geometrically compatible with approach roadways; does not meet capacity needs for 2030 or the ability to maintain two-way traffic flow; and would not improve safety on the existing bridge. Alternate 13 is not prudent because it would 1) be unreasonable to proceed with the alternate in light of the project's stated purpose and need; and 2) result in unacceptable safety and operational problems. Therefore, Alternate 13 is being eliminated because it causes other severe problems of a magnitude that substantially outweighs the importance of protecting Section 4(f) properties within the project area.

E. Alternate 14: Transit

Alternate 14 would involve stand-alone transit improvements, such as bus operation, in conjunction with improvements to maintain service on the existing Nice Bridge (similar to Alternate 1). No additional capacity or widening would occur to US 301. Alternate 14 would also have no impact to residences or businesses, streams, wetlands, floodplains, agricultural land, or forest. Because a new bridge would not be constructed, the alternate would have a substantially lower cost than Modified Alternate 7.

Alternate 14 would avoid all Section 4(f) properties and have minimal environmental impact. However, it does not meet the project purpose and need because it does not provide a geometrically compatible crossing with approach roadways; does not meet capacity needs for 2030 or the ability to maintain two-way traffic flow; and would not improve safety on the existing roadway approaches or the bridge. Alternate 14 is not prudent because 1) it would be unreasonable to proceed with the alternate in light of the project's stated purpose and need; and 2) it results in unacceptable safety, capacity, and operational problems. Therefore, Alternate 14 is being eliminated because it causes other severe problems of a magnitude that substantially outweighs the importance of protecting Section 4(f) properties within the project area.

Conclusion of Avoidance Analysis

Based on the evaluation presented in this section, there is no feasible and prudent avoidance alternative to the use of Section 4(f) properties.

VII. LEAST OVERALL HARM ANALYSIS

Pursuant to 23 CFR 774.3(c)(1), if the avoidance analysis determines that there is no feasible and prudent avoidance alternative, then only the alternative that causes the least overall harm may be approved. Therefore, this section provides a review of the multiple remaining alternates that use one or more Section 4(f) properties, including remaining alternates that would eliminate or reduce the use of individual Section 4(f) properties.

Build Alternates 2 through 6 were retained for detailed study for the Environmental Assessment/Draft Section 4(f) Evaluation, and as such, each includes an option to construct a bike/ped path. The 10-foot wide path would require no additional permanent impact to the park resources in Virginia. For consistency with Modified Alternate 7, each of these retained alternates is assumed to include a single two-way bike/ped path, as opposed to the two one-way paths which were presented in the Draft Section 4(f) Evaluation.

23 CFR 774.3(c)(1) provides seven factors for identifying the alternative with the least overall harm. ***Table 9*** presents a comparison of the alternates by each least overall harm evaluation factor, and identifies the alternate resulting in the least overall harm. Potential *de minimis* impact findings for individual Section 4(f) properties are factored into the least overall harm analysis.

