III. Alternatives

3.1 Introduction

FAA Order 1050.1E[1] and FAA Order 5050.4B[2] establish the FAA's policies and procedures for compliance with NEPA and the implementing regulations issued by the CEQ (40 CFR Parts 1500-1508). These Orders and regulations require a thorough and objective assessment of the Proposed Action, the No Action alternative, and all "reasonable" alternatives that would achieve the stated Purpose of and Need for the Proposed Action. The alternatives analysis in this EA is consistent with the requirements of FAA Orders 1050.1E and 5050.4B.

The process followed to identify the range of initial alternatives for consideration and the screening process used to determine which alternatives would reasonably satisfy the Purpose and Need for the Proposed Action and thus be carried forward for analysis of environmental consequences are described in this section. A preliminary list of permits needed for the Proposed Action and lists of applicable laws and regulations considered during the analysis are provided at the end of this section.

FAA Order 5200.8 requires that all RSAs at federally obligated airports and airports certificated under 14 CFR Part 139 conform to the standards defined in FAA AC 150/5300-13 to the extent practicable. The AC provides dimensional requirements for RSAs based on the physical and operating characteristics of the critical design aircraft operating at an airport. FAA direction for determining whether a specific RSA improvement is practicable is provided in FAA Order 5200.9.

FAA planning guidelines presented in AC 150/5325-4B, *Runway Length Requirements for Airport Design*, and Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, define a substantial use threshold of 500 or more annual itinerant operations (landings and take-offs) to identify the critical design aircraft for an airport. The critical design aircraft may be a single aircraft or a composite of the most demanding characteristics of several aircraft. Design criteria for the critical design aircraft are contained in FAA AC 150/5300-13. The ALP[3] for the Airport identifies the Boeing 757 and the Boeing 767 as the critical design aircraft for the existing and ultimate Runway 1-19 configuration, respectively. Although the Boeing 767 is identified as the critical design aircraft for an ultimate Runway 1-19, Delta Air Lines recently introduced the Boeing 767 to the Airport. The standard RSA design dimensions are the same for the Boeing 757 and the Boeing 767; however, the Boeing 767 requires a longer EMAS bed than the Boeing 757 at the same speed. The Boeing 757 is used in this EA as the critical design aircraft for Runway 1-19 EMAS alternatives.

The FAA, in its 2007 *Runway Safety Area Determination*[4] for the Airport, concluded that the current RSA did not meet the dimensional standard for the critical design aircraft beyond the Runway 19 end

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1 Federal Aviation Administration, Order 1050.1E, *Environmental Impacts: Policies and Procedures*, Change 1, March 20, 2006.

2 Federal Aviation Administration, Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, April 28, 2006.

3 Metropolitan Washington Airports Authority, *Ronald Reagan Washington National Airport, Airport Layout Plan*, October 15, 2007.

4 Federal Aviation Administration, *Runway Safety Area Determination: Ronald Reagan-Washington National Airport*, February 21, 2007.

and that it would be practicable to meet the RSA standards. The Runway 1 RSA extends only 750 feet beyond the north end of Runway 1-19, compared to the 1,000-foot design standard. Therefore, the RSA for landings on and take-offs from Runway 1 is deficient by 250 feet, per FAA AC 150/5300-13. The Authority commissioned two RSA studies[5,6] to address this deficiency and identify potential alternatives to bring the RSA for primary Runway 1-19 into compliance with FAA standards.

3.2 Alternatives Identification

3.2.1 Alternatives Included in FAA Order 5200.8

Pursuant to FAA Order 5200.8, "the first alternative to be considered in every case is constructing the traditional graded area surrounding the runway. Where it is not practicable to obtain the entire safety area in this manner, as much as possible should be obtained."[7] If the standard graded RSA cannot be obtained, the Order then directs that the following alternatives be considered:

- Relocation, shifting, or realignment of the runway;
- Reduction in runway length where the existing runway length exceeds that which is required for the existing or projected design aircraft;
- A combination of runway relocation, shifting, grading, realignment, or reduction;
- Use of declared distances; and
- Use of EMAS.

3.2.2 Phase II Study Alternatives

Evaluations of the variations of the alternatives identified in FAA Order 5200.8 were presented in the *Final Report, Runway Safety Area Study Phase II*[8] (the Phase II Study). At the time the Phase II Study was prepared, the standard dimensions for an RSA were slightly different from the current RSA standards. The standard RSA dimensions prior to the end of the runway and beyond the end of the runway for the type of aircraft operating on Runway 1-19 were the same: 1,000 feet. However, FAA AC 150/5300-13, Change 8, effective September 30, 2004, reduced the RSA dimension prior to the landing threshold from 1,000 feet to 600 feet. Each of the Phase II Study alternatives would result in construction of an RSA that met the FAA AC 150/5300-13 design standard with varying degrees of environmental and operational impacts. **Table III-1** presents a comparison of the key elements of the Phase II Study planning alternatives, defined as follows:

- Alternatives A1, A2, and A3 would each extend the Runway 1 RSA 250 feet beyond the north end of Runway 1-19 by placing fill or constructing a pier in Roaches Run. The primary differences among these three alternatives are the proposed impacts on the flow of Roaches Run. Alternative A1 also involves a potential taking of a portion of Gravelly Point.

