

An aerial photograph of Potomac Park in Washington, D.C. The park is situated between the Potomac River to the west and the city of Washington to the east. A rectangular area in the northern part of the park, containing a large pond and several buildings, is highlighted with a blue and green overlay, indicating the project area. The surrounding city is shown in a sepia tone.

Potomac Park Levee Project

ENVIRONMENTAL ASSESSMENT



January 2009

Printed On Recycled Paper



POTOMAC PARK LEVEE SYSTEM

ENVIRONMENTAL ASSESSMENT

(NATIONAL CAPITAL REGION – NATIONAL MALL AND MEMORIAL PARKS)

Environmental Assessment

January 2009

[This page intentionally left blank]

PROJECT SUMMARY

The National Park Service (NPS), in cooperation with the U.S. Army Corps of Engineers (USACE) and the National Capital Planning Commission (NCPC), has prepared this Environmental Assessment (EA) to evaluate a range of alternatives for the design and construction of improvements to the Potomac Park levee system located in Washington, D.C. This EA presents five action alternatives for the construction and operation of a redesigned levee system and assesses the impacts that could result from the continued use of the current levee system (the baseline condition, or no action alternative). Upon conclusion of this EA and decision-making process, one of the five alternatives or an alternative that incorporates features of these five will be selected as the preferred alternative.

The purpose of this action is to improve the reliability of river flood protection provided by the Potomac Park levee system to a portion of the monumental core and downtown Washington, D.C. in a manner that respects the resources and values of the National Mall. Without adequate flood protection measures, several downtown District of Columbia (the District) locations, including portions of the monumental core, portions of Pennsylvania and Constitution Avenues, and other public and private facilities located south of the U.S. Capitol to Fort McNair, are at risk of flooding from a major (100-year plus) flood event.

The existing Potomac Park levee structure extends from the vicinity of 23rd Street, parallel to the Lincoln Memorial Reflecting Pool in Constitution Gardens, and ends on the Washington Monument Grounds (Monument Grounds) east of 17th Street. Currently, during a flood event, the NPS must provide temporary closures at 23rd Street (using sandbags) and at 17th Street. The temporary closure at 17th Street consists of using a combination of sandbags, Jersey barriers, and soil (i.e., an earthen dike) to create a temporary barrier across the street to block the flow of water into downtown Washington, D.C. This system has not been favored by the USACE, due to the large scope of this type of emergency closure, coupled by unknown weather conditions and logistic requirements. Based on new policies since Hurricane Katrina, the USACE deemed the 17th Street closure unreliable and consequently gave the levee an unacceptable inspection rating. For this reason, the Federal Emergency Management Agency's (FEMA) most recently proposed 100-year floodplain map for this area reflects a 100-year flood event as if the currently designed 17th Street closure did not exist. This new mapping puts a portion of downtown Washington, D.C. and the monumental core within the 100-year flood insurance rate zone, which would require additional flood insurance and/or costly upgrades to comply with building standards for those facilities that now fall within the new 100-year floodplain. In addition, a number of projects that are currently in development would need to be revised and could be delayed in order to comply with these building codes.

FEMA has agreed to delay the final issuance of the new floodplain mapping to allow the District and the NPS to design and implement a solution that would, at a minimum, reliably stop the 100-year flood at 17th Street south of Constitution Avenue. This solution would remove the necessity for FEMA to map this area within the 100-year floodplain. However, unless a solution is implemented and accredited by FEMA by November 2009, FEMA will issue the proposed floodplain maps and the affected area will be subject to new constraints and more stringent requirements for development.

In 1936, Congress authorized the USACE to design and construct a flood protection project to contain a flow of 700,000 cubic feet per second (cfs)¹. At this time, the USACE has not received funds to construct a permanent levee that would meet this level of protection. Nevertheless, since the original levee is a congressionally authorized project, it is necessary that any modifications are consistent with the original authorization. Therefore, the 100-year solution will be designed in a way that ensures that the congressionally authorized level of protection can ultimately be achieved once funding is appropriated.

¹ 700,000 cfs exceeds the anticipated flow of a 100-year flood event.

During the completion of this EA, it became apparent that considerable costs and time of construction, and therefore time of disturbance to the National Mall and visitors, could be avoided if the levee at 17th Street was constructed to the higher level of protection initially, if funding would be available. However, since funding is not certain, the alternatives in this EA are presented in a phased approach:

- Phase 1 solutions satisfy the FEMA requirements for reliably stopping the 100-year flood at 17th Street, although it is recognized that they may be built to the congressionally authorized level of protection if funding becomes available at the time of construction and the design lends itself to this. A few Phase 1 alternatives would be built to Phase 2 elevation standards, based on specific design requirements.
- Phase 2 addresses design solutions to satisfy the congressionally authorized level of protection at 23rd Street, the Reflecting Pool, and 17th Street and includes measures to enhance the visual character of the levee and the surrounding landscape.

OBJECTIVES IN TAKING ACTION

Objectives are “what must be achieved to a large degree for the action to be considered a success” (NPS *Director’s Order 12*) and represent more specific statements of purpose and need. All alternatives selected for detailed analysis should meet these objectives and must resolve the purpose of and need for action. The following objectives were identified by the planning team for this project:

- Provide immediate protection to downtown Washington, D.C. and the monumental core in the event of a 100-year flood, thereby meeting the National Flood Insurance Program (NFIP) requirements (FEMA required level of protection).
- Ensure that the selected design can be easily modified or enhanced to provide a solution that meets the congressionally authorized level of protection.
- Avoid or minimize adverse impacts on the cultural landscapes, historic structures, and other cultural resources of the National Mall and the project area.
- Avoid or minimize adverse impacts on the viewsheds of the National Mall and the monumental core, and the visual quality of the project area.
- Minimize disruption to visitor use and experience in the National Mall and monumental core.
- Minimize adverse impacts on park management and operations and provide the NPS with the most effective and reliable closure system in advance of a flood event.
- Avoid additional costs of insurance or construction to property owners in the project area.
- Minimize disruption of traffic in the downtown Washington, D.C. project area during construction.

ALTERNATIVES CONSIDERED

The NPS explored and objectively evaluated a range of alternatives, and six alternatives (the no action and five action alternatives) were carried forward for further analysis. These are briefly summarized below:

No Action Alternative - The no action alternative represents the existing plan for the levee system and the implementation of existing NPS operations and procedures during a flood event. The current Potomac Park levee system extends from the vicinity of 23rd Street, parallel to the Lincoln Memorial Reflecting Pool in Constitution Gardens, and ends on the Monument Grounds east of 17th Street. When notification of an impending flood is received, the NPS would implement temporary closures at 17th Street (construction of a temporary earthen levee, using a combination of Jersey barriers, sandbags and soil/fill),

and sandbags would be added at the 23rd Street location across Constitution Avenue if the flood would meet or exceed the 100-year level. The no action alternative does not satisfy the FEMA requirement at the north edge of the Reflecting Pool levee. However, no part of the existing levee currently meets the congressionally authorized solution.

Action Alternatives (alternatives 1, 2, 3, 4, & 5) - All of the action alternatives are presented in two phases:

Phase 1 satisfies the FEMA 100-year floodplain requirement, and is referred to as the “FEMA required” solution. Phase 1 provides for a minimum level of closure at 16.7 NAVD², although the closure at 17th Street could be initially constructed to the permanent level of protection if funding is available and the design lends itself to this, since that would reduce the overall project construction costs and duration of disturbance. Phase 2 satisfies the congressionally authorized level of protection (a flow of 700,000 cfs) and is referred to as the “congressionally authorized” solution (see Chapter 1, Background, for more detail). Phase 2 provides a level of closure at 18.7 NAVD.

