for compliance with NEPA also will be used to comply with Section 106 of the National Historic Preservation Act of 1966, as amended. Rock Creek Park is listed in the National Register of Historic Places.

In the meantime, we welcome any initial comments you may have. As the timeline for this project is very tight, we would like to address your concerns and incorporate your recommendations at the earliest possible time.

Should you need additional information or have any questions regarding this project, please

contact Michael Buckler, Environmental Protection Specialist, at 202-895-6076 or at michael_buckler@nps.gov.

Sincerely,

Stephen Syphax
Acting Superintendent, Rock Creek Park

Cc:
Steve Saari, DDOE

GOVERNMENT OF THE DISTRICT OF COLUMBIA
STATE HISTORIC PRESERVATION OFFICE

DC STATE HISTORIC PRESERVATION OFFICE
FEDERAL AGENCY SECTION 106 REVIEW FORM

TO: Mr. Michael Buckler, Environmental Protection Specialist

ADDRESS: via email: michael_buckler@nps.gov

PROJECT NAME/DESCRIPTION: Installation of Regenerative Stormwater Conveyances (RSCs)

PROJECT ADDRESS/LOCATION DESCRIPTION: Rock Creek Park – Bingham Run and Milkhouse Run

DC SHPO PROJECT NUMBER: 11-080

The DC State Historic Preservation Office (DC SHPO) has reviewed the above-referenced federal undertaking(s) in accordance with Section 106 of the National Historic Preservation Act and has determined that:

☐ This project will have **no effect** on historic properties. No further DC SHPO review or comment will be necessary.

☐ There are **no historic properties** that will be affected by this project. No further DC SHPO review or comment will be necessary.

☐ This project will have **no adverse effect** on historic properties. No further DC SHPO review or comment will be necessary.

☒ This project will have **no adverse effect** on historic properties **conditioned** upon fulfillment of the measures stipulated below.

☐ **Other Comments / Additional Comments** (see below):

Based upon a review of the project description included in the submittal letter, the DC SHPO believes that this project is unlikely to constitute an "adverse effect" on historic properties. Therefore, we have determined that this project will have "no adverse effect" on historic properties provided that the NPS will consult further with our office if any potential adverse effects are identified through review of the forthcoming Environmental Assessment.

BY: _____ **DATE:** February 18, 2011

C. Andrew Lewis
Senior Historic Preservation Specialist
DC State Historic Preservation Office

1100 4th Street, S.W., Suite E650, Washington, D.C. 20024 Phone: 202-442-7600 Fax: 202-442-7638

"Dettman, Shane" <shane.dettman@ncpc.gov>
02/23/2011 06:06 PM To
"'michael_buckler@nps.gov'" <michael_buckler@nps.gov>
cc
"Dettman, Shane" <shane.dettman@ncpc.gov>, "Levy, David W." <david.levy@ncpc.gov>
bcc
Subject
Rock Creek Park Projects (Regenerative Stormwater Conveyances / Fire Suppression System)
History:
This message has been replied to.

Michael,

It was nice talking with you this afternoon and I appreciate you spending a little time describing the Fire Suppression System and Regenerative Stormwater Conveyances (RSC) projects to me. As I mentioned to you, given that these projects are located on federal land in the District of Columbia, they are subject to NCPC review and approval pursuant to Section 5 of the National Capital Planning Act. As we discussed, specific to the Fire Suppression project, I will brief our Director of Urban Design and Plan Review, David Levy, and we will determine whether this project can be exempt from NCPC review per our submission guidelines. Based on your description of the RSC project, this project will definitely need to be submitted for review.

As NCPC has approval authority over both of these projects we also have an individual responsibility to satisfy the requirements of NEPA and Section 106. Our rules require that we work with applicants to develop NEPA documentation that both agencies can rely upon to complete the necessary environmental compliance. Therefore, at your earliest convenience I'd like to request that you share both EA's that have been prepared for these projects so that we can assess whether they contain the information we'll need to complete our review. Any correspondence you've had with the DC SHPO regarding Section 106 would be helpful as well.

Despite the substantial completion of the project plans and environmental documentation in advance of NCPC review, I think we may still be able to complete our review within the project timelines you described on the phone based on my current understanding of the scope of each project. This may change once we get a full understanding of the scope and complexity of each project. As a near-term next step, I recommend that we talk further about NCPC's project submission process, required submission materials, and potential submission/review dates. One of our Project Review Officers will contact you shortly to begin this discussion. In the meantime, I will discuss with David Levy whether the Fire Suppression Project can be exempt from review and get back to you once a determination is made. Finally, as a way to expedite our review of the projects I recommend that you prepare: a formal letter requesting review of the projects addressed to our Executive Director, Marcel Acosta, a complete project narrative, project maps / drawings / and renderings, NEPA and Section 106 documentation

(including FONSI's), and any other materials necessary. More information on our project submission guidelines, including required submission materials, can be found by clicking the link below.

NCPC Project Submission Guidelines

In advance of one of our team members contacting you, if you have any questions or need additional information please feel free to contact me.

Sincerely,

Shane L. Dettman, AICP
Senior Urban Planner
National Capital Planning Commission
401 9th Street, NW - Suite 500
Washington, DC 20004
202.482.7267 (o) | 202.641.0327 (c) | 202.482.7272 (f)

U.S. COMMISSION OF FINE ARTS

ESTABLISHED BY CONGRESS 17 MAY 1910

401 F STREET NW SUITE 312 WASHINGTON DC 20001-2728 202-504-2200 FAX 202-504-2195 WWW.CFA.GOV

18 March 2011

Dear Mr. Saari:

In its meeting of 17 March 2011, the Commission of Fine Arts reviewed and approved the following project on the Consent Calendar, with accompanying staff recommendation:

CFA 17/MAR/11-e
D.C. Department of the Environment
Rock Creek Park
Milkhouse Run, Rock Creek Park
Regenerative Stormwater Conveyance
Final

RECOMMENDATION: No objection to the final plans for the installation of a regenerative stormwater conveyance in Milkhouse Run on the west side of Rock Creek Park between the Park Police stables and Military Road to the south, as shown in materials received and dated 3 March 2011 Refer to DC Historic Preservation Office.

Sincerely,

Thomas E. Luebke, AIA
Secretary

Steven Saari
D. C. Department of the Environment
1200 1st Street, NE, 6th floor
Washington, DC 20002

cc: Stephen Syphax, National Park Service, National Capital Region
Michael Buckler, National Park Service, National Capital Region

U.S. COMMISSION OF FINE ARTS

ESTABLISHED BY CONGRESS 17 MAY 1910

401 F STREET NW SUITE 312 WASHINGTON DC 20001-2728 202-504-2200 FAX 202-504-2195 WWW.CFA.GOV

18 March 2011

Dear Mr. Saari:

In its meeting of 17 March 2011, the Commission of Fine Arts reviewed and approved the following project on the Consent Calendar, with accompanying staff recommendation:

CFA 17/MAR/11-d
D.C. Department of the Environment
Rock Creek Park
Bingham Run, Rock Creek Park,
Regenerative Stormwater Conveyance
Final

RECOMMENDATION: No objection to the final plans for the installation of a regenerative stormwater conveyance in Bingham Run on the west side of Rock Creek Park south of Bingham Drive, as shown in materials received and dated 3 March 2011 Refer to DC Historic Preservation Office.