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5 HNTB Corporation, *Final Report, Runway Safety Area Study Phase II*, March 25, 2003.

6 HNTB Corporation, *Ronald Reagan Washington National Airport, Runway 1-19 Safety Area Study – Phase III*, August 2005.

7 Federal Aviation Administration, Order 5200.8, *Runway Safety Area Program*, Appendix 2, "Supporting Documentation for RSA Determinations", October 1, 1999.

8 HNTB Corporation, *Final Report, Runway Safety Area Study Phase II*, March 25, 2003.

Table III-1

Phase II Study Alternatives Comparison

	Phase II Study Alternatives								
Key Elements	A1	A2	A3	B1	B2	C	D	E1	E2
Runway Variations (feet)									
Extend Runway 1 Pavement				250	250	250	240		
Relocate Runway 19 Threshold				250	250		250		
Displace Runway 19 Threshold						250			
Relocate Runway 1 Threshold							240		
Effective Runway 1 Landing Length	6,869	6,869	6,869	6,869	6,869	6,619	6,859	6,869	6,869
Effective Runway 1 Takeoff Length	6,869	6,869	6,869	6,869	6,869	6,869	6,859	6,869	6,869
Effective Runway 19 Landing Length	6,869	6,869	6,869	6,869	6,869	6,619	6,859	6,869	6,869
Effective Runway 19 Takeoff Length	6,869	6,869	6,869	6,869	6,869	6,869	6,859	6,869	6,869
Fill/Pier in River Variations									
Place Fill in Roaches Run	Yes	Yes							
Place Pier in Roaches Run			Yes						
Redirect Roaches Run	Yes								
Roaches Run Flow through Box Culverts		Yes							
Relocate Public Boat Ramp[a/]	Yes	Yes	Yes						
Place Fill in Potomac River				Yes					
Place Pier in Potomac River					Yes				
EMAS – Runway 19									
Distance from Runway End (feet)								>300	0
Length of EMAS								Varies	Varies
Runway 1 Approach Lights Variations									
Extend Approach Lights				Yes	Yes				
Install in-pavement Approach Lights						Yes			
Reduce Approach Light Spacing							Yes		
Meet ALSF-2 Minimum Length							No		

Note:
a/ The public boat ramp is located on Roaches Run, opposite the Airport's shoreline, northwest of the Runway 19 end.

Source: Ricondo & Associates, Inc., October 2008, based on HNTB Corporation, *Final Report: Runway Safety Area Study Phase II*, March 25, 2003.
Prepared by: Ricondo & Associates, Inc., October 2008.

- Alternatives B1 and B2 would each shift Runway 1-19 250 feet to the south, thereby increasing the RSA north of the runway to 1,000 feet. The 250 feet of the RSA lost on the south end of Runway 1-19 would be replaced by placing a pier or fill in the Potomac River near the mouth of Four Mile Run. The effective runway length of 6,869 feet would not change. The primary difference between Alternatives B1 and B2 is whether fill or a pier would be placed in the Potomac River/Four Mile Run.
- Alternative C would extend the Runway 1 RSA 250 feet beyond the north end of Runway 1-19 by adding 250 feet of new runway pavement to the south end of the runway and using declared distances to maintain the effective takeoff length of Runway 1 at 6,869 feet. Alternative C also involves displacing the Runway 19 threshold 250 feet to the south and displacing the Runway 1 threshold 250 feet to the north of the end of the new pavement (which would avoid the need to relocate the approach lights), thereby reducing the effective runway landing length in each direction by 250 feet.
- Alternative D would extend the Runway 1 RSA 250 feet beyond the north end of Runway 1-19 by adding 240 feet of new runway pavement to the south end of the runway, relocating the Runway 1 threshold to the end of the new pavement, relocating the Runway 19 threshold 250 feet to the south, and reducing the available landing and takeoff lengths of the runway in both directions by 10 feet, to 6,859 feet. The 240 feet corresponds to the distance that the ALSF-2 lights would be able to be adjusted to avoid lengthening the pier on which the lights are currently mounted. Further, this alternative would reduce the spacing of the ALSF-2 approach lights so that the overall length of the approach light system would fall short of the minimum required length.
- Alternatives E1 and E2 would each provide a Runway 1 RSA beyond the north end of Runway 1-19 by the use of EMAS at the Runway 19 end. The difference between these alternatives is the location of the EMAS bed in relation to the runway threshold.

