5. ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

As a requirement of the NEPA process, the potential impacts of the project must be evaluated. Based on the results of the plan formulation (Chapter 4), the impacts of three alternatives that are a combination of lateral and vertical expansion were evaluated in addition to the No-Action Alternative. The alternatives evaluated for impacts were:

1. Alternative 1 – is a 575-acre lateral expansion with 60 percent wetland habitat and 40 percent upland habitat, plus 5-ft vertical expansion of the existing upland cells.

2. Alternative 2 – is a 575-acre lateral expansion with 50 percent wetland habitat and 50 percent upland habitat, plus 5-ft vertical expansion of the existing upland cells.

3. Alternative 3 – is a 575-acre lateral expansion with 29 percent wetland habitat, 47 percent upland habitat, and 24 percent open-water embayment habitat, and a 5-ft vertical expansion of the existing upland cells (Environmentally Preferred Alternative and Recommended Plan).

4. No-Action Alternative – the existing PIERP at its 1996 authorized built-out configuration of 1,140 acres in size with 570 acres of upland habitat and 570 acres of wetland habitat.

Action-specific details for each alternative are described in the following section (Section 5.1). It is important to note that each of the three alternatives considered, as well as the no-action alternative, also include impacts related to the actions required to complete the existing PIERP that were evaluated under the authority of the GRR/SEIS. Actions that are required to complete the existing project and recreational and educational components considered as part of the project are described in Section 5.3, and are common to each of the alternatives (including the no-action alternative) regardless of whether an expansion alternative is implemented. The environmental consequences of the actions required to complete the project, including the environmental, cultural, socioeconomic, and recreational resources are also discussed in Section 5.3. The environmental consequences of the alternatives, including the environmental, cultural, socioeconomic, and recreational resources are discussed in Section 5.4.

As stated previously in Chapter 3, the **existing project area** is defined as the authorized project as it presently exists, with a footprint of 1,140 acres. To accommodate flexibility for specific engineering and site constraints, a 1,080-acre **Study Area** located to the north and northeast of the existing project was defined (Figure 5-1) and includes the northern access channel that would be required to support the lateral expansion, and the footprint for the proposed sand borrow area located to the northeast of the existing PIERP. The **region of influence** includes resources located outside of the Study Area, but adjacent to the project including the southwestern borrow area, Poplar Harbor, Jefferson Island, and Coaches Island as well as the Middle-Bay (Mid-Bay) region.

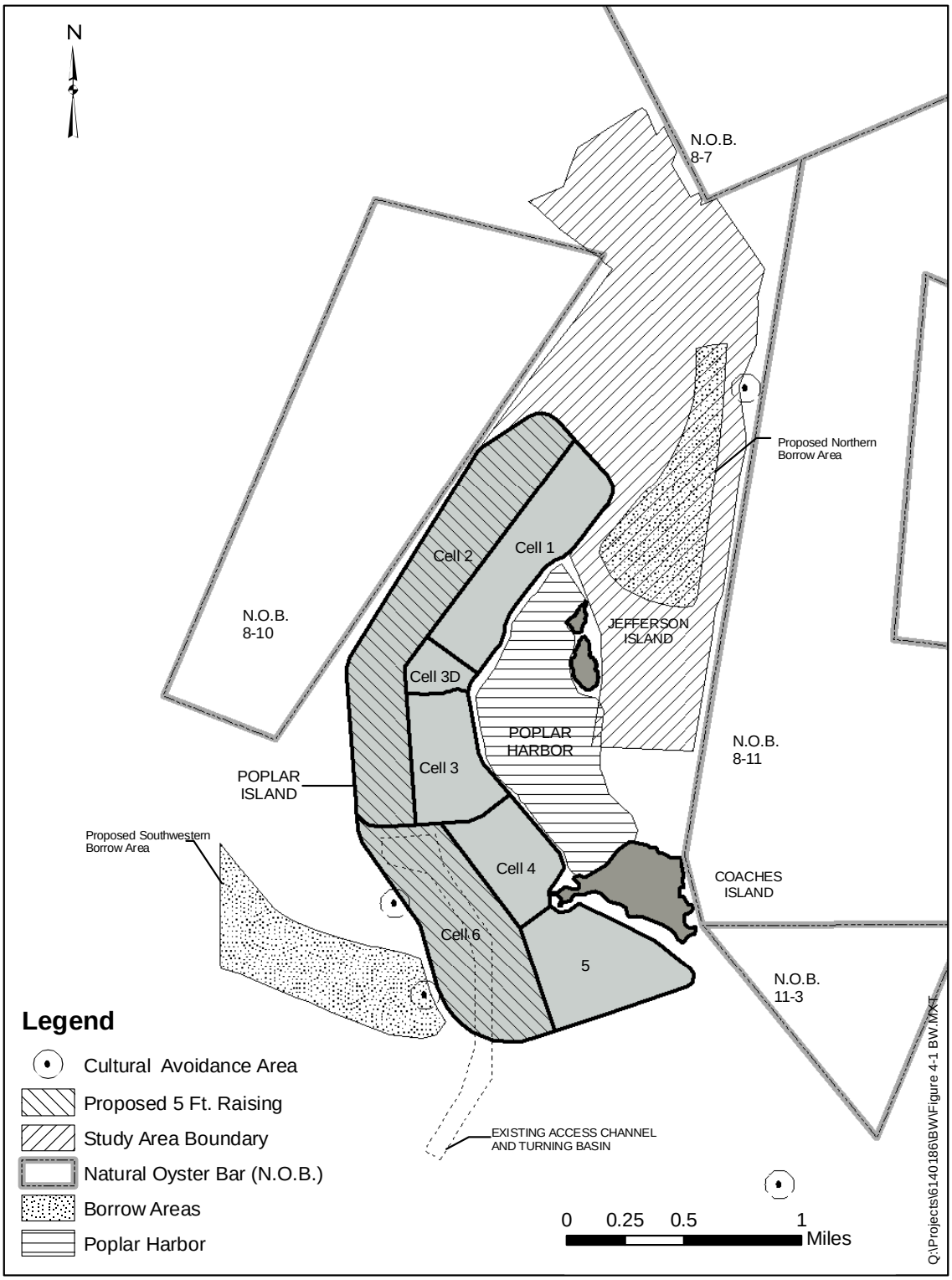


Figure 5-1. Poplar Island Expansion Proposed Study Area, Sand Borrow Areas, Cells Proposed for Vertical Dike Raising and Cultural Avoidance Areas

5.1 ALTERNATIVES EVALUATED

5.1.1 Alternative 1 – a 575-acre lateral expansion with 60 percent wetland habitat and 40 percent upland habitat, and a 5-ft vertical expansion of the upland cells of the existing PIERP

Alternative 1 consists of a 575-acre lateral expansion of the existing PIERP to the north and northeast, consisting of approximately 60 percent wetland and 40 percent upland habitat and a vertical expansion component consisting of a 5-foot raising of the upland Cells 2 and 6 of the existing project (Figure 5-2). Approximately 315 acres of wetlands and approximately 235 acres of uplands, plus a 25-acre tidal gut will be constructed in the lateral expansion as a result of Alternative 1. Alternative 1 will provide approximately 29 mcy of additional placement capacity. The wetland cells will be located in the western portion of the northern lateral expansion (Figure 5-2), based on the experience at the existing project. It is difficult to achieve the necessary final design elevations for functional wetland cells if they are constructed on top of the deep holes created by sand borrow. Therefore, the wetland cells within the northern lateral expansion were located in the northern and western portions of the lateral expansion, and the upland cells were located on top of the sand borrow area on the eastern side of the proposed expansion, closest to the shoreline.

It is anticipated that Alternative 1 will be comprised of an approximate 575-acre dredged material placement area, as calculated from the centerline of the exterior dike. The area from the centerline of the exterior dike outward to the end of the toe dike encompasses approximately 25 acres of bottom. Therefore, the total area of impact analyzed in this section from the lateral expansion is a footprint approximately 600 acres in size. Impacts associated with converting approximately 600 acres of open water located to the north and northeast of the existing PIERP to island habitat, dredging of sand from a proposed 215-acre southwestern borrow area to use in the construction of the lateral and vertical expansion components, and dredging of a northern access channel and turning basin are addressed for this alternative. The final elevation of the upland cells for the lateral expansion component for Alternative 1 will be +20 ft MLLW.

The approximate 600-acre area of impact will be located completely within the 1,080-acre Study Area located to the north and northeast of Poplar Island. The placement area may be adjusted within this area as necessary to avoid unsuitable foundation material or other unforeseen site conditions. It is anticipated that most temporary construction impacts outside of the actual perimeter dike for the lateral expansion component will occur within the 1,080-acre Study Area boundary. Therefore, impacts to the entire 1,080-acre Study Area are evaluated as a conservative scenario for the lateral expansion (Figure 5-1). However, impacts associated with dredging the southwestern borrow area are located outside of the Study Area depicted in Figure 5-1.

The analysis of this alternative also includes impacts associated with a vertical expansion (increase in elevation) of 5-ft for the existing PIERP upland cells, to a final design height of +25 ft MLLW. The existing uplands dikes in Cells 2 and 6 will be raised to a temporary dike

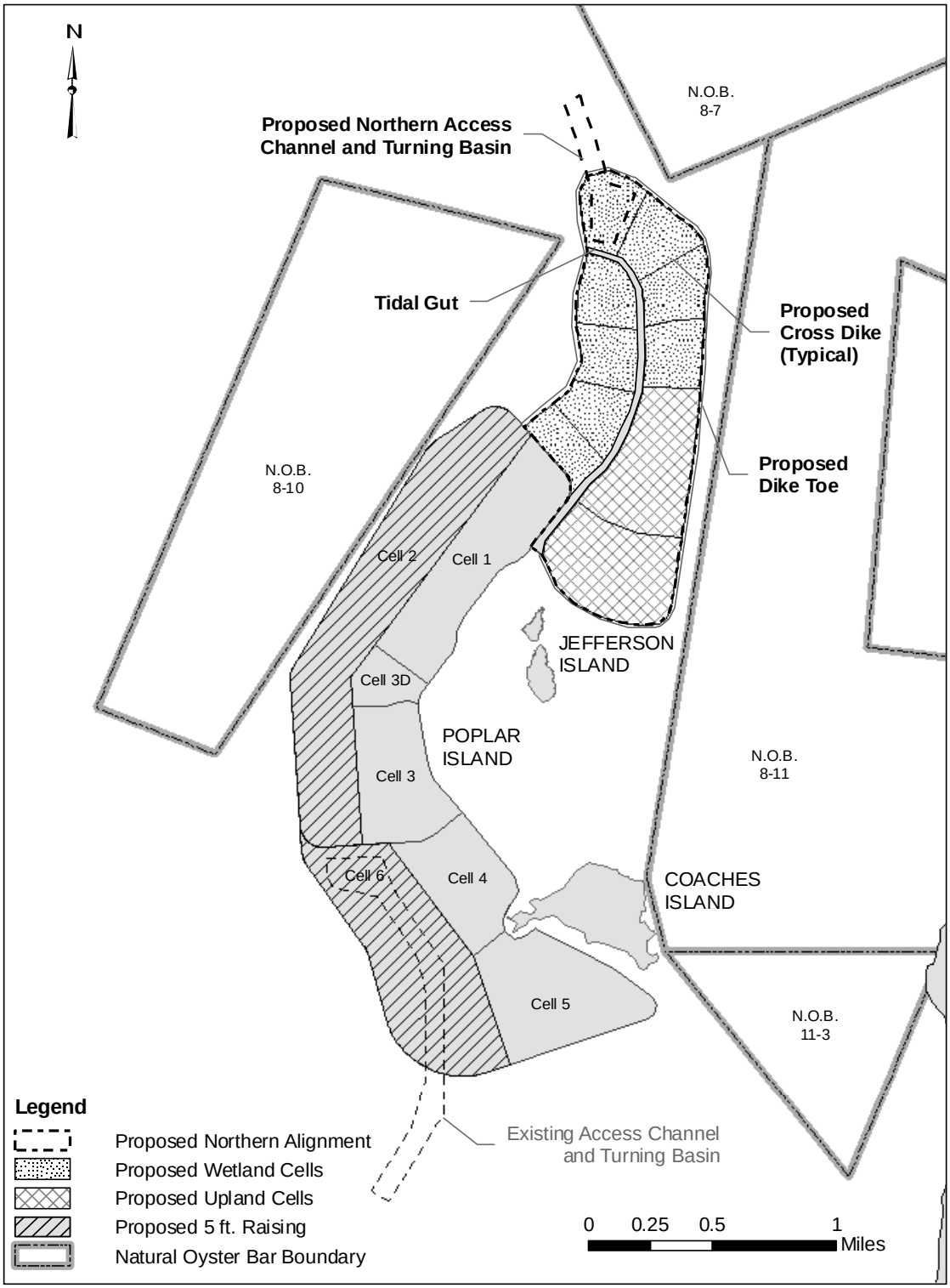


Figure 5-2. Alternative 1 (60% Wetland to 40% Upland Ratio and 5 ft. Raising of PIERP Upland Cells)

height of +30 ft MLLW until the upland cells are filled (approximately 10 years), at which point the dikes will then be lowered to +25 ft MLLW during final site grading. The final heights within the upland cells (after the completion of dredged material placement, grading, and planting) will be variable, and will incorporate the topographic relief required for proper drainage of the upland habitat.

The impacts analysis for Alternative 1 includes an evaluation of dike construction activities, site operations, dredged material inflow, crust management, and habitat development. Dike construction activities include the construction of the exterior stone toe dike, construction of the sand containment dikes, excavation of the borrow areas (both northern and southwestern areas) (Figures 5-1 and 5-2), and dredging of the northern access channel. Existing rock reefs are located within the lateral expansion and provide in-water refugia and physical habitat within the footprint of lateral expansion. These reefs will be relocated to an additional area in consultation with the appropriate resource agencies and commercial and recreational fisheries groups.

The southwestern borrow area encompasses an area of approximately 215 acres with suitable sand for construction (Figure 5-1). Water depths in the proposed southwestern borrow area range from about -16 ft MLLW at its western boundary to about -8 ft MLLW immediately adjacent to the PIERP. Following dredging, the borrow area would have a surface grade similar to existing conditions, but water depths may increase an average of approximately 10 ft across the bottom. The total extent of the bottom footprint that will be directly impacted during the proposed sand dredging in the southwestern borrow area will not be known until the project dredging plan is submitted and approved by appropriate resource agencies. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although this depth may change once the final dredging plan is submitted for approval, and gradual shoaling may occur in this area. Sand excavation within the southwestern borrow area would begin in the southeast corner because sufficient access for the dredges already exists by way of the existing access channel south of Cell 6 and previously utilized borrow areas (Figure 5-1). The total extent of the bottom footprint that will be directly impacted during the proposed sand dredging in the southwestern borrow area will not be known until the project dredging plan is submitted and approved by appropriate resource agencies. As currently planned, it is anticipated that approximately 91 acres of the southwestern borrow area will be impacted during the construction of the lateral expansion and vertical expansion components for Alternative 1. As stated above, the total acreage of the southwestern borrow area that will be impacted may change once the final dredging plan is submitted for approval.

The northern access channel and turning basin will provide access to the expansion cells for placement of dredged materials. During construction, a 400-ft wide channel with side slopes of 3H:1V will be dredged to a depth of approximately –25 MLLW ft (with up to 2 ft overdepth) to support project operations. This channel will extend from the existing –25 ft MLLW contour northwest of the site, to the northern end of the placement site (Figure 5-1). The turning basin and approximately 20 percent of the access channel will be contained within the northern wetland cell, while the remaining 80 percent of the channel will extend outside the footprint of the lateral expansion, but within the Study Area (Figure 5-1). The

total area disturbed by the channel and turning basin excavation will be approximately 30 acres. Approximately 0.5 mcy yards of sandy material will be dredged from the northern access channel and turning basin and will serve as an additional source of sand borrow for dike construction in the lateral expansion.

Other construction phase activities include the inflow of dredged material, dewatering and effluent discharge, crust maintenance, creation of interim habitats within cells [the habitats existing while placement is occurring (i.e., mudflats), but prior to planting and habitat development], interior dike construction, and vehicular traffic traveling along the perimeter and interior dike roads.

5.1.2 Alternative 2 – a 575-acre lateral expansion with 50 percent wetland habitat and 50 percent upland habitat, and a 5-ft vertical expansion of the upland cells of the existing PIERP

Alternative 2 consists of a 575-acre lateral expansion of the existing PIERP to the north and northeast, consisting of approximately 50 percent wetland and 50 percent upland habitat and a vertical expansion component consisting of a 5-foot raising of upland Cells 2 and 6 of the existing project (Figure 5-3). Approximately 275 acres of wetlands and approximately 275 acres of uplands plus a 25-acre tidal gut will be constructed in the lateral expansion as a result of Alternative 2. Alternative 2 will provide approximately 30 mcy of additional placement capacity. Similar to Alternative 1, the wetland cells will be located in the western portion of the northern lateral expansion (Figure 5-3), based on the experience at the existing project.

Identical to Alternative 1, Alternative 2 will be comprised of an approximate 575-acre dredged material placement area, as calculated from the centerline of the exterior dike. The area from the centerline of the exterior dike outward to the end of the toe dike encompasses approximately 25 acres of bottom. Therefore, the total area of impact analyzed in this section from the lateral expansion is a footprint approximately 600 acres in size. The only difference between Alternative 2 and Alternative 1 is the ratio of wetlands to uplands within the 575-acre placement site.

Similar to Alternative 1, the second alternative includes impacts associated with the alignment for the northern lateral expansion and the vertical expansion of the existing upland Cells 2 and 6 at the PIERP. Impacts associated with converting approximately 600 acres of open water located to the north and northeast of the existing PIERP to island habitat, dredging of sand from a proposed 215-acre southwestern borrow area to use in the construction of the lateral and vertical expansion components, and dredging of a northern access channel and turning basin are addressed for this alternative (Figure 5-3). The final upland elevation for the lateral expansion component of Alternative 2 will be +20 ft MLLW.

As described for Alternative 1, the approximate 600-acre area of impact will be located completely within the 1,080-acre Study Area. The placement area may be adjusted within this area as necessary to avoid unsuitable foundation material or other unforeseen site conditions. It is anticipated that most temporary construction impacts outside of the actual the perimeter dike footprint for that lateral expansion component will occur within the 1,080-acre

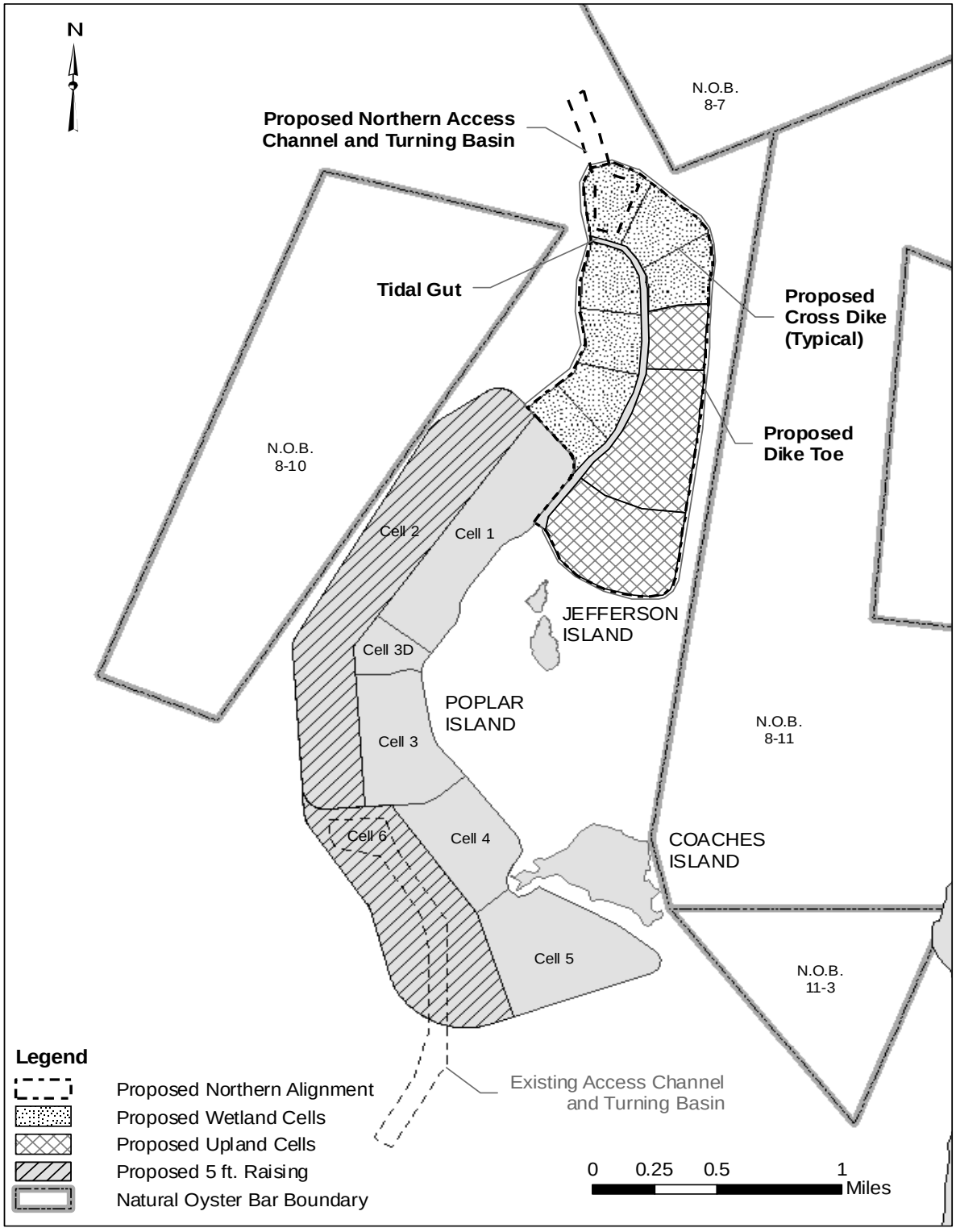


Figure 5-3. Alternative 2 (50% Wetland to 50% Upland Ratio and 5 ft. Raising of PIERP Upland Cells)

Study Area boundary. Therefore, impacts to the entire 1,080-acre Study Area are evaluated as a conservative scenario for the lateral expansion (Figure 5-1).

Identical to Alternative 1, the analysis of this alternative also includes impacts associated with a vertical expansion (increase in elevation) of 5-ft for the existing PIERP upland cells, to a final design height of +25 ft MLLW. The existing uplands dikes in Cells 2 and 6 will be raised to a temporary dike height of +30 ft MLLW until the upland cells are filled (approximately 10 years), at which point the dikes will then be lowered to +25 ft MLLW. The final heights within the upland cells (after the completion of dredged material placement, grading, and planting) will be variable, and will incorporate the topographic relief required for proper drainage of the upland habitat. Existing rock reefs are located within the lateral expansion and provide in-water refugia and physical habitat within the footprint of lateral expansion. These reefs will be relocated to an additional area in consultation with the appropriate resource agencies and commercial and recreational fisheries groups.

Construction of less wetland acreage proposed for Alternative 2 will increase the quantity of sand available for construction from within the area of impact of the northern lateral expansion. Therefore, less sand will be required and dredged from the southwestern borrow area for construction activities, thus impacting a smaller area, as compared to the dredging in the southwestern borrow area required for Alternative 1. Approximately 49 acres of the southwestern borrow area will be impacted during the construction of the lateral expansion and vertical expansion components for Alternative 2. As stated previously, the extent of the southwestern borrow area impacts (total acres impacted) is subject to change based on submittal and approval of a final dredging plan.

The impacts analysis for Alternative 2 includes dike construction activities, site operations, dredged material inflow, crust management, and habitat development. These activities are identical to those described above in Alternative 1, including the location and dimensions of the northern access channel.

5.1.3 Alternative 3 – a 575-acre lateral expansion with 29 percent wetland habitat, 47 percent upland habitat, and 24 percent open-water embayment habitat, and a 5-ft vertical expansion of the existing upland cells

Alternative 3 (Preferred Alternative in the Recommended Plan) integrates an open-water embayment into the northern lateral expansion. Based upon coordination and consultation with various resource agencies (USEPA, USFWS, NMFS, MDNR, and MDE) the open-water embayment could potentially range between 80 to 140 acres in size. However, for the purposes of the impacts assessment in this document, the size of the open-water embayment within the northern lateral expansion is estimated at approximately 130 acres in size. The final size (acreage) of the open-water embayment will be determined during subsequent design phases of the project.

Alternative 3 consists of a 575-acre lateral northern expansion of the existing PIERP to the north and northeast, consisting nominally of 29 percent wetland habitat, 47 percent upland habitat, and 24 percent open-water embayment; plus a vertical expansion component

consisting of a 5-ft raising of the upland cells of the existing project (Figure 5-4). Alternative 3 will provide approximately 28 mcy of additional placement capacity. Approximately 165 acres of wetland habitat and 270 acres of upland habitat will be created, approximately 130 acres of open-water embayment habitat will be protected and conserved as a result of Alternative 3, and 10 acres of tidal gut habitat will be created. The open-water embayment will be located directly adjacent to the proposed wetland cells on the western side within the northern lateral expansion. Based on the experience at the existing project, wetland cells within the northern lateral alignment will not be constructed on top of the sand borrow area located within the footprint of the expansion. It is difficult to achieve the necessary final design elevations for functional wetland cells if they are constructed on top of the deep holes created by sand borrow. Therefore, the wetland cells within the northern lateral expansion were located in the northern and western portions of the lateral expansion, and the upland cells were located on top of the sand borrow area on the eastern side of the proposed expansion, closest to the shoreline.

When construction is complete, it is anticipated that the embayment will provide a necessary trophic link between the wetland cells and the open water habitat outside the dikes as well as inside the open-water embayment. Several small subtidal artificial reefs and avian nesting islands are also proposed within the open-water embayment as part of Alternative 3.

To create the open-water embayment, breakwater segments will replace the western edge of the perimeter dike (Figure 5-4). As currently designed, the breakwater sections are approximately 200-ft in length and will be separated by approximately 50 feet of open water, with one or two larger openings of approximately 200 feet. Alternative 3 also includes approximately 10-acres of a tidal gut located in the southwest portion of the expansion to provide necessary tidal access to Cell 1 in the existing PIERP (Figure 5-4). The proposed tidal gut is approximately 200 to 250 feet wide and its features would be consistent with the tidal gut separating the southern portion of the existing project and Coaches Island. Therefore, a total of approximately 140 acres of open-water habitat will be included as part of Alternative 3 (130 acres of open-water embayment + 10 acres of a tidal gut).

It is anticipated that Alternative 3 will provide approximately 435-acres of dredged material placement area, as calculated from the centerline of the exterior dike, plus a 10-acre tidal gut. The area from the centerline of the exterior dike outward to the end of the toe dike encompasses approximately 25 acres of additional bottom. Therefore, the total area of impact analyzed for Alternative 3 is a footprint of approximately 470 acres in size.

Impacts associated with converting approximately 470 acres of open water located to the north and northeast of the existing PIERP to island habitat, dredging of sand from a proposed 215-acre southwestern sand borrow area to use in the construction of the lateral and vertical expansion components, and dredging of a northern access channel and turning basin are addressed for this alternative. The final elevation of the upland cells for the lateral expansion component for Alternative 3 will be +20 ft MLLW. As currently planned, it is anticipated that approximately 19 acres of the southwestern borrow area will be impacted during the

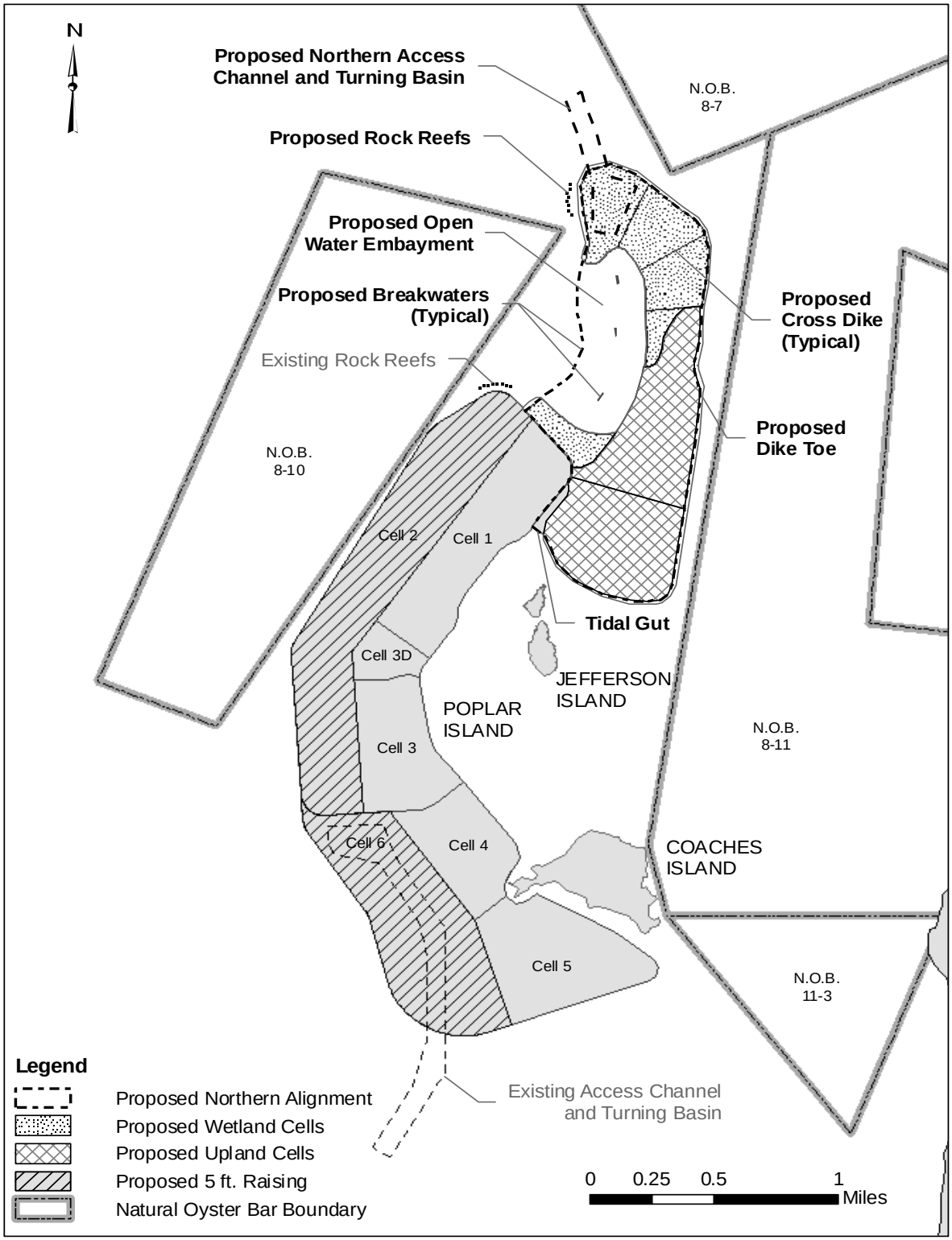


Figure 5-4. Alternative 3 – Environmentally Preferred Alternative (29% wetland, 47% upland, and 24% open-water embayment; plus a 5-ft raising of existing PIERP upland cells)

construction of the lateral expansion and vertical expansion components for Alternative 3. The extent of the southwestern borrow area impacts (total acres impacted) is subject to change based on submittal and approval of a final dredging plan for the project but is estimated at this time to be approximately 19 acres.

The approximate 470-acre area of impact will be located completely within the 1,080-acre Study Area. The alignment footprint may be adjusted within this area as necessary to avoid unsuitable foundation material or other unforeseen site conditions. It is anticipated that most temporary construction impacts outside of the actual the perimeter dike will occur within the 1,080-acre Study Area boundary. Therefore, impacts to the entire 1,080-acre Study Area are evaluated as a conservative scenario for the Alternative 3 (Figure 5-1).

Identical to Alternatives 1 and 2, the analysis of this Alternative 3 also includes impacts associated with a vertical expansion (increase in elevation) of 5-ft for the existing PIERP upland cells, to a final design height of +25 ft MLLW. The existing uplands dikes in Cells 2 and 6 will be raised to a temporary dike height of +30 ft MLLW until the upland cells are filled (approximately 10 years), at which point the dikes will then be lowered to +25 ft MLLW during final site grading. The final heights within the upland cells (after the completion of dredged material placement, grading, and planting) will be variable, and will incorporate the topographic relief required for proper drainage of the upland habitat. Existing rock reefs are located within the lateral expansion and provide in-water refugia and physical habitat within the footprint of the lateral expansion. These reefs will be relocated to an additional area in consultation with the appropriate resource agencies and commercial and recreational fisheries groups.

Internal containment dikes will be constructed with sand from borrow sources within the lateral expansion footprint. The dikes that form the perimeter of the open-water embayment would require slope protection to prevent erosion from the exposure along the embayment, however, dike height and slope protection requirements will be refined as hydraulic analyses (including studies required to determine size, location, and stability of the open-water embayment) are completed during future design phases. Inclusion of the open-water embayment in Alternative 3 will require less sand borrow from outside the project footprint, as compared to Alternatives 1 and 2. As currently estimated, approximately 19 acres of the southwestern borrow area will be impacted during the construction of the lateral expansion and vertical expansion components for Alternative 3, compared to approximately 91 acres and 49 acres for Alternatives 1 and 2, respectively. The extent of the southwestern borrow area impacts (total acres impacted) is subject to change based on submittal and approval of a final dredging plan for the project.

The impacts analysis for Alternative 3 also includes dike construction activities, site operations, dredged material inflow, crust management, and habitat development. These activities are identical to those described above in Alternatives 1 and 2, including the location and dimensions of the northern access channel.

5.1.4 No-Action Alternative

The no-action alternative discusses impacts to existing conditions if the northern lateral expansion and the raising of existing upland cells is not approved. Evaluation of the no-action alternative includes impacts associated with the existing PIERP project features, which have not yet been completed, to the 1996 authorized configuration of 1,140 acres in size, with 570 acres of upland habitat and 570 acres of wetland habitat and 40 mcy of capacity (USACE/MPA, 1996). On-going activities associated with the existing PIERP include site operations, dredged material inflow, crust management, and habitat development. Impacts from these activities were addressed in the EIS for the existing project (USEPA/MPA, 1996).

The PIERP is not yet completed and several additional actions are required to complete the existing project: raising the existing temporary upland dikes from +23 ft MLLW to +25 ft MLLW to allow for placement and consolidation of the dredged material necessary to reach the original upland target elevation of 20 feet; dredging of a new southern access channel and turning basin to accommodate the closure of Cell 6; restoration of internal borrow sites within wetland Cell 4; construction of temporary cross dikes within wetland Cell 5; and constructing new discharge, pier, and bulkhead structures to accommodate the closure of Cell 6. The impacts associated with these additional activities and design modifications necessary to complete the existing project are summarized and discussed in Section 5.3 as impacts common to each alternative.

5.2 DEFINITION OF IMPACTS

Impacts of the proposed project and alternatives to the environmental and socioeconomic resources, as identified in Chapter 3, were considered in this chapter. A list of NEPA impact descriptors was created to evaluate the impacts and includes the following:

Significant Impact is a measure of the *intensity* and the *context* of effects of a major Federal action on, or the importance of that action to, the human environment (40 CFR 1508.27). "Significant" is a function of the short-term, long-term, and cumulative impacts, both positive and negative, of the action on that environment. Because this project has anticipated significant impacts, the NEPA process is documented in the form of this SEIS.

Short-term impacts are impacts with no lasting effects (i.e., temporary) that occur during construction or dredged material placement activities and subside and return to normal after construction ends.

The primary temporal disruptions will be related to construction of the exterior dike for the lateral expansion and raising of the upland dikes (i.e., sand dredging and placement, rock placement, etc.). It is expected that construction related to both vertical and lateral expansion will occur concurrently, and construction is estimated to be completed within two construction seasons. Following completion of the dike construction activities, disruptions will be limited to seasonal inflow activities and the trenching and grading necessary for dewatering and cell development. Therefore, disruptions during a two-year construction

period would be considered short-term and temporary. Inflow, trenching, and grading would occur for an extended period of time (until approximately 2022); however, disruptions related to these activities are of substantially less magnitude than the construction-related impacts and similar to activities at the existing project.

Long-term impacts are defined as impacts with lasting effects that occur during construction or dredged material placement activities that remain and do not diminish after placement ceases for island habitat restoration.

Direct impacts are defined as impacts caused by the action and occur at the same time and place (40 CFR 1508.8)

Indirect impacts are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8).

Cumulative Impacts are those combined effects on quality of the human environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what Federal or non-Federal agency or person undertakes such other actions [40 CFR 1508.7, 1508.25(a), and 1508.25(c)]. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or taking place within a defined area or region. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis.

Impacts Associated with Resources:
*Beneficial impacts are defined as those impacts that result in a net gain of resources associated with the proposed project or a favorable change in existing conditions (i.e., improved air quality).

*Adverse impacts are defined as those impacts that result in a net loss of resources associated with the proposed project or an unfavorable change in existing conditions (i.e., increase in noise levels).

Impacts Associated with Economics:
*Negative impacts are defined as those impacts that result in a numeric decrease in monetary values.

*Positive impacts are defined as those impacts that result in a numeric increase in monetary values.

****These descriptors can be used in conjunction with significant, cumulative, short-term, long-term, direct, and indirect impacts (i.e., positive, short-term impacts may occur if jobs become available through the project for the local population).***

5.3 IMPACTS FROM ACTIVITIES COMMON TO ALL ALTERNATIVES

The existing project is not yet completed, and site operations – dredged material placement and habitat development – are ongoing at the PIERP. Under the auspices of the GRR, USACE-Baltimore District assessed the current project and identified several additional project actions required to complete the existing project, regardless of the Alternative, including the No-Action Alternative, selected. The majority of these actions were mentioned in the initial EIS for the existing project (USACE/MPA, 1996), but were not discussed and evaluated in detail. These actions are, therefore, included in this GRR/SEIS evaluation. These actions include raising the existing upland temporary dikes from +23 ft MLLW to +25 ft MLLW, Cell 6 closure and additional cell activities, and recreational/educational opportunities. Because these activities will occur regardless of which alternative is ultimately selected, they were evaluated separately, and impacts associated with these activities would be common to all alternatives. Impacts associated with these activities are assessed in addition to the impacts identified for each alternative, including the no-action alternative.

5.3.1 Raising the Existing Upland Cells from +23 ft MLLW to +25 ft MLLW

Regardless of the alternative selected, a temporary dike height increase of 2-ft above the existing temporary upland dike elevation is required to support the water drainage (dewatering) in the upland cells necessary for consolidation. Currently, the final design height of the existing upland cells at the PIERP is +20 ft MLLW. In the EIS for the existing project (USACE/MPA, 1996), the upland dikes were limited to a temporary height 3 feet above the final design height of +20 MLLW (temporary height of +23 ft MLLW). However, based on the experience during on-going site operations, it was determined that a temporary dike height of +30 ft MLLW is required to achieve proper dewatering and subsequent consolidation of the dredged material to the final target elevation of +25 ft MLLW. Therefore, a design modification to raise existing upland cells from a dike height of +23 ft MLLW to a dike height of +25 ft MLLW was evaluated. Table 5-1 outlines the authorized final and temporary dike heights for the existing upland cells (Cells 2 and 6) and the proposed dike heights for the lateral expansion:

Table 5-1. Temporary and Final Upland Dike Heights

	Authorized Final Dike Height	Authorized Temporary Dike Height
Uplands of the Existing PIERP (Cells 2 and 6)	+ 20 ft MLLW	+ 23 ft MLLW*
Uplands of Existing PIERP (Cells 2 and 6) plus 5-ft Raising	**+ 25 ft MLLW**	**+ 30 ft MLLW**
Uplands in Lateral Expansion	**+ 20 ft MLLW**	**+ 25 ft MLLW**

** As part of the actions to complete the existing project, the Cell 6 dikes would be raised to a temporary height of +25 MLLW prior to construction of the vertical expansion*

Impacts Associated with Raising Existing Upland Cells
No significant impacts to resources are anticipated for raising the existing upland cells from a dike height of +23 ft MLLW to a dike height of +25 ft MLLW. Short-term, minor impacts to air quality and noise quality may occur, but are expected to be similar to the effects noted during current site operations at the PIERP. Noise impacts to the avian community resulting from the temporary dike construction may occur and impacts to air quality during construction activities may occur, but impacts would be short-term and not significant. Aesthetic impacts associated with increasing the height of the temporary dike raising for Cells 2 and 6 by two feet to +25 ft MLLW would be negligible.

5.3.2 Cell 6 Closure and Additional Cell Activities Cell 6 is currently an open water basin with free, unrestricted tidal exchange with the Chesapeake Bay, and barges utilize the Cell 6 opening and existing channel within the cell to access existing offloading facilities currently located on the interior cross-dike between Cells 3 and 6 (Figure 5-5). Regardless of the alternative selected, Cell 6 will be closed off from the Chesapeake Bay so that dredged material placement within the cell can begin.

Additional construction activities required for Cell 6 closure include relocation of the existing southern access channel, dredging a turning basin, sand borrow excavation south of the existing project, raising the Cell 6 perimeter dike to elevation +23 ft MLLW, relocating the existing offloading facilities and fuel farm, and constructing a new personnel pier and other support structures. The closure of Cell 6 and the Cell 6 perimeter dike raising to +23 ft MLLW are currently planned for 2006 or 2007. Cell 6 closure activities will require dredging sand from the southwestern borrow area and from the southern access channel and turning basin. Additional cell activities required to complete the project include the restoration of internal borrow sites within wetland Cell 4 and construction of temporary cross dikes within wetland Cell 5.

The following sections describe the sand borrow sources required to complete the existing project. An analysis of impacts due to dredging for sand borrow follows these sections.

Sand Borrow Sources - Borrow Areas F and G
During the Phase II construction for the PIERP, Borrow Areas F and G, located immediately south of Cells 5 and 6, were partially utilized as a borrow source for sand and are no longer in an undisturbed condition (Figure 5-5). Remaining sand within these areas may be used to complete the projected work, but are in insufficient quantities to satisfy project requirements. Sand fill materials required to complete the Cell 6 closure and additional cell activities will be obtained from the existing borrow areas on either side of the access channel immediately outside of Cell 6 (Borrow Areas F and G), and the southern portion of the southwestern borrow area (Figure 5-5). The actions required to complete the existing project will require sand borrow from previously disturbed areas in Borrow Area F (approximately 60 acres) and Borrow Area G (approximately 35 acres). These activities will require a total of approximately 2.5 mcy of sand and, as currently estimated, will disturb approximately 147 acres of Bay bottom in the southwest borrow area and in the southern access channel and turning basin. A small portion of the required sand (0.4 mcy) will be generated by the

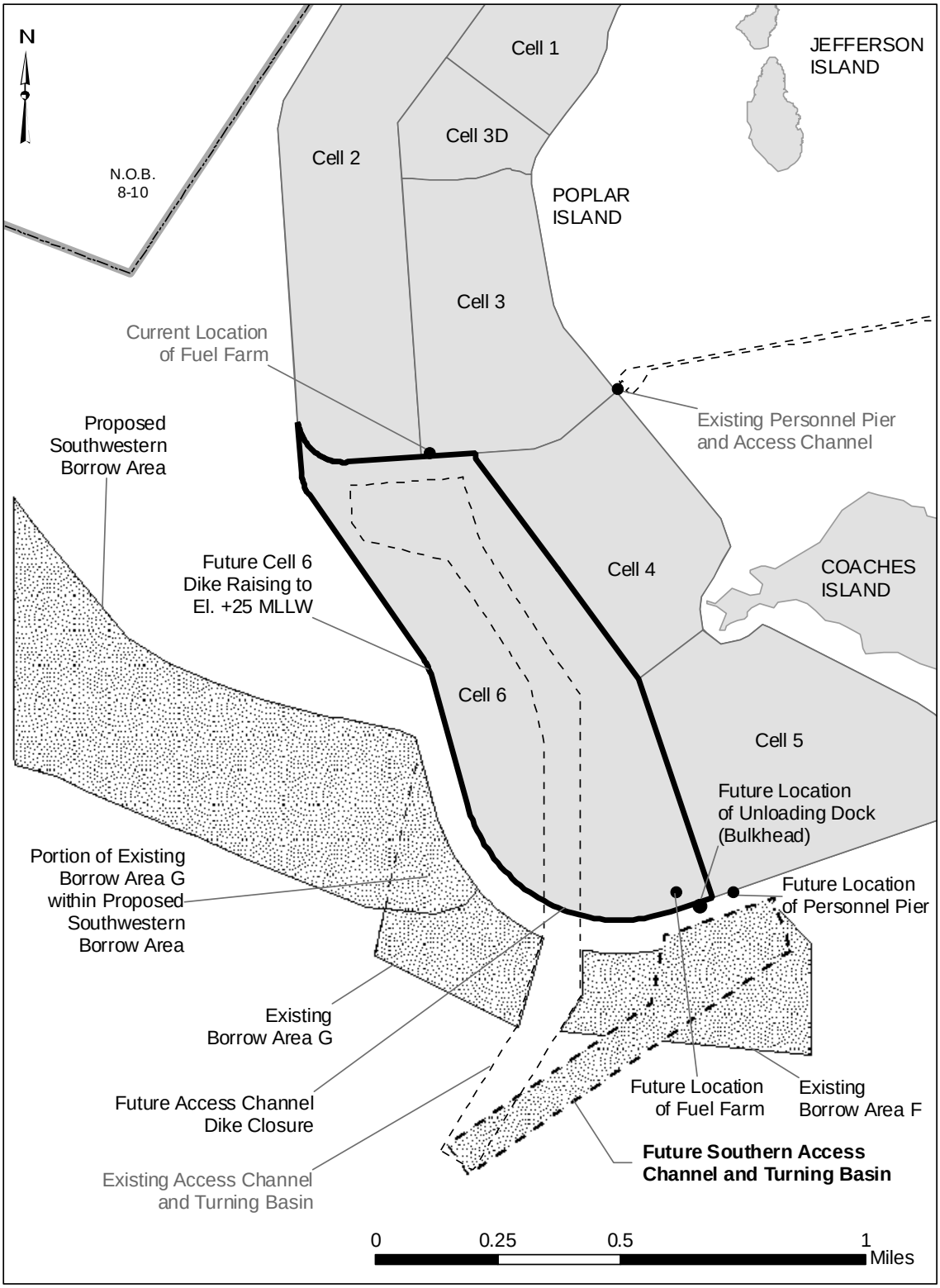


Figure 5-5. Cell 6 Closure Activities Required for Poplar Island

dredging for the access channel and turning basin, but the majority of the sand will be obtained from other borrow sources. Therefore, after exhausting Borrow Areas F and G, and impacting a total of 95 acres (60 + 35 acres), additional borrow to complete the current project will be obtained from the southwestern borrow area (Figure 5-5).