Sincerely,

Thomas E. Luebke, AIA
Secretary

Steven Saari
D. C. Department of the Environment
1200 1st Street, NE, 6th floor
Washington, DC 20002

cc: Stephen Syphax, National Park Service, National Capital Region
Michael Buckler, National Park Service, National Capital Region

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MD 21203-1715

NOV 10 2010

REPLY TO
ATTENTION OF
Operations Division

District Department of the Environment
c/o Mr. Steve Saari
1200 First Street NE, 6th Floor
Washington, D.C. 20002

Dear Mr. Saari:

This is in reference to your application, NAB-2010-02160-M30 (Bingham Run), dated July 13, 2010, for Department of Army (DA) verification of Nationwide Permit (NWP) authorization to construct 11 approximately 5-foot long by 14-foot wide rock weir structures and to construct 5 approximately 10-foot long by 14-foot wide rock cascade structures to stabilize approximately 1,000 linear feet of an unnamed tributary to Bingham Run near the intersection of North Hampton Street and Oregon Avenue in Rock Creek Park, Washington DC.

Our evaluation has determined that the proposed work, if accomplished in accordance with the enclosed plan(s), is authorized by Nationwide Permit(s) for purposes of Section 404 of the Clean Water Act as published in the March 12, 2007 Federal Register, Final Notice of Issuance, Reissuance, and Modification of NWPs (72 FR 11090), NWP number **27** provided all District authorizations are granted. If any of the information contained in the application and/or plan(s) is later found to be in error, this authorization may be subject to modification, suspension, or revocation.

Enclosed is a list of conditions and management practices which must be followed for purposes of the NWP(s) in performing the work.

Each permittee who receives NWP verification from the Corps of Engineers must submit a signed certification regarding completed work and any required mitigation. Therefore, upon completion of the authorized work and required mitigation, you are required to complete the enclosed compliance certification form and return it to the address indicated thereon.

This verification is valid for two years from the date of this letter, unless the NWP is modified, reissued, or revoked. It is incumbent upon you to remain informed of changes to the NWPs. We will issue a public notice announcing the changes when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the NWP is modified or revoked, you will have 12 months from the date of the modification or revocation to complete the activity under the present terms and conditions of this NWP.

After you have obtained all required Federal, State, and/or local authorizations, you may proceed with the authorized work.

When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below. A copy of this nationwide permit verification signed by the transferee must be submitted to the Baltimore District to validate the transfer.

If you have any questions concerning this matter, please call Erica Schmidt of this office at (410) 962-6029.

Sincerely,

Kathy B. Anderson
Chief, Maryland Section Southern

Enclosures

_____ _____
(Transferee)

To identify how we can better serve you, we need your help. Please take the time to fill out our customer service survey at http://www.nab.usace.army.mil/Regulatory/survey.htm

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MD 21203-1715

APR 19 2011

REPLY TO
ATTENTION OF

Operations Division

District Department of the Environment
c/o Mr. Stephen Reiling
1200 First Street NE, 6th Floor
Washington, DC 20002

Dear Mr. Reiling:

This is in reference to your application, NAB-2010-02161 (Rock Creek/Milkhouse Run), dated July 13, 2010, for Department of Army (DA) verification of Nationwide Permit (NWP) authorization to construct 44 approximately 10-foot long by 14-foot wide rock weir structures to stabilize approximately 1,100 linear feet of two unnamed tributaries of Milkhouse Run near the intersection of North Hampton Street and Oregon Avenue in Rock Creek Park, Washington, DC.

Our evaluation has determined that the proposed work, if accomplished in accordance with the enclosed plan(s), is authorized by Nationwide Permit(s) for purposes of Section 404 of the Clean Water Act as published in the March 12, 2007 Federal Register, Final Notice of Issuance, Reissuance, and Modification of NWPs (72 FR 11090), NWP number **27** provided all District authorizations are granted. If any of the information contained in the application and/or plan(s) is later found to be in error, this authorization may be subject to modification, suspension, or revocation.

Enclosed is a list of conditions and management practices which must be followed for purposes of the NWP(s) in performing the work.

Each permittee who receives NWP verification from the Corps of Engineers must submit a signed certification regarding completed work and any required mitigation. Therefore, upon completion of the authorized work and required mitigation, you are required to complete the enclosed compliance certification form and return it to the address indicated thereon.

This verification is valid for two years from the date of this letter, unless the NWP is modified, reissued, or revoked. It is incumbent upon you to remain informed of changes to the NWPs. We will issue a public notice announcing the changes when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the NWP is modified or revoked, you will have 12 months from the date of the modification or revocation to complete the activity under the present terms and conditions of this NWP.

After you have obtained all required Federal, State, and/or local authorizations, you may proceed with the authorized work.

April #1
received
4-29-11

When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below. A copy of this nationwide permit verification signed by the transferee must be submitted to the Baltimore District to validate the transfer.

If you have any questions concerning this matter, please call Erica Schmidt of this office at (410) 962-6029.

Sincerely,

Kathy B. Anderson
Chief, Maryland Section Southern

Enclosures

_____ _____
(Transferee)

To identify how we can better serve you, we need your help. Please take the time to fill out our customer service survey at http://www.nab.usace.army.mil/Regulatory/survey.htm

APPENDIX C – NPS ARCHEOLOGICAL TESTING RESULTS[4]

[4] To conserve paper, attached are the cover sheet and abstract of the archeological report. A complete public copy (with redactions of non-public information protected by ARPA) is available upon request.

Phase I Archaeological Survey of Portions of Bingham and Milkhouse Runs, Rock Creek Park, Washington D.C.

Prepared for:
District of Columbia
Department of the Environment

DDOE
DISTRICT DEPARTMENT OF THE ENVIRONMENT

1200 First Street NE, 6th Floor
Washington, DC 20002

Prepared by:

James G. Gibb and Sarah Michailof

Straughan Environmental, Inc.

STRAUGHAN ENVIRONMENTAL SERVICES, INC.
10245 Old Columbia Road
Columbia, MD 21046

in association with Biohabitats

2081 Clipper Park Road
Baltimore, MD 21211

September 2010

ABSTRACT

Straughan Environmental, Inc., (Straughan) conducted a Phase I archaeological survey along portions of Bingham and Milkhouse runs in Rock Creek Park in Washington, D.C. The survey was undertaken as part of the Oregon Avenue Regenerative Stormwater Conveyance Project proposed by the District of Columbia Department of the Environment. The archaeological investigation was undertaken in compliance with the National Historic Preservation Act of 1966, as amended, and under the terms of Archaeological Resources Protection Act permit number 10-ROCR-008. The District of Columbia proposes modifications to the stream banks and beds at or near the drainage heads of Bingham and Milkhouse runs, east of Oregon Avenue and south of Bingham Drive as a component of stream restoration projects at those sites.

Earlier surveys have identified aboriginal, Colonial, 19th-century domestic, and 19th-century industrial sites within the park. Fort DeRussy, one of the redoubts built to protect Washington, DC, in 1861-1862, is just south of the Milkhouse Run study area. Much of the surface within the proposed limits of disturbance for both study areas is moderately steep, wooded, and eroded. The eastern edge of the Bingham Run study area had been graded for construction of a now-derelict macadam road.

The principal author, aided by three technicians, conducted fieldwork on July 20, 2010. Ten shovel tests (B1-B10) at 50-foot intervals were excavated along the paved path on the west side of the Bingham Run study area and the crew scanned the transect with a metal detector. Metal detecting identified one large wire nail and a machine bolt. The test units encountered only discarded trash, except at unit B10. This unit was excavated just south of the previously identified and tested E.T. Meeds site (51NW186), a late 19th-century cellar hole and toppled brick fireplace and chimney stack. Only a colorless sherd of glass was noted. The historical significance of the Meeds site remains unevaluated, but it lies outside of the area of proposed disturbance.

Nineteen shovel tests (M1-M19) were excavated around the Milkhouse Run study area and that transect was also scanned with a metal detector. The only magnetic anomalies were from a series of recent surveyors' points and discarded beverage cans associated with extensive surface scatters of beverage bottles. Isolated late historic artifacts—a colorless vessel glass sherd (M2), brick fleck (M3), and white graniteware sherd (M5)—were recovered and may be associated with architectural and domestic debris that borders the lawn and community gardens at the top of the slope.