In the Phase II Study, a specific alternative for relocating or realigning Runway 1-19 was not developed or evaluated. Runway 1-19 is bordered by Roaches Run to the north, the Potomac River to the east and south, and the passenger terminal buildings, passenger aircraft aprons, and Airport ancillary facilities to the west (see Exhibit II-2). Insufficient land area exists to relocate, shift, or realign Runway 1-19 while maintaining a 6,869-foot runway length and providing FAA-compliant RSAs without impacting Roaches Run, the Potomac River, the existing passenger terminal buildings, passenger aircraft aprons, or Airport ancillary facilities. Thus, either fill or the construction of a pier would be required in Roaches Run or the Potomac River, or some existing Airport facilities would need to be relocated. Further, the operational issues associated with realigning or relocating the runway would be significant.

3.2.3 Phase III Study Alternatives

Another RSA planning study commissioned by the Authority, referred to as the Phase III Study[9], included a 300-foot extension to Runway 1, and shifting arrivals and departures on Runway 1 by 300 feet to the south while maintaining the current effective runway length of 6,869 feet in both directions through the use of declared distances. FAA AC 150/5300-13, Change 8, issued September 30, 2004, changed the RSA design standard for undershoots during landings from 1,000 feet to 600

[9] HNTB Corporation, *Ronald Reagan Washington National Airport, Runway 1-19 Safety Area Study – Phase III*, August 2005.

feet. This change to the RSA design standard made it possible to develop compliant RSAs for Runway 1-19 without having to place fill or a pier in the Potomac River. The 300-foot extension would minimize the required changes to the ALSF-2 approach light system. If the Authority were to shift the runway by 250 feet, all of the Runway 1 lights would have to be relocated. By extending the runway by a multiple of 100 feet (the same as the light spacing), the Authority would be able to continue using most of the existing ALSF lights and the existing approach light pier.

3.2.4 Preliminary EA Alternatives

The alternatives identified and evaluated in the Phase II and Phase III Studies were refined for this EA. **Table III-2** presents a comparison of the key elements of each preliminary alternative carried forward in this EA and identifies the related improvements needed to implement each of the action alternatives (i.e., Alternatives 1 through 5). Each action alternative includes construction of a standard RSA for Runway 1-19, expansion of the Runway 1 Hold Apron, and the resurfacing of Runway 1-19. The following points describe the action alternatives and no action alternative:

- Alternative 1 combines Phase II Study Alternatives A1, A2, and A3 and considers them as one alternative with variations. Operationally they are the same; they differ only in how Roaches Run would be affected.
- Alternative 2 combines Phase II Study Alternatives B1 and B2; operationally, the alternatives are the same, with the only difference being how the Potomac River would be affected.
- Alternative 3 incorporates declared distances to effectively reduce the landing and takeoff distances available for Runway 1 by 300 feet.
- Alternative 4 would extend the Runway 1 pavement 300 feet to the south and incorporate declared distances for Runway 1 and Runway 19 to maintain the current available landing and takeoff distances at 6,869 feet in each direction.
- Alternative 5 is a refined EMAS alternative (Alternatives E1 and E2) that would use an EMAS bed 425 feet long and 150 feet wide located 175 feet from the Runway 19 threshold.
- Alternative 6 is the No Action alternative that must be considered in the EA pursuant to CEQ regulations and FAA Orders 1050.1E and 5050.4B. This alternative does not provide a standard RSA for Runway 1-19, expand the Runway 1 Hold Apron, or resurface Runway 1-19.

The relocation or realignment of Runway 1-19, other than a longitudinal shift along the runway axis, is not considered in this EA for the reasons stated in Section 3.2.2. Alternative D from the Phase II Study was not carried forward because the associated reduction in spacing of the ALSF-2 approach lights would not meet the minimum design standard for the length of the ALSF-2 approach light system.

3.2.5 Alternatives Not within FAA Jurisdiction

CEQ regulations and FAA Orders 1050.1E and 5050.4B require consideration in an EA of all reasonable alternatives to the proposed action that fulfill the stated purpose and need. No off-Airport alternatives or alternatives outside the jurisdiction of the FAA were identified during previous planning studies, consultation with regulatory agencies during the scoping process, or the public workshops. Further, since the solution to the Runway 1-19 RSA deficiency and the inability of the largest aircraft at the Airport to bypass aircraft on the Runway 1 Hold Apron must be implemented on Airport property, all alternatives considered in this EA would fall under FAA jurisdiction.