Borrow Areas F and G (Figure 5-5) encompass approximately 60 and 50 acres, respectively, and were originally estimated to contain approximately 0.7 and 1.0 mcy of sand, respectively. Approximately 20 acres of Borrow Area G is located within the proposed southwestern borrow area. Phase II construction for the PIERP extracted approximately 60 to 70 percent of the original estimated quantity of borrow material. The original bottom elevations varied from about elevation –5 ft MLLW to –13 ft MLLW, and the current bottom elevations within the disturbed area range from –18 to –20 ft MLLW, indicating that approximately 1.0 to 1.2 mcy of borrow excavation occurred for the Phase II construction. The borrow area slopes parallel to the Cell 6 dikes were limited to a slope of approximately 10H:1V to minimize the effect on the wave energy adjacent to the dikes. Additional subsurface investigations will be required to quantify the remaining borrow quantities within these areas. Based on the original borrow estimates, approximately 0.5 mcy is estimated to remain in Borrow Areas F and G. However, the depth of excavation in Borrow Area G was restricted to material above bottom elevation –20 ft MLLW. Therefore, some additional suitable borrow materials may be obtained from this site by excavating to a depth of –25 ft MLLW and extending the borrow area slightly to the east and/or south. At that final bottom elevation, both Borrow Areas F and G would merge with the –25 ft MLLW existing Bay bottom contour and assure connection to, and circulation with, the deeper bottom waters.

Southern Access Channel

A southern access channel and turning basin will replace the existing channel and basin after Cell 6 has been closed in 2006 or 2007. This channel will extend from the end of the existing channel at the elevation –25 ft MLLW contour, and extend northeast to the southern end of the longitudinal dike of the existing project where a new turning basin will be excavated. Approximately 1.2 mcy of excavation will be required for the new access channel and turning basin, and sand from approximately 28 acres (0.6 mcy) of the southern access channel and turning basin dredging will be utilized to complete the Cell 6 closure activities. Based on preliminary subsurface excavations, about 50 percent of the excavated material will consist of sand suitable for dike fill and 50 percent will consist of clay or silt that will be placed within the existing project limits. It is anticipated that the sand portion of the excavation will provide most of the material needed to complete the closure of the existing gap in the Cell 6 dike alignment. The channel and basin will be excavated to elevation –25 ft MLLW with up to 2 ft of over-depth dredging allowed. The bottom width will be 400 ft, and the side slopes of the channel will be 3H:1V.

Southwestern Borrow Area

The southwest borrow area was investigated as part of the reconnaissance studies conducted by the MPA in 2002. Based on historical and recent borings, a 215-acre area was delineated immediately west of existing Cell 6 (Figure 5-5). The bottom elevations of the area currently range from –8 ft MLLW near the outside toe of the Cell 6 dike, to approximately –16 ft MLLW at the southwestern corner of the area. The sand deposit ranges from approximately

10 to 22 feet in thickness providing a total volume of suitable dike fill material of approximately 4.4 mcy. It may be possible to limit the depth of borrow removal to approximately elevation –25 ft MLLW by restricting the borrow excavation to about 10 ft below the existing bottom elevations. It is also proposed that the borrow excavation begin at the western limits of existing Borrow Area G, and advance to the west in the southwestern sand borrow area as needed, always maintaining a deep water connection with deeper portions of Borrow Area G to assure adequate circulation (Figure 5-5).

Specifically, in the southwestern borrow area, approximately 54 acres (0.9 mcy) will be required to complete the Cell 6 dike raising to +23 ft MLLW, approximately 38 acres (0.6 mcy) will be required to complete the Cell 4 restoration, and approximately 27 acres (0.4 mcy) will be required for the completion of miscellaneous cell development. Therefore, it is anticipated that between 1.0-1.5 mcy of this sand will be excavated from the southwestern borrow area, disturbing approximately 119 acres (54 + 38 + 27 acres) of Bay bottom for the Cell 6 dike raising and restoration/cell development activities.

Impacts Associated with Additional Existing Project Construction Activities

The primary impacts associated with the construction activities proposed for the existing project would result from the dredging required for additional activities, sand borrow excavation within Borrow Areas F and G and the southwestern borrow areas, and the southern access channel and turning basin construction. A total of approximately 242 acres (119 acres in southwestern borrow area, 60 acres in Borrow Area F, 35 acres in Borrow Area G, and 28 acres in the southern access channel and turning basin) of bottom habitat will be disturbed by actions required to complete the existing PIERP.

The majority of the impacts associated with the excavation of the borrow areas will be temporary and not significant, although long-term impacts will occur. The impacts from excavating the borrow areas would include short-term water quality impacts associated with increased turbidity during dredging. These short-term impacts will directly affect the water quality in the project area and may indirectly affect the phytoplankton and zooplankton communities, clam species, blue crabs, finfish species, and potentially the EFH species summer flounder. The dredging activities conducted in Borrow Areas F and G will potentially require excavation completely down to the underlying clay materials, and would change the existing substrate from predominantly sand to clay. The alteration of dominant substrates may have an effect on the benthic species repopulating the area. Although a substantial volume of sand would be removed from the southwestern borrow area and underlying clays may be exposed locally, dredging would likely leave the majority of the area retaining a sandy substrate, similar to existing conditions. In addition, subsequent reworking of sand by natural processes would likely reduce the area of exposed clays. Dredging both the southwestern borrow area and Borrow Areas F and G could potentially have an impact on clam species, blue crabs, benthic species, and finfish species expected to utilize this area following sand borrow activities.

Long-term impacts to the bathymetry of the borrow areas are anticipated. The excavation of the southwestern borrow area will increase the water depths from –8 to –16 ft MLLW to a maximum depth of –25 ft MLLW, although some gradual shoaling may occur in this area.

This long-term impact and increase in water depth may have an impact on blue crab and finfish utilization of this area following excavation activities, particularly in warmer months when deeper areas of the Chesapeake Bay are prone to oxygen depletion. This effect would be important if the southwestern borrow area is excavated below the pycnocline, which generally occurs at a depth between 20 and 40 ft in mid-Bay waters (Kemp *et al*., 1999), and would decrease the habitat value within the southwestern borrow area for clams, blue crabs, benthos, finfish, and EFH species once dredging is complete. It is proposed that the southwest borrow excavation begin at the western limits of existing Borrow Area G, and advance to the west as needed, always maintaining contact with the day lighted southern limits of Borrow Area G to assure adequate circulation with deeper water (Appendix A).

Long-term adverse impacts to sediment quality may occur as a result of dredging in the borrow areas and the southern access channel. These impacts are due to the potential for a change in sediment substrate as a result of dredging and future shoaling in the northern access channel and turning basin. However, sands dredged from the access channel are expected to be clean because they are not located near sources of anthropogenic contamination. Dredging sands from the borrow area may change the physical characteristics of the sediment surface (from sand to clay), but will not change the overall sediment quality since the newly exposed strata will be underlying virgin material.

Dredging the southwestern borrow area could also have potential impacts on noise quality, air quality, light, economic impacts to aquatic resources (specifically, clams, blue crabs, and finfish species), and commercial and recreational fishing. The temporary use of the borrow area could potentially conflict with pound net and gill net fisheries if nets cannot be shifted to equally productive sites.

5.3.3 Recreational/Educational Opportunities From 2003 to 2004, 175 educational tours of PIERP were provided to interested groups and individuals from around the world; interest in the project is expected to continue and a similar number of tours per year would be provided. Regardless of the alternative selected, recreational and educational opportunities to be considered would include: recreational fisheries enhancements, interpretive nature trails, and other passive recreational/education opportunities. The Talbot County Commissioners have expressed interest in additional recreational benefits in keeping with the project's environmental restoration focus (Appendix F).

USACE regulations require that recreational components at ecosystem restoration projects are compatible with the objectives of the project and enhance the public's experience by taking advantage of natural values (ER 1105-2-100). The social, cultural, scientific, and educational values of recreational components should be considered within the framework of the ecosystem restoration project purpose. Recreational components of the project may be implemented only to the extent that recreation does not adversely impact the ecosystem restoration process. A conceptual plan of the recreational and educational components considered for further analysis in this section as part of the proposed project is included in Figure 5-6.

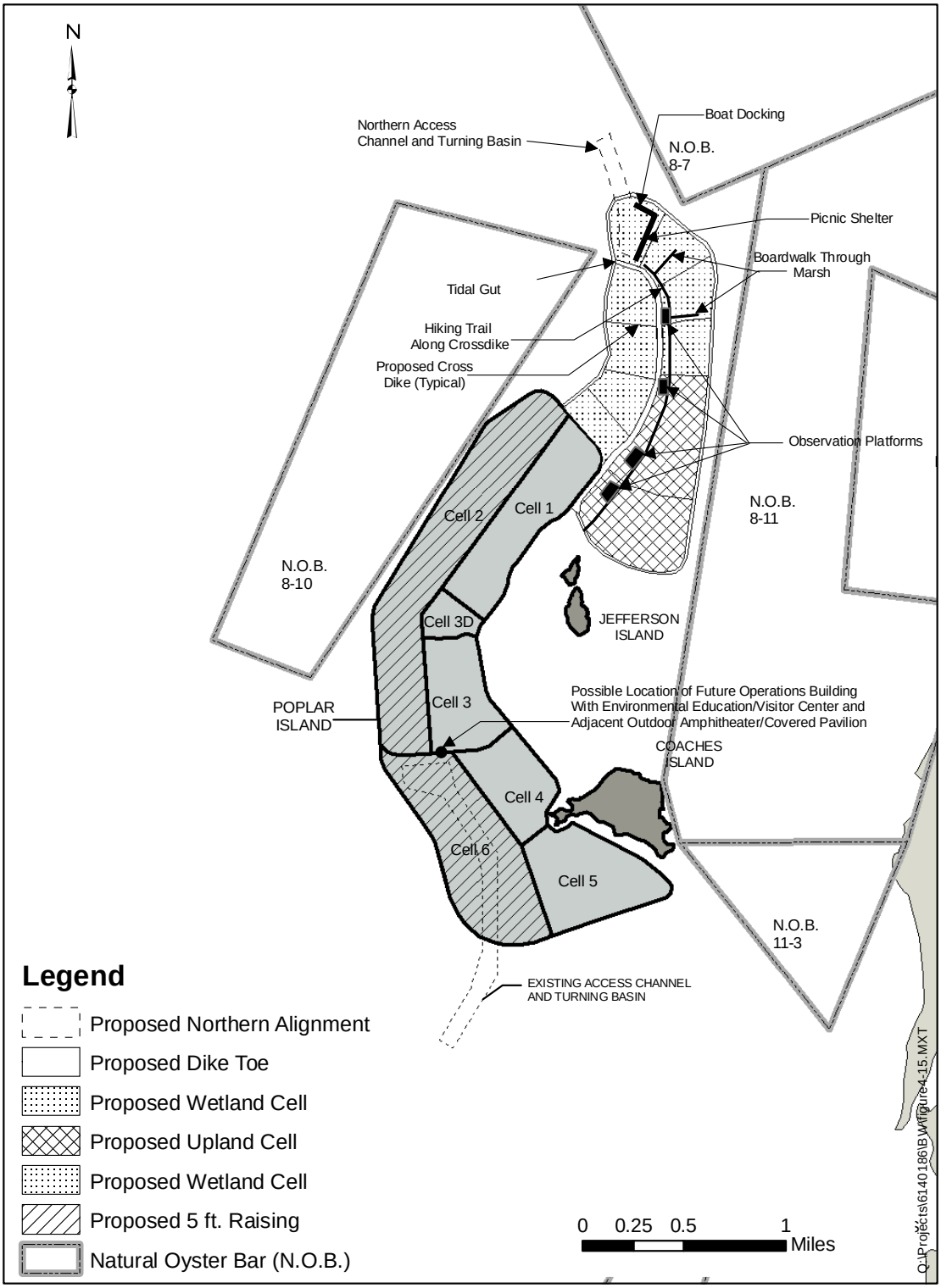


Figure 5-6. Recreational and Educational Components Considered

Educational/Recreational Components

The following recreational/educational resources may be considered as part of the northern lateral expansion:

- Public tours of the Island – The tours of the PIERP offered to the public will be continued and are expected to serve approximately 175 tours per year, similar to the number of tours currently provided per year.

- Self-guided/interpretive nature trails and boardwalks – A low-impact nature trail could be created beginning at the northern access channel and turning basin. The nature trail could be located along and adjacent to the tidal gut on existing interior cross-dikes and perimeter dikes. A series of small boardwalks could be located in the proposed wetland cells as part of the lateral expansion and could connect with the nature trail along the tidal gut. Additional boardwalks may also be located on the PIERP at existing water quality monitoring stations (i.e., Cell 4DX) that overlook the Chesapeake Bay area to the east.

- Kiosks with informative signage – Appropriate signage could be located at set areas along the nature trail and boardwalk in the lateral expansion, and at specified locations at the existing PIERP. An informational kiosk could be placed at the island entrance(s), displaying a map of the islands with pertinent features and appropriate visitor use limitations. Relevant brochures, such as maps, bird and wildflower lists, and local history could also be provided at the kiosk.

- Avian observation areas – Areas for viewing wildlife could be created at specified locations along the nature trail adjacent to the tidal gut. Platforms and/or observation decks would include benches and an overlook of the potential embayment area in the western portion of the lateral expansion. The platforms would be sized large enough to accommodate approximately 10 visitors; visitors may bring scoping equipment to set-up on the observation areas and view wildlife or take photographs.

- Research opportunities for educational institutions – Similar to current conditions, universities and academic institutions will be provided opportunities and permitted to conduct scientific studies at the PIERP and at the lateral expansion during site operations. Research topics may include terrapin studies, SAV seeding/planting, wetlands survival studies, avian nesting/utilization studies.

- Volunteer opportunities – Similar to current conditions, volunteers would be invited to participate in both wetland and upland plantings, bird census, and research opportunities at the PIERP and the lateral expansion during construction activities. Volunteers could also be included in the creation of making functional wildlife boxes for placement at the PIERP and lateral expansion.

- Docking area for authorized visiting boats – A dock for authorized visitors to tie-up boats could be located in the turning basin at the northern portion of the lateral

expansion with a set number of slips upon project completion. A picnic area and nature trail could be located directly adjacent to and accessible to the docking area. Restrictions may be placed on boating hours and standard fishing regulations would apply.

- Picnic area – An area for visitors with a set number of tables for picnicking could be located near the boat-docking facility at the northern portion of the lateral expansion. The picnic area would be accessible from both the boat-docking area and the nature trail. Durable tables would be acquired and the area would require periodic maintenance (i.e., grass mowing, trash collection).

- Demonstration garden – Similar to the demonstration area at the PIERP, a garden display area depicting native plants with identification tags would be created in a location to be determined in the northern lateral expansion.

- Stone sculpture/monument/memorial area - Similar to existing conditions at the PIERP, a stone sculpture area, a monument, or an appropriately designed memorial could be created in a location to be determined in the northern lateral expansion, if appropriate.

- Resting/viewing areas – Locations for resting on benches along the proposed nature trail and the shoreline areas, off of designated paths, could be located in the lateral expansion and the existing PIERP. Recently created wetlands provide beneficial habitat for avian species, and viewing opportunities would be plentiful at created platforms and along the shoreline of the island. Benches placed along the trail, including the shoreline, could provide resting areas as well as wildlife viewing.

Impacts Associated with Recreational/Educational Components

The educational and passive recreational components that are being considered as part of this project will not interfere with the original project goal of remote island habitat and will be constructed to avoid or minimize impacts to the created habitats and the wildlife species currently using the interim habitats available at the PIERP. In addition, beneficial impacts to land and water use may occur through the increase in tourism of area. All anticipated impacts from the proposed recreational and educational components are discussed below.

Public tours of the Island

Tours of the PIERP to the public currently occur on a regular basis. A tour bus is permanently located on the island and travels along existing cross-dike and perimeter dike roads during tours. No adverse impacts are expected with continuing tours of the island. Additionally, maintaining a positive relationship with the public is a beneficial impact of providing the tours. Providing tours is also a positive recreational experience and opportunity, and therefore, continuing the tours will have a positive impact on recreational opportunities that are anticipated as part of the project.

Nature trails and boardwalks

Interior cross-dikes and perimeter dikes consisting of dirt and gravel are currently used at the PIERP and are proposed for construction of the lateral expansion. The existing dikes could be used for trail development to avoid impacts to the created uplands and wetland habitats and to discourage visitors from impacting recently planted cells. Trails would be developed in a manner that would not cause the islands to lose natural character. These types of trail bases are sturdy and do not contribute to erosion. For trails through created wetlands, a recycled wood composite could be used to construct boardwalks, and footbridges could be constructed over open water areas to minimize the footprint of the trails in the wetland areas. Care would be taken to ensure that trails produce no negative effect on wildlife. The construction of a boardwalk along the shore and into wetland areas would allow visitors to closely examine wildlife and wetland ecology without causing major disturbance of these habitats. Viewing areas and educational signage could be used to reinforce the value these habitats provide.

Kiosks with informative signage

No adverse impacts are anticipated with creating kiosks on the PIERP or the lateral expansion. The kiosks would be located on existing cross-dikes or perimeter dikes to avoid all impacts to existing and created upland and wetland vegetation. The information presented at the kiosks will provide visitors with brochures, such as maps, bird and wildflower lists, to provide a greater appreciation of the project and the goals of the PIERP and proposed expansion. Additionally, rules and regulations applicable to the island would be disseminated at the kiosks to reduce any adverse impacts to the natural resources and wildlife the visitors could cause. Providing project information should have a positive impact on education by making greater information available.

Avian observation areas

No adverse impacts are associated with creating avian observation areas. By creating nesting habitats, benefits to recreation are anticipated by providing increased wildlife viewing opportunities.

Research opportunities for educational institutions

Providing continued opportunities for researchers to conduct research at the PIERP and lateral expansion would be a positive impact. The USACE would allow researchers to continue to collect data during construction activities for educational purposes and to document successes and lessons learned on the island. Increased research opportunities are anticipated with the lateral expansion that will create positive impacts to education.

Volunteer opportunities

Positive impacts to students and groups would occur by continuing volunteer opportunities at the PIERP and allowing these opportunities as part of the lateral expansion. Maintaining a positive relationship with the public is a beneficial impact of providing volunteer opportunities. Increased volunteer opportunities are anticipated with the lateral expansion that will create positive impacts to education and recreation.

Boat docking area
No significant impacts are anticipated with creating a boat docking area. The proposed docking area would be located at the northern access channel and turning basin, created as part of the lateral expansion. All impacts associated with creating the access channel and turning basin are discussed in the sections. Noise impacts to wildlife may occur, but should be less than the prior noise generated through construction activities associated with the lateral expansion. Restrictions may be placed on boating hours to reduce impacts to wildlife during hours when staff is not located on the island.

Picnic areas
No adverse impacts are associated with providing picnic areas for visitors. The picnic areas could be located on the existing cross-dikes and exterior dikes and would, therefore, have no impact on created habitats. To reduce impacts to the created habitats and the wildlife that utilize the area, periodic maintenance, including trash collection would be required at all picnic areas. Providing increased picnicking areas will have a positive impact on recreation.

Demonstration garden
No adverse impacts are associated with creating a demonstration garden. Positive impacts associated with the recreational experience are anticipated by providing a demonstration garden.

Stone sculpture/monument/memorial area
No adverse impacts are associated with creating a stone sculpture area, monument, or memorial area that would be designed in a manner to be sensitive to the island habitat. Positive impacts associated with the recreational experience are anticipated by providing sculpture area, monument, or memorial area.

Resting/viewing areas
No adverse impacts are associated with creating resting and/or viewing areas along the nature trails. By creating resting and/or viewing areas benefits to recreation are anticipated by providing increased wildlife viewing opportunities.

5.4 ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES CONSIDERED

5.4.1 Setting/Location

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Construction of the northern lateral expansion will have a permanent impact on the setting/location of the project area. Figure 5-7 shows the distance from the Eastern Shore mainland to the northern lateral expansion. Currently, the northeastern portion of the PIERP is located 1.88 miles from Lowes Point on the Eastern Shore mainland. The Study Area of the northern lateral expansion would be located 1.35 miles from Lowes Point, on the Eastern Shore mainland. The construction of the northern lateral expansion will decrease the distance between the Eastern Shore mainland and the existing northeastern portion of the PIERP approximately 0.5 miles. The southeastern

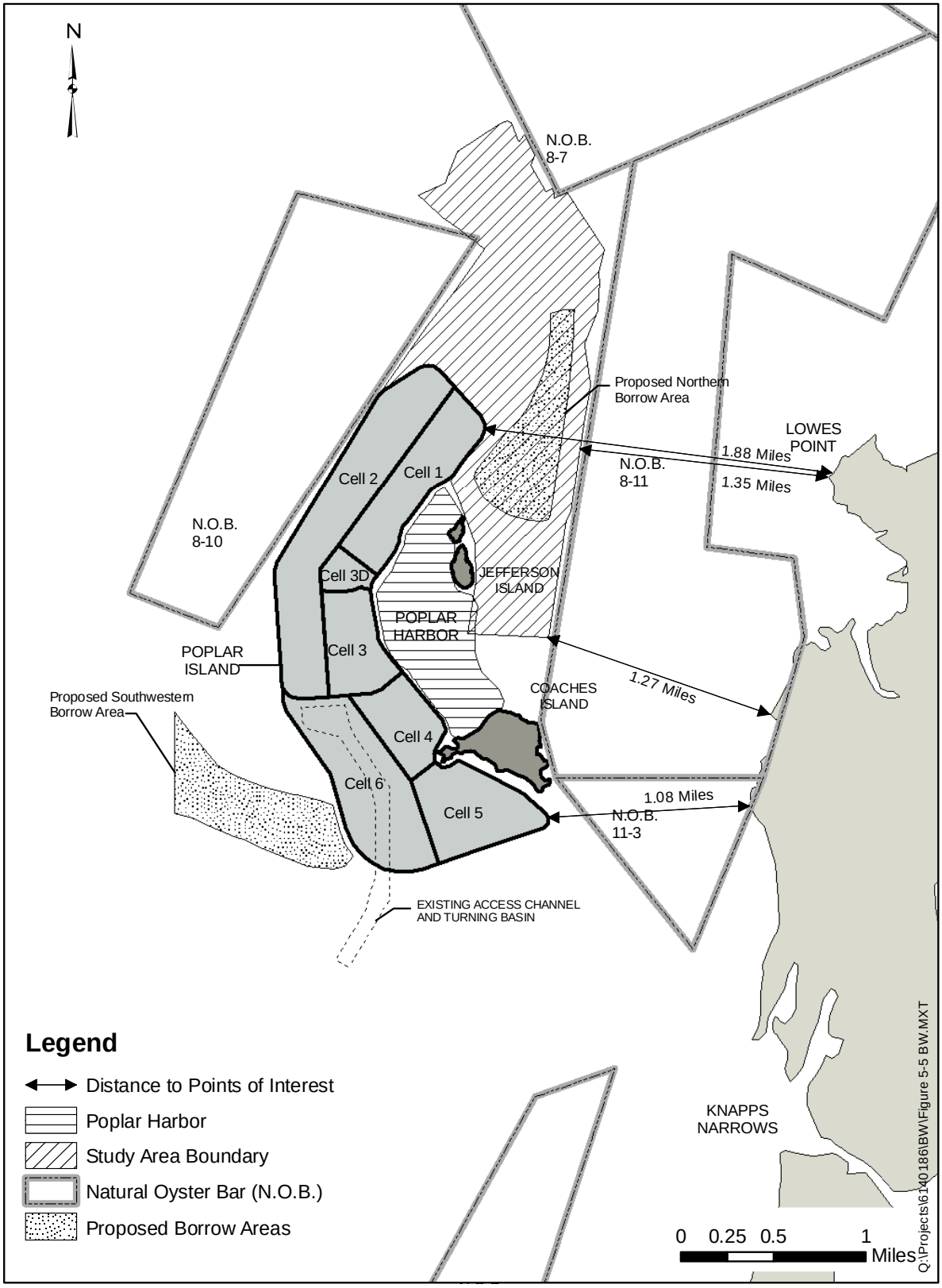


Figure 5-7. Proximity of the Study Area to the Eastern Shore Mainland

portion of the PIERP is currently located 1.08 miles from the Eastern Shore mainland; the southern portion of the Study Area would be located 1.27 miles from the Eastern Shore mainland, south of Lowes Wharf. These calculations represent the maximum potential change in the distance between the lateral expansion and the mainland shoreline. The actual alignment of the preferred alternative will be located within the 1,080-acre Study Area (Figure 5-7), potentially increasing the distance of the lateral expansion from the mainland shoreline. However, the construction of the northern lateral expansion will serve as a wind and wave buffer to Poplar Harbor and create quiescent conditions necessary for the reestablishment of SAV in Poplar Harbor. Additionally, the northern lateral expansion will also protect Jefferson Island by reducing erosion and preserving the habitat located on the island. Impacts to aesthetics and viewshed are specifically addressed in Section 5.7.

No additional impacts on the setting or location of the project are expected with the raising of existing upland cells.

Southwestern Borrow Area No additional impacts to the setting/location are associated with dredging in the southwestern borrow area.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Impacts associated with Alternative 2 are the same as discussed above for Alternative 1. No additional impacts to the setting/location are associated with dredging in the southwestern borrow area as part of Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Impacts associated with Alternative 3 are the same as discussed above for Alternatives 1 and 2. No additional impacts to the setting/location are associated with dredging in the southwestern borrow area as part of Alternative 3.

No-Action Alternative

No additional impacts on the setting or location of the project are expected with the no-action alternative. The existing setting of the PIERP would not change with the no-action alternative.

5.4.2 Physiography, Geology, Soils, and Groundwater

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Significant changes to the existing physiography will occur as a result of the expansion. Long-term impacts to the physiography of the project area will occur when the footprint of the lateral expansion is converted from open water habitat to wetland and upland habitats, and when water depths within the northern access channel increase as a result of dredging activities. Water depths in the northern access channel will increase depths to –25 ft MLLW, although some gradual shoaling may occur in this area. The northern access channel and turning basin will provide access to the expansion cells for placement of dredged materials. During construction, a 400-ft wide channel with side slopes of 3H:1V will be dredged to a depth of approximately –25

MLLW ft (with up to 2 ft overdepth) to support project operations. This channel will extend from the existing –25 ft MLLW contour northwest of the site, to the northern end of the placement site. The total area disturbed by the channel and turning basin excavation will be approximately 30 acres.

Impacts to the physiography of the Study Area from raising the existing upland cells as part of the vertical expansion are not anticipated. Upland Cells 2 and 6 are currently authorized to a final height of +20 ft MLLW and a temporary height of +23 ft MLLW. For the vertical expansion, the height of the existing upland cells of the PIERP (Cells 2 and 6) will be raised to a temporary height of +30 ft MLLW until the upland cells are filled, and then lowered to a final nominal design height of +25 ft MLLW. Comparatively, the surface elevations on Coaches and Jefferson Islands have current maximum heights of approximately +12 ft MLLW, which is similar to the existing height of +10 ft MLLW for the existing wetland cells. Raising the height of the dikes for the upland cells would result in a barely perceptible change in the viewshed, and the final design height of +25 MLLW would be generally consistent with the regional landscape, even with mature vegetation. Impacts to aesthetics and viewshed are specifically addressed in Section 5.7.

The construction of the lateral expansion and the vertical expansion of the existing upland cells will not have a significant impact on the geology or groundwater in the Study Area. Perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel and sand borrow excavation will not be deep enough to disturb the Aquia formation, the current source for groundwater at the PIERP. No impacts to geology are anticipated with Alternative 1. The creation of both wetlands and uplands as part of the lateral expansion will create new soils through dredging and converting open water habitat to an island habitat. Section 5.5.7 discusses the benefits of upland and wetland creation in more detail.

Southwestern Borrow Area The excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. The lateral expansion will convert approximately 600 acres of open water habitat to island habitat, sand borrow excavation activities within the southwestern borrow area will impact approximately 91 total acres (1.5 mcy) of bottom habitat, and dredging for the northern access channel and turning basin will impact approximately 30 acres of bottom habitat, although some gradual shoaling may occur in this area (Figure 5-1). Coordination between the USACE and the BEWG, fishermen, and resource agencies is currently on-going to determine ways to reduce the impacts (acreage) of dredging the southwestern borrow area.

Sand required for the vertical and expansion will come entirely from the southwestern borrow area. Excavation of the southwestern borrow area will result in a permanent change in the water depth over approximately 91 acres. The extent of the dredging and total number of acres impacted within the southwestern borrow area may change once the final dredging plan is submitted for approval. Although a substantial volume of sand would be removed and underlying clays may be exposed locally, dredging would likely leave the majority of the

southwestern borrow area retaining a sandy substrate; subsequent reworking of sand by natural processes would likely reduce exposed clays in the area.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to the physiography associated with the area disturbed by the channel and turning basin excavation and impacts of raising the existing upland cells at the PIERP (Cells 2 and 6) are the same as those discussed above for Alternative 1. However, to achieve 50 percent wetlands within the lateral expansion, the quantity of sand required from the southwestern sand borrow area will decrease compared to Alternative 1 . Impacts to the sand borrow area are discussed below.

Southwestern Borrow Area Approximately 49 total acres (0.8 mcy) of the southwestern borrow will be disturbed by activities associated with Alternative 2 (Figure 5-1). Compared to Alternative 1, Alternative 2 will require 42 acres less of the southwestern borrow area to support the development of 50 percent wetland habitat within the lateral expansion. As stated above for Alternative 1, excavation of sand from the southwestern borrow area for construction of the vertical expansion will result in a permanent change in the water depth, although this change would only occur over approximately 49 acres. The excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to the physiography associated with the area disturbed by the channel and turning basin excavation and impacts of raising the existing upland cells at the PIERP (Cells 2 and 6) are the same as those discussed above for Alternatives 1 and 2. Long-term impacts to the physiography of the project area will occur when the 470-acre footprint of the lateral expansion is converted from open water habitat to wetland and upland habitats, and when water depths within the southwestern sand borrow area and northern access channel increase as a result of dredging activities. Therefore, the conservation of approximately 130-acres of open water reduces the project footprint from approximately 600 acres (Alternatives 1 and 2) to 470 acres.

Southwestern Borrow Area Incorporation of the open-water embayment results in less sand borrow from the southwestern sand borrow area, disturbing only approximately 19 acres of borrow area, as compared to approximately 91 acres for Alternative 1 and approximately 49 acres for Alternative 2.

No-Action Alternative

No additional beneficial or adverse impacts on the physiography, geology, soils, and groundwater are expected with the no-action alternative. When completed, the PIERP is planned to be approximately 570 acres of wetlands and 570 acres of uplands, with habitats consistent with those found on other remote mid-Bay islands.

5.4.3 Hydrology and Hydrodynamics

The hydraulic and hydrodynamic modeling for the 575-acre northern lateral expansion of the PIERP included the evaluation of four major components:

1. impacts to current velocity and changes to flow patterns (USACE-ERDC, 2005a),
2. changes in the residence time of water in Poplar Harbor (USACE-ERDC, 2005a),
3. impacts to wave heights along the Eastern Shore mainland (USACE-ERDC, 2005b), and
4. life cycle analysis for the dike design (USACE-ERDC, 2005c).

In addition, two previous studies (M&N, 2004; 2003) evaluated the potential for erosion and deposition of cohesive and non-cohesive sediment based on a generic northern alignment (see Section 4.5.2.a, Alignment 7) for the lateral expansion used in the reconnaissance study. The UCB-FEM model (see Section 3.1.3.g) was used to evaluate the hydrodynamic impacts of the 630-acre northern lateral alignment, and the hydrodynamic results were then used as input parameters in the sedimentation model.

A discussion of the results of the life cycle analysis for the perimeter dike design is presented in Chapter 6 (Section 6.2.2.a). Results from the other hydraulic and hydrodynamic studies are summarized below and in Appendix B.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Hydrodynamic Modeling

The hydrodynamic model results indicated that water surface elevations would be unaffected by construction of the 575-acre northern lateral alignment (Appendix B), and relatively small impacts would occur to current velocities (USACE-ERDC, 2005a). Modeled changes in current speeds were observed at locations in the near-field - adjacent to the northern lateral expansion –as a result of the interference of the additional landmass which increases friction in the shallower water and changes the current speed and direction (USACE-ERDC, 2005a). Changes in current speeds for locations in Poplar Narrows were not observed (USACE-ERDC, 2005a), indicating that the northern lateral expansion would only have a localized effect on current speed. Following construction of the northern lateral alignment, flow would be displaced northward, and current velocity would increase at the northernmost point (M&N, 2003). Current velocity decreases where flow is blocked by the island, creating an area of increased quiescence to the east, west and immediately south of the of the northern lateral alignment area (M&N, 2003).

Currents near the PIERP are on the order of 0.1 to 1.2 ft/sec, and construction of the northern lateral alignment would not significantly change current velocities in the surrounding vicinity (M&N, 2003). The hydrodynamic model for the reconnaissance study (the 630-acre northern lateral alignment) indicated that there were minor velocity increases of about 0.04 to 0.2 ft/sec north and south of the island, with decreased current velocity of about 0.04 to 0.2 ft/sec to the

east and west. South of the northern lateral alignment, within Poplar Harbor, velocities also decreased. Numerical comparisons of peak current velocities from the hydrodynamic modeling results are shown in Table 5-2.

Table 5-2. Hydrodynamic Modeling Results

	Existing Conditions		630-acre Northern Lateral Alignment	
	Peak Flood Current (ft/s)	***Peak Ebb Current (ft/s)***	***Peak Flood Current (ft/s)***	***Peak Ebb Current (ft/s)***
Northwest of Project	0.63	0.62	0.43	0.34
North of Project	0.43	0.44	0.61	0.70
Northeast of Project	0.31	0.38	0.11	0.08
East of Project	0.27	0.29	0.21	0.25
Southeast of Project	1.02	1.01	1.05	1.03
South of Project	0.13	0.14	0.03	0.02

Source: M&N, 2003

Results of both models (USACE-ERDC, 2005a and M&N, 2003) indicate that the northern lateral alignment will not have a significant impact on the water levels or current velocities in the vicinity of the PIERP.

Potential Eastern Shore Mainland Wave Heights

Potential impacts to the Eastern Shore mainland from the 575-acre northern lateral alignment were evaluated by modeling the relative difference in wave heights at specified points along the Eastern Shore mainland from before and after the construction of the northern lateral expansion. Details of the methods, model inputs, and model results can be found in Appendix B and the *Shoreline Impact Study for Poplar Island Expansion* (USACE-ERDC, 2005b).

Results of the model indicated that in each case, the maximum difference in wave height for each case was directly in the lee of the lateral expansion, and no increases in wave height along the Eastern Shore mainland were predicted from the lateral expansion, as compared to the conditions from the existing PIERP (USACE-ERDC, 2005b). The maximum reductions in wave height from the lateral expansion are predicted to be 3-4 ft directly in the lee of lateral expansion. Close to the Eastern Shore mainland (depth of 9 ft), the maximum reductions in wave height are 1-1.5 ft (USACE-ERDC, 2005b). The sheltering effect of the northern lateral expansion was stronger for waves from the north and west, and weaker for waves from the south. Wave height did not increase along the Eastern Shore mainland as a result of the northern lateral expansion for any cases simulated, and therefore, the northern lateral alignment is not anticipated to have a significant impact on erosion along the Eastern Shore mainland.

Sedimentation Modeling

Sedimentation modeling of a 630-acre northern lateral expansion (see Section 4.5.2.a, Alignment 7) was conducted as part of the reconnaissance study (M&N, 2003). The

sedimentation model SED-2D was used to model sediment deposition and erosion of both non-cohesive and cohesive sediment (silts and clays) for the 630-acre northern lateral alignment. Results were normalized to a unitless scale because of the empirical use of the sedimentation model as a result of insufficient local calibration data. Cohesive sediment (silts and clays) have properties (shape, plasticity, electric charge) that cause the particles to remain in suspension for relatively long periods of time before they settle out, generally resulting in a larger area affected by sedimentation and erosion from cohesive sediment (silts and clays) as compared to non- cohesive sediment (sands).

Sedimentation modeling results for non- cohesive sediment (sands) for 16-mph NNW, N and NNE winds, respectively are presented in Appendix B. Sixteen (16)-mph winds were determined to be the minimum winds necessary to cause sediment suspension and transport for non-cohesive sediments. Comparison of sedimentation patterns with bathymetry indicates that the areas of erosion correspond to shallow water depths, while deposition occurs in adjacent deep-water areas. The model results for the 16-mph NNW, N and NNE winds indicated no transport of non-cohesive sediment (sands) with the construction of the 630-acre northern lateral alignment.

Sedimentation modeling results for cohesive sediment (silts and clays) for 13-mph NNW, N, NNE and NE winds, respectively are presented in Appendix B. Modeling results for cohesive sediment (silts and clays) for 13-mph N, NNE, and NE winds are generally similar. Following construction of the 630-acre northern lateral alignment, a large area of Poplar Harbor, including Jefferson Island, would be sheltered by the expansion, resulting in decreased erosion of sediment from the shallow areas within Poplar Harbor and decreased deposition in the deeper areas east of Poplar Harbor in the Poplar Island Narrows. In addition, a reduction in the erosion of Jefferson Island was predicted by the model after construction of the 630-acre northern lateral alignment.

Based on the sedimentation modeling results, the construction of a 630-acre northern lateral alignment, however, would have a beneficial impact because it would provide shelter to Poplar Harbor from wind and waves coming from the NNW, N, NNE and NE directions, reducing erosion of Jefferson Island and shallow areas of the harbor. This reduction in erosion would likely reduce suspended sediment and improve water clarity within Poplar Harbor.

Residence Time in Poplar Harbor

The residence time modeling was conducted by USACE-ERDC (2005a) by tracking the movement of neutrally buoyant particles, which represented water exchange (Appendix B). The model evaluated the results of two scenarios for the northern lateral expansion as compared to the existing condition – Option 1 had one southern opening to the tidal gut and Option 2 had two openings (one at the northern end and one at the southern end) for the tidal gut.

With the construction of the northern lateral alignment, residence times in Poplar Harbor for the modeled low-energy, eight day reference period were approximately eight hours longer with one opening in the tidal gut (Option 1), and approximately 14.6 hours longer with two openings in the tidal gut (Option 2), as compared to the residence time for the existing

condition (Table 5-3). The residence time for Option 1 is lower because of an increased current from the south end of the tidal gut into the harbor reference area. Option 2 allows two points of egress of flow from the expansion area and thereby has a reduced current from the south end of the tidal gut relative to Option 1. The predicted increase in the residence time of particles within Poplar Harbor (between eight and 15 hours) is not anticipated to have a significant impact on the water quality, benthic community, finfish, or SAV in the Harbor.

Table 5-3. Modeled Residence Times in Poplar Harbor

	Average Residence Time (days)	
	Reference	**Storm**
Existing	4.07 (97.7 hr)	0.69 (16.6 hr)
Option 1	4.41 (105.8 hr)	0.91 (21.8 hr)
Option 2	4.68 (112.3 hr)	0.93 (22.3 hr)

Source: (USACE-ERDC, 2005a)

During the modeled higher-energy, four day storm period, both options produced an increase in residence time of between five and five and a half hours, with a slightly lower increase for Option 1 (one tidal gut opening). The substantially shorter reference time for the storm events was expected because the water level and current increased significantly with the storm surge used in the model (model was based on measured results from Hurricane Isabel). As indicated by the model results, storm events will greatly shorten residence times and enhance flushing within Poplar Harbor.

Southwestern Borrow Area Modeling of hydrodynamic impacts related to dredging within the southwestern borrow area may be conducted in the future but has not occurred to date.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Modeling of hydrodynamic impacts related to dredging within the southwestern borrow area has not been conducted.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to current velocities, Eastern Shore mainland wave heights, sedimentation in the vicinity of the expansion, and residence time in Poplar Harbor associated with Alternative 3 are anticipated to be similar to those discussed for Alternative 1.

Residence Time in the Open-Water Embayment

Residence time within the open-water embayment was modeled by USACE-ERDC, using a modified version of the particle-tracking model (Appendix B). The sheltering effect of the exterior dikes and segmented breakwaters of the open-water embayment produces a

substantially longer residence time as compared to the existing condition (free, unrestricted particle movement in the current) (Table 5-4).

Table 5-4. Modeled Residence Times in the Open-Water Embayment

	Average Residence Time (days)	
	Validation (hr)	Storm (hr)
Existing	0.25 (6)	0.18 (4.3)
Open-Water Embayment	3.79 (91)	1.10 (26.4)

Source: (USACE-ERDC, 2005a)

However, the inclusion of an open-water embayment within the northern lateral expansion has raised additional questions regarding long-term stability, sedimentation, erosion, and the potential for debris accumulation within the embayment. Additional hydrodynamic modeling to address these concerns is on-going, and will be completed in the next design phase of the project. The non-Federal sponsor, interested state and Federal agencies, and other parties will be advised of any design modifications necessitated by the results of the modeling. No significant impacts to hydrology and hydrodynamics are anticipated from the implementation of Alternative 3.

Southwestern Borrow Area Modeling of hydrodynamic impacts related to dredging within the southwestern borrow area has not been conducted.

No-Action Alternative

Impacts from the no-action alternative would be similar to those discussed in the existing conditions (Section 3.1.3). Long-term, adverse impacts to Jefferson and Coaches Islands and the Eastern Shore mainland would be expected with the no-action alternative because additional protection from the lateral expansion would not be afforded to these shorelines. The no-action alternative would allow the continued erosion of Jefferson Island, Coaches Island, and the mainland shoreline.

5.4.4 Water Quality

The existing project operates under a water quality certification (EA, 2004d), which prescribes the discharge limits for TSS at each spillway and turbidity resulting from discharge. The lateral and vertical expansion will be constructed under an separate water quality certification that will be obtained from MDE prior to the start of construction, as required by section 401(c) of the Clean Water Act. Once the construction for the lateral and expansion is completed, the water quality certification for the existing project will be amended, and the entire project (existing plus the expansion) will operate under one comprehensive water quality certification.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Short-term, localized water quality impacts will result from the perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. A Clean Water Act Section 404(b)(1) evaluation was performed and is included in Appendix K.

Perimeter Dike Construction

The primary short-term impact will be an increase in water column turbidity in the construction and dredging areas. For construction of the perimeter containment dikes, sand will be hydraulically dredged from the borrow area and pumped to a stockpile located within the existing PIERP. The construction of the sand perimeter dikes will be completed by mechanical placement of sand using trucks to transport the sand from the stockpile, and some additional mechanical shaping of the sand will be required before armor stone can be placed on the exterior slopes. Construction of the sand perimeter dikes is expected to cause a visible turbidity plume. The orientation and size of the expected turbidity plumes will vary on a daily basis, depending on the winds and currents in the Study Area during construction and dredging for the access channel. The stone toe of the armored section of the dike will be constructed before the sand dike section to minimize turbidity impacts during construction and dredging.

Prior to the construction of the existing PIERP, it was anticipated that the perimeter dike construction would be accomplished by direct hydraulic placement of sand dike fill materials. Based on previous experience with hydraulic placement of sand and the properties of the in-situ borrow materials, it was anticipated that the borrow excavation quantity might exceed the dike fill quantity by as much as 25 percent. The extra 25 percent would be lost as suspended sediment or materials that accumulated on the bay bottom beyond the formal dike limits. However, the dikes for both phases of the existing PIERP were constructed using mechanical placement techniques with much lower losses (see Appendix A, Section 5.5.3). Because of the close proximity of the oyster bars and the need maximize the use of sand obtained from within the project footprint, mechanical placement of dike fill will also be required for the construction of the northern lateral expansion (see Section 6.2.2).

Turbidity monitoring conducted during both Phase I and Phase II construction of the PIERP indicated that the turbidity levels quickly diminished to background levels, except during periods of sustained high winds. However, even during periods of sustained high winds turbidity levels were consistent with levels at the reference locations, indicating that the increased turbidity was not solely a result of dike construction. Based on these findings, increases in turbidity associated with the construction of the perimeter dike for the northern lateral alignment and the dredging for the northern access channel are expected to be temporary, short-term and localized. Turbidity monitoring may be conducted during perimeter dike construction and dredging for the lateral expansion as per requirements of the WQC. The turbidity monitoring program currently in place tests the hypothesis that turbidity levels outside of a defined mixing zone will remain in compliance with the WQC limitations during construction activities. Turbidity impacts to aquatic resources are evaluated in more detail in the appropriate sections below.

Additionally, the release of nutrients or chemical constituents from the sediments during dredging activities is expected to be a short term, temporary, and localized water quality impact during the construction of the northern lateral expansion and dredging of the northern access channel.

Site Operations

Temporary, localized impacts on the water quality are expected during site operations for the lateral expansion. The primary pathway for water discharge from the wetland cells located within the northern lateral expansion will be through a central tidal gut that will allow eventual unrestricted tidal exchange with Poplar Harbor from the southern end of the expansion area. Based on the results of hydrodynamic modeling, the tidal gut will have only the one opening in the south, but a controlled inlet structure at the northern end of the tidal gut is also planned. The northern opening to the tidal gut would remain closed under normal operating conditions, but would provide the option for additional flushing though the tidal gut if needed. The final configuration of the tidal gut has not yet been determined, and will be based on the results of future studies conducted prior to construction.

Discharge from the wetland and upland cells into the tidal gut will be controlled by internal dike structures during dredged material placement and cell development. During dredged material placement, three or four spillway structures will connect the wetland cells with the tidal gut. However, each of the seven planned wetland cells will eventually (i.e. after inflow and cell grading has been completed) have an opening to the tidal gut. These openings will be initially controlled, and later will become full breaches. The wetland sub-cells will be hydraulically connected to each other as they are in the existing project. For the upland cells, one primary spillway will be located at the south end of the upland cell that discharges to the Chesapeake Bay, and a second spillway is planned for water discharge from the upland cells into the tidal gut.

Spillways or outlet structures (both internal and external) associated with the wetland cells will allow the cell to be closed off if the water quality of the discharge during placement exceeds water quality standards. The spillway located at the south end of the upland cell will be at least 500 yards from the boundary of NOB 8-11. This spillway should not have a significant water quality impact on NOB 8-11, and, as stated above, if discharge during placement exceeds water quality standards, the spillway structure will be closed and discharge will be stopped. Once the wetland cells are completely developed, free tidal exchange will occur between the functioning wetlands, the tidal gut, and Poplar Harbor. Free tidal exchange will typically be initiated one month prior to planting, and once planting has begun, regular tidal exchange will be necessary to sustain the plants. Once planted, there will be unrestricted tidal exchange except for extreme storm events. Water quality will be monitored during cell development at spillways and within the tidal gut, at locations to be determined by the monitoring sub-group, and will be in accordance with the approved monitoring framework (Chapter 8).