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APPENDIX D – HYDROLOGICAL DATA

(appendices excluded)

Biohabitats
Incorporated

2081 Clipper Park Rd
The Stables
Baltimore , MD 21211
(410) 554-0156
(410) 554-0168 (fax)
www.biohabitats.com

Date: January 13, 2010

To: District of Columbia Department of Environment

From: Suzanne Hoehne, Biohabitats, Inc.

RE: DC Rock Creek Bingham Run RSC
Biohabitats Project No. 09044.01
SUBJ: Hydrology and Hydraulic Analysis Memo

1.0 Introduction

Biohabitats, Inc. has been contracted by the DC Department of Environment (DDOE) to Design and install regenerative stormwater conveyance for an intermittent stream that discharges near Bingham Run in the main stem of Rock Creek. This memorandum describes the project goals and the design approach and rationale for restoration at the project site, also known as Bingham Run. In addition, this memorandum provides detail on the hydrologic and hydraulic modeling that underlay the design.

1.1. Goals

Based on stream conditions observed within the project area, the following goals have been established to guide the project:

- Improve water quality at the location and downstream water quality by reducing nutrient and sediment pollution from erosion.
- Demonstrate the RSC technology as an alternative solution to traditional, more costly, and less ecologically friendly approaches to stream and outfall erosion.
- Minimize disturbance and loss of trees. Reuse any trees removed, if possible.

It is anticipated that this approach will create a stable, self-sustaining channel geometry over the long-term that can adjust to changes in physical processes with minimal human intervention.
The objectives of the hydrologic and hydraulic investigation include the following: 1) identification of 2-, 10-, and 100-year return interval discharges within the project area, 2) investigation of the existing and proposed channel hydraulics for the 2- and 10-year peak discharges, and 3) delineation of the existing and proposed 2-, 10-, and 100-year floodplain. This information was used for sizing the proposed channel, evaluating proposed channel stability, and comparing the existing and proposed 100-year floodplain.

1.2. Project Description

Bingham Run is a first-order stream that originates directly east of Oregon Ave and south of Bingham Drive in Washington D.C. (Figure 1). Bingham Run begins as two tributaries whose subwatersheds originate in the residential area west of Oregon Ave and in the parkland east of Oregon Ave respectively. The tributaries merge into one channel, Bingham Run, which extends approximately 2500 feet before flowing into Rock Creek.

The annual average rainfall is 39 inches in the Washington DC area. The Bingham Run watershed is completely within the Maryland Piedmont Physiographic Region and has a drainage area of 21 acres. The upper watershed has been impacted by significant residential development. This development combined with a moderately steep slope of 5.2% in the valley has contributed to the instability of the stream banks and channel bed leading to increased erosion of the stream banks and sediment loading.

DC Rock Creek Bingham RSC
January 13, 2011
RE: Hydrologic and Hydraulic Analysis Memo
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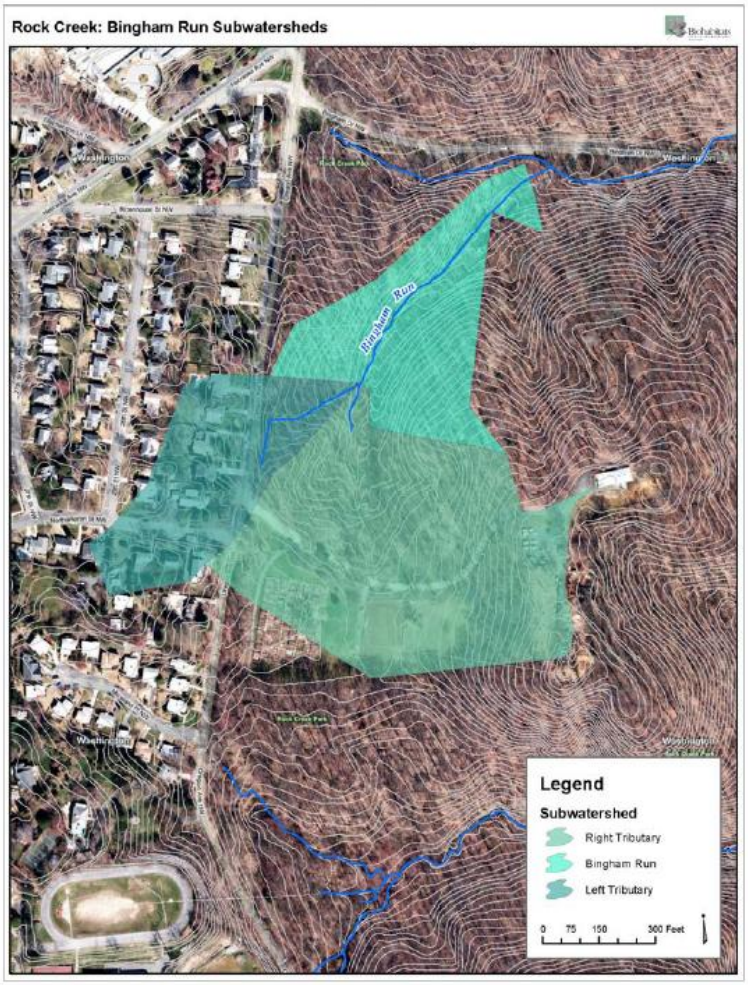

Figure 1. Site Map of the DC Rock Creek Bingham Run RSC Project Watershed Area including Subwatershed boundaries.

2.0 Hydrologic Modeling

This section presents the development of the hydrologic model and reviews model results.

2.1 Methodology

Peak discharges were predicted for the Bingham Run watershed using HydroCAD which utilizes methods based largely on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS), combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. HydroCAD maintains a complete database for the watershed and drainage system, making it much more user-friendly than the DOS-based TR-20 program.

The Bingham Run watershed was divided into 3 main subwatersheds, one for the left tributary, one for the right tributary and one for the area adjacent to the main channel (See figure 1). The watershed boundaries were determined using LiDAR based topographic data provided by the government of the District of Columbia. Land use cover types were then delineated using ARCGIS 9.3.1 (ESRI, 2009) and 2008 Orthophotos, also provided by the government of the District of Columbia. The hydrologic soil group data (from the USDA SSURGO soils database) and aerial imagery were overlaid and different land use designations were assigned to determine aerial extents of certain land use practices. These areas then were assigned a runoff curve number depending on their respective land use practice and hydrologic soil group
For time of concentration determination, an assumption was made that all the flow west of Oregon Avenue is piped. The flow length above Oregon Avenue was measured along the lowest point as indicated in the topographic mapping. This flow was assumed to be shallow concentrated flow on pavement due to the lack of information about the stormsewer system.

HydroCAD was run using the SCS TR-20 method with the Type II 24 hr rainfall for the 2-, 5-, 10-, 25-, 50- and 100-yr events.

2.2 Results

Peak discharge estimates from HydroCAD for the Bingham Run watershed are listed in Table 1 and were used for the design discharges. For the full HydroCAD model input and results, see Appendix A.

Table 1: Predicted peak discharges within the Bingham Run Watershed using HydroCAD.

