APPENDIX A

CHOOSING BY ADVANTAGES PROCESS

1.0 FEASIBILITY OF POTENTIAL SITE LOCATIONS

On December 6 and 7, 2005, the project team met in Christiansted, Virgin Islands to review the conceptual site plans and complete the Choosing by Advantages (CBA) process, as well as a Value Analysis. In this analysis, the term "factor" describes a potential issue affecting the alternatives. For the purpose of this project, these factors were grouped under the four functions the MREC must serve in order to be feasible: Protecting Cultural and Natural Resources; Meeting the Needs of the Marine Research and Education Center; Providing for Visitor Enjoyment; and Providing Benefits to the Local Community.

During the site analysis phase of the project, the consultant team developed a set of potential factors for the MREC, analyzing each to determine whether the alternatives differed on them, for it is the difference among alternatives that the CBA process considers an "advantage." Factors for which the alternatives were considered not to differ in any substantial manner have been noted in this report as "Factors Considered but Eliminated." The project team considered these at the session at Christiansted and concurred that a difference among them could not be determined.

Elements of a "factor" are considered "attributes" in CBA parlance. For example, under the factor of "Minimizing Impacts to Water Resources," the "attribute," or measure, of the factor was determined to be the number of feet that the seawater intake line would need to traverse on the Bay floor to reach an acceptable intake point. The length of these lines would differ depending on where the MREC would be sited, and the advantage of an alternative is a shorter line, measured in feet.

At the CBA session, the project team identified the advantages of each factor and compared these advantages to one another, to determine which advantage was most important to this project, or "paramount." (This "paramount advantage" receives a score of 100 in the CBA matrix.) The next step is to compare the other advantages to this "paramount advantage" to determine their importance relative to the paramount advantage and then to assign an appropriate score for each. After this exercise is completed, the scores of each alternative are calculated, and the alternative that scores the highest is considered the best alternative.

1.1 FACTORS USED IN CHOOSING BY ADVANTAGES PROCESS

The factors developed for the CBA process are described below, with the matrix of CBA scores in the next section.

1.1.1 Function: Protect Cultural/Natural Resources

Minimize Impacts to Mangroves/Wetlands: This factor refers to the impact of the MREC to the mangroves and wetlands located at SARI. It is estimated that Alternatives 1, 2 and 3 (East, South, and West Sites) would impact 0.31, 0.55, and 0.5 acres of mangroves/wetlands, respectively. ***Advantage:*** This factor's attributes were measured as acres. The scores assigned to these advantages are shown in the matrix.

Minimize Impacts to Coastal Barriers: This factor refers to the impact of the MREC in designated coastal barriers. The Wet Lab, Maintenance Building, boat dock, and mooring facilities of Alternative 1 (East Site) and Alternative 3 (West Site) would be located in an area designated as a coastal barrier. The maintenance dredging required at Alternatives 1 and 2 would also occur in an area designated as a coastal barrier. The only structures located within an area

designated as a coastal barrier for Alternative 2 (South Site) would be the boat dock and mooring facilities.

Additionally, the underwater pipeline that would bring salt water from the sea to the MREC facility would impact the coastal barrier at all alternatives. ***Advantage:*** This factor's attributes were measured as impacts, on a high-medium-low scale, with low being the best. Alternative 2 (South Site) was considered to have the lowest impact.

Minimize Impacts to Floodplains: This factor refers to the impact of the MREC on the 100-year floodplain (as mapped by FEMA). Alternative 2 (South Site) is not located within a 100-year floodplain. The boat dock, boat launch, and moorings of Alternatives 1 and 3 (East and West Sites) are located in the 100-year floodplain. Negligible impacts are anticipated to the floodplain from these alternatives.

The underwater pipeline that would bring salt water from the sea to the MREC facility and Wet Lab would impact the 100-year floodplain at Alternative 1. There would be no impact to the 100-year floodplain from the pipeline at Alternatives 2 and 3. However, it is not possible to fully evaluate the impacts of the pipeline because site-specific water quality sampling would be needed to make this assessment. Based on available information, the impacts are not expected to be significant at any of the sites. ***Advantage:*** This factor's attributes were measured as impacts, with Alternative 2 (South Site) considered not having direct impacts.

