EVALUATION OF ALTERNATIVES

II.1.0 ALTERNATIVE PLAN DEVELOPMENT

The alternative plan formulation process is designed to identify plans that are publicly acceptable, implementable, and feasible from economic, environmental, engineering, and social standpoints. . The process was developed by the U.S. Army Corps of Engineers (USACE) and is described in detail in ER 1105-2-100. It requires the systematic preparation and evaluation of alternative solutions for addressing identified problems, needs, and opportunities under the objectives of National Economic Development (NED), consistent with protecting the Nation's environment. Alternative plans are formulated to identify specific ways to achieve the planning objectives, so as to solve the identified problems and realize the identified opportunities. Each alternative plan is formulated in consideration of four criteria: (1) completeness, (2) efficiency, (3) effectiveness, and (4) acceptability. Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. Efficiency is the extent to which an alternative plan is the most cost-effective means of achieving the objectives. Effectiveness is the extent to which the alternatives plans contribute to achieve the planning objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies.

Alternatives evaluated in this section include new and existing sites for dredge material management and port facilities. The primary objective of this analysis is to determine which alternative or combination of alternatives will meet the need for increased dredge material disposal capacity, additional marine cargo handling facilities, and military logistical and tactical deployment support areas while minimizing environmental impacts to the extent practical.

II.1.1 ALTERNATIVE PLAN DEVELOPMENT CRITERIA

The following specific formulation and evaluation criteria have been identified for this study.

Technical Criteria

- The plan selected should be consistent with local, regional, and state goals for water resources development.
- Plans must be realistic and reflect state-of-the-art measures and analysis techniques.
- The optimization scale of project development should be identified by analyzing NED and engineering feasibility.
- The plan should be capable of handling all types of material normally dredged in Hampton Roads, i.e., silt, sand, shell, and mixtures of these, as well as suitable and unsuitable material.
- The plan should accommodate large and small input loads without undue sacrifice of

effectiveness. It should be capable of accommodating unanticipated new work without appreciable disruption.

- With the possible exception of extreme storms, the plan should function regardless of weather conditions.
- The entire plan should withstand disruption as a result of damage to part of the system. It should be a product of proven elements and practices and be resilient under emergency or catastrophic conditions, such as storms, floods, waves, and so on.
- The plan should be capable of serving or utilizing all types of dredging equipment, including hopper dredges, hydraulic pipeline dredges, and mechanical (bucket) dredges. It should permit simultaneous operation of several types of dredges.
- Levees must be sized sufficiently to withstand storm tides and wave action.
- The plan should be capable of accommodating future port development.

Economic Criteria

- Each separable unit of improvement must provide benefits at least equal to its costs.
- The scope of the proposed development must be scaled to provide maximum net benefits. However, departure from a project that provides economic optimum is possible in cases where the departure is justifiable and substantiated.
- There must be no more economical means, evaluated on a comparable basis, of accomplishing the same purpose that would be precluded from development if the Federal plan was under taken. This limitation applies only to those alternative possibilities that would be physically displaced or economically precluded from development if the project were undertaken. The Federal plan cannot be used to eliminate a more economical plan because it would be physically displaced by the Federal plan.

Institutional Criteria

- Plans must be consistent with existing Federal, state, and local laws;
- Plans must be locally supported to the extent that non-Federal partner provide a letter of intent stating that it understands its responsibilities and obligations as set forth in the WRDA of 1986, as amended.
- Prior to the Preconstruction Engineering and Design (PED) Phase, the non-Federal partner would enter into a written Design Agreement to cost share 25 percent of the costs of the Design Phase upfront. Ultimate cost-sharing of design is the same percentage as for construction. Settlement is made at the time of construction subsequent to execution of the Project Cooperation Agreement (PCA).
- Prior to the Construction Phase, the non-Federal partner would enter into a written PCA to provide all items of local cooperation satisfactory to the Secretary of the Army, as mandated by Section 22 of Public Law 91-611, as amended.

Environmental and Social Criteria

- The plan should minimize the commitment of natural resources, whether they are marine bottom-lands, wetlands, other coastal zones, inland environments, or wildlife in these areas.
- The plan should minimize environmental impacts and maximize environmental quality in the project area to the extent practicable considering environmental, economic, and engineering criteria.
- The available sources of expertise should be used to identify environmental resources that might be endangered, damaged, or destroyed by plan implementation. These would include the U.S. Fish and Wildlife Service (USFWS), Environmental Protection Agency (USEPA), National Marine Fisheries Service (NMFS), and appropriate state agencies, such as Virginia Institute of Marine Science (VIMS), Virginia Marine Resources Commission (VMRC), Virginia Department of Environmental Quality (DEQ), and the Virginia Department of Historic Resources (VHDR).
- Measures should be incorporated into the Recommended Plan to protect, preserve, restore, or enhance environmental quality in the project area.
- The plan should be capable of being integrated into local or regional planning for water and air pollution abatement, transportation, recreation, and land use.
- As much as possible, the plan should minimize noise, dust, odor, unsightliness, and potential health risks.
- The plan should meet existing public health and environmental control standards.
- As nearly as possible, the plan should be aesthetically pleasing to the public, which has to support and live with it.
- The plan should not displace, devalue, or destroy important historical and cultural landmarks or sites.
- The adverse impacts on area recreation resources should be minimized.
- The plan should be publicly acceptable.

The degree to which any water resources development project meets the foregoing criteria is taken as a measure of its relative merit. Clearly, no plan could meet all these criteria fully. However, the evaluation, selection, and development of alternatives will emphasize optimization in terms of the respective economic (NED) benefits along with the consideration of environmental, social, and regional impacts.

II.2.0 ALTERNATIVES ANALYSIS

The alternatives analysis involves six essential steps:

- Step 1: Identification, examination, and screening of potential solutions;
- Step 2: Development of initial alternative plans;
- Step 3: Screening of initial alternative plans;
- Step 4: Evaluation of alternative plans;

- Step 5: Optimization and comparison of alternative plans; and
- Step 6: Selection of a plan.

II.2.1 IDENTIFICATION AND EXAMINATION, AND SCREENING OF INITIAL ALTERNATIVES, INCLUDING NO ACTION ALTERNATIVE (STEPS 1-3)

In Steps 1-3, dredged material disposal alternatives and potential marine terminal sites were identified and evaluated individually on the basis of their suitability, applicability, and merit in meeting the planning objectives and constraints for the study. Without undertaking an in-depth analysis, the goal of this step was to screen out those solutions that obviously do not accommodate the need for increased dredged material disposal capacity or port expansion, have significant environmental impacts, or are inappropriate due to other factors such as prohibitively high costs. As part of this step, all the long-term dredge material management alternatives and all potential marine terminal locations in the Hampton Roads area are considered.

II.2.1.1 CIDMMA EXPANSION ALTERNATIVES

A comprehensive list of all the dredge material alternatives identified for initial screening is included in Table II-1. Identified potential long-term dredged material storage locations are shown in Figure II-1. Currently the CIDMMA operates consistent with a Dredged Material Management Plan (DMMP). Part of the plan calls for use of the existing north, center, and south containment cells to be rotated. Rotation allows optimal drying of the dredged material within the facility. A general assumption for initial alternatives screening is that any proposed confined disposal facility (CDF) expansion cell will be added into the cell rotation plan to continue optimal drying of material within the facility. In addition, it is assumed that expansion cells will be rapidly filled for port development, which consists of having dredged material placed into that cell as rapidly as possible without the expansion cell participating in the DMMP cell rotation for optimal drying.

Table II-1 serves as a simplified synopsis of the initial screening analysis. This section explains how to use this table.

The first column is a listing of all the possible alternatives for long-term dredged material storage for Hampton Roads. The remaining columns are grouped together to provide a concise reference to indicate whether the associated alternative meets the objectives of the study: provision for dredged material capacity, consideration to port development, military usage, and environmental considerations. The alternatives are grouped into the following major categories:

- **No Action Alternative:** Based on ERDC simulations, CIDMMA will reach its maximum capacity in 2025 under without project conditions. CIDMMA capacity is regularly increased to meet short-term inflow projections by raising the interior height of the dikes. Interior dike heights currently range from 33 to 36 feet above MLW. Under without project conditions, the dikes are capable of being raised to an interior height of 47 feet, which is projected to accommodate forecasted inflow volumes until 2025. After 2025, with the dikes at an interior height of 47 feet, the CIDMMA foundation will have reached its bearing capacity, and additional inflows will no longer be accommodated. At this time ocean disposal will be utilized for suitable material.

- **On Site Alternatives:** These include modifications of the existing site that could extend the life of CIDMMA and provide port development. An example of such a measure is installation of strip drains to help consolidate material within the site.

- **East Expansions:** These include potential solutions for eastward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development. Expansion cell dikes would be constructed from the existing CIDMMA eastern dike into the Elizabeth River, and the cell would be filled with dredged material. Many different dike construction and construction phasing techniques were considered. Consideration was given to utilization of this site as only a CDF and as a CDF with port terminal development. When considering a port terminal, such development would occur on top of the expansion footprint once the cell has been filled with dredged material. A channel and berthing area would be dredged to allow for both dike construction and ship access to the port facility.

- **North Expansions:** These include potential solutions for northward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development. A larger northward expansion and a smaller northward expansion were considered. A northward expansion cell would require dike construction from the existing CIDMMA northern dike northward into Hampton Roads. The cell would be filled with dredged material. Many different dike construction and construction phasing techniques were considered. Utilization of this site both as only a CDF and as a CDF with port terminal development was both considered. When considering a port terminal, such development would occur on top of the expansion footprint once the cell has been filled with dredged material. A channel and berthing area would be dredged to allow ship access to the port facility.

- **West Expansions:** These include potential solutions for westward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development. Several different westward expansion footprints were considered. The smallest footprint expansion was one that would minimally extend the life of the facility. The largest possible expansion was the footprint that would fit within physical constraints surrounding the site. A westward expansion cell would require dike construction from the existing CIDMMA western dike westward into the James River. The cell would be filled with dredged material. Many different dike construction and construction phasing techniques were considered. Utilization of this site both as only a CDF and as a CDF with port terminal development was both considered. When considering a port terminal, such development would occur on top of the expansion footprint once the cell has been filled with dredged material. A channel and berthing area would be dredged to allow ship access to the port facility.