Table 9: Least Harm Analysis

Alternative	Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the officials with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)	vii. Substantial differences in cost among the alternatives	**CONCLUSION**
Modified Alternate 7 (Proposed Action)	Strong ability to mitigate impacts. Recordation/interpretive displays and signage of Nice Bridge and Administration Building per PA (***Appendix C***). Replacement parkland for Barnesfield, Dahlgren Wayside, and Welcome Center per MOA (***Appendix D***). Refer to Section VIII of this document.	Severe harm to Nice Bridge and Administration Building, Barnesfield Park, Dahlgren Wayside Park, and Welcome Center. Harm is mitigated through PA and MOA (Refer to Section VIII of this document).	All resources in the project area are currently considered to be equally significant. Balancing the effects of one resource to another is not appropriate based on the current available information.	MHT and VDHR have signed a PA that mitigates the adverse effects to the Nice Bridge historic site; Officials with jurisdiction over parks have signed an MOA that mitigates impacts.	Meets purpose and need.	Impacts to Potomac River, forests; minor impacts to streams, wetlands, floodplains, and business property.	Alternate would cost approximately $805-885 M[3]	Meets purpose and need; impacts to properties not protected by Section 4(f) are minimized; appropriate mitigation measures for Section 4(f) properties to minimize harm
Alternates Retained for Detailed Study								
Alternate 2	Mitigation would not be necessary under this alternate.	Minimal harm to Administration Building; therefore *de minimis* impact likely for Nice Bridge. No harm to parks.	All resources in the project area are currently considered to be equally significant. Therefore, balancing the effects of one resource to another is not appropriate based on the current available information.	MHT and VDHR have signed a PA that mitigates the adverse effects to the Nice Bridge historic site associated with Modified Alternate 7. Officials with jurisdiction over parks have signed an MOA that mitigates impacts from Modified Alternate 7.	Would only partially meet purpose and need; perpetuates safety, operations, and capacity deficiencies of the existing Nice bridge.	Similar impacts to Modified Alternate 7. Substantial impacts to NSF Dahlgren.	Alternate would cost approximately $515-565 M[2]	Less harm to Nice Bridge and parks, but only partially meet purpose and need; substantial impacts to NSF Dahlgren.
Alternate 3	Similar mitigation as Modified Alternate 7 for Nice Bridge historic site; mitigation not necessary for parks.	Severe harm to historic Nice Bridge. Harm could be mitigated through PA. No harm to park properties.			Meets purpose and need.	Greater dredging impacts than Mod. Alternate 7. Substantial impacts to NSF Dahlgren.	Alternate would cost approximately $915-1010 M[2]	Less harm to parks than Modified Alternate 7, but substantial impact to NSF Dahlgren and greater cost.

Table 9: Least Harm Analysis

Alternative	Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the officials with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)	vii. Substantial differences in cost among the alternatives	**CONCLUSION**
Alternate 4	Mitigation would be outlined in a PA for impacts to Administration Building only. Mitigation for parks would be similar to Modified Alternate 7.	No harm to Nice Bridge itself; Administration Building removed. Less harm to Barnesfield, Dahlgren Wayside, and Welcome Center compared to Mod. Alternate 7	All resources in the project area are currently considered to be equally significant. Therefore, balancing the effects of one resource to another is not appropriate based on the current available information.	MHT and VDHR have signed a PA that mitigates the adverse effects to the Nice Bridge historic site associated with Modified Alternate 7. Officials with jurisdiction over parks have signed an MOA that mitigates impacts from Modified Alternate 7.	Would only partially meet purpose and need; perpetuates safety, operations, and capacity deficiencies of existing Nice Bridge.	Environmental impacts similar to Modified Alternate 7. No impact to NSF Dahlgren.	Alternate would cost approximately $570-625 M[2]	Less harm to Nice Bridge than Mod. Alternate 7, but only partially meets purpose and need.
Alternate 5	Similar mitigation as Modified Alternate 7.	Compared to Modified Alternate 7, would have similar harm to Section 4(f) properties, except slightly less impact to parks.			Meets purpose and need.	Greater dredging impacts than Modified Alternate 7. No impact to NSF Dahlgren.	Alternate would cost approximately $945-1040 M[2]	Slightly less harm to parks, but greater environmental impact and cost than Mod. Alternate 7.
Alternate 6	Mitigation would not be necessary under this alternate.	Minimal harm to Administration Building; therefore *de minimis* impact likely for Nice Bridge. No harm to parks.			Meets purpose and need.	Environmental impacts would be similar to Mod. Alternate 7. Substantial impacts to NSF Dahlgren.	Alternate would cost approximately $805-885 M[2]	Less harm to Nice Bridge and parks, meets purpose and need; but substantial impacts to NSF Dahlgren.
Other Minimization Alternates								
Alternate 9	Depending on location of shift, mitigation would be similar to Modified Alternate 7 or no mitigation required for specific resource.	Harm to Nice Bridge from modification. *MD South* shift would similar harm to park resources as Mod. Alternate 7.	(See response for Alternates 4 through 6)	(See response for Alternates 4 through 6)	Would only partially meet purpose and need; perpetuates safety, operations, and capacity deficiencies.	Environmental impacts would be similar to Mod. Alternate 7. *MD North* shift has substantial impacts to NSF Dahlgren.	Alternate would cost approximately $500 million	Less harm to Section 4(f) properties, but only partially meets the purpose and need.