At 23rd Street and along the existing levee along the Reflecting Pool, the five action alternatives all propose the same actions:

- The Phase 1 action for both locations is the same as the no action alternative since the no action scenario at these locations currently meets the FEMA 100-year floodplain standards.
- The Phase 2 action at 23rd Street consists of re-grading the northeast portion of the site to raise the ground elevation by approximately one to two feet.
- The Phase 2 action at the existing levee along the Reflecting Pool consists of filling in of numerous low spots comprising several hundred feet of the levee to meet the congressionally authorized level of protection.

The 17th Street closures vary among the five action alternatives although all would use a post and panel system to achieve the closure across 17th Street. The five alternatives would use different walls or re-grading approaches at different locations along the area of 17th Street, near the alignment of the current levee. The main closure features of five action alternatives at 17th Street are summarized below and are described in detail in chapter 2 of the EA.

Alternative 1 – “Arc Wall” – This alternative (Phase 1) would utilize two concrete flood walls to the east and west of 17th Street. There are two options for this alternative that are differentiated by their respective distances south from the centerline of Constitution Avenue and physical configurations which would be either asymmetric (option 1A) or symmetric (option 1B) to the north and south axis of 17th Street.

Option 1A would use two concrete walls to the east and west of 17th Street, approximately 198 feet south of the centerline of Constitution Avenue. The east wall would be an arc-shaped exposed concrete wall that would appear to recede into the landscape. The west wall would be an exposed concrete wall that runs parallel to Constitution Avenue then bends back to the southwest, aligned to the existing sidewalk. The east wall would incorporate a partially submerged storage vault for the post and panels which would be incorporated into the design of the landscape and flood wall.

The implementation of Phase 2 would involve meeting the congressionally authorized level of protection would involve re-grading against the concrete walls and raising the elevation from 16.7 NAVD to 18.7 NAVD, which would be done under Phase 2 unless funding became available sooner. Under Phase 2, the remaining visible sections of the levee wall would be clad in stone to match the historic character of the adjacent cultural landscapes and historic resources. The cladding would enhance the aesthetic quality and

² The North American Vertical Datum (NAVD) is the vertical control datum (elevation) established for surveying by the National Geodetic Survey (NGS 2008). All references to elevations and heights are in feet using the NAVD 88 Datum.

character of the landscape to mitigate against adverse effects associated with concrete walls. On the west side of 17th Street, the wall would frame the southern edge of the northeast-southwest pedestrian path connecting to the Constitution Gardens, disappearing into the ground as the grade rises to the Gardens level. On the east side of 17th Street, the wall would appear as a stand-alone structure, gradually disappearing into the ground as the grade rises towards the Washington Monument. Tree planting and final landscaping would also be completed as part of Phase 2.

Option 1B would use two symmetrical curved concrete flood walls on either side of 17th Street, approximately 253 south of the centerline of Constitution Avenue. The flood walls would require the re-grading of both the northwest corner of the Monument Grounds as well as the eastern edge of Constitution Gardens between the Overlook Terrace and 17th Street. Each wall would be set back approximately 23 feet east and west of 17th Street. The Phase 1 walls would be built to the congressionally authorized solution to accommodate the re-grading proposed under this option. Tree planting and final landscaping would also be completed as part of Phase 1. The implementation of Phase 2 would involve cladding the remaining visible sections of the levee wall in stone to match the historic character of the adjacent cultural landscapes and historic resources. The cladding would enhance the aesthetic quality and character of the landscape to mitigate against adverse effects associated with concrete walls. Option 1B is the NPS Preferred alternative.

Alternative 2 – “Gate Walls” - This alternative (Phase 1) would involve raising 17th Street approximately one foot in height at a location approximately 138 feet south of the centerline of Constitution Avenue to fill in the current depression. In addition, alternative 2 would use two concrete walls to the east and west of 17th Street. There are two options for this alternative that are differentiated by their Phase 1 west walls and their Phase 2 solutions, which would be either an asymmetric (option 2A) or symmetric (option 2B) design.

Both options would include the use of concrete walls to the east and west of 17th Street, approximately 138 feet south of the centerline of Constitution Avenue. The west wall would run parallel to Constitution Avenue and bend back to the southwest. The west walls of options 2A and 2B would be similar, but there is a slight variation in the bend of their angles to the southwest. In both options, the east wall abutment would require the re-grading of the northwest corner of the Monument Grounds. A storage vault for the post and panels would be built into this east wall abutment.

The implementation of Phase 2 would involve raising the height of the walls by re-grading against the concrete wall and raising the elevation of the wall from 16.7 NAVD to 18.7 NAVD (unless already funded and completed in Phase 1). The remaining visible sections of the levee wall would be clad in stone to match the historic character of the adjacent cultural landscapes and historic resources. The cladding would enhance the aesthetic quality and character of the landscape to mitigate against adverse effects associated with concrete walls. The concrete walls would be either asymmetrically (option 2A) or symmetrically placed (option 2B) on either side of 17th Street. Tree planting and final landscaping would also be completed as part of Phase 2.

Alternative 3 – “Constitution Garden Walls” - This alternative (Phase 1) would use two concrete walls to the east and west of 17th Street, approximately 365 feet south of the centerline of Constitution Avenue aligned on the centerline of the area known as the “Overlook Terrace.” The east and west walls would be symmetrical and chevron-shaped, and the far east and west ends of the wall would appear to recede into the landscape. To the west of 17th Street and to the south of the Lockkeeper’s House, there would be a partially submerged storage vault for the post and panels. In alternative 3, the walls would be constructed to 16.7 NAVD, since the Phase 2 solution is a totally different design.

Phase 2 would involve more than just raising the height of the walls—in this alternative, Phase 2 involves re-grading of the entire area and the creation of a terraced landscape with walls leading up to 17th Street on either side. The post and panel length would need to be extended to meet the edge of the lowest terraced wall abutments. Since the profile of the terrace walls would step down, and the entire height

would not be uniform, Jersey barriers would be placed on top of the walls to achieve the required height. The terraced walls would be clad in stone to match the historic character of the adjacent cultural landscapes and historic resources. The cladding would enhance the aesthetic quality and character of the landscape to mitigate against adverse effects associated with concrete walls. Tree planting and final landscaping would also be completed as part of Phase 2.

Alternative 4 – “Hybrid” - This alternative (Phase 1) would use two concrete walls to the east and west of 17th Street, approximately 177.5 feet south of the centerline of Constitution Avenue. The east wall would be an arc-shaped exposed concrete wall that would appear to recede into the landscape. The west wall would be an exposed concrete wall that runs parallel to Constitution Avenue then bends back to the southwest, to the west of the existing walkway. A storage vault for the post and panels would be built into the landscape west of 17th Street to the south of the Lockkeeper’s House, surrounded by a retaining wall and visual screen to conceal it from views along Constitution Avenue.

The implementation of Phase 2 would involve re-grading against the concrete walls and raising the elevation from 16.7 NAVD to 18.7 NAVD (unless already funded and completed in Phase 1). The remaining visible sections of the levee wall would be clad in stone to match the historic character of the adjacent cultural landscapes and historic resources. The cladding would enhance the aesthetic quality and character of the landscape to mitigate against adverse effects associated with concrete walls. On the west side of 17th Street, the wall would frame the southern edge of the northeast–southwest pedestrian path connecting to the Constitution Gardens, disappearing into the ground as the grade rises to the gardens’ level. On the east side of 17th Street, the wall would appear as a stand-alone structure, gradually disappearing into the ground as the grade rises towards the Washington Monument. Tree planting and final landscaping would also be completed as part of Phase 2.