Minimize Impacts to Water Resources: This factor refers to the impact of the seawater pipeline to resources located in the bay (i.e., underwater cultural resources, seagrasses, coral, fish, and benthos). An underwater archaeological survey would be needed for each alternative to determine if submerged resources are present, and to investigate and evaluate the impacts to these resources.

Because Alternative 1 (East Site) is the closest to the Caribbean Sea, it has a lower potential to affect submerged resources than either Alternative 2 (South Site) or Alternative 3 (West Site - Salt River Bay Marina), both of which are at the back of the bay. Seagrasses would be impacted by the pipeline at all alternatives; however, these impacts would pose a short-term temporary impact. Impacts from the pipeline to coral are unknown until site-specific water quality data is collected. Short-term minor adverse effects to fish and benthos would occur during installation of the pipeline. ***Advantage:*** This factor's attributes were measured as number of feet of pipeline, with the shorter lengths being considered advantages.

Protect the Cultural Landscape: This factor refers to the impact of the MREC to the cultural landscape at SARI. SARI is a cultural landscape, with the Salt River Bay being the only known US-owned location where Columbus landed as well as a focus of prehistoric and early historic settlement. Construction of the MREC thus has the potential to have an effect on this landscape.

Alternative 1 (East Site) would have an effect on the SARI cultural landscape, however, depending on the mass and scale of the MREC's facilities, this effect may not be adverse. The view of the MREC structures would be shielded from ocean approaches from the east but would visible from the west as well as directly off shore from Salt River Bay. Demolition of the Virgin Grand Hotel shell, if completed in concert with construction of the MREC, could be considered as a mitigating factor for visual effect as the Virgin Grand structure is far more visually intrusive than the proposed MREC buildings. The visual effect (as well as potential effect on archaeological resources) could also be mitigated by moving the MREC building, visitors center, cafeteria and dormitories south of the wet lab and water tanks, further from the mouth of the bay.

Alternative 2 (South Site) is located on a knoll at the back of the bay. The proposed MREC facilities would be located behind a hill which dominates this point. Use of this alternative should not have an effect on SARI's cultural landscape, so long as the mass and scale of buildings did not significantly exceed the height of this hill.

For Alternative 3 (West Site), the Salt River Bay Marina is tucked back into the southwest corner of the bay and is not visible from the ocean. Use of this marina would not have an adverse affect on SARI's cultural landscape, as long as the new facilities' mass and scale were appropriate. The Visitor Contact Station sits on a hill above Salt River Bay, and while visible, does not detract from the cultural landscape of the bay as it is well elevated above the bay and the Columbus Landing site. Reuse of this building or new construction on the site of the Visitor Contact Station should not have an effect on Salt River Bay's cultural landscape, so long as the new construction does not substantially vary from the height of the Visitor Contact Station. Structures taller than three stories on this location could have an adverse effect. ***Advantage:*** This factor's attributes were measured as impacts, on a high-medium-low scale, with low being the best. Alternative 2 (South Site) was considered to create the least amount of disturbance.

Provide Improvements to Water Quality Where Possible: This factor refers to the potential impact of the MREC to the water quality (i.e., fecal coliform, runoff) at SARI. Water quality impacts are expected to be minor from all alternatives. Alternative 3 (West Site) would benefit the water quality at SARI by reducing/eliminating the Salt River Bay Marina water quality issues when the NPS has control over the marina operations. ***Advantage:*** This factor's attributes were measured as improvements to water quality, on an excellent-good-fair-poor scale, with qualitative assessments made by the team given their interpretation of the data. Alternative 3 (West Site) was considered to have the highest likelihood for significant improvements.