Table 9: Least Harm Analysis

Alternative	Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the officials with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)	vii. Substantial differences in cost among the alternatives	CONCLUSION
Alternate 11	Mitigation would be outlined in a PA for impacts to Nice Bridge. No mitigation required for park properties.	Harm to Nice Bridge from modification. No harm to parks.	All resources in the project area are currently considered to be equally significant. Therefore, balancing the effects of one resource to another is not appropriate based on the current available information.	MHT and VDHR have signed a PA that mitigates the adverse effects to the Nice Bridge historic site associated with Modified Alternate 7. Officials with jurisdiction over parks have signed an MOA that mitigates impacts from Modified Alternate 7.	Would only partially meet purpose and need; perpetuates safety, operations, and capacity deficiencies.	Less environmental impact than Modified Alternate 7. Similar impacts to NSF Dahlgren as Alternate 3.	Alternate would cost approximately $890 million	Less harm to Section 4(f) properties, but only partially meets the purpose and need and could have impacts to NSF Dahlgren Property.
Alternate 12	Mitigation would be outlined in a PA for impacts to Nice Bridge. No mitigation required for park properties.	Harm to Nice Bridge from modification. No harm to parks.			Does not meet purpose and need; perpetuates safety, operations, and capacity deficiencies.	Less environmental impact than Modified Alternate 7. Less impact to NSF Dahlgren compared to Modified Alternate 7, but likely would still have substantial impact on facility operations..	$220 million	Less harm to Section 4(f) properties, but does not meet the purpose and need and would impact NSF Dahlgren Property.
Alternate 15	Mitigation would be outlined in a PA for impacts to Nice Bridge. No mitigation required for park properties.	Severe harm to Nice Bridge from removal. No harm to parks.			Meets purpose and need; perpetuates safety, operations, and capacity deficiencies.	Similar environmental impacts to Mod. Alternate 7. Substantial impacts to NSF Dahlgren and regional commerce resulting from lengthy detour during construction.	$620 million	Less harm to park properties and meets the purpose and need, but would have substantial impact NSF Dahlgren Property and major impact to regional commerce.

Table 9: Least Harm Analysis

Alternative	Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
	i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)	ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes or features that qualify each Section 4(f) property for protection	iii. The relative significance of each Section 4(f) property	iv. The views of the officials with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets the purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)	vii. Substantial differences in cost among the alternatives	**CONCLUSION**
ANALYSIS RESULTS	Under alternates for which mitigation is needed for a specific resource, mitigation for that resource would be similar to the mitigation proposed for Modified Alternate 7.	Alternate 2 would have the least severe harm. Modified Alternate 7 would have the most severe harm; however, this harm has been appropriately mitigated with the PA and MOA.	Since all resources are considered to have equal value, this factor does not differentiate the project alternates.	By signing the PA and the MOA, The officials with jurisdiction have demonstrated their support for the mitigation measures proposed for Modified Alternate 7.	Modified Alternate 7, Alternate 5 and Alternate 6, fully meet the purpose and need.	All alternates would have similar environmental impacts to Modified Alternate 7, except Alternates 3 and 5 would result in greater dredging impacts. Alternates 2, 3, 6, 9, 11, 12 and 15 would have greater impacts to NSF Dahlgren compared to Modified Alternate 7.	Alternates 1, 2, 4, 9, 12, and 15 would cost less than Modified Alternate 7.	The MDTA Preferred Alternate, Modified Alternate 7, causes the least overall harm to Section 4(f) properties.