Return Period	Bingham Run
(yr)	(cfs)
2	7.46
5	11.34
10	19.33
25	28.52

DC Rock Creek Bingham RSC
January 13, 2011
RE: Hydrologic and Hydraulic Analysis Memo
Page 5 of 16

50	34.39
100	41.47

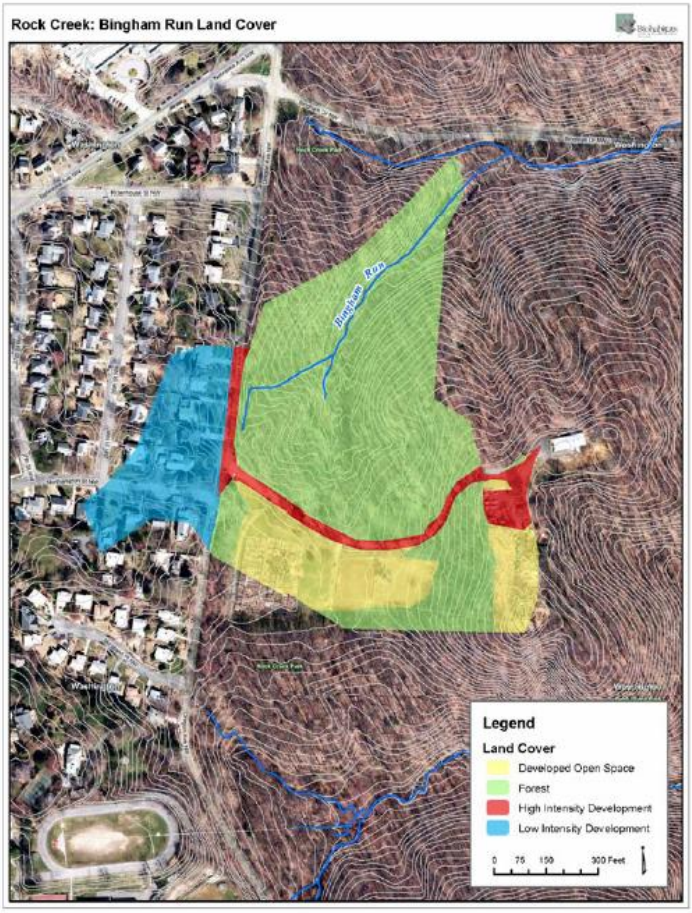

Figure 2. Land Use Map Distribution within the Bingham Run Watershed.

DC Rock Creek Bingham RSC
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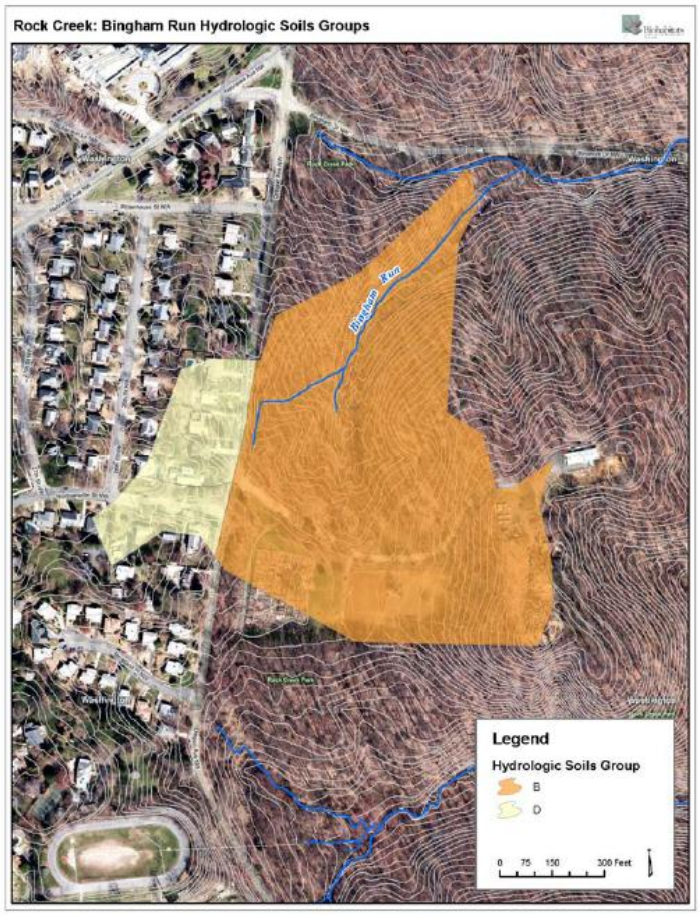

Figure 3. Hydrologic Soils Group distribution within the Bingham Run Watershed.

3.0 Hydraulic Modeling

This section presents the development of the hydraulic model and reviews model results.

3.1 Methodology

The purposes of the hydraulics analysis are as follows:

1) To identify any changes to the 2-, 10-, and 100-year floodplain predicted by the model resulting from the proposed restoration.
2) To ensure that the proposed restoration meets the design objectives for additional floodplain access and supporting in-stream habitat.

The Hydrologic Engineering Center's River Analysis System (HEC-RAS Version 4.0, 2008) was used to develop the hydraulic computations for the existing and proposed conditions of the Bingham Run. HEC-RAS is a one-dimensional, steady flow water surface profile model. The computational procedure is based on the solution of the one-dimensional energy equation with energy loss due to viscous and Reynold's stresses computed using the Manning's equation. The computational procedure is generally known as the Standard Step Method and can be used for subcritical as well as supercritical flow conditions. The effects of various obstructions such as bridges, culverts, weirs, and structures in the floodplain may be considered in the computations.

The model was used to predict discharges resulting from the 2-, 10-, and 100-year peak discharges for Bingham Run and its tributaries. The model was developed using U.S. Army Corps of Engineers HEC-GeoRAS 4.2.93 extension for ArcGIS from a topographical survey with 1-foot contours. Cross sections were located at the upstream end of the proposed in-stream structures and cut along both an existing and proposed surface in GeoRAS.

3.2 Roughness Coefficients

The Manning's n values used in the HEC-RAS model were based on a visual examination of the stream channel and overbanks, and by utilizing the methodology presented by Arcement & Schneider (1989). This methodology uses six variables which are scored based on a scale of severity or extremeness. The scores of the six variables, which are variation in cross section, effect of obstruction, amount of vegetation, degree of meandering, degree of irregularity, and base roughness, are added together to get a composite Manning's n value. The in-channel Manning's n values used in the model are shown in Table 2. For overbank roughness, land use type was determined from aerial photography taken in 2010 on Google Earth. The corresponding Manning's n and its associated land use cover are listed in Table 2 which were utilized in this model.

Table 2: Manning n's values used for the HEC-RAS model for various land uses.

Land Use	Manning's n
Meadow, mown grass, stream	0.05
Woods	0.09

DC Rock Creek Bingham RSC
January 13, 2011
RE: Hydrologic and Hydraulic Analysis Memo
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3.3 Boundary Conditions

Normal depth at the channel invert slope was used to establish water surface elevations at the upstream limits of each tributary and at the downstream end of Bingham Run. The model was run using a mixed flow regime (subcritical and supercritical flow profiles examined in a single HEC-RAS run) to determine the water surface elevations within each reach.

Ineffective flow areas and levees are used to define areas of a cross section where water is not actively being conveyed. This occurs on the cross sections where the cross section might have a depression that is not hydraulically connected to an upstream cross section.

Appendix B contains maps showing the relative cross section locations to the stream with the 2-, 10-, and 100-year water surface elevations, and Appendix C contains the hydraulic model reports for the existing and proposed conditions.

3.4 FEMA Studies

Research was performed into any previous FEMA floodplain mapping studies of the project area. Bingham Run has not been mapped by FEMA, the latest revision occurring in September of 2010. Bingham Run is located on maps 1100010008C and 1100010006C (Figure 4 and Figure 5).