Mitigate Impacts to Native Vegetation: This factor refers to the impact to native vegetation (other than mangroves and wetlands) from the MREC. Alternative 1 would impact approximately 0.35 acres of forest, 6.55 acres of vegetated fields, and 5.0 acres of shrubs due the MREC facilities, roads, and associated parking facilities. However, most of the vegetation at this site is invasive. Impacts to native plants are expected to be minor. Alternative 2 would impact approximately 10.93 acres of forest, 0.09 acres of shrubs, and 0.34 acres of vegetated fields by the MREC. Impacts to native plants are expected to be moderate for this alternative. Alternative 3 would impact approximately 0.77 acres of forest, 0.49 acres of shrubs, and 2.73 acres of vegetated fields at the Visitor Contact Station and the marina. Most of the vegetation at the Visitor Contact Station is invasive; therefore impacts to native plants are expected to be minor. ***Advantage:*** This factor's attributes were measured as impacts, on a high-moderate-low-none scale, with Alternative 1 (East Site) considered to have low impact to native plants.

1.1.2 Function: Meet the Needs of the Marine Research and Education Center

Provide Direct Vehicular Access to the MREC via a Public Right of Way: This factor refers to the ability of MREC staff, students and visitors to access the facility. If the MREC is to serve the public, it requires roadway access via a public right of way for users and support vehicles providing service to the center. Alternative 3 (Visitor Contact Station and Salt River Bay Marina) have adequate public road access. Road access to Alternative 1 (East Site) and Alternative 2 (South Site) are restricted. Public road access would have to be negotiated for these sites or new roads provided. ***Advantage:*** This factor's attributes were measured as access, on an excellent-fair-good-poor scale, with Alternative 3 (West Site) having the best access and Alternative 1 (East Site) and Alternative 2 (South Site) requiring some road improvements.

Have Access to Seawater: This factor refers to the MREC's need for seawater for research to be undertaken in the Wet Lab and the MREC itself. To accomplish this, an intake pipe would be placed along the bottom of the bay to connect an intake point at an appropriate location to pumps and holding tanks adjacent to the Wet Lab. While it is believed that this intake line can be built and connected to the Wet Lab in each alternative, the length of the line will vary by alternative. It is estimated that this line would be at least 1,000 linear feet at Alternative 1 (East Site) and at least 1,600 linear feet from Alternative 2 (South Site) and Alternative 3 (West Site). The longer the line, the more it would cost to construct and maintain and the larger the impact it would have on water resources. ***Advantage:*** This factor's attributes are measured as linear feet of the seawater intake line, with shorter lengths being considered advantages.

Provide Adequate Space for Proposed and Existing MREC and NPS Programs: This factor relates to site capacity. Each site must have adequate developable area to support the MREC program and accessory facilities. In gross terms, Alternative 1 (East Site) is approximately 70 acres, Alternative 2 (South Site) is about 58 acres, and the combined area of Alternative 3 (West Site), which includes the Visitor Contact Station and Salt River Bay Marina, (including only the portion of the marina site proposed for use) is about 10 acres. Additional site analysis will be required to determine the actual developable area on each site. However, it is known that floodplains, cultural resources and other considerations including steep slopes would reduce the amount of developable land at each site. ***Advantage:*** This factor's attributes are measured as acres, with more acres being considered advantages.

Provide a Contiguous Site for All MREC Uses: This factor relates to the desire to create a unified MREC in a campus setting. Although it is not imperative that the MREC be contained on one site, the consortium has expressed a preference for this to be the case. ***Advantage:*** This factor's attributes are measured as whether an alternative has or does not have contiguousness, with continuousness being the advantage.

Construct the MREC on Available Land: This factor relates to the need for NPS to acquire properties for the MREC that it does not currently own if the MREC is to be constructed on those sites. The NPS owns the East Site and land at the Visitor Contact Station, but it does not own the South Site or land at the Salt River Bay Marina. ***Advantage:*** This factor's attributes as measured on the amount of land acquisition needed, with the East Site (Alternative 1) considered best because no acquisition would be needed.

Address Need for Dredging: This factor relates to the need for the NPS or other governmental body dredging the bay or an inlet to support the MREC and docking facility. ***Advantage:*** This factor's attributes are measured as the likelihood for dredging in the near term, on a high-medium-low scale, with low as the best, with Alternative 2 (South Site) as the highest since this alternative has a high probability for dredging in the foreseeable future and is located further back in the bay.