A. Alternate 2: New Two-lane Bridge to the South; Rehabilitate Existing Bridge

Alternate 2 proposes the rehabilitation of the existing bridge and the construction of a new bridge parallel to, and south of, the existing structure. It is assumed that rehabilitation of the existing Nice Bridge would be made in accordance with the AASHTO *Guidelines for Historic Bridge Rehabilitation and Replacement* to avoid Section 4(f) use of this resource. Consequently Alternate 2, as presented here, would result in less harm than Alternate 2 presented in the Draft Section 4(f) Evaluation. However, it is recognized that, over time, rehabilitation of the Nice Bridge could impact the historic integrity of the bridge and may result in a Section 4(f) use.

Alternate 2 would require approximately 0.1 acre of land from the historic boundary of the Administration Building, resulting in a Section 4(f) use of the Nice Bridge historic site. However, the impact of 0.1 acre of land from the historic boundary of the Administration Building would likely be appropriate to be considered a Section 106 no adverse effect and a *de minimis* Section 4(f) use.

Alternate 2 would not result in permanent property impacts or Section 4(f) use of Barnesfield Park, Dahlgren Wayside Park, or the Potomac Gateway Welcome Center.

By retaining the existing structure with its narrow cross section, Alternate 2 would not fully meet the needs of safety, incident management, or consistent cross section because the bridge carrying southbound traffic would not accommodate shoulders, and the steep grade of the existing bridge would be retained. The lack of shoulders would provide no opportunity for disabled vehicles to pull off the travelway or for emergency responders to bypass stalled traffic. The steep grade would slow the movement of heavy trucks, resulting in reduced capacity and increased passing maneuvers. The design of the existing bridge would not meet current load requirements, and both the cross section and load rating are insufficient for the needs of the STRAHNET. Capacity would be affected during routine maintenance operations due to the need for lane closures. Crossings by wide-load vehicles would also necessitate a lane closure. Thus while Alternate 2 is feasible, and has the advantage of preserving the historic structure as a functioning component of the transportation network, it would not fully meet the needs of the project related to geometric inconsistencies, capacity limitations, operations and safety, incident management, bridge maintenance, and accommodating the STRAHNET.

As shown in ***Table 8a***, Alternate 2 would impact environmental resources not protected by Section 4(f). These impacts are generally comparable to, or less than, the environmental impacts of Modified Alternate 7. However, Alternate 2 would require 3.3 acres of right-of-way from NSF Dahlgren, resulting in a negative effect to the facility and its mission. Unique and essential national and defense research capabilities are housed in an exclusive building adjacent to the Nice Bridge. According to the US Navy, the property fence line may not be moved closer to these operations without jeopardizing their military mission. Furthermore, special facilities and equipment critical to the Navy's mission may not be encroached upon, and these unique mission capabilities cannot be duplicated or relocated elsewhere on the base. Any relocation of the existing NSF Dahlgren perimeter fence line south of its current position would significantly reduce the safe standoff distance for nine major operational, test, and administrative facilities and approximately 1,300 employees who work in this area of the installation. Specifically, the required right-of-way for Alternate 2 would reduce the existing clear zone and make NSF Dahlgren buildings that much closer to a public right-of-way. The diminution of the security zone resulting from this alternate has a substantial and direct impact on the mission of NSF Dahlgren. Furthermore, during construction activities, Alternate 2 would place construction workers and equipment closer to the installation fence line and property, introducing a substantial security issue.

Alternate 2 would cost approximately $430-$475 million without a bike/ped path and $515-$565 million with a bike/ped path, making it the least expensive build alternate.

B. Alternate 3: New Two-lane Bridge to South; Replace Existing Bridge

Alternate 3 proposes the construction of a new two-lane bridge parallel to, and south of, the existing structure. The existing bridge would then be removed, and a second new two-lane bridge constructed in its place. These activities would cause a Section 4(f) use of the Nice Bridge. There also would be 0.1 acre of impact to the Administration Building historic boundary. However, Alternate 3 would not result in any permanent impacts or Section 4(f) use of Barnesfield Park, Dahlgren Wayside Park or the Potomac Gateway Welcome Center.