- **East and North Expansions:** These include potential solutions for eastward and northward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development. These expansion footprints are combinations of the north and east expansion footprints discussed above.

- **East and West Expansions:** These include potential solutions for eastward and westward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development. These expansion footprints are combinations of the east and west expansion footprints discussed above.

- **North and West Expansions:** These include potential solutions for northward and westward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development. These expansion footprints are combinations of the north and west expansion footprints discussed above.

- **Upland Placement Sites:** These include new confined upland placement sites involving acquisition of upland real estate and construction of new diked facilities. Such sites are located in land areas that are considered upland, not periodically inundated with seawater during tidal fluctuations. Such placement sites generally require larger tracts of land. The tracts should be of such a shape to facilitate water clarification goals of a dredged material placement site. Upland sites are constructed by building containment dikes to hold the dredged material. The dimensions of the upland site should be such that appropriate ponding and freeboard are maintained at all times. Weir structures should be installed to allow ponding of the water and decanting of clarified water. Management plans should be developed to optimally operate the site and maximize its lifespan. For the upland sites examined in this study, each lifecycle phase should be considered. Design efforts should consider site location, environmental and institutional considerations, real estate, technical parameters, and so forth. Initial construction and operation and maintenance (O&M), as well as closeout phases are also considered.

- **Ocean Placement Sites:** These include the two ocean placement sites accessible off the Virginia coast: Dam Neck Ocean Disposal Site (DNODS), and Norfolk Ocean Site (NOS). These two sites were designated previously and are considered to be possible alternatives to the CIDMMA.

- **Beneficial Use Sites:** These include beneficial use of dredged material placement. Beneficial use sites for the purposes of this study are those sites where dredged material could be used to accomplish environmental benefits. Examples of such benefits could include beach nourishment, marsh creation or restoration, oyster ground creation, creation of fish and wildlife habitat, and use of dredged material as construction materials. Design, construction, and placement techniques, as well as O&M procedures are specific to the beneficial use goal.

- **Creation of New Island Facilities:** These include building new islands in open water similar to the existing CIDMMA that could be operated as new DMMA's. These sites were identified in prior studies and were revisited for this study. In most cases, such sites would require building dikes up from the existing subaqueous bottom to contain a large area of harbor, bay, or river bottom. Dredged material would be deposited into the site until the dredged material elevation exceeded the high water line. Then the site would be operated much as the existing CIDMMA is operated. Management plans should be developed to optimally operate the site and maximize its lifespan. Each lifecycle phase should also be considered. Design efforts should consider site location, environmental and institutional considerations, real estate, technical parameters, etc. Initial construction, O&M, and closeout phases are also considered.

- **Deep Hole Sites:** These include locations within the Hampton Roads area where deep water exists that may have sufficient capacity to serve as pits for placement of dredged material. The concept of such a placement site is that dredged material would be deposited into the deep holes such that the deep holes would eventually be filled enough for the bottom contours to increase enough to match the surrounding bathymetry.

- **Combined Aquatic Disposal Facilities:** These include sites that could be used as borrow sources of sand that could be used for numerous construction projects. Once the sand is removed, a pit would remain that could provide dredged material storage capacity. Once the removal of borrow material is complete, dredged material could be placed into the pit. The pit would be filled until the increasing bottom contours match the surrounding bathymetry.

The second column indicates whether the alternative provides dredged material placement capacity. Results of screening analysis are summarized in the third column as:

- **"Yes."** In this case, the alternative provides long-term dredged material storage capacity for Norfolk Harbor (generally the geographic area currently included within the bounds authorized to the existing CIDMMA facility).
- **"No."** In this case, the alternative does not provide sufficient long-term dredged material storage capacity.
- **"Possibly."** The level of design detail to determine whether dredged material storage capacity could be increased cannot be determined. However, with the limited information available increased storage appears to be likely.
- **"Minimally."** At the current level of design, an increase of dredged material storage capacity appears likely, but the increased capacity does not really increase enough to provide long-term capacity for Norfolk Harbor.

The third column includes information as to whether the alternative would allow development of a port terminal facility in conjunction with the dredged material placement site. Results of the screening analysis for this study objective are summarized as:

- **"Yes."** In this case, the alternative has potential for port terminal development and as a dredged material placement site.
- **"No."** The alternative does not provide potential for terminal development.

The fourth column includes information as to whether the alternative provides for military use of the site. There were two potential military uses of each alternative. The first use would be use of the alternative as a port facility for military logistics. The facility could be used to provide for transport of troops, supplies, weapons, equipment, and so forth. The second use would be for military training purposes. The Army has at times used a portion of the east side of the CIDMMA at the Rehandling Basin to practice landings. The extent to which the Army would use it in the future is unknown; however, the option remains open. The results of screening analysis for this study objective are summarized as:

- **"Yes."** In this case, the alternative provides potential for both types of military use, training and logistics.
- **"No."** The alternative does not provide potential for either military use.
- **"Partial."** Here, the alternative provides for either logistical or training use. In most cases, "Partial" means only training use is support.
- **"Possibly."** There could be military use opportunities, but the degree to which the site could be used cannot be determined at the level of design for this study.
- **"Conflict."** A conflicting use would be an alternative that prevents military activities that are current on-going at an alternative's location from continuing once the alternative is constructed.

The fifth column depicts the results of the initial environmental analysis of the various alternatives in an abbreviated form. This analysis, presented in Tables II-2 and II-3, evaluated the degree of impact of the alternatives in various environmental categories.

The last column in Table II-1 is a brief synopsis of the major reasons for eliminating or carrying forward an alternative. This column's data indicate whether an alternative progressed to the next phase of the analysis or was eliminated from consideration.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development (1)	Supports national defense needs	Environmental considerations	Determination
NO ACTION ALTERNATIVE	No	No	No	No significant effects	**Does not meet objectives.** This does not allow for more capacity, port development, or support of national defense needs.
ON SITE ALTERNATIVE: Existing CIDMMA & west berm construction	Yes	No	Partial	No significant effects	**Retain For Least-Cost Dredged Material Disposal Analysis -** An additional alternative site is needed to meet the port development objective.
ON SITE ALTERNATIVES: Various potential solutions that include port development on existing CIDMMA	No/ Possibly	No	Yes	No significant effects	Constructability, operability, and storage capacity problems. Possible reduction in capacity. Elevation is too high for marine terminal construction.
EAST EXPANSION: Eastward expansion for CDF cell only	Yes	No	Partial	Aquatic biota	**Retain For Least-Cost Dredged Material Disposal Analysis -** An additional alternative site is needed to meet the port development objective.
EAST EXPANSION: Eastward expansion for CDF cell & port development (1)	Yes	Yes	Yes	Aquatic biota and air quality	**Retain For Least-Cost Dredged Material Disposal Analysis -** (First, southern 1/3 of cell is filled, then port is constructed, then remaining 2/3rd's of cell is filled.)