Improve Operational Efficiency and Sustainability: This factor relates to the potential for the MREC to improve the operational efficiency and sustainability of the Park Service's existing facility and services in the area. ***Advantage:*** This factor's attributes were measured as the likelihood of improved operations, on a high-medium-low scale, with high as the best. Alternative 3 (West Site) was considered the most likely to result in improved operations.

1.1.3 Function: Provide for Visitor Enjoyment

Provide a Quality Visitor Experience: This factor refers to the impact of the MREC on visitor experience at SARI. There are currently no visitor services authorized by NPS at SARI. Regardless of the alternative, the visitor experience at SARI would be greatly enhanced from current conditions by the addition of the MREC facility. Additionally, Alternative 1 has the potential in the future to interpret archaeological sites and offer additional recreation at this site. Alternative 3 (West Site) has the potential in the future to interpret the Columbus Landing site. ***Advantage:*** This factor's attributes are measured in the extent of improvement expected from each alternative, on a high-medium-low scale. Alternative 1 (East Site) was considered to have the most potential for improvement given the size of the site, the existing vista and cultural and historic resources available on the site.

1.1.4 Function: Provide Benefits to the Local Community

Support Compatibility with Adjacent Land Uses: This factor relates to the relationship of the MREC to adjacent land uses as well as the impact of adjacent land uses to the MREC. The use of the facility will generate traffic and noise on the site, and these impacts will be greater if and when the center becomes more heavily used. ***Advantage:*** This factor's attributes were measured as compatibility to and with adjacent land uses, on a high-medium-low scale, with high the best. Alternative 1 (East Site) was considered the most compatible because improvements at the site would result in more controlled use of the property.

Provide Socio-Economic Benefits to the Local Community: This factor refers to the impact of the MREC to benefit the socioeconomics of the local community. Constructing the MREC would provide opportunities for employment and educational programs, which would create an economic benefit to the community. In each alternative, the local economy would benefit from the construction of the facility; in areas where commercial uses would be allowed, there may be some indirect economic impacts as well. ***Advantage:*** This factor's attributes were measured as the potential for economic benefits, on a high-medium-low scale, with Alternative 3 (West Site) being considered the most likely to support economic uses, given the existing marina and the site's proximity to a heavily-traveled public road and the potential for additional uses supporting the ones already in place.

1.2 FACTORS CONSIDERED BUT ELIMINATED

The following factors were considered in the CBA process but were determined not to have significant differences among the alternatives:

Air Quality: Minor impacts to air quality may occur from stationary and mobile sources at the MREC regardless of the alternative.

RTE Species: The MREC would not adversely affect the federally listed species regardless of the alternative.

Seismic Activity: Mitigation for seismic activity would occur regardless of the alternative.

Noise: There would be minor impacts associated with the noise from the MREC regardless of the alternative.

Hydrology/Ground Water: No impacts to hydrology or groundwater are anticipated as a result of implementing the MREC facility.

Utilities: Access and use of utilities would be the same for each alternative.

Hurricanes: Mitigation (i.e., thicker roof designed to withstand 150 mph winds, insulated steel-enforced concrete walls, stronger windows and doors) for earthquakes at MREC would occur regardless of the alternative.

Land-Based Cultural Resources: An archaeological survey would be required for areas of new construction and such survey may identify archaeological resources requiring further investigation regardless of the alternative.

Wildlife: There would be short-term, minor impacts to the birds and mammals in the area regardless of the alternative.

1.3 CHOOSING BY ADVANTAGES MATRIX

The outcomes of the CBA process are shown on Figure 1-1.

1.4 CONCLUSIONS

The purpose of this study was to determine the feasibility of three alternatives for siting a proposed MREC at SARI. To determine the feasibility of the alternatives several steps were taken including describing the existing conditions of the sites under consideration and evaluating the environmental impacts of the alternatives. The alternatives (or sites) were examined in detail, given the information available on existing conditions, and preliminary site plans were developed for each alternative. Among the elements evaluated were floodplains, topography, susceptibility to hurricanes and earthquakes, cultural and historic resources, and environmental impacts. The individual site plans attempted to mitigate impacts to these elements and accommodate the building program in an environmentally responsible manner while providing the means to compare the advantages of each alternative.