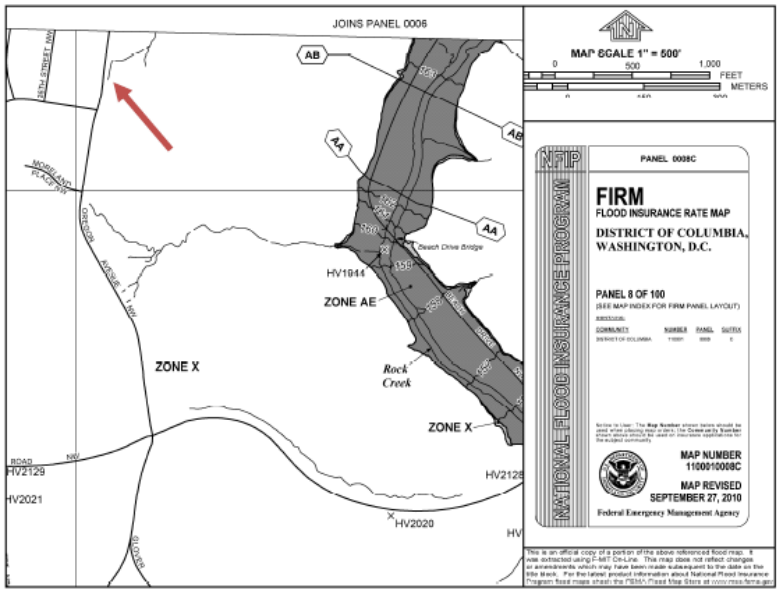

Figure 4. FEMA Flood Insurance Rate Map with Bingham Run indicated by the red arrow.

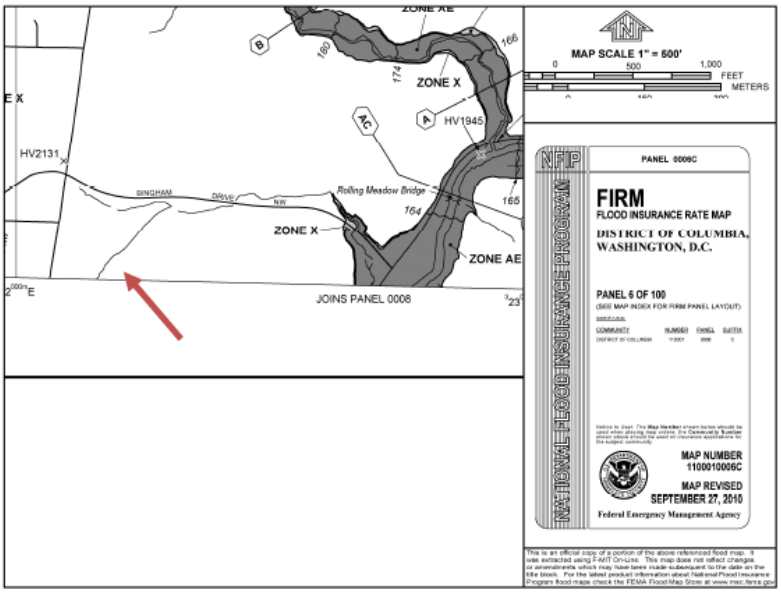

Figure 5. FEMA Flood Insurance Rate Map with Bingham Run indicated by the red arrow.

3.5 Results

In this section the results from the existing and proposed hydraulic model are summarized with regard to the 2-, 10, and 100-year water surface elevations.

3.5.1 2-, 10-, 100-Year Storm Events

The 2-, 10-, and 100-year peak discharges were used to calculate the equivalent floodplain elevation for the existing and proposed conditions at Bingham Run. Figure 6 shows the various water surface elevations for the corresponding storm events. All cross sections are located on National Park Land. For the HEC-RAS output for the proposed and existing conditions see Appendix C and cross section index map showing the 2-, 10-, and 100-year WSE extents, see Appendix B.

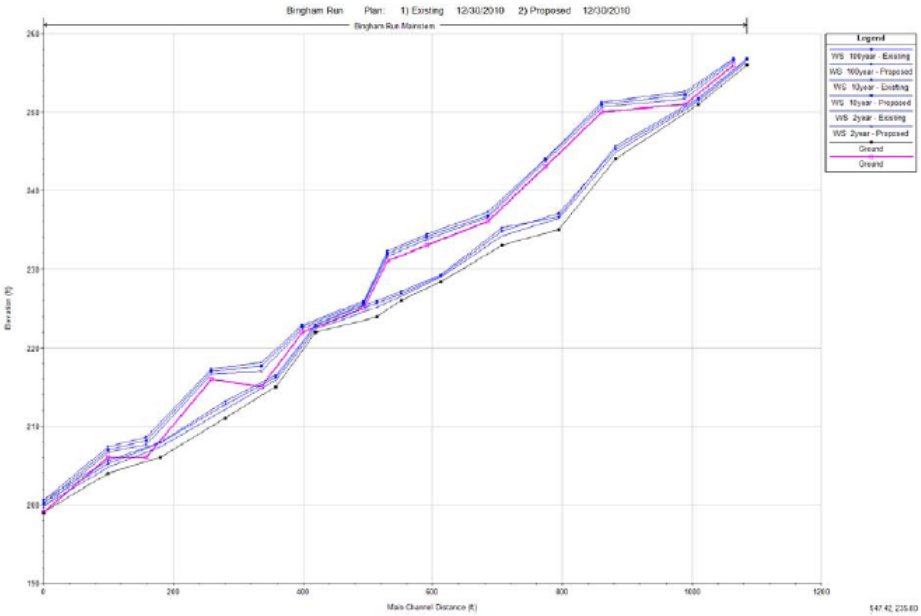

Figure 6. 2-, 10-, and 100- year existing and proposed water surface elevations.

4.0 Restoration Approach

A majority of the watershed upstream of the project site has been developed and much of the drainage has been piped. The increase in the amount of impervious surface from development and the piping of flows from those areas has led to an increase in the volume of runoff and a quicker and larger magnitude peak in the watershed's runoff hydrograph. This runoff pattern has led Bingham Run and its tributaries to their current condition of incised channels with limited connection to the existing floodplain.. These condition results in continued channel degradation and high sediment yield from stormwater flows.

With these conditions in mind the primary design goals are: 1) Restoring the incised section of the channels with the goal of eliminating bed and bank erosion; 2) connecting the channel to the adjacent floodplain; and 3) restoring aquatic habitat conditions for fish and benthic communities. Because the project site is located within national park property, an additional overarching goal is to achieve the restoration with minimal disturbance to trees.

The proposed methodology for design is based upon the Regenerative Storm Conveyance Methodology or RSC. Regenerative Stormwater Conveyance (RSC) systems are filtering systems that utilize a series of shallow aquatic pools, riffle/weir, native vegetation, and the

underlying sand channel to treat and slow the conveyance of storm flow. RSC systems also promote the conversion of storm water to groundwater through infiltration. RSC systems combine features and treatment benefits of swales, infiltration, filtering, and wetland practices. In addition, these systems are designed to convey flows associated with extreme floods (i.e., 100-year flood event) in a non-erosive manner, which results in a reduction of channel erosion impacts. The riffle/weirs have been designed to carry the 100 year storm event for each channel at the upstream end of the structure. For further detail please see the attached design spreadsheets in Appendix D.

5.0 Summary

Bingham Run and Tributaries exhibit extensive bank erosion and have become disconnected from their floodplain. To address these problems, the restoration design approach presented above includes reconnection of the stream with its floodplain to alleviate incision, as well as the restoration of habitat, increased flood retention in the watershed and protection of existing infrastructure.

6.0 References

Arcement, G.J. and V.R. Schneider, 1989. Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains. U.S.G.S. Water Supply Paper 2339. http://onlinepubs.er.usgs.gov/djvu/WSP/wsp_2339.djvu (accessed February 5, 2009).

District of Columbia GIS Data Clearinghouse Catalog, 2010. Available at http://dcatlas.dcgis.dc.gov/catalog/search_predef.as (accessed March 2010)

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FEMA, 2010. Flood Insurance Study for the District of Columbia, Washington D.C., Community # 1100010008C and # 1100010006C, September 29, 2010.

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Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for [Washington DC]. available online at http://soildatamart.nrcs.usda.gov accessed March 2010].