Alternate 3 would impact environmental resources not protected by Section 4(f), as shown in ***Table 8a.*** The need to remove the existing bridge prior to constructing the second new two-lane bridge would extend the construction timeframe to an additional construction season, which would add to the cost of this alternate and result in the need for a second season of dredging, pile driving, and associated aquatic impacts which would prolong the exposure of fish and benthic organisms to turbidity and shock wave impacts. Alternate 3 would require 3.1 acres of right-of-way from NSF Dahlgren that would result in the same unacceptable effects as Alternate 2.

Alternate 3 would meet the purpose and need for the project and would cost approximately $735-$810 million without a bike/ped path and $915-$1,010 million with a bike/ped path.

C. Alternate 4: New Two-lane Bridge to the North; Rehabilitate Existing Bridge

Alternate 4 proposes the rehabilitation of the existing structure and the construction of a new bridge parallel to, and north of, the existing structure. Similar to Alternate 2, it is assumed that rehabilitation of the existing Nice Bridge would be made in accordance with the AASHTO *Guidelines for Historic Bridge Rehabilitation and Replacement* to avoid Section 4(f) use of this resource. Consequently Alternate 4, as presented here, would result in less harm than Alternate 4 presented in the Draft Section 4(f) Evaluation. However, it is recognized that, over time, rehabilitation of the Nice Bridge could impact the historic integrity of the bridge and may result in a Section 4(f) use. The contributing Administration Building would be removed under Alternate 4.

Alternate 4 would result in 0.4 acre of permanent impact to Barnesfield Park. The impacts would occur along the southern boundary of the park, where realignment of US 301 would be necessary to connect southbound US 301 to the proposed new bridge. There would be no effect to Barnesfield Park recreational facilities, including the ball fields, concession areas, and parking lot. Early coordination with King George County indicates it is likely that Alternate 4 would not adversely affect the activities, features, or attributes that make the property eligible for Section 4(f) protection. Therefore it is likely that a *de minimis* impact determination would be appropriate for Barnesfield Park.

Due to the shift northward from the existing alignment, Alternate 4 would permanently impact 1.4 acres of the southern portion of Dahlgren Wayside Park, resulting in a Section 4(f) use. The impacted area includes a portion of the park entrance road, a parking area, a portion of the picnic area, and a portion of the beach area.

Alternate 4 would result in permanent acquisition of the Potomac Gateway Welcome Center property (2.1 acres). The impact would be caused by the northward shift of the US 301 southbound lanes. The Welcome Center building would be removed.

As shown in ***Table 8a***, Alternate 4 would impact environmental resources not protected by Section 4(f), although these impacts are comparable to, or less than, the environmental impacts of the Preferred Alternate. There would be no right-of-way required from NSF Dahlgren.

Like Alternate 2, Alternate 4 would preserve the existing bridge for one direction of traffic. By retaining the existing bridge for the northbound direction of travel, Alternate 4 would only partially meet the purpose and need for the project, for the same reasons enumerated under Alternate 2. Thus while Alternate 4 causes less harm to Section 4(f) resources, it would not fully meet the needs of the project related to geometric inconsistencies, capacity limitations, operations and safety, incident and evacuation management, bridge maintenance, and accommodating the STRAHNET.

Alternate 4 would cost approximately $485-$535 million without a bike/ped path and $570-$625 million with a bike/ped path, which would make it one of the least costly alternates.

D. Alternate 5: New Two-lane Bridge to the North; Replace Existing Bridge

Alternate 5 would construct a new parallel, two-lane bridge north of the existing structure. The existing Nice Bridge would be removed, and a new two-lane bridge constructed in its place, resulting in an adverse effect and use of the historic structure. The contributing Administration Building would be removed under this alternate.