Table III-2

Preliminary EA Alternatives Comparison

	Alternatives					
Key Elements	1	2	3	4	5	6
RSA Improvements						
Runway Variations (feet)						
Extend Runway 1 Pavement				300		
Shift Runway 1-19 South		300				
Effective Runway 1 Landing Length	6,869	6,869	6,569	6,869	6,869	
Effective Runway 1 Takeoff Length	6,869	6,869	6,569	6,869	6,869	
Effective Runway 19 Landing Length	6,869	6,869	6,869	6,869	6,869	
Effective Runway 19 Takeoff Length	6,869	6,869	6,869	6,869	6,869	
Fill/Pier in River Variations						
Place Fill or Pier in Roaches Run, Redirect Roaches Run, or Place Box Culverts in Roaches Run	Yes					
Relocate Boat Ramp	Yes					
Place Fill or Pier in Potomac River/Four Mile Run		Yes				
Declared Distances						
Runway 1 Landing			Yes	Yes		
Runway 1 Takeoff			Yes	Yes		
Runway 19 Landing				Yes		
Runway 19 Takeoff				Yes		
EMAS – Runway 19 (feet)						
Distance from Runway Threshold					175	
Length of EMAS					425	
Related Improvements Variations						
Relocate Runway 1 Approach Lights		Yes		Yes		
Shift/Add Runway Edge Lighting		Shift		Add		
Relocate Runway 1 TDZ Lighting		Yes		Yes		
Relocate Runway 19 TDZ Lighting		Yes				
Add Taxiway Edge Lighting		Yes		Yes		
Extend Taxiway J Pavement		Yes		Yes		
Reroute Service Road		Yes		Yes		
Relocate Glide Slope Antenna		Yes		Yes		
Grading and Soil Stabilization	Yes	Yes		Yes	Yes	
Expand Runway 1 Hold Apron						
Expand Runway 1 Hold Apron	Yes	Yes	Yes	Yes	Yes	
Related Improvements (Relocate TV-900 and Install Ductwork)	Yes	Yes	Yes	Yes	Yes	
Resurface Runway 1-19	Yes	Yes	Yes	Yes	Yes	

Note: TDZ = Touchdown Zone

Source: Ricondo & Associates, Inc., October 2008.
Prepared by: Ricondo & Associates, Inc. October 2008.

3.3 Alternatives Evaluation

The alternatives identified above were evaluated to identify and retain for further consideration those action alternatives that would fulfill the Purpose and Need of the Proposed Action and that would be reasonable, practicable, and feasible. CEQ regulations and FAA Orders 1050.1E and 5050.4B require that a No Action alternative also be carried forward for further consideration. The evaluation criteria, screening process, and results of the alternatives evaluation are described in this section.

3.3.1 Alternatives Evaluation Process and Criteria

The six alternatives identified in Section 3.2.4 (including the No Action alternative) were subjected to a two-level screening process to determine their ability to reasonably satisfy the purpose of and need for the Proposed Action (see Section II). Under the two-level screening process, once an alternative failed to meet one of the criteria within the first level, it was eliminated from further consideration and was not carried forward to the second level. Only those alternatives that were able to meet the criteria in both levels were carried forward for determination of their potential environmental consequences. The evaluation criteria are listed in **Table III-3** and the criteria are discussed in this section.

Table III-3

Alternatives Evaluation Criteria

Evaluation Criteria	Description
Level 1:	
Compliance with FAA RSA Design Standard	To meet this criterion, an alternative must provide the FAA design standard RSA. See Section 3.3.1.1 for additional discussion of this criterion.
Operational Feasibility	To meet this criterion, an alternative must be operationally feasible based on the requirements of the critical design aircraft identified for Runway 1-19 (Boeing 757). See Section 3.3.1.2 for additional discussion of this criterion.
Level 2:	
Financial Feasibility	The financial feasibility of each alternative was evaluated pursuant to FAA Order 5200.9. See Section 3.3.1.3 for additional discussion of this criterion.
Avoidance of Extraordinary Environmental Consequences	To meet this criterion, an alternative must avoid potentially significant environmental impacts to specific resources protected by special purpose laws. See Section 3.3.1.4 for additional discussion of this criterion. Alternatives that would adversely impact these particular resources would be eliminated from further consideration unless no feasible alternative exists that would avoid or minimize impacts to the resource.

Sources: Ricondo & Associates, Inc., 2008, based on FAA AC 150/5300-13, *Airport Design*, Changes 1-13, June 19, 2008; Metropolitan Washington Airports Authority, *Ronald Reagan Washington National Airport, Airport Layout Plan*, October 15, 2007; FAA Order 5200.9, *Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Material Arresting Systems*, March 15, 2004.

Prepared by: Ricondo & Associates, Inc., October 2008.

3.3.1.1 Compliance with FAA RSA Design Standard

Meeting FAA AC 150/5300-13 design standards for an RSA based on the critical design aircraft for the Airport was a Level 1 criterion. The FAA RSA design standard for a runway accommodating Airport Reference Code (ARC) C-IV aircraft[10] is an RSA 500 feet wide and extending 1,000 feet beyond the runway end for overruns and 600 feet prior to the runway arrival threshold for undershoots. If EMAS is used, the length requirement beyond the runway departure end is reduced to 600 feet. Alternatives were evaluated to determine whether these RSA dimensions could be provided.