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U.S. Army Corps of Engineers, Hydrologic Engineering Center, "HEC GeoRAS GIS Tools for Support of HEC-RAS User's Manual", Version 4.2, September 2009.

U.S. Department of Agriculture, 1987 & 1990. Computer Program for Project Formulation Hydrology, Natural Resources Conservation Service, Technical Release 20.

Biohabitats
Incorporated

2081 Clipper Park Rd
The Stables
Baltimore , MD 21211
(410) 554-0156
(410) 554-0168 (fax)
www.biohabitats.com

Date: January 10, 2010

To: District of Columbia Department of Environment

From: Suzanne Hoehne, Biohabitats, Inc.

RE: DC Rock Creek Milkhouse RSC
Biohabitats Project No. 10002.01
SUBJ: Hydrology and Hydraulic Analysis Memo

1.0 Introduction

Biohabitats, Inc. has been contracted by the DC Department of Environment (DDOE) to Design and install regenerative stormwater conveyance for an intermittent stream that discharges near Milkhouse Ford in the main stem of Rock Creek. This memorandum describes the project goals and the design approach and rationale for restoration at the project site, also known as Milkhouse Run. In addition, this memorandum provides detail on the hydrologic and hydraulic modeling that underlay the design.

1.1. Goals

Based on stream conditions observed within the project area, the following goals have been established to guide the project:

- Improve water quality at the location and downstream water quality by reducing nutrient and sediment pollution from erosion.
- Demonstrate the RSC technology as an alternative solution to traditional, more costly, and less ecologically friendly approaches to stream and outfall erosion.
- Minimize disturbance and loss of trees. Reuse any trees removed, if possible.

It is anticipated that this approach will create a stable, self-sustaining channel geometry over the long-term that can adjust to changes in physical processes with minimal human intervention.
The objectives of the hydrologic and hydraulic investigation include the following: 1) identification of 2-, 10-, and 100-year return interval discharges within the project area, 2) investigation of the existing and proposed channel hydraulics for the 2- and 10-year peak discharges, and 3) delineation of the existing and proposed 2-, 10-, and100-year floodplain. This information was used for sizing the proposed channel, evaluating proposed channel stability, and comparing the existing and proposed 100-year floodplain.

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1.2. Project Description

Milkhouse Run is a first-order stream that originates directly west of Oregon Ave in Washington D.C. (Figure 1). Milkhouse Run begins at the confluence of three tributaries which flow approximately 400 ft. The two main tributaries, for the purposes of this project, are respectively called Right Tributary and Left Tributary. The Milkhouse study area begins approximately 20 ft west of Oregon Avenue and extends downstream 100 ft past the confluence of the two tributaries. Milkhouse Run eventually flows into Rock Creek approximately 490 ft at the bottom of the hillslope.

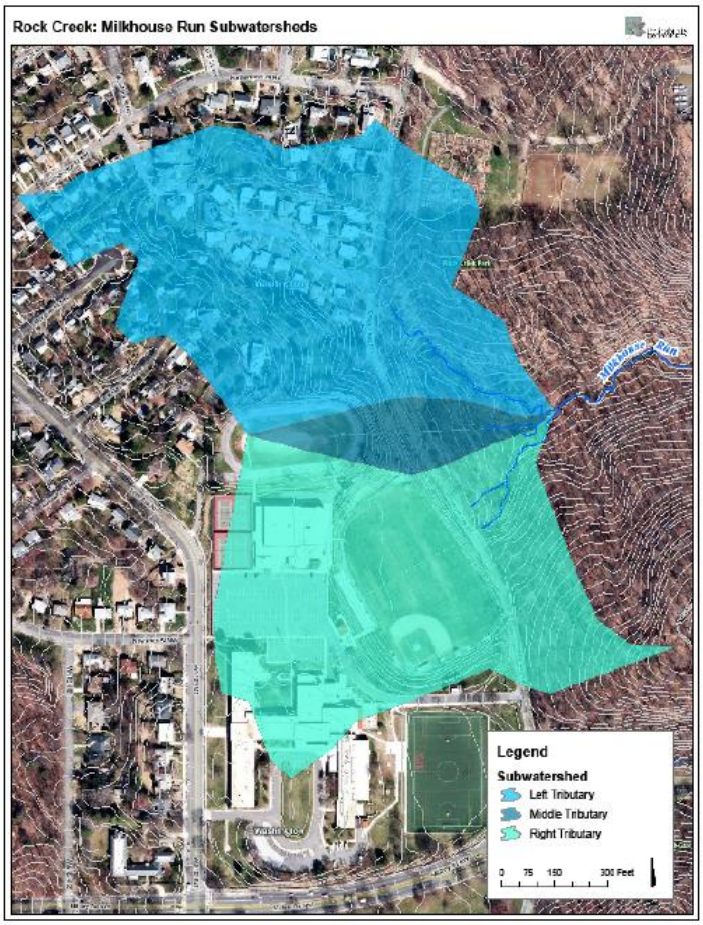

Figure 1. Site Map of the DC Rock Creek Milkhouse RSC Project Watershed Area including Subwatershed boundaries.

The annual average rainfall is 39 inches in the Washington DC area. The Milkhouse Run watershed is completely within the Maryland Piedmont Physiographic Region and has a drainage area of 36 acres. The upper watershed has been impacted by significant residential development. This development combined with a moderately steep slope of 5.7% in the valley has contributed to the instability of the stream banks and channel bed leading to increased erosion of the stream banks and sediment loading.

2.0 Hydrologic Modeling

This section presents the development of the hydrologic model and reviews model results.

2.1 Methodology

Peak discharges were predicted for the Milkhouse Run watershed using HydroCAD which utilizes methods based largely on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS), combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. HydroCAD maintains a complete database for the watershed and drainage system, making it much more user-friendly than the DOS-based TR-20 program.

The Milkhouse Run watershed was divided into 3 main sub watersheds, one along the left tributary, the right tributary and one along a small drainage way between the two main tributaries (See figure 1). The watershed boundaries were determined using LiDAR based topographic data provided by the government of the District of Columbia. Land use cover types were then delineated using ARCGIS 9.3.1 (ESRI, 2009) and 2008 Orthophotos, also provided by the government of the District of Columbia. The hydrologic soil group data (from the USDA SSURGO soils database) and aerial imagery were overlaid and different land use designations were assigned to determine aerial extents of certain land use practices. These areas then were assigned a runoff curve number depending on their respective land use practice and hydrologic soil group.

For time of concentration determination, an assumption was made that all the flow above Oregon Avenue is piped. The flow length above Oregon Avenue was measured along the lowest point as indicated in the topographic mapping. This flow was assumed to be shallow concentrated flow on pavement due to the lack of information about the storm sewer system. Downstream of Oregon Avenue the flow was considered to be channel flow.

HydroCAD was run using the SCS TR-20 method with the Type II 24 hr rainfall for the 2-, 5-, 10-, 25-, 50- and 100-yr events.