The dredged material placed in the lateral and vertical expansion will be anoxic (low to no oxygen) silt and clays dredged from the channel bottoms. As the dredged material dries and

dewaters, it is exposed to the atmosphere and oxidizes. As a result of geochemical processes, metals become soluble and the pH decreases, altering the water quality of effluent discharged through the spillways. Dredged material that will be placed in the cells is limited to material from the upper Chesapeake Bay approach channels to the Port of Baltimore and other Federal navigation channels (does not include material from the Patapsco River and from Baltimore Harbor), which does not contain high concentrations of chemical analytes (EA, 2003b; 2000a; 2000b), minimizing potential chemical impacts to water quality. Exterior water quality monitoring in the vicinity of the PIERP has not identified any significant changes to the water quality as a result of dredged material placement (EA, 2004a; 2002d). Minimal releases of phosphorus and nitrogen (ammonium) are expected during construction and dredging, but are not expected to be significant. Because organic and inorganic chemical constituents in the sediment in the Study Area are present at low concentrations (EA, 2004f and 2002c), the dredging process is not expected to result in a significant release of dissolved constituents that will impact water column organisms or affect human health.

Fluctuations in ammonia, DO, and pH could impact the water quality of discharges from the expansion cells. Ammonia can affect water quality because it creates an oxygen demand, it is a nutrient that promotes algal growth, and it can be toxic at high concentrations. Based on the results of the discharge monitoring conducted for the PIERP, ammonia concentrations are not anticipated to be high enough to significantly increase algal growth in the surrounding water (MES, 2005a; 2003a; 2002). Discharge monitoring also indicated that pH concentrations at the locations 100-yds from the spillway were within the normal range for estuarine waters (pH of about 8.0) (MES, 2005a, 2003a, 2002), indicating the full mixing of the spillway discharge and the surrounding Chesapeake Bay water. Water discharged from the northern lateral expansion will be monitored closely, and must meet State water quality standards, and the turbidity and TSS limits prescribed in the Water Quality Certification and the Maryland Tidal Wetlands License. Discharge from the proposed spillways should result in only short term, minor perturbations to local water quality. For discharges, a Clean Water Act Section (CWA) 404(b)(1) evaluation was completed and is included in Appendix K.

Vertical Expansion of Existing Upland Cells

No additional, impacts on the water quality in the vicinity of the PIERP are expected from raising the existing upland cells. Water from the upland cells will primarily runoff to the wetland cells and through the existing spillways to the Chesapeake Bay. However, some runoff will continue to be discharged directly to the Chesapeake Bay, consistent with current practices. Discharge from the spillways will continue to be controlled and monitored, and will be required to meet State water quality standards, and the turbidity and TSS limits prescribed in the Water Quality Certification and the Tidal Wetlands License. Discharge from the existing spillways should result in only short term, minor perturbations to local water quality.

Northern Access Channel and Turning Basin

Long-term, adverse impacts to water quality are anticipated as a result of dredging 30 acres for a 400-ft wide channel with side slopes of 3H:1V to a depth of approximately –25 MLLW ft (with up to 2 ft overdepth) for the northern access channel and turning basin. If the northern access channel and turning basin are excavated below the pycnocline, hypoxic and/or

anoxic conditions could also occur in the bottom waters – localized reductions in dissolved oxygen may occur during the summer months.

Southwestern Borrow Area Both long-tern and short-term, localized water quality impacts will result from dredging 91 acres of sand in the southwestern borrow area and are the same as discussed above for the lateral and vertical expansion. The primary short-term impact will be an increase in water column turbidity in the dredging area. The sandy sediments that are proposed for dredging from the sand borrow area and northern access channel do not have elevated concentrations of nutrients or chemical constituents (EA, 2005a; 2004f; 2002c; 2002e), and the biological and chemical oxygen demand is not expected to be significant. In addition to short-term impacts, the excavation of 91 acres of the southwestern borrow area will increase the water depth in this area. Following dredging, the borrow area would have a surface grade similar to existing conditions, but water depths may increase an average of approximately 10 ft across the bottom. The total extent of the bottom footprint that will be directly impacted during the proposed sand dredging in the southwestern borrow area will not be known until the project dredging plan is submitted and approved by appropriate resource agencies.

Long-term impacts are associated with dredging the southwestern borrow area. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although this depth may change once the final dredging plan is submitted for approval and some gradual shoaling may occur in this area. If the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could also occur in the bottom waters. Localized reductions in dissolved oxygen may occur during the summer months, but the southwestern borrow is generally well-mixed as a result of wind and wave action. It is proposed that the borrow area excavation advance to the west as needed, always maintaining contact with the day-lighted southern limits of Borrow Area G to assure adequate circulation with deeper water.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, short-term, localized water quality impacts will result from dredging the southwestern borrow area, although only 49 acres of the borrow area will be disturbed. The excavation of 49 acres of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, which will have a similar and minor, localized impact on water quality as discussed above for Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to impacts discussed above for Alternatives 1 and 2. Short-term,

localized water quality impacts will result from the perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel and long-term adverse impacts will result from dredging the northern access channel and turning basin, which increases the potential for anoxia in warmer months. A Clean Water Act Section (CWA) 404(b)(1) evaluation was completed for the recommended plan and is included in Appendix K.

Perimeter Dike Construction

The primary short-term impact will be an increase in water column turbidity in the construction and dredging areas, similar to impacts stated for Alternatives 1 and 2. The construction of the internal sand perimeter dikes is expected to initially cause a visible turbidity plume in the open-water embayment area.

As stated previously for Alternatives 1 and 2, the release of nutrients or chemical constituents from the sediments during dredging activities is expected to be a short term, temporary, and localized water quality impact during the construction of the northern lateral expansion and dredging of the northern access channel.

Site Operations

The 10-acre tidal gut included in Alternative 3 would be located at southwestern portion of the expansion to provide necessary tidal access to Cell 1 of the existing project (Figure 5-4). The proposed tidal gut is approximately 200 to 250 feet wide and would be modeled after the tidal gut separating the southern portion of the existing project and Coaches Island. Current engineering judgment indicates that circulation within the embayment will be sufficient for tidal flushing of the wetland cells, and that connection of the tidal gut remnant at the southern end of the embayment will not be necessary. If future hydraulic analyses indicate otherwise, or if environmental considerations make it desirable, the tidal gut can be connected to the embayment through the wetlands. The shoreline of the southern end of the open-water embayment was adjusted to provide a smoother alignment that should both improve hydraulic performance (by minimizing the potential for areas of poor circulation) and increase the proportion of marsh shoreline.

During placement of dredged material into the wetland cells, water will be discharged in accordance with water quality standards into the open-water embayment through approximately three spillway structures (two associated with the northern wetland area, and one associated with the separate southern area). After placement of dredged material in wetland cells is complete, temporary interior dikes will be removed and channel systems will be established to assure hydraulic interconnection throughout the wetland areas and with the embayment. As part of the of the final wetland construction, the spillways will be replaced with temporary outlet control structures that will connect the wetland cells to the embayment to allow full tidal exchange while wetland plants are established and while the dredged material is stabilized to minimize erosion. After full stabilization has been achieved, the wetland control structures will be replaced with open breaches connecting to the embayment.

During placement into the upland cell, water will be discharged to the Chesapeake Bay through one primary spillway located at the southern end of the upland cell. The spillway will

be located a minimum of 1,500 feet from the nearest oyster bar. A second spillway will be located along the western side of the upland cell to allow for occasional discharge into the open-water embayment. It is anticipated that the upland area will be graded to drain toward the adjacent wetland and open-water embayment areas rather than toward the Bay and Poplar Harbor.

Spillways and outlet structures will comply with water quality standards, and if discharge during placement exceeds these standards, the spillway structure will be closed and discharge will be stopped. Similar to Alternatives 1 and 2, water quality will be monitored during cell development at spillways and at locations to be determined by the monitoring sub-group. Water quality monitoring will be in accordance with the approved monitoring framework (Chapter 8).

As similarly stated for Alternatives 1 and 2, fluctuations in ammonia, DO, and pH could impact the water quality of discharges from the expansion cells. Water discharged from the proposed Alignment 3 will be monitored closely, and must meet State water quality standards, and the turbidity and TSS limits prescribed in the Water Quality Certification and the Maryland Tidal Wetlands License. Discharge from the proposed spillways should result in only short term, minor perturbations to local water quality. Water quality implications for dredged material placed in the lateral and vertical expansion is expected to be similar to impacts discussed for Alternatives 1 and 2. A Clean Water Act Section (CWA) 404(b)(1) evaluation was completed and is included in Appendix K.

Southwestern Borrow Area Similar to Alternatives 1 and 2, short-term, localized water quality impacts will result from dredging the southwestern borrow area, although only 19 acres of the borrow area will be disturbed, compared to 91 acres for Alternative 1 and 49 acres for Alternative 2. The excavation of 19 acres of the southwestern borrow area will increase the water depth in this area and water depths may increase an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, which will have a similar and minor, localized impact on water quality as discussed above for Alternatives 1 and 2.

No-Action Alternative

No additional significant impacts on the water quality in the vicinity of the PIERP are expected with the no-action alternative because activities associated with this alternative are equivalent to the existing conditions at the PIERP. Erosion of Jefferson Island will continue, increasing turbidity in Poplar Harbor. Short-term, localized impacts may occur during periods of high discharge, but results of the spillway monitoring (MES; 2005a, 2003a, 2002), the exterior nutrient monitoring (EA, 2004a), and the exterior water quality monitoring (EA; 2004a, 2002d) have not indicated a significant impact on the water quality. Discharge from the spillways is controlled and monitored – discharge does not occur when water quality parameters within the cells exceed operational goals for discharge. Water discharged though the spillways must meet State water quality standards, and the turbidity and TSS limits prescribed in the Water Quality Certification and the Wetlands License.

5.4.5 Sediment Quality

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No major, significant impacts to sediment quality are expected from the perimeter dike construction for the northern lateral alignment, dredging the northern access channel, or the vertical expansion of the existing upland Cells 2 and 6. However, long-term adverse impacts to sediment quality may occur as a result of dredging the northern access channel and turning basin.

No significant impacts on the sediment quality are expected from the placement of dredged material in the lateral expansion. Sediments from the upper Chesapeake Bay approach channels to the Port of Baltimore accepted for placement at the PIERP are currently tested every three years, a requirement that would apply to sediment from the channels designated for placement within the expansion cells, including material from the upper Chesapeake Bay approach channels and other Federal navigation channels (excluding material from the Patapsco River and Baltimore Harbor) to the Port of Baltimore. Testing and evaluation of the Federal navigation channel sediments conforms to the guidance in the *Inland Testing Manual* (USEPA/USACE 1998), and concentrations of detected constituents are compared to reference site concentrations. Dredged material placed in the lateral expansion will expose the anoxic, sulfur-rich sediments to the atmosphere, oxidizing the sediment, lowering the pH, and mobilizing metals that were bound to the sediment. Dissolved metals released through the spillways as a result of this process could potentially be harmful to aquatic organisms. However, based on the sediment chemistry results from the Federal navigation channels approved for placement at the PIERP (EA, 2003b; 2000a; 2000b), and the exterior monitoring sediment studies (EA, 2004f; 2002c) no significant releases of contaminants to the surrounding estuarine environment or substantial increases in the concentrations of metals or organic constituents in the sediments in the vicinity of the lateral expansion are expected. Post-placement studies of the sediment quality outside of the lateral expansion will continue, according to the schedule and methods determined by the PIERP monitoring sub-group and approved in the Monitoring Framework (MES, 2003d).

No additional, significant impacts on the sediment quality are expected from raising the existing upland cells. Clean dredged material from the upper Chesapeake Bay approach channels to the Port of Baltimore will be placed in the upland cells, and clean sand dredged from the sand borrow area will be used to increase the height of the dikes. Dredging the sands from the borrow area may change the physical characteristics of the sediment surface (from sand to clay), but will not decrease the overall sediment quality. The underlying sediments are virgin material of local origin.

Long-term adverse impacts to sediment quality may occur as a result of dredging the northern access channel and turning basin. These impacts are due to the potential for a change in sediment substrate as a result of dredging and future shoaling in the northern access channel and turning basin. However, sands dredged from the access channel are expected to be clean because they are not located near sources of anthropogenic contamination. Dredging sands from the borrow area may change the physical characteristics of the sediment surface (from

sand to clay), but will not change the overall sediment quality since the newly exposed strata will be underlying virgin material.

Southwestern Borrow Area Long-term adverse impacts to sediment quality may occur as a result of activities associated with dredging 91 acres of the southwestern borrow area. These impacts are similar to those described above for the northern access channel and turning basin. These impacts are because of the potential for a change in sediment substrate as a result of dredging and future shoaling in the southwestern borrow area. However, sands dredged from the southwestern borrow area are expected to be clean because they are not located near sources of anthropogenic contamination. Dredging sands from the borrow area may change the physical characteristics of the sediment surface (from sand to clay), but will not change the overall sediment quality since the newly exposed strata will be underlying virgin material

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Impacts associated with Alternative 2 are the same as discussed above for Alternative 1, although only 49 acres of the southwestern borrow area will be disturbed as part of Alternative 2 – no additional impacts to sediment quality are associated with dredging 49 acres of the southwestern borrow area for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to impacts discussed for Alternatives 1 and 2. However, the open-water embayment within Alternative 3 could become an area of localized sedimentation as a result of decreased water velocities and quiescent conditions. Sediment accumulation from ambient Bay water circulating within the open-water embayment is not anticipated to have an impact on the sediment quality because the fine-grained sediments carried by Bay currents are not typically from sources of anthropogenic contamination. In addition, no dredged material will be placed within the open-water embayment. Therefore, no significant impacts to sediment quality are anticipated as a result of Alternative 3.

Southwestern Borrow Area Impacts associated with Alternative 3 are similar to impacts discussed above for Alternatives 1 and 2, although only 19 acres of the southwestern borrow area will be disturbed as part of Alternative 3 – no additional impacts to sediment quality are associated with dredging 19 acres of the southwestern borrow area for Alternative 3.

No-Action Alternative

No additional beneficial or adverse impacts on the sediment quality in the vicinity of the PIERP are expected with the no-action alternative since activities associated with this alternative are equivalent to the existing conditions at the PIERP.

5.4.6 Aquatic Resources

5.4.6.a Plankton

Studies of the PIERP have indicated that phytoplankton biomass concentrations and zooplankton communities are within the normal range identified for the Mid-bay portion of the Chesapeake Bay.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Short-term, indirect impacts to phytoplankton and zooplankton communities are expected as a result of perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. No significant, adverse impacts from the lateral expansion are anticipated on the phytoplankton and zooplankton communities. Monitoring has shown that these communities have not been impacted by similar, ongoing operations at the PIERP.

Short-term increases in turbidity associated with construction and dredging activities, such as dike placement, could potentially suppress light penetration into the water column and could temporarily and locally depress phytoplankton communities. As a means of minimizing and containing turbidity, the stone toe of the armored section of the dike will be constructed before the sand dike section will be placed. This practice should reduce turbidity and minimize impacts to the phytoplankton and zooplankton communities.

During dredging activities, no significant increases in nutrient and chemical constituent concentrations are anticipated. Minor, localized increases in nutrient concentrations could potentially stimulate phytoplankton growth, but such nutrient increases are not expected to be significant because of low concentrations of nutrients released (MES, 2005a; 2004a; 2002). Tidal currents and wave action are expected to reduce these localized nutrient effects on the phytoplankton through exchange with nearby waters. Short-term, adverse impacts to phytoplankton are expected to be negligible, although there is the potential for additional releases of nutrients from spillways and subsequent algal blooms due to the longer period of operations associated with the lateral expansion. Phytoplankton and zooplankton could become physically entrained (caught) in sediment slurry during hydraulic dredging activities and construction and would be destroyed as a result. However, the potential impact would be localized and short term, and is considered negligible. As a result, zooplankton communities dependent on phytoplankton densities are not expected to be limited by food availability. Phytoplankton and zooplankton communities are widely distributed in the Mid-Bay region and are not a unique resource to the general Poplar Island area.

No additional, significant impacts to the phytoplankton and zooplankton communities are expected as a result of raising the existing upland cells. Water from the raised upland cells will runoff to the wetland cells and through the existing spillways to the Chesapeake Bay, once the vegetation in the wetland cells has matured and the habitat has been developed. Discharge from the spillways would continue to be controlled and monitored, and is required

to meet MDE water quality standards prior to discharge. Therefore, nutrient increases that could potentially stimulate phytoplankton blooms are not anticipated.

Southwestern Borrow Area Short-term, indirect impacts to phytoplankton and zooplankton communities are expected as a result of dredging 91 acres of the southwestern borrow area and are similar to the impacts discussed above.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Impacts associated with the lateral expansion and vertical expansion of existing uplands for Alternative 2 are identical to those discussed above in Alternative 1, although only 49 acres of the southwestern borrow area will be disturbed. Compared to Alternative 1, no additional impacts to phytoplankton and zooplankton are associated with dredging 49 acres of the southwestern borrow area for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Impacts to phytoplankton and zooplankton communities associated with the lateral expansion and vertical expansion of existing uplands for Alternative 3 are similar to those discussed for Alternatives 1 and 2. Compared to Alternatives 1 and 2, no additional impacts to phytoplankton and zooplankton are associated with dredging 19 acres of the southwestern borrow area for Alternative 3. Minor, localized increases in nutrient concentrations during dredging activities could potentially stimulate phytoplankton growth, but such nutrient increases are not expected to be significant because of low concentrations of nutrients released (MES, 2005a; 2004a; 2002). However, current engineering judgment indicates that circulation within the embayment is expected to be sufficient for flushing of the wetland cells. Therefore, tidal exchange and wave action is expected to reduce localized nutrient effects on the phytoplankton through exchange with nearby waters. Consequently, the short-term, adverse impacts to phytoplankton are expected to be negligible. The open-water embayment will be designed to maximize marsh edge and tidal channels to provide the greatest connection between the open water and marsh and to provide the greatest input of marsh production to enhance detrital concentrations (which provide a food source) and zooplankton productivity.

No-Action Alternative

No additional beneficial or adverse impacts to the phytoplankton and zooplankton communities are expected with the no-action alternative. Studies of the PIERP have indicated that phytoplankton biomass concentrations and zooplankton communities are within the normal range identified for the Mid-bay portion of the Chesapeake Bay.

5.4.6.b Fisheries The PIERP is located in the South Central Bay segment (MDNR waterbody code 027) of the Chesapeake Bay, and the area in the vicinity of the PIERP supports a diverse fish community, including many fish species that support valuable commercial and recreational fisheries.

Finfish – Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Direct, indirect, short-term, and long-term impacts to finfish are expected as a result of perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. Construction activities that directly disturb bottom substrates will have adverse impacts on finfish.

The shallows surrounding the PIERP provide habitat and feeding grounds for many species of finfish common throughout the Chesapeake Bay. The area between Poplar and Coaches Island (the notch), and the sampling locations within Poplar Harbor support a substantial number of commercially and recreationally important species, as well as forage species (EA, 2005a). The notch was the only location where juvenile red drum, an EFH species, was collected (see detailed discussion in Section 5.4.6.c). Existing conditions surveys confirmed that most species currently using the area are common in the Chesapeake Bay and typical of the Mid-Bay region (EA, 2005a).

The permanent loss of approximately 600 acres of open water habitat utilized by finfish species within the footprint of the lateral expansion is considered a significant, adverse impact. However, similar open water habitat is located adjacent to the lateral expansion for finfish utilization. Much of the open water in the vicinity of the PIERP is void of considerable amounts of cover items for finfish species, particularly SAV and viable oyster bars (although scattered SAV has been observed in Poplar Harbor and live oysters have been recovered in NOB 8-11). Pelagic fishes, such as menhaden and striped bass, and more mobile members of the demersal fish community, such as summer flounder, are expected to easily move out of or generally avoid the areas of construction during dredging activities. The finfish species that would be directly and adversely affected by the lateral expansion include the smaller, resident species with limited mobility such as gobies and blennies, and young fish using the area within the lateral expansion footprint for nursery grounds. Sedimentation from construction activities associated with the northern lateral expansion could have a short-term, adverse impact on less mobile and demersal finfish species, as discussed in more detail in Section 5.4.6.b, *Fisheries*. However, the depths and lack of habitat features in most of the Study Area would limit utilization by many of these less mobile species, so the impact is expected to be minimal.

Short-term and direct adverse impacts on the early life stages of some fish species, specifically during egg and larval stages, are expected as a result of dredging operations and the increased turbidity during pre-construction and construction activities. Adverse impacts to finfish populations could result from the entrainment of fish eggs and larvae during hydraulic dredging. However, the adverse impacts associated with entrainment are expected to affect only a small portion of the local fish community, and would be a short-term, localized impact. Suspended particles readily adhere to many of the fish eggs, making them less buoyant (in the case of pelagic eggs) or smothering them (in the case of demersal eggs). Fish species that have demersal eggs (i.e., silversides, gobies, and blennies) may be indirectly affected by the increased turbidity and siltation, and would be considered most sensitive to the expansion activities. Although impacts to fish eggs and larvae are expected to occur, fish eggs and larvae are widely dispersed in the Mid-Bay region and are not considered a resource

unique to Poplar Island nor are they expected to exist in higher concentrations surrounding the vicinity of Poplar Island than in other areas.

Suspended sediments could also indirectly affect finfish by impairing the ability to feed (by limiting sight and ability to detect prey) of some larval and juvenile fish, including striped bass that are dependent on vision to detect prey. Short-term increases in turbidity are expected to have a negligible effect on larger, more mobile members of the fish community that will likely avoid the areas of highest turbidity. However, these potentially impacted species are common regionally (with the exception of red drum), and any adverse impacts to finfish populations would be short-term and local. As a means of minimizing and containing turbidity, the stone toe of the armored section of the dike will be constructed before the sand dike section will be placed. This practice should reduce turbidity and minimize adverse impacts to finfish communities.

Long-term, adverse impacts to finfish are anticipated as a result of dredging 30 acres for the northern access channel and turning basin. If the northern access channel and turning basin are excavated below the pycnocline, hypoxic and/or anoxic conditions could also occur in the bottom waters – localized reductions in dissolved oxygen may occur during the summer months. However, the increase in depths of the southwestern borrow area following excavation may also have the potential to beneficially provide wintering habitat for resident finfish species.

Other important areas of cover include in-water refugia and physical habitat for finfish species found within the footprint of the lateral expansion are the created rock reefs and the exterior armor stone dike, although the reef and the stone structures are not naturally occurring in the Mid-Bay region. These areas were quickly colonized by finfish following construction of the PIERP and have been noted as important habitat for striped bass (among other species, as discussed in Section 3.1.6.f). One of the two existing northeastern rock reefs would be buried within the new expansion area, although the other northwestern rock reef would remain intact and available for finfish habitat. The existing rock reefs that are located within the lateral expansion will be relocated to an additional area in consultation with the appropriate resource agencies and commercial and recreational fisheries groups. Therefore, no cumulative losses to reef habitat for finfish would occur; habitat diversity within the relatively open, homogeneous flats in the vicinity of the PIERP would be created as a result. The construction of additional perimeter dikes for the lateral expansion is expected to provide additional cover for the same finfish species that currently utilize these habitats of the PIERP.

The shift from a predominantly aquatic habitat to an uplands/wetlands habitat is expected to result in changes within the fish community utilizing the open-water area following perimeter dike completion, particularly within and directly adjacent to the expansion. Initially (during construction and placement), finfish usage of the lateral expansion area by smaller fish will be limited because of the lack of refugia. Eventually (following construction and marsh development), finfish utilization is expected to shift to earlier lifestages and smaller species that commonly utilize marsh creeks and ponds. In addition, use of this area by adults of some of the larger species that utilize the deeper, northern areas around the expansion, observed during existing conditions investigations, will be restricted. Finfish species composition in

the waters surrounding the expansion is not expected to change significantly in the long-term. Monitoring studies conducted during pre- and post-construction of the PIERP (NOAA, 2003 and 2001) have indicated that nearly identical finfish species compositions occur before and after placement activities. These results indicate that finfish populations will likely return to pre-construction levels after construction and placement of the lateral expansion.

Long-term, beneficial impacts to finfish are anticipated from the lateral expansion. Construction of the lateral expansion is expected to provide Poplar Harbor with additional protection from wind-driven waves, increasing the potential for SAV establishment. SAV is an important nursery ground and area of cover for finfish species. In addition, the marsh habitat created in the lateral expansion will support a wide variety of forage species and provide alternate forage for finfish species.

Southwestern Borrow Area Seasonal finfish studies (EA, 2005a) indicated that the diversity and abundance of finfish sampled by gillnet in the southwestern borrow area were among the highest of the areas surveyed, most likely because of deeper water and submerged rock pilings in the area. Minor additional impacts to finfish are expected as a result of sand borrow excavation in the southwestern borrow areas. Approximately 91 acres of bottom habitat in the southwestern borrow area will be disturbed as part of raising the existing upland cells. Pelagic fishes are expected to easily move out of or generally avoid the areas of construction during dredging activities. The excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. However, this may have a minor, localized impact on fish usage of this area in warmer months when oxygen depletion is most prevalent. Additionally, if the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters, decreasing the habitat value for the finfish species once dredging is complete. However, the increase in depths of the southwestern borrow area following excavation may also have the potential to beneficially provide wintering habitat for resident finfish species.

Finfish – Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, minor impacts to finfish are expected from dredging 49 acres of the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 2. Less total borrow area will be required for Alternative 2 (49 acres) compared to Alternative 1 (91 acres).

Finfish – Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Similar to the discussions above for Alternatives 1 and 2, direct, indirect, and short-term impacts to finfish are expected as a result of the northern lateral alignment proposed as part of Alternative 3.

The size of the open-water embayment for the proposed Alternative 3 is approximately 130 acres in size and, which would permanently impact 470 acres of open-water and Bay bottom habitat. However, the open-water embayment will reduce the footprint of the northern lateral expansion compared to Alternatives 1 and 2 by 130 acres, conserving the open-water and Bay bottom habitat within the embayment. No dredged material will be placed in the open-water embayment and the bottom of the embayment will not be disturbed by construction activities. The permanent loss of approximately 470 acres of open water habitat utilized by finfish species within the footprint of the lateral expansion is considered a significant, adverse impact, as is the loss of 600 acres of open-water habitat for Alternatives 1 and 2. As stated above for Alternatives 1 and 2, pelagic fishes, such as menhaden and striped bass, and more mobile members of the demersal fish community, such as summer flounder, are expected to easily move out of or generally avoid the areas of construction during dredging activities. The finfish species that would be directly and adversely affected by the lateral expansion include the smaller, resident species with limited mobility, such as gobies and blennies, and young fish using the area within the lateral expansion footprint for nursery grounds.

Similar to Alternatives 1 and 2, short-term and indirect adverse impacts because of sedimentation on the early life stages of some fish species, specifically during egg and larval stages, are anticipated as a result of dredging operations and the increased turbidity during pre-construction and construction activities.

To protect the open-water embayment, segmented breakwaters would replace a portion of the western perimeter dike. As currently designed, the breakwater segments are expected to be approximately 200 feet long and will be separated by approximately 50 feet of open water, with a few large openings to allow access and adequate openings into the open-water embayment, which would facilitate fish utilization of the area. In addition, several small subtidal artificial reefs will be included within the open-water embayment to provide additional refugia and physical habitat for finfish species. The proposed avian nesting islands will also potentially provide underwater habitat and refugia within the open-water embayment. The existing northeastern artificial reef habitat that lies within the footprint of the northern lateral expansion will be encompassed into the expansion. This reef habitat will be replaced following construction activities and relocated to an additional area in consultation with appropriate resource agencies. This relocated rock reef will provide comparable submerged habitat to finfish species.

Long-term, beneficial impacts to finfish are anticipated from the lateral expansion.
With the incorporation of embayment and reef structures, the exchange and interaction between wetland cells and open water could particularly benefit juvenile finfish species such as Atlantic silverside and would support juvenile blue crabs. Created fish habitat would include the submerged rock reefs and the avian nesting islands within the open-water embayment and the stone breakwater structure. These structures would provide predatory habitat for the finfish species and would diversify the habitat of the existing, relatively flat and even bathymetry in the vicinity. The conservation of the original bottom substrate within the embayment would also provide foraging habitat for bottom-feeding finfish species. The 130-acre open-water embayment should also create quiescent conditions that could potentially

support additional SAV beds along the shoreline preferred by finfish species, including EFH species.

Finally, the open-water embayment would provide more diverse habitat types for finfish species within the northern lateral expansion including deep and shallow subtidal zones, an open water pelagic zone, mudflat habitat, tidal guts throughout the wetland cells, submerged reef habitat, and rock reef habitat.

Southwestern Borrow Area Impacts are similar to those expected for Alternatives 1 and 2 – no additional impacts to finfish are expected from dredging the southwestern borrow area, although only 19 acres will be impacted from this alternative compared to 91 acres for Alternative 1 and 49 acres for Alternative 2. As stated above for Alternatives 1 and 2, the excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, which may have a minor, localized impact on fish usage of this area in warmer months when oxygen depletion is most prevalent, although some gradual shoaling may occur in this area.

Finfish – No-Action Alternative

The no-action alternative will not have any additional adverse impacts on finfish – smaller, resident species with limited mobility and young fish using the area within the lateral expansion footprint for nursery grounds will not be lost within the footprint of the lateral expansion or the southwestern borrow area. The no-action alternative will not provide additional beneficial impacts to finfish in the vicinity of the PIERP due to the created wetlands and tidal gut as part of the lateral expansion, including providing valuable nursery and refuge area for a variety of finfish species. Poplar Harbor and areas located adjacent to the PIERP rock dike and rock reefs will continue to be utilized by finfish species, although no additional protection will be afforded to Poplar Harbor or Jefferson Island.

5.4.6.c Essential Fish Habitat (EFH) Pursuant to Section 305 (b)(2) of the Magnuson-Stevens Fishery Conservation & Management Act (MSFCMA), the USACE prepared an EFH Assessment for the proposed action (Alternative 3) that occur within coastal waters of the United States (Appendix D). The detailed EFH Assessment includes the following components: a description of the proposed action, a listing of the life stages of all species with EFH designated in the project area, an analysis of the effects of the proposed action, and the Federal agency's opinions regarding the effects of the proposed action.

Based on agency coordination with John Nichols at NMFS, it was determined that the area for the proposed expansion lies within waters designated as EFH for the following species and their life stages: juvenile and adult summer flounder, adult and juvenile bluefish, and red drum (Appendix D). Both adult and juvenile summer flounder, juvenile bluefish, and juvenile red drum were collected in the vicinity of the PIERP during seasonal finfish surveys conducted in 2004 (EA, 2005a). HAPC was identified in Poplar Harbor associated with juvenile and adult summer flounder and juvenile red drum because small beds of SAV have been observed in this area (USFWS, 2004a).

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Construction, dredging, and site operations activities associated with the lateral expansion are expected to cause the permanent loss of approximately 600 acres of EFH through long-term and direct impacts. In addition to EFH, approximately 300 acres of shallow water habitat (SWH) and Tier II/III SAV habitat (Section 3.1.6.e) are located within the Study Area (1,080 acres), which includes the adjacent open-water habitat outside of Alternative 1. SWH is defined as areas with depths less than 2 meters deep (6.5 ft). However, because the footprint of the conceptual alignment will be approximately 600 acres, only approximately 100 acres of SWH are located within the footprint. Shallow-water habitat is discussed in more detail in Section 5.4.6.g.

The following paragraphs describe specific impacts to individual EFH species, EFH habitat, and prey consumed by EFH species.

Impacts to Individual Fish of each EFH Species

Because they are considered good swimmers and can easily avoid construction activities, direct impacts to bluefish (juvenile and adult), red drum, and summer flounder (juvenile and adult) are unlikely, even if construction occurs during warmer months. During colder weather months, individuals of these species are unlikely to be present, thus no impacts would be expected at those times of the year.

Impacts to EFH Habitat

Construction of the lateral expansion have a long-term, direct impact on EFH habitat by causing the loss of approximately 600 acres of open water habitat utilized by bluefish, red drum, and summer flounder. Most of the Study Area for the expansion is sandy substrate, which is a preferred habitat for summer flounder, but is not considered HAPC. However, sandy substrates are predominant along the shoreline in much of this reach of the Bay (Bay Bridge to the Smith Island) and the expansion acreage is small and not unique relative to the overall acreages of sandy bottom in the Mid-Bay region.

Construction of the northern lateral expansion is not expected to directly impact SAV (currently exists in Poplar Harbor only – no construction will occur in the harbor), which is HAPC for juvenile red drum and juvenile and adult summer flounder, since SAV is absent from within the northeast expansion project area. The northern expansion is expected to protect and promote growth of SAV beds within Poplar Harbor by providing protection from wind-driven waves from the west-northwest. Construction of the expansion would cause the permanent loss of approximately 100 acres of Tier II SAV recovery habitat (SWH less than 6.5 feet deep) (Figure 5-8). However, it is unknown whether SAV would reoccupy this area in the foreseeable future if the project was not constructed anyway because of regionally impaired water clarity.

All juvenile red drum collected in the vicinity of Poplar Island during recent surveys were collected from the tideway ("notch") between the existing project and Coaches Island, presumably because the close proximity of SAV and marsh makes this desirable habitat. No construction or dredging activities are proposed for this portion of Poplar Island as part of the

expansion project. The marshes and tidal creeks created as part of the expansion project are expected to increase the abundance of SAV within Poplar Harbor, and provide habitat for bluefish, red drum, and summer flounder. The provision of these habitats by the project would likely compensate somewhat for loss of open water habitat.

Long-term, adverse impacts to EFH are anticipated as a result of dredging 30 acres for the northern access channel and turning basin. If the northern access channel and turning basin are excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters – localized reductions in dissolved oxygen may occur during the summer months. However, the increase in depths of the northern access channel and turning basin following excavation may also have the potential to beneficially provide wintering habitat for EFH species.

Impacts to Prey Consumed by EFH Species

The permanent reduction of open water and benthic communities caused by construction of the northern lateral expansion will reduce biomass available for consumption by finfish species. Bluefish and red drum prey occur throughout the water column over a broad area of the Chesapeake Bay, so impacts to individual prey species, bluefish, and red drum populations are expected to be negligible. Impacts to prey would be of greatest concern for summer flounder since they are bottom feeders and a loss of their preferred habitat would occur as a result of the project. However, prey consumed by summer flounder occur over a broad area of the Chesapeake Bay, and populations of prey species are expected to remain regionally healthy because of the availability of these lost habitats elsewhere in region. Thus, adverse impacts to prey consumed by summer flounder population are not expected.

Creation of wetlands, including the 25-acre tidal gut, in the lateral expansion and the expected development of SAV in Poplar Harbor will support a wide variety of bluefish, red drum, and summer flounder forage species and partially compensate for the loss of EFH.

Southwestern Borrow Area

Impacts to Individual Fish of each EFH Species

Bluefish, red drum, and summer flounder could be within waters of the southwestern borrow area during dredging in warmer months, however direct impacts to individuals are not expected because juveniles and adults of these species are strong swimmers and can easily avoid destruction. If construction occurs during colder weather months, individuals of these species would be unlikely to be present, thus no impacts would be expected at those times of year.

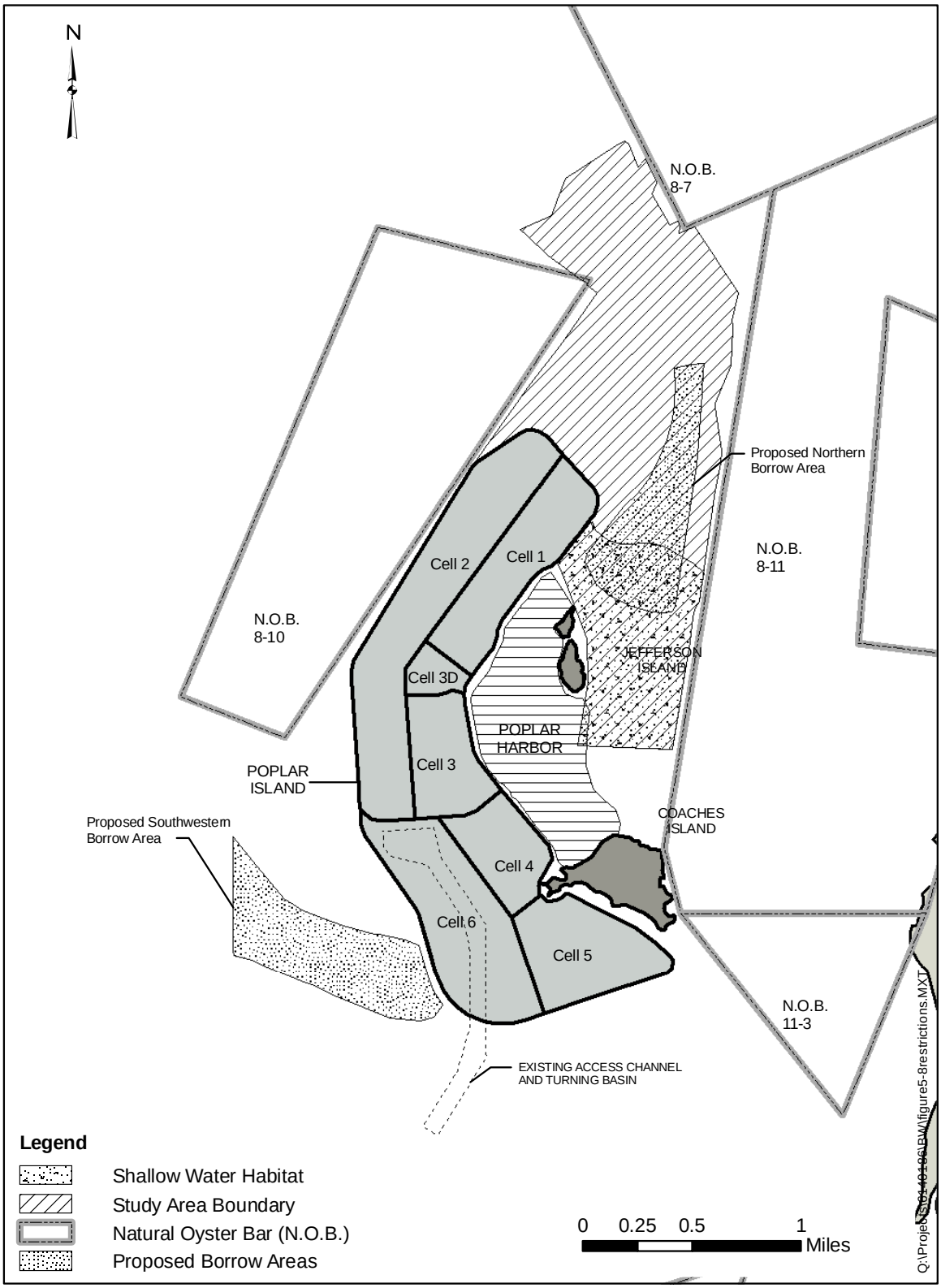


Figure 5-8. Shallow Water Habitat (SWH) within the Study Area

Impacts to EFH Habitat

Short-term and long-term impacts to EFH species may occur as a result of dredging the southwestern borrow area. Approximately 91 acres of bottom habitat at the southwestern borrow area will be disturbed as part of the expansion activities. Dredging the southwestern borrow area would directly disturb bottom habitat and increase the depth of existing open water habitat to approximately –25 ft MLLW, although some gradual shoaling may occur in this area. Following dredging, the borrow area would have a surface grade similar to existing conditions, but water depths may increase an average of approximately 10 ft across the bottom. The total extent of the bottom footprint that will be directly impacted during the proposed sand dredging in the southwestern borrow area will not be known until the project dredging plan is submitted and approved by appropriate resource agencies. These changes would be expected to have minimal impacts on bluefish or red drum because these species are not obligate bottom species. Parts of the southwestern borrow areas that are dredged to –18 feet or greater have the potential to become hypoxic or anoxic in warmer months of years when impaired water quality problems are pervasive below the pycnocline in the Chesapeake Bay. Under these conditions, bottom habitat in the southwestern borrow area would be unsuitable as habitat for summer flounder, and they would be expected to avoid this area. This temporary loss of habitat would not be expected to adversely impact summer flounder populations because of the abundance of suitable habitat remaining in other areas of the Chesapeake Bay.

Dredging the southwestern borrow area is not expected to directly impact SAV, since SAV is absent from this area because the borrow area is too deep to support SAV. Therefore, no direct impacts to summer flounder HAPC are anticipated with activities associated with the southwestern borrow area. Deepening of waters and bottom disturbance from dredging of the southwestern borrow area would not directly impact SAV because of the absence of SAV from this area. The deeper, existing water depths preclude consideration of this area as SAV recovery habitat, thus no loss of future SAV habitat would occur.

As stated above, following dredging activities, the southwestern borrow area would have a surface grade similar to existing conditions, but water depths may increase an average of approximately 10 ft across the bottom. Although a substantial volume of sand would be removed in the southwestern borrow area and some underlying clays may be exposed locally, dredging would likely leave the majority of the area retaining a sandy substrate, although this would ultimately be dependent upon the depth of dredging. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although this depth may change once the final dredging plan is submitted for approval, and gradual shoaling may occur in this area. However, the subsequent reworking of sand by natural processes in the southwestern borrow area would likely reduce the area of exposed clays. Increases in exposed clay substrate would reduce habitat quality of the area for summer flounder, which prefer a sand substrate habitat.

Impacts to Prey Consumed by EFH Species

The temporary loss of benthic communities in the southwestern borrow area will reduce biomass available for consumption by EFH species. However, forage fish and invertebrates consumed by summer flounder, bluefish, and red drum occur over a broad area of the

Chesapeake Bay, so impacts to any individual prey species are expected to be minimal. In addition, the southwestern borrow area will likely recover a benthic community comparable to pre-project conditions within several years following cessation of dredging, as is typical of benthos occurring on sands and fine mobile estuarine deposits (Newell, 1998). Parts of the southwestern borrow area left at depths below the pycnocline following dredging have the potential to lose their benthic macroinvertebrate communities in the future if hypoxic or anoxic conditions occur for prolonged periods of time.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, short-term impacts to EFH species may occur due to dredging 49 acres of the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Similar to Alternatives 1 and 2, construction, dredging, and site operations activities associated with Alternative 3 are expected to cause the loss approximately 470 acres of EFH through long-term and direct impacts and approximately 100 acres of SWH are located within the footprint. The open-water embayment will, however, reduce the footprint of disturbance and conserve both open-water and Bay bottom habitat by approximately 130 acres. When construction is complete, it is anticipated that the embayment will provide a necessary trophic link between the wetland cells and the open water habitat that will benefit EFH species. As currently designed, a small tidal gut will be incorporated in the southwest portion of the expansion to provide necessary tidal access to existing Cell 1. The preliminary, proposed tidal gut is approximately 200 to 250 feet wide, and will be designed to have features comparable to the tidal gut separating the southern portion of the existing project and Coaches Island. The open-water embayment will provide diversity of habitat types for the project including deep and shallow subtidal zones, an open water pelagic zone, mudflat habitat, tidal guts throughout the wetland cells, submerged reef habitat, and rock reef habitat. These enhancements should partially offset the loss of 470 acres of EFH.

The following paragraphs describe specific impacts to individual EFH species, EFH habitat, and prey consumed by EFH species.

Impacts to Individual Fish of each EFH Species

Similar to Alternatives 1 and 2, because they are considered good swimmers and can easily avoid construction activities, direct impacts to bluefish (juvenile and adult), red drum, and summer flounder (juvenile and adult) are unlikely, even if construction occurs during warmer months. During colder weather months, individuals of these species are unlikely to be present, thus no impacts would be expected at those times of the year.

Impacts to EFH Habitat

Construction of the proposed Alternative 3 have a long-term, direct impact on EFH habitat by causing the permanent loss of approximately 470 acres of open water habitat utilized by bluefish, red drum, and summer flounder. Similar to Alternatives 1 and 2, construction of the proposed Alternative 3 is not expected to directly impact SAV (currently exists in Poplar Harbor only), which is HAPC for juvenile red drum and juvenile and adult summer flounder, because SAV is absent from within the northeast expansion project area. The proposed Alternative 3 is expected to protect and promote growth of SAV beds within Poplar Harbor and within the 130-acre open-water embayment along the shorelines by creating quiescent conditions that could potentially support additional SAV beds and HAPC preferred by both adult and juvenile summer flounder. Construction of the proposed Alternative 3 will cause the permanent loss of approximately 100 acres of Tier II SAV recovery habitat (SWH less than 6.5 feet deep) (Figure 5-8).

Long-term, adverse impacts to EFH are anticipated as a result of dredging 30 acres for the northern access channel and turning basin. If the northern access channel and turning basin are excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters – localized reductions in dissolved oxygen may occur during the summer months. However, the increase in depths of the northern access channel and turning basin following excavation may also have the potential to beneficially provide wintering habitat for EFH species.

Juvenile summer flounder, juvenile bluefish, and juvenile red drum utilize salt marsh gut habitat, which will be created as part of the northern lateral expansion. It is anticipated that a direct trophic link between the open-water embayment and the proposed wetland cells will be created and will be utilized by summer flounder as part of the proposed Alternative 3. The open-water embayment will provide access to the small tributaries and tidal guts in the wetland cells for juvenile EFH species, Atlantic silversides, and juvenile blue crabs. This habitat enhancement and the resulting forage access are expected to partially compensate for the proposed conversion of open-water and benthic habitats to island habitat.

Finally, the open-water embayment would also provide more diverse habitat types for EFH species within the northern lateral expansion including deep and shallow subtidal zones, an open water pelagic zone, mudflat habitat, tidal guts throughout the wetland cells, submerged reef habitat, and rock reef habitat.

Impacts to Prey Consumed by EFH Species

The permanent reduction of 470 acres of open water and benthic communities caused by the construction of the northern lateral expansion will reduce biomass available for consumption by finfish species. For Alternative 3, it is anticipated that a direct trophic link between the open-water embayment and the proposed wetland cells will be created and will be beneficial to all three EFH species within the project area. The marshes and tidal guts created as part of the expansion project will also support a wide variety of forage species consumed by both bluefish and red drum. The habitat in the created wetland cells will export both detritus and micronutrients via the tributaries and tidal guts into the open-water embayment, thus enhancing the existing benthic community within the open-water embayment. Because 130

acres of open water will be conserved and not disturbed as part of the northern lateral expansion, it is expected that the existing benthic community (which is currently dominated by a single species of suspension feeder) will eventually become both more stable and more diverse as a result of the detrital inputs from the adjacent wetlands cells, thus providing more forage opportunities for EFH species.