Alternate 5 would result in impacts to Barnesfield Park (0.4 acre), Dahlgren Wayside Park (1.4 acres), and the Potomac Gateway Welcome Center (2.1 acres). These park impacts would be lower than the impacts of Modified Alternate 7 but identical to those for Alternate 4.

Alternate 5 would also impact environmental resources not protected by Section 4(f) as shown in ***Table 8a***. The need to remove the existing bridge prior to constructing the second two-lane bridge would extend the construction timeframe to an additional construction season, necessitating a second season of dredging and pile driving that would prolong the exposure of fish and benthic organisms to turbidity and shock wave impacts. The acreage of dredging would also be greatest with this alternate. There would be no right-of-way required from NSF Dahlgren.

Alternate 5 would meet the purpose and need for the project and would cost approximately $765-$850 million without a bike/ped path, and $945-$1,040 million with a bike/ped path, substantially more than the cost of the Preferred Alternate.

E. Alternate 6: New Four-lane Bridge to the South; Take Existing Bridge Out of Service

Under Alternate 6, a new parallel, four-lane bridge would be constructed south of the existing bridge. For the purpose of this least harm analysis, it is assumed that the existing bridge would be taken out of service and not owned by MDTA, but would remain standing. Future maintenance and/or rehabilitation of the existing Nice Bridge could be made in accordance with the AASHTO *Guidelines for Historic Bridge Rehabilitation and Replacement* to maintain the historic integrity of the bridge and avoid Section 4(f) use. Consequently Alternate 6, as presented here, would result in less harm than Alternate 6 presented in the Draft Section 4(f) Evaluation. However, it is recognized that, over time, rehabilitation of the Nice Bridge could impact the historic integrity of the bridge and may result in a Section 4(f) use. Alternate 6 would also require approximately 0.1 acre of land from the historic boundary of the Administration Building.

Alternate 6 would not result in any impacts or Section 4(f) use of Barnesfield Park, Dahlgren Wayside Park, or the Potomac Gateway Welcome Center.

Alternate 6 would impact environmental resources not protected by Section 4(f) as shown in ***Table 8a***; however, these impacts are comparable to, or less than, the environmental impacts of the Modified Alternate 7. Alternate 6 would require 3.7 acres of right-of-way from NSF Dahlgren and the same negative effects to the facility as described under Alternate 2.

Alternate 6 would meet the purpose and need for the project and would cost approximately $640-$705 million without a bike/ped path and $805-$885 million with a bike/ped path.

F. Alternate 9: Roadway Shift

Alternate 9 would consist of shifting US 301 to either the north or south of the existing alignment on either shore. A new two-lane bridge would be constructed to diagonally cross over a portion of the existing bridge to minimize impacts to Section 4(f) properties and other environmental resources. This alternate may require some modification to the historic Nice Bridge that would result from building a new two-lane bridge over the existing structure. Two variations of Alternate 9 were evaluated.

1. Alternate 9 (northern shift in Maryland, southern shift in Virginia)

This variation of Alternate 9 would shift the US 301 alignment north on the Maryland shore and terminate south of the existing alignment on the Virginia shore. The Administration Building would be removed, similar to Alternates 4, 5, and 7. There would be no Section 4(f) use of the park properties in Virginia.

Alternate 9-MD North would impact environmental resources not protected by Section 4(f), as shown in ***Table 8b***. Since the existing bridge would be retained for one direction of travel, the project purpose and need to address geometric inconsistencies, capacity limitations, operations and safety, incident and evacuation management, bridge maintenance, and accommodate the STRAHNET would not be fully met. Impacts to NSF Dahlgren would likely be identical to the impacts of Alternate 2 (3.3 acres).