Alternative 5 – “3B” - This alternative (Phase 1) would use a concrete wall to the west of 17th Street and a stand-alone structure to the east of 17th Street, on the Monument Grounds, at a location approximately 525 feet south of the centerline of Constitution Avenue. The west wall would be arc-shaped and would extend to the southeast off of the existing walkway from Overlook Terrace. The Phase 1 structure would be built to the height of the congressionally authorized solution (18.7 NAVD), since it would be difficult to increase the height of a building at a later time. Given that, the west wall would also be built to 18.7 NAVD in Phase 1.

The structure on the Monument Grounds would measure 25 x 40 feet, with an extending unit built into the slope measuring 19.5 x 17 feet, and would serve as the storage vault for the post and panels. A treatment plan will be developed to define how the adverse visual effects of any visible elements (e.g., freestanding concrete walls) of the Phase 1 design will be mitigated through plant material, earthwork, and/or alternative surface wall treatments, such as color, texture, and formwork, until such time that the Phase 2 design is completed and implemented.

The implementation of Phase 2 would involve cladding the remaining visible sections of the levee wall in stone to match the historic character of the adjacent cultural landscapes and historic resources. The cladding would enhance the aesthetic quality and character of the landscape to mitigate against adverse effects associated with concrete walls. Tree planting and final landscaping would also be completed as part of Phase 2.

ENVIRONMENTAL CONSEQUENCES

The five alternatives were assessed in accordance with NPS *Director’s Order 12: Conservation Planning, Environmental Impact Assessment, and Decision-Making*. The *Director’s Order 12* handbook requires that impacts on park resources be analyzed in terms of their context, duration, and intensity.

Methodologies were developed to assess the impacts that would occur with the implementation of the alternatives. Thresholds for adverse impacts were established for each impact topic to understand the severity and magnitude in the effects on resource conditions. Each action alternative (alternatives 1, 2, 3,

4, and 5) is compared to a baseline to determine the context, duration, and intensity of resource impacts. The baseline, for purposes of impact analysis, is the continuation of the current levee system, or the no action alternative.

The following table summarizes the results of the impact analysis for each resource area analyzed in this EA, including Vegetation, Aesthetic/Visual Resources, Cultural Resources (Historic Districts and Structures, Cultural Landscapes, and Archeology), Visitor Use, Public Safety, Land Use and Socioeconomics, Traffic and Transportation, Infrastructure and Utilities, and Park Operations and Maintenance. Each resource area has detailed descriptions regarding methodology and assumptions and definitions of impact thresholds for evaluating degree of effect in “Chapter 4: Environmental Consequences.”

Table 1.1: Summary of Environmental Consequences

Resource Area	No Action Alternative	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Vegetation*	Minor short-term adverse impacts on vegetation as a result of continued visitor use.	Moderate long-term adverse impacts on vegetation as a result of construction activities related to floodwall improvements and removal of 15 trees, including four older, mature trees (alternative 1A) up to 98 trees and three older trees (alternative 1B). Minor to moderate long-term adverse cumulative impacts.	Minor and moderate short- and long-term adverse impacts as a result of construction activities related to floodwall improvements and removal of an additional 38 trees. Minor to moderate and long-term cumulative impacts.	Moderate long-term adverse impacts as a result of construction activities related to floodwall improvements and removal of 25 (alternative 2A) or 26 (alternative 2B) trees, including three older, mature trees. Minor and long-term cumulative impacts.	Minor and moderate short- and long-term adverse impacts on vegetation as a result of construction activities related to floodwall improvements and removal of additional 29 (2A) or 38 (2B) trees. Minor to moderate long-term cumulative impacts.	Moderate long-term adverse impacts as a result of construction activities related to floodwall improvements and removal of 18 trees, including one older, mature tree. Minor long-term cumulative impacts.	Minor and mostly moderate short- and long-term adverse impacts on vegetation as a result of construction activities related to floodwall improvements and removal of an additional 83 trees. Moderate and long-term cumulative impacts.	Moderate long-term impacts on vegetation as a result of construction activities related to floodwall improvements and removal of 28 trees, including three older, mature trees. Minor and long-term cumulative impacts.	Minor and moderate short- and long-term adverse impacts as a result of construction activities related to floodwall improvements and removal of an additional 32 trees. Minor to moderate and long-term cumulative impacts.	Moderate long-term impacts on vegetation as a result of construction activities related to floodwall improvements and removal of 43 trees, including two older, mature trees. Minor and long-term cumulative impacts.	Minor and moderate short- and long-term adverse impacts as a result of construction activities related to floodwall improvements, with no additional removal of trees. Minor to moderate and long-term cumulative impacts.
Floodplains	No impact. <i>While FEMA would re-map under the no action, there is no inherent alternation to the floodplain (i.e., flows, effect on water table).</i>	Negligible short-term adverse impacts. The proposed improvements would not alter the ability to convey flood waters, and existing floodplain designations would remain unchanged.		Since this alternative presents relatively similar area of impact as alternative 1, the effects are the same as alternative 1.		Since this alternative presents relatively similar area of impact as alternative 1, the effects are the same as alternative 1.		Since this alternative presents relatively similar area of impact as alternative 1, the effects are the same as alternative 1.		Since this alternative presents relatively similar area of impact as alternative 1, the effects are the same as alternative 1.	

* In all alternatives, the volume of trees removed in each alternative is an estimate, based on the conceptual design. The exact type and number trees that would need to be removed will be determined in the design process. It is also important to note that additional grading and tree loss will likely be required beyond what is identified here as a result of an updated USACE soil and flow analysis.