3.3.1.2 Operational Feasibility

Operational feasibility was also used as a Level 1 criterion to screen the EA alternatives. Alternatives were evaluated to determine whether they could accommodate the critical design aircraft for Runway 1-19, which is identified on the ALP as the Boeing 757.[11] At a standard day temperature of 59 degrees Fahrenheit and an elevation at sea level,[12] the Boeing 757 requires a runway length between 6,500 and 9,900 feet at its maximum take-off weight, depending on the engine and model type.[13] Because the existing length of Runway 1-19 is 6,869 feet, any alternative that would shorten the effective runway length was considered unacceptable for operational feasibility.

3.3.1.3 Financial Feasibility

FAA Order 5200.9 specifies that the financial feasibility of RSA improvements must be considered when evaluating alternatives. Financial feasibility is typically calculated by comparing the cost to improve the RSAs using traditional means with the cost to install EMAS. FAA Order 5200.9 states that if the life cycle cost for any full-length RSA alternative is less than 90 percent of the EMAS life cycle cost, then the full-length RSA alternative is the financially feasible alternative for improving the RSA. Based on the EMAS bed requirements for a Boeing 757 at maximum take-off weight, a standard EMAS bed of approximately 425 feet in length would be required, according to FAA Order 5200.9. The distance between the runway end and the beginning of the EMAS bed would be 175 feet to protect the EMAS bed from potential jet blast impacts, for a total required length of 600 feet beyond the runway end. According to FAA Order 5200.9, an EMAS bed 150-feet wide and 425-feet long would cost approximately $5.9 million to construct and install; replacement and annual maintenance costs would bring the total life cycle cost for EMAS to $7.6 million.

In accordance with FAA Order 5200.9, any full-length RSA alternative that would cost less than $6.8 million (90 percent of the EMAS life cycle cost) was considered financially feasible and preferred over the EMAS alternative.

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[10] In FAA AC 150/5300-13, aircraft are grouped into five Aircraft Approach Categories, A through E, based on the aircraft's final approach speed and into six wingspan categories, referred to as Airplane Design Groups (ADGs). Taken together, the Aircraft Approach Categories and the ADGs define the Airport Reference Code (ARC). The ARC indicates the general capability of an airport or runway to accommodate a specific size and performance of an aircraft. Runway 1-19 is designed and maintained to accommodate ARC C-IV aircraft, aircraft with approach speeds less than 141 knots and wingspans less than 171 feet. As identified on the Airport's ALP, the critical aircraft for Runway 1-19 is the Boeing 757.

[11] Metropolitan Washington Airports Authority, *Ronald Reagan Washington National Airport, Airport Layout Plan*, October 15, 2007.

[12] The official airport elevation (i.e., the highest point of an airport's usable runways) at the Airport is 15 feet above mean sea level.

[13] Boeing Commercial Airplanes, *757-200/300 Airplane Characteristics for Airport Planning*, August 2002.

3.3.1.4 Avoidance of Extraordinary Environmental Circumstances

This criterion relates to the potential environmental impacts of an alternative on specific resources protected by special purpose laws, which require project sponsors to avoid impacts unless no feasible alternative exists. The applicable special purpose laws are identified below.

Executive Order 11990, *Protection of Wetlands*, implemented by U.S. DOT Order 5660.1A, *Preservation of the Nation's Wetlands*, requires federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction, degradation, or modification of wetlands whenever there is a practicable alternative.

Executive Order 11988, *Floodplain Management*, implemented through U.S. DOT Order 5650.2, *Floodplain Management and Protection*, mandates all federal agencies to find that no other practicable alternatives exist before taking an action that would encroach on a floodplain. If the only practicable alternative results in a floodplain encroachment, further analysis is required, including ways to minimize potential harm and a determination of whether or not such encroachment would be significant.

The Coastal Zone Management Act of 1972, as amended in 1996, declares the preservation of the nation's coastal zones as a national priority and provides the framework for coastal states to develop a coastal zone management plan (CZMP). The National Oceanic and Atmospheric Administration (NOAA) reviews and approves each state's plan, which must include a definition of the coastal zone(s) within the state and must identify the enforceable policies that support the overall goal of the law. All federal or federally funded activities with any reasonably foreseeable coastal effect must be consistent with the state's plan. In 1986, NOAA approved the Virginia Coastal Resources Management Program (VCP) as Virginia's CZMP, which requires avoidance of wetlands in coastal zones.