2. Alternate 9 (southern shift in Maryland, northern shift in Virginia)

This variation of Alternate 9 would shift the US 301 alignment south on the Maryland shore and terminate north of the existing alignment on the Virginia shore. The Administration Building would not be removed, and the encroachment onto the historic boundary for the Administration Building would be limited to 0.1 acres, similar to Alternates 2, 3, and 6. Impacts to the park properties in Virginia would be less than impacts from Modified Alternate 7, and would be identical to Alternate 4. It is likely that a *de minimis* impact finding could be pursued for Barnesfield Park.

Alternate 9-MD South would impact environmental resources not protected by Section 4(f), as shown in ***Table 8b***. The alternate would result in no direct right-of-way impacts to NSF Dahlgren.

Either variation of Alternate 9 would only result in minor reductions to Virginia parks and other environmental impacts as compared to Modified Alternate 7. Complex construction techniques would be required to build a new bridge over the existing bridge. Transitioning the northbound or southbound lanes across the new bridge would also create difficult conditions for maintenance of traffic during construction.

Alternate 9 would cost approximately $500 million, which is well below the cost of Modified Alternate 7. The alternate would only partially meet the purpose and need because, similar to Alternate 2, the existing two-lane bridge would be retained for one direction of travel and capacity, safety, and operational constraints would not be addressed.

G. Alternate 11: Stacked Deck

Alternate 11 would involve construction of a new two-lane structure over the existing structure. Each level would carry traffic in a single direction. Access ramps on the Maryland and Virginia shores would be constructed to carry travelers to the upper structure. The existing bridge would be retained, but the alternate would result in modifications to the historic bridge structure that would likely result in an adverse effect and Section 4(f) use of the Nice Bridge. Assuming that upper deck access ramps are

constructed to avoid use of Section 4(f) properties, there would be no use of the park properties in Virginia, however, access to Roseland Road would be limited to one direction along US 301.

Alternate 11 would impact environmental resources not protected by Section 4(f). Although environmental impacts would be caused primarily by upper deck access ramps as opposed to the US 301 mainline, the impacts would likely be similar to Alternate 3. Property impacts to NSF Dahlgren would also be similar to Alternate 3 (***Table 8b***).

The alternate would not include the addition of shoulders on the existing bridge and the steep grade of the existing bridge would be retained; therefore, it would not fully meet the needs of the project related to geometric inconsistencies, capacity limitations, operations and safety, incident and evacuation management, bridge maintenance, and accommodating the STRAHNET. Furthermore, the substructure of the existing bridge would need to be substantially strengthened in order to support the new structure. Alternate 11 would cost approximately $890 million.

H. Alternate 12: Three-lane Bridge with Movable Barrier

This alternate would include rehabilitating and widening the existing bridge and approach roadways to accommodate a reversible third lane. The third lane would be located south of the existing lanes to minimize impacts to Section 4(f) properties. The existing bridge would be retained, but the alternate would result in modifications to the historic bridge structure that would likely result in an adverse effect and Section 4(f) use of the Nice Bridge. Impacts to the Administration Building, Dahlgren Wayside Park, Barnesfield Park, and the Potomac Gateway Welcome Center would be avoided.

Alternate 12 would impact environmental resources not protected by Section 4(f). These impacts, shown in ***Table 8b***, would be associated with the construction of an additional lane on US 301 approaching the bridge, and would be less than the impacts of Modified Alternate 7 (which includes construction of two new lanes on US 301 approaching the bridge). The alternate would require approximately 1.0-2.0 acres of right-of-way from NSF Dahlgren, resulting in other negative effects to the facility similar to those described for Alternate 2.

Alternate 12 would not provide sufficient lane capacity to meet the projected travel demand over the Nice Bridge, particularly during summer weekends. Furthermore, the alternate would not provide a roadway cross section that is compatible with the existing roadway approaches in both Maryland and Virginia. The bridge width would not be sufficient to provide full shoulders, and the width would be inconsistent with the needs of the STRAHNET. The existing 3.75 percent grade and HS 20 loading would not be improved. Therefore the alternate would not meet the purpose and need. Alternate 12 would cost approximately $220 million. Ongoing activities required to operate the movable barrier would increase the long-term cost of this alternate.