Table 1.1: Summary of Environmental Consequences

Resource Area	No Action Alternative	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Aesthetics and Visual Quality:	No effects along the Reflecting Pool levee. Short-term moderate adverse impact at 23 rd Street due to the presence of sandbags during a flood event; and short-term moderate adverse impact associated with the temporary closure at 17 th Street due to the disturbance and subsequent restoration of the Monument Grounds.	Same as no action at Reflecting Pool & 23 rd Street; During construction, there would be a moderate short-term impact resulting from the activity and staging. During a flood event, there would be a minor short-term impact due to the presence of the post and panels. For alternative 1A at 17th Street, there would be a long-term first degree moderate adverse impact due to the aesthetically inconsistent nature of the exposed concrete wall, removal of 15 existing trees, and the relatively small area of impact (0.44 acres). This alternative would adversely impact views looking north towards President's Park from 17th Street, the vista looking southeast vista from Virginia Avenue to the Monument Grounds, and the view of toward the Washington Monument from the north side of Constitution Avenue. The net cumulative effect would be a first degree long-term moderate adverse effect.	Same as no action at Reflecting Pool & 23 rd Street. Same effects as Phase 1 during construction and a flood event. For alternative 1A, there would be a long term minor adverse effect on views and viewsheds. A landscape plan would ensure that the overall visual character and integrity of the cultural landscape would be compatible with the original design of the project area. In addition, stone cladding would enhance the visual character to mitigate the Phase 1 impacts downward one degree (to an adverse effect that is long-term and less than moderate but greater than minor). The net cumulative effect would be long-term minor to moderate adverse impacts on visual resources. For alternative 1B, there would be a long-term minor adverse impact. The stone cladding on the levee walls and aesthetic improvements would reduce the Phase 1 long-term minor to moderate adverse impacts to a long-term minor adverse impact for this phase. The net cumulative impact would be long-term minor and adverse.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long-term first degree moderate adverse effect on views and viewsheds since this alternative would obscure views looking north towards President's Park from 17th Street, the vista looking southeast vista from Virginia Avenue to the Monument Grounds, and the view of toward the Washington Monument from the north side of Constitution Avenue. There would be a long-term second degree moderate adverse impact due to the aesthetically inconsistent nature of the exposed concrete wall and the removal of existing trees. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be a long-term second degree moderate adverse effect on visual resources.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long term minor adverse effect on views and viewsheds. For alternative 2A, a landscape plan and stone cladding would mitigate the Phase 1 impacts downward one degree from Phase 1 to a long-term first degree moderate adverse effect. The net cumulative effect would be a long-term first degree moderate adverse effect. For alternative 2B, a long-term second degree moderate adverse impact would result from the visible change in the landscape character and visual character in the project area. The net cumulative effect would be a long-term second degree moderate adverse effect.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long-term first degree moderate adverse impact due to the aesthetically inconsistent nature of the exposed concrete wall and a minor to moderate long-term adverse impact resulting from the removal of 18 existing trees. The low lying nature of the terraced walls would create a minor effect, only minimally obscuring views looking south toward the Monument Grounds or north from 17 th Street. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be a long-term first degree moderate adverse effect on visual resources.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long term minor adverse effect on views and viewsheds. There would be a long-term second degree moderate adverse impact due to the relatively large size of the affected area, the large loss of trees, and the introduction of a new terraced landscape that mimics the adjacent Overlook Terrace walls but which is inconsistent with the existing character of the Monument Grounds. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be long-term second degree moderate adverse effect on visual resources.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long-term first degree moderate adverse impact due to the aesthetically inconsistent nature of the exposed concrete wall and the removal of 28 existing trees. This alternative would obscure views looking north towards President's Park from 17 th Street, the vista looking southeast vista from Virginia Avenue to the Monument Grounds, and the view of toward the Washington Monument from the north side of Constitution Avenue. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be a long-term first degree moderate adverse effect on visual resources.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long term minor adverse effect on views and viewsheds. There would be a long-term adverse impact that is greater than minor but less than moderate because the stone cladding and landscape plan would mitigate the adverse effects on the landscape and visual character of the project area. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be a minor to moderate long-term adverse effect on visual resources.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long-term second degree moderate adverse impact due to the aesthetically inconsistent nature of the exposed concrete wall, the removal of 43 existing trees, and the intrusion of the concrete structure on the Monument Grounds. This alternative would adversely impact views looking north towards President's Park from 17 th Street. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be a long-term second degree moderate adverse effect.	Same as alternative 1 at 23 rd Street and Reflecting Pool levee. Same effects as alternative 1 during construction and a flood event. There would be a long term first degree moderate adverse effect on views and viewsheds. There would be a long-term first degree moderate adverse impact due to the aesthetically inconsistent nature of the exposed concrete wall, the removal of 43 existing trees, and the intrusion of the concrete structure on the Monument Grounds. When combined with the long-term minor adverse effects of the cumulative impact projects, the net cumulative effect would be a long-term first degree moderate adverse effect.

Summary of Visual Effects	No Action	Alternative 1A		Alternative 1B		Alternative 2A		Alternative 2B		Alternative 3		Alternative 4		Alternative 5	
		Ph 1	Ph 2	Ph 1	Ph 2	Ph 1	Ph 2	Ph 1	Ph 2	Ph 1	Ph 2	Ph 1	Ph 2	Ph 1	Ph 2
Impacts on landscape character and vegetation	O	O	X	X	-	X	X	X	XX	O-X	XX	X	X	XX	XX
Impacts resulting from new visual features	-	X	O-X	O-X	O	XX	X	XX	X	X	X	X	O-X	XX	X
Impacts to Views	-	X	O	O-X	O	X	O	X	O	X	O	X	O	X	X
Cumulative Impacts	-	X	O-X	O-X	O	XX	X	XX	XX	X	XX	X	O-X	XX	X
Conclusion	-	X	O-X	O-X	O	XX	X	XX	XX	X	XX	X	O-X	XX	X

- (-) **Negligible:** The proposed action would not impact the aesthetics or visual viewshed of the proposed project area during construction or operations.
- (o) **Minor Adverse:** The proposed action would not substantially change the scenic vista; would not substantially change scenic resources; and would not substantially change the existing visual character or quality of the site and its surroundings. The effect would be detectable, but slight, and would minimally diminish overall integrity, or affect the character defining feature(s) of the visual resources and aesthetic environment.

Moderate Adverse: The proposed action would result in a noticeable adverse effect on a scenic vista. The proposed elements would adversely alter scenic resources or existing visual character or quality of the project area. The overall integrity of the project area would be diminished because it would adversely alter the aesthetic environment.
- (x) **First Degree Moderate Adverse Impact:** There would be an adverse effect on the landscape character due to loss of trees; there would be an adverse effect on the visual character due to new built elements with a large affected area; there would be an adverse effect on the existing views and vistas because they would be partially obscured by new built elements.
- (xx) **Second Degree Moderate Adverse Impact:** The adverse effect on the landscape and visual character of the project area would be of a greater intensity than the first degree due to a greater loss of trees or affected area; existing important viewsheds would be completely altered or obscured.

Table 1.1: Summary of Environmental Consequences (continued)

Resource Area	No Action Alternative	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Cultural Resources: Impacts on Historic Structures and Plans	Minor short-term adverse impact on the Washington Monument and Grounds (reversible); Negligible impacts on all other architectural resources	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan (1A only) due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan (1A only) due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds due to compromise of setting by an intrusive structure. L'Enfant Plan not impacted. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds and L'Enfant Plan due to compromise of setting by an intrusive structure. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds due to compromise of setting by an intrusive structure. L'Enfant Plan not impacted. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.	Moderate long-term adverse impact on the Washington Monument and Grounds due to compromise of setting by an intrusive structure. L'Enfant Plan not impacted. Negligible to minor impacts on all other architectural resources. Net cumulative long-term minor to moderate adverse impact.
Cultural Resources: Impacts on Cultural Landscape	Negligible short-term impact on Lincoln Memorial Grounds* due to sandbagging and short-term minor adverse impact on The Washington Monument and Grounds* due to reversible earth moving.	Moderate long-term adverse impact on Constitution Gardens* due to landform and landscape character alteration. (Implementation of Landscape Plan replanting required to avoid major adverse impact.) Moderate long-term adverse impact on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. The proposed curving walkways in alternative 1B would provide a new relationship between two adjacent, but previously disconnected, cultural landscapes. Net cumulative long-term moderate adverse impact.	Negligible short-term impact on Lincoln Memorial Grounds due to sandbagging at 23 rd Street. Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration. (Implementation of Landscape Plan replanting required to avoid major adverse impact.) Moderate long-term adverse impact on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. Net cumulative long-term moderate adverse impact.	Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. Net cumulative long-term moderate adverse impact.	Negligible short-term impact on Lincoln Memorial Grounds due to sandbagging at 23 rd Street. Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. Net cumulative long-term moderate adverse impact.	Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. Net cumulative long-term moderate adverse impact.	Negligible short-term impact on Lincoln Memorial Grounds due to sandbagging at 23 rd Street. Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. Net cumulative long-term moderate adverse impact.	Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to landform and landscape character alteration as well as view loss. Net cumulative long-term moderate adverse impact.	Negligible short-term impact on Lincoln Memorial Grounds due to sandbagging at 23 rd Street. Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to the introduction of a new structure as well as landform and landscape character alteration. Net cumulative long-term moderate adverse impact.	Moderate long-term adverse impact on Constitution Gardens due to the due to landform and landscape character alteration and on the Washington Monument and Grounds due to the introduction of a new structure as well as landform and landscape character alteration. Net cumulative long-term moderate adverse impact.	Negligible short-term impact on Lincoln Memorial Grounds due to sandbagging at 23 rd Street. Moderate long-term adverse impact on Constitution Gardens due to landform and landscape character alteration and on the Washington Monument and Grounds due to landform and landscape character alteration. Net cumulative long-term moderate adverse impact.
Cultural Resources: Impacts on Archeological Resources	Negligible impacts on archeology.	Potential negligible to moderate long-term adverse impacts, capable of being mitigated.	Negligible impacts on archeology.	Same as alternative 1. Potential negligible to moderate long-term adverse impacts, capable of mitigation.	Same as alternative 1. Negligible impacts on archeology.	Same as alternative 1. Potential negligible to moderate long-term adverse impacts, capable of mitigation.	Same as alternative 1. Negligible impacts on archeology.	Same as alternative 1. Potential negligible to moderate long-term adverse impacts, capable of mitigation.	Same as alternative 1. Negligible impacts on archeology.	Same as alternative 1. Potential negligible to moderate long-term adverse impacts, capable of mitigation.	Same as alternative 1. Negligible impacts on archeology.