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development (1)	Supports national defense needs	Environmental considerations	Determination
EAST EXPANSION: EASTWARD EXPANSION FOR CDF CELL & PORT DEVELOPMENT & WEST BERM CONSTRUCTION (1)	Yes	Yes	Yes	Aquatic biota and air quality	**RETAIN.** (First, southern 1/3 of cell is filled, then port is constructed, then remaining 2/3rd's of cell is filled.)
NORTH EXPANSION: Large northward expansion for CDF cell only	Yes	No	Partial	Aquatic biota, hydrodynamics, and water quality	Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community. Also, institutional concerns.
NORTH EXPANSION: Large northward expansion for CDF cell & port development (1)	Yes	Yes	Yes	Aquatic biota, hydrodynamics, water quality, and air quality	Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community. Also, institutional concerns.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development (1)	Supports national defense needs	Environmental considerations	Determination
NORTH EXPANSION: Small northward expansion for CDF cell only	Yes	No	Partial	Aquatic biota, hydrodynamics, and water quality	Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community. Also, institutional concerns.
WEST EXPANSION: Large westward expansion for a CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/ commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.
WEST EXPANSION: Medium westward expansion for a CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/ commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development (1)	Meets objectives: Supports national defense needs	Environmental considerations	Determination
WEST EXPANSION: Small westward expansion for CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/comer-cial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.
WEST EXPANSION: Modified (after hydrodynamic modeling) large westward expansion for a CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/comer-cial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.
WEST EXPANSION: Large westward expansion for CDF cell & port development (1)	Yes	Yes	Yes	Water quality, aquatic biota, visual/aesthetic, air quality, and recreational/comm er-cial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development (1)	Meets objectives: Supports national defense needs	Environmental considerations	Determination
WEST EXPANSION: Medium westward expansion for CDF cell & port development (1)	Yes	Yes	Yes	Water quality, aquatic biota, visual/aesthetic, air quality, and recreational/commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.
WEST EXPANSION: Small westward expansion for CDF cell & port development (1)	Yes	Yes	Yes	Water quality, aquatic biota, visual/aesthetic, air quality, and recreational/commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.
EAST & NORTH EXPANSIONS: Various combinations of various sizes of eastward & northward expansions for CDF cells only	Yes	No	Partial	Water quality, aquatic biota, and hydrodynamics	Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development (1)	Meets objectives: Supports national defense needs	Environmental considerations	Determination
EAST & NORTH EXPANSIONS: Various combinations of eastward & northward expansions for CDF cells & port development (1)	Yes	Yes	Yes	Water quality, aquatic biota, hydrodynamics, and air quality	Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community.
EAST & WEST EXPANSIONS: Various combinations of various sizes of eastward & westward expansions for CDF cells only	Yes	No	Partial	Water quality, aquatic biota, hydrodynamics, visual/aesthetics, and recreational/ commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion from westward expansion cause a non-workable solution among stakeholder community.
EAST & WEST EXPANSIONS: Various combinations of various sizes of eastward & westward expansions for CDF cells & port development (1)	Yes	Yes	Yes	Water quality, aquatic biota, hydrodynamics, visual/aesthetics, air quality, and recreational/com-ercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion from westward expansion cause a non-workable solution among stakeholder community.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development (1)	Supports national defense needs	Environmental considerations	Determination
NORTH & WEST EXPANSIONS: Various combinations of various sizes of northward & westward expansions for CDF cells only	Yes	No	Partial	Water quality, aquatic biota, hydrodynamics, visual/aesthetic s, and recreational/ commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion from westward and northward expansions cause a non-workable solution among stakeholder community.
NORTH & WEST EXPANSIONS: Various combinations of various sizes of northward & westward expansions for CDF cells & port development (1)	Yes	Yes	Yes	Water quality, aquatic biota, hydrodynamics, visual/aesthetics , and recreational/ commercial water use	Current State law prohibits a westward expansion of the CIDMMA. Hydrodynamic impacts and larval dispersion from westward and northward expansions cause a non-workable solution among stakeholder community.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development (1)	Meets objectives: Supports national defense needs	Environmental considerations	Determination
UPLAND PLACEMENT SITE: Southeastern Public Service Authority landfill site in Suffolk	Yes	No	No	Water quality, sanctuaries and refuges, protected species/critical habitat, visual/ aesthetics, and wetlands	**RETAIN** Many environmental, real estate, engineering, and institutional concerns.
UPLAND PLACEMENT SITE: Upland site in Portsmouth between power generation plant and State Highway 164	Possibly	Yes	Yes	Transportation, visual/aesthetics, wetlands, land use, and utilities	**RETAIN** Conflict of land use with Maersk port development.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs	Environmental considerations	Determination
OCEAN PLACEMENT: Dam Neck ocean placement site	Possibly	No	No	No significant effects	**RETAIN** An additional alternative site is needed to meet the port development objective. Also, placement site would require major modifications.
BENEFICIAL USE OF DREDGED MATERIAL SITE: Ragged Island site	Possibly	No	No	Hydrodynamics, water quality, and protected species and critical habitat	**RETAIN** Site cannot be rapidly filled. An additional alternative site is needed to meet the port development objective given that site is a State wildlife management refuge.
BENEFICIAL USE OF DREDGED MATERIAL SITE: Hoffler Creek site	No	No	No	Hydrodynamics, water quality, protected species and critical habitat, and aquatic biota	Conflict of use, since it is a wildlife preserve Also, cannot be rapidly filled.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs	Environmental considerations	Determination
BENEFICIAL USE OF DREDGED MATERIAL SITE: Lily Creek site	No	No	No	Hydrodynamics, water quality, protected species and critical habitat, and aquatic biota	Cannot be rapidly filled. Also, conflict of use since the land was recently developed as residential housing.
CREATION OF NEW ISLAND FACILITIES: Buckroe Beach/Horseshoe Flats	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Conflict of use since area is borrow site for Buckroe Beach Federal project. Also, this is a finfish migratory route and crab nursery.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development	Meets objectives: Supports national defense needs	Environmental considerations	Determination
CREATION OF NEW ISLAND FACILITIES: Willoughby Bay Island	Yes	Possibly	Could conflict	Hydrodynamics, water quality, aquatic biota, and recreational/com-mercial water use	Protected area for juvenile fish. Also, drainage of the Mason Creek area could be disrupted. Also, strong recreational and military use of this bay.
CREATION OF NEW ISLAND FACILITIES: Ocean View offshore/ Chesapeake Bay	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/com-mercial water use	Heavy use of this site for fishing, and recreation would be lost and is, therefore, socially unacceptable. Also, there are possible incompatibilities with Norfolk Redevelopment Plan.
CREATION OF NEW ISLAND FACILITIES: East of Chesapeake Bay Bridge-Tunnel	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/com-mercial water use	Conflicts with Chesapeake Bay multi-agency goals. Also, site would likely need larger capacity than other alternatives considered for this report, since its location would be favorable for projects not traditionally allowed to use CIDMMA. Also, beyond the scope of this study.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development	Meets objectives: Supports national defense needs	Environmental considerations	Determination
CREATION OF NEW ISLAND FACILITIES: Hampton Flats	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Would be detrimental to shellfish larvae and other marine organisms. Also, disruptive to hydrodynamics.
DEEP HOLE SITE: Site in James River	Possibly	No	No	Hydrodynamics, water quality, and aquatic biota	**RETAIN** Dredged material nutrient release concerns. Also, scour concerns. An additional alternative site is needed to meet the port development and national defense objectives.
DEEP HOLE SITE: Site near Hampton Roads Bridge-Tunnel	Possibly	No	No	Hydrodynamics, water quality, and aquatic biota	**RETAIN** Dredged material nutrient release concerns. Also, scour concerns. An additional alternative site is needed to meet the port development objective.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port developmen t	Supports national defense needs	Environmental considerations	Determination
DEEP HOLE SITE: Site in southern Chesapeake Bay	Possibly	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/com-mercial water use	**RETAIN** Dredged material nutrient release concerns. Also, scour concerns. An additional alternative site is needed to meet the port development and national defense objectives.
COMBINED AQUATIC DISPOSAL FACILITY: Offshore of River Shore neighborhood in Portsmouth	Minimally	No	No	Hydrodynamics, water quality, and aquatic biota	**RETAIN** An additional alternative site is needed to meet the port development and national defense objectives.
COMBINED AQUATIC DISPOSAL FACILITY: Offshore of old Tidewater Community College campus in Suffolk	Minimally	No	No	Hydrodynamic, water quality, and aquatic biota	**RETAIN** High commercial fishery value. An additional alternative site is needed to meet the port development objective.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development	Meets objectives: Supports national defense needs	Environmental considerations	Determination
COMBINED AQUATIC DISPOSAL FACILITY: Mouth of Nansemond River	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/ commercial water use	**RETAIN** Environmental impacts to James and Nansemond Rivers. An additional alternative site is needed to meet the port development and national defense objectives.
COMBINED AQUATIC DISPOSAL FACILITY: James River between mouths of Nansemond River and Chuckatuck Creek	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/ commercial water use	**RETAIN** Disruptive of discharge from Nansemond River and Knotts Creek. An additional alternative site is needed to meet the port development and national defense objectives.
COMBINED AQUATIC DISPOSAL FACILITY: Middle ground site west of Monitor Merrimac Bridge-Tunnel	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/ commercial water use	**RETAIN** High commercial fishery value. An additional alternative site is needed to meet the port development and national defense objectives.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development	Meets objectives: Supports national defense needs	Environmental considerations	Determination
COMBINED AQUATIC DISPOSAL FACILITY: Middle ground site east of Monitor Merrimac Bridge-Tunnel	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	High commercial fishery value. VMRC Clam brood stock area.
COMBINED AQUATIC DISPOSAL FACILITY: Hampton Flats west side	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, recreational/commercial water use, and submerged aquatic vegetation (SAV)	High commercial fishery value. Also, disruptive to "plunging front" hydrodynamics that are critical to larval fisheries. Also, possible navigation concerns.
COMBINED AQUATIC DISPOSAL FACILITY: Channel to Newport News	Minimally	No	No	Water quality, aquatic biota, and recreational/commercial water use	Full time use as a placement site would disrupt navigation.
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Hampton Creek entrance	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, recreational/commercial water use, and SAV	High commercial fishery value. Also, proximity to Hampton Flats and associated "plunging front" hydrodynamics that are critical to larval fisheries.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

	Meets objectives				
Potential solutions	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs	Environmental considerations	Determination
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Willoughby Federal navigation channel in Norfolk	Minimally	No	Possible conflicts with other military use	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	High commercial fisheries value. Also, proximity to navigation channel is undesirable. Also, possible conflicts with Virginia Department of Transportation and/or Navy interests.
COMBINED AQUATIC DISPOSAL FACILITY: North of Norfolk Naval Base carrier docks	Minimally	No	Conflicts with other military use	Water quality, aquatic biota, and recreational/commercial water use	Placement site option is incompatible with Navy's use of site.
COMBINED AQUATIC DISPOSAL FACILITY: Norfolk Harbor	Minimally	No	No	Water quality, aquatic biota, and recreational/commercial water use	**RETAIN** An additional alternative site is needed to meet the port development objective.
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Norfolk International Terminals North	Minimally	No	No	Aquatic biota and recreational/commercial water use	Navigational issues. Conflicts with Virginia Pi Association and port facility interests. An addi alternative site is needed to meet the port development objective.

Table II-1. RESULTS OF SCREENING OF DREDGE MATERIAL MANAGEMENT ALTERNATIVES
(Cont'd)

Potential solutions	Meets objectives: Extends life of existing CIDMMA facility	Meets objectives: Provides for anticipated future port development	Meets objectives: Supports national defense needs	Environmental considerations	Determination
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Norfolk International Terminals South	Minimally	No	No	Aquatic biota and recreational/commercial water use	Conflict of use with borrow site for oyster shell for oyster restoration programs. Borrow material quality is questionable. An additional alternative site is needed to meet the port development and national defense objectives.
COMBINED AQUATIC DISPOSAL FACILITY: East side of existing CIDMMA	Minimally	No	No	Aquatic biota and recreational/commercial water use	**RETAIN** An additional alternative site is needed to meet the port development and national defense objectives.

(1) See Section 2.1.2 and Table II-4 for additional information on site selection for port development.

Alternatives that, according to the modeling results, result in significant hydrodynamic impacts or are counter to current State laws specific to CIDMMA expansion were automatically eliminated. Sites that present a conflict with current Federal or State government use or U. S. military use, present navigational concerns, or are located in a defined fishery management area were also eliminated.

The following tables provide a more detailed evaluation and comparison of potential environmental impacts that may result from implementation of various alternatives including the No Action Alternative. A brief description of the significance criteria for evaluating degrees of impacts to each resource is provided in Table II-2 and focuses on the resources that are most likely to be impacted by the alternatives. Table II-3 presents the relative degree of impact expected to occur in each resource category for each alternative.