Southwestern Borrow Area Similar to Alternatives 1 and 2, short-term and long-term impacts to EFH species may occur because of dredging in the southwestern borrow, although only 19 acres would be impacted as a result of Alternative 3, compared to 91 acres for Alternative 1 and 49 acres for Alternative 2.

No-Action Alternative

The no-action alternative will have no additional impacts on EFH in the vicinity of the PIERP. No additional EFH will be taken as a result of the no-action alternative. Habitat designated as EFH, SWH, and Tier II/III SAV habitat identified in Poplar Harbor and areas located adjacent to the PIERP will continue to be utilized by finfish species but will not be afforded the additional protection that would be provided by the lateral expansion. The no-action alternative will not provide additional beneficial impacts to EFH species in the vicinity of the PIERP due to the created wetlands and tidal gut as part of the lateral expansion. Once completed, wetland areas and tidal gut created as part of the expansion could provide valuable nursery and refuge area for EFH species such as red drum. Poplar Harbor and areas located adjacent to the PIERP rock dike and rock reefs will continue to be utilized by EFH species.

5.4.6.d Benthic and Epibenthic Invertebrates In comparison to similar areas throughout the Chesapeake Bay, the benthic habitat surrounding the PIERP supports fewer benthic taxa and lower diversity (EA, 2002e). The benthic habitat in the vicinity of the PIERP is not rare given the extent of the benthic habitat throughout the Mid-Bay region. Prior to construction of the PIERP in 1996, and following construction and placement in studies conducted in 2000, 2001, 2002, and 2004, the benthic community in the vicinity of Poplar Island was characterized as having low diversity but high abundance (USACE/MPA 1996; EA 2005a). A general discussion of impacts to the benthic community, including shellfish (oysters and clams) and blue crabs is included in the following paragraphs.

Benthic Community – Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Permanent long-term and short-term impacts to the benthic community are anticipated for Alternative 1. A permanent impact on the benthic community in the vicinity of the PIERP is expected as a result of the perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel and sand borrow excavation. Any existing benthic communities within the footprint or within the access channel will be permanently lost during construction and dredging activities. It is anticipated that the expansion will result in the permanent loss of approximately 600 acres of benthic habitat and non-mobile benthic organisms. All benthos located within the containment dikes will be buried under dredged material.

The creation of tidal wetland habitat construction within the expansion area is likely to include the creation of some intertidal benthos, although these tidal wetlands will probably not support same benthos as open water substrates habitat. However, it is assumed that the creation of wetland habitat will not be comparable to the amount of permanently lost habitat because the wetland will be higher in elevation, and therefore inappropriate for the species that currently inhabit the benthic area surrounding the PIERP (USACE/MPA, 1996). Epibenthic colonization of the exterior perimeter dike constructed for the lateral expansion will offset some loss of benthic habitat, and the benthic communities adjacent to the lateral expansion and within the access channels are expected to recover and repopulate once construction is complete. In addition, the natural substrate bottom within the constructed tidal gut is expected to also provide some additional benthic habitat.

Short-term, localized impacts to the benthic community that inhabit the exterior footprint are also expected from the turbidity plumes and siltation resulting from the dredging and construction. Sedimentation from construction activities associated with the northern lateral expansion could have a short-term, adverse impact on the benthic community as discussed in more detail in the oyster section below. Because benthic invertebrates have limited mobility the benthos would not be able to move to adjacent areas to avoid burial from sediment plumes. However, benthos have the ability to survive limited sedimentation impacts if the occurrence is not on a regular basis.

No additional impacts to the benthic community are anticipated for the vertical expansion of the existing upland cells and no significant impact on the benthic community in the vicinity of the PIERP is expected during the site operations of the lateral expansion. Once the construction of the perimeter dikes and the dredging of the access channel are completed, the benthic communities adjacent to the expansion will begin to recover, and epibenthic communities will begin to colonize the exterior dike face. Post-placement monitoring of the benthic and epibenthic communities in the vicinity of the PIERP have not indicated significant changes in the composition, abundance, or diversity of the benthic communities compared to pre-construction conditions (EA, 2004b). The recovery time of benthic communities following disturbance is dependent on environmental conditions, the level of disturbance, and water depth (Newell *et al*., 1998). Benthic communities in the Chesapeake Bay are generally well adapted to rapid recolonization of sediment that is subject to frequent disturbance because of the constant physical and chemical perturbations associated with a shallow-water estuary (Newell *et al*., 1998). In estuarine environments characterized by fine sediments, rates of recovery of disturbed benthic communities is estimated to take approximately six to eight months, whereas areas characterized by course grain sediments including sand and gravel may take approximately two to three years to fully recover (Newell *et al*., 1998).

Both short-term and long-term, adverse impacts to the benthic community are anticipated as a result of dredging 30 acres for the northern access channel and turning basin. Short-term impacts will occur through the loss of 30 acres of benthic habitat. In addition, if the northern access channel and turning basin are excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters – localized reductions in dissolved oxygen may occur during the summer months. Long-term impacts to the benthic community associated

with the increase in water depth and change to the bathymetry and substrates may also occur in the northern access channel and turning basin. The increase in the water depth of this area and the potential exposure of some clay in the northern access channel and turning basin could result in the recolonization of a different type of benthic community.

Southwestern Borrow Area Short-term, localized impacts to the benthic community exterior footprint are expected from the turbidity plumes and siltation resulting from the dredging and of the southwestern borrow area. Long-term impacts associated with the increase in water depth and change to bathymetry would also occur in the southwestern borrow area. Benthic invertebrates have limited mobility and will not be able to move to adjacent areas to avoid burial from sediment plumes. However, benthos have the ability to survive limited sedimentation impacts if the occurrence is not on a regular basis.

Additionally, approximately 91 acres of bottom habitat at the southwestern borrow area will be disturbed and the benthos will be removed during dredging as part of the proposed expansion activities. A short-term impact to the benthic community is expected from the dredging in the southwestern borrow area. Long-term impacts from dredging in the southwestern borrow area are expected since dredging will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. The increase in the water depth of this area and the potential exposure of some clay in the southwestern borrow area could result in the recolonization of a different type of benthic community. Although a substantial volume of sand would be removed from the southwestern borrow area and underlying clays may be exposed locally, dredging would likely leave the majority of the area retaining a sandy substrate, similar to existing conditions. In addition, subsequent reworking of sand by natural processes would likely reduce the area of exposed clays. Dredging the southwestern borrow area could potentially have an impact on benthic species recolonizing the area. Additionally, if the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters, thus decreasing the habitat value for benthos once dredging is complete. Localized reductions in dissolved oxygen may occur during the summer months and impact the benthic community, but the Study Area for the dredging and construction activities is well-mixed. However, while the species composition may change and be temporarily impacted by lowered dissolved oxygen, the benthic community is expected to repopulate the area disturbed as a result of the sand borrow excavation. Benthic communities in the Chesapeake Bay are generally well adapted to rapid recolonization of sediment that is subject to frequent disturbance, as discussed above in the previous paragraphs (Newell *et al*., 1998).

Benthic Community – Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, short-term impacts to benthic species may occur due to dredging southwestern borrow area, although only 49 acres will be disturbed due to the lateral and vertical expansion activities of Alternative 2.

Benthic Community – Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands It is anticipated that the northern lateral expansion will result in the loss of approximately 470 acres of benthic habitat and non-mobile benthic organisms (compared to 600 acres for Alternatives 1 and 2). The most notable difference in benthic impacts compared to Alternatives 1 and 2 is that approximately 130 acres of bottom habitat within the northern lateral expansion footprint would be conserved and would not be permanently altered. No dredged material would be placed in the open-water embayment, thus preserving the existing substrate, benthic community, and natural bathymetry. Therefore, up to 130 acres of bottom habitat would not be directly or adversely impacted, but would be protected within an open-water embayment with stone breakwater structures.

In addition, the habitat in the created wetland cells for Alternative 3 will export both detritus and micronutrients via the tributaries and tidal guts into the open-water embayment, thus potentially enhancing the existing benthic community within the open-water embayment. As stated above for Alternative 1, the creation of tidal wetland habitat construction within the expansion area is likely to include the creation of some intertidal benthos, although these tidal wetlands will probably not support same benthos as open water substrates habitat. Because 130 acres of open water will be conserved and not disturbed as part of the northern lateral expansion, it is expected that the existing benthic community (which is currently dominated by a single species of suspension feeder) will eventually become both more stable and more diverse as a result of the detritus inputs from the adjacent wetlands cells.

For Alternative 1, both short-term and long-term, adverse impacts to the benthic community are anticipated as a result of dredging 30 acres for the northern access channel and turning basin. Short-term impacts will occur through the loss of 30 acres of benthic habitat. In addition, if the northern access channel and turning basin are excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters – localized reductions in dissolved oxygen may occur during the summer months. Long-term impacts to the benthic community associated with the increase in water depth and change to the bathymetry and substrates would also occur in the northern access channel and turning basin. The increase in the water depth of this area and the potential exposure of some clay in the northern access channel and turning basin could result in the recolonization of a different type of benthic community.

Southwestern Borrow Area Similar to Alternative 1, short-term and long-term impacts to benthic species may occur because of dredging in the southwestern borrow area, although only 19 acres will be disturbed as a result of Alternative 3, compared to 91 acres disturbed for Alternative 1 and 49 acres disturbed for Alternative 2.

Benthic Community – No-Action Alternative

No additional significant impacts on the benthic community in the vicinity of the PIERP are expected with the no-action alternative – benthos within the lateral expansion footprint will not be lost within the footprint of the lateral expansion or the southwestern borrow area. Post-placement monitoring of the benthic and epibenthic communities in the vicinity of the PIERP have not indicated significant changes in the composition, abundance, or diversity of the benthic communities (EA, 2004b). The perimeter rock dikes along the PIERP and rock reefs in the northeast and northwest will not be disturbed by the no-action alternative and will continue to be utilized by the benthic community. The no-action alternative will not provide additional beneficial impacts to the benthic species in the vicinity of the PIERP due to the created wetlands and tidal gut as part of the lateral expansion.

Oysters – Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Short-term, direct impacts to NOBs are expected from perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. The four NOBs in the vicinity of the PIERP (NOBs 8-10, 8-7, 8-11, and 11-3) are outside of the Study Area. An area of NOB 8-11 (located to the northeast of the PIERP) is considered a productive oyster bar because of the volume of oysters recovered during a December 2004, MDNR survey (Tarnowski MDNR, 2005). These locations have not been quantified at a detailed level, and therefore, the number of live oysters at NOB 8-11 could be greater than the results the survey presented. Additionally, NOB 11-3 might also support live and viable oysters, but this NOB was not included in the MDNR survey.

The lateral expansion was designed to specifically minimize impacts to the adjacent NOBs, although short-term impacts to NOBs may occur. The primary short-term impact on NOBs is expected to be an increase in water column turbidity in the construction and dredging areas. A shellfish bed sedimentation study of NOB 8-10 indicated that some minor sedimentation occurred over NOB 8-10 following construction activities at the PIERP (Halka and Ortt, 2002a). This sedimentation cannot be definitively linked to construction, but the proximity of the sandy sediment to the dike suggests that the sedimentation was related to construction activities. Similar impacts to NOBs 8-10, 8-11, and 8-7 could potentially occur as a result of the expansion activities. Sedimentation on NOBs could reduce the potential for spat to adhere to the existing oyster bars and thus decrease potential for live oyster recovery. However, as a means of minimizing and containing turbidity, the stone toe of the armored section of the dike will be constructed before the sand dike section will be placed.

Sedimentation modeling is currently underway and the results will be used to modify and minimize the potential construction and site operations impacts to the NOBs. Potential modifications could include using the toe dike feature to contain sediment (as discussed above), similar to the effective practices employed during the Phase I and Phase II construction of the PIERP. During construction of the PIERP, NOB 8-10 was located approximately 100 ft from Phase I activities. Because the lateral alignment for the expansion has increased that distance to about 300 ft, the potential for sedimentation on the NOB has decreased. If the modeling indicates that more severe conditions (higher wave or current

energy) would be expected, the distance that the toe dike needs to be completed ahead of the fill placement could be extended to dissipate more of the energy.

Increased levels of turbidity associated with project construction have the potential to disrupt the oyster beds, and the footprint of the lateral expansion has been designed to minimize impacts to nearby oyster beds. Time of year (TOY) restrictions on construction will be in place during perimeter dike construction and dredging of the northern access channels and sand borrow area to minimize impacts to the oyster bars (Figure 5-9). Coordination with MDNR and NMFS will be ongoing to ensure that minimal, adverse impacts to the NOBs occur as a result of the proposed expansion activities.

Based on agency coordination with MDNR, TOY oyster restrictions associated with the lateral expansion would include dredging restrictions within a 500 yard buffer area adjacent to an NOB (Appendix C, Table C-3). Specifically, TOY restrictions would include no hydraulic dredging within 500 yards of an NOB boundary during the period 1 June through 30 September of any year, and no mechanical dredging within 500 yards of an NOB boundary during the periods 16 December through 14 March and 1 June through 30 September of any year (Limpert MDNR, 2004a) (Figure 5-9). The dredging for the northern access channel will be subject to both mechanical and hydraulic TOY restrictions. However, because the toe-dike will be constructed as part of the lateral expansion and will serve as containment, mechanical dredging restrictions will not be required during the construction of the perimeter dike.

Hydraulic TOY restrictions during perimeter dike construction will be required if construction is located within 500 yards of an NOB (Mendelsohn USACE, 2004). The proposed offloading facility planned for the lateral expansion will also be subject to hydraulic dredging TOY restrictions regarding the use of Chesapeake Bay water to slurry the dredged material to pump and place into the site. The offloading site is located within 500 yards of the NOB boundary and the pumping of Chesapeake Bay water has the potential to entrain oyster larvae, similar to the effects from a hydraulic dredging operation (Limpert MDNR, 2004b).

The Study Area that was evaluated was approximately 1,080 acres. It is anticipated that Alternative 1 will be approximately half that size, approximately 575 acres. However, impacts are assessed from the end of the toe dike, resulting in a footprint approximately 600 acres in size. Currently, the toe dike of the northeastern portion of the PIERP is located approximately 130 ft (43 yd) from NOB 8-10. The shortest distance between the toe of the dike for the northern lateral expansion and adjacent oyster bar (NOB 8-11) is approximately 117 yd. The toe of the dike of the northern alignment is approximately 143 yd from NOB 8-7, 142 yd from 8-10, and 117 yd from NOB 8-11. The northern alignment is also located to the north of NOB 11-3. The proposed northern access channel is located adjacent to NOBs 8-7 and 8-10 (approximately 215 to 290 yd).

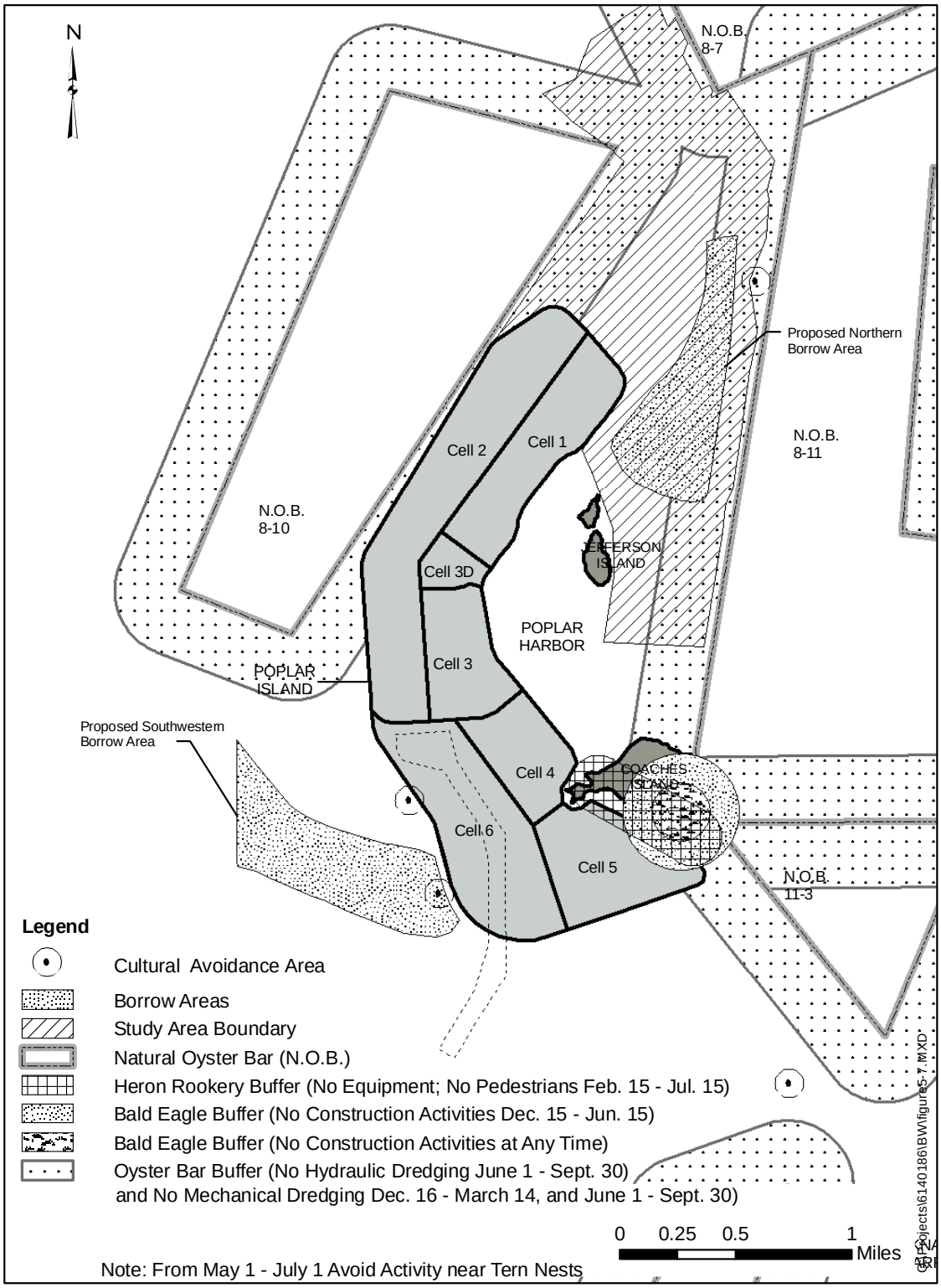


Figure 5-9. Environmental Restrictions Proposed for the Poplar Island Expansion

The sequence of the perimeter dike construction for the lateral expansion will be sequenced to honor TOY restrictions on NOBs and will be designed to reduce sedimentation and larval entrainment impacts to the NOBs (Figure 5-9). Because the available distance between the two NOBs (NOB 8-7 and 8-10) on either side of the proposed access channel is less than 1,000 yards, it is not possible to completely avoid the restricted area (500 yd buffer) because the two oyster bars are less than 1,000 yards apart. Therefore, the channel has been configured to optimize borrow sources. The potential for oyster entrainment as a result of dredging activities may occur because of the pelagic, passively drifting nature of oyster larvae (Reine and Clarke, 1998), although the TOY oyster restrictions should reduce the potential for any entrainment. Because dredging operations entrain a very small portion of the total water volume flowing past the dredge and considering that larval oysters suffer a high mortality rate naturally (over 99.9 percent), the effects of entrainment during non-spawning oyster seasons is not a significant impact (Reine and Clarke, 1998).

Dredged material placement using the offloading facility for the lateral alignment will be restricted from 1 June to 30 August (the TOY oyster restriction for hydraulic dredging) because of potential entrainment of oyster larvae in the water pumped from the Chesapeake Bay to slurry the dredged material for placement. No dredged material placement will take place during this time period. At least 50 percent of the northern borrow area is within 500 yards of the eastern NOB 8-11 boundary. Therefore, the timing of sand borrow excavation will be restricted by the TOY NOB hydraulic dredging restrictions, and the material will be stockpiled so that mechanical placement of dike fill materials can occur when necessary. Initial project construction would be dependent on exactly when the contract is awarded. Potentially, the contractor could complete the hydraulic dredging activities, in the portion of the borrow area located beneath the lateral expansion within 500 yards of NOB 8-11, during the unrestricted period between 1 October and 1 June.

No additional impacts to NOBs are expected as a result of raising the existing upland cells at the PIERP. Impacts to NOBs from changes in the nutrients and chemical constituents as a result of the dredging are anticipated to be minimal, temporary, and localized. Discharge from the existing spillways during dredged material placement operations will comply with State water quality standards, and should result in only temporary, localized perturbations to local water quality and are not expected to impact oyster populations the in vicinity of the PIERP.

Southwestern Borrow Area Short-term, direct impacts to NOBs are expected from dredging 91 acres of the southwestern borrow area and are similar to the impacts discussed above. Approximately 91 acres of bottom habitat in the southwestern borrow area will be disturbed through hydraulic dredging as part of the vertical expansion activities. The southwestern borrow area is located more than 500 yards from NOB 8-10, and therefore, TOY restrictions on hydraulic and mechanical dredging to protect oyster bars would not apply. The excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. Excavation of the southwestern borrow area may have a

minor, localized impact on water quality during the warmer months when oxygen depletion is most prevalent. However, because the southwestern borrow area is located over 500 yards from NOB 8-10, low DO conditions should not affect NOB 8-10. Localized reductions in dissolved oxygen may occur during the summer months, but the Study Area for the dredging and construction activities is well-mixed.

Oysters – Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Short-term, direct impacts to NOBs are expected from dredging 49 acres of the southwestern borrow area and are similar to the impacts discussed above for Alternative 1. Because the southwestern borrow area is located more than 500 yards from NOB 8-10 TOY restrictions on hydraulic and mechanical dredging to protect oyster bars would not apply, thus no impacts to NOBs are anticipated from sand excavation in the southwestern borrow area.

Oysters – Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2. During placement of dredged material into the wetland cells, water will be discharged in accordance with water quality standards into the open-water embayment through approximately three spillway structures (two associated with the northern wetland area, and one associated with the separate southern area). As stated above for Alternative 1, localized impacts could occur during dewatering activities within the open-water embayment and the potential exists for sedimentation impacts to NOB 8-10.

Southwestern Borrow Area Short-term, direct impacts to NOBs are expected from dredging 19 acres of the southwestern borrow area, and are similar to the impacts discussed above for Alternative 1. Because the southwestern borrow area is located more than 500 yards from NOB 8-10 TOY restrictions on hydraulic and mechanical dredging to protect oyster bars would not apply, thus no impacts to NOBs are anticipated from sand excavation in the southwestern borrow area.

Oysters – No-Action Alternative

The no-action alternative will have no additional impacts on the NOBs in the vicinity of the PIERP. With the no-action alternative, there is no potential for increased turbidity and sedimentation of NOBs related to construction activities as a result of the lateral expansion.

Clams – Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Both direct and indirect short-term and long-term impacts to clams are expected from perimeter dike construction for the

northern lateral alignment and the dredging for the northern access channel. Proposed construction activities for the lateral alignment will directly disturb bottom habitat.

Soft-shell clams and razor clams are two commercially important bivalves native to the area around the PIERP. The habitat in the vicinity of the lateral expansion is sufficient to support soft-shell and razor clams (EA, 2005), although no productive clam bars currently exist in the Study Area. Based on the results of the commercial shellfish study, none of the sampling areas within the Study Area, southwestern borrow area, or Poplar Harbor would be classified by MDNR as a productive clam bar for soft-shell clams or razor clams (EA 2005a). At the current clam densities, construction of the lateral expansion would not significantly affect the abundance or catch of either type of commercial clam species. However, construction of the lateral expansion permanently removes clam beds that have the potential to be productive in the future. The Study Area is approximately 1,080 acres, although it is anticipated that the total area of impact will be approximately half the size of the Study Area, approximately 600 acres. Therefore, all bivalves existing within the footprint of the lateral expansion, approximately 600 acres, and within the 30 acres of the northern access channel and turning basin will be permanently lost.

Short-term, adverse impacts from turbidity have the potential to impact adjacent communities of clams located outside the footprint of the expansion. Clams have limited mobility and cannot move to avoid burial from sediment plumes resulting from dredging and construction activities. The limited mobility of soft-shell clams, coupled with their slow re-burrowing time, makes them vulnerable to sediment disturbances and the resulting sediment resuspension and turbidity (Abraham, 1986). Soft-shell clams are also impacted by anoxia, which restricts their distribution to waters less than 33 ft (10 m) deep (Abraham, 1986). As a means of minimizing and containing turbidity, the stone toe of the armored section of the dike will be constructed before the sand dike section will be placed. Additionally, during all expansion activities, TOY oyster restrictions will be in place to reduce adverse impacts to the NOBs, which should also reduce impacts to the adjacent clam populations. Because the area in the vicinity of the PIERP does not currently support productive existing commercial clam beds, the impacts on clams from the lateral expansion will not be significant.

No additional impacts are expected from the vertical expansion of the existing upland cells. Discharge from the existing spillways during dredged material placement will comply with State water quality standards, and should result in only temporary, localized changed to local water quality that are not expected to impact clam populations the in vicinity of the PIERP.

Both short-term and long-term, adverse impacts to clams are anticipated as a result of dredging 30 acres for the northern access channel and turning basin, although no productive clam bars currently exist in the Study Area. Short-term impacts will occur through the loss of 30 acres of potential clam habitat. Long-term impacts to clams associated with the increase in water depth and change to the bathymetry and substrates would also occur in the northern access channel and turning basin. The increase in the water depth of this area and the potential exposure of some clay in the northern access channel and turning basin could influence the recolonization of this area by clams.

Southwestern Borrow Area Both short-term, minor impacts and potential long-term impacts to clams are expected from dredging 91 acres of the southwestern borrow area. The southwestern borrow area is not classified by MDNR as a productive clam bar for soft-shell clams or razor clams (EA, 2005a). Dredging for the expansion will disturb approximately 91 acres of bottom habitat at the southwestern borrow area. Local populations of clams within the southwestern borrow area and adjacent to the lateral expansion are expected to suffer short-term adverse impacts during dredging activity.

Although a substantial volume of sand would be removed from the southwestern borrow area and underlying clays may be exposed locally, dredging would likely leave the majority of the area retaining a sandy substrate, similar to existing conditions. In addition, subsequent reworking of sand by natural processes would likely reduce the area of exposed clays. Dredging the southwestern borrow area could potentially have a long-term effect on water levels, the bathymetry, and thus clams repopulating this area. The excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. Excavation of the southwestern borrow area may have a minor, localized impact on water quality during the warmer months when oxygen depletion is most prevalent. Additionally, if the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters, thus decreasing the potential for clams to repopulate the area once dredging is complete. The recovery time of benthic communities, including clam species, following disturbance is dependent on environmental conditions, the level of disturbance, and water depth (Newell *et al*., 1998). Benthic communities in the Chesapeake Bay are generally well adapted to rapid recolonization of sediment that is subject to frequent disturbance because of the constant physical and chemical perturbations associated with a shallow-water estuary (Newell *et al*., 1998). In estuarine environments characterized by fine sediments, rates of recovery of disturbed benthic communities is estimated to take approximately six to eight months, whereas areas characterized by course grain sediments including sand and gravel may take approximately two to three years to fully recover (Newell *et al*., 1998). Because the area in the vicinity of the southwestern borrow area does not currently support productive existing commercial clam beds, the impacts on clams from the lateral expansion will not be significant.

Clams – Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, Short-term, minor impacts to clams are expected from excavating the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 2, although only 49 acres of the southwestern borrow area will be disturbed. These impacts are expected to be similar to those discussed above for Alternative 1.

Clams – Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2, although less total area would be permanently impacted by Alternative 3. The bivalves removed within the existing 470-acre footprint of the lateral expansion and within the 30 acres of the northern access channel and turning basin would be permanently lost. However, the 130-acre open-water embayment should create protected, quiescent conditions that could potentially support additional SAV beds along the shorelines and, therefore, support the establishment of clam beds.

Southwestern Borrow Area Similar to Alternative 1, short-term, minor impacts to clams are expected from dredging in the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 3, although only 19 acres of the southwestern borrow area will be disturbed. These impacts are expected to be similar to those discussed above for Alternative 1.

Clams – No-Action Alternative

The no-action alternative will have no additional impacts on the clams in the vicinity of the PIERP – clams will not be lost within the footprint of the lateral expansion or the southwestern borrow area. With the no-action alternative, there is no potential for increased turbidity and sedimentation of existing clam resources related to construction activities as a result of the lateral expansion. However, no additional protection will be provided to Poplar Harbor for the continued reestablishment of SAV and repopulation of clams in this area with the no-action alternative.

Blue Crabs – Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Long-term and direct impacts to blue crabs are expected from the perimeter dike construction for the northern lateral alignment and dredging for the northern access channel. The blue crab fishery is currently the most valuable fishery in the Chesapeake Bay, and the waters around the PIERP are used extensively for setting crabpots and lines (EA, 2005a). The open water habitat in the vicinity of the PIERP within the Study Area supports seasonal commercial harvesting of blue crabs. Because of the shallow depths surrounding the PIERP, the crabbing season is extended in the area locally since blue crabs move into this area when deeper areas become anoxic or when crabs require SAV (in Poplar Harbor) or other cover for molting. Some blue crabs could overwinter in the vicinity of the PIERP, although this area is not a prime overwintering location for blue crabs compared to other areas in this section of the Chesapeake Bay that contain deeper waters (EA, 2002e).

Observations of crabpot usage indicated that the highest level of crabpot usage was northeast of the PIERP, including areas within the Study Area (Section 3.1.6.b) (EA, 2005a). Although the surveys of crab pots and lines usage were only spot checks, the survey data also indicated that much of the lateral expansion area is utilized as a productive commercial crabbing area. Legally, water depths of at least four feet are required for commercial crabbing using crab pots. Water depth within the Study Area is greater than four feet; therefore the entire Study Area comprises potentially active crabbing area. Construction of the lateral expansion would result in the permanent loss of approximately 600 acres of bottom area for blue crab utilization. In addition, commercial watermen that utilize areas for blue crabs in the vicinity of the expansion could experience space-use time conflicts during construction activities.

An adverse impact of the lateral expansion will be the loss of blue crab summer habitat in the shallow areas surrounding Jefferson Island. Shallower open water habitat increases the length of the crabbing season for commercial harvesters because crabs move into these shallow areas when deeper water becomes anoxic or when blue crabs require SAV or other cover for molting. Blue crabs are highly mobile and are expected to vacate the area during construction, except for crabs that are contained within the confines of the perimeter dike and those that may be overwintering within the area. Over-wintering blue crabs caught within the perimeter dike would be permanently lost during construction. Winter crab densities are quite variable (Section 3.1.6.b), but some annual surveys have indicated as many as 20 per 10,760 ft^2 (1,000 m^2) could exist in the Mid-Bay region at depths less than 40 feet. Assuming a 600-acre expansion, over 48,500 crabs could potentially be buried during construction. However, using 2003 landing statistics that were among the lowest in the last 5 years (Table 3-21), this loss would constitute less than 0.04 percent of the commercial landing in the region. The actual impact, however, is expected to be much lower since the dike will not be constructed entirely in the winter (so the crabs will be more mobile) and the actual over-wintering densities within the project area could be much lower, potentially 2.5 crabs per 10,760 ft^2 (1000 m^2). The loss of overwintering crabs would be a one-time take and would be considered minor relative to crab abundances in the Mid-Bay region.

Although the loss of open water habitat is a significant, adverse impact, the wetlands and tidal gut created in the lateral expansion will be comprised of intertidal habitat that would offset the loss of shallow water habitat. It is anticipated that when the lateral expansion is complete, the created marsh creeks in the wetland cells (when complete) will provide valuable habitat for each stage of the crabs' life cycle, specifically the younger stages. Long-term, beneficial impacts from the lateral expansion that will partially compensate for loss of open water habitat include providing additional quiescent areas in Poplar Harbor in the future for blue crabs if SAV continues to reestablish in this area. To offset the loss of open water habitat utilized by watermen for crabs, an additional crabbing area may be opened for trot-lining
.
No additional impacts to blue crabs are expected for the vertical expansion of the existing upland cells. Discharge from the existing spillways during dredged material placement will comply with State water quality standards, and should result in only temporary, localized changes to water quality that are not expected to impact blue crab populations in the vicinity of the PIERP.

Both short-term and long-term adverse impacts to crabs are anticipated as a result of dredging 30 acres for the northern access channel and turning basin. Short-term impacts will occur through the loss of 30 acres of crabbing area and habitat. Long-term impacts to crabs associated with the increase in water depth and change to the bathymetry and substrates would also occur in the northern access channel and turning basin. Also, if the northern access channel and turning basin is excavated below the pycnocline, hypoxic and/or anoxic conditions could also occur in the bottom waters, thus decreasing habitat value for blue crabs utilizing the area.

Southwestern Borrow Area Short-term and long-term direct and indirect impacts to blue crabs are expected from dredging the southwestern borrow area. Approximately 91 acres of bottom habitat in the southwestern borrow area will be disturbed as part of raising the existing upland cells. Additionally, short-term, temporary impacts to blue crabs may occur in shallower portions of the southwestern borrow areas during hydraulic dredging for raising the existing upland cells. Long-term impacts include that the excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom, effectively changing the existing bathymetry in the area. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. Excavation of the southwestern borrow area may have a minor, localized impact on water quality during the warmer months when oxygen depletion is most prevalent. If the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could also occur in the bottom waters, thus decreasing habitat value for blue crabs utilizing the area. Although the surveys of crab pots and lines usage were only spot checks, observations of crabpot usage indicated that the southwestern borrow area is not highly used by watermen for blue crabs (EA, 2005a), and blue crabs are expected to have some ability to vacate this area during dredging activities. Dredging in the southwestern borrow area would result in the temporary loss of bottom area for blue crab utilization during construction and dredging activities. There is the potential for some overwintering crabs to be lost in the deeper portions of the southwestern borrow area during dredging activities, but these numbers are expected to be minimal, as discussed above.

Blue Crabs – Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, direct and indirect impacts to blue crabs are expected from dredging the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 2, although only 49 acres of the southwestern borrow area would be disturbed. These impacts are expected to be similar to those discussed above for Alternative 1.

Blue Crabs – Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to the discussion above for Alternatives 1 and 2, although only 470 acres of potential blue crab habitat will be permanently removed. Impacts associated with dredging the northern access channel and turning basin are the same as discussed above for Alternative 1. It is anticipated that a direct trophic link between the open-water embayment and the proposed wetland cells will be created. The open-water embayment would provide access to the small tributaries and tidal guts in the wetland cells for each stage of the crabs' life cycle, specifically the juvenile stages. Long-term, beneficial impacts from the proposed Alternative 3 that will partially compensate for loss of open-water habitat include providing additional quiescent conditions that could potentially support additional SAV beds along the shorelines and, therefore, create suitable blue crab habitat. Thus, indirect impacts of Alternative 3 could potentially benefit blue crabs.

Southwestern Borrow Area Similar to Alternative 1, impacts to blue crabs are expected from dredging in the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 3, although only 19 acres of the southwestern borrow area would be disturbed.

Blue Crabs – No-Action Alternative

The no-action alternative will have no additional impacts on blue crabs in the vicinity of the PIERP – blue crabs will not be lost within the footprint of the lateral expansion or the southwestern borrow area. The highly utilized Poplar Harbor area and areas located adjacent to the PIERP rock dike will continue to be used by commercial watermen for blue crabs without any space-use time conflicts. However, no additional protection will be provided to Poplar Harbor as a result of the no-action alternative.

5.4.6.e Submerged Aquatic Vegetation (SAV)

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands SAV was not recovered at any of the 74 sampling locations during the spring 2004 survey, or at any of the 75 sampling locations during the summer 2004 survey located within the Study Area during the existing conditions surveys (EA, 2005a). These results indicate that the Study Area footprint, including the access channel, does not currently support SAV beds (EA, 2005a). Outside of the Study Area, SAV has been documented by the USFWS in Poplar Harbor, beginning in 2001 (after the initial construction of the PIERP). The USFWS surveys have indicated the presence of three species of SAV in Poplar Harbor including widgeon grass, sago pondweed and horned pondweed. Sampling has continued on an annual basis, presently through 2004 (USFWS, 2003). It was expected that by re-creating an area of calm, shallow water in Poplar Harbor, the PIERP would aid in restoring local SAV beds to historic levels (USFWS, 2003). Continued survival of SAV observed in Poplar Harbor since 2001 represents a promising potential for resurgence.

Adverse, direct impacts to existing SAV (and Tier I habitat) associated with the lateral expansion are not expected because SAV does not occur in the 575-acre lateral expansion area. The Study Area for the lateral expansion could potentially come within approximately 350 ft of SAV occurring in Poplar Harbor, immediately northeast of Jefferson Island (USFWS, 2003). However, the footprint of the conceptual alignment is not expected to be close to the observed SAV because the final alignment will be approximately half the size of the Study Area (1,080 acres) for the expansion. The closest SAV observation is located approximately 660 ft from the toe dike of the lateral expansion.

Dredged material placement may cause short-term impacts to SAV because of elevated turbidity and the potential for siltation near the SAV beds in Poplar Harbor during construction of the southern portion of the perimeter dike. As a means of minimizing and containing turbidity, the stone toe of the armored section of the dike will be constructed before the sand dike section will be placed. This practice should reduce turbidity and minimize impacts to adjacent SAV beds. Impacts from dredged material placement and offloading activities and turbidity resulting from barge positioning are not expected to impact the SAV resources because these activities will be conducted sufficiently far from the SAV beds located in Poplar Harbor.

Permanent, indirect impacts to SAV from the lateral expansion would occur because of the loss of open habitat within the Study Area, specifically in the shallow waters northeast of Jefferson Island. Approximately 100 acres of Tier II/III SAV habitat (waters less than 6.5 ft deep) within the conceptual alignment footprint would be permanently unavailable for the potential reestablishment of SAV.

Alternative 1 includes a tidal gut passing through the wetland cells with an opening at both the northern and southern end of the expansion footprint to supply tidal flow to the wetland habitat (Appendix A). The bottom elevation of the tidal gut could be raised from the current -8 to -12 ft MLLW elevations to -4 to -6 ft MLLW using clays dredged from the access channel excavation. However, dimensions of the tidal gut would be flexible to accommodate a range of channel depths, including providing a shallower depth and a wider tidal channel that could potentially support the establishment of SAV species once construction is complete.

Construction of the northern lateral expansion could have long-term, positive impacts to SAV growth in Poplar Harbor by increasing quiescent conditions within the Harbor. The northern alignment was designed specifically to protect Poplar Harbor and the existing SAV and Tier I/II habitat from wind and waves from the northeast. Therefore, the expansion is expected to continue to promote SAV recolonization in Poplar Harbor by reducing exposure to direct wave action, subsequently reducing water column turbidity from the erosion of Jefferson Island. This elimination/reduction of suspended solids is expected to enhance the suitability of the area for future SAV growth.

Discharge of water from the lateral expansion during dredged material placement is not expected to have an impact on the SAV beds in Poplar Harbor. Water quality changes from

discharge through the spillways and exchange in the tidal gut are expected to be minor, temporary and localized.

Because there is the potential for construction and dredging activities to occur 350 ft from an SAV bed observed in Poplar Harbor, TOY restrictions for SAV beds would be in place to minimize potential impacts to the SAV beds located in Poplar Harbor (Appendix C, Table C-3). TOY restrictions could be in place for SAV beds located in Poplar Harbor during perimeter dike construction for the northern lateral alignment and dredging the northern sand borrow area. These restrictions limit construction activity to the period of time that coincides with the dormant period of dominant SAV species (October through April). Specifically, TOY restrictions for SAV beds state that no excavation or dredging should occur within 500 yards of SAV beds between 1 April and 1 October each year. The specific SAV species protected in the TOY restrictions include sago pondweed, widgeon grass, and horned pondweed, each of which has been observed in Poplar Harbor during the USFWS SAV surveys (USFWS 2004a, 2003, 2001a). The construction sequence of the lateral expansion would be phased to reduce impacts to the SAV beds and honor TOY restrictions. Potentially, the contractor could complete the hydraulic dredging activities, in the portion of the borrow area located beneath the lateral expansion within 500 yards of SAV beds in Poplar Harbor, during unrestricted periods.

No additional impacts to SAV are anticipated as a result of the vertical expansion of the existing upland cells.

Adverse, direct impacts to existing SAV (and Tier I habitat) associated with dredging the northern access channel and turning basin are not expected because SAV does not occur in the area proposed for dredging of the northern access channel.

Southwestern Borrow Area No significant impacts to SAV are anticipated during the excavation of 91 acres of the southwestern borrow area. SAV was not recovered at any of the 108 sampling locations during the spring 2004 survey, or at any of the 105 sampling locations during the summer 2004 survey located within the southwestern borrow area during the existing conditions survey (EA, 2005a). These results indicate that the southwestern borrow area does not currently support SAV beds (EA, 2005a). As stated above, outside of the Study Area, SAV has been documented by the USFWS in Poplar Harbor, beginning in 2001 (after the initial construction of the PIERP). The southwestern borrow area does not currently support SAV (Tier I habitat), and the southwestern borrow area is not Tier II/III habitat because of the existing deeper depths. The area is exposed to substantial wave action. Consequently, establishment of SAV following the hydraulic dredging of the borrow site is unlikely.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to SAV associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, no significant impacts to SAV are anticipated due to dredging 49 acres of the southwestern borrow area associated with the lateral and vertical expansion activities of Alternative 2 because the southwestern borrow area does not currently support SAV beds.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Adverse, direct impacts to existing SAV (and Tier I habitat) associated with the proposed Alternative 3 are not expected because SAV does not occur in the 470-acre proposed lateral expansion area or the area proposed for dredging of the northern access channel. Similarly stated for Alternative 1, the closest SAV observation is located approximately 660 ft from the toe dike of the proposed Alternative 3. Also similar to Alternatives 1 and 2, Alternative 3 will cause the loss of approximately 100 acres of Tier II/III SAV habitat (waters less than 6.5 ft deep) within the alignment footprint that will be permanently unavailable for the potential reestablishment of SAV. Impacts associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2, although only 470 acres will be permanently removed as potential SAV habitat. For the most part, the depths within the open-water embayment (10 to 12 ft) will be too deep to support Tier II/III SAV habitat. Some long-term, beneficial impacts from the proposed Alternative 3 may partially compensate for loss of open-water habitat include providing quiescent conditions and additional protection to Poplar Harbor, including limited Tier II/III SAV habitat around the shoreline areas of the open-water embayment and within the tidal gut areas. Thus, indirect impacts of Alternative 3 could potentially benefit SAV.

Southwestern Borrow Area Similar to Alternatives 1 and 2, no significant impacts to SAV are anticipated from dredging 19 acres in the southwestern borrow area for Alternative 3. The southwestern borrow area does not currently support SAV beds because the area is too deep and exposed to substantial wave action.

No-Action Alternative

No additional significant impacts to SAV are anticipated for the no-action alternative. The no-action alternative will continue to provide protection to Poplar Harbor enhancing the quiescent conditions necessary to support reestablishment of SAV in Poplar Harbor. However, Poplar Harbor will not be afforded the additional protection from the northeast that would be provided by the lateral expansion to beneficially impact the reestablishment of SAV in the harbor. With the no-action alternative, Jefferson Island will continue to erode, create turbid local conditions, and deposit sediment in Poplar Harbor. With the no-action alternative, approximately 100 acres of Tier II/III SAV habitat (waters less than 6.5 ft deep) would still be available for the potential reestablishment of SAV. However, the no-action alternative does not include creating additional areas for the potential of SAV species to establish in the proposed tidal gut as part of the lateral expansion once construction is complete.

5.4.6.f Perimeter Dike and Rock Reef Habitat

The armored rock dike of stone used to construct the PIERP not only serves as a protective barrier to contain dredged material, but also provides approximately 34 acres of underwater epibenthic habitat (MES, 2004b). Artificial reefs were constructed in October 1999 to provide forage habitat for fish and to replace the snag habitat lost during the construction of the PIERP (MES, 2004b), and to provide in-water refugia and physical habitat. Although artificial in nature, the area below the water line on the existing exterior dikes, and the stacked armor stone used for building the artificial reef are habitat for both epibenthic species colonization (MES, 2004b) and utilization by fish species (NOAA, 2001).

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Short-term, permanent impacts to the epibenthic community on the exterior perimeter dikes are expected to result from the construction of the lateral expansion. Approximately 2,828 linear feet of the exterior perimeter rock dike along the northern portion of Cells 1 and 2 will be permanently lost during construction activities for the lateral expansion. The existing armored exterior dikes will be converted to interior sand cross dikes that will tie into expansion cells. The exterior stone from the perimeter dike of Cells 1 and 2 will be reused in the construction of perimeter dike sections for the expansion project. Epibenthic species currently colonizing the exterior stone on the perimeter dike of Cells 1 and 2 will be permanently displaced. At the completion of construction of the lateral expansion, approximately 4.6 miles of new, armored, exterior perimeter dike will be created. Therefore, impacts to the epibenthic community will occur initially, but these losses will be offset by an increase in total rock dike habitat. Most epibenthic species are expected to repopulate on the rock face of the perimeter dike of the lateral expansion.

Two artificial reef habitats are located off the northeastern and northwestern corners of the PIERP. The northeastern reef habitat lies within the footprint of the northern lateral expansion and will be encompassed into the expansion as part of this project. However, this reef habitat will be replaced following construction activities and relocated adjacent to the northeastern corner of the expansion in consultation with appropriate resource agencies. Therefore, no cumulative losses to reef habitat are anticipated as a result of this Alternative. The fish species that utilize the artificial reef habitat (striped bass, bluefish, Atlantic menhaden, spot, and white perch) are considered mobile fish species and are expected to relocate. The epibenthic species that currently inhabit the northeastern rock reef will be permanently displaced. However, the northeastern rock reef will be replaced in the general area in which it was displaced following the dike construction of the lateral expansion.

No additional, significant impacts to the habitat created by the exterior perimeter rock dike or the rock reefs are expected as a result of the vertical expansion of the existing uplands at the PIERP.