* documented as a cultural landscape.

Table 1.1: Summary of Environmental Consequences (continued)

Resource Area	No Action Alternative	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Visitor Use & Experience	Short-term minor adverse impacts from excavation of Washington Monument Grounds during a flood event; otherwise no impacts.	Short-term minor to moderate adverse impacts from construction and street closures. Long-term minor to moderate adverse impact on visitor experience due to presence of walls and removal of trees; negligible impacts on visitor use. Long-term minor to moderate adverse cumulative impacts.	Minor adverse impacts during construction. Long-term adverse or beneficial impact on visitor experience depending on perception of clad wall, but with long-term adverse impacts from tree loss decreasing to minor over time as trees are replanted. Negligible impact on visitor use. Long-term negligible to minor adverse cumulative impacts.	Same as alternative 1, Phase 1.	Same as alternative 1, Phase 2.	Short-term minor to moderate adverse impacts from construction and street closures. Long-term moderate adverse impact on visitor experience due to presence of concrete wall and removal of trees in currently open expanse of Monument Grounds; negligible impacts on visitor use. Long-term minor adverse cumulative impacts.	Minor adverse impacts during construction. Likely long-term adverse impact on visitor experience due to change in visual character of the area (loss of 90 trees for some time) and the terraced wall appearance, although some visitors could find it beneficial. Negligible impact on visitor use. Long-term minor adverse cumulative impacts.	Same as alternative 1, Phase 1.	Same as alternative 1, Phase 2.	Same as alternative 3, Phase 1, with moderate long-term impact due to presence of and appearance of the unclad structure and wall and removal of 32 trees.	Same as alternative 3, phase 2, except minor to moderate long-term impacts.
	Mainly beneficial long-term cumulative impacts from other projects and plans.										

Resource Area	No Action Alternative	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Public Health & Safety	<p>Negligible to possible minor impacts on employee safety due to the possibilities of accidents occurring during construction of an earthen levee under adverse conditions. No immediate impact to the public, which would be evacuated from the area. Negligible adverse impact on the delivery of emergency services under expected traffic conditions.</p> <p>Overall, the low relative reliability of the earthen closure represents a moderate adverse impact to public safety.</p>	<p>Short-term negligible impact on public safety during the construction phase. Following its completion, the arc wall would provide a, congressionally authorized level of protection, which represents a long-term beneficial impact on public safety due to the improvement in reliability over the current levee system.</p> <p>Since each alternative has similar construction requirements and each would provide the same level of protection from the 100-year flood, the effects from alternatives 2- 5 would be the same as Phases 1 and 2 of alternative 1.</p>		<p>Since each alternative has similar construction requirements and each would provide the same level of protection from the 100-year flood, the effects from alternatives 2 – 5 would be the same as Phases 1 and 2 of alternative 1.</p>							
Land Use and Socio-Economics	<p>Major adverse impacts on residents, businesses and government entities with buildings located within the 100-year floodplain. If FEMA issues the new 100-year floodplain map, entities would be required to obtain insurance from the NFIP, which would likely approach \$50 million per year.</p> <p>Cumulative impacts would occur as new development properties would not only have to purchase the costly insurance but comply with new building codes which would increase total cost of development, making some projects less financially feasible, or eliminate usable commercial space on lower levels of buildings.</p>	<p>Long term beneficial impact to the residents, businesses and government entities that reside or have facilities within the study area. Existing building owners would not have to purchase costly flood insurance on an annual basis and new construction would not need to comply with regulations and building codes for structures located in floodplains</p> <p>Long term beneficial impact on socioeconomic resources.</p>		<p>Since each alternative has similar construction requirements and each would provide the same level of protection from the 100-year flood, the effects from alternatives 2 – 5 would be the same as Phases 1 and 2 of alternative 1.</p>							
Traffic and Transportation	<p>Minor short-term adverse impacts from disruptions during flood events</p> <p>Minor long-term cumulative impacts, mainly from other sources.</p>	<p>Short-term moderate adverse impact on travel in the area with two lanes open (one lane in each direction) during peak and off-peak hours for the anticipated intense construction period, and if signal timing and aggressive public information mitigation actions are undertaken.</p> <p>Phase 2 is anticipated to have a short-term minor effect on traffic in the area due to minor disruptions while bringing in equipment and materials for construction and re-grading.</p>		<p>Since each alternative has similar construction requirements (staging activity, duration, and closure of 17th Street), the effects from alternatives 2 – 5 would be the same as Phases 1 and 2 of alternative 1.</p>							

Table 1.1: Summary of Environmental Consequences (continued)

Resource Area	No Action Alternative	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Utilities and Infrastructure	No impact, provided the NPS avoids existing subsurface gas and water lines beneath the Monument Grounds when excavating the area during a flood event.	Negligible impacts on water supply lines, sanitary sewer lines, natural gas lines, and underground electric lines. Water supply lines and electric lines would require the installation of sleeves to allow utilities to pass through constructed walls. Minor impacts on irrigation lines and moderate impacts on storm drains, sanitary sewer, and communication lines. Negligible cumulative impacts.	Since the design of Phase 2 is situated in the same footprint as Phase 1, the impacts associated with Phase 2 would be the same as those for Phase 1.	Same as alternative 1 phase 1	Since the design of Phase 2 is situated so that no new footings would be needed, the impacts associated with Phase 2 would be the same as those for Phase 1.	Same as alternative 1 phase 1.	Phase 2 would occupy a new footprint that is different than Phase 1 and would require additional subsurface work. As a result there would be minor short term adverse impacts associated with relocating irrigation lines to the east of the site. All other utilities would be relocated in Phase 1.	Same as alternative 1, phase 1.	Since the design of Phase 2 is situated n the same footprint as Phase 1, the impacts associated with Phase 2 would be the same as those for Phase 1.	Same as alternative 1 phase 1.	Since there would be no new ground disturbance associated with Phase 2 of this alternative, there would be no additional impacts on utilities and infrastructure. No additional cumulative impact; impacts remain negligible.
Park Management and Operations	Negligible impacts except in event of a flood; short-term moderate adverse impacts as the levee plan is implemented over 24- hour period, and resources are reallocated to address the emergency. Long-term minor adverse cumulative effects.	Negligible to minor short-term adverse impacts during initial construction. Short-term minor adverse impacts during implementation of the post and panel system during a flood event; this would require only about 12 hours, a long-term benefit compared to current procedures. Long-term minor adverse impacts associated with annual maintenance. Long-term minor adverse cumulative effects.	Same as Phase 1.	Since implementation would take about the same level of effort, impacts would be the same as alternative 1, phase 1.	Same as Phase 1.	Since implementation would take about the same level of effort, impacts would be the same as alternative 1, phase 1.	Same impacts as other alternatives except for impacts from implementation -- would require 24 hours and additional staff due to use of Jersey barriers and longer post and panel system, resulting in a short-term and moderate adverse, with fewer benefits than the other proposed action alternatives.	Since implementation would take about the same level of effort, impacts would be the same as alternative 1, phase 1.	Same as Phase 1.	Since implementation would take about the same level of effort, impacts would be the same as alternative 1, phase 1.	Same as phase 1.