The final steps in determining the feasibility of the alternatives involved a cost analysis and the Choosing by Advantages (CBA) process. A preliminary estimate of probable costs based on schematic designs was prepared for each of the alternatives, which resulted in similar costs among alternatives. The project team reviewed the conceptual site plans and completed the CBA process, as well as a Value Analysis. The factors or attributes developed for the CBA process were to protect cultural/natural resources, meet the needs of the MREC, provide for visitor enjoyment, and provide benefits to the local community. CBA scores for each alternative were calculated, and the alternatives were ranked based on total CBA scores. Alternative 1 (East Site) scored the highest, so it was considered the best alternative for the MREC.

FACTORS	ALTERNATIVES					
	East Site		South Site		West Site	
Function: Protect Cultural/Natural Resources						
Minimize Impacts to Mangroves/Wetlands						
Attributes	0.31 ac		0.55 ac		0.5 ac	
Advantages	0.24 ac	5			0.19 ac	10
Minimize Impacts to Coastal Barriers						
Attributes	Medium		Low		High	
Advantages	Some impact	5	Lowest impact	10		
Minimize Impacts to Floodplains						
Attributes	Medium Impact		No Impact		Low Impact	
Advantages			No direct impact	10	No direct impact	15
Minimize Impacts to Water Resources						
Attributes	950 feet		1600 feet		400 feet	
Advantages	1350 feet	30			1200 feet	25
Protect the Cultural Landscape						
Attributes	Medium		High		Low	
Advantages	Minor impacts	10	Least disturbed	20		
Provide Improvements to Water Quality Where Possible						
Attributes	Good		Fair		Excellent	
Advantages	Moderate	20			Significant improvements	40
Mitigate Impacts to Native Vegetation						
Attributes	Moderate		High		None	
Advantages	Some road impacts	5			Minor Impacts	10

Figure 1-1. Choosing by Advantages Process for the MREC

FACTORS	ALTERNATIVES					
	East Site		South Site		West Site	
Function: Meet the Needs of the Marine Research and Education Center						
Provide Direct Vehicular Access to the MREC via a Public Right of Way						
Attributes	Fair		Good		Excellent	
Advantages			Moderate road improvements needed	40	Direct Existing Access	60
Have Access to Seawater						
Attributes	1000 lf		1600 lf		1600 lf	
Advantages	600 fewer lf	65				
Provide Adequate Space for Proposed and Existing MREC and NPS Programs						
Attributes	70 acres		58 acres		10 acres	
Advantages	60 more acres	70	48 more acres	60		
Provide a Contiguous Site for All MREC Uses						
Attributes	Yes		Yes		No	
Advantages	Site is contiguous	80		80		
Construct the MREC on Available Land						
Attributes	Excellent		Poor		Fair	
Advantages	No acquisition needed	100			Some acquisition needed	20
Address Need for Dredging						
Attributes	Medium		High		Low	
Advantages	Some dredging needed	20			Low probability of near-term dredging	55
Improve Operational Efficiency and Sustainability of Facility						
Attributes	Medium		Medium		High	
Advantages					Improved operations	5

Figure 1-1. Choosing by Advantages Process for the MREC

FACTORS	ALTERNATIVES					
	East Site		South Site		West Site	
Function: Provide for Visitor Enjoyment						
Provide a Quality Visitor Experience						
Attributes	High		Medium		Low	
Advantages	Greatly improved	60	Some improvement	30		
Function: Provide Benefits to the Local Community						
Support Compatibility with Adjacent Land Uses						
Attributes	High		Low		Medium	
Advantages	Most compatible	45			Compatible	35
Provide Socio-Economic Benefits to the Local Community						
Attributes	Low		Low		Medium	
Advantages					Some benefits	5
TOTAL IMPORTANCE OF ADVANTAGES	515		250		285	

Figure 1-1. Choosing by Advantages Process for the MREC