Southwestern Borrow Area No impacts to the exterior perimeter rock dike or the rock reefs are expected as a result of the lateral and vertical expansion of the existing uplands at the PIERP associated with Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to the exterior perimeter rock dike or the rock reefs associated with Alternative 2 are the same as discussed above for Alternative 1. Similar to Alternative 1, the reef habitat will be replaced following construction activities and relocated to an additional area in consultation with appropriate resource agencies. Therefore, no cumulative losses to reef habitat are anticipated as a result of Alternative 2. No additional impacts to the exterior perimeter rock dike or the rock reefs are expected as a result of dredging the southwestern borrow area associated with Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to the exterior perimeter rock dike or the rock reefs associated with Alternative 3 are the same as discussed above for Alternatives 1 and 2. As stated above, the reef habitat will be replaced following construction activities and relocated in consultation with resource agencies. Therefore, no cumulative losses to reef habitat are anticipated as a result of Alternative 3. No additional impacts to the exterior perimeter rock dike or the rock reefs are expected as a result of dredging the southwestern borrow area associated with Alternative 3. Although Alternatives 1 and 2 provide more submerged exterior perimeter rock dike habitat, the embayment is estimated to contain approximately 3,400 feet of submerged breakwater habitat. As currently designed, the open-water portion of the embayment also includes three small interior breakwater reefs. Both the segmented breakwaters and interior breakwater structures will provide predatory habitat for EFH species, other numerous finfish species, and benthic invertebrates and will diversify the habitat of the existing, relatively flat and even bathymetry in the vicinity. The proposed avian nesting islands will also potentially provide underwater habitat and refugia within the open-water embayment. Similar to Alternative 1, the epibenthic species that currently inhabit the northeastern rock reef will be permanently displaced. However, the northeastern rock reef will be replaced in the general area in which it was displaced following the dike construction of the lateral expansion. No additional impacts to the exterior perimeter rock dike or the rock reefs are expected as a result of dredging the southwestern borrow area associated with Alternative 3.

No-Action Alternative

The no-action alternative will have no additional impacts to the habitat created by the exterior perimeter rock dike or the rock reefs at the PIERP. The perimeter rock dikes along the PIERP and rock reefs in the northeast and northwest will not be disturbed by the no-action alternative and will continue to be utilized by the benthic community and finfish species.

5.4.6.g Shallow Water Habitat (SWH)

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Direct and adverse impacts to shallow-water habitat will result from the perimeter dike construction for the northern lateral alignment. Because water depths in parts of the northern expansion are less than 6.5 ft, the Study Area (which includes adjacent areas outside of the northern lateral alignment) could potentially permanently impact approximately 300 acres of SWH (Figure 5-8). However, the actual footprint of the northern alignment would only impact 100 acres of SWH. Within the Study Area, the existing SWH also corresponds to the Tier II and Tier III SAV recovery areas. Generally, the northern access channel and the northern portions of the expansion area are in deeper water that is not classified as SWH. In most other areas of the lateral expansion footprint, the existing SWH would be converted to wetland/upland habitats, displacing usage by aquatic and avian species. However, no SAV was observed within the footprint of the Study Area during the existing conditions study (EA, 2005a). This is a worst-case, conservative estimate of SWH loss because the final alignment footprint for the lateral expansion (approximately 600 acres) will be approximately half the size of the current Study Area (1,080 acres). Construction of the lateral expansion would convert approximately 100 acres of shallow water habitat to wetland or upland island habitat. The majority of the shallow-water habitat within the Study Area is located immediately adjacent to and north of Jefferson Island. No SAV was observed in the shallow-water areas of the footprint within the lateral expansion (EA, 2005a). Although no SAV was observed, the lateral expansion would cause the permanent loss of up to 100 acres of potential SAV recovery habitat. However, whether SAV would reoccupy this area in the foreseeable future if the expansion was not constructed is highly uncertain, given trends in the project area, outside of Poplar Harbor.

Shallow-water habitat is considered a harsh environment, although a vast diversity of aquatic life is known to inhabit these areas (CBP, 2005) and many Chesapeake Bay species depend on vegetated shallow-water habitats at some point during their life cycle. The loss of shallow-water habitat will reduce the amount of nursery habitat and refuge for blue crabs, grass shrimp (*Palaemonetes pugio*), striped killifish (*Fundulus majalis*), and juveniles of larger fish species. Predators, including blue crabs, spot, striped bass, summer flounder, waterfowl, colonial waterbirds, and raptors that forage in shallow-water habitat for prey will be displaced by the loss of this habitat. Prey species, including grass shrimp, bay opossum shrimp (*Americamysis bahia*), Atlantic silversides, and bay anchovy, that utilize shallow-water habitat will also be displaced by the lateral expansion. The juvenile red drum, an EFH species, utilizes shallow-water habitat, has only been recovered in the "notch" area during existing conditions surveys (EA 2005a). The notch area will not be disturbed during the lateral expansion activities. In addition to finfish species, the loss of shallow water foraging and resting areas will directly affect other species such as gulls, terns, shorebirds, dabbling ducks, overwintering waterfowl, and diamondback terrapins as discussed in more detail in Section 5.4.7.

Although the loss of SWH is an adverse impact, the created wetlands and tidal gut will be intertidal habitat, reducing the net loss of SWH in the footprint of the alignment.

Approximately 25 acres of shallow water habitat will be created in the tidal gut, and approximately 35 acres of shallow water habitat will be created within the wetland channels (based on the development of Cell 3D in the existing PIERP). This habitat should attract the same species described above, most notably juvenile red drum, that are known to utilize shallow-water habitat. Also of note, the shallow water area associated with the expansion constitutes only a minimal loss of shallow open water areas located regionally within the mainstem Bay from the Bay Bridge to the mouth of the Potomac River. Existing conditions surveys have indicated that the area for the lateral expansion is not unique habitat nor is the area inhabited by unique aquatic communities when compared to other shallow water areas in the mesohaline portion of the Chesapeake Bay. In addition, the lateral expansion will offer protection of the Jefferson Island shoreline, thereby reducing erosion and reducing sediments suspended in the water column of the shallow water habitat in Poplar Harbor. The additional protection provided to SWH in Poplar Harbor should enhance quiescent conditions necessary to support reestablishment of SAV.

No additional significant impacts to SWH are anticipated for raising the existing upland cells.

Southwestern Borrow Area No impacts to SWH will result from sand excavation over the approximately 91 acres in southwestern borrow area required to support construction of the lateral expansion and raising the existing upland cells for Alternative 1. The southwestern borrow area is located in water depths greater than 6.5 ft and is therefore not classified as SWH. Deepening of waters and bottom disturbance from dredging of the southwestern borrow area would not directly impact SWH or SAV because of the absence of SAV from this area (EA, 2005a). Existing water depths preclude consideration of this area as SAV recovery habitat, and therefore, no loss of future SAV habitat would occur.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to SWH associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area Similar to Alternative 1, no impacts to SWH will result from sand excavation, although only approximately 49 acres in southwestern borrow area is required to support construction of the lateral expansion and raising the existing upland cells for Alternative 2.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to SWH associated with Alternative 3 are the same as discussed above for Alternatives 1 and 2. The footprint of Alternative 3 is only 470 acres in size, as compared to approximately 600 acres for Alternatives 1 and 2. No SWH is located within the open-water embayment, and therefore, construction of Alternative 3 would still convert approximately 100 acres of SWH to wetland or upland island habitat on the eastern portion of the proposed expansion. As stated previously, no SAV was observed in the shallow-water areas of the footprint within the proposed lateral expansion (EA, 2005a). Although the loss of SWH is an adverse impact, the

created wetlands and the 10-acre tidal gut will provide intertidal habitat, reducing the net loss of SWH in the footprint of the alignment. In addition, although the open-water embayment will have pockets of water 10 to 12 feet deep, shoreline areas surrounding the open-water embayment will be shallow, intertidal habitat, and will partially offset the loss of SWH.

No-Action Alternative

No additional beneficial or adverse impacts to SWH are anticipated as a result of the no-action alternative. The no-action alternative will continue to provide protection to the SWH in Poplar Harbor, thereby enhancing the quiescent conditions necessary to support reestablishment of SAV in Poplar Harbor. However, Poplar Harbor will not be afforded the additional protection from the northeast that would be provided by the lateral expansion. Jefferson Island will continue to erode away at approximately 2.0 ft/yr (Halka MDNR, 2005), create turbid local conditions, and deposit sediment within the SWH in Poplar Harbor. With the no-action alternative, approximately 100 acres of SWH habitat (waters less than 6.5 ft) within the lateral expansion would still be available for the potential reestablishment of SAV. The no-action alternative will not provide additional SWH in the vicinity of the PIERP due to the created wetlands and tidal gut as part of the lateral expansion. Once completed, the wetland areas and tidal gut created as part of the expansion will provide habitat for a variety of finfish species, benthic invertebrates, avian species, and other wildlife species.

5.4.6.h Shoreline Habitats

Island Habitat

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No adverse impacts to island habitat are anticipated for Alternative 1. The northern portion of the PIERP, described as remote island habitat, would be temporarily unavailable to avian and wildlife species during construction activities. However, the lateral expansion would create 575 acres of placement, therefore creating additional remote island habitat at the PIERP. The development of island habitat specifically for targeted avian species will provide a significant long-term positive impact as a result of the lateral expansion. Offshore islands are a unique ecosystem component in the Chesapeake Bay watershed. These islands are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. Because the Chesapeake Bay, including Poplar Island, lies within the Atlantic Flyway, neotropical migrants, migrating waterfowl, and resident birds would use the lateral expansion as a foraging, resting, and nesting area, similar to the current utilization of the PIERP by avian species. Although similar vegetative communities may occur on the Eastern Shore mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for colonial waterbirds and other avian species, including the Federally-listed Bald Eagle. Additionally, the vegetation and habitat restoration objectives implemented at the PIERP will also be applied to the lateral expansion would create additional island habitat that includes: creating bare or sparsely vegetated islands as nesting habitat for colonial waterbirds, such as terns, and/or creating vegetated islands for waterbirds, such as egrets and herons.

No additional significant impacts to island habitat are anticipated for raising the existing upland cells.

Southwestern Borrow Area No impacts to island habitat will result from dredging over the approximately 91 acres in the southwestern borrow area required to support construction of the lateral expansion and raising the existing upland cells for Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Similar to Alternative 1, no impacts to island habitat will result from the lateral expansion and vertical expansion of existing uplands or the dredging within the southwestern sand borrow area. Approximately 49 acres in southwestern borrow will be disturbed from activities associated with Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Similar to Alternatives 1 and 2, no impacts to island habitat will result from the lateral expansion and vertical expansion of existing uplands or the dredging within the southwestern sand borrow area.

No-Action Alternative
Long-term, adverse impacts to Jefferson and Coaches Islands and the Eastern Shore mainland would be expected with the no-action alternative since additional protection from the lateral expansion would not be afforded to these shorelines. The no-action alternative would allow the continued erosion of Jefferson Island, Coaches Island, and the Eastern Shore mainland shoreline. No additional benefits of creating additional remote island habitat would be acquired with the no-action alternative.

Intertidal Flats Habitat

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No adverse impacts to intertidal flats habitat are anticipated for Alternative 1. The existing sparsely vegetated islands created at the PIERP, which would be considered intertidal habitat once free exchange between the Chesapeake Bay and the cells is allowed, will not be disturbed by the lateral expansion activities. The impacts to Least Terns that utilize these habitats are described in more detail in Section 5.4.7.a. As currently designed, approximately 21 additional acres of mudflats/intertidal flats habitat (Table 4-9) and sparsely vegetated islands will be created as part of the lateral expansion activities specifically to attract Least Terns to nest at the island sites. The interim intertidal mudflats habitat that will be created temporarily during construction of the lateral expansion will create additional beneficial impacts to avian species. Although temporary in nature, the mudflat habitats have proven to be one of the most highly utilized habitats at the PIERP and should provide for similar usage in the lateral expansion.

No additional significant impacts to intertidal flats habitat are anticipated for raising the existing upland cells, although creating temporary mudflat habitats in Cells 2 and 6 during the raising will provide beneficial impacts to avian species, as discussed above.

Southwestern Borrow Area No impacts to intertidal flats habitat will result from sand excavation over the approximately 91 acres in southwestern borrow area required to support construction of the lateral expansion and raising the existing upland cells for Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Similar to Alternative 1, no impacts to intertidal flats habitat will result from the lateral expansion and vertical expansion of existing uplands or the dredging in the southwestern borrow area. As currently designed, approximately 18 additional acres of mudflats/intertidal flats habitat (Table 4-9) and sparsely vegetated islands will be created as part of the lateral expansion activities specifically to attract Least Terns to nest at the island sites. The interim intertidal mudflats habitat that will be created temporarily during construction of the lateral expansion will create additional beneficial impacts to avian species.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Similar to Alternatives 1 and 2, no impacts to intertidal flats habitat will result from the lateral expansion, vertical expansion of existing uplands, or the dredging in the southwestern borrow area. Additional mudflats/intertidal flats habitat or sparsely vegetated islands will be created as part of the proposed Alternative 3 activities specifically to attract Least Tern nesting at the island sites. The interim intertidal mudflats habitat that will be temporarily created during construction and inflow activities and will provide additional benefits to avian species. In addition, although the open-water embayment will have pockets of water 10 to 12 feet deep, shoreline areas surrounding the open-water embayment will provide additional shoreline and mudflats/intertidal flats habitat.

No-Action Alternative
The no-action alternative will have no additional significant impacts on the existing intertidal flats or sparsely vegetated island habitat at the PIERP. The habitat will continue to be developed as planned, and the ecosystems will continue to mature to support the repopulation of the Least Tern and other avian species. However, the benefits associated with creating additional sparsely vegetated island habitat or intertidal flats and the subsequent Least Tern nesting habitat as part of the lateral expansion will not be acquired with the no-action alternative.

5.4.7 Terrestrial Resources

5.4.7.a Avian Community Avian groups that utilize the PIERP and off-shore areas that may be affected by the project and construction activities include transitory migrants (primarily spring and fall), overwintering birds, and breeding seasonal residents. Avian species are categorized into the following groups for a more detailed impacts analysis and discussion: waterfowl, predatory and scavenging birds, shorebirds and marsh birds, and miscellaneous land birds. A general avian discussion of projected impacts from the lateral expansion precedes a more detailed discussion of expected adverse impacts to each avian group. The

discussion also includes impacts to nesting by each avian group. The Study Area used to evaluate impacts is approximately 1,080 acres, although it is anticipated that the final alignment footprint will be, at a maximum, estimated at half that size, approximately 600 acres for Alternatives 1 and 2 and approximately 470 acres for Alternative 3.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The construction of the northern lateral expansion will have both adverse and beneficial short-term and long-term impacts to the avian community. The proposed perimeter dike construction and the dredging for the northern access channel and sand borrow excavation will occur in phases, and therefore, the associated impacts to avifauna will vary depending upon timing and location of construction activities. The most notable long-term adverse impact to avian species in the Study Area will be the conversion of open water habitat (including shallow-water habitat) within the lateral expansion footprint to upland and wetland habitats.

A long-term impact includes the permanent loss of shallow-water foraging and resting areas utilized by avian species within the 600-acre footprint of the lateral expansion. Avian species utilizing these habitats will be required to move to other interim open water habitats at the PIERP or in the vicinity of Jefferson and Coaches Islands. For avian species dependent on fish, these birds will likely follow the mobile forage fish that will avoid construction activities and seek new areas with similar habitat located adjacent to the project. Although the loss of open water habitat is an adverse impact, the created wetlands and tidal gut will be comprised of intertidal habitat, reducing the overall loss of open water habitat. The open water area loss associated with the lateral expansion constitutes only a minimal loss of regional open water areas and the area within the lateral expansion is not unique habitat nor inhabited by unique avian communities when compared to other open water areas in the mesohaline portion of the Chesapeake Bay.

Construction activities associated with the lateral expansion will temporarily disturb the avian species that currently utilize the interim habitats created at the PIERP. Temporary, short-term disturbances will be associated with vehicular traffic traveling along the perimeter and interior dike roads during construction of the lateral expansion. Disturbances to the avian community may occur in the northern portions of Cells 1 and 2 during construction of the dike for the lateral expansion, subsequent inflow to the expansion cells, and maintenance activities. These construction activities may influence and affect avian species utilizing the open water areas within the lateral expansion, as well as SWH located adjacent to the expansion (Poplar Harbor). These activities will likely displace birds utilizing the existing interim habitats available in cells at the PIERP. The interim habitats include the nesting islands, open water, mudflats, beaches, and wetland habitats created at the PIERP. Avian usage surveys indicated all cells had avian usage, but it is assumed that avian species will avoid the areas of construction, specifically the northern portions of Cells 1 and 2, and move to other available interim habitats located at the PIERP. Adjacent avian habitat is also located at Coaches and Jefferson Islands, and the new habitats created as part of the expansion, including new nesting islands, will add significant benefits for avian species and offset the temporary loss of interim habitats during construction of the lateral expansion.

The expected adverse impacts to avian species will be minor, and habituation to construction activities is likely, as seen by the current utilization of the PIERP (while under construction) by over 115 different avian species. Habituation may also occur towards water-based transportation in and out of the project area through the established access channel. Both the short-term and long-term impacts from construction are considered minor because comparable habitat is located in adjacent cells as upland and wetland cells are developed at the PIERP. A more detailed analysis of noise impacts to the avian community is included in Section 5.4.10.

No significant impacts to the avian community are associated with the proposed raising of existing upland cells. Vehicular traffic associated with raising the existing upland cells will be similar to the current conditions at the PIERP and, therefore, no additional adverse impacts are anticipated. An additional impact of the vertical dike raising to the avian community is the delay in the development of upland habitat in Cells 2 and 6 for avian species that could potentially utilize the PIERP. The delay, defined as the time until grading and planting is initiated, is estimated to be approximately three years. This delay increases the time until the cells are mature and may impact terrestrial species that would utilize mature habitats, including the avian community. The upland habitat area in Cells 2 and 6 will be reduced by approximately 15 acres as a result of raising the existing upland cells. The habitat loss results from the additional interior fill required to support the height of the dikes. This decrease in habitat is expected to have a minimal impact on the avian communities that will utilize the habitat because additional upland acreage will be created in the lateral expansion.

The development of remote island habitat specifically for targeted avian species will provide a significant long-term positive impact as a result of the lateral expansion. Offshore islands are a unique ecosystem component in the Chesapeake Bay watershed, which are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. Although similar vegetative communities may occur on the mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for colonial waterbirds and other avian species, including the Bald Eagle. The lateral expansion will increase the amount of placement area, and thus remote island habitat available at the PIERP by approximately 575 acres. Additionally, the vegetation and habitat restoration objectives of upland and wetland habitat implemented at the PIERP will also be applied to the lateral expansion. For Alternative 1, these objectives specifically include creating bird islands (bare or sparsely vegetated islands as nesting habitat for colonial waterbirds, such as terns, and/or creating vegetated islands for waterbirds, such as egrets and herons) high marsh habitat, low marsh habitat and mudlfat/intertidal flats habitat (Table 4-9). For avian species, these new habitats in the lateral expansion will be more significant than the loss of open water habitat.

Gulls, Terns, and Skimmers

An adverse effect on gulls, terns, and skimmers will result from the elimination of open water foraging and resting areas within the footprint of the lateral expansion. However, the construction of the PIERP has attracted large numbers of gulls and terns to the area, increasing the usage in the vicinity of the PIERP compared to pre-construction conditions.

Even though these primarily piscivorous species of birds prefer open water habitats, the overall impact to these avian species will be a positive because they will utilize much of the other habitat created in the lateral expansion, including the mudflats and nesting islands.

The Common Tern and the Least Tern, both species of high priority in Maryland will be impacted by the lateral expansion and are discussed in more detail in Section 5.4.8. Other unlisted terns (see Table C-8 in Appendix C) will be affected by the conversion of open water foraging areas to the upland and wetland habitats that will be created in the lateral expansion. Terns will be forced to seek foraging areas elsewhere and will likely follow the forage fish stocks. Adjacent tern nesting habitat is located along shoreline areas on Jefferson Island and at other interim habitats at the PIERP. Terns are expected to populate these areas during construction activities associated with the lateral expansion. Also, additional nesting island sites will be created within the lateral expansion to support these birds, which should result in a net beneficial impact to terns.

Gulls, particularly Herring and Great-Black Backed Gulls, are very common in the region and have demonstrated adaptability to human presence. These and other gull species will likely adapt to other foraging areas and will quickly take to new structural features, such as dikes or pilings. Herring and Great-Black Backed Gulls are considered nuisance species that are actively being managed by USFWS and APHIS at the PIERP. A Federal Migratory Bird Treaty Act Permit is required to use lethal control for nuisance species, including control measures that "discourage nesting," such as breaking up nests after eggs are laid. A Federal Migratory Bird Treaty Act Permit is obtained annually by the USACE for control of avian species at the PIERP. The permit allows the taking of both the species included in the permit and their nests. The 2005 permit includes three species: Herring Gulls, Great Black-Backed Gulls, and resident Canada Geese (Miller USFWS, 2005).

Waterfowl

An adverse impact of the lateral expansion to waterfowl will be the conversion of the open water habitat within the lateral expansion footprint to upland and wetland habitats. However, the construction of the PIERP has attracted large numbers of waterfowl to the area, increasing the usage in the vicinity of the PIERP compared to pre-construction conditions. The overall impact to these avian species will be a positive because they will utilize much of the other habitat created in the lateral expansion, including the mudflats and nesting islands.

A total of 27 species of waterfowl have been observed at the PIERP and in the surrounding waters, including ducks (dabbling ducks, diving ducks, and sea ducks), geese, loons, grebes, and swans, since 2001. The expansive, shallow-water habitats in Cells 1, 2, 3, 4C, and 5 are important feeding and resting locations for migrant waterfowl. Natural, adjacent open water habitat is available, and the new habitats created as part of the lateral expansion will ultimately provide greater benefits to waterfowl species that utilize shallow water areas and/or marsh habitats, offsetting the loss of open water shallow habitat.

A positive impact to local native breeding waterfowl could be associated with American Black Duck nesting. Black Ducks have declined in the last 50 years and continue to be a species of management concern (USGS, 2005). Numbers of Black Ducks recorded in

Maryland declined until 1983 when the trend reversed, and the number of Black Ducks increased as a result of restrictive harvest regulations. The distribution of Black Ducks in the Chesapeake Bay changed from predominant use of the upper Bay to predominant use of mid-Bay, Eastern Shore, and Potomac River sites. The current redistribution (since 1983) of wintering Black Ducks seems to be associated with habitat change, loss of SAV, and degradation of water quality (USGS, 2005). The Black Duck population has also suffered long-term population declines resulting from competition and hybridization with the expanding breeding Mallard populations. However, in January 2004, over 100 American Black Ducks were wintering at the PIERP (Appendix C, monitoring month 01-04) and were also observed nesting (possibly Black Duck x Mallard hybrids) in Cell 4DX. Black Ducks are expected to continue to utilize the interim habitats available at the PIERP during construction of the lateral expansion. It is also anticipated that the local population of American Black Duck will benefit as marsh habitat and scrub/shrub cover are created and the ecosystems mature.

Additional potential adverse impacts of the lateral expansion to waterfowl include the elimination of open water foraging and resting areas. This loss would primarily affect overwintering waterfowl, including sea ducks and diving ducks such as Long-Tailed Duck (formerly known as Oldsquaw), Scoters, Redhead, Canvasback, Scaup, and Bufflehead. The sea ducks, particularly Long-Tailed Duck, are common, abundant inhabitants of the Chesapeake Bay and should readily shift to other available areas to forage. Short-term adverse impacts to the avian community that utilize the open water habitat southwest of Cell 6 will also occur during excavation of the southwestern borrow area, although the impacts of excavation are expected to be temporary. Adjacent open water habitat is available, and waterfowl are expected to relocate to these areas during construction activities.

Long-term, indirect, beneficial impacts are expected from the project since the lateral expansion will provide additional protection to Poplar Harbor and Jefferson Island that will provide quiescent areas for SAV to continue to reestablish in Poplar Harbor (see Section 5.4.6.e). By providing protection from wind-driven waves from the west and northwest, the lateral expansion is expected to contribute significantly to protection of Tier I/II SAV habitat. This would provide a significant positive benefit to a wide variety of waterfowl species dependent on SAV for forage, particularly the dabbling ducks that have been observed on the PIERP such as Black Ducks, Mallards, American Widgeon, Gadwall (*Anas strepera*), Canvasback, Green-Winged Teal (*Anas crecca*), and Blue-Winged Teal (*Anas discors*). Furthermore, the wetland cells will create tidal marsh interspersed with tidal creeks that will provide foraging areas and resting locations for waterfowl in the future.

Predatory and Scavenging Birds

The primary raptor potentially affected by the lateral expansion is the Osprey. Ospreys have been observed nesting and fledging young on the PIERP in Cells 1 and 2 in 2002 (five breeding pairs), 2003 (six breeding pairs), and 2004 (seven breeding pairs). Osprey will opportunistically nest on a variety of elevated structures, including pilings, channel markers, building roofs, and piers. Artificial nesting platform structures can be created to facilitate Osprey nesting. Because of the opportunistic breeding nature of the Osprey, adverse impacts to Osprey populations in the area are not expected from the lateral expansion. However, local

construction activities associated with the lateral expansion may temporarily disturb Ospreys utilizing the northern portion of the PIERP, specifically Cells 1 and 2. Other disturbances to predatory and scavenging birds include the permanent loss of open water habitat within the footprint of the expansion area as a foraging area. For the predators and scavengers dependent on fish, these birds will likely follow the mobile forage fish that will avoid construction activities by seeking comparable adjacent habitat. Short-term adverse impacts to the predators and scavengers that utilizes the open water habitat southwest of Cell 6 will occur during excavation of the southwestern borrow area, although the impacts of excavation are expected to be temporary.

Another raptor, the Federally-listed threatened Bald Eagle, has been observed nesting on Coaches Island. Disturbances to avian resources, including the Bald Eagle nest on Coaches Island, are not expected as part of the project, since the Bald Eagle and nest remained undisturbed throughout the construction of the PIERP. The detailed potential effects of the lateral expansion on the Bald Eagle are specifically discussed in Section 5.4.8.

Pelicans, Cormorants, and Gannets

Adverse impacts to these species will result from the permanent loss of open water and shallow-water habitat in the footprint of the lateral expansion. However, these birds will likely follow the forage fish that will avoid construction activities and seek comparable adjacent habitat. Short-term adverse impacts to the predators and scavengers that utilize the open water habitat southwest of Cell 6 will also occur during excavation of the southwestern borrow area, although the impacts of excavation are expected to be temporary.

Shorebirds and Marsh Birds

No significant adverse impacts are expected to the shorebirds and marsh birds from the lateral expansion. A total of 30 species of shorebirds and three species of marsh birds have been observed at the PIERP. Shorebirds identified at the PIERP that may potentially be negatively affected by the lateral expansion construction activities include Sandpipers, Willets, Dunlins (*Calidris alpina*), Dowitchers, Herons, Egrets, Plovers, Oystercatchers, and Avocets. Pairs of Willet, Killdeer, Red-Winged Blackbird, Snowy Egret, and Cattle Egret, have been observed nesting on the PIERP (MES, 2003a). The American Oystercatcher, a bird of concern and listed as rare in Maryland, was observed on the PIERP, but documentation of the nesting success was not verified (Erwin, 2004). Most shorebirds and marsh birds have either nested in Cell 4DX or the created islands in various Cells 1 and 3. Construction activities associated with the lateral expansion are not proposed for Cell 4DX, although routine vehicular traffic will occur in the vicinity. The northern portions of Cells 1 and 2 will experience increased construction activities to support the lateral expansion. Vehicle traffic on the perimeter dike roads associated with construction activities could disturb the shorebirds and marsh birds utilizing areas immediately adjacent to these roads. These impacts from construction are considered minor because comparable habitat is located in the adjacent upland and wetland cells developed at the PIERP and on Coaches Islands. For shorebirds and marsh birds, there are no habitat losses associated with the lateral expansion. The lateral expansion will not be constructed in areas highly utilized by shorebirds and marshbirds, which include foraging areas such as beaches, intertidal zones, or tidal marshes along shorelines of the PIERP, Jefferson, and Coaches Island.

Shorebirds and marsh birds that utilize Coaches Island will generally remain unaffected by the lateral expansion. Disturbances to shorebirds and marsh birds and the Great Blue Heron rookery at Coaches Island are not expected as part of this project. The heron rookery has remained successful throughout the construction of the PIERP and would be expected to remain successful throughout the construction of the lateral expansion. The southernmost limit of the expansion Study Area is located approximately 2,570 ft from the outer edge of the heron rookery buffer. Shorebirds and marsh birds that utilize Jefferson Island may be temporarily displaced because of short-term noise disturbances from the lateral expansion construction activities.

Long-term positive impacts to the shorebird and marsh bird populations are expected from the lateral expansion. It is anticipated that in the long-term, the expansion will have upland and wetland habitat that will ultimately favor colonization by a variety of shorebirds and marsh birds, including those species currently using the area. The creation of the lateral expansion, including tidal marshes, tidal flats, and beach areas, will benefit nesting Willets and other seasonally migratory shorebirds by providing a much larger area for nesting and feeding. This benefit will outweigh open water losses to shorebirds and marsh birds.

Miscellaneous Land Birds

A total of 20 miscellaneous land birds, typically associated with mainland terrestrial habitats, have been observed utilizing the interim habitats and nesting at the PIERP. Increased vehicular traffic associated with construction activities for the lateral expansion will cause short-term impacts to land birds utilizing these habitats. These birds may move to other interim habitats at the PIERP or to Jefferson and Coaches Islands. Land birds are expected to populate the upland habitats at the PIERP and the lateral expansion as these areas are planted and the vegetation matures.

Management of Avian Species

The management of selected avian species because of predation, nuisance species, and disease outbreaks is expected to continue within the northern lateral expansion, since the lateral expansion would increase the size of the PIERP, and thus increase the total birds attracted to the island. It is assumed that that existing control program would be continued by the USDA, and that a Federal Migratory Bird Treaty Act Permit would be obtained annually by the USACE from the USFWS Region 5 office in Hadley, MA. Outbreaks of avian diseases will be managed using procedures similar to those currently in use at the PIERP.

Southwestern Borrow Area Short-term adverse impacts to the avian community that utilize the open water habitat southwest of Cell 6 could occur during excavation of the 91 acres of the southwestern borrow area, although the impacts are expected to be temporary. However, this open water habitat is not a unique resource in the Poplar Island area, and following sand excavation in the borrow area, avian species are expected to return and utilize the open water area for foraging.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Adverse impacts associated with Alternative 2 are the same as discussed above for Alternative 1. Benefits from Alternative 2 are similar to Alternative 1 and include the creation of upland habitat, high marsh, low marsh, and mudflat/intertidal flats habitat. Avian nesting islands will also be created as part of Alternative 2 (Table 4-9). For avian species, these new habitats created in the lateral expansion will be more significant than the loss of open water habitat.

Southwestern Borrow Area Similar to Alternative 1, short-term, temporary adverse impacts to the avian community that utilize the open water habitat southwest of Cell 6 will occur during excavation, although approximately 49 acres of the southwestern borrow area will be disturbed by activities associated with Alternative 2. However, this open water habitat is not a unique resource in the Poplar Island area, and following sand excavation in the borrow area, avian species are expected to return and utilize the open water area for foraging.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to the avian community associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2. With the open-water embayment in proposed Alternative 3, the area within the perimeter footprint of the alignment will contain approximately 47 percent upland habitat (270 acres), approximately 29 percent wetland habitat (165 acres), approximately 24 percent open-water embayment habitat (130 acres), and a 10-acre tidal gut compared to Alternative 1 (60 percent wetland, 40 percent upland, and a 25-acre tidal gut) and Alternative 2 (50 percent wetland, 50 upland, and a 25-acre tidal gut). Alternative 3 also includes the incorporation of avian nesting islands into the design, similar to Alternatives 1 and 2. Therefore, up to 130 acres of currently unprotected open-water and bottom habitat, both habitats that are highly utilized by avian species, would be protected within an open-water embayment with stone breakwater structures.

The conservation of open-water and bottom habitat will benefit the primarily piscivorous species of birds that prefer open water habitats, including gulls, terns, skimmers, predators, scavenging birds, pelicans, cormorants, and gannets. The open-water embayment is expected to create more diverse habitat types for finfish including deep and shallow subtidal zones, an open water pelagic zone, mudflat habitat, tidal guts throughout the wetland cells, submerged reef habitat, and rock reef habitat. Because these habitats will be created to attract a variety of finfish species, it is assumed that the piscivorous-dependent bird species described above will benefit from the open-water embayment. After construction is complete, avian species dependent on fish will likely follow the mobile forage fish species and utilize the open-water embayment habitat.

The conservation of 130 acres of open water habitat within the protected embayment will also benefit waterfowl that would utilize this area for foraging and resting activities. The 130-acre open-water embayment is anticipated to create quiescent conditions that could potentially support additional SAV beds along the shoreline areas preferred by waterfowl.

It is anticipated that a direct trophic link between the open-water embayment and the proposed wetland cells will be created. Thus, the open-water embayment will provide access to the small tributaries and tidal guts in the wetland cells for a variety of juvenile fish species, juvenile blue crabs, and a more diverse and stable benthic community. This habitat enhancement and the resulting forage access are expected to provide long-term positive impacts to shorebirds and marsh birds and that the new habitats created as part of the lateral expansion will be far more significant than the loss of open water habitat to avian species.

Southwestern Borrow Area Similar to Alternatives 1 and 2, short-term, temporary adverse impacts to the avian community that utilize the open water habitat southwest of Cell 6 will occur during dredging, although only approximately 19 acres of the southwestern borrow area will be disturbed by activities associated with Alternative 3. However, this open water habitat is not a unique resource in the Poplar Island area, and following sand dredging activities, avian species are expected to return and utilize the open water area for foraging.

No-Action Alternative

The no-action alternative will not have additional impacts on the avian community at the PIERP. Avian species will continue to use the habitats created at the PIERP for foraging, resting, and nesting activities. The habitats will continue to be developed as planned, and the ecosystems will continue to mature to support the repopulation of listed avian species such as the Least and Common Tern and other avian species. However, the benefits associated with creating additional avian habitats and the subsequent nesting habitats on created islands as part of the lateral expansion will not be achieved with the no-action alternative. The management of selected avian species due to predation, nuisance species, and disease outbreaks is expected to continue at the PIERP as part of the no-action alternative.

5.4.7.b Mammals

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No adverse impacts to mammals are expected from the perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. A few common mammal species (white-tailed deer, river otter, muskrat, raccoon, house mouse, and beaver) have been observed utilizing the PIERP during normal site operations and during Phase II construction activities. Most mammal species will acclimate quickly to the construction activities, and therefore, no significant impacts to existing mammal resources from the lateral expansion are expected. Short-term, temporary impacts from noise and construction activities may cause mammal species to avoid areas in close proximity to the construction (northern portions of Cells 1 and 2), but these effects would diminish after construction is completed. Additionally, a beneficial impact of the expansion will be the creation of additional areas of wetland/upland habitat for mammals to populate and utilize once the habitats are mature.

An additional impact to the mammalian community from raising the existing upland cells is the delay in the development of upland habitat in Cells 2 and 6 for species that could

potentially utilize the PIERP. The delay, defined as the time until grading and planting is initiated, is estimated to be approximately three years. This delay increases the time until the cells are mature and may impact terrestrial species that would utilize these matured habitats, including the mammalian community. Vehicular traffic associated with raising the existing upland cells will be similar to the current conditions at the PIERP and, therefore, no additional adverse impacts are anticipated. The upland habitat area in Cells 2 and 6 will be reduced by approximately 15 acres as a result of raising the existing upland cells. The habitat loss results from the additional interior fill required to support the height of the dikes. This decrease in habitat is expected to have a minimal impact on the mammals that will utilize the habitat because additional upland acreage will be created in the lateral expansion. Similar to existing conditions at the PIERP, the USFWS will most likely obtain trapping permits from MDNR to control the red fox population at Poplar Island, including the lateral expansion.

Southwestern Borrow Area No additional impacts to the mammalian community are expected as a result of dredging 91 acres of the southwestern borrow area as part of Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area No additional impacts to the mammalian community are expected as a result of dredging 49 acres of the southwestern borrow area as part of Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2. However a 130-acre open-water embayment is planned for Alternative 3, thus reducing the acreage of created wetland habitat by approximately 115 acres. Therefore, less total remote island habitat (uplands and wetlands) would be available for exclusively terrestrial mammalian species.

Southwestern Borrow Area No additional impacts to the mammalian community are expected as a result of dredging 19 acres of the southwestern borrow area as part of Alternative 3.

No-Action Alternative

The no-action alternative will not have additional impacts on mammals at the PIERP. The limited mammalian species that have been observed at the PIERP will continue to use the available and interim habitats. The upland and wetland habitats will continue to be developed as planned, and the ecosystems will continue to mature to support the repopulation of mammalian species. No impacts from additional noise and construction activities will occur and no delay in the development of the existing upland habitat in Cells 2 and 6 for species that could potentially utilize the PIERP would occur with the no-action alternative. However, the

benefits associated with creating additional upland and wetland habitats as part of the lateral expansion will not be acquired with the no-action alternative.

5.4.7.c Reptiles, Amphibians, and Invertebrates

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No adverse impacts to reptiles, amphibians, or invertebrates are expected as a result of perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel and sand borrow excavation. The PIERP is largely void of reptiles and amphibians, with the exception of some common species and the diamondback terrapin. Impacts to the diamondback terrapin are specifically addressed in more detail below.

Consultation with NMFS have indicated that four species of sea turtles potentially occur in the area, including the Federally-listed leatherback sea turtle, loggerhead, Kemp's ridley, and the green sea turtle (see Section 5.4.8 for a detailed discussion of sea turtles).

Invertebrates that currently utilize the interim habitats at the PIERP include butterflies, moths, spiders, grasshoppers, crickets, and dragonflies. These are common, opportunistic, mobile species that will not be adversely impacted by the lateral expansion, and are expected to repopulate the new wetland/upland habitats once they are created. The reptiles, amphibians, and invertebrate species that have been reported at the PIERP were observed utilizing the site during normal PIERP operations and during Phase II construction activities. This observation demonstrates that most species acclimate quickly to the construction activities, and therefore, no significant impacts from the lateral expansion are expected. Short-term, temporary impacts from noise and construction activities may cause reptiles, amphibians, and invertebrate species to avoid areas in close proximity to the construction, but these effects would diminish after construction is completed. Additionally, a beneficial impact of the expansion is the creation of additional areas of wetland/upland habitat for reptiles, amphibians, and invertebrates to populate and utilize as the ecosystems mature.

An additional impact of raising the existing upland cells to the reptile, amphibian, and invertebrate species is the delay in the development of upland habitat in Cells 2 and 6 for species that could potentially utilize the PIERP. The delay, defined as the time until grading and planting is initiated, is estimated to be approximately three years. This delay increases the time until the cells are mature and may impact terrestrial species that would utilize matured habitats, including the reptiles and amphibians community. Vehicular traffic associated with raising the existing upland cells will be similar to the current conditions at the PIERP and, therefore, no additional adverse impacts are anticipated. The upland habitat area in Cells 2 and 6 will be reduced by approximately 15 acres as a result of raising the existing upland cells. The habitat loss results from the additional interior fill required to support the height of the dikes. This decrease in habitat is expected to have a minimal impact on the reptile, amphibian, and invertebrate species that will utilize the habitat because additional upland acreage will be created in the lateral expansion.

Southwestern Borrow Area No additional impacts to reptiles, amphibians, or invertebrates are expected as a result of dredging 91 acres of the southwestern borrow area as part of Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area No additional impacts to reptiles, amphibians, or invertebrates are expected as a result of dredging 49 acres of the southwestern borrow area as part of Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as discussed for Alternatives 1 and 2. The open-water embayment has the potential to positively impact horseshoe crabs by creating spawning habitat. The marsh shoreline within the open-water embayment could potentially provide spawning habitat for the horseshoe crab if sandy beaches are created along the shorelines of the open-water embayment.

Southwestern Borrow Area No additional impacts to reptiles, amphibians, or invertebrates are expected as a result of dredging 19 acres of the southwestern borrow area as part of Alternative 3.

No-Action Alternative

The no-action alternative will not have additional impacts on reptile, amphibian, and invertebrate species at the PIERP. The reptile, amphibian, and invertebrate species that have been observed at the PIERP will continue to use the available and interim habitats. The upland and wetland habitats will continue to be developed as planned, and the ecosystems will continue to mature to support the repopulation of reptile, amphibian, and invertebrate species. No impacts from additional noise and construction activities will occur and no delay in the development of the existing upland habitat in Cells 2 and 6 for species that could potentially utilize the PIERP would occur with the no-action alternative. However, the benefits associated with creating additional upland and wetland habitats as part of the lateral expansion will not be acquired with the no-action alternative.

Diamondback Terrapins - Alternative 1 (60:40 Ratio)

Lateral Expansion and Vertical Expansion of Existing Uplands No significant adverse impacts to the diamondback terrapin nesting are expected from the perimeter dike construction for the northern lateral alignment and dredging the northern access channel. However, construction of the lateral expansion is expected to provide additional positive impacts to diamondback terrapins. The diamondback terrapin has used the PIERP extensively

for nesting, because the island provides excellent nesting habitat that includes accessible sandy areas above the mean high tide (Roosenburg, 2003). There has been no nesting activity (to date) of the diamondback terrapin utilizing the area in the northeast of the PIERP (northern portions of Cells 1 and 2), where the lateral expansion will connect to the PIERP. The majority of the terrapin nesting activities has occurred in Cells 3/3D, Cell 4, and Cell 5, although limited use has also occurred in Cell 6.

The most highly utilized area for nesting terrapin females is the "notch" area, which is a long sandy beach along the south shore of Coaches Island at the shorelines of Cells 4 and 5. The area lies within the ¼-mile Bald Eagle nest TOY restriction buffer (no construction activities December 15 through June 15) and the Great Blue Heron rookery buffer (no equipment or pedestrians February 15 through July 15) on Coaches Island. Terrapin nesting at the "notch" area has remained successful throughout the construction of the PIERP and would be expected to remain successful throughout the construction of the lateral expansion. However, TOY restrictions associated with the Great Blue Heron rookery and Bald Eagle nest buffer on Coaches Island would be in place to minimize any unforeseen potential disturbances and should aid in reducing any unforeseen impacts to terrapins utilizing the notch area. Additionally, this area will not be directly disturbed by the expansion, since most of the construction activities will occur in the northern portion of the PIERP. As part of the expansion activities, the incorporation of features to enhance terrapin habitat, such as the creation of non-recreational sandy beaches, to encourage increased diamondback terrapin nesting activity are being considered.

No additional significant impacts to diamondback terrapin nesting are anticipated from raising the existing upland cells. A total of 311 terrapin nests have been documented at the PIERP during the years 2002 through 2004. Of these 311 nests, only seven nests were located in the Cell 6 and no nests were located in Cell 2; both cells are proposed for raising at the PIERP. Vehicular traffic associated with raising the existing upland cells will be similar to the current conditions at the PIERP and, therefore, no additional adverse impacts are anticipated.

Southwestern Borrow Area No additional impacts to diamondback terrapins are expected as a result of dredging 91 acres of the southwestern borrow area as part of Alternative 1.

Diamondback Terrapins - Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area No additional impacts to diamondback terrapins are expected as a result of dredging 49 acres of the southwestern borrow area as part of Alternative 2.

Diamondback Terrapins - Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2. However, additional positive impacts to the diamondback terrapin are anticipated with the inclusion of

the open-water embayment. To date, the diamondback terrapin has used the PIERP extensively for nesting, because the island provides excellent nesting habitat that includes accessible sandy areas above the mean high tide (Roosenburg, 2003). Specifically, the "notch" area and sandy areas along the eastern perimeter dike facing Poplar Harbor have provided nesting habitat for the diamondback terrapin. The 10,600-foot perimeter of the embayment consists of approximately 1,500 feet of upland shoreline, and 5,700 feet of wetland shoreline. The shoreline of the southern end of the embayment was adjusted to provide a smoother alignment and increase the proportion of marsh shoreline. Marsh shoreline within the open-water embayment could potentially provide additional nesting habitat for the diamondback terrapin, similar to the habitat that the "notch" area and Poplar Harbor are currently providing. The 10-acre tidal gut located at the southern end of the expansion footprint adjacent to existing wetland Cell 1 will also potentially provide additional diamondback terrapin habitat.

Southwestern Borrow Area No additional impacts to diamondback terrapins are expected as a result of dredging in the southwestern borrow area as part of Alternative 3.

Diamondback Terrapins - No-Action Alternative

The no-action alternative will not have additional impacts diamondback terrapins at the PIERP. The diamondback terrapins that have been observed at the PIERP will continue to use the PIERP for nesting, hatching, and juvenile activities as the project continues and the ecosystems mature. No impacts from additional noise and construction activities will occur and no delay in the development of the existing upland habitat in Cells 2 and 6 for diamondback terrapins that could potentially utilize the PIERP would occur with the no-action alternative. However, the benefits associated with creating additional wetland habitat and potentially creating additional terrapin nesting habitat as part of the lateral expansion will not be acquired with the no-action alternative.

5.4.7.d Wetland Habitat

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Executive Order 11990-*Protection of Wetlands*, issued May 24, 1977, directs all Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands; and also to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. The lateral expansion and raising of existing upland cells is not anticipated to have any long-term, negative impacts on the PIERP's existing wetlands. A total of approximately 315 acres of wetlands and a total of approximately 235 acres of uplands will be created for Alternative 1. Alternative 1 also includes a 25-acre tidal gut to supply the water needed for tidal flushing of wetland cells. Therefore, the project will result in an overall increase in the total amount of wetlands at the PIERP and in the Mid-Bay region. Sand excavated from the southwestern borrow area for use in raising the existing upland cells and will be temporarily stockpiled within Cell 4. Sand is currently stockpiled in this location and this portion of the cell has not yet been planted, therefore, no impacts to existing wetland vegetation at PIERP are anticipated.

The lateral expansion will create a long-term positive impact by creating approximately 330 acres of wetland habitat and 25 acres of tidal gut habitat. This habitat will have a beneficial impact to numerous avian and wildlife species, in particular when the vegetation and habitat within the cells matures. Design goals and guidelines will be created to achieve each of the habitat types to be created as part of the expansion study, including low tidal marsh, high tidal marsh, bird-nesting islands in the marsh, tidal and non-tidal pools in the marsh, uplands, freshwater wetlands in the uplands, and mudflats. Offshore remote islands are a unique ecosystem component in the Chesapeake Bay watershed. These islands are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. Although similar vegetative communities may occur on the mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for colonial waterbirds and other avian species, including the Bald Eagle.

The wetlands included as part of the lateral expansion are expected to increase the PIERP's biotic productivity, improve water quality, and provide breeding and foraging grounds for avian species, wildlife, commercially and recreationally important fish, bird, and wildlife species; and RTE species. Three wetland "development" cells have been constructed at the PIERP and include Cell 3D and Cell 4D/Cell 4DX; the wetlands in Cell 4DX have already been utilized by many bird species, and as the area develops into a more cohesive ecosystem, more species are expected to utilize this area. Similar results for wetland cells that would be developed as part of the lateral expansion are expected. It is thought the benefits created by the wetlands will also support increased recreation, education, and research on and around the PIERP (USACE/MPA, 1996). The created wetlands are expected to benefit aquatic resources by reducing the amount of suspended solids eroding into the water column, therefore improving water quality and available fish habitat, provide areas of restored benthic and SWH to be utilized by benthic organisms and EFH species, and restore valuable habitat for fish and other aquatic species vital to the Chesapeake Bay ecosystem.