Table II-2. CRITERIA FOR RATING LEVEL OF IMPACTS

Impact Level	Aquatic Biota[1]	Threatened, Endangered, or Candidate Species	Air Quality	Water Quality/ Hydrodynamics	Wetlands and Submerged Vegetation (SAV)
None	No appreciable impact	No appreciable impact	No appreciable impact	No appreciable impact	No appreciable impact
Negligible	Impact localized and not detectable, or at lowest levels of detection	Change in a population or individuals of a species; consequences to population not measurable or perceptible, or other changes not measurable or perceptible	Impact not perceptible and not measurable; not affecting surroundings	Impact not detectable, no discernible effect on water quality/hydrodynamics.	Impact barely perceptible and not measurable; confined to small areas and would not fill or destroy wetland or SAV.
Minor	Impact localized and slightly detectable but would not affect overall structure of any natural community	Change in a population or individuals of a species, if measurable, would be small and localized, or other changes would be slight but detectable	Impact perceptible but not measurable; would remain localized.	Impact slightly detectable but would not affect overall water quality/hydrodynamics.	Impact perceptible and measurable, but would remain localized; affecting a wetland or SAV that is unavoidable, such as repairing a pipeline or burying an upgraded electrical line.
Moderate	Impact clearly detectable; could affect individual species, communities, or natural processes appreciably	Change in a population or individuals of a species measurable but localized	Impact detectable and possibly affecting integrity of surroundings. Air quality testing would be required.	Impact clearly detectable and could have an appreciable effect on water quality/hydrodynamics.	Impact sufficient to change a wetland or SAV but would not diminish resource's integrity enough to jeopardize its viability.
Major	Impact highly noticeable and would substantially influence natural resources, e.g. individuals or groups of species, communities, or natural processes	Change in a population or individuals of a species measurable and would result in permanent consequence to the population	Impact would have a significant impact on surroundings.	Impact would have a substantial, highly noticeable, potentially permanent effect on water quality/hydrodynamics.	Substantial, highly noticeable change in the wetland or SAV resulting in a significant impact.

[1]Aquatic biological resources including finfish, shellfish, and other benthic populations.
Short-term = Less than one year, normally during construction and recovery; *Long-term* = Longer than one year, normally from operations; *Cumulative* = Cumulative impacts to environmental resources result from incremental effects of proposed actions when combined with other past, present, and reasonably foreseeable future projects in the area.

Table II-2. CRITERIA FOR RATING LEVEL OF IMPACTS
(Cont'd)

Impact Level	Sanctuaries and Refuges	Noise	Human Effects[2]	Historical and Cultural Resources	Executive Orders
None	No appreciable impact	No appreciable impact	No appreciable impact	No appreciable impact	No appreciable impact
Negligible	Impact barely perceptible and not measurable.	Impact not detectable, no discernible effect	Impact not perceptible and not measurable; not affecting surroundings	Impact barely perceptible and not measurable; confined to small areas or affecting a single contributing element of a larger National Register District with low data potential	Impact localized and not detectable, or at lowest levels of detection
Minor	Impact perceptible and measurable, but would remain localized, affecting an area that is unavoidable.	Impact slightly detectable but would not affect targets including residential dwellings.	Impact perceptible but not measurable; would remain localized.	Impact perceptible and measurable, but would remain localized; affecting a single contributing element of a larger National Register District with low to moderate data potential, or would not affect character-defining features of a National Register eligible or listed property	Impact localized and slightly detectable but would not affect overall community.
Moderate	Impact sufficient to change resource area's features but with sufficient implementable mitigation that would not diminish the usefulness of the site(s).	Impact clearly detectable and could have an appreciable effect on targets including residential dwellings.	Impact detectable and possibly affecting integrity of surrounding area.	Impact sufficient to change a character-defining feature but would not diminish resource's integrity enough to jeopardize its National Register eligibility, or it generally would involve a single or small group of contributing elements with moderate to high data potential	Impact clearly detectable; could affect community; implementable mitigation provided to avoid impacts
Major	Change in resource area that is measurable and would result in permanent consequence to the environment.	Impact would have a substantial, highly noticeable, and potentially permanent influence on targets including residential dwellings.	Impact would have a significant affect on surrounding area.	Substantial, highly noticeable change in character-defining features would diminish resource's integrity so much that it would no longer be eligible for National Register listing, or it would involve a large group of contributing elements or individually significant properties with exceptional data potential	Impact highly noticeable and would substantially influence individuals/communities outside Fort Monroe.

2 – Includes transportation, utilities, waste management, land use, visual and aesthetic resources, recreational and commercial uses, economics, environmental justice, secondary growth, and public safety

Short-term = Less than one year, normally during construction and recovery; ***Long-term*** = Longer than one year, normally from operations; ***Cumulative*** = Cumulative impacts to environmental resources result from incremental effects of proposed actions when combined with other past, present, and reasonably foreseeable future projects in the area.

Table II-3. ENVIRONMENTAL IMPACTS OF ALTERNATIVES

Alternatives	Resource Impact Categories	Hydrodynamics/Water Quality	Air Quality	Protected Species and Critical Habitat	Aquatic Biota	Wetlands and SAV	Sanctuaries and Refuges	Transportation	Utilities	Waste Management	Land Use	Noise	Visual and Aesthetic Resources	Recreational and Commercial Use of Waters	Economics	Environmental Justice	Public Safety	Historical and Archaeological Resources	Secondary Growth
NO ACTION		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON SITE (CIDMMA)		0	3	2	0	0	0	2	1	0	2	1	2	0	1	0	0	0	1
EAST EXPANSION																			
CDF Cell Only		1	2	1	3	1	1	1	1	1	1	1	2	3	1	1	1	1	1
CDF Cell and Port		1	3	1	3	1	1	2	2	2	2	2	2	3	1	1	1	1	2
CDF Cell, Port and West Berm		1	3	1	3	1	1	2	2	2	2	2	2	3	1	1	1	1	2
NORTH EXPANSION																			
CDF Cell Only		4	2	2	4	1	2	1	1	1	1	1	2	4	1	1	1	1	1
CDF Cell and Port		4	3	2	4	1	2	2	2	2	2	2	2	4	1	1	1	1	2
CDF Cell, Port, and West Berm		4	3	2	4	1	2	2	2	2	2	2	2	4	1	1	1	1	2

Alternatives (Continued)	Resource Impact Categories	Hydrodynamics/Water Quality	Air Quality	Protected Species and Critical Habitat	Aquatic Biota	Wetlands and SAV	Sanctuaries and Refuges	Transportation	Utilities	Waste Management	Land Use	Noise	Visual and Aesthetic Resources	Recreational and Commercial Use of Waters	Economics	Environmental Justice	Public Safety	Historical and Archaeological Resources	Secondary Growth
WEST EXPANSION																			
CDF Cell Only – Small, Medium, Large		3	2	3	3	1	1	1	1	1	2	2	2	3	1	1	1	1	2
CDF Cell and Port – Small, Medium, Large		3	3	3	3	1	1	2	2	2	2	3	3	3	1	1	1	1	2
EAST AND NORTH EXPANSION (CDF and Port)		4	3	2	4	1	1	2	2	2	2	2	2	3	1	1	1	1	2
EAST AND WEST EXPANSION																			
CDF Cell Only		3	2	3	3	1	2	1	1	1	2	2	2	3	1	1	1	1	2
CDF Cell and Port		3	3	3	3	1	3	2	2	2	2	3	3	3	1	1	1	1	2
NORTH AND WEST EXPANSION																			
CDF Cell Only		4	2	3	4	1	2	1	1	1		2	2	3	1	1	1	1	2
CDF Cell and Port		4	3	3	4	1	3	2	2	2		3	3	3	1	1	1	1	2
UPLAND PLACEMENT																			
SPSA Landfill in Suffolk		3	2	3	2	4	4	2	2	2		2	2	2	1	1	1	1	2
Portsmouth @ State Highway 164		1	2	2	2	3	1	2	2	2		2	2	2	1	1	1	1	2

	Resource Impact Categories	Hydrodynamics/Water Quality	Air Quality	Protected Species and Critical Habitat	Aquatic Biota	Wetlands and SAV	Sanctuaries and Refuges	Transportation	Utilities	Waste Management	Land Use	Noise	Visual and Aesthetic Resources	Recreational and Commercial Use of Waters	Economics	Environmental Justice	Public Safety	Historical and Archaeological Resources	Secondary Growth
Alternatives (Continued)																			
OCEAN PLACEMENT																			
Dam Neck Site		1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Norfolk Site		1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BENEFICIAL USE SITES																			
Ragged Island		3	2	3	3	2	2	2	1	1	2	1	2	2	1	1	1	2	2
Hoffler Creek		4	2	4	3	2	3	2	1	1	2	2	2	3	1	1	2	2	2
CREATION OF NEW ISLAND FACILITIES																			
Hampton Flats		4	2	3	4	1	1	1	1	1	2	1	2	4	1	1	2	2	2
Buckroe Beach/Horseshoe Flats		3	2	2	4	1	1	1	1	1	2	2	2	4	1	1	2	2	2
Willoughby Bay		4	2	2	3	1	1	1	1	1	2	1	2	4	1	1	2	2	2
Ocean View/Chesapeake Bay		3	2	2	3	1	1	1	1	1	2	1	2	4	1	1	2	2	2
DEEP HOLE SITES																			
James River		2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1
Hampton Roads Bride Tunnel		3	2	2	2	1	1	2	1	1	1	1	1	2	1	1	1	2	1
Southern Chesapeake Bay		3	2	2	3	1	1	1	1	1	1	1	1	2	1	1	1	2	1

	Resource Impact Categories	Hydrodynamics/Water Quality	Air Quality	Protected Species and Critical Habitat	Aquatic Biota	Wetlands and SAV	Sanctuaries and Refuges	Transportation	Utilities	Waste Management	Land Use	Noise	Visual and Aesthetic Resources	Recreational and Commercial Use of Waters	Economics	Environmental Justice	Public Safety	Historical and Archaeological Resources	Secondary Growth
Alternatives (Continued)																			
COMINED AQUATIC DISPOSAL FACILITIES																			
Offshore TCC in Suffolk		2	2	2	3	1	1	1	1	1	1	1	1	2	1	1	1	2	1
Mouth of Nansemond River		2	2	2	3	1	1	1	1	1	1	1	1	2	1	1	1	2	1
James River Between Nansemond River and Chuckatuck Creek		3	2	2	3	1	2	1	1	1	1	1	1	3	1	1	1	2	1
Middle Ground West Of Monitor Merrimack Bridge-Tunnel		2	2	2	4	1	1	1	1	1	1	1	1	4	1	1	1	2	1
Hampton Flats		3	2	2	4	4	1	1	1	1	1	1	1	4	1	1	2	2	1
Hampton Creek Entrance		2	2	2	3	4	1	1	1	1	1	1	1	4	1	1	2	2	1
Adjacent to Willoughby Federal Navigation Channel		2	2	2	3	1	1	1	1	1	1	1	1	3	1	1	2	2	1
North of Norfolk Naval Base Carrier Docks		2	2	2	2	1	1	1	1	1	1	1	1	3	1	1	1	2	1
Norfolk Harbor		2	2	2	2	1	1	1	1	1	1	1	1	3	1	1	1	2	1
Adjacent to NIT North		2	2	2	2	1	1	1	1	1	1	1	1	3	1	1	1	2	1
Adjacent to NIT South		2	2	2	2	1	1	1	1	1	1	1	1	3	1	1	1	2	1
East of CIDMMA		2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1

II.2.1.2 TERMINAL CONSTRUCTION ALTERNATIVES

Overview

In addition to the dredge material management alternatives described previously in Part II, various sites throughout Hampton Roads were evaluated for the construction and operation of a marine terminal. Alternatives meeting the criteria for development of a marine terminal would be developed in conjunction with alternatives that would satisfy the dredge material disposal objective.