NOTE TO REVIEWERS AND RESPONDENTS:

If you wish to comment on the EA, you may mail comments directly via US Post or submit them electronically. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Mailed comments can be sent to:

Glenn DeMarr, Project Manager
Potomac Park Levee Project EA
National Park Service -National Capital Region
1100 Ohio Drive, SW
Washington, DC 20242

Comments can also be submitted on-line at:

- comments@potomaclevee.com
- <http://parkplanning.nps.gov/document.cfm?parkID=427&projectId=22260&documentID=23463>
- <http://parkplanning.nps.gov/>

And search for National Mall and Memorial Parks, Environmental Assessment for Design Alternatives for the Potomac Park Levee System

[This page intentionally left blank]

TABLE OF CONTENTS

CHAPTER 1

Introduction.....	1-1
Purpose of and Need for Action.....	1-2
Objectives	1-4
Scope of the Proposed Action.....	1-5
Project Background.....	1-5
Project Location	1-8
Purpose and Significance of the National Mall and Memorial Parks (NAMA)	1-8
Applicable Federal Laws, Regulations, Executive Orders, Plans, And Policies	1-11
Issues and Impact Topics	1-22
Vegetation	1-22
Floodplains.....	1-22
Aesthetics and Visual Quality.....	1-22
Cultural Resources	1-22
Visitor Use and Experience	1-23
Public Safety	1-23
Surrounding Land Use and Economics.....	1-24
Traffic and Transportation	1-24
Utilities and Infrastructure	1-24
Park Management and Operations	1-24
Impact Topics Eliminated (or Dismissed) from Further Analysis and Consideration	1-24
Wildlife or Wildlife Habitat.....	1-24
Air Quality	1-25
Soundscapes.....	1-25
Threatened, Endangered, Rare, and Special Concern Species.....	1-25
Wetlands	1-25
Ethnographic Resources.....	1-25
Prime Farmland.....	1-26
Water Quality and Quantity	1-26
Geohazards.....	1-26
Geological Resources (soils, bedrock, streambeds).....	1-26
Paleontological Resources	1-26
Marine or Estuarine Resources	1-26
Unique Ecosystems, Biosphere Reserves, World Heritage Sites.....	1-26
Museum Collections	1-27
Environmental Justice.....	1-27

CHAPTER 2

Alternatives	2-1
Introduction.....	2-1
No Action Alternative.....	2-2
Elements Common To All Action Alternatives (Alternatives 1, 2, 3, 4, & 5).....	2-3
23 rd Street	2-3
Reflecting Pool Levee.....	2-4
Alternative 1 – “Arc Wall” Options 1A and 1B	2-5
Alternative 2 – “Gate Walls” Options 2A and 2B	2-12
Alternative 3 – “Constitution Garden Walls”	2-20
Alternative 4 – “Hybrid”.....	2-27
Alternative 5 – “3B”	2-31
Mitigation Measures Common To All Alternatives	2-36
General Mitigation To Reduce Impacts on Surrounding Environment	2-36
Vegetation	2-36
Visual/Aesthetics	2-37
Cultural Resources	2-37
Visitor Use And Experience	2-38
Public Safety	2-38
Transportation	2-38
Alternatives Considered But Not Carried Forward.....	2-40
The Environmentally Preferred Alternative.....	2-42
The Preferred Alternative	2-42

CHAPTER 3

Affected Environment.....	3-1
Vegetation	3-1
Floodplains	3-2
Aesthetics And Visual Resources	3-3
Cultural Resources	3-7
Historic Structures And Districts	3-10
Cultural Landscapes.....	3-14
Archeological Resources	3-17
Visitor Use And Experience	3-22
Public Safety	3-27
Socioeconomics	3-29
Transportation.....	3-35
Infrastructure And Utilities.....	3-39
Park Management And Operations.....	3-41

CHAPTER 4

Environmental Consequences	4-1
General Methodology for Establishing Impact Thresholds and Measuring Effects	4-1
Cumulative Impacts	4-1
Impairment of resources	4-5
Vegetation	4-7
Floodplains	4-20
Aesthetics and Visual Resources	4-27
Cultural Resources	4-56
Visitor Use and Experience	4-108
Public Safety	4-124
Land Use and Socioeconomics	4-133
Traffic and Transportation	4-144
Infrastructure and Utilities	4-154
Park Management and Operations	4-160

CHAPTER 5

Consultation And Coordination	5-1
Agencies And Organizations Who Will Be Notified of the Publication of the EA	5-3
List Of Preparers	5-5
Contributors	5-6
References	5-9
Acronyms	5-17
Key Word Glossary	5-19

APPENDIX

Coordination and Consultation Correspondence	APPENDIX A
Section 106 Correspondence	APPENDIX B
Alternatives	APPENDIX C
Viewshed Analysis	APPENDIX D
Cultural Resources Maps	APPENDIX E
Top of Protection Summary	APPENDIX F
Statement of Findings for Floodplains.....	APPENDIX G

TABLES

Table 1.1 – Summary of Environmental Consequences	vi
Table 1.2 – Project Background.....	1-6
Table 2.1 – Description of Alternatives	2-45
Table 2.2 – How Alternatives Meet the Objectives	2-47
Table 2.3 – Summary of Environmental Consequences	2-49
Table 3.1 – Historic Resources Within The Area Of Potential Effects	3-11
Table 3.2 – Management and Operations of the Monuments and Memorials	3-23
Table 3.3 – Public Safety Incidents, 2003–2007	3-27
Table 3.4 – Employee Safety Incidents, 2003–2007	3-28
Table 3.5 – Selected Buildings Within The Federal Triangle Area of Washington, D.C.....	3-31
Table 3.6 – Federally Owned Buildings Within the Study Area	3-31
Table 3.7 – Nonprofit Buildings Within the Study Area	3-32
Table 3.8 – Race, Population, and Poverty Statistics for Washington, D.C.	3-33
Table 3.9 – Minority and Poverty Statistics for Census Blocks in and near the Study Area.....	3-33
Table 3.10 – Housing Characteristics in the District and in the Study Area, 1999.....	3-34
Table 4.1 – Cumulative Impact Scenario.....	4-2
Table 4.2 – Summary of Visual Impacts per Alternative	4-55
Table 4.3 – Annual Insurance Rates Per Square Foot for \$100 in coverage for Buildings in Zone C (basic/additional)	4-135
Table 4.4 – Cost to Federally Owned Buildings.....	4-136
Table 4.5 – Additional Insurance Cost to Special Buildings in the Study Area	4-137
Table 4.6 – Additional Insurance Cost to Residential Buildings in the Study Area.....	4-137
Table 4.7 – Level of Service Descriptions.....	4-145
Table 4.8 – ADT and Levels of Service during construction	4-148