Alternative 1 will create 10 percent more wetlands compared to Alternative 2. The benefits of creating ten percent more wetlands as part of Alternative 1 are therefore, greater than the benefits of Alternative 2. These benefits include an increase in biotic productivity, improved water quality, and providing breeding and foraging grounds for avian species, wildlife, commercially and recreationally important fish, bird, and wildlife species; and RTE species.

The lateral expansion will provide a positive impact on the wetland vegetation on Jefferson Island, by providing protection from wind-driven waves from the northeast, reducing erosion and stabilizing the existing upland and wetland habitats. The expansion will not connect with Jefferson Island, and therefore, existing wetland communities and the existing tidal marsh on the island will not be disturbed by construction of the expansion. In addition, no impacts to existing wetland vegetation on Coaches Island is anticipated with Alternative 1.

Southwestern Borrow Area No additional impacts to vegetation are expected as a result of dredging 91 acres of the southwestern borrow area as part of Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands A total of approximately 275 acres of wetland habitat will be created for Alternative 2. Impacts associated with Alternative 2 are similar to the impacts discussed above for Alternative 1, however, ten percent less wetland habitat will be created for Alternative 2. Alternative 2 consists of a 575-acre lateral expansion component consisting of 550 placement acres of approximately 50 percent upland and 50 percent wetland habitat and a 25-acre tidal gut to supply the water needed for tidal flushing of wetland cells. As discussed above, benefits of the created wetlands include improving aquatic resources by reducing the amount of suspended solids eroding into the water column, therefore improving water quality and available fish habitat, providing areas of restored benthic and SWH to be utilized by benthic organisms and EFH species, and restoring valuable habitat for fish and other aquatic species vital to the Chesapeake Bay ecosystem.

Southwestern Borrow Area No additional impacts to vegetation are expected as a result of dredging 49 acres of the southwestern borrow area as part of Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Beneficial impacts associated with Alternative 3 are similar to the impacts discussed above for Alternatives 1 and 2, although fewer acres of wetland habitat will be created for Alternative 3. A total of approximately 165 acres of wetland habitat and approximately 270 acres of upland habitat will be created, and approximately 130 of open-water habitat will be conserved, and 10 acres of tidal gut habitat will be created as a result of Alternative 3. Although fewer acres of wetland habitat is proposed for Alternative 3, it is anticipated that a direct trophic link between the open-water embayment and the proposed wetland cells will be created and that the wetland habitat will include small tributaries and tidal guts that will provide diverse habitat for juvenile EFH and finfish species, juvenile blue crabs, and will support a more stable benthic community. The open-water embayment will be surrounded by shoreline wetland habitat as well.

A beneficial impact of Alternative 3 is that the open-water embayment habitat will be available in a shorter time period because this habitat is being conserved, compared to the habitat proposed for creation in Alternatives 1 and 2.

Southwestern Borrow Area No additional impacts to vegetation are expected as a result of dredging activities in the southwestern borrow area as part of Alternative 3.

No-Action Alternative

The no-action alternative will have no additional beneficial impacts on the existing vegetation at the PIERP. However, long-term adverse impacts to the existing wetlands at both Jefferson and Coaches Island will occur as these habitats continue to erode into the Bay, resulting in a net loss of wetlands. The wetland cells at the PIERP, however, will continue to be developed and planted as planned, and the ecosystems will continue to mature to support the repopulation of wildlife species. The benefits associated with creating additional wetlands

(described above in Alternative 2) and the tidal gut as part of the lateral expansion would not be acquired with the no-action alternative.

5.4.7.e Upland Habitat

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Terrestrial vegetation currently existing on Poplar, Jefferson, and Coaches Islands will be largely unaffected by perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel because most construction will occur in the water. Existing cells will be used to stockpile excess material prior to placement – "unsuitable" materials would most likely be stockpiled within Cell 2. No impacts to upland vegetation are anticipated as a result of the stockpiling, since these cells are currently being used for the same purpose during the construction of the PIERP.

The lateral expansion will provide a positive impact on the vegetation on Jefferson Island, by providing protection from wind-driven waves from the northeast, reducing erosion and stabilizing the existing upland and wetland habitats. The expansion will not connect with Jefferson Island, and therefore, existing vegetative communities and the existing tidal marsh on the island will not be disturbed by construction of the expansion.

The lateral expansion will create a long-term positive impact on terrestrial vegetation by creating approximately 235 acres of upland island habitat. This habitat will be a beneficial impact to numerous avian and wildlife species, in particular when the vegetation and habitat within the cells matures. Design goals and guidelines will be created to achieve the upland habitat types proposed to be created as part of the expansion study. Offshore remote islands are a unique ecosystem component in the Chesapeake Bay watershed. These islands are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. Although similar vegetative communities may occur on the mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for colonial waterbirds and other avian species, including the Bald Eagle.

Additional impacts to terrestrial vegetation associated with raising the existing upland cells include the delay of mature vegetation in the upland Cells 2 and 6. The delay, defined as the time until grading and planting is initiated, is estimated to be approximately three years. This delay increases the time until the cells are mature. Because the raising the existing upland cells will occur in the undeveloped and currently unvegetated Cells 2 and 6, no impacts to vegetation at the PIERP are anticipated as a result of raising the existing upland cells.

Southwestern Borrow Area No additional impacts to vegetation are expected as a result of dredging 91 acres of the southwestern borrow area as part of Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are similar to the impacts discussed above for Alternative 1, however, ten percent more uplands will be created for Alternative 2. Approximately 275 acres of uplands will be created for Alternative 2.

Southwestern Borrow Area No additional impacts to vegetation are expected as a result of dredging 49 acres of the southwestern borrow area as part of Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to the impacts discussed above for Alternatives 1 and 2, however, approximately 270 acres of uplands will be created for Alternative 3, compared to approximately 235 acres for Alternative 1 and approximately 275 acres for Alternative 2.

Southwestern Borrow Area No additional impacts to vegetation are expected as a result of dredging in the southwestern borrow area as part of Alternative 3.

No-Action Alternative

The no-action alternative will have no additional beneficial impacts on the existing upland vegetation at the PIERP. However, long-term adverse impacts to the existing upland habitat at both Jefferson and Coaches Island will occur as these habitats continue to erode into the Chesapeake Bay. The upland cells at the PIERP will continue to be developed and planted as planned, and the ecosystems will continue to mature to support the repopulation of wildlife species. No delays will occur from the environmental benefits identified for Cells 2 and 6. However, the success of development of the upland habitat at PIERP will be at greater risk with the no-action alternative if the cells are overloaded. Extensive consolidation and/or differential consolidation after planting may also damage the existing upland vegetation that has been planted. Also, the benefits associated with creating additional uplands as part of the lateral expansion will not be acquired with the no-action alternative.

5.4.8 RARE, THREATENED, AND ENDANGERED SPECIES

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Listed Avian Species

Lateral Expansion and Vertical Expansion of Existing Uplands Since avian monitoring at the PIERP was initiated, 18 listed avian species have been observed utilizing the interim habitats available at the PIERP. The most notable avian species, the State and Federally-listed threatened Bald Eagle, could potentially be impacted by constructing the lateral expansion, as well as other State-listed avian species that have been observed nesting on the PIERP. Based on conversations with Jason Miller (Fish and Wildlife Biologist, USFWS), the Bald Eagle nest on Coaches Island is considered to be active by the USFWS. Listed avian species that have nested at the PIERP or in the vicinity could potentially be affected by the lateral

expansion in addition to the Bald Eagle include the State-listed threatened Least Tern, the State-listed rare Spotted Sandpiper (nesting at the PIERP has not been confirmed, but possible), the State-listed rare American Oystercatcher, and the State-listed rare Double-Crested Cormorant. The Common Tern and the Least Tern, both species of high priority in Maryland will be impacted by the lateral expansion. These listed terns will be affected by the conversion of open water foraging areas to the upland and wetland habitats that will be created in the lateral expansion. However, open water habitat is not a limiting resource in the vicinity of Poplar Island, as adjacent open water is available in the immediate vicinity. Therefore, terns will be forced to seek foraging areas elsewhere and will likely follow the forage fish stocks. Common and Least Terns have used the created islands at the PIERP for nesting, although nesting was essentially unsuccessful during both 2003 and 2004, apparently as a result of predation by red fox and other factors. Adjacent tern nesting habitat is located along shoreline areas on Jefferson Island and at other interim habitats at the PIERP. Terns are expected to populate these areas during construction activities associated with the lateral expansion. Also, additional nesting island sites will be created within the lateral expansion to support these birds, which should result in a net beneficial impact to terns.

Disturbances to most avian resources, including the Bald Eagle nest on Coaches Island, are expected to be minimal as part of the project, since the Bald Eagle and nest remained undisturbed throughout the construction of the PIERP and listed avian species have utilized and nested on the PIERP during the on-going construction activities. The lateral expansion is sufficiently outside of the ¼-mile Bald Eagle buffer, and therefore, the TOY restrictions are not expected to impact the schedule of construction for the lateral expansion.

No significant adverse impacts to these avian resources are anticipated with the lateral expansion because the avian species are currently utilizing the PIERP during on-going construction activities. The proposed perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel will occur in phases, and therefore, the associated impacts to listed avian species will vary depending upon timing and location of construction activities. The construction of the northern lateral expansion may have short-term and long-term impacts to listed avian species. The most notable long-term adverse impact to avian species in the Study Area will be the conversion of open water habitat, including shallow-water habitat, within the lateral expansion footprint to upland and wetland habitats. Open water foraging and resting areas utilized by resident and migrating listed avian species will be permanently lost in the footprint of the expansion. As discussed in Section 3.1.8.b, existing conditions studies demonstrated that the PIERP provides breeding and foraging grounds for several Federal or State-listed species. Since May 2001, 18 listed avian species have been observed at the PIERP (see Table 3-7). The listed avian species utilizing these habitats will be required to move to other adjacent interim open water habitats available at the PIERP or in the vicinity of Jefferson and Coaches Islands. Because comparable foraging and nesting habitat is located adjacent to the lateral expansion and these avian species can easily access these areas by flight, the loss of open water foraging and resting areas is not anticipated as a significant impact to listed avian species. For avian species dependent on fish, these birds will likely follow the mobile forage fish that will avoid construction activities and seek comparable adjacent habitat. Listed avian species that

normally utilize open water habitat and have been observed at the PIERP include the Bald Eagle, Northern Harrier, Peregrine Falcon, and Brown Pelican.

Short-term impacts may also occur during the initial construction phases of the expansion, specifically to avian species that have recently nested at the PIERP or in the vicinity of the Study Area. These short-term impacts may be associated with the increased vehicular traffic along the perimeter and interior dike roads, specifically in the "notch" area at Coaches Island and in the northern portion of Cells 1 and 2. It is possible that State-listed avian species may choose to nest in the construction areas during construction, as has occurred with Least Tern nesting on dikes during construction of PIERP. In that event, the ongoing avian monitoring activities would likely rapidly identify these occurrences and consultation would be conducted with the USFWS and the MDNR.

No additional significant impacts to listed avian species are anticipated from raising the existing upland cells because the dike raising will occur in the undeveloped and currently unvegetated Cells 2 and 6. The raising of existing upland cells will delay the development of potential upland habitat for RTE species in Cells 2 and 6, increasing the time until the cells are mature and wildlife, including RTE species can fully utilize the mature habitats. Vehicular traffic associated with raising the existing upland cells will be similar to the current conditions at the PIERP and, therefore, no additional adverse impacts are anticipated.

Alternative 1 would create 575 acres of placement area and additional remote island habitat at the PIERP for utilization by listed avian species. The development of island habitat specifically for targeted avian species will provide a significant long-term positive impact as a result of the lateral expansion. Offshore islands are a unique ecosystem component in the Chesapeake Bay watershed. These islands are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. Although similar vegetative communities may occur on the mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for listed avian species, including the Bald Eagle and the Common and Least Terns.

A response letter from USFWS dated 14 April 2004 stated that any construction or forest clearing activities within one-quarter mile of active nests may impact Bald Eagles and that further consultation would be necessary. Because all activities associated with the lateral expansion will occur outside of the one-quarter mile buffer, no additional coordination concerning the Bald Eagle with the USFWS was necessary. The U.S. Department of the Interior, Office of the Secretary, Office of Environmental Policy and Compliance (USFWS), responded to the Draft GRR/SEIS in a 5 August 2005 letter that was submitted in accordance with the Fish and Wildlife Coordination Act and the Endangered Species Act (Appendix F). The letter stated that further Section 7 coordination with the USFWS concerning the federally-threatened bald eagle was not necessary if all construction activities occur outside of the ¼-mile nest buffer, as planned and stated in the Draft GRR/SEIS

However, further coordination with the MDNR Natural Heritage Division was suggested in the 14 April 2004 letter from USFWS and was completed by the USACE. The MDNR Natural Heritage Division responded to the USACE with a letter dated 8 August 2005 stating

that they had no comments in regards to bald eagle nest protection on activities proposed outside of the ¼ mile buffer from the nest and that waterbird colonies (herons and terns) should also be protected with a ¼ mile buffer (Appendix F).

Southwest Borrow Area Short-term adverse impacts to listed avian species that utilize the open water habitat southwest of Cell 6 will occur during dredging 91 acres of the southwestern borrow area, although the impacts of excavation are expected to be temporary and additional open water forage habitat is available in the vicinity of the site. Following the completion of excavation, this area will be available as open water habitat.

Listed Aquatic Species

Lateral Expansion and Vertical Expansion of Existing Uplands Section 7 consultation for Shortnose Sturgeon (SNS) occurred for the dredging and placement activities within the Chesapeake Bay. The biological assessment for SNS was finalized and submitted to NMFS on 27 August 2005. Individual project Section 7 consultations for the lateral and vertical expansion occurred and is complete. In an agency correspondence letter dated 22 August 2005, NMFS stated that no sea turtles and/or shortnose sturgeon have been encountered in previous dredging operations at Poplar Island and that no direct effects to shortnose sturgeon and/or sea turtles are likely to result from the required dredging operations (Appendix F). As a result of the agency correspondence, the USACE has determined, and NMFS has concurred in the 22 August letter, that the proposed northern lateral expansion is not likely to adversely affect any threatened or endangered species within the jurisdiction of NOAA and that no further consultation pursuant to Section 7 of the ESA is required (Appendix F).

No SNS have been captured in the vicinity of the PIERP site as part of the Reward Program (through January 13, 2005). The nearest SNS catch was approximately 9.2 miles (8 nautical miles) to the west of Poplar Island near Herring Bay and was caught with a gillnet (Figure 3-24). This site was not sampled as part of the USFWS/USACE Sturgeon study. No shortnose sturgeon were captured near the PIERP during any of the site-specific studies conducted in the area since 1995, and no takes of Shortnose Sturgeon occurred during PIERP site construction. Informal consultations with NMFS have indicated that the agency considers SNS present within the Chesapeake Bay (Nichols NMFS, 2004). Because SNS are only expected to be transient to the area, no impacts to this species are anticipated from the lateral expansion.

Consultations with NMFS have indicated that four species of sea turtles potentially occur in the area and could be affected by the lateral expansion, including the Federally-listed leatherback sea turtle, loggerhead, Kemp's ridley, and the green sea turtle. Although records of all sea turtles exist for the Chesapeake Bay, most occur in very low numbers in Maryland waters (Section 3.1.8.a). Only loggerhead sea turtles utilize the Chesapeake Bay north of the Choptank River with any regularity (Evans *et al.*, 1997). Recent sea turtle stranding data has indicated that less than four sea turtles, on average, are stranded north of the Choptank River per year. This would indicate that sea turtles are transient to the area and the potential for direct adverse impacts from project development are low. USFWS has indicated that juvenile forage areas for these sea turtles may be present in the waters surrounding the PIERP (Appendix C, Table C-9). Sea turtles utilize a variety of forage habitats (Keinath *et al.*, 1987)

although SAV beds are preferred due to the prevalence of macroinvertebrates and juvenile fish (Lutcavage and Musick, 1985). Because no SAV occurs within the expansion area, project impacts to preferred forage areas will be minimal. If sea turtles were observed in the areas proposed for dredging, it is likely that they would avoid areas of construction due to their mobility in water. In the longer term, project impacts to sea turtles are expected to be positive. Created wetland areas and recovering SAV beds will provide more forage habitat for sea turtles than is currently present within the Study Area.

No additional significant impacts to listed aquatic species are anticipated from raising the existing upland cells because the dike raising will occur in the undeveloped and currently unvegetated Cells 2 and 6. The raising of existing upland cells will delay the development of potential upland habitat for RTE species in Cells 2 and 6, increasing the time until the cells are mature and wildlife, including RTE species can fully utilize the mature habitats. Vehicular traffic associated with raising the existing upland cells will be similar to the current conditions at the PIERP and, therefore, no additional adverse impacts are anticipated.

Southwest Borrow Area No additional impacts to listed aquatic species are anticipated in the southwest borrow area associated with Alternative 1. Sea turtles prefer to forage in habitats where SAV beds are present due to the prevalence of macroinvertebrates and juvenile fish (Lutcavage and Musick, 1985). Because no SAV occurs within the southwest borrow area, project impacts to preferred forage areas will be minimal. Additionally, no SNS have been captured in the vicinity of the PIERP site as part of the Reward Program (through January 13, 2005). Because SNS are only expected to be transient to the area, no impacts to this species are anticipated from the southwestern borrow area activities associated with Alternative 1.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

As a result of the agency correspondence, the USACE has determined, and NMFS has concurred, that the northern lateral expansion will have no effect on species within the jurisdiction of NOAA. Impacts to listed aquatic and avian species for Alternative 2 are the same as impacts discussed above for Alternative 1, although approximately 49 acres of the southwestern borrow area will be disturbed for Alternative 2. No additional impacts to aquatic species are anticipated for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Listed Avian Species

Lateral Expansion and Vertical Expansion of Existing Uplands As a result of the agency correspondence, the USACE has determined, and NMFS has concurred, that the proposed northern lateral expansion will have no effect on species within the jurisdiction of NOAA. Adverse impacts associated with listed avian species for Alternative 3 are similar to the discussions above for Alternatives 1 and 2. However, less open-water habitat, shallow-water foraging habitat, and resting areas utilized by listed avian species will be permanently lost (470 acres for Alternative 3 as compared to compared to 600 acres for Alternatives 1 and 2). Alternative 3 includes 130 acres of conserved open water protected by a line of segmented breakwater structures, and the incorporation of avian nesting islands into the design. Similarly discussed in Section 5.4.7.a *Avian Community*, up to 130 acres of currently

unprotected open water and bottom habitat, both habitats that are highly utilized by avian species, would not be directly or adversely impacted, but would be protected within an open-water embayment with stone breakwater structures. In addition to conserving open-water and Bay bottom habitat, mudflats/intertidal habitat and shoreline areas that provide a trophic link between the created wetlands and open-water embayment would both also be created as part of Alternative 3.

The conservation of 130 acres of open water and Bay bottom habitat within the protected embayment will benefit listed waterfowl such as Blue-Winged Teal and Gadwall that would utilize this area for foraging and resting activities. However, adjacent open water foraging and resting areas are not unique resources in the immediate vicinity of Poplar Island. The 130-acre open-water embayment is anticipated to create quiescent conditions that could potentially support additional SAV beds along the shoreline areas preferred by waterfowl. The conservation of open water habitat will also benefit listed avian species that are primarily piscivores that utilize open water habitats and have been observed at the PIERP, including the Bald Eagle, Brown Pelican, Least Tern, Double-Crested Cormorant, Royal Tern, Sandwich Tern, and Black Skimmer. The open-water embayment is expected to create more diverse habitat types for finfish including deep and shallow subtidal zones, an open water pelagic zone, mudflat habitat, tidal guts and tributaries throughout the wetland cells, submerged reef habitat, and rock reef habitat. Because these habitats will be created to attract a variety of finfish species, it is assumed that the listed piscivorous-dependent avian species described above will also benefit from the open-water embayment.

It is anticipated that a direct trophic link between the open-water embayment and the proposed wetland cells will be created. The open-water embayment would provide access to the small tributaries and tidal guts in the wetland cells for a variety of juvenile fish species, juvenile blue crabs, and a more diverse and stable benthic community. This habitat enhancement and the resulting forage access are expected to provide long-term positive impacts to shorebirds and marsh birds, and the new habitats created as part of the lateral expansion will be more significant than the loss of open water habitat for listed avian species. The conservation of bottom water habitat and the tidal guts and tributaries throughout the wetland cells will benefit the listed avian species that feed primarily on benthic invertebrates such as the Spotted Sandpiper, American Oystercatcher, and Gull-Billed Tern.

No-Action Alternative

The no-action alternative will have no additional impacts on listed aquatic and avian species at the PIERP. Listed aquatic and avian species that utilize open water habitat will not be displaced within the footprint of the lateral expansion or the southwestern borrow area. The upland and wetland cells will continue to be developed and planted as planned, and the habitats will continue to mature to potentially support RTE species. The environmental benefits that will occur as a result the increased upland and wetland habitat proposed as part of the lateral expansion, including the creation of foraging, resting, and nesting habitats for listed avian species will not be available with the no-action alternative. The upland cells at the PIERP will continue to be developed and planted as planned, and the ecosystems will continue to mature to support the repopulation of wildlife species. No delays will occur from the environmental benefits identified for Cells 2 and 6. The no-action alternative will not

provide additional beneficial impacts to listed aquatic species in the vicinity of the PIERP due to the created wetlands and tidal gut as part of the lateral expansion, including providing valuable nursery and refuge area for a variety of finfish species.

Long-term adverse impacts to the existing upland habitat at both Jefferson and Coaches Island will occur as these habitats continue to erode into the Chesapeake Bay. The Bald Eagle nest currently located on Coaches Island would potentially require relocation in the future due to an estimated shoreline erosion rate of 2.6 ft/yr at Coaches Island.

5.4.9 AIR QUALITY

The lateral expansion of the PIERP and construction of a vertical dike will generate air emissions from the operation of dump trucks, excavators, bulldozers, and other heavy-duty equipment. The pollutants of interest include nitrogen oxides (NO_X) and volatile organic compound (VOC) emissions because they are the precursors to the formation of ozone, as well as carbon monoxide (CO) and particulate matter (PM_{10}). A Federal conformity determination was not required because Talbot County is in attainment for all NAAQS.

Air emissions were estimated based on equipment type, engine sizes, and estimated hours of operation. Using the assumptions regarding diesel equipment operating times and USEPA diesel equipment and truck engine emission factors, air emissions were calculated for the northern lateral expansion, raising the existing upland cells, and the no-action alternative.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Emissions will result from two primary activities – hydraulic dredging the during excavation of the sand borrow areas and construction of the lateral expansion. Hydraulic dredging in the sand borrow areas will be a short-term activity, conducted only during construction of the perimeter dikes. Emissions associated with the construction of the lateral expansion were estimated using historical data from Phase I and II construction at the PIERP. During Phase II construction, data on types of equipment and their estimated operating hours were tracked. Using these data as a surrogate for the lateral expansion, emissions were calculated. However, because the lateral expansion is approximately 40 percent larger than the previous Phase II expansion, the operating usage data were scaled accordingly. Estimated emissions are summarized in Table 5-5 for the lateral expansion.

Table 5-5. Estimated Total Air Emissions from the PIERP Northern Lateral Expansion Construction Equipment

Construction Equipment	Average Rated HP	Usage (hrs)[1]	Emissions (lbs)			
			CO	NO_X	VOC	PM_{10}
Dump Trucks	260	22,686	17,561	60,209	5,413	5,017
Bulldozers	260	9,487	8,679	29,757	2,675	2,046
Excavators	260	15,448	26,705	55,208	3,662	7,395
Graders	260	568	556	1,905	171	159
Gradall	200	1,149	809	2,773	249	231
Water Truck	175	406	250	856	77	71
Cranes	250	13,091	17,576	43,103	5,411	6,026
Total		**(lbs):**	72,136	193,812	17,658	20,946
		(tons):	36.07	96.91	8.83	10.47

Source: Estimates were calculated using the methodology and information provided in the *Nonroad Engine and Vehicle Emission Study--Report*, USEPA Doc 21A-2001, 1991.

[1] Surrogate data from PIERP Phase II construction equipment hours scaled upward by a factor of 1.2 to account for the larger construction area

[2] Air emissions from dredging of sand in borrow areas adjacent to the Island for vertical dike construction have not been included, but are expected to be minimal. An estimate of these emissions will be included in the Final GRR/SEIS.

It should be noted that emissions calculated for the lateral and vertical expansion are a one-time event, generated only over the time frame of the lateral and vertical expansion construction.

Increased Annual Operating Air Emissions In addition to temporary increases in air emissions from the planned construction activities, emissions associated with dredged material placement will increase after completion of construction. At that time, open-water placement of dredged material from maintenance dredging of the southern approaches to the C&D Canal at Pooles Island will cease, and this material will be transported to the PIERP. This will result in a increase in annual dredged material placement volumes at the PIERP from 2 mcy to 3.2 mcy, with an attendant increase in air emissions from these activties. The current estimated annual air emissions from dredged material placement at the PIERP are presented in Table 3-10. Estimated Air Emissions from the PIERP Earthmoving Equipment Operations. Increasing these emissions proportionally to the increased placement volumes results in the annual air emissions shown in Table 5-6.

Table 5-6. Estimated Air Emissions from PIERP Earthmoving Equipment Operations – Post Construction

Emissions (tons/yr)			
CO	NO_X	VOC	PM_{10}
12.11	28.34	3.33	2.90

The additional air emissions associated with raising the existing upland cells were estimated using historical data from previous vertical dike construction activities. Using these data as a surrogate for the vertical dike raising, emissions were calculated. Estimated emissions are summarized in Table 5-7 for the raising of existing upland cells construction activities.

Table 5-7. Estimated Total Air Emissions from the PIERP Raising of Existing Upland Cells Construction Equipment

Construction Equipment	Average Rated HP	Usage (hrs)[1]	Emissions (lbs)			
			CO	NO_X	VOC	PM_{10}
Dump Trucks	220	18,124	12,026	41,231	3,706	3,436
Bulldozers	260	8,840	6,931	23,765	2,136	1,634
Excavators	260	11,151	16,524	34,159	2,266	4,576
Grader	260	1,232	1,034	3,545	319	295
Front End Loader	260	882	692	2,371	213	198
Water Truck	175	1,081	666	2,282	205	190
Roller	100	1,243	572	1,403	176	196
Total		**(lbs):**	38,444	108,756	9,022	10,525
		(tons):	19.22	54.38	4.51	5.26

Source: Estimates were calculated using the methodology and information provided in the *Nonroad Engine and Vehicle Emission Study--Report*, US EPA Doc 21A-2001, 1991.

[1] Surrogate data from PIERP Phase II construction equipment hours scaled upward by a factor of 1.2

To put these construction and increased operating air emissions into perspective for the region, total estimated emissions associated with the construction of the northern lateral expansion, the raising of existing upland cells construction, and additional air emissions from increasing the annual dredged material placement volume from 2 to 3.2 mcy annually, are compared to annual Talbot County air emissions in Table 5-8.

Table 5-8. Estimated Total Air Emissions from the PIERP Northern Lateral Expansion and Raising Of Existing Upland Cells Construction Equipment

	Emissions (tons)			
	CO	**NO_X**	**VOC**	**PM_{10}**
Northern Lateral Expansion	36.07	96.91	8.83	10.47
Raising Existing Upland Cells	19.22	54.38	4.51	5.26
Increased Annual Placement Volumes	12.11	28.34	3.33	2.90
Total from Alternative 1	**67.4**	**179.63**	**16.67**	**18.63**
Annual Talbot County Emissions	14,000	3,000	2,437	2,729
Percent of Talbot County Emissions	0.5	6.0	0.7	0.7

This comparison represents a conservative (worst case) assumption because it assumed that all construction would be done concurrently and accomplished within a year and that the emissions from increased annual dredged material placement volumes would also be concurrent. The Federal General Conformity Regulations that often apply to Federally-funded construction projects do not apply to the PIERP because the area is in attainment for all criteria pollutants, including ozone. However, the General Conformity Regulations include a definition of a "regionally significant action/project" for areas where the conformity regulations do apply. A regionally significant action/project is defined as a Federal project or action with total emissions greater than 10 percent of the emissions inventory for the area. As noted in Table 5-8, emissions of CO, VOC, and PM_{10} emissions are less than one percent of those of Talbot County, while NO_X emissions are well below the 10 percent used to define a project of regional significance, therefore, the General Conformity Regulations do not apply to the PIERP and no consultation with MDE is required.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Impacts to air quality for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts to air quality are anticipated for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Impacts to air quality for Alternative 3 are the same as impacts discussed above for Alternatives 1 and 2, although less perimeter dike construction will be required, resulting in a negligible reduction in construction-related emissions.

No-Action Alternative

No additional significant increases in air emissions on the PIERP are expected with the no-action alternative because the operation of heavy-duty diesel equipment are equivalent to the existing conditions at the PIERP. No additional air emissions would be anticipated at PIERP due to the no-action alternative.

5.4.10 NOISE

5.4.10.a Noise Impacts to Eastern Shore Mainland, Jefferson Island, and Coaches Island Noise ordinances for Talbot County set a maximum permitted sound level of 55 dBA beyond the project boundary within rural residential areas (Talbot County, 2004). Sounds are permitted to exceed this level by 10 dBA for a single period per day, up to 15 minutes. However, noise associated with vehicles, construction, and warning signals are exempted from this requirement.

Methods

Sound levels associated with perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel and sand borrow excavation were evaluated to determine likely sound levels experienced by people in the vicinity of the project. Both the types of equipment likely to be used during different phases of the project and whether that equipment was likely to be used at night were identified. Nighttime noise is generally perceived as more bothersome than daytime noise and therefore is of particular concern. Sensitive noise receptors including residential, recreational and commercial areas in the vicinity of the PIERP were identified using the most recent tax assessment database and other sources described Section 3.1.10.

Although sound transmission is a function of specific conditions between the sound source and receptor, for purposes of this analysis, techniques to model sound transmission were used that assumed typical or average conditions. Commonly accepted rules of thumb were used to calculate the perceived sound levels after transmission of sound over land and water. Standard assumptions were used regarding the additive effects of multiple sound sources. These assumptions will misrepresent sound transmission under atypical conditions, which may occur frequently. For example, temperature inversions will occur on most calm, clear nights and will have the effect of amplifying sound levels heard around dawn.

Sound level attenuation between noise-generating activities and receptors was calculated by assuming that sounds originating from the island project traveled primarily over water, and therefore were attenuated 5 dBA with each doubling of distance (Bloomberg, 2004). Additional attenuation associated with molecular absorption and analogous excess absorption was also factored into the analysis. Molecular absorption refers to the linear attenuation of sound intensity as a result of its passage through air, and results in a 0.7 dBA decrease per 1,000 ft. Analogous excess attenuation is also linear, and is associated with other factors that reduce sound intensity such as humidity or ground cover, and was assumed to be a 1.0 dBA decrease per 1,000 ft.

When considering several sources producing sound simultaneously, sound levels cannot be added arithmetically because decibels are a logarithmic measure. Instead, the additive nature of sounds is such that the sound pressure level from two sources generating the same decibel level is approximately 3 dB greater than the sound pressure level of just one source (Table 5-9). Such rules of thumb were used in the analysis to calculate total sound levels associated with typical project conditions, such as the simultaneous, proximate operation of several pieces of heavy machinery.

Table 5-9. Addition of Multiple Sound Sources

Difference between sound level of 2 sources	Amount added to higher value
0 to 1 dBA	3
2 to 3 dBA	2
4 to 9 dBA	1
10 or more dBA	0

Source: Federal Highway Administration (1995)

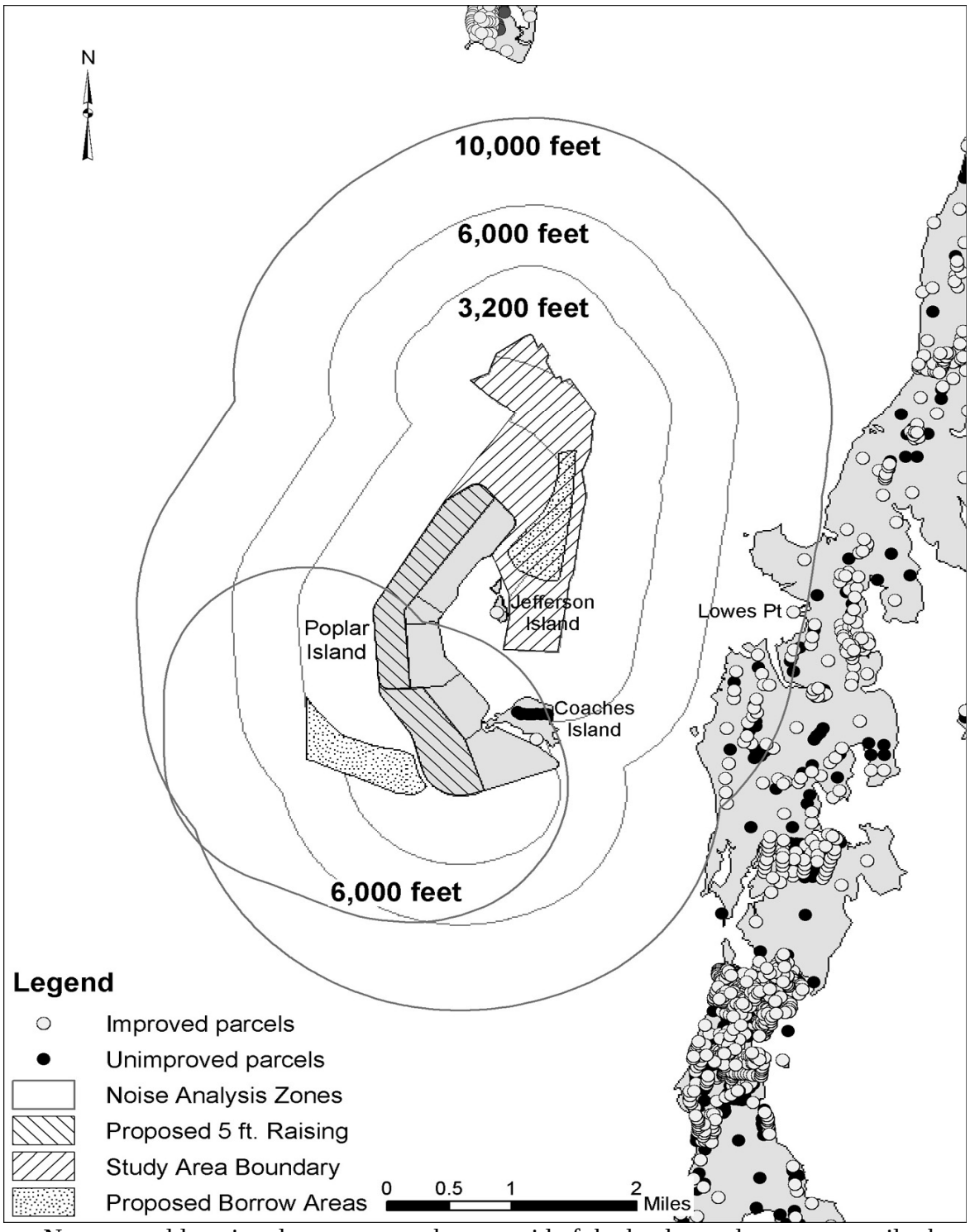
To quantify sound levels generated by construction and other equipment for the lateral expansion and raising the existing upland cells, the construction history of the PIERP was used as a model of typical conditions that could be expected during new phases of construction. Data on type and quantity of equipment used at the PIERP, duration of each phase of that project, and timing of activities within each phase were gathered from the USACE-Baltimore District, MES and other sources. Likely noise impacts associated with the project were identified using different noise analysis zones distinguished by different types of noises.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Sustained noise levels generated by typical daily operations associated with the proposed lateral expansion are expected to peak around 90 dBA at 50 ft. This sound level represents several pieces of heavy equipment (i.e., dump trucks, dozers, compactors) working simultaneously in close proximity to one another. For any given observer the sustained, elevated sound level experienced will depend on distance from the work vehicle, atmospheric conditions, and proximity of multiple work vehicles to each other. Factoring attenuation over water, molecular absorption, and analogous excess attenuation, a 90 dBA sound is estimated to decrease to typical daytime background levels (55 dBA) within 3,200 ft of the noise source.

Based on the results of the GIS analysis for the proposed lateral expansion, two improved (developed), residential parcels fall within 3,200 ft of the Study Area perimeter. These parcels are located on Jefferson and Coaches islands. Additionally, ten unimproved (undeveloped) parcels, located on Coaches Island, fall within 3,200 ft of the Study Area boundary (Figure 5-10). The total exposure of residents and visitors to elevated noise levels at these properties will depend on the amount of time equipment is operating in proximity to the islands and the season and duration of use by residents and visitors.

Rock placement and back-up alarms will produce the loudest sounds, but these sounds are periodic in nature. . Sound levels from back-up alarms can vary from 85 to 110 dBA at 50 ft, and the placement of rock during initial phases of construction will also generate sound levels in this range. These activities generally occur during daytime hours. A sound at the 110 dBA level attenuates to daytime background levels within 10,000 ft of the source. The GIS analysis for the lateral expansion alternative indicates that about 29 improved residential



Note: parcel location dots represent the centroid of the land parcel, not necessarily the location of the house or building within the parcel. Parcels were considered to fall within a given noise zone if any part of the parcel fell within the zone.

Figure 5-10. Zones Used for Noise Analysis for Lateral Expansion and Vertical Expansion of Existing Uplands

parcels (19 waterfront, 10 non-waterfront) fall within this range of the Study Area boundary (Figure 5-10). Additionally, there are 17 unimproved waterfront and 8 unimproved, non-waterfront parcels within 10,000 ft of the Study Area boundary that have the potential to be developed into residences or other uses, suggesting that the future population affected by noise could be marginally higher. This zone of periodically elevated noise levels extends north of the island over a major portion of the neighboring recreational fishing area.

Noise-related impacts to parcels located on Jefferson and Coaches Islands are anticipated from sound-generating activities that will occur day and night, such as movement of tugs and barges and operation of pumps. These activities are associated with inflow, and therefore will persist for the duration of the project development. Inflow occurs September to March, so these effects are expected to be seasonal. Sound levels associated with these activities would be in the range of 82 dBA for barges, 81 dBA for generators used to power lights, and 76 dBA for pumps. These sounds have the potential to combine into the equivalent of a single source generating 85 dBA at 50 ft, if all equipment is operated in close proximity. That sound level would typically be attenuated to a nighttime background level of 40 dBA in about 6,000 ft. The GIS analysis of the Study Area boundary showed that the two improved and ten unimproved parcels on Jefferson and Coaches islands are within this range. The duration of noticeable nighttime noise increase will depend on the actual distance between equipment and observers, duration of activities in areas proximate to the islands, and proximity of multiple pieces of noise-generating equipment. The actual project boundary is not yet known with 100% certainty, therefore the noise analysis has been conducted for an area larger than the expected footprint. Residents of and visitors to Coaches and Jefferson islands would be expected to experience elevated nighttime noise levels during those periods when equipment is operating within 6,000 feet of the islands.

Intensity and types of activities will vary during the proposed project's construction and development. The most intense period of sound generation will occur during exterior dike construction and the raising of the existing upland cells. These construction activities will occur concurrently, and are expected to be completed within an approximate two-years period. During this period, the level of construction activity at the proposed expansion will be high, and therefore noise levels (as described above) may be elevated frequently. After construction is complete, however, the intensity of activities will decrease. Activities associated with inflow, site maintenance, and habitat development will use the types of equipment and will generate the noise levels described above, but with a diminished intensity of effort. Therefore, it is expected that noise levels will be elevated less frequently. Additionally, because the analysis of the proposed lateral expansion was conducted at the Study Area scale (i.e., sounds were evaluated as if they were occurring at the edges of the Study Area in all cases), the number of parcels affected by periodic noise disturbances is likely an overestimation. Sound levels associated with sustained activities (i.e., operation of vehicles, pumping of dredged material) of the proposed lateral expansion will generally not be noticeable simultaneously to the entire set of potentially affected residents and boaters.

Generally, noise impacts associated with the proposed lateral expansion are not expected to interfere with residential or recreational activities. The loudest sounds will be periodic or of relatively short duration. Occasionally, noise levels at 10-20 nearby waterfront residences or

businesses may exceed levels typical to quiet, suburban neighborhoods. During times of the year when residents are primarily inside with windows closed, the noise levels should not be noticeable by residents. Once construction of the lateral expansion is complete, the occasional boat traffic that might be associated with limited visitation to the island will be consistent with pre-existing noise levels. Because the areas of noise disturbance do not extend far inland, any future development of unimproved or agricultural parcels should not have a significant effect on the number of future residents affected by noise.

Raising the existing upland cells will involve equipment similar to that used in the construction, inflow, and maintenance of the existing PIERP; therefore, the vertical dike raising will not introduce new types of sounds. After the dikes are raised, noise impacts will be similar to what residents currently experience in association with the inflow and cell development at the PIERP. Compared to the proposed lateral expansion, the same set of parcels is expected to experience noise impacts in association with the proposed raising of existing upland cells. However, raising the dikes would lengthen the time needed to fill the existing upland cells, therefore, the sound-generating activities (i.e., inflow) would persist for a longer period of time.

Overall, the noise levels generated by the project are largely unavoidable and some of the loudest noises are generated as part of mandatory safety equipment (i.e., backup alarms on trucks). Use of backup alarms and other safety equipment is required in accordance with USACE Safety requirements (Engineer Manual (EM) 385-1-1, November 2001). Contractors will be required to comply with all applicable requirements related to noise during the period of construction/operations activity.

The potentially increased effects of noise will be associated with recreational boaters and the owners of improved parcels on Coaches and Jefferson Islands. Recreational boaters that use areas near the expansion project may be disturbed by the periodic noises, particularly during perimeter dike construction, which will exceed typical ambient noise levels. Use of Coaches and Jefferson islands by the landowners or their guests is likely to be periodically disrupted by raised noise levels. Noise levels at Coaches and Jefferson will not be appreciably different from levels associated with the site operations currently occurring at the PIERP; however, the duration of significantly elevated noise levels will persist throughout construction of the expansion project.

Southwestern Borrow Area Sand dredging in the southwestern borrow area is not expected to create noise levels that will reach residents of adjacent Eastern Shore mainland areas. In the analysis, it was assumed that the total sound level of equipment would be on the order of 85 dBA at 50 ft, as was previously used to represent tugs, barges and pumps operating simultaneously. Sand dredging may occur at night, so a 6,000-foot buffer zone around the borrow area was evaluated. This zone represents the area likely to experience sounds above 40 dBA at night. The analysis showed that no residences or businesses on the Eastern Shore mainland fell within or close to this zone (Figure 5-10). Coaches Island does fall completely within this zone, indicating that the seasonal users of this island will experience elevated nighttime noise during any periods of nighttime sand dredging. Recreational use of Coaches and Jefferson islands by the landowners or their guests is likely to be periodically disrupted by

raised noise levels. Noise levels at Coaches and Jefferson will not be appreciably different from levels associated with the construction activities currently occurring at the PIERP; however, the duration of significantly elevated noise levels will persist throughout construction of the expansion project.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to noise quality for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts to noise quality are anticipated for Alternative 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to noise quality for Alternative 3 are the same as impacts discussed above for Alternative 1. No additional impacts to noise quality are anticipated for Alternative 3.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1 with the exception that the duration of the noise effects is expected to be reduced.

No-Action Alternative

No additional noise impacts are expected with the no-action alternative.

5.4.10.b Noise Impacts to Wildlife

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The noise impacts to avian activity resulting from perimeter dike construction and dredging for the northern access channel are expected to be similar in magnitude to the effects of site operations activities at the PIERP. Many of the avian incidences at the PIERP appear to be associated with loud noises. Noise and associated human activity at temporary pump stations may influence potential nesting on bird islands and may cause abandonment. The excavation of drainage ditches along cell dikes and the construction of new interior cross dikes may cause feeding or resting birds to temporarily abandon that location because of noise; timing and location of these activities is a concern. Perimeter trench construction adjacent to occupied nest islands may cause some flushing and/or agitation among nearby nesting birds creating opportunities for egg and/or young predation by other nesters or predators (MES, 2003a). If construction occurs during the nesting season, nest islands may not be utilized because of noise from construction activities. Excavation of borrow areas and vehicular traffic along haul roads could also potentially disturb avian utilization during construction of the lateral expansion. Colony flushing and/or fatalities may occur, depending on the proximity of the colony to the

haul roads. Dredged material placement and site operations at the expansion may also cause bird abandonment of the area of activity, specifically the northern portions of Cells 1 and 2. Feeding and resting shorebirds may abandon locations of construction activity and inhabit more favorable locations because of noise during this period. Trucks and machinery traveling along dike roads may cause resting, feeding, or nesting birds within cells to flush, or avian species could potentially collide with vehicles along the dike roads. However, all precautions will be taken to avoid any collisions with avian species, similar to current conditions. These precautions include set speed limits on the island, vehicles travel only on established roads, and vehicle operators are instructed to avoid birds.

If Federal or State-listed avian species are observed nesting in construction areas during construction activities, additional consultation will be conducted with USFWS and MDNR.

Noise impacts to all avian species will be minimized through TOY restrictions specifically identified for the Bald Eagle, the Least Tern, the Common Tern, and heronry species (Great Blue Heron, Snowy Egret, Cattle Egret, and Little Blue Heron) (Appendix C, Table C-3). However, perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel and sand borrow excavation are located sufficient distance from the Bald Eagle and heron rookery buffers that TOY restrictions should not restrict construction activities for the expansion.

Noise impacts to terrapins associated with the lateral expansion are expected to be minimal. The majority of the terrapin nesting activities has occurred in Cells 3/3D, Cell 4, and Cell 5, although limited use has also occurred in Cell 6. The most highly utilized area for nesting terrapin females is the "notch" area, which is a long sandy beach along the south shore of Coaches Island at the shorelines of Cells 4 and 5. These TOY restrictions in place for the Bald Eagle and heron rookery on Coaches Island will reduce potential impacts to terrapins utilizing the notch area. Loud heavy machinery is a component of the PIERP landscape and will continue to be a component of the lateral expansion. There is the potential that construction activity may disturb terrapin nesting when it occurs in close vicinity to nesting beaches. Terrapins will abandon nesting when disturbed, resulting in incomplete nests (Roosenburg, 2003). There has been no nesting activity (to date) of the diamondback terrapin utilizing the area in the northeast of the PIERP, where the lateral expansion will connect to the PIERP.

No additional impacts to avian activity are anticipated from raising the existing upland cells since activities associated with this project will be similar to the existing conditions at the PIERP. Loud heavy machinery is a component of the PIERP landscape and will continue to be a component of the proposed raising of existing upland cells. Short-term noise-related impacts to avian activity during excavation of the southwestern borrow area could potentially temporary displace species that use this open water area.