As discussed in Part I, Need for Port Facilities section, the container terminals operated by the VPA are nearing their capacity to handle cargo growth. In an attempt to meet forecasted cargo area demand at the Port of Hampton Roads, the VPA has chosen to increase the capacity at its existing cargo handling terminals (i.e., NIT, PMT, and NNMT). In addition to expanding the VPA terminals, Maersk Sealand is constructing a new 280-acre container terminal in Portsmouth that would increase The Port of Virginia's capability to handle containerized cargo. However, this terminal combined with increasing capacity at VPA's existing terminals will not meet the forecasted cargo demand. The VPA has determined that a new container terminal is needed to provide sufficient capacity to meet the containerized cargo forecast for Hampton Roads and continuing long-term cargo growth anticipated during the 2050 planning horizon.

New Container Terminal Requirements

Container vessels are growing in size to meet market demand. These newer vessels require larger cranes and deeper water, resulting in the need for dredging and for rehabilitating or renovation of existing wharf structures. These larger vessels will require loading and discharging a higher number of containers per vessel call without an increase in port time. Thus, state-of-the-art landside facilities and handling equipment will be required at new container terminal facilities. In summary, a feasible site to develop a new marine terminal requires:

- large tracts of waterfront land to develop port infrastructure,
- good road infrastructure,
- good rail infrastructure, and
- deep water access to Federal navigation channels.

Land Area

As discussed in the Need for Port Facilities section, 850 acres of land is needed to meet the 2050 projected cargo volume.

Transportation Corridors

Successful port development is dependent upon proximity to major highways, railroads, and deep navigation channels. Roadways in the vicinity of the proposed port facility must be capable of accommodating the movement of freight into and out of the Hampton Roads region and providing trucks and worker vehicles with ready access to the port terminal. The internal height of tunnels and underpasses associated with the access roadways must be sufficient to accommodate all trucks (minimum of 14.6 feet). Existing freight rail networks are required in the vicinity of the port facility to provide direct links between the Hampton Roads area and major consumer centers throughout the United States.

The port terminal must be close to one of the Hampton Roads commercial marine transportation channels, such as the Norfolk Harbor Channel, the Newport News Channel, the Thimble Shoal Channel, or other Hampton Roads ancillary channels. To support the newer container cargo vessels, navigation channels to the port facility must be at least 50 feet deep. Figure II-2 identifies major roadways, rail corridors, and navigation channels in the Hampton Roads area, along with available mapping of current land use.

Description of Potential Locations
A search for large undeveloped sites in the Hampton Roads area was conducted using available digital land use mapping (digital mapping of current land use for Gloucester County, Poquoson, Suffolk, and Isle of Wight County was not available). Figure II-3 identifies all land classified as vacant or undeveloped in the Hampton Roads area (in red), based on the available information. No large undeveloped, waterfront sites were identified in Chesapeake, Newport News, Norfolk, or Virginia Beach.

<u>Craney Island Eastward Expansion</u>
The eastward expansion of CIDMMA would provide approximately 580 acres of waterfront property for container terminal development in the Hampton Roads area. The terminal would be close to deep navigation channels, rail corridors, and major highways. Access from the terminal to major transportation corridors would be provided by a connector highway from VA Route 164 to CIDMMA. The proposed Third Hampton Roads Crossing would function as a strategic complementary project but is not absolutely necessary for the success of the site of the east expansion of CIDMMA since the proposed connector road corridor could be completed without constructing the Third Crossing. Existing rail corridors would be accessed via new rail lines from the terminal. To the extent practicable, the new rail lines would be constructed within existing rail and road ROW's to minimize impacts. Vessel access to the terminal would occur via the existing Norfolk Harbor Reach and Craney Island Reach navigation channels. Dredging activities proposed for the Craney Island eastward expansion would provide adequate port access and 50-foot deep channels to accommodate deep draft ships. Expansion of the east side of the CIDMMA is limited to 580 acres as the area is bounded by the Federal navigation channel, the CIDMMA re-handling basin, and the hydrodynamic impacts associated with any subaqueous fill on the North side of the CIDMMA.

<u>Waterfront Sites in Hampton</u>
Three large undeveloped areas consisting of at least 400 acres were identified along the Chesapeake Bay frontage and Back River frontage of Hampton.. The site fronting the Chesapeake Bay is bordered to the north by the Grandview Natural Preserve, which forms the northeast corner of the city of Hampton. Based on the city of Hampton Tidal Marsh Inventory (Barnard, 1975), approximately half of the site consists of tidal wetlands known as White Pond Swamp. This wetland system is noted as having high environmental values by providing flood attenuation, sediment retention, and habitat for Federal- and state-protected wildlife and waterfowl (Barnard, 1975). The other two Hampton sites front both Harris River and Back River, tributaries of the Chesapeake Bay. According to the City of Hampton Tidal Marsh Inventory (Barnard, 1975) and the National Wetland Inventory Hampton quadrangle (USFWS, 1973), valuable tidal wetlands also constitute a substantial portion of these sites. These two sites also fall within the Accident Potential Zone of the Langley Air Force Base runways. Furthermore, all of the Hampton sites are surrounded by residential zoning areas.

In addition to wetland impacts, access to these sites from existing commercial marine transportation channels would require substantial dredging. The existing transportation channels are located at least 5 miles offshore. Based on U.S. Geological Survey mapping, existing depths in the vicinity of these sites are less than 1 foot and remain less than 30 feet deep to the Chesapeake Bay Channel and less than 20 feet deep to Thimble Shoal in the vicinity of the Thimble Shoal Channel. Primary roadways and rail corridors are not readily accessible from these sites. Substantial road and rail corridor construction would be required to develop these sites as container cargo port facilities.

Waterfront Site in York County

One large undeveloped, waterfront site was identified on Crab neck in York County.. The site is located south of Goodwin Islands and fronts the Chesapeake Bay. Based on the York County and Town of Poquoson Tidal Marsh Inventory (Silberhorn, 1981), the site contains substantial acreages of tidal wetlands. This marsh system provides high values in productivity, wildlife and waterfowl habitat, fish spawning and nursery areas; is important to the shellfish industry; and provides shoreline stabilization (Silberhorn, 1981). This site is located over 5 miles from the York River Entrance Channel, and the existing depth in the vicinity of the site is less than 1 foot and remains less than 30 feet deep to the channel; therefore, extensive dredging would be required to provide access to large container cargo vessels. Disposal of the large amount of dredged material would provide further difficulties.

Roadways in the vicinity of the site include U.S. 17, a major transportation corridor within the Hampton Roads region. However, U.S. 17 is already heavily congested due to commuter traffic between Gloucester County and the Lower Peninsula. This travel corridor is also heavily commercialized with numerous traffic lights, which would significantly delay truck traffic associated with a large cargo facility.

Other Potential Sites in York and Gloucester Counties

Although digital mapping of current land use was not available for Gloucester County, the information in Figure II-3 does show that the Gloucester Point area fronting the York River and the Chesapeake Bay is either developed or contains substantial tidal wetland areas. Waterfront sites north of Gloucester Point may have adequate land area to support port development, but these rural areas lack major roads and rail corridors capable of supporting a large containerized cargo facility. As stated above, U.S. 17, the major roadway within Gloucester County, is not capable of supporting heavy volumes of additional truck traffic and does not provide ready connections with other major U.S. highways.

Large undeveloped areas may also exist upstream of the Coleman Bridge on the York River; however, frequent bridge openings would cause significant traffic problems between Gloucester and the Lower Peninsula. Dredging would also be required since the navigation channel upstream of the bridge is less than 45 feet deep and decreases in depth upstream of the Cheatham Annex.

Maersk Sealand Property

Another large area identified on Figure II-3, which fronts the Elizabeth River, is the 500-acre Maersk Sealand property in Portsmouth. As described in the "Need for Proposed Port" section, Maersk Sealand is planning to develop a 280-acre container cargo facility on this property.

Sites Fronting the James River

No large undeveloped areas of waterfront property exist between the I-664 Monitor-Merrimac Bridge Tunnel and the James River Bridge. According to information obtained from Figure II-3, within this stretch of river, industrial development occupies the majority of waterfront property on the east bank of the river. Residential development, golf courses, and wetlands occupy the majority of the waterfront property along the west bank of the James River and along the Nansemond River. Although large waterfront areas may be available upstream of the James River Bridge, the channel depth is less than 40 feet and less than 30 feet upstream of Fort Eustis. Substantial dredging would be required to deepen the navigation channel, to create an access channel to a new port facility, and to establish a deep draft anchorage. Port development upstream of the James River Bridge would also result in significant traffic impacts resulting from the high frequency of bridge lifts required to accommodate the large cargo vessels. In rural areas, existing rail and roadway infrastructure would not be capable of supporting a large containerized cargo port facility.

Recently, a 620-acre site on the James River located just upstream of Fort Eustis in James City County was released for sale. The property provides valuable waterfront access and existing rail corridors; however, substantial dredging would be required to provide access for the large container cargo vessels. The site is located 18 miles upstream of the James River Bridge, and, as stated above, the channel depth upstream of the bridge is less than 40 feet. The navigation channel in the vicinity of the site, the Tribell Shoal Channel, is 1 mile west of the site, and the water depths decrease from 30 feet at the channel to less than 3 feet at the site. Port development on this site would also cause significant traffic impacts resulting from frequent James River Bridge lifts required to accommodate large cargo vessels.