The National Historic Preservation Act of 1966, as amended, mandates federal agencies to identify and protect historic properties and to protect properties to be included in or eligible for inclusion in the National Register of Historic Places (NRHP). The Authority's consultation procedures regarding the National Historic Preservation Act are outlined in a 1987 *Programmatic Memorandum of Agreement* among the U.S. DOT, the Virginia State Historic Preservation Officer (VASHPO), and the Advisory Council on Historic Preservation (ACHP). Historic properties are also covered under Section 4(f) of the DOT Act, which stipulates that no program or project that requires the use of publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or land from a historic site of national, state, or local significance, shall be approved unless there is no feasible and prudent alternative to using such publicly owned land.

3.3.2 Evaluation of Preliminary EA Alternatives

The preliminary EA alternatives, including the No Action alternative, were screened against the evaluation criteria described above. As stated in Section 3.3.1, if an alternative other than the No Action alternative failed to meet a Level 1 criterion, it was eliminated from further consideration under the Level 2 criteria. CEQ regulations and FAA Orders 1050.1E and 5050.4B require an EA to retain the No Action alternative for evaluation. The results of the alternatives evaluation are summarized in **Table III-4**. Expansion of the Runway 1 Hold Apron, relocation of electrical vault TV-900 to a tentative site on a paved area south of Levee Road in the vicinity of the Airport Beacon, installation of a new ductbank along Levee Road from the relocated vault to the general area of the existing vault, and the resurfacing of Runway 1-19 are included in all EA alternatives except the No

Action alternative; therefore, when comparing the relative costs of the EA alternatives, the costs for the hold apron, electrical vault, new ductbank and runway resurfacing were excluded. The evaluation results are discussed below.

Table III-4

Evaluation of Runway 1-19 RSA Alternatives

		Preliminary EA Alternatives [a/]					
Tier	Evaluation Criteria	1	2	3	4	5	6
Level 1	Compliance with FAA RSA Design Standard	Yes	Yes	Yes	Yes	Yes	No
	Operationally Feasible	Yes	Yes	No	Yes	Yes	No
	Retain for Level 2 Screening?	Yes	Yes	No	Yes	Yes	Yes
Level 2	Financially Feasible	No	No		Yes	No	Yes
	Avoidance of Extraordinary Environmental Circumstances	F, W	F, W		None	None	None
	Retain for Environmental Analysis?	No	No		Yes	No	Yes

Notes:
F Floodplain impacts
W Wetland impacts
a/ See Section 3.2.4 for detailed descriptions

Source: Ricondo & Associates, Inc., October 2008.
Prepared by: Ricondo & Associates, Inc., October 2008.

Alternative 1 would require filling, constructing a pier in, placing a box culvert into, or rerouting Roaches Run. This alternative meets both Level 1 criteria. An alternative that would place a box culvert into Roaches Run was estimated to cost $6 million,[14] which would meet the financial feasibility test; however, the filling of Roaches Run was estimated to cost $11.5 million and rerouting Roaches Run was estimated to cost of $9 million, which would fail the Level 2 criterion for financial feasibility.[15] All variations of this alternative would fail the Level 2 criterion of avoiding extraordinary environmental circumstances associated with filling or impacting portions of Roaches Run, which would cause both wetland and floodplain impacts. These impacts could be avoided through implementation of another practicable alternative. For these reasons, Alternative 1 was eliminated from further consideration.

Alternative 2 would extend Runway 1-19 300 feet to the south, allowing for the construction of a standard RSA on the Runway 19 end at an estimated construction cost of $5 million.[16] However, this alternative would require the filling of the Potomac River or construction of a pier in the Potomac River, causing wetland and floodplain impacts. Because these impacts can be avoided through implementation of another practicable alternative, Alternative 2 was eliminated from further consideration.

Alternative 3 would reduce the landing and takeoff distances available for Runway 1 to 6,569 feet. However, the critical aircraft for Runway 1-19 requires between 6,500 feet and 9,900 feet of runway

[14] All costs discussed in this section are in 2003 dollars.
[15] HNTB Corporation, *Final Report, Runway Safety Area Study Phase II*, March 25, 2003.
[16] HNTB Corporation, *Final Report, Runway Safety Area Study Phase II*, March 25, 2003.

for take-off in standard conditions and temperatures, at the maximum take-off weight. This required length increases with higher temperatures and in wet conditions. Any reduction in runway length would have an operational impact and be considered unacceptable by the Authority. Therefore, Alternative 3 was considered to fail the Level 1 criterion for operational feasibility and was eliminated from further consideration.

Alternative 4 would extend the Runway 1 pavement and use declared distances for Runway 1 and Runway 19. Alternative 4 meets each of the Level 1 criteria. The estimated construction cost of Alternative 4 is $5 million.[17] Alternative 4 would also avoid extraordinary environmental circumstances. Therefore, Alternative 4 was retained for further consideration and is the Authority's preferred alternative.