FIGURES

Figure 1.1 – Historic & Existing Potomac Park Levee System.....	1-3
Figure 1.2 – Existing and Proposed FEMA 100-year Floodplain Boundary.....	1-5
Figure 1.3 – Project Location for the Phase 2 Potomac Park Levee system improvements.....	1-8
Figure 1.4 – The National Mall and Memorial Parks	1-10
Figure 1.5 – Memorials and Museums Master Plan Commemorative Zones.....	1-17
Figure 1.6 – Overlook Terrace location	1-20
Figure 2.1 – Phase 2 Solution at the 23 rd Street Location.....	2-3
Figure 2.2 – Alternative 1A Phase 1 Solution at 17 th Street	2-7
Figure 2.3 – Historic Resources in the 17 th Street project area.....	2-8
Figure 2.4 – Alternative 1A Phase 2 Solution at 17 th Street	2-10
Figure 2.5 – Alternative 1B Phase 1 Solution at 17 th Street	2-12
Figure 2.6 – Alternative 1B Phase 2 Solution at 17 th Street	2-13
Figure 2.7 – Alternative 2A Phase Solution at 17 th Street	2-16

Figure 2.8 – Alternative 2B Phase 1 Solution at 17 th Street	2-17
Figure 2.9 – Alternative 2A Phase 2 Solution at 17 th Street	2-20
Figure 2.10 – Alternative 2B Phase 2 Solution at 17 th Street	2-21
Figure 2.11 – Alternative 3 Phase 1 Solution at 17 th Street	2-24
Figure 2.12 – Constitution Garden Terraced Walls	2-25
Figure 2.13 – Alternative 3 Phase 2 Solution at 17 th Street	2-27
Figure 2.14 – Alternative 4 Phase 1 solution at the 17 th Street	2-29
Figure 2.15 – Alternative 4 Phase 2 Solution at 17 th Street	2-31
Figure 2.16 – Small structures on or adjacent to the Monument Grounds	2-33
Figure 2.17 – Alternative 5 Phase 1 Solution at 17 th Street	2-34
Figure 2.18 – Alternative 5 Phase 2 Solution at 17 th Street	2-35
Figure 3-1 – Current Areas of Potential Inundation	3-2
Figure 3-2 – Areas of Potential Inundation if Levee is Decertified	3-3
Figure 3-3 – Centerline of the Existing Levee Looking West from the WWII Memorial	3-4
Figure 3-4 – Constitution Gardens- looking west from the Overlook Terrace	3-5
Figure 3.5 – 23 rd Street project area	3-5
Figure 3.6 – 17 th Street location map and views	3-7
Figure 3.6 – A-I Views at the 17 th Street project site	3-8
Figure 3.7 – Boschke Map 1857 Depicting the 17 th Street Wharf	3-18
Figure 3.8 – Attractions on the National Mall	3-22
Figure 3.9 – Attendance of the Independence Day Celebration on the National Mall	3-23
Figure 3.10 – Recreational Visits to the Lincoln Memorial in 2007	3-24
Figure 3.11 – Recreational Visitation to the Vietnam Veterans Memorial in 2007	3-24
Figure 3.12 – Recreational Visits to the Korean War Veterans Memorial in 2007	3-25
Figure 3.13 – Recreational Visits to the Washington Monument, 2007	3-25
Figure 3.14 – Recreational Visits to the World War II Memorial	3-26
Figure 3.15 – Defined Study Area for Socioeconomic and Land Impacts	3-30
Figure 3.16 – Location of Census Tracts with Potential EJ Populations	3-34
Figure 3.17 – Regional Transportation System	3-36

APPENDIX TABLES

Table C.1 –Alternatives Comparative Matrix	C-2
Table F.1 – Top of Protection Summary	F-3

APPENDIX FIGURES

Figure C.1 – 1A Arc Wall Phase 1 Site Plan	C-3
Figure C.2 – 1A Arc Wall Phase 1 Perspectives	C-4
Figure C.3 – 1A Arc Wall Phase 1 Sections	C-5
Figure C.4 – 1A Arc Wall Phase 1 View A	C-6
Figure C.5 – 1A Arc Wall Phase 1 View B	C-7
Figure C.6 – 1A Arc Wall Phase 1 View C	C-8
Figure C.7 – 1A Arc Wall Phase 1 View D	C-9

Figure C.8 – 1A Arc Wall Phase 2 Site Plan	C-10
Figure C.9 – 1A Arc Wall Phase 2 Perspectives.....	C-11
Figure C.10 – 1A Arc Wall Phase 2 Sections	C-12
Figure C.11 – 1A Arc Wall Phase 2 View A.....	C-13
Figure C.12 – 1A Arc Wall Phase 2 View B	C-14
Figure C.13 – 1A Arc Wall Phase 2 View C	C-15
Figure C.14 – 1A Arc Wall Phase 2 View D.....	C-16
Figure C.15 – 1B Arc Wall Phase 1 Site Plan	C-17
Figure C.16 – 1B Arc Wall Phase 1 Rendering.....	C-18
Figure C.17 – 1B Arc Wall Phase 1 Perspectives.....	C-19
Figure C.18 – 1B Arc Wall Phase 1 Sections	C-20
Figure C.19 – 1B Arc Wall Phase 1 View A	C-21
Figure C.20 – 1B Arc Wall Phase 1 View B	C-22
Figure C.21 – 1B Arc Wall Phase 1 View C	C-23
Figure C.22 – 1B Arc Wall Phase 1 View D.....	C-24
Figure C.23 – 1B Arc Wall Phase 2 Site Plan	C-25
Figure C.24 – 1B Arc Wall Phase 2 Rendering.....	C-26
Figure C.25 – 1B Arc Wall Phase 2 Perspectives.....	C-27
Figure C.26 – 1B Arc Wall Phase 2 Sections	C-28
Figure C.27 – 1B Arc Wall Phase 2 View A	C-29
Figure C.28 – 1B Arc Wall Phase 2 View B	C-30
Figure C.29 – 1B Arc Wall Phase 2 View C	C-31
Figure C.30 – 1B Arc Wall Phase 2 View D	C-32
Figure C.31 – 2A Gate Wall Phase 1 Site Plan	C-33
Figure C.32 – 2A Gate Wall Phase 1 Perspectives.....	C-34
Figure C.33 – 2A Gate Wall Phase 1 Sections	C-35
Figure C.34 – 2A Gate Wall Phase 1 View A	C-36
Figure C.35 – 2A Gate Wall Phase 1 View B.....	C-37
Figure C.36 – 2A Gate Wall Phase 1 View C.....	C-38
Figure C.37 – 2A Gate Wall Phase 1 View D	C-39
Figure C.38 – 2A Gate Wall Phase 2 Site Plan 1.....	C-40
Figure C.39 – 2A Gate Wall Phase 2 Rendering	C-41
Figure C.40 – 2A Gate Wall Phase 2 Perspectives	C-42
Figure C.41 – 2A Gate Wall Phase 2 Sections	C-43
Figure C.42 – 2A Gate Wall Phase 2 View A	C-44
Figure C.43 – 2A Gate Wall Phase 2 View B.....	C-45
Figure C.44 – 2A Gate Wall Phase 2 View C.....	C-46
Figure C.45 – 2A Gate Wall Phase 2 View D	C-47
Figure C.46 – 2B Gate Wall Phase 1 Site Plan	C-48
Figure C.47 – 2B Gate Wall Phase 1 Perspectives	C-49
Figure C.48 – 2B Gate Wall Phase 1 Sections.....	C-50
Figure C.49 – 2B Gate Wall Phase 1 View A.....	C-51
Figure C.50 – 2B Gate Wall Phase 1 View B.....	C-52
Figure C.51 – 2B Gate Wall Phase 1 View C.....	C-53