Sites Fronting the Elizabeth River

There are no large undeveloped waterfront sites on the Elizabeth River. Although there are a few small, undeveloped waterfront sites along the Upper Reach of the Southern Branch that are near each other, they would have to be contiguous in order to allow the operational efficiency that is required of a container terminal. There are also traffic concerns related to sites in this area. Only limited road and rail corridors serve the immediate area, and there would be a negative impact on local traffic across the Jordan Bridge due to the multiple daily openings that would be required to allow passage for container ships arriving to and departing from the terminal.

The size of the Upper Reach channel itself also raises concerns. It is only 35 feet deep and 500 feet wide, which is not deep or wide enough for deep-draft container ships. Even if the channel can be dredged deeper, a turning basin for a 1,100 feet ship is impossible.

Comparison of Marine Terminal Alternatives

Table II-4 compares the ability of the various potential locations to meet the container terminal requirements. It should be noted that, as discussed previously, 850 acres of land are required to meet the cargo needs during the planning horizon. Small sites were not necessarily eliminated out of hand, and the initial screening criteria were to provide:

- Large tracts of land
- Access to the 50-feet channel
- Access to road
- Access to rail

The above criteria quickly eliminated most areas from further consideration. For example, there are brownfield sites in the Southern Branch of the Elizabeth River; however, these sites are far from the 50-foot channel, and the size of vessels that carry containerized cargo would not be able to transit this portion of the river due to the narrow winding river and the length of the large container ships (900 – 1200 feet in length). Sites such as these were not listed in the table because they were eliminated from further consideration early in the screening process.

Table II-4. CONTAINER TERMINAL REQUIREMENTS FOR IDENTIFIED POTENTIAL DREDGED MATERIAL STORAGE LOCATIONS

Potential Locations	Container Terminal Requirements		
	Land Area (> 400 acres)	**Road and Rail Corridors**	**Deep Water Channel Access**
CIDMMA Eastward Expansion	Provides 580 acres of container cargo area	Close proximity to major transportation corridors	Provides port access for deep draft vessels; minimal dredging required to access Federal navigation channel relative to other options.
Hampton Sites	Substantial acreages of tidal wetlands	Not readily accessible	Federal navigation channels at least 5 miles from sites, extensive dredging required to access federal navigation channel.
York County Site	Substantial acreages of tidal wetlands	Not readily accessible	Navigation channel at least 5 miles from site, extensive dredging required to access federal navigation channel.
Other Potential York and Gloucester County Sites	No known undeveloped waterfront sites	Frequent bridge openings to allow vessels upstream of the Coleman Bridge would result in significant traffic impacts; U.S. 17 not suitable to support additional heavy truck traffic; no major roads and rail corridors within rural areas	Substantial dredging would be required to deepen the navigation channel, to create an access channel to a new port facility, and to establish a deep draft anchorage.
Maersk Sealand Property	Proposed 280 acres of container cargo area	Close proximity to major transportation corridors	Provides port access for large container cargo vessels.
James River Sites	No sites downstream of the James River Bridge; one known site just upstream of Fort Eustis	Significant traffic impacts resulting from frequent James River Bridge lifts to accommodate vessels; no major roads and rail corridors within rural areas	Substantial dredging would be required to deepen the navigation channel, to create an access channel to a new port facility, and to establish a deep draft anchorage.
Elizabeth River Sites	Multiple small sites, questionable suitability since non-contiguous	Traffic impacts resulting from Jordan Bridge openings to accommodate vessels; limited major road and rail corridors in areas	Substantial dredging would be required to deepen the navigation channel; a turning basin is physically infeasible.

Selected Port Alternative

Based on the evaluation of these potential sites, it was determined that other than the CIDMMA eastward expansion alternative, no other sites in the Hampton Roads area could reasonably support the land capacity, navigational access, and transportation requirements of a major container handling facility. The proposed eastward expansion site is close to 50-foot deep navigation channels and major highway and railroad corridors.

This eastward expansion is also the only proposed port location that is a dredge material disposal area alternative that remained after the initial screening. As a result, the eastward expansion alternatives that include port facility construction are the only alternatives that meet the requirements of the study authorization and are believed to have minimal hydrodynamic and navigation impacts relative to all possible alternatives, other than the "No Action" alternative. It should be noted that any combination of alternatives that provide for port expansion and extending the life of CIDMMA would be acceptable. If a large tract of land could be identified off-site, it could be considered; however, the screening process determined that no sites are reasonably available that are close to the 50-foot channel and major road and rail connections.

II.3.0 ELIMINATION OF NO ACTION ALTERNATIVE

Under a No Action scenario, CIDMMA would reach its capacity by 2025. The CIDMMA would close and a new disposal site would need to be constructed for material deemed unsuitable for ocean disposal. In addition, engineering constraints would prohibit a marine terminal from being constructed on the current site as the elevation of the site would be too high. The Port of Virginia would continue to operate, but its future capacity would be limited to the combined maximum capacity of existing port facilities and the new Maersk terminal that is under construction.

The most noteworthy local effect of the No Action alternative would be the negative economic consequences to the Hampton Roads area. Direct economic benefits to the regional economy from construction and operation of the terminal site on the east expansion of CIDMMA in the short-term and long-term would not be realized. The anticipated shortfall in cargo handling capacity and potential delays in moving and handling cargo would likely result in a shift in vessel traffic and business to other East Coast ports. This scenario would, thus, have a negative impact on the local and regional economy.

Long-term economic benefits from secondary growth would also be greatly reduced under the No Action alternative. Commercial and industrial development would be reduced since new businesses or expanded businesses would no longer be needed to serve the terminal site on the east expansion of CIDMMA. This, in turn, would reduce regional benefits from increased employment, the purchase of goods and services, and the tax revenues generated by secondary growth. These effects would be felt by the entire Commonwealth of Virginia.

The most noteworthy national effect of the No Action alternative would be the economic consequences felt by the entire East Coast and Midwest markets. The trade growth experienced by Virginia is felt throughout the Nation, and most other ports are also experiencing capacity challenges. Therefore, one can not assume that cargo can simply be diverted to other East Coast ports with no additional costs being incurred. There are only a few ports that are expected to have available capacity, but there would be significant added inland transportation costs as a result of diverting cargo through the other ports.

Two separate studies on the potential economic impacts of the proposed the terminal site on the east expansion of CIDMMA have been conducted. The first study, "Craney Island Eastward Expansion Feasibility Study" (Benefits Analysis), is national in scope and is was conducted by David Miller & Associates for the USACE (David Miller & Associates, 2004). This study examines the national landside savings the proposed port expansion may deliver and provides a detailed explanation of how the No Action alternative has a negative impact on the national economy. The findings of the report detail the added landside transportation costs that would be incurred without the terminal site on the east expansion of CIDMMA and are as follows:

- If the terminal site on the east expansion of CIDMMA is not built, the Port of Virginia will not be able to meet its forecasted demand and cargo will have to be diverted to other ports (18 alternate ports were considered).
- Diverted cargo incurs significant added landside transportation costs over a Norfolk routing. This equates to approximately $331 million in additional transportation costs on an annual basis when compared to an eastern expansion.
- Over the 50-year study period (2010-2060), these added costs equal $5.9 billion or $331 million annually.
- The second study, "Economic Impact Study: Craney Island Marine Container Terminal," is regional in scope and is being conducted by Moffat & Nichol for the VPA (Moffat & Nichol, 2004). The draft Impact Study was commissioned to determine the state/regional economic impacts from the terminal site on the east expansion of CIDMMA construction and operation, as well as the nearby distribution center activity that would be generated. Direct, indirect, and induced activities were considered at the terminal and throughout the distribution, warehousing, and transportation sectors. The preliminary findings are as follows:
- Under the No Action alternative, there would be a $1.4 billion shortfall in benefits to Virginia's economy from terminal design and construction and an average annual unrealized gain of $2.5 billion from the operation of the terminal site on the east expansion of CIDMMA.
- There would also be an annual average of $2.7 billion in lost opportunities for economic activity from distribution center operations that would be generated from the new terminal as well.

Absent a proposed eastward expansion with port facility construction, the Port of Virginia would be missing one of the keys to its successful and competitive future and CIDMMA would close. Negative economic consequences to the entire Hampton Roads region as well as the remainder of the Commonwealth and the entire Nation would be expected under the No Action alternative. As a result this alternative was eliminated since it did not meet the study objectives. The No Action alternative will continue to be the baseline against which all plans are compared to determine feasibility in addition to comparing the environmental effects those alternatives have on the study area. It is the condition that provides the basis for measuring what is an impact, beneficially or otherwise. More detailed economic information is available in Appendix B of the Feasibility Report.

II.4.0 EVALUATION OF ALTERNATIVE PLANS (STEP 4)

At the end of this multi-objective screening process, two potential alternative solutions remained: (1) eastward expansion of the CIDMMA, and (2) eastward expansion of the CIDMMA with construction of a west berm. Additional navigation simulations and comprehensive hydrodynamic modeling were conducted on the alternatives. The results of these studies indicated that hydrodynamic and navigational impacts resulting from the construction of the alternative would be minimal. These reports may be found in the Feasibility Report, Appendix A, and are referenced in EIS Sections III and IV.

Eastward Expansion Alternative

The Eastward Expansion of the CIDMMA alternative includes the construction of an additional 580-acre disposal cell to the east of the existing CIDMMA. Perimeter dikes will be constructed around the area of the new cell to contain dredged material. The western limit of the proposed cell will tie into the existing east dike of the CIDMMA. After filling, the new cell will be turned over to the local sponsor for the construction of a new marine terminal.

The main dike will be approximately 8,500 feet in length and constructed to elevation +18 feet MLLW, with a 5H:1V side slope below elevation +5 feet and 2H:1V side slope above +5 feet. The remaining dikes, which run east-west, will be constructed with a 10H:1V side slope from the mudline to elevation +5 feet MLLW and an 8H:1V side slope from +5 feet to +18 feet.