Alternative 5 would involve the placement of an EMAS bed at the end of Runway 19. Alternative 5 meets each of the Level 1 criteria. In accordance with FAA Order 5200.9, if the life cycle cost for any full-length RSA alternative is less than 90 percent of the EMAS life cycle cost, then the full-length RSA alternative is the financially feasible alternative for improving the RSA. Because the cost of Alternative 4 is less than the $6.8 million estimated as 90 percent of the EMAS life cycle costs for Alternative 5, Alternative 5 fails the Level 2 financial feasibility criterion. Therefore, Alternative 5 was eliminated from further consideration.

Subsequent to the Phase III Study, the Authority conducted detailed cost analyses of Alternatives 4 and 5 that incorporated design considerations, the relocation of Levee Road, and relocation of the ALSF-2 lighting system. This cost analysis went beyond the planning and evaluation analysis stipulated in FAA Order 5200.9. The life-cycle cost analysis for the total project implementing Alternative 4 ranged from $18.6 million to $22.3 million. The range in cost is dependent on the base material (concrete or asphalt), and the pavement types and thicknesses used to construct the runway extension. The life-cycle cost analysis for the total costs to implement Alternative 5 ranged from $25.5 million to $37.0 million. This range in cost would be sufficient to provide an EMAS bed capable of stopping a Boeing 767 that leaves the runway traveling at 70 knots. The range in cost is dependent on the length of the EMAS bed, maintenance assumptions (whether the EMAS would have useful life of 10 years or would require replacement before 10 years after installation), and whether a concrete or asphalt base was provided. The detailed cost estimates still result in the highest cost estimate for Alternative 4 ($22.3 million) being less than 90 percent of the cost of the cheapest EMAS alternative ($25.5 million). Thus, Alternative 5 fails the Level 2 financial feasibility criterion.

Alternative 6, the No Action alternative, would not provide Runway 1-19 RSAs that conform to the RSA standards defined in FAA AC 150/5300-13. While operationally feasible, the RSA on Runway 19, under the No Action alternative, will continue to be deficient in terms of the FAA standard. Because there would be no construction or implementation associated with the No Action alternative, there would be no financial costs and no potential for environmental impacts. Although the No Action alternative does not meet the stated Purpose and Need or satisfy all of the evaluation criteria, CEQ regulations require a comparison of the effects of no action versus the proposed action to determine the extent of potential impacts under the build alternative. Therefore, the No Action alternative was retained for further analysis.

[17] HNTB Corporation, *Final Report, Runway Safety Area Study Phase II*, March 25, 2003.

3.4 Alternatives Carried Forward for Analysis of Environmental Consequences

3.4.1 The Proposed Action (Alternative 4)

The Authority's Proposed Action to bring RSA deficiencies on the north end of Runway 1-19 into compliance with FAA standards includes extension of the runway pavement 300 feet to the south. Land area is available to extend the runway to the south and to provide the standard dimensions on the north end of the runway (Runway 19), while still maintaining the full RSA on the south end (Runway 1). The extension of the runway would shift arrivals and departures on Runway 1 by 300 feet to the south, but would maintain the current usable runway length of 6,869 feet in both directions through the use of declared distances. The runway extension and use of declared distances would meet the requirements for a 1,000-foot RSA for overruns and a 600-foot RSA for undershoots at both ends of the runway. Under the Proposed Action, the Runway 1-19 RSA would meet the FAA AC 150/5300-13 RSA design standards consistent with an ARC C-IV runway without requiring the placement of fill in the Potomac River or Roaches Run.

The Proposed Action, shown on Exhibit II-5, includes the related improvements identified in Section 2.3.

3.4.2 No Action

Under the No Action alternative, the RSA deficiency on the north end of Runway 1-19 would not be corrected. None of the other improvements shown on Exhibit II-5 would be implemented. The south end of the runway currently provides standard RSA dimensions for Runway 19 operations. The current dimensions of the existing Runway 1 Hold Apron would continue to prevent the largest aircraft operating at the Airport from bypassing aircraft on the hold apron. Although the No Action alternative would not meet the stated Purpose and Need, it was retained for analysis in this EA to fulfill CEQ regulations implementing NEPA and to comply with FAA Orders 1050.1E and 5050.4B.

3.5 Permits Required

As required under FAA Order 1050.1E, paragraph 405(d)(4), the permits that would be required for implementation of the Proposed Action are listed in **Table III-5**. The list of applicable permits is preliminary because detailed design and construction-related planning is ongoing.

3.6 Federal Laws and Regulations Considered

In accordance with FAA Order 1050.1E, paragraph 405(d)(4), the relevant Federal laws and statutes, Executive Orders, and other regulations considered during preparation of this EA are listed in **Tables III-6**, **III-7**, and **III-8**, respectively.