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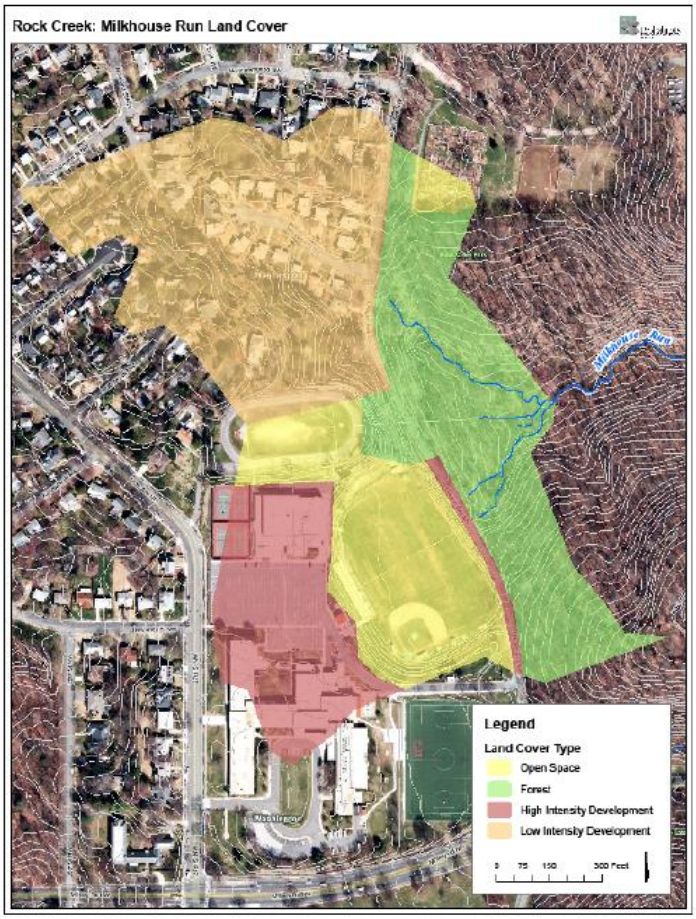

Figure 2. Land Use Map Distribution within the Milkhouse Run Watershed.

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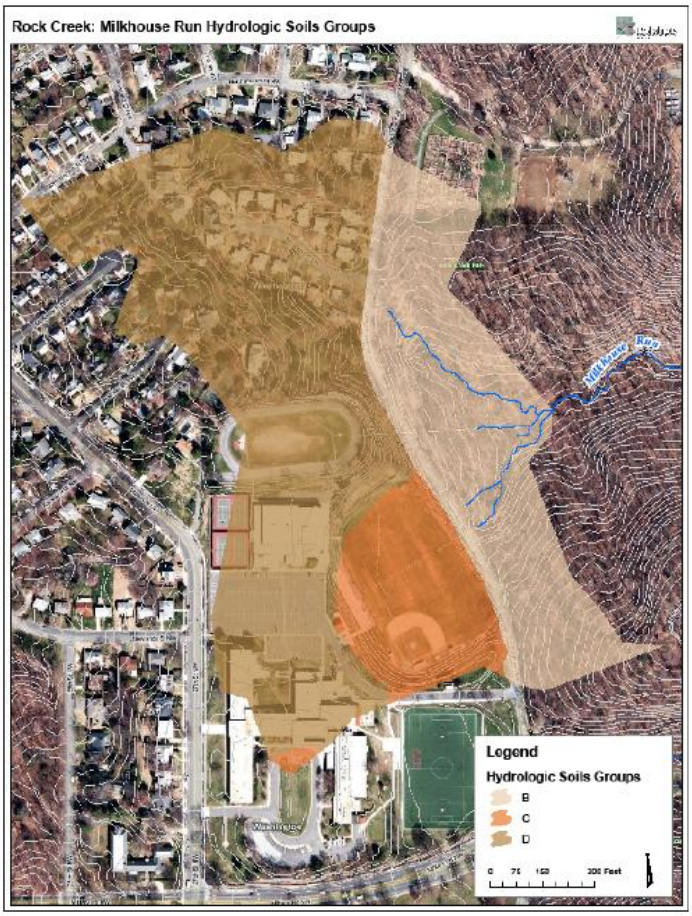

Figure 3. Hydrologic Soils Group distribution within the Milkhouse Run Watershed.

2.2 Results

Peak discharge estimates from HydroCAD for the Milkhouse Run watershed are listed in Table 1 and were used for the design discharges. For the full HydroCAD model input and results, see Appendix A.

Table 1: Predicted peak discharges within the Milkhouse Watershed using HydroCAD.

Return Period	Left Tributary	Right Tributary	Milkhouse Run
(yr)	(cfs)	(cfs)	(cfs)
2	37.3	36.2	72.8
5	57.8	56.8	113.5
10	79.2	78.2	156.2
25	92.2	91.3	182.2
50	107.5	106.7	212.8
100	125	124.4	248

3.0 Hydraulic Modeling

This section presents the development of the hydraulic model and reviews model results.

3.1 Methodology

The purposes of the hydraulics analysis are as follows:

1) To identify any changes to the 2-, 10-, and 100-year floodplain predicted by the model resulting from the proposed restoration.
2) To ensure that the proposed restoration meets the design objectives for additional floodplain access and supporting in-stream habitat.

The Hydrologic Engineering Center's River Analysis System (HEC-RAS) Version 4.0 (USACE, 2008) was used to develop the hydraulic computations for the existing and proposed conditions of the Milkhouse Run. HEC-RAS is a one-dimensional, steady flow water surface profile model. The computational procedure is based on the solution of the one-dimensional energy equation with energy loss due to friction computed using the Manning's equation. The computational procedure is generally known as the Standard Step Method and can be used for subcritical as well as supercritical flow conditions. The effects of various obstructions such as bridges, culverts, weirs, and structures in the floodplain may be considered in the computations.

The model was used to predict discharges resulting from the 2-, 10-, and 100-year peak discharges for Milkhouse Run and its tributaries. The model was developed using U.S. Army Corps of Engineers HEC-GeoRAS extension for ArcGIS (USACE, 2009) from a topographical survey with 1-foot contours that extended from Georgia Avenue at the upstream end to 100 feet below the confluence of the two tributaries. Cross sections were cut along the stream centerline from just below the culvert under the pedestrian path at the upstream end of the project site to the below the proposed work and cut along both an existing and proposed surface in GeoRAS. Proposed cross sections were located at

the upstream end of the proposed structures. Upstream of the proposed site the system is either surface drainage or piped until it daylights on the east side of Georgia Avenue.

3.2 Roughness Coefficients

The Manning's n values used in the HEC-RAS model were based on a visual examination of the stream channel and overbanks, and by utilizing the methodology presented by Arcement & Schneider (1989). This methodology uses six variables which are scored based on a scale of severity or extremeness. The scores of the six variables, which are variation in cross section, effect of obstruction, amount of vegetation, degree of meandering, degree of irregularity, and base roughness, are added together to get a composite Manning's n value. The in-channel Manning's n values used in the model are shown in Table 2. For overbank roughness, land use type was determined from aerial photography taken in 2010 on Google Earth. The corresponding Manning's n and its associated land use cover are listed in Table 2 which were utilized in this model.

Table 2: Manning n's values used for the NB 1 HEC-RAS model for various land uses.

Land Use	Manning's n
Meadow, mown grass, stream	0.05
Woods	0.09

3.3 Boundary Conditions

Normal depth at the channel invert slope was used to establish water surface elevations at the upstream limits of each tributary and at the downstream end of Milkhouse Run. The model was run using a mixed flow regime (subcritical and supercritical flow profiles examined in a single HEC-RAS run) to determine the water surface elevations within each reach.

Ineffective flow areas and levees are used to define areas of a cross section where water is not actively being conveyed. This occurs on the cross sections where the cross section might have a depression that is not hydraulically connected to an upstream cross section.

Appendix B contains maps showing the relative cross section locations to the stream with the 2-, 10-, and 100-year water surface elevations, and Appendix C contains the hydraulic model reports for the existing and proposed conditions. .

3.4 FEMA Studies

Research was performed into any previous FEMA floodplain mapping studies of the project area. The project site has been mapped by FEMA, the latest revision occurring in September of 2010. The site is located on map 1100010008C and is in Zone X (Figure 4).