No additional impacts to diamondback terrapins are anticipated from raising the existing upland cells because activities associated with this project will be similar to the existing conditions at the PIERP. Vertical raising of the existing PIERP uplands would not introduce

new types of sounds, so noise impacts to the notch area would be the same as the current conditions.

Raising the dikes would lengthen the time needed to fill the existing upland cells, therefore, the sound-generating activities (i.e., inflow) would persist for a longer period of time. Generally, noise impacts associated with raising the existing upland cells are expected to be minimal and similar to noises currently generated at the PIERP.

Southwest Borrow Area Short-term adverse impacts to avian species that utilize the open water habitat southwest of Cell 6 will occur during dredging 91 acres of the southwestern borrow area, although the impacts of excavation are expected to be temporary and additional open water forage habitat is available in the vicinity of the site. Following the completion of excavation, this area will be available as open water habitat.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Noise impacts to wildlife for Alternative 2 are the same as noise impacts discussed above for Alternative 1, although approximately 49 acres will be dredged in the southwestern borrow are for Alternative 2. No additional noise impacts to wildlife are anticipated for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Noise impacts to wildlife for Alternative 3 are the same as noise impacts discussed above for Alternatives 1 and 2, although approximately 19 acres will be dredged in the southwestern borrow area for Alternative 3. No additional noise impacts to wildlife are anticipated for Alternative 3.

No-Action Alternative

No additional impacts to avian activity or to diamondback terrapins are anticipated from the no-action alternative since activities associated with this alternative are equivalent to the existing conditions at the PIERP.

5.4.11 Light

Lighting regulations for Talbot County have three requirements: (1) that light not produce "excessive" illumination beyond the site boundary, (2) that flickering or intrinsically bright sources of illumination be shielded or aimed away from roads and neighboring properties, and (3) that lights on piers, docks and wharves be shielded so that light is not visible from 75 ft away from the pier (Talbot County, 2004).

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No significant, long-term lighting impacts from the perimeter dike construction for the northern lateral expansion and the dredging for the northern access channel and sand borrow excavation are anticipated. Additionally, no significant impacts from light are expected from the vertical expansion of existing uplands. The raising of existing upland cells is expected to result in similar light impacts to those associated with the PIERP, but these impacts will persist for a longer period

of time. Any homes on the adjacent Eastern Shore mainland or on Coaches or Jefferson Islands bothered by lights used during infill would experience similar impacts.

For the lateral expansion, light levels will be comparable to existing activities, but the new construction activities will extend effects further into the future. Early phases of the new project may involve more frequent nighttime lighting than current conditions for a relatively short duration. Otherwise, lighting associated with material inflow will be essentially the same. Light trespass from the PIERP has been the source of a few complaints by neighboring residents. The primary complaint is a loss of the darkness that residents are accustomed to seeing. Some of the activities in the lateral expansion would be about ½ mile closer to the mainland residences than previous activities (Figure 5-6).

Light from nighttime activities is likely to be visible for many miles but will not necessarily be perceived as bothersome over that range. The inflow activities use the highest power bulbs of any project activity and because they are raised as high as 30 ft above sea level, they have the potential to be seen over 10 miles away by an observer at 15 ft above sea level, under very clear atmospheric conditions. These lights are shielded to direct light downwards or toward operations, so glare does not typically reach nearby residences or affect boaters. Current inflow activities are conducted within Cell 6, but inflow associated with the lateral expansion will be located within the expansion footprint. The exact location of the proposed offloading facility has not yet been determined, but it is not expected to be closer to the Eastern Shore mainland than current activities.

The duration of different nighttime activities will vary with the lateral expansion. Sand dredging would be continuous over the first several months of the project, while inflow activities occur seasonally once initial construction is complete. Therefore, light impacts associated with these phases of activity will be temporary and seasonal, respectively. These operations use lights that are shielded, so glare should be minimal and not reach residences.

Over the long term, the expansion project would not be expected to substantially increase lighting in the area relative to existing plans for the island. Lighting of a permanent structure designed to serve as the operations center is already planned for the existing project (Section 3.1.11.b). Lights used as aids to navigation may be added as a result of the project, but will be in keeping with existing lighting along the waterway, and in compliance with Coast Guard regulations.

In summary, implementation of the lateral expansion will introduce additional nighttime light to the project areas primarily during the construction and inflow phases. The main group affected by this increased lighting will be the waterfront homes in close proximity to the project including those on Coaches and Jefferson Islands, and any impacts will depend on homeowner perceptions of these increased light levels. Evidence from the PIERP suggests that lighting will be considered acceptable to those in support of the project, while other residents are likely to notice and object to increased light levels. Long-term lighting impacts from the lateral expansion are expected to be minor.

Southwestern Borrow Area Sand dredging in the southwest borrow area will be substantially the same as previous sand dredging activity and will occur in a location farther from Eastern Shore mainland residences. Therefore, this activity is not expected to generate any new type of light impacts.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2 with the exception that the duration of the light effects is expected to be reduced.

No-Action Alternative

No additional impacts for light are associated with the no-action alternative.

5.4.12 Hazardous, Toxic, and Radioactive Wastes, and Unexploded Ordnance (UXO)

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No significant impacts from hazardous, toxic, and radioactive wastes are expected during perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. Hazardous, toxic, or radioactive wastes are not and will not be located on Poplar Island and are not expected to be encountered during dredging activities.

The recent discovery of small UXO on Poplar Island, as a result of dredged material placement into Cell 2, was identified as WWI and WWII hand grenades. All UXO discovered during dredged material placement at Poplar Island has been and will continue to be disposed of in accordance with established safety protocols, including UXO potentially discovered as part of the expansion study.

The lateral expansion and raising of existing upland cells will not affect the amount of fuel that is currently stored on Poplar Island. The three existing 8,000-gallon tanks will continue to be used at the PIERP. The current plan is to move all three tanks to the southern portion of Cell 6 as part of the Cell 6 closure activities since the area will no longer be accessible to boat

and barge traffic. See Section 5.3 for more details concerning the Cell 6 closure activities and associated impacts.

No additional impacts for hazardous, toxic, and radioactive wastes are expected with raising the existing upland cells. Conditions for raising the existing upland cells will be similar to those currently in place at the PIERP.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Impacts from hazardous, toxic, radioactive wastes, and UXO for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts for hazardous, toxic, radioactive wastes, and UXO are anticipated with Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Impacts from hazardous, toxic, radioactive wastes, and UXO for Alternative 3 are the same as impacts discussed above for Alternatives 1 and 2. No additional impacts for hazardous, toxic, radioactive wastes, and UXO are anticipated with Alternative 3.

No-Action Alternative
No additional impacts for hazardous, toxic, radioactive wastes, and UXO are expected with the no-action alternative. All UXO discovered during dredged material placement at Poplar Island will continue to be disposed of in accordance with established safety protocols. Based upon these conditions, the construction and use of the area will not pose any significant environmental liability or concern.

5.4.13 Navigation and Transportation

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No significant adverse impacts to local or regional navigation and transport are expected during perimeter dike construction for the northern lateral alignment and the dredging for the northern access channel. The PIERP lies in shallow water and does not affect any typical commercial boat/barge navigation routes. There are also several, smaller local navigation channels within the region of influence that support the commercial fishing in Talbot and southern Queen Anne's Counties and recreational boaters. Specific impacts related to recreational boating (displacement of activity) are addressed in Section 5.7.1. Outside of the Study Area and the Region of Influence, the major Chesapeake Bay shipping channel, which runs the length of the Chesapeake Bay mainstem and connects Baltimore Harbor with other East Coast and international shipping destinations, is located approximately 2 miles west of the expansion of the PIERP. Dredging and offloading activities conducted during the proposed expansion construction, will cause an increase in barge traffic. This temporary increase in barge traffic has the potential to impact local navigation during the dredging season. However, barge activity for the expansion is expected to be similar to barge activity that existed for the construction of the PIERP (which did not negatively impacted regional navigation), and will ultimately have an overall positive impact on commercial navigation and navigational safety.

Long-term adverse impacts are expected from the lateral expansion. The northern lateral expansion will require some commercial and recreation vessels that utilize the area in the vicinity of Poplar Island to navigate a longer route around the island.

No additional significant impacts to local and regional navigation and transport are anticipated as a result of raising the existing upland cells, because conditions will be the same as those currently in place at the PIERP.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Impacts to navigation and transportation for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts to navigation and transportation are anticipated with Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Impacts to navigation and transportation for Alternative 3 are the same as impacts discussed above for Alternatives 1 and 2. No additional impacts to navigation and transportation are anticipated with Alternative 3.

No-Action Alternative

The no-action alternative would result in a placement capacity shortfall beginning in 2010 (assuming no other dredged material management options come online). To avoid overfilling the existing PIERP (in the case of a placement shortfall), some channel maintenance dredging would need to be postponed. Postponing dredging activities in the upper Bay channels could negatively impact regional commercial navigation and navigational safety.

5.4.14 Coastal Zone Management

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Because the PIERP is located in the Chesapeake Bay, the Coastal Zone Management Act (CZMA) is applicable and a coastal zone Federal consistency determination (CZCD) will be required. The USACE–Baltimore District will be consistent to the extent practicable with the CZMA for the lateral expansion to be in compliance with the State of Maryland's coastal zone management program. The USACE has determined that the project is in compliance with the CZMA and requested concurrence from MDE to ensure compliance between the Federal, State, and local coastal zone management programs. MDE has formally stated that this document is "Generally Consistent with the regulatory programs at MDE (Appendix F).

A Federal consistency is the review of Federal projects for consistency with State coastal policies. The term "Federal consistency" refers to the review process mandated by Section 307 of the CZMA, and NOAA regulations (15 CFR part 930). The CZMA requires that Federal actions, which are reasonably likely to affect any land or water use, or natural resource of a State's coastal zone, be conducted in a manner that is consistent with a State's Federally approved Coastal Zone Management Program (CZMP). The Federal consistency review is based on the enforceable policies of Maryland's CZMP.

No additional impacts to coastal zone management are expected as a result of raising the existing upland cells at the PIERP.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Impacts to coastal zone management for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts to coastal zone management are anticipated for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Impacts to coastal zone management for Alternative 3 are the same as impacts discussed above for Alternatives 1 and 2. No additional impacts to coastal zone management are anticipated for Alternative 3.

No-Action Alternative
The no-action alternative will not have additional impacts on coastal zone management at the PIERP.

5.4.15 Coastal Barriers

The PIERP is not currently mapped by the USFWS as a barrier island and therefore the Coastal Barriers Resource Act (CBRA) is not applicable to the northern lateral expansion, raising the existing upland cells, or the no-action alternative.

5.4.16 Chesapeake Bay Critical Areas

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The PIERP is located within a critical area and falls under the Critical Area regulations outlined in COMAR 27.02 (Gallo Critical Area Commission, 2004). The Chesapeake Bay Critical Area Protection Program was passed by the Maryland General Assembly in 1984 to enact the CZMA at the State level. The State of Maryland Critical Area Commission conducts a review process of the project and drafts a staff report to determine consistency with COMAR 27.02 and to determine conditions of the project, if approval is granted during the review process. The lateral and vertical expansion associated with Alternative 1 requires formal review and approval by the Critical Area Commission, which is currently ongoing (Appendix F). The Critical Area Commission has informally determined that the Draft GRR/SEIS is consistent with COMAR 27.02, but the project will require formal approval by the Critical Area Commission prior to the initiation of construction (Appendix F).

No additional impacts to the critical area are expected as a result of raising the existing upland cells at the PIERP.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Impacts to the Chesapeake Bay Critical Areas for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts to the Chesapeake Bay Critical Areas are anticipated for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Impacts to the Chesapeake Bay Critical Areas for Alternative 3 are similar to impacts discussed below for Alternatives 1 and 2. No additional impacts to the Chesapeake Bay Critical Areas are anticipated for Alternative 3.

No-Action Alternative
The no-action alternative will have no additional impacts on the critical area at the PIERP.

5.4.17 Floodplains

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands A FIRM map with the updated PIERP configuration is not available. Based on the 1985 map, the Poplar Island archipelago was located completely within the 100-year floodplain. Construction of the lateral alignment will actually create land located in the floodplain. The lateral expansion project would be managed with the PIERP as one unit – as a remote island habitat. Executive Order 11988 was taken into consideration for this project, although the location of the PIERP and the subsequent location of the lateral expansion requires construction of a beneficial use project in an area that was once classified as a 100-year floodplain. Because the Federal government is self-insured, flood insurance is not necessary for the PIERP and a variance to the County's Floodplain Management Regulations is not applicable.

No additional, impacts to the floodplain are expected as a result of raising the existing upland cells.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Impacts to the 100-year floodplain for Alternative 2 are the same as impacts discussed above for Alternative 1. No additional impacts to the 100-year floodplain are anticipated for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Impacts to the 100-year floodplain for Alternative 3 are the same as impacts discussed above for Alternatives 1 and 2. No additional impacts to the 100-year floodplain are anticipated for Alternative 3.

No-Action Alternative
The no-action alternative will have no additional impacts on 100-year floodplains.

5.4.18 Wild and Scenic Rivers

There are no designated wild and scenic rivers in Talbot or Queen Anne's Counties, therefore, the Wild and Scenic Rivers Act is not applicable to the northern lateral expansion, raising the existing upland cells, or the no-action alternative. Therefore, the project is in full compliance with the Act.

5.4.19 Prime and Unique Farmland

Because no farmland exists at the PIERP, the Farmland Protection Policy Act is not applicable to the northern lateral expansion, raising the existing upland cells, or the no-action alternative. Therefore, the project is in full compliance with the Act.

5.5 CULTURAL AND ARCHAEOLOGICAL RESOURCES

During the Phase I and Phase II cultural resource remote sensing surveys within the footprint of the lateral expansion and the southwestern sand borrow area, numerous magnetic and acoustic anomalies were recorded. The overwhelming majority of these anomalies were single source ferrous debris consistent with crab traps, ground tackle, and other modern materials lost in the waters around the PIERP. In some cases, multiple spatially overlapping anomalies were grouped into targets. Each of these targets was examined for characteristics consistent with submerged watercraft or other possible cultural resources. A total of six targets (Targets #8, #13, #25, #28, #29, and #30) were identified (Figure 3-28) that could have potentially represented archeological resources eligible for listing on the National Register of Historic Places.

The six locations were recommended for avoidance, and further survey was warranted if avoidance was not feasible (RCG&A, 2004; 2005). Following completion of the Phase I investigation report, USACE-Baltimore District redefined the footprint of the lateral expansion footprint to avoid four of the six potential shipwreck locations. However, the buffer areas of two of the potential shipwreck locations (Targets #13 and #29) were considered too close to the revised project boundaries, and Phase II investigation of those two particular sites was conducted. The results of the Phase II investigation showed that Target 13 did not meet any criteria set forth in the National Register criteria for evaluation (RCG&A, 2005) and that Target 13 was not eligible for the National Register of Historic Places, and no further archeological work was warranted or recommended and that Target #13 proved not to be a cultural resource.

Coordination with the State Historic Preservation Office (SHPO) has occurred and is complete. Following all surveys and agency coordination, the MHT has concurred with the USACE determination that the northern lateral expansion (including Alternatives 1, 2, and 3) will have no effect on historic properties or features (Appendix F). The MHT determination is based in part on the fact that submerged Targets #25 and #30 are no longer located within the northern lateral expansion and that Targets #8 and #28, located in proximity to the southwestern borrow area, will be marked and avoided with a buffer of 300 foot radius.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to the cultural resources identified in the Phase I and Phase II cultural surveys are not anticipated. The MHT has concurred with the USACE determination that the northern lateral expansion will have no effect on historic properties or features. Of the six locations recommended for either avoidance or Phase II study, three of the targets were located within the Study Area – Target #8, Target #13, and Target #29 (Figure 3-28).

Targets #13 and #29 were subjected to Phase II-level archeological diver investigation. Target 13 is a badly fragmented wooden shipwreck, identified a possible schooner (bugeye or pungie). Because this boat form is well documented, and because it does not appear unique in any fashion, this poorly preserved wreck does not appear to be eligible for listing on the National Register of Historic Places. In addition, Target 13 does not meet any criteria set forth in the National Register criteria for evaluation, primarily because of poor site integrity. Based upon these findings, Target 13 does not appear to be eligible for the National Register of Historic Places, and no further archeological work is warranted or recommended.

Diver investigation of Target 29 revealed that it is submerged tree limbs protruding above the mudline. The tree limbs are not a cultural resource, and no further work is warranted on this target.

The remaining target within the footprint of the lateral expansion, Target #8, will be marked with buoys and avoided, with a buffer of 300 ft radius. If avoidance is not possible, further evaluation (Phase II-level archeological diver investigation) of these targets will be performed.

Southwestern Borrow Area Impacts to the cultural resources identified in the Phase I and Phase II cultural surveys within the southwestern borrow area are not anticipated. Of the six locations recommended for either avoidance or Phase II study, two of the targets were located within the southwestern borrow area – Target #25 and Target #28 (Figure 3-28).

Only Phase I studies were conducted at Target #25 and Target #28. Both targets will be marked with buoys and avoided, with a buffer of 300 ft radius. If avoidance is not possible, further evaluation (Phase II-level archeological diver investigation) of these targets will be performed.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as discussed above for Alternative 1. The MHT has concurred with the USACE determination that the northern lateral expansion will have no effect on historic properties or features.

Southwestern Borrow Area Impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as discussed above for Alternatives 1 and 2. None of the targets evaluated in more detail for the Phase II investigation were located in the open-water embayment proposed as part of Alternative 3. The MHT has concurred with the USACE determination that the proposed Alternative 3 will have no effect on historic properties or features.

Southwestern Borrow Area Impacts associated with Alternative 3 are similar to the discussion above for Alternatives 1 and 2.

No-Action Alternative

The no-action alternative will have no additional impacts to the cultural resources identified in the Phase I and Phase II cultural surveys in the vicinity of the PIERP.

5.6 SOCIOECONOMIC RESOURCES

5.6.1 Economic Impacts to Aquatic Resources

Impacts of the lateral expansion on commercial fisheries are associated with:

- potential changes in resource conditions as reflected by changes in the abundance, availability, or catch per unit effort, of fish; and
- potential effects on fishing operations as reflected by project-imposed changes in travel time (i.e., distance to fishing areas), searching time (i.e., difficulty of locating productive fishing areas), or fishing time (i.e., difficulty operating fishing gear).

Negative impacts on commercial fisheries are associated with: (1) loss of bottom fish habitat, (2) loss of fishing area, and (3) space-use conflicts between fishing and dredging/material placement equipment. Positive impacts on commercial fisheries are associated with: (1) additional reef habitat from the dike construction of the lateral expansion, (2) fishery-related improvements associated with the wetlands that will be created in the lateral expansion, and (3), fishery-related improvement associated with the protected open-water embayment associated with Alternative 3. Impacts on specific commercial fisheries were identified by focusing on: a) expected changes in the abundance, availability, and catchability of fish; b) expected changes in travel, searching, and fishing time; and c) any "congestion externalities" that are expected to result from fishermen shifting effort from the expansion area to locations that are already being fished.

Throughout the GRR/SEIS process, the concerns of local watermen have been solicited and considered and are detailed in Chapter 9. The discussion of impacts below first considers the general pattern of impacts to commercial fisheries as a whole, and then discusses impacts

specific to important aquatic resources. Impacts to fisheries resources, including clams, oysters, blue crabs, and finfish are discussed in more detail in Sections 5.6.1.a through 5.6.1.d.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The lateral expansion would be expected to result in a pattern of impacts on fisheries that includes some short-term economic losses, followed by the potential for long-term economic gains. No additional, impacts to fisheries from the vertical expansion of existing upland Cells 2 and 6 are expected (besides impacts associated with the southwestern borrow area that are discussed below). During the initial phases of development, a period of several years, the placement of armor stone and other construction activities may disturb bottom sediments and water quality (turbidity) and, at some sites, may cause small, but unavoidable space/use conflicts between equipment and barge operators involved in site construction and fishermen as they travel to and from fishing areas and set gear. These temporary, adverse impacts will subside once construction ends, and will be offset by long-term beneficial impacts as the island matures and provides improved fish habitat and fishing areas.

The lateral expansion of the PIERP will reduce the quantity of relatively low-value fine sands and mud bottom fish habitat by the size of the restoration, approximately 575 acres. This area is considered too small to result in any significant decline in fish abundance because most affected fish populations are expected to find suitable alternative habitat nearby. This loss in the quantity of bottom fish habitat is expected to be an offset because the lateral expansion is also expected to improve the quality of nearby fish habitat by reducing turbidity and providing underwater structure in the form of rock reefs. In addition to the potential benefits of rock reefs, some recreational species may become more abundant as a result of the potential expansion of SAV beds because of the wave and surge protection and erosion-control provided to Poplar Harbor by the lateral expansion. Proximity to the high quality habitat afforded by SAV beds would also be expected to enhance commercial catch rates for some species.

Southwestern Borrow Area Sand dredging activities in the southwestern borrow area may result in some short-term space-use conflicts and will disturb bottom habitat over approximately 91 acres.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1, although only 49 acres of the borrow area will be disturbed.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 will be similar to those expected from Alternatives 1 and 2, although the effect on open water and sand/mud bottom is smaller than in Alternatives 1 and 2. Alternative 3, with its 130-acre open-water embayment, reduces fine sand and mud bottom fish habitat by approximately 445 acres. As with the other alternatives, this loss of bottom fish habitat will be somewhat offset by habitat improvements associated with the project. In addition to the potential positive impacts associated with the overall footprint (discussed above), the open-water embayment will provide a diversity of habitat including a combination of reef structure, vertical relief and quiescent conditions that could potentially support additional SAV beds along the shoreline areas.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed above in Alternative 1, although only 19 acres of the borrow area will be disturbed allowing fishermen to maintain access to a larger fishing area.

No-Action Alternative

No additional fishery-related impacts are anticipated for the PIERP with the no-action alternative. However, benefits associated with the creation of additional wetlands and upland habitat as part of the lateral expansion will not be acquired with the no-action alternative.

5.6.1.a Clam Fishery The soft-shell clam and the razor clam are the commercially important clam species in the Chesapeake Bay. The soft clam harvest has been generally declining in catch and value in the vicinity of the PIERP and Bay wide over the past seven years (Table 3-21). Commercial clam studies in the vicinity of the PIERP show that the densities of soft clams within the Study Area are presently well below commercially-harvestable levels[1] (EA, 2005a).

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The vertical expansion of existing upland cells is not expected to impact the commercial clam fishery as it does not cover any additional bottom area. In the lateral expansion area, razor clam densities are well below commercially productive beds (EA, 2005). The most productive razor clam areas of those surveyed, which were still below commercially harvestable levels, were within the Study Area, but these areas are not known to be used by clammers (M. Gary MDNR, 2003). Trends in razor clam catches are unknown because they are typically used for bait and are not tracked in the commercial catch database. Clammers reported that the dockside price of razor clams in October of 2004 was about $20/bushel.

[1] The MD DNR defines a productive natural clam bar as having an existing or potential harvesting rate of 1/2 bushel soft-shell clams (*Mya arenaria*) per hour, or 1.5 bushels of razor clams (*Tagelus plebius*) per hour (Code of Maryland Regulations, 2004).

At current clam densities, the lateral expansion would not significantly impact the abundance or catch of either type of commercial clam species. However, the expansion permanently removes clam beds from the fishery that have the potential to be productive in the future. Future impacts associated with this removal will depend on whether razor clam densities rebound to commercially sustainable levels. If the fishery becomes viable, fishermen that would have used beds within the footprint would need to travel farther to access clam beds, marginally reducing earnings. In summary, because of the lack of commercially productive beds (presently) and the low value of the potential catch, effects on the commercial clam fishery appear to be negligible in the short-term, but over the long term the project has the potential to impact future earnings if razor clams rebound to harvestable levels.

Southwestern Borrow Area Surveys indicate that clams had densities well below commercially productive levels in the southwestern borrow area (EA, 2005a). At current clam densities, use of that area for dredging would not be expected to significantly impact the abundance or catch of either type of commercial clam species. Due to the length of hydraulic dredges that are used to collect clams, areas deeper than approximately 14 ft are normally not sampled by commercial watermen for clam collections. The depth of the southwestern borrow area is currently a maximum of –16 ft MLLW; following excavation activities, the water depth will increase to approximately –25 ft MLLW, although some gradual shoaling may occur in this area. After excavation, 91 acres of the southwestern borrow area would then be unavailable to commercial clamming by hydraulic dredging in the future. However, because the area in the vicinity of the southwestern borrow area does not currently support productive existing commercial clam beds, the impacts on commercial clammers from the lateral expansion will not be significant.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1, although only 49 acres would be disturbed.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts to commercial clam fisheries associated with Alternative 3 will be similar to those described for Alternatives 1 and 2. However, inclusion of the open-water embayment in this alternative will reduce the loss of clam beds by approximately 130 acres. Access to the beds within the open-water embayment by commercial watermen will be determined by consultation and coordination with MDNR and USFWS.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2, although only 19 acres would be disturbed.

No-Action Alternative
The no-action alternative is not expected to have additional impacts on commercial clamming. The lateral expansion would not permanently remove existing bivalves or clam beds that have the potential to be productive in the future as part of the no-action alternative.

5.6.1.b Oyster Fishery The American oyster has historically been a commercially important species in the Chesapeake Bay. The area surrounding the PIERP is not currently commercially productive for oysters although it may have been commercially productive in the recent past (Table 3-21).

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands All NOBs near the PIERP are outside the Study Area (Figure 5-11), so if productivity were to increase in these beds in the future, the project would not be expected to have negative long-term impacts on oyster abundance and may even have positive effects. Some higher levels of turbidity and sedimentation associated with project construction have the potential to disrupt the oyster beds; however, TOY restrictions would be expected to minimize impacts.

The PIERP lies in shallow water and does not affect any typical commercial boat navigation routes. Therefore, the lateral expansion project is not expected to increase travel time of commercial fishermen to the NOBs.

No additional, impacts associated with raising the existing upland dikes will impact the commercial oyster harvest.

Southwestern Borrow Area The southwestern borrow area falls well outside of any NOBs (Figure 5-11). Therefore, sand dredging activities at the southwestern borrow area are not expected to impact oysters.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed above for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed above in Alternatives 1 and 2.

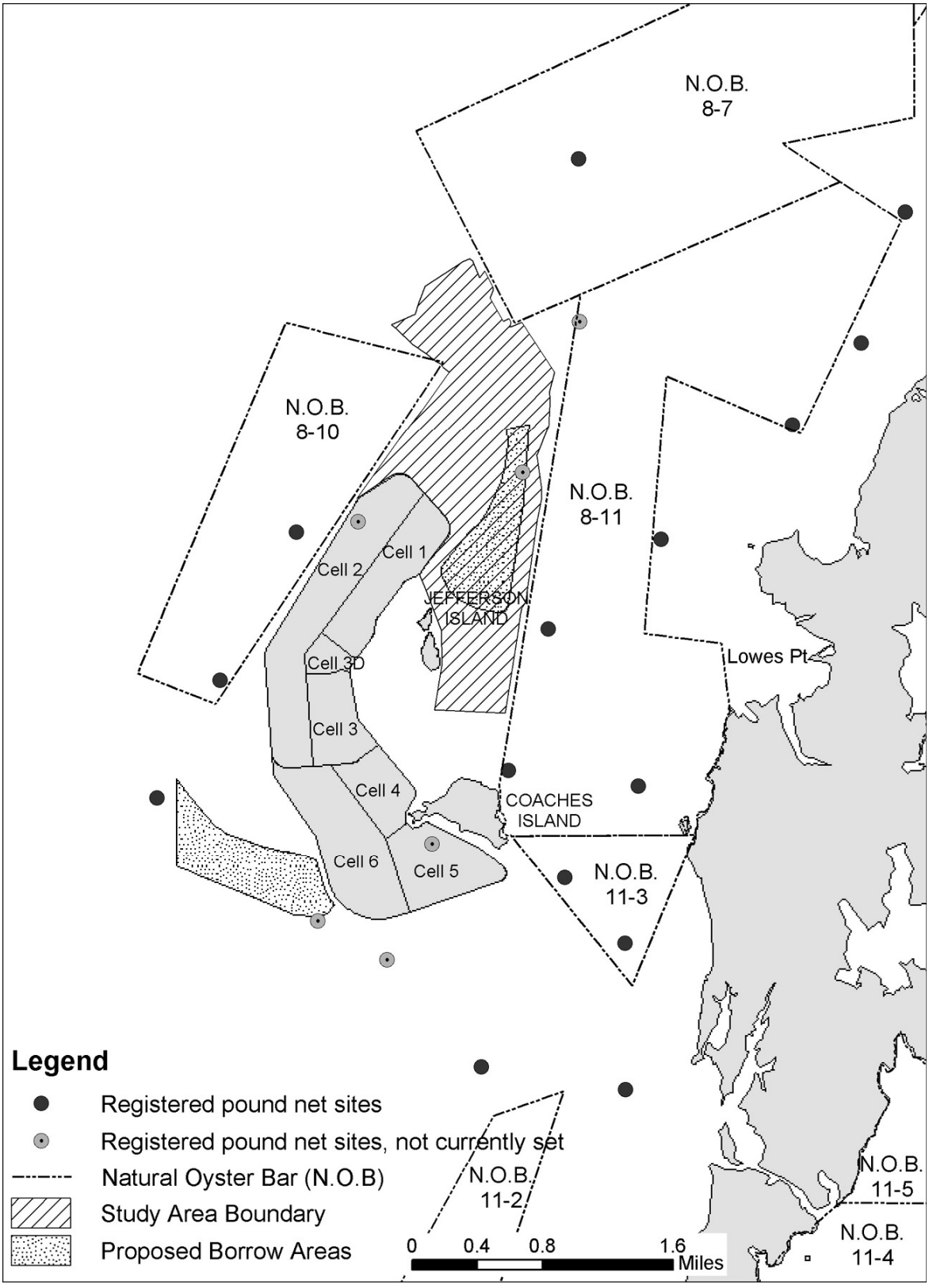


Figure 5-11. Areas of Potential Commercial Fishing Activity

No-Action Alternative
The no-action alternative will not have additional impacts on commercial oyster harvesting. With the no-action alternative, there is no potential for increased turbidity and sedimentation of NOBs related to construction activities as a result of the lateral expansion.

5.6.1.c Blue Crabs The blue crab fishery is currently the most valuable fishery in the Chesapeake Bay, and the waters around the PIERP are used extensively for setting crab pots and lines. In recent surveys, areas of observed crab pot usage near the PIERP, the Study Area, and the southwestern borrow area differ by month.

No additional impacts to commercial crabbing are associated with raising the existing upland cell dikes.

Southwestern Borrow Area Approximately 91 acres of sand dredging activities in the southwestern borrow area have the potential to create short-term impacts on commercial crabbing. Crab pot and line surveys conducted during June, July, August, and September 2004 indicated that the sampling region to the southwest of the PIERP, including the southwestern borrow area, was used lightly for crabbing but was the least-used of the areas surveyed (EA, 2005a). The degree of the effect of the southwestern borrow area on commercial crabbing will depend on when the sand dredging occurs. If the sand dredging occurs during the summer months, some space use conflicts will arise, but given the relatively low level of effort in that area, crabbers are likely to be able to shift to new locations with negligible effects on catches.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1, although only 49 acres will be disturbed.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 will depend on the level of access to the open-water embayment allowed. Access to the open-water embayment by commercial watermen will be determined by consultation and coordination with MDNR, USFWS, NOAA, MWA concerning recreational fisheries. In the event that commercial fishing is permitted in the open-water embayment, the amount of crabbing area for Alternative 3 lost will be approximately 445 acres, a reduction of 130 acres compared to Alternatives 1 and 2. Additionally, the enhancements associated with the open-water embayment, specifically the direct trophic link between the open water and the wetlands, will likely improve blue crab habitat locally, and therefore, may increase local crab

populations. If commercial fishing is restricted in the open-water embayment, then impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2, although only 19 acres will be disturbed.

No-Action Alternative

The no-action alternative will have no additional impacts on commercial crabbing in the vicinity of the PIERP – blue crabs will not be lost within the footprint of the lateral expansion or the southwestern borrow area. The highly utilized Poplar Harbor area and areas located adjacent to the PIERP rock dike will continue to be used by commercial watermen for blue crabs without any space-use time conflicts.

5.6.1.d Finfish Landings data aggregated for the region suggest that finfish are a valuable resource in the area of the Chesapeake Bay near Poplar Island. Catches in the South Central Bay segment, which includes areas near Poplar Island, have fluctuated but remained fairly steady overall (Table 3-21). Pound net, gill net, and hook and line fishing areas exist near the PIERP, but effort does not appear to be targeted within the Study Area boundary or southwestern borrow area.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Seasonal finfish studies indicate that a variety of commercially and/or recreationally important species occur near the PIERP (EA, 2005a). These species include striped bass, white perch, Atlantic menhaden, Atlantic croaker, summer flounder, spot, bluefish, red drum, and weakfish. The results of the seasonal surveys show that the areas around Poplar, Jefferson, and Coaches Islands provide nursery and foraging habitat for many of these species. In general, sampling locations in Poplar Harbor had greater diversity and abundance of finfish species than sampling locations in the Study Area, located to the northeast of existing Poplar Island.

Overall, impacts of the lateral expansion to commercial finfisheries should be minimal. The area of Chesapeake Bay bottom that will be lost to the expansion is not expected to affect finfish catches because the area is not a prime finfishing area. Local fishermen did not report any conflicts between the expansion footprint and current pound net locations. The two pound net licenses that are mapped in or near the Study Area (Figure 5-11) are reportedly not set at those locations currently, and may not be in use by the license-holders. The additional stone dikes, wetlands, and potential increase in SAV associated with the lateral expansion are expected to provide more shelter and foraging habitat for commercially valuable finfish species.

Travel-time impacts associated with the lateral expansion are anticipated to be minimal. For commercial fishermen traveling from the south (i.e., Knapps Narrows area), the expansion would not affect travel time to pound net areas around the PIERP because the footprint is to the north of the existing project. Commercial fishermen traveling from the north (i.e., Eastern

Bay) would be slightly impacted when accessing the western side of the PIERP. Under these circumstances, fishermen would have to travel about one-quarter mile farther to avoid the expansion footprint.

Raising the dikes in the existing upland cells of the PIERP is not expected to have an additional impact on commercial finfishing.

Southwestern Borrow Area Seasonal finfish studies revealed that diversity (average of six species) and abundance (average of over 120 species) of finfish sampled by gillnet in the southwestern borrow area were among the highest of those areas surveyed, although the finfish sampled in the vicinity of the southwestern borrow area had extremely low abundance (one species) and diversity (one species) for each season. Short-term space-use conflicts in the southwestern borrow area may affect commercial fishermen. Two pound net licenses fall within or adjacent to the southwestern borrow area (Figure 5-11), however these nets are not currently set (Luisi MDNR, 2005). Sand dredging is a relatively short-term phase of the project, lasting two to three months, therefore the impact to commercial fishermen would also be short-term and temporary. The excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW, although some gradual shoaling may occur in this area. However, excavation of the southwestern borrow area may have a minor, localized impact on fish usage of this area in warmer months when oxygen depletion is most prevalent. Additionally, if the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters, decreasing the habitat value for the finfish species once dredging is complete. However, the increase in depths of the southwestern borrow area following excavation may also have the potential to beneficially provide wintering habitat for resident finfish species. More detailed discussions of impacts to finfish species are included in the aquatic resources Section 5.4.6.b.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are expected to be similar to those discussed above for Alternatives 1 and 2. The inclusion of the open-water embayment has the potential to provide additional fish habitat improvement, as compared to Alternatives 1 and 2, by providing more shelter and foraging habitat for juvenile through adult life-stages of commercially valuable finfish species (see Appendix D – EFH Assessment). The open-water embayment will also improve habitat for important prey species. As discussed above, the area being affected is not considered a prime

fishing location, but indirect effects from the improved habitat associated with the wetlands and open-water embayment have the potential to improve fisheries in this area.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed above in Alternatives 1 and 2.

No-Action Alternative

No additional adverse impacts to commercial finfishing are expected with the no-action alternative. Finfish will not be lost within the footprint of the lateral expansion or the southwestern borrow area as part of the no-action alternative. The no-action alternative will not provide additional beneficial impacts to commercial finfishing in the vicinity of the PIERP due to the created wetlands and tidal gut as part of the lateral expansion, including providing valuable nursery and refuge area for a variety of finfish species. Poplar Harbor and areas located adjacent to the PIERP rock dike and rock reefs will continue to be utilized by finfish species and available for commercial finfishing.

5.6.2 Employment, Income, and Revenues

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The regional economic impacts of spending on the lateral expansion and raising the existing upland cells are similar to those associated with the ongoing PIERP, and are typically measured in terms of expected changes in jobs, incomes, business sales, and tax revenues. These impacts include *direct impacts* associated with the project itself, and also *indirect impacts* or multiplier effects that are associated with purchases and sales by businesses that supply inputs to businesses that are directly impacted by project spending. Businesses unrelated to dredging may also benefit as direct and indirect spending result in increases in household income that generate additional rounds of consumer spending and what are known as *induced impacts.*

The analysis was designed to trace and measure direct, indirect, and induced economic impacts of the lateral expansion and raising the existing upland cells in the PIERP's region of influence (primarily Talbot County, MD), and for the larger economic area of the State of Maryland. The following regional economic analysis applies to the lateral expansion. The raising of existing upland cells will not significantly alter the results. No additional economic impacts are anticipated for the no-action alternative.

Separate pathways of economic impacts associated with various stages of the expansion project were estimated, including dredging, transport, placement, habitat restoration, and site monitoring and maintenance. This section outlines how the analysis was performed and summarizes results.

5.6.2.a Methods Assessment of the economic impacts of the lateral and vertical expansion of the PIERP involved five steps:

1. Estimate out-of-State, in-State, and local Talbot County spending associated with various phases of dredging, dredged material placement, island restoration, and site maintenance and monitoring;
2. Develop an economic input-output model of Maryland and Talbot County; characterize spending on various activities in terms of input purchases from various industrial and household sectors;
3. Generate Statewide and county-level economic multipliers for each industrial sector expected to experience direct impacts;
4. Use spending estimates and sector-level State and county economic multipliers to estimate direct, indirect, and induced impacts over the 12-year period of island expansion, development, maintenance, and monitoring; and
5. Estimate the average annual economic impacts over the project period and the approximate pattern of annual economic impacts over that period.

Estimates of direct spending on the tasks associated with the PIERP expansion were developed for the Federal DMMP (USACE, 2005) based on a 600-acre expansion (roughly 50 percent upland and 50 percent wetland) constructed and developed over a 12-year period. UMCES conducted phone and in-person interviews with industry and government dredging and restoration experts and used secondary sources to estimate the amount of spending per task that is likely to take place in the vicinity of the PIERP, elsewhere in the State of Maryland, and out-of-State. Average annual spending over the 12-year period and regional spending allocations based on these surveys were then used to establish direct spending impacts associated with each task in each region. These annual regional spending estimates were then used within county-level and State-level input-output models to estimate direct, indirect, and induced impacts at the local (Talbot County) level and Statewide. These regional impacts were estimated using the IMPLAN (IMpact PLANning) regional economic modeling system. [Minnesota Implan Group (MIG), 2002]

Expected spending on each of the tasks allocated to specific industrial sectors (i.e., purchases of fuel, stone, plant material) and to primary (or household) sectors (i.e., employee compensation, proprietor income) to generate estimates of direct impacts on various measures of economic performance including: job creation, employee compensation, other household income, business sales and tax revenues generated. Direct spending in each Statewide and local industrial sector was then used within State and county IMPLAN models to generate total direct, indirect, and induced economic impact estimates for both economic areas. Impacts at the county-level are based on estimated local spending and the existing (2002) economic structure of the county. Impacts estimated at the State level are based on Statewide inter-industry linkages and patterns of in-State and out-of-State purchases and sales during 2002.

Impacts were developed based on average annual spending per activity over the life of the project. Because actual spending patterns vary over the life of the expansion project, using average annual spending to reflect spending in each year will result in overestimates and underestimates of the impacts of some activities during some years. For some tasks, planning or site development for example, using average annual impacts to represent all years results in an underestimate of economic impacts during early years and an overestimate during later

years. For other tasks, such as habitat development and long-term site monitoring, using average impact estimates for all years results in overestimates during early years and understates impacts during later years.

5.6.2.b Maryland Statewide Economic Impacts The Statewide economic impacts of dredging, material transport and placement, island restoration, and site maintenance and monitoring are summarized in Table 5-10. The level of on-site spending on perimeter dike construction, development and maintenance over 12 years is approximately $146 million. Adding the cost of dredging and material transport and placement the total cost of the project over 12 years is approximately $340 million. This spending is estimated to create approximately 131 direct jobs, which are measured as full time equivalents (FTEs) in Maryland. After multiplier effects are considered, this spending is expected to generate approximately 249 total jobs in Maryland. Average annual Statewide spending is expected to generate about $12.1 million in direct business sales in Maryland, and is expected to generate total (direct, indirect, and induced) annual Statewide business sales of $21.7 million.

The analysis indicated that over half of the positive economic impacts associated with spending on dredging and material placement in Maryland leak outside the State because of imported inputs and labor. Analytical results show that the PIERP expansion will generate economic impacts that will last up to 20 years from the period of initial site studies through site development and construction, material placement, and site finishing and restoration. Economic impacts will persist beyond 20 years as a result of long-term commitments to site monitoring and maintenance. Approximately 57 percent of Statewide economic impacts will tend to accrue in the vicinity of dredging activities (primarily Baltimore County), but the remaining 43 percent will accrue elsewhere in the State, especially in the vicinity of material placement and expansion activities (Talbot County).

5.6.2.c Talbot County Economic Impacts Talbot County will experience few direct economic impacts associated with dredging and material transport because these activities involve purchases of labor and inputs from elsewhere in the State and from out-of-State. However, the county will experience some local impacts associated with material placement activities that will involve crews being stationed at or near the PIERP, and a significant share of economic impacts associated with habitat restoration work and long-term site monitoring and management. These impacts are summarized in Table 5-11.

The analysis shows that of the $340 million in overall project spending over 12 years, approximately $142.9 million, or approximately $11.9 million annually, will be spent in the vicinity of the island restoration/placement site on site construction, habitat development, and long-term maintenance and monitoring. Because the economic base of nearby Talbot County is relatively narrow, many of the economic impacts of this local spending may "leak" to other parts of the State and out-of-State. Expected spending in the vicinity of the PIERP excludes direct spending on dredging, transport, and placement, but includes local spending associated with tourist visits to the site (which include visits by researchers). The estimated $11.9 million in local spending is expected to generate approximately 87 direct annual jobs (FTEs)

Table 5-10. Summary of State Economic Impacts of PIERP Expansion (Over 12 Year Site Development)

SUMMARY OF STATE AND LOCAL ECONOMIC IMPACTS
of
POPLAR ISLAND EXPANSION
(over 12 year site development)

Part 1 STATE-WIDE ECONOMIC IMPACTS

	Initial Study/Permitting/ Design Costs	Site Development	Dredging	Transport	Placement	Habitat Development	Long-Term Site Maintenance & Monitoring	Total	Total Less Dredging/Transport/ Placement
I. Direct Impacts									
Total Spending[1]	$3,000,000	$90,840,017	$90,000,000	$50,400,000	$54,000,000	$14,748,000	$37,347,000	$340,335,017	$145,935,017
Average Annual Spending[2]	$250,000	$7,570,001	$7,500,000	$4,200,000	$4,500,000	$1,229,000	$3,112,250	$28,361,251	$12,161,251
Average Annual Employment[3]	3.3	46.3	26.4	15	15	33.3	48.2	188	131
II. Economic Impacts[4]									
Impact Category									
Total Jobs (FTEs)[5]	6.1	121.1	92.5	52	54.6	43.2	78.3	448	249
Labor Income	239,499	5,267,626	4,642,228	2,599,781	2,785,575	839,091	2,424,020	$18,797,820	$8,770,236
Employee Compensation	219,324	4,586,310	3,890,441	2,178,772	2,334,473	720,902	2,147,167	$16,077,389	$7,673,703
Proprietors Income	20,175	681,316	751,787	421,009	451,102	118,189	276,852	$2,720,430	$1,096,532
Indirect Business Taxes	14,524	383,368	407,662	228,301	244,613	77,220	177,991	$1,533,679	$653,103
Other Property Type Income	42,230	1,331,177	1,080,143	604,918	648,131	371,533	671,283	$4,749,415	$2,416,223
Value Added	296,253	6,982,171	6,130,033	3,433,000	3,678,318	1,287,844	3,273,293	$25,080,912	$11,839,561
Business Sales	472,603	13,707,599	13,566,628	7,597,634	8,140,299	2,043,611	5,564,713	$51,093,087	$21,788,526

[1] Direct spending by task over the 12 year project life was estimated as part of the Federal DMMP (USACE 2005)

[2] Average annual cost per task over 12 year project life (not adjusted for annual fluctuations in spending per task)

[3] Direct employment per task was estimated based on surveys of experts, secondary sources, and comparable industrial sectors.

[4] Average annual economic impacts over 12 year project life
--- Includes direct, indirect and induced economic impacts of both state and federal spending in Maryland
--- Direct, indirect and induced impacts were estimated using the IMPLAN regional economic modeling system

[5] These numbers represent the average number of full-time equivalent (FTE) jobs in each task over the 12 year project. The number of man-years associated with each task, therefore, is the value shown here multiplied by 12. The jobs associated with some tasks will be primarily in early years and the jobs associated with some tasks will be in later years. (See text)

Table 5-11. Summary of Talbot County Economic Impacts of PIERP Expansion (Over 12 Year Site Development)

SUMMARY OF STATE AND LOCAL ECONOMIC IMPACTS
of
POPLAR ISLAND EXPANSION
(over 12 year site development)

PART 2 LOCAL (TALBOT COUNTY) ECONOMIC IMPACTS

	Initial Study/Permitting/ Design Costs	Site Development	Habitat Development	Long-Term Site Maintenance & Monitoring	Tourism	Total
I. Direct Impacts[1]						
Total Spending[1]	$3,000,000	$90,840,017	$14,748,000	$37,347,000	$286,200	$142,935,017
Average Annual Spending[2]	$250,000	$7,570,001	$1,229,000	$3,112,250	$23,850	$11,935,101
Average Annual Employment[3]	4.2	19	10	53	0.5	87
II. Economic Impacts[4]						
Impact Category						
Total Jobs (FTEs)[5]	6.6	78.3	19.6	78.5	0.7	184
Labor Income	$189,221	$2,840,808	$731,487	$1,986,199	$12,553	$5,760,268
Employee Compensation	$169,319	$2,431,148	$618,166	$1,713,611	$11,290	$4,943,534
Proprietors Income	$19,902	$409,659	$113,320	$272,588	$1,263	$816,732
Indirect Business Taxes	$10,403	$245,854	$63,473	$136,699	$1,996	$458,425
Other Property Type Income	$30,182	$747,604	$318,602	$541,087	$4,698	$1,642,173
Value Added	$229,806	$3,834,265	$1,113,562	$2,663,985	$19,247	$7,860,865
Business Sales	$406,947	$11,740,991	$1,919,406	$4,857,009	$37,917	$18,962,270

[1] Direct spending by task over the 12 year project life was estimated as part of the Federal DMMP (USACE 2005)

[2] Average annual cost per task over 12 year project life (not adjusted for annual fluctuations in spending per task)

[3] Direct employment per task was estimated based on surveys of experts, secondary sources, and comparable industrial sectors.