Table III-5

Preliminary List of Permits Required for the Proposed Action

Issuing Agency	Permit Name/Type
Federal	
U.S. Army Corps of Engineers	Rivers and Harbors Act Section 10 Permit
U.S. Army Corps of Engineers	Clean Water Act Section 404 Permit
U.S. Environmental Protection Agency	National Pollutant Discharge Elimination System Permit for industrial activities
National Park Service	Concurrence on Section 4(f) Land Impacts
Commonwealth of Virginia and/or District of Columbia	
Virginia Department of Environmental Quality	The Virginia Water Protection Permit (serves as Virginia's Section 401 certification program for Federal Section 404 permits issued under the Clean Water Act)
Virginia Department of Conservation and Recreation	Virginia Pollutant Discharge Elimination System General Storm Water Permit for Construction
Virginia Marine Resources Commission	Wetlands Permits
D.C. Department of the Environment, Water Quality Division	Water Quality Certification
Virginia Department of Environmental Quality	VCP Consistency Concurrence
Virginia Department of Historic Resources	Concurrence on Historic, Architectural, Archaeological, and Cultural Resources

Note: VCP = Virginia Coastal Resources Management Program

Source: Ricondo & Associates, Inc., October 2008.
Prepared by: Ricondo & Associates, Inc., October 2008.

Table III-6

Federal Laws and Statutes Considered

Federal Law or Statute	Citation
National Environmental Policy Act of 1969	Public Law (PL) 91-190, 42 USC 4321-4370(d), effective January 1, 1970, as last amended by PL 94-83
Clean Air Act of 1970, as amended	PL 91-604, 42 USC 7401-7661
Department of Transportation Act of 1966, Section 4(f)	49 USC 303(c)
Aviation Safety and Noise Abatement Act of 1979	14 CFR Part 150
Federal Aviation Act	49 USC 40101
Endangered Species Act of 1973	PL 93-205, 16 USC 1531
Fish and Wildlife Coordination Act of 1958	16 USC 661-666c
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Community Environmental Response Facilitation Act of 1992	42 USC 6901-9675
Resource Conservation and Recovery Act of 1976, as amended by the Solid Waste Disposal Act of 1980	42 USC 6901-6992(k)
National Historic Preservation Act of 1966, as amended	16 USC 470
Archaeological and Historic Preservation Act of 1974, as amended	16 USC 469
Federal Water Pollution Control Act of 1972, as amended (commonly referred as the Clean Water Act)	33 USC 1251
Clean Water Act, Section 404	33 USC 1344
Rivers and Harbors Act of 1899, Section 10	
Protection of Historic and Cultural Properties	36 CFR 800
Farmland Protection Policy Act	7 USC 4201-4209
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970	42 USC 4601
Wild and Scenic Rivers Act of 1968	16 USC 1271-1287

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc., October 2008.

Table III-7

Executive Orders Considered

Executive Order	Citation
Executive Order 11593, *Protection and Enhancement of the Cultural Environment*	36 Federal Register (FR) 8921
Executive Order 11988, *Floodplain Management*	43 FR 6030
Executive Order 11990, *Protection of Wetlands*	42 FR 26961
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	59 FR 7629
Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*	62 FR 19883
Executive Order 13112, *Invasive Species*	64 FR 6183

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc., October 2008.

Table III-8

FAA Orders, Advisory Circulars, Federal Aviation Regulations, and Other Guidance Considered

FAA Order 1050.1E: *Environmental Impacts: Policies and Procedures*
FAA Order 5050.4B: *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*
U.S. DOT Order 5680.1: *Final Order to Address Environmental Justice in Low-Income and Minority Populations*
U.S. DOT FAA AC 150/5020-1: *Noise Control and Compatibility Planning for Airports*
U.S. DOT Order 5650.2: *Floodplain Management and Protection*
U.S. DOT FAA AC 150/5200-33A: *Hazardous Wildlife Attractants on or near Airports*
U.S. DOT FAA AC 36-3H: *Estimated Airplane Noise Levels in A-Weighted Decibels*
U.S. DOT FAA Federal Aviation Regulations (FAR) Part 71: *Designation of Class A, Class B, Class C, Class D, and Class E Airspace Areas; Airways; Routes; and Reporting Points*
U.S. DOT FAA FAR Part 135: *Operating Requirements: Commuter and On-Demand Operations and Rules Governing Persons on Board Such Aircraft*
U.S. DOT FAA AC 150/5300-13: *Airport Design*
U.S. DOT FAA AC 150/5370-10A: *Standards for Specifying Construction of Airports*
U.S. DOT Order 5650.2: *Floodplain Management and Protection*
U.S. DOT Order 5660.1A: *Preservation of the Nation's Wetlands*
FAA *Environmental Desk Reference for Airport Actions*, October 2007

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc., October 2008.