Eastward Expansion with West Dike Strengthening Alternative

The Eastward Expansion With West Dike alternative includes the construction of an additional 580-acre disposal cell to the east of the existing CIDMMA in conjunction with a strengthening of the western dike in 2028. Perimeter dikes will be constructed around the area of the new cell to contain dredged material. The western limit of the proposed cell will tie into the existing east dike of the CIDMMA. After filling, the new cell will be turned over to the local sponsor for the construction of a new marine terminal.

The main dike will be approximately 8,500 feet in length and constructed to elevation +18 feet MLLW, with a 5H:1V side slope below elevation +5 feet and 2H:1V side slope above +5 feet. The remaining dikes, which run east-west, will be constructed with a 10H:1V side slope from the mudline to elevation +5 feet MLLW and an 8H:1V side slope from +5 feet to +18 feet.

The strengthening of the western dike will be accomplished with the construction of a berm along the outside of the dike. It would consist of a 150-foot berm extending from the outside edge of the existing dike and would have to be constructed of suitable sandy material to elevation +8 feet MLLW. With the construction of the stability berm and building the dike exterior slopes on a 10H:1V side slopes, the west dike can be built to elevation +60 feet MLLW with adequate factors of safety, while the existing facility without a west dike strengthening can only be raised to +47 feet MLLW with adequate factors of safety.

II.5.0 ECONOMIC EVALUATION OF ALTERNATIVE PLANS (STEP 5)

Economic benefits for the Eastward Expansion alternative and the Eastward Expansion with West Dike alternative plan were derived from the reduction in the systems dredging costs, the actual cost of dredging and disposing of material in Hampton Roads, and the reduction in transportation costs of containerized cargo traffic. Cost inputs included the following:

- Expansion Costs
- Systems Dredging Costs
- O&M Costs
- Environmental Mitigation Costs
- Real Estate Costs
- Transportation Costs

Expansion Costs

Expansion costs are the initial costs necessary to construct a containment facility or port facility. The cost estimates require a feasibility level design of containment cell structures (including dikes, weirs, etc.) and port structures (including alternative construction techniques for bulkheads, foundation treatments, channel design, etc).

Systems Dredging Costs

Systems dredging costs were developed to determine how much dredging in the local area would cost for each placement site alternative considered. A unit cost per cubic yard for placement of dredged material in each of the alternative placement cells was required. For this study, the systems dredging analysis included various cost variables. Among these variables are: consideration of dredging project magnitude, the distance of the user’s dredging project site to the placement site alternative, a contractor's dredging plant and equipment required to perform the dredging, type of material dredged, fuel costs to operate the dredge and attendant plant, dredge hired labor costs, dredging plant availability and contractor competition, etc.

Operation and Maintenance

The O&M cost component was forecasted to estimate long-term costs associated with expansion of the CIDMMA. Some considerations captured in the O&M cost component were historical O&M costs to establish a baseline. During the study, the prior years’ funding levels were examined to determine how the Norfolk District’s O&M funding baselines and capabilities may be changed as the result of CIDMMA expansion alternatives. For instance, the financial records have been detailed regarding how much funding has been used to maintain the CIDMMA containment dikes. Current funding levels and existing funding capability were reviewed. Analyses were performed to determine how future O&M funding needs would increase with expansion alternatives.

Current Norfolk District policies regarding the operation of CIDMMA will likely change with different expansion alternatives. Current O&M practices have been reviewed and assumptions have been made as to how these practices must be modified with expansion alternatives. Some examples include: modifications to cell rotation cycles and dike maintenance schedules, as well as policies with customers regarding timing of dredged material placement into the CIDMMA. For all of the O&M analyses discussed in this section, the USACE ERDC filling and capacity studies were used to help predict future years’ O&M funding requirements.

Environmental Mitigation Costs

Construction of any expansion at CIDMMA will adversely impact the environment with the filling of open water habitat. The proposed east expansion of CIDMMA would fill approximately 580 acres of open water. In order to offset these losses, mitigation measures include sediment remediation, wetlands restoration and conservation, oyster restoration, and a bird management plan. The mitigation plan was developed with stakeholder input using USACE guidelines and evaluation criteria.

Real Estate
Real Estate costs consisting of administration costs as well as changes to any potential salvage value of the existing facility. As the facility ages, the discounted present value of the salvage value would be lower. Therefore, this change in the discounted present value of the salvage value is counted as a cost against any alternative..

Transportation Costs
A basic assumption of this analysis is that excess TEU's will be handled at alternative ports in order to maintain the forecasted trade between commodity origins and destinations. These alternative ports would most likely be on the same or similar service strings that include Hampton Roads as a port-of-call, so insufficient capacity would not affect vessel deployment or waterborne transportation costs. The transportation costs calculated in this analysis are the landside costs of transit between the landside origin/destination and the port handling the commodities. The single exception is the reduced waterborne transportation costs for TEU's arriving from Asia that are offloaded at the ports of Los Angeles/Long Beach (CA) instead of Hampton Roads, in which case the commodity's trip through the Panama Canal is avoided.

Average Annual Benefits. Optimization of the alternative plans was based on the two priority benefit categories of reduced dredging costs and reduced transportation costs savings at October 2005 price levels. These benefits represent the direct reduction in the costs of dredged material disposal and the reduction in transportation costs that could be realized by the Nation when a project is built. As previously discussed, the USACE has made various efforts over the years to increase the capacity of CIDMMA. This would be accomplished with the construction of a project at CIDMMA as well that could provide for anticipated future port development. A summary of the reduction in dredged material disposal costs and transportation costs for each alternative is shown in the Table II-5.

Table II-5. AVERAGE ANNUAL BENEFITS

Alternative plan	Without project total costs ($)	With project total costs ($)	Average annual benefits ($)
Eastward expansion	781,513,000	447,945,000	333,568,000
Eastward expansion with west dike strengthening	781,513,000	441,685,000	339,828,000

<u>Average Annual Costs</u>

Initial construction and O&M costs were developed for each alternative. The costs are annualized for comparison to the average annual benefits for individual project alternatives. The costs include estimates for initial construction and associated port terminal construction costs. They reflect October 2005 (FY 2006) price levels and were annualized over the 50-year period of analysis at a discount rate of 5-1/8 percent. Cost estimates were compiled over a period of several months and were made consistent at October 2005 (FY 2006) price levels to allow proper analysis at a common period in time. A summary of the average annual costs for the alternative plans considered for optimization is shown in Table II-6. Table II-7 shows the total investment cost of the alternative plans.

<u>Table II-6. AVERAGE ANNUAL PROJECT COST AND INCREMENTAL COST</u>

Item	Eastward expansion ($)	Eastward expansion with west dike strengthening ($)
Cell Construction	$37,341,000	$37,341,000
Terminal Construction 3	$4,688,000	$34,688,000
West Dike Strengthening (2)		$1,669,000
Real estate (3)	$69,000	$284,000
Incremental O&M	$65,000	$1,558,000
Access Channel O&M	$209,000	$209,000
Environmental mitigation	$3,018,000	$3,018,000
Total	$75,389,000	$78,766,000

(1) Includes annualized port terminal costs and west dike strengthening costs.
(2) Includes incremental real estate cost and annualized administrative real estate costs.

Table II-7. ALTERNATIVE PLAN INVESTMENT

Item	Eastward expansion ($)	Eastward expansion with west dike strengthening ($)
Initial construction		
Design	$27,824,000	$27,824,000
Construction management	$23,187,000	$23,187,000
Construction	$423,732,000	$423,732,000
Navy Fuel Pipeline	$40,000,000	$40,000,000
West Dike Strengthening (1)		$77,262,000
Environmental mitigation	$50,200,000	$50,200,000
Contingencies	$106,398,000	$106,398,000
Sub-Total	$671,340,000	$748,602,000
Interest during construction		
Construction	$47,590,000	$47,590,000
Environmental Mitigation	$3,846,000	$3,846,000
Total Investment	$722,776,000	$800,038,000

(1) Cost also includes cost allocated to the western dike strengthening, even though it is not needed until 2028.

II.6. 0 PLAN SELECTION (STEP 6)

Table II-8 presents the net NED benefits of the two alternative plans. Although the plan including western dike strengthening has a higher AAEQ cost, it is the alternative that reasonably maximizes net economic benefits consistent with protecting the Nation's environment.

Table II-8. AAEQ ALTERNATIVE PLAN NET BENEFITS (1)

Item	Costs	Benefits (2)	Net benefits	Benefit-to-cost ratio
Eastward expansion	$75,389,000	$333,566,000	$258,179,000	4.42
Eastward expansion with western dike strengthening	$78,766,000	$339,828,000	$261,062,000	4.31

(1) Discounted to base year 2010 at 5.125 percent.
(2) Benefits include transportation cost savings and dredged material disposal cost savings.

The previous table identifies the eastward expansion with strengthening of the western dikes in 2028 as the plan with the greatest net benefits that satisfies all the planning objectives and constraints that guided the planning process. However, the non-Federal partner, the VPA, who has collaborated in the detailed evaluation of the two alternative plans, prefers the less costly alternative plan, which excludes strengthening the western dikes. This preference is based on project cost savings and the uncertainty associated with making a decision today to strengthen the western dikes in 2028. A General Reevaluation Report and updated NEPA document would also likely be required prior to implementation in 2028. It is unlikely that such a plan would be authorized so far in advance. The USACE regulations allow the selection of the Locally Preferred Plan (LPP), if such a plan is of less scope and cost than the plan with the most NED benefits. In this case, with the previous factors, the LPP was selected. In addition, throughout the course of the study, there has been strong opposition from homeowners in the Rivershores community adjacent to the CIDMMA to any project located on the western side of the CIDMMA. The homeowners are also supported by the city of Portsmouth in their opposition. In view of these concerns, the local sponsor does not support including the western dike strengthening as a feature of the selected plan.

Recommended Plan – Eastward Expansion of the CIDMMA

Although the eastern expansion in combination with the western dike strengthening meets the planning objectives and maximizes beneficial contributions to the Nation, the plan is not supported by the local sponsor, as previously discussed. Of the two alternatives, only the Eastward Expansion is supported by the local sponsor and is therefore designated as the Recommended Plan.