I. Alternate 15: Replace Existing Bridge on Existing Alignment

Alternate 15 would remove the existing historic bridge and rebuild a new four-lane bridge in its place. This would result in a Section 4(f) use of the Nice Bridge (excluding the Administration Building), but would reduce impacts to park properties in Virginia.

Alternate 15 would impact environmental resources not protected by Section 4(f) (***Table 8b***). These impacts would be associated with the construction of two additional lanes on the US 301 bridge approach roadway south of the existing alignment. The impacts would be less than the impacts of Modified Alternate 7 because the roadway would tie to the location of the existing bridge. Similar to Alternate 2, Alternate 15 would require right-of-way from NSF Dahlgren (approximately 3.1 acres).

Alternate 15 would meet the purpose and need for the project. Although the alternate would result in minimal park and environmental impact, it would result in closure of the existing bridge crossing for many months. Closing the bridge crossing would require travelers to detour more than 100 roadway miles to the next nearest Potomac River crossing at the Woodrow Wilson Bridge (I-95) near Washington, DC. The bridge closure would also have severe negative effects on regional economic conditions and operations at NSF Dahlgren, as well as many other businesses in Charles County and King George County that rely on mobility over the existing bridge. Alternate 15 would cost approximately $620 million.

Conclusion of Least Harm Analysis

Based on the evaluation presented in this section, and in ***Table 9***, Modified Alternate 7 is the alternate that causes the least overall harm to Section 4(f) properties.

VIII. ALL POSSIBLE PLANNING TO MINIMIZE HARM

"All possible planning," as defined in 23 CFR 774.17, includes all reasonable measures identified in the Section 4(f) Evaluation to minimize harm and mitigate for adverse impacts and effects. Modified Alternate 7 minimizes harm to Section 4(f) resources by incorporating measures into the project that minimize the impact on, and the use of, the resources. This section summarizes these minimization measures and also provides a review of alignment shifts and mitigation.

To reduce the amount of encroachment that Modified Alternate 7 would have on park properties in Virginia, the distance between the existing Nice Bridge and the proposed new bridge to the north has been minimized to a distance that would allow typical bridge construction methods. Other minimization measures to reduce park impacts will continue to be evaluated during the design phase, including steeper side slopes, reduced median width, retaining walls, and mechanically stabilized embankments (MSE).

Modified Alternate 7 proposes a single two-way bike/ped path on the south side of the new bridge. Compared to constructing two one-way paths (as presented with Alternate 7 in the Draft Section 4(f) Evaluation), a single two-way path results in less encroachment into Dahlgren Wayside Park and reduces the project cost by approximately seven percent. Consideration was also given to placing the path on the north side of the new bridge. This would locate the path closer to the park and enhance park amenities; however, a path loop beneath the west end of the bridge could also potentially result in greater encroachment into the park. Consideration for placing the path on either the north or south side of the new bridge will continue during final design. Park and recreational facilities on either side of the bridge would be fully accessible by the bike/ped path, regardless of the path location.

Modified Alternate 7 was evaluated to determine the possibility of allowing the existing historic bridge to remain standing, rather than removing it. Two options were considered: 1) retaining the bridge and taking it out of service, and 2) retaining the bridge and maintaining it as a bike/ped path.

If the existing bridge were retained and taken out of service, future maintenance and rehabilitation would need to occur in accordance with AASHTO *Guidelines for Historic Bridge Rehabilitation and Replacement*. The relative severity of harm to the historic bridge would be reduced, likely resulting in no adverse effect. However, retention of the bridge would result in the following costs:

- Routine bridge maintenance (costs to repair structural defects discovered during annual inspections, torque bolts, and make routine repairs) is expected to incur an annual expense of $1.5 million (in 2009 dollars).
- Maintenance of the bridge deck to prevent debris falling into the river and navigational channel is expected to cost $65 million every 40 years (or an average annual cost of $1.6 million, in 2009 dollars).