Figure C.52 – 2B Gate Wall Phase 1 View D.....	C-54
Figure C.53 – 2B Gate Wall Phase 2 Site Plan 1	C-55
Figure C.54 – 2B Gate Wall Phase 2 Rendering.....	C-56
Figure C.55 – 2B Gate Wall Phase 2 Perspectives	C-57
Figure C.56 – 2B Gate Wall Phase 2 Sections.....	C-58
Figure C.57 – 2B Gate Wall Phase 2 View A.....	C-59
Figure C.58 – 2B Gate Wall Phase 2 View B	C-60
Figure C.59 – 2B Gate Wall Phase 2 View C	C-61
Figure C.60 – 2B Gate Wall Phase 2 View D.....	C-62
Figure C.61 – Constitution Garden Walls Phase 1 Site Plan	C-63
Figure C.62 – Constitution Garden Walls Phase 1 Perspectives	C-64
Figure C.63 – Constitution Garden Walls Phase 1 Sections.....	C-65
Figure C.64 – Constitution Garden Walls Phase 1 View A.....	C-66
Figure C.65 – Constitution Garden Walls Phase 1 View B	C-67
Figure C.66 – Constitution Garden Walls Phase 1 View C	C-68
Figure C.67 – Constitution Garden Walls Phase 1 View D.....	C-69
Figure C.68 – Constitution Garden Walls Phase 2 Site Plan 1	C-70
Figure C.69 – Constitution Garden Walls Phase 2 Rendering.....	C-71
Figure C.70 – Constitution Garden Walls Phase 2 Perspectives	C-72
Figure C.71 – Constitution Garden Walls Phase 2 Sections.....	C-73
Figure C.72 – Constitution Garden Walls Phase 2 View A.....	C-74
Figure C.73 – Constitution Garden Walls Phase 2 View B	C-75
Figure C.74 – Constitution Garden Walls Phase 2 View C	C-76
Figure C.75 – Constitution Garden Walls Phase 2 View D.....	C-77
Figure C.76 – Hybrid Phase 1 Site Plan	C-78
Figure C.77 – Hybrid Phase 1 Perspectives.....	C-79
Figure C.78 – Hybrid Phase 1 Sections	C-80
Figure C.79 – Hybrid Phase 1 View A	C-81
Figure C.80 – Hybrid Phase 1 View B	C-82
Figure C.81 – Hybrid Phase 1 View C	C-83
Figure C.82 – Hybrid Phase 1 View D	C-84
Figure C.83 – Hybrid Phase 2 Site Plan 1	C-85
Figure C.84 – Hybrid Phase 2 Rendering	C-86
Figure C.85 – Hybrid Phase 2 Perspectives.....	C-87
Figure C.86 – Hybrid Phase 2 Sections	C-88
Figure C.87 – Hybrid Phase 2 View A	C-89
Figure C.88 – Hybrid Phase 2 View B	C-90
Figure C.89 – Hybrid Phase 2 View C	C-91
Figure C.90 – Hybrid Phase 2 View D	C-92
Figure C.91 – Alternative 3B Phase 1 Site Plan	C-93
Figure C.92 – Alternative 3B Phase 1 Perspectives.....	C-94
Figure C.93 – Alternative 3B Phase 1 Sections.....	C-95
Figure C.94 – Alternative 3B Phase 1 View A.....	C-96
Figure C.95 – Alternative 3B Phase 1 View B	C-97

Figure C.96 – Alternative 3B Phase 1 View C	C-98
Figure C.97 – Alternative 3B Phase 1 View D	C-99
Figure C.99 – Alternative 3B Phase 1 View E	C-100
Figure C.99 – Alternative 3B Phase 2 Site Plan 1	C-101
Figure C.100 – Alternative 3B Phase 2 Rendering.....	C-102
Figure C.101 – Alternative 3B Phase 2 Perspectives.....	C-103
Figure C.102 – Alternative 3B Phase 2 Sections	C-104
Figure C.103 – Alternative 3B Phase 2 View A	C-105
Figure C.104 – Alternative 3B Phase 2 View B	C-106
Figure C.105 – Alternative 3B Phase 2 View C	C-107
Figure C.106 – Alternative 3B Phase 2 View D	C-108
Figure C.107 – Alternative 3B Phase 1 View E	C-109
Figure D.1 – Viewshed Analysis Map	D-3
Figure D.2 – View A Existing Conditions	D-4
Figure D.3 – View B Existing Conditions	D-4
Figure D.4 – View C Existing Conditions	D-5
Figure D.5 – View D Existing Conditions	D-5
Figure D.6 – View East Existing	D-6
Figure D.7 –Alternative 1A-Phase 1 View A	D-7
Figure D.8 –Alternative 1A-Phase 1 View C	D-7
Figure D.9 –Alternative 1A-Phase 2 View A	D-8
Figure D.10 –Alternative 1A-Phase 2 View C	D-8
Figure D.11 –Alternative 1B-Phase 1 View A	D-9
Figure D.12 –Alternative 1B-Phase 1 View C	D-9
Figure D.13 –Alternative 1B-Phase 2 View A	D-10
Figure D.14 –Alternative 1B-Phase 2 View C	D-10
Figure D.15 –Alternative 2A-Phase 1 View A	D-11
Figure D.16 –Alternative 2A Phase 1 View C	D-11
Figure D.17 –Alternative 2A-Phase 2 View A	D-12
Figure D.18 –Alternative 2A-Phase 2 View C	D-12
Figure D.19 –Alternative 2B-Phase 1 View A	D-13
Figure D.20 –Alternative 2B Phase 1 View C	D-13
Figure D.21 –Alternative 2B-Phase 2 View A	D-14
Figure D.22 –Alternative 2B-Phase 2 View C	D-14
Figure D.23 –Alternative 3-Phase 1 View A	D-15
Figure D.24 –Alternative 3-Phase 1 View B	D-15
Figure D.25 –Alternative 3-Phase 1 View C	D-16
Figure D.26 –Alternative 3-Phase 1 View D	D-16
Figure D.27 –Alternative 3-Phase 2 View A	D-17
Figure D.28 –Alternative 3-Phase 2 View B	D-17
Figure D.29 –Alternative 3-Phase 2 View C	D-18
Figure D.30 –Alternative 3-Phase 2 View D	D-18
Figure D.31 –Alternative 4-Phase 1 View A	D-19
Figure D.32 –Alternative 4-Phase 1 View C	D-19

Figure D.33 –Alternative 4-Phase 1 View E	D-20
Figure D.34 –Alternative 4-Phase 2 View A	D-20
Figure D.35 –Alternative 4-Phase 2 View C	D-21
Figure D.36 –Alternative 4-Phase 2 View E	D-21
Figure D.37 –Alternative 5-Phase 1 View A	D-22
Figure D.38 –Alternative 5-Phase 1 View B	D-22
Figure D.39 –Alternative 5-Phase 1 View C	D-23
Figure D.40 –Alternative 5-Phase 1 View D	D-23
Figure D.41 –Alternative 5-Phase 2 View A	D-24
Figure D.42 –Alternative 5-Phase 2 View B	D-24
Figure D.43 –Alternative 5-Phase 2 View C	D-25
Figure D.44 –Alternative 5-Phase 2 View D	D-25
Figure E.1 – Map of the Area of Potential Effect (APE).....	E-3
Figure E.2 – Individually Listed Historic Properties within the APE.....	E-4
Figure E.3 – Historic Districts and Contributing Properties within the APE	E-5
Figure E.4 – Cultural Landscapes within the APE	E-6

[This page intentionally left blank]