The Eastward Expansion also provides significant benefits to the Nation. Average annual benefits of $258 million, or over 99 percent of the benefits that would have resulted from construction of the eastward expansion west dike alternative, are expected to accrue as a result of the Recommended Plan (Table II-8). In addition, average annual costs of the eastward Expansion are slightly less than the Eastward Expansion with West Dike annual costs.

The Recommended Plan ensures an extension of the useful life of CIDMMA by an additional 3 years and provides for anticipated future port development and related national defense needs. The Eastward Expansion also results in the least environmental impact of the expansion alternatives evaluated. For these reasons, it is believed that implementation of the Recommended Plan is warranted and in the best interest of the study area, the region, and the Nation.

II.7.0 DESCRIPTION OF EASTWARD CIDMMA EXPANSION

The Recommended Plan includes construction of a 580-acre cell to the east of the existing CIDMMA. After construction and filling the new cell will become the location for a new terminal facility. The following construction methods, assumptions, and figures are used to describe the construction as it is envisioned at this time. Construction would take place over a period of 5 years. A general layout of the expansion is shown in Figure II-4.

Pre-dredging along the main dike is anticipated to be completed by a combination of bucket and pipeline cutter-head dredges. Approximately 10 percent of the pre-dredge foundation and access channel dredging material is assumed to go into the existing CIDMMA via a pipeline dredge. The remaining 90 percent, anticipated to be dredged by a combination of hydraulic and/or mechanical dredges, would be disposed of in the Norfolk offshore placement site. Figure II-5 shows the limits of pre-dredging.

The access channel dredging is defined as the area between the Federal navigation channel (Norfolk Harbor and Craney Island Reaches) and the new wharf. The Access Channel is generally 500 feet in width and will be flared at both ends where it adjoins the Federal channel. The dredging depth will be 50 feet MLLW with 2 feet advance maintenance dredging. Maintenance material within the existing channel template was not included in the estimated quantities. Figure II-5 shows the limits of the Access Channel while Table II-9 shows the estimated quantities to be dredged.

Table II-9. ESTIMATED QUANTITIES TO BE DREDGED FROM DIKE FOUNDATIONS AND ACCESS CHANNEL

Area	**Estimated Quantity (CY)**
Pre-Dredge Foundation to -60’	15,400,000
Access Channel to -52’ (50’ +2’ Advance Maintenance)	3,700,000

The predominately clayey material to be dredged in both locations is likely undisturbed, with contamination transport through layers unlikely. However it is assumed that by placing the upper few feet of material in CIDMMA, all remaining material will be suitable for ocean disposal. The upper several feet will be defined as 10 percent of material dredged. At this time it is not known exactly what percent of material going into CIDMMA is unsuitable for ocean placement; however, 10 percent is thought to capture a conservative upper limit. Environmental testing to verify this assumption is anticipated to be completed during PED. The 10 percent (estimated to be up to 1.8 mcy) could be placed into CIDMMA without impacting operations.

In order to construct the dikes, sand will most likely be dredged from offshore channel areas by hopper dredge. Once transported to the eastward expansion site the material will be offloaded using a self-contained offshore transfer station buoy ("SCOTS buoy"). The Atlantic Ocean Channel is designated as the primary source of material for dike construction, with Thimble Shoal and Cape Henry Channels as secondary sources. Figure II-6 shows dike layout while Figures II-7 and II-8 show dike geometry. The total amount of required sand fill is estimated to be 19.5 mcy (in-place at dikes), dis-aggregated as shown in Table II-10:

Table II-10. REQUIRED SAND FILL FOR CIDMMA EXPANSION DIKE CONSTRUCTION

Phase 1 – 220-acre cell	
Main Dike (3,000 linear feet [LF])	5.3 million CY
South Dike (2,800 LF)	1.5 million CY
Division Dike (2,800 LF)	1.5 million CY
Phase 2 to 4 – completes remaining 380-acre cell	
Continue Main Dike (5,500 LF)	9.7 million CY
North Dike (2,800 LF)	1.5 million CY
Total	**19.5 million CY**

Note: A single hopper dredge is capable of 10,000 cy/day.

To provide protection to the dikes from erosion, slopes will be protected with riprap. As the dikes are constructed, the slopes along the exterior of the dike along the wharf will be protected from +8 feet to -3 feet MLLW. The riprap section for this reach will consist of a 4-foot thick layer of VDOT Class III riprap underlain by a 1.5-foot thick layer of VDOT No. 1 stone, underlain by geotextile. The interior slopes of the dikes in the northern cell, including the division dike, will also be protected. Interior slope riprap will consist of a 2.8-foot thick layer of VDOT Class II riprap underlain by a 1-foot thick layer VDOT No. 1 stone, underlain by geotextile. The riprap will be placed on the exterior of the slopes from elevation +8 feet to -3 feet.

USACE modeling estimated that it will take 12 months to rapidly fill the southern part of the cell to elevation +15 feet MLLW. This would be done within normal dredging operations in the Port of Hampton Roads. The northern part of the expansion cell would then be used in tandem with the existing site annually to fill it over the next 5 years. Surcharge and ground improvements will begin approximately 3 to 6 months after the rapid filling of the southern part. After that time, a surface crust will form allowing the surcharge and strip drains to be installed.

Construction of the wharf will start concurrent with filling of the cell, as it is envisioned that shaping the main dike and beginning installation of wick drains would begin soon after the dike has be constructed.

Access to Eastward Expansion and Proposed Craney Island Marine Terminal

Vessel access to the proposed Eastward Expansion and proposed Craney Island Marine Terminal would be provided via the existing Norfolk Harbor Reach and Craney Island Reach navigation channels (see Figure II-2). As part of the proposed CIDMMA eastward expansion and other proposed harbor channel improvements, all dredging activities needed for port development and operation would be completed. These dredging activities, including the area between the navigation channel and proposed wharf, would be completed in conjunction with expansion cell construction and port development and will provide a minimum of 50-foot-deep inbound and outbound channels to accommodate deep draft ships.

Although not specifically required for the port development, the proposed VDOT Hampton Roads Third Harbor Crossing would facilitate truck and auto access to the proposed port (see Figure II-9). Access points to the port facility would connect with VDOT's proposed roadway crossing of CIDMMA, located along the eastern edge of the current limits of CIDMMA. The Third Harbor Crossing has an approved EIS, although the project is currently unfunded and will take years to complete. In the event the Third Crossing is not completed within the next 10 years, a connector highway and rail corridor would be constructed from the southern end of CIDMMA to the existing VA Route 164 freeway, from which the existing interstate highway and rail systems can be accessed.

Rail access to the Eastward Expansion and proposed Craney Island Marine Terminal would be accomplished through a VDOT rail corridor development project that would connect the port facility to both the Norfolk Southern and CSX railways in the vicinity of the Hampton Roads Airport in Suffolk. It is currently envisioned that, to the maximum extent practicable, the rail corridor would be located within the cleared ROW of VDOT's connector highway from CIDMMA to VA Route 164, and within the ROW's of existing highways VA Route 164 and I-664. This new rail corridor would provide rail access to port facilities proposed in Portsmouth by VPA and Maersk Sealand, as well as to the Craney Island Fuel Depot and businesses that may have need of the rail access (see Figure II-10).

It should be noted that when I-664 and Route 164 were built, the bridges and medians were designed to accommodate dual track for double-stack trains. Currently VPA and Norfolk Southern are working with state and Federal representatives to identify funding for this rail improvement, which is part of the Heartland Corridor Initiative. The Heartland Corridor would significantly increase intermodal freight mobility as it improved rail for containerized cargo from Portsmouth, VA, to Columbus, OH.

Phased Development of Craney Island Marine Terminal

The VPA 2040 Master Plan identifies projects to renovate and expand the existing marine terminals; however, even with the build-out of the existing terminals, VPA is projected to run out of capacity by 2007. The construction of the Maersk facility will provide additional capacity to 2015. After 2015, VPA will require a new container terminal to meet long-term needs. Figure II-10 illustrates the port capacity challenges and how the new port construction will meet the long-term needs.

As shown in Figure II-11, the proposed port facility is anticipated to be constructed in four phases. Phased construction will allow the forecasted business needs to meet with the financial ability of the VPA. The initial Phase I will cover approximately 220 acres. Figure II-12 illustrates the Phase I conceptual plan of the Craney Island Marine Terminal, and Figure II-13 shows the full build-out condition. Table II-11 lists key components envisioned for each of the four phases of the proposed CIDMMA port development.

Table II-11. CRANEY ISLAND PORT DEVELOPMENT COMPONENTS BY PHASE

COMPONENTS	PHASE I	PHASE II	PHASE III	PHASE IV
Cranes	8 @ 100 ft	12 @ 100 ft	16 @ 100 ft	20 @ 100 ft
Wharf (ft)	3,000	4,800	6,600	8,400
Strad Storage	5,376 TGS (10,752 TEU @ 2 high) (16,128 TEU @ 3 high)	9,984 TGS (19,968 TEU @ 2 high) (29,952 TEU @ 3 high)	15,744 TGS (31,488 TEU @ 2 high) (47,232 TEU @ 3 high)	19,584 TGS (39,168 TEU @ 2 high) (58,752 TEU @ 3 high)
Grounded Reefer Storage	232 TGS (464 40ft cont. @ 2 high) (696 40ft cont. @ 3 high)	324 TGS (648 40ft cont. @ 2 high) (972 40ft cont. @ 3 high)	349 TGS (698 40ft cont. @ 2 high) (1,047 40ft cont. @ 3 high)	575 TGS (1,150 40ft cont. @ 2 high) (1,725 40ft cont. @ 3 high)
Transfer Zone Slots	46	61	96	144
Empty Storage	0	2,800 TGS (11,200 TEU @ 4 high) (16,800 TEU @ 6 high)	2,800 TGS (11,200 TEU @ 4 high) (16,800 TEU @ 6 high)	2,800 TGS (11,200 TEU @ 4 high) (16,800 TEU @ 6 high)
Wheeled Slots	722	722	1,841	2,329
Inbound Lanes	13	13	13	26
Outbound Lanes	6	6	6	12
Loading/Unloading Track (ft)	10,900	16,160	16,160	16,160
Runaround Track (ft)	5,400	10,690	10,690	16,160
Storage Track (ft)	22,800	37,830	37,830	37,830