[4] Average annual economic impacts over 12 year project life
--- Includes direct, indirect and induced economic impacts of both state and federal spending in Maryland
--- Direct, indirect and induced impacts were estimated using the IMPLAN regional economic modeling system

[5] These numbers represent the average number of full-time equivalent (FTE) jobs in each task over the 12 year project. The number of man-years associated with each task, therefore, is the value shown here multiplied by 12. The jobs associated with some tasks will be primarily in early years and the jobs associated with some tasks will be in later years. (See text)

in Talbot County if the entire amount were spent within the county. If spending were spread over a larger economic area (i.e., the Eastern Shore of Maryland), a portion of these jobs would shift to other counties within that area.

A significant amount of the indirect and induced economic impacts of local spending will leak outside the region because of the need to import labor and material to the restoration site. However, the total number of Talbot County jobs created by the project, including new jobs for existing county residents and new jobs for people who will relocate to Talbot County to work on the project, is estimated to be 184 FTEs. Of the $28.3 million in annual spending associated with the expansion of the PIERP, about $11.9 million is expected to involve direct spending in Talbot County. Local multiplier effects of this direct spending is expected to result in indirect and induced spending of another $7.1 million (total direct, indirect and induced business sales less average annual spending), so the expected total changes in business sales (direct, indirect, and induced) is estimated to be approximately $19.0 million.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)
Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)
Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative
No additional economic impacts are associated with the no-action alternative.

5.6.3 Land and Water Use

A baseline of likely future land conditions and probable uses in the absence of the expansion of the PIERP was evaluated to establish a baseline from which to compare with-project changes. Changes in residential land use, commercial use, or recreational uses of the project area could affect the level of perceived impact of the island expansion project. Yet, recent residential trends in the vicinity of the PIERP (Table 3-17) do not show high growth rates for the area. Much of the Eastern shore mainland with views of the project is already developed, although some potential for infill or increased density of development is possible. See Section 5.6.1 for economic impacts to aquatic resources and Section 5.7.1 for impacts to recreational resources.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No significant impacts to land and water use in the vicinity of the PIERP are anticipated from the lateral expansion and vertical expansion of existing uplands.

Southwestern Borrow Area No land and water use impacts associated with sand dredging in the southwestern borrow area are anticipated.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative

No additional significant impacts to land and water use in the vicinity of the PIERP are anticipated from the no-action alternative.

5.6.4 Environmental Justice

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This Executive Order requires Federal agencies to consider the environmental and human health effects of their policies, procedures, and projects on minority and/or low-income populations. Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, or incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Each Federal agency was mandated to make environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and/or low-income populations.

The USEPA Office of Environmental Justice defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Fair treatment means that no group of people including a racial, ethnic, or socio-economic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies (cited in USEPA, 1998). Additionally, Maryland's definition, which builds on USEPA's definition, specifically notes that all citizens of the State should expect (1) to be protected from public health hazards and (2) to have access to the socio-economic resources necessary to address concerns about their livelihood and health. (Maryland Commission on Environmental Justice & Sustainable Communities**,** *Annual Report 2002*).

Environmental justice concerns arise only if a project is expected to generate negative environmental or economic consequences. Results of the air quality and water quality analyses suggest that sediments placed at this site will be free of contaminants and will not generate health risks to people within the area. The economic effects of the project are expected to be largely positive, so negative economic impacts are not a concern. However, temporary noise and light effects, visual impacts and recreational boater disruptions during the construction period could potentially be seen as undesirable impacts. For this reason, the presence of any vulnerable racial, ethnic, or socio-economic group in the vicinity of the project was reviewed.

County subdivision data from the 2000 U.S. Census were used to evaluate the demographics of the area around the project. Variables on race and household income were assessed to determine whether areas near the project contained a disproportionate share of any vulnerable group. Vulnerable groups were defined as:

- African-Americans
- Hispanics (non-white)
- All minorities (all non-white)
- Households below the Federal poverty level

In addition, whether the median household and per capita income levels were below the county or State level was evaluated to compare impacts to socio-economic groups.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Relative to the county and State, the Bay Hundred county subdivision (Figure 3-30) had a lower proportion of minorities and slightly higher incidence of poverty (Table 5-12). The African American population of Bay Hundred makes up 6.2 percent of the population, compared to 15.4 percent of the county and 27.9 percent of the State. The median household income and per capita income of Bay Hundred are each considerably lower than county and State levels. The proportion of households with Supplemental Security Income and income below the poverty level were somewhat higher for this subdivision than the county or State. Therefore, the only indication that a vulnerable group may be targeted by this project is the slightly elevated proportion of the subdivision in poverty and below average incomes.

Table 5-12. Demographic Statistics for Area Near the PIERP

	Bay Hundred	Talbot County	Maryland
Total Population	1,949	33,812	5,296,486
White, not of Hispanic/Latino origin, %	92.8 %	81.2 %	62.1 %
Black or African American, not of Hispanic/Latino origin, %	6.2 %	15.4 %	27.9 %
Hispanic or Latino origin, %	0.5 %	1.8 %	4.3 %
Median household income in 1999	$38,323	$43,532	$52,868
Per capita income in 1999	$19,323	$28,164	$25,614
Households With Supplemental Security Income (SSI), %	5.4 %	3.7 %	3.4 %
Persons with income in 1999 below poverty level, %	9.2 %	8.3 %	8.5 %

Source: U.S. Census 2000

Using finer-scale analysis of the census data, it is apparent that the residents closest to the project do not exhibit high poverty rates. The two census block groups that comprise the Bay Hundred county subdivision have greatly different poverty rates (Figure 5-12). The more northerly of these block groups, which is in closest proximity to the lateral expansion and vertical expansion of existing uplands, has one of the lowest poverty rates in Talbot County. Furthermore, the waterfront homeowners that are expected to be most impacted by the noise and visual impacts are less likely to include residents living below poverty because these homes frequently have the highest values in the area.

Southwestern Borrow Area No environmental justice impacts associated with sand dredging in the southwestern borrow area are anticipated.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

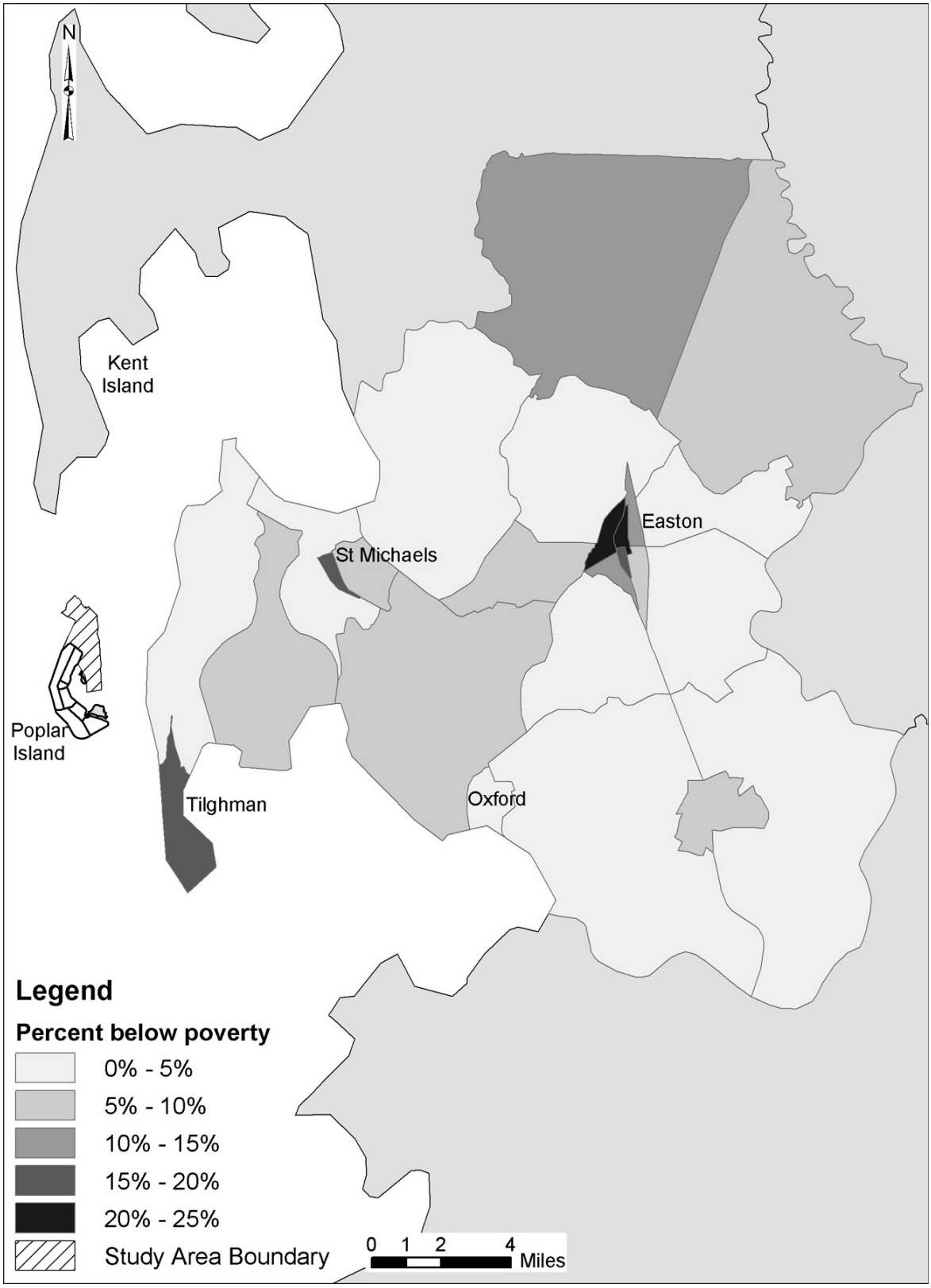
Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.



Source data from U.S. Census 2000.

Figure 5-12. Census Block Group Poverty Rates in Talbot County

No-Action Alternative
No additional impacts to low-income and minority populations are expected with the no-action alternative.

5.6.5 Safety for Children

On April 23, 1997, President Clinton issued Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks." Under this Executive Order, Federal agencies are required to make it a high priority to identify and assess environmental health risks and safety risks resulting from its policies, programs, activities, and standards that may disproportionately affect children.

> "*A growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health risks and safety risks… Therefore, …each Federal agency: (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." (Executive Order 13045, April 21, 1997).*

Children are particularly prone to potential environmental health and safety risks because a child's bodily systems are still developing and they ingest more in proportion to their body weight than adults do. A child's size and weight may reduce the effectiveness of standard safety features, and children's behavior patterns make them more susceptible to accidents because they are less able to protect themselves.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands No health or safety risks to children associated with the project have been identified. The types of activities associated with the lateral expansion and vertical expansion of existing uplands at the PIERP will not generate chemical constituents that may pose health risks to children. Additionally, because this project is located offshore, children will not have general access to construction areas located on site. Children who tour the PIERP as part of the educational tours will be closely supervised at all times, and tour groups will avoid areas of active construction activity.

Southwestern Borrow Area No impacts to children's safety associated with sand dredging in the southwestern borrow area are anticipated.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative
No additional impacts to safety to children are anticipated with the no-action alternative.

5.7 AESTHETICS AND RECREATIONAL RESOURCES

5.7.1 Recreational Resources

5.7.1.a Recreational Boating To evaluate potential impacts of the project on recreational boaters, effects on the number of recreational boating trips for various classes of vessels were considered. To distinguish recreational boaters from those primarily fishing, recreational boaters were assumed to be passing through the waters near the PIERP on their way to typical boating destinations. Likely boating destinations and the typical routes that sail and motorboats would be likely to take in the vicinity of the island were considered, and whether the lateral expansion would affect passages along these routes was evaluated. Visual or other disruptions to commercial or recreational boaters, which were described in Section 5.7 were also considered.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Although boaters do not necessarily follow shipping channels or designated routes, the majority of recreational boaters that use the Chesapeake Bay use navigational markers of charted locations to set courses. Recreational boat use of waters in the vicinity of the PIERP is high for the mid-Bay, and a large portion of transient boaters would be likely to pass by the PIERP on their way in or out of port locations in Eastern Bay and the Miles River. Boats navigating from the Chesapeake Bay mainstem channel into Eastern Bay would tend to use the channel north of the project into Eastern Bay. Even the small boats that choose to use the shallows adjacent to the channels will not typically be required to change course to avoid the island; however boaters departing Lowes Wharf for points north would need to travel an extra half-mile to avoid the expansion and reach the mainstem channel. Non-powered boats (i.e., kayaks and canoes) are more likely to make the island a destination than to find it is an impediment to travel.

Boaters in the vicinity of the PIERP during construction and site operations of the lateral expansion and vertical expansion of existing uplands will be exposed to an increase in barge traffic as well as temporary noise and visual disturbances. Boats that are not fishing or

lingering in the area will experience these effects for a short duration only. Boaters who wish to avoid the areas immediately around the project have many alternative boating areas and will not be prevented from reaching common boating destinations in Eastern Bay and the Miles River. Similar to existing conditions, for safety purposes during construction, warning signs for recreational boaters would be placed in locations where potential submerged hazards may exist. The MDNR police would also cooperate with the State to enforce the existing restrictions at the PIERP and lateral expansion during construction, when necessary.

Southwestern Borrow Area Sand dredging activities in the southwestern borrow area will generate short-term noise disturbances for recreational boaters. However, boaters that are passing through this area will experience these impacts for a short time period only, and boaters wishing to avoid this area altogether have many alternative locations to choose from.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts during construction are the same as those discussed above for Alternative 1. Depending on the final design, water depths within embayment will be 8 to 12 feet, thereby potentially making the area accessible to boaters. However, the level of allowable access to the embayment has yet to be determined and will be a function of safety and environmental concerns. Additionally, should recreational boating be permitted in the open-water embayment, potential hazards, in the form of rock reefs and breakwater structures, may exist in the final design and will need to be adequately marked.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed above in Alternative 1.

No-Action Alternative

No additional impacts to recreational boating are associated with the no-action alternative.

5.7.1.b Recreational Fishing The economic value that recreational fishermen place on a fishing site depends on factors that include: the abundance, availability, and size of fish at the site; the distance to and accessibility of the site, fishing congestion at the site, non-fish related characteristics of the site (i.e., sheltered vs. open water), and the availability of alternative fishing sites. Activities associated with the lateral expansion of the PIERP that change recreational fishing opportunities or affect fishing success at sites for which there are few

comparable substitutes have far greater impacts than activities at sites that are near many other potential fishing sites.

Effects on recreational fishing were considered in three categories: 1) potential impact on boat access, 2) potential impact on fish catches, and 3) potential effect on quality of the recreational experience. To address the first concern, routes local boaters would be likely to take were considered and whether the project would interfere with navigation along these routes was evaluated. For the second concern, conclusions from the aquatic biology analyses were evaluated, interviews with personnel knowledgeable about recreational fishing activities near the island were conducted, and research on the potential effect of underwater rock placement on recreational fish species was evaluated. For the third concern, potential aesthetic and congestion effects during construction and in the long term were evaluated.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands

Boat Access to Fishing Areas

The areas of primary interest to recreational fishermen in the vicinity of the PIERP are channels and adjacent shelf areas. Recreational fishermen using the waters near the PIERP will arrive from a variety of starting points but will tend to use the same boat access channels and routes as commercial fishermen. Following the analysis of commercial fishermen, only negligible effects on the time it takes most boaters to reach fishing destinations near the project location are expected from the lateral expansion of the PIERP. During and after project construction, the lateral expansion footprint should not interfere with typical travel routes used by recreational fishermen. However, barge traffic and some construction activities are likely to force fishermen to temporarily avoid certain fishing areas.

Fish Abundance and Catches

Because the lateral expansion will take up an area of relatively shallow Chesapeake Bay bottom, some shallow-water recreational fishing areas will be lost. Up to about 600 acres of soft sands and mud and the overlying water will be converted to upland or wetland with the expansion. The recreational fishermen who seek out these soft-bottom areas should be able to shift to the abundant shallow areas adjacent to or near the site with no significant effect on congestion levels or catch rates.

For fishermen targeting areas with hard bottom, dike construction has the potential to increase local fish abundance and catch rates of some recreational species in nearby fishing areas. Observations from the existing PIERP and other artificial reefs indicate that fish make use of the rocks at the base of dikes for feeding and shelter. The artificial reef habitat was constructed in October 1999, and a fisheries utilization study of the artificial reef habitat was conducted in 2001. Fish species observed utilizing the artificial reef habitat in 2001 included striped bass, bluefish, Atlantic menhaden, spot, and white perch (NOAA, 2001). However, because the constructed rock reefs associated with the PIERP are well utilized, creation of additional reefs may only marginally improve habitat for recreational fish species.

In addition to the potential benefits of rock reefs, some recreational species may become more abundant if the wave and surge protection and erosion-control that is expected to be provided by the expansion of the existing PIERP results in expanded SAV beds in Poplar Harbor. Proximity to the high quality habitat afforded by SAV beds would also be expected to enhance recreational catch rates for some species.

The value of improved fishing will depend on many factors including how catch rates increase and how higher catch rates affect the total number of trips taken, trip lengths, searching time, and so on. However, economic studies have shown that increasing the probability of catching fish creates measurable economic benefits to fishermen. Such studies show that even if a Chesapeake Bay rockfish angler would be expected to catch only half a striped bass extra per trip (i.e., one additional fish for every two trips) the value to that fisherman, on average, would be $4.95 per trip (Lipton and Hicks, 1999). Others have calculated a value of $9.53 per each additional fish caught per fisherman per trip (Norton *et al*., 1983).

Quality of Fishing Experience

Because the expansion footprint will take up primarily open water that is not prime fishing area, and it is not in the route between most fishing ports to prime fishing areas, the lateral expansion project's impact on the spatial allocation of recreational fishing effort appears to be small. GIS analysis indicates that the shoreline of the PIERP expansion will be closer to some of the fishing areas in the vicinity of the PIERP than the existing project shoreline, which may make the fishing area feel more congested. However, little of the prime recreational fishing areas in the vicinity will be lost. It should be noted, however, that the eroding 3-acre remnants of Poplar Island encompassed by the existing PIERP were considered good recreational fishing habitat. Noise from construction activities may reduce the quality of the fishing experience for some anglers for brief periods of time.

The raising of existing upland cells will not generate any additional impacts to recreational fishing except to periodically preclude use of certain water areas.

Southwestern Borrow Area Short-term space-use conflicts have the potential to emerge in association with sand dredging in the southwestern borrow area. The time of year when sand dredging occurs will affect whether this activity has short-term impacts on recreational fishing, but timing has not yet been determined.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are similar to those discussed above for Alternatives 1 and 2. The open-water embayment included in Alternative 3 will provide a diversity of fish habitat that may attract recreational fishermen, including reef structure; tidal creeks; trophic interaction between the wetlands and open water; and quiescent conditions that may produce SAV habitat where none currently exists. However, the level of allowable access to the open-water embayment has not yet been determined and will be a function of safety and environmental concerns. Additionally, the breakwaters and rock reefs that could provide new recreational fishing opportunities may also be potential hazards to recreational boaters and fishermen, and will need to be adequately marked, should access to the open-water embayment be permitted.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed above in Alternatives 1 and 2.

No-Action Alternative

No additional impacts are to recreational fishing are anticipated from the no-action alternative.

5.7.1.c Hunting

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Hunting opportunities are expected to increase because the lateral expansion is likely to attract a variety of waterfowl to the area. The vertical expansion of existing upland cells in the PIERP will not impact hunting opportunities. While it is not currently envisioned that hunting will be permitted on the island, the waters near the island have the potential to support hunting from boats or from adjacent shoreline. Waterfowl hunting is a popular type of hunting in the region and trends indicate that it will continue into the future (USFWS, 2001c).

Southwestern Borrow Area Impacts to hunting associated with sand dredging activities in the southwestern borrow area are not anticipated.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative

The no-action alternative will not generate additional impacts to hunting.

5.7.1.d Wildlife Viewing

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Wildlife viewing opportunities are likely to increase with the lateral expansion, which will provide additional recreational opportunities for the many area birders, among others. According to the most recent National Survey of Fishing, Hunting and Wildlife-Associated Recreation (USFWS 2001b), 22 percent of Maryland residents participate in birding.[2] Of the people who birded in Maryland in 2001, 82 percent were Maryland residents and 18 percent were individuals who traveled from outside the State. Waterbirds were among the most popular birds for viewing and continued interest in viewing waterbirds and shorebirds is likely to drive interest in viewing birds at the island into the future.

The vertical dike expansion of existing upland cells in the PIERP will not additionally or significantly impact wildlife viewing opportunities since wildlife viewing can persist in other areas when Cells 2 and 6 are being modified. The delay in planting upland Cells 2 and 6 will result in a delay in realizing the total acreage of habitat benefits that, in turn, may temporarily decrease the chance of encountering particular species that use uplands habitat.

Southwestern Borrow Area There will be no additional impacts to wildlife viewing associated with sand dredging activities in the southwestern borrow area.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

[2] The Survey uses the following definition of a birder: "an individual must have taken a trip a mile or more from home for the primary purpose of observing birds and/or closely observed or tried to identify birds around the home."

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative
The no-action alternative will not generate additional impacts to wildlife viewing.

5.7.1.e Educational Uses

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Educational opportunities may increase with the lateral expansion since enhancements to educational programs are being considered as part of the project. The vertical dike expansion of existing upland cells in the PIERP is not expected to have additional impacts on educational uses, which occur during all phases of the project.

Southwestern Borrow Area Educational uses will not be impacted by sand excavation in the southwestern borrow area.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative
No additional impacts to educational uses are expected with the no-action alternative.

5.7.1.f Other Recreational Uses

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The areas adjacent to the PIERP are promoted as scenic destinations by both State and county promotional materials. During construction, the lateral expansion and vertical expansion of existing uplands may detract from uses related to sightseeing in the area. Also, noise during rock placement may have a minor impact on outdoor social activities of residents and tourists such as outdoor dining and backyard picnics by introducing higher than normal background noise levels. However, the ongoing PIERP has been a big draw for birders, tourists, and other interested individuals, even during construction phases. The long-term impact of the island expansion on sightseeing is expected to be positive.

Southwestern Borrow Area Sand dredging in the southwestern borrow area will not impact other uses.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 2 are the same as those discussed above for Alternative 1.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 2 are the same as those discussed above in Alternative 1.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Impacts associated with Alternative 3 are the same as those discussed for Alternatives 1 and 2.

Southwestern Borrow Area Impacts associated with the southwestern borrow area for Alternative 3 are the same as those discussed for Alternatives 1 and 2.

No-Action Alternative
No additional impacts are anticipated with the no-action alternative.

5.7.2 Aesthetics

The approach for this visual assessment is an adaptation of the Visual Resources Assessment Procedure (VRAP) developed for the U.S. Army Corps of Engineers (Smardon *et al*., 1988) and the Forest Service Scenery Management System (USDA Forest Service, 1995). Both procedures are intended to be used as general guidelines rather than rigid processes in the analysis of visual effects of projects.

Evaluating project-related potential aesthetic impacts to a region begins with an inventory of the visual features of the landscape to establish a baseline of the region's visual character.

This process includes assessing the quality of visual resources relative to the regional characteristics and identifying the area from which the project can be seen and the viewers affected. With this baseline, a proposed project can be systematically evaluated for its level of impact. The level of impact depends on the magnitude of change in the visual resource and the concern of viewers for those changes.

The steps followed for this analysis were:

1. Assess existing landscape character and visual resources
2. Assess scenic attractiveness of project location
3. Assess project visibility and visual sensitivity of observers
4. Simulate landscape with and without project
5. Evaluate change in view characteristics with project
6. Describe overall impact of project on visual resources

Visual resources were described by considering the following characteristics described by Smardon *et al*., 1988 (VRAP):

1. Landform
2. Water Resources
3. Land use and use intensity
4. Vegetation distribution

Landform is typically described in terms of elevation, range of elevation and distinct land elements such as mountains, rivers or streams. Water resources are described in terms of the proportion of a landscape in water and how water elements are incorporated in views. Land use and use intensity includes a description of land cover types, particularly how much of the land is developed versus in a natural State, the density of development, types of buildings and other cultural features. Vegetation distribution is a description of the proportion of land in different types of vegetation and the pattern and fragmentation of elements. These characteristics combine to portray the regional character and the sensitivity of the existing landscape to change.

Elements of the landscape that contribute to quality of views can be described through a variety of variables (Table 5-13). People's preferences can vary greatly, but some elements are fairly common to visual appeal (Smardon, 1983; Zube *et al*., 1975). Diversity of land uses, elevations, heights of dominant elements and patch sizes within views generally contribute to scenic attractiveness. Particular value is placed by viewers on water views and long views in most landscape contexts. The amount of natural land overall, is strongly correlated with increased public preferences, although the amount of natural land vs. agricultural or developed land seen as desirable varies by dominant land use and characteristics of the natural area (Hunziker and Kienast, 1999).

Table 5-13. Landscape Characteristics Contributing to Aesthetic Quality.

Landform
Range of vertical elevation
Drainage density
Mean slope
Land use
Land use diversity
Percent tree cover
Proportion of natural land use
Edges
Land use edge density
Variety across edges
Land use compatibility across edges
Contrast
Height contrast between dominant elements
Proportion of elements in height classes
Grain contrast/evenness: difference in land use patch sizes and their distribution
Water
Water edge density
Percentage area water
View
Area of view
Length of view
Relative vertical position of the viewer to the view

Source: adapted from Craik (1975)

Scenic attractiveness and impact on attractiveness may be assessed using measures of view characteristics and results of visual preference research. However, the final test of impact of a project is the public perception of any change in visual quality, which is subjective and may be specific to the population being affected. Public opinion on attractiveness may be judged by determining whether areas are designated scenic areas or by conducting surveys. Because public surveys were not conducted for this EIS, scenic designations have been combined with known preferences to evaluate scenic quality.

To evaluate impacts on visual resources, the measure of change in quality of a view was combined with an evaluation of the visibility of the project and the sensitivity of viewers to changes. Visibility of the project was assessed through a combination of GIS analysis and field reconnaissance. GIS viewshed analysis was used to delineate areas in Talbot County that had potential views of the existing island and proposed project. Then surveys were conducted by boat and by car to assess which of the identified houses, commercial areas and road segments had views of the existing PIERP and adjacent waters.

Viewer sensitivity or level of concern was measured by considering the visibility of the project, the proximity of viewers, the number of viewers, the duration of views and the type of viewer and associated expectations (i.e., recreationist, commuter, resident). Distance zones

were used to describe the relative importance of changes to the viewer. Specifically, the view was divided into foreground (up to ½-mile from viewer), middleground (up to 4 miles from the foreground) and long water views (6 miles from viewer to the horizon). Because changes that occur farther from the viewer are less apparent, changes were given less weight with increasing distance zone.

Views of the landscape with and without the project were simulated using GIS analysis. Both map views and 3-D visualizations of the viewer perspective of the project were investigated. The with-project conditions were simulated using elevation, land cover, land use maps and the most recent conceptual diagram of the expansion including the layout of upland and wetland areas. However, it is likely that the final design will include some changes to the expansion design and these may affect the visual perceptions of the island.

The effect of a change in view was evaluated using the visual impact modifiers of *spatial dominance, scale contrast* and *compatibility*, as defined in the VRAP (Table 5-14). To provide input into this assessment, the GIS analysis was used to calculate the change in appropriate landscape characteristics from Table 5-14. Several viewpoints were used to assess quantitative changes in the views. The viewpoints were chosen by evaluating sites with highest visual sensitivity. Road segments, homes, commercial property, sightseeing areas and public lands with views were evaluated in the selection process. The quantitative results of the viewpoint analyses were used in a qualitative assessment of the visual impact of the proposed project relative to existing visual resources.

Table 5-14. Rating System Used to Assess Visual Impact

Modifier	Definition	Rating
Spatial dominance	The prevalent occupation of a space in a landscape by an object(s) or landscape element. Spatial dominance can be described in terms of being Dominant, Co-dominant, or Subordinate.	Dominant – the modification is the major object or area in a confined setting and occupies a large part of the setting. Co-dominant – the modification is one of the major objects or areas in a confined setting, and its features are of equal visual importance. Subordinate – the modification is insignificant and occupies a minor part of the setting.
Scale contrast	The difference in absolute or relative scale in relation to other distance objects or areas in the landscape. Scale contrast can be described in terms of being Severe, Moderate, or Minimal.	Severe – the modification is much larger than the surrounding objects. Moderate – the modification is slightly larger than the surrounding objects. Minimal – the modification is much smaller than the surrounding objects.

Modifier	Definition	Rating
Compatibility	The degree to which landscape elements and characteristics are still unified within their setting. Compatibility can be described in terms of being Compatible, Somewhat Compatible, or Not Compatible.	Compatible – the modification is harmonious within the setting. Somewhat Compatible – the modification is more or less harmonious within the setting. Not Compatible – the modification is not harmonious within the setting.

Source: Smardon *et al*. (1988)

Regional Landscape

The general character of the region's visual resources was discussed in the existing conditions section. Important aspects of the landscape used to evaluate visual impacts are the characteristically long views enjoyed by observers on the water or mainland, the low and relatively flat elevation of the region, and the lack of public access points to the waterfront (Figure 5-13). Because of these characteristic features, the islands in this region are highly visible for viewers on or near the water, but, because of the flat terrain, are not generally visible from inland areas. Little of the mainland shoreline in this region is publicly owned or accessible and therefore, visual effects on the mainland shoreline primarily affect a relatively small number of residents in addition to the local water-users. A significant number of transient boaters are likely to be able to see the island.

Existing Aesthetic Quality

The waterway in and around the PIERP is an important visual resource for the region. Talbot County tourism materials promote nearby towns of St. Michael's, Oxford, and Tilghman Island as picturesque historic towns. In addition, State Scenic Road, Route 33, runs along the peninsula and drivers along this road have views of the waterway with occasional views of the PIERP. The mid-Bay islands, including the PIERP, are part of a rich history of the region (i.e., Horton, 1994) and Tilghman Island is home to the last commercial sailing fleet in North America, the skipjacks in Dogwood Harbor. The mid-Bay islands, which are typically forested, add to land use diversity of views from the Eastern Shore mainland and from boats traveling in the mainstem.

Affected Area and Viewers

For purposes of the visual aesthetic analysis, the affected area includes (1) land areas where residents and transient visitors would be able to view the proposed lateral expansion and raising of existing upland cells and (2) waterways where boaters would be able to view each

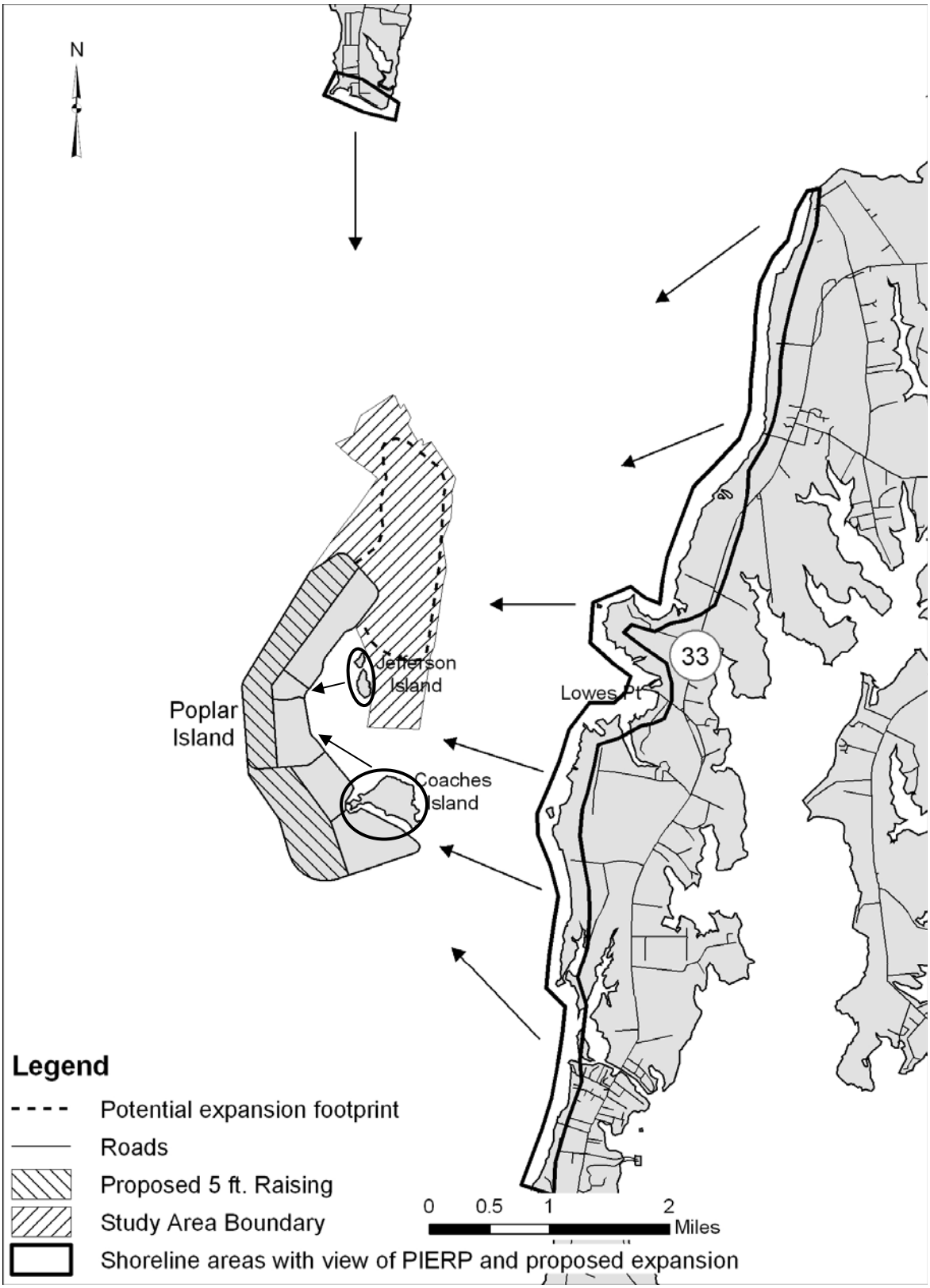


Figure 5-13. Areas with Current Views of Poplar Island, the Proposed Lateral Expansion, and Vertical Expansion of Existing Uplands

alternative. Residential areas will have extended periods of viewing and are considered to have among the highest visual sensitivity. Views from scenic roads, businesses catering to tourists (i.e., restaurants with water views), and natural recreational areas (including water areas) are also considered to have high visual sensitivity. Other business areas and commuters or non-recreational travelers on roads, are not thought to focus on views and therefore have low visual sensitivity.

The affected land area for the proposed lateral expansion and raising of existing upland cells includes primarily residential and agricultural areas (Figure 5-14). The types of non-residential areas with views of the island include a hotel and marinas (Figure 5-15). Transient views of the island may be seen from secondary roads where the roads are close to the mainland shoreline and from several locations along scenic Route 33, as shown in Figure 5-13. The island is visible in clear weather from portions of the western shore of the Chesapeake Bay, but these viewers will see the PIERP and expansion as a very small proportion of the visual field and are not considered to be affected viewers.

Using GIS analysis and ground surveys, it was determined that 127 parcels in Talbot County and 7 parcels in Queen Anne's County were likely to have a view of the proposed lateral expansion and raising of existing upland cells. Generally, these parcels are the waterfront parcels from the southern end of Tilghman Island north to Wades Point and parcels at the southern tip of Kent Island (Figure 5-16). The majority of these parcels are residences, and 96 residential parcels currently are improved, indicating that they contain homes. The remainder of the parcels are in agricultural or commercial uses. Of the 33 agricultural parcels, 15 contain structures, which may include some homes. Two of the parcels are marinas. One is a tax-exempt public works property.

Water users may operate anywhere in the vicinity of the proposed project, but the greatest number of boats in view of the island will be passing through the area along the Chesapeake Bay mainstem channel or using the channel to the east of the island to move between the Choptank River and Eastern Bay. Transient boaters would have lower visual sensitivity than boaters using the waters nearby the island. All boaters using the areas near the PIERP would be expected to have an unobstructed view of the restored island, although boaters remaining on the SW side of the island are likely to have their view of the expansion obstructed by the existing part of the PIERP.

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Views were assessed from several points in the landscape that were chosen to represent concentrations of viewers and viewers most affected by the project. The private marina and inn due east of the island (Lowes Wharf) was used as one viewpoint because of the high sensitivity of tourists likely to use this area. Four other sites were selected to represent distinct residential areas, and Coaches and Jefferson islands were selected due to their close proximity to the project (Figure 5-17). For each viewpoint, the changes in foreground, middleground, and long water views associated with the lateral expansion were evaluated to weight the impact of visual changes.

Note: Photo taken from boat near shore, not from the PIERP

Figure 5-14. Characteristic Shoreline Area Near Poplar Island

Note: Photo taken from boat near shore, not from the PIERP

Figure 5-15. Marina/Hotel Near Poplar Island

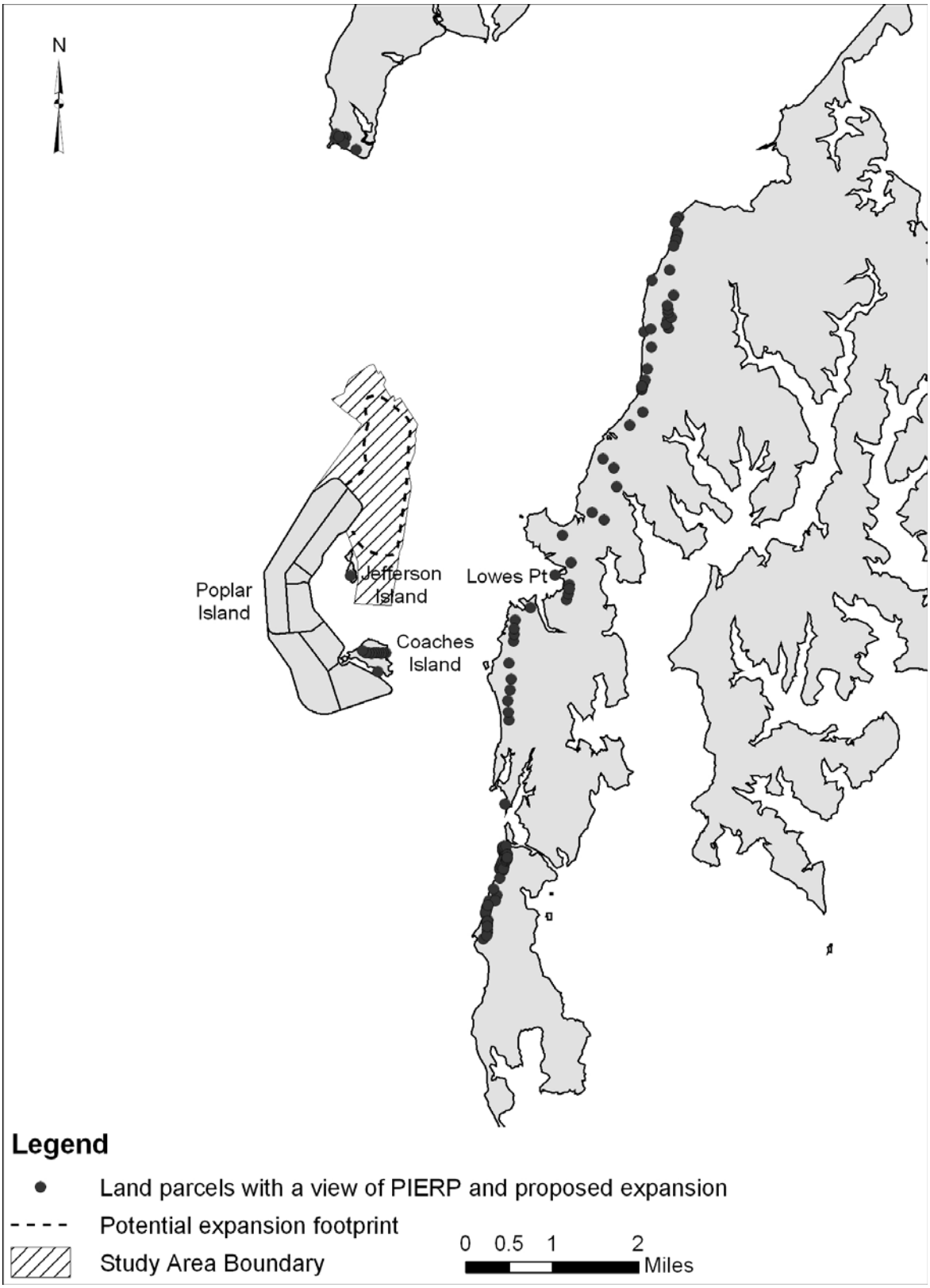


Figure 5-16. Parcels with a View of the Proposed Lateral Expansion and Vertical Expansion of Existing Uplands

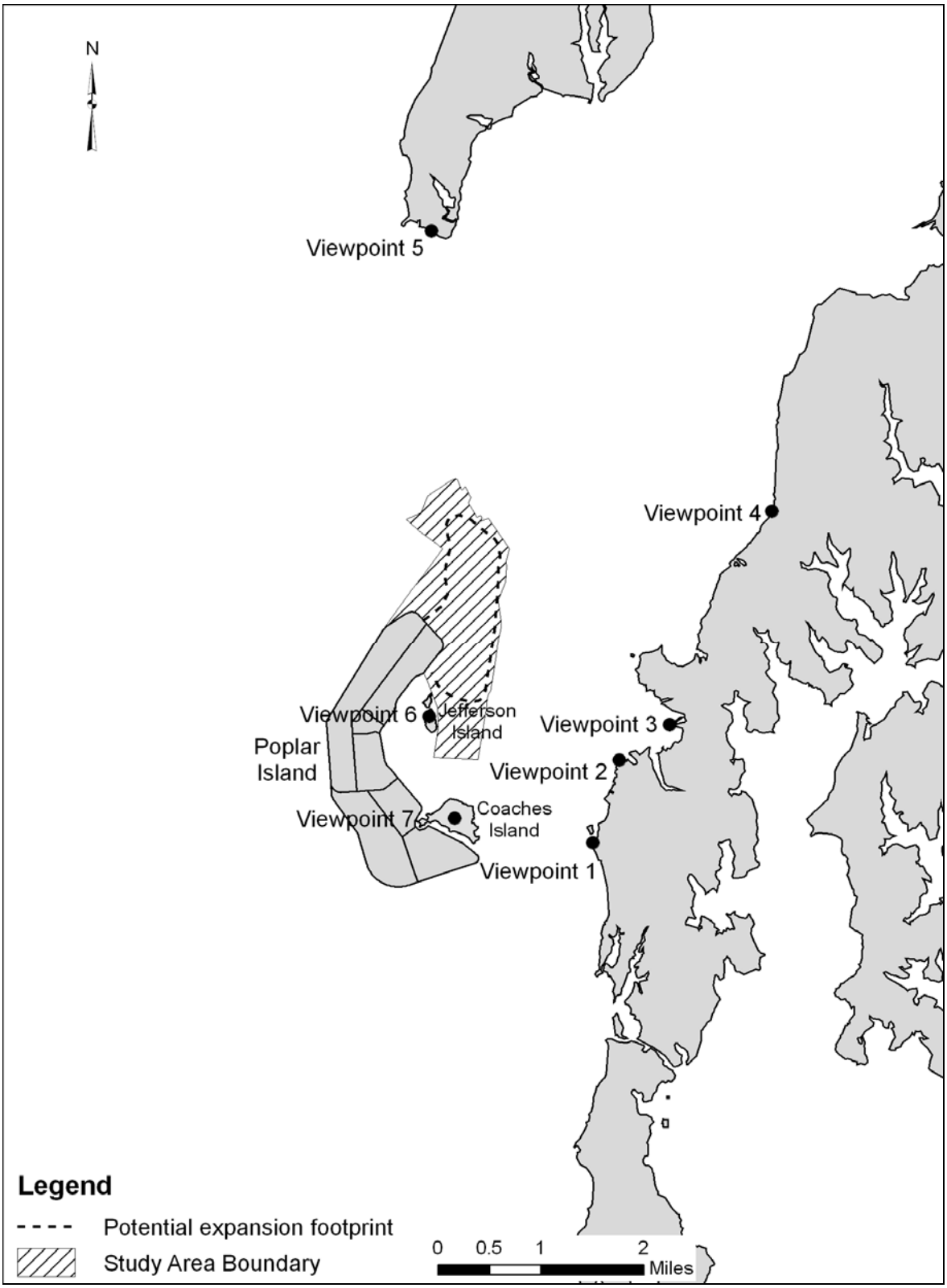


Figure 5-17. Viewpoints Used in Aesthetic Analysis

A variety of landscape features were compared for the expansion project and the adjacent mainland shoreline. In this section, the analyses of the variables that were quantified to judge spatial dominance of the project are presented. Other variables examined in the GIS are discussed in the summary of impacts. The variables that best captured the changes in views in this waterfront environment were measures of change in the proportion of foreground and middleground view that was water, the proportion of foreground and middleground view that was constructed island, and proportion of long water views, meaning views to the horizon or distant land mass.

Initially, the total field of view from a particular point was characterized for each distance zone (foreground, middleground or long water view) by measuring the angular portion of the field of view at a specified distance from the viewer. For example, the total view for the middleground represents the angle of the view over which an observer can see at least ½ mile, and the water view represents the angle of the view over which open water can be seen from ½ to 4 miles. The land view is the angle of the view from ½ to 4 miles, which contains any amount of land. Next, the change in the proportion of the field of view that was water, land, or constructed island was measured for each distance zone. Using three different distances allows the effect of changes in length of view and changes in view character to be analyzed and weighted.

The project falls in the foreground of the Jefferson Island viewpoint only. Currently, the foreground view from Jefferson Island is made up of 71 percent water and 29 