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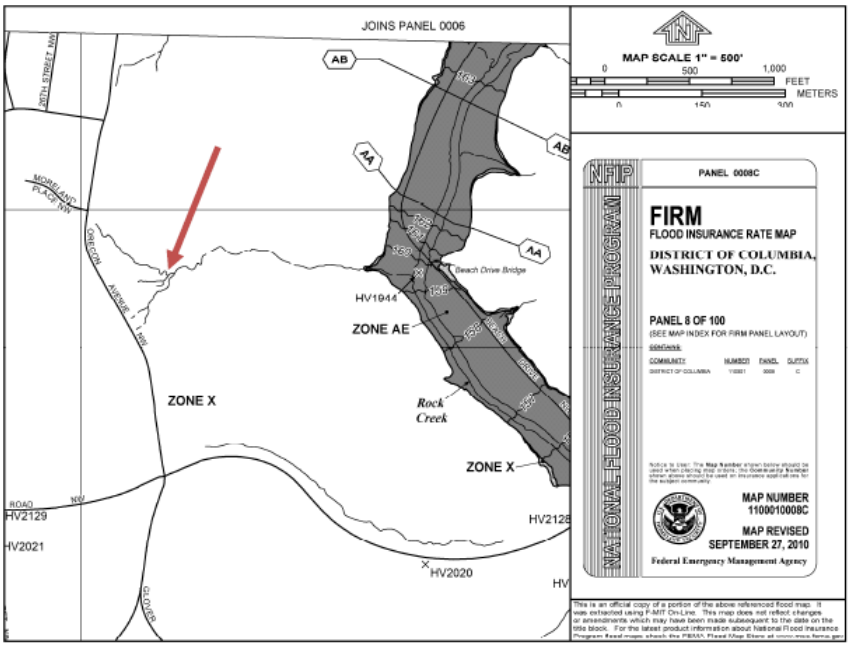

Figure 4. FEMA Flood Insurance Rate Map with Milkhouse Run indicated by the red arrow.

3.5 Results

In this section the results from the existing and proposed hydraulic model are summarized with regard to the 2-, 10, and 100-year water surface elevations.

3.5.1 2-, 10-, 100-Year Storm Events

The 2-, 10-, and 100-year peak discharges from HydroCAD was used with the HEC-RAS hydraulic model to calculate the equivalent floodplain elevation for the existing and proposed conditions at Milkhouse Run. Figures 5 and 6 depict the various water surface elevations for the corresponding storm events. All cross sections are located on National Park Land. The HEC-RAS output for the proposed and existing conditions are located in Appendix C. The cross section index map showing the 2-, 10-, and 100-year WSE extents are located in Appendix B.

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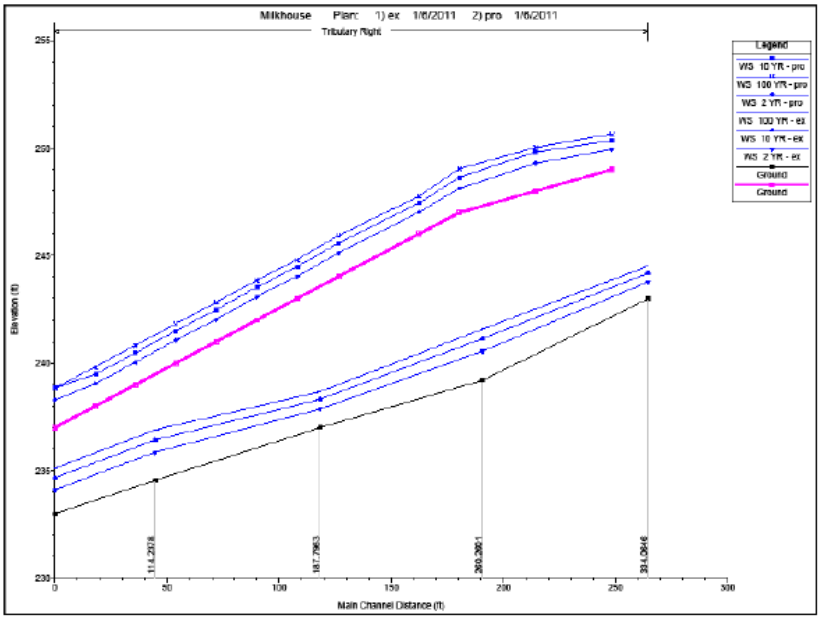

Figure 5. 2-, 10-, and 100 – yr Water Surface Elevations for the Right Tributary.

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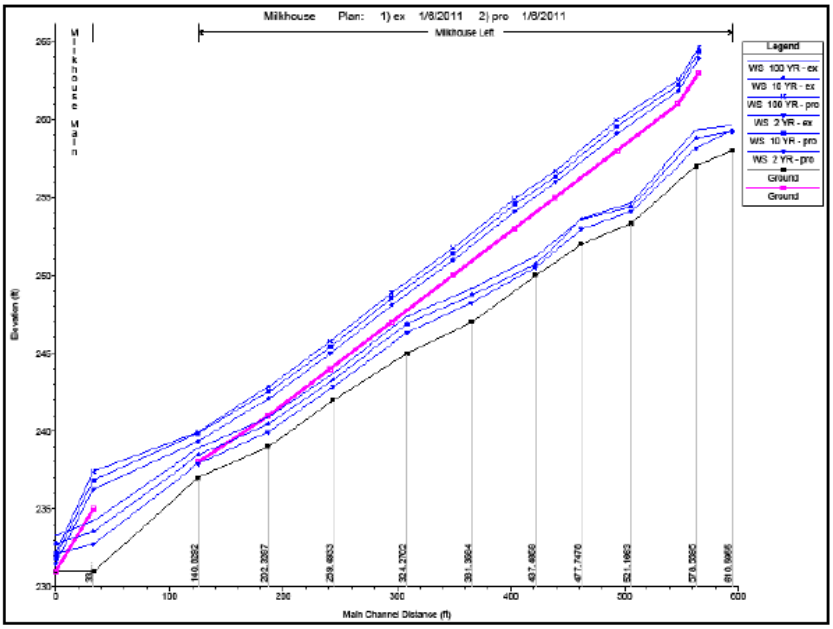

Figure 6. 2-, 10-, and 100 – yr Water Surface Elevations for the Left Tributary and Mainstem.

4.0 Restoration Approach

A majority of the watershed upstream of the project site has been developed and much of the drainage has been piped. These conditions have resulted in several effects to Milkhouse Run and its tributaries. First the increase in the amount of impervious surface has led to an increase in the amount of short-term runoff which is further compounded by the drainage area being completely subsurface. This excessive runoff has led Milkhouse Run and its tributaries to their current condition of incised channels with limited connection to the existing floodplain. These condition results in continued channel degradation and high sediment yield from stormwater flows.

With these conditions in mind the primary design goals are: 1) Restoring the incised section of the channels with the goal of eliminating bed and bank erosion; 2) connecting the channel to the adjacent floodplain; and 3) restoring aquatic habitat conditions for fish and benthic communities. Because the project site is located within national park property, an additional overarching goal is to achieve the restoration with minimal disturbance to trees.

The proposed methodology for design is based upon the Regenerative Storm Conveyance Methodology or RSC. Regenerative Stormwater Conveyance (RSC) systems are filtering systems that utilize a series of shallow aquatic pools, riffle/weir, native vegetation, and the underlying sand

channel to treat and slow the conveyance of storm flow. RSC systems also promote the conversion of storm water to groundwater through infiltration. RSC systems combine features and treatment benefits of swales, infiltration, filtering, and wetland practices. In addition, these systems are designed to convey flows associated with extreme floods (i.e., 100-year flood event) in a non-erosive manner, which results in a reduction of channel erosion impacts. The riffle/weirs have been designed to carry the 100 year storm event for each channel at the upstream end of the structure. For further detail please see the attached design spreadsheets in Appendix D.

5.0 Summary

Milkhouse Run and Tributaries exhibit extensive bank erosion and have become disconnected from their floodplain. To address these problems, the restoration design approach presented above includes reconnection of the stream with its floodplain to alleviate incision, as well as the restoration of habitat, increased flood retention in the watershed and protection of existing infrastructure.

6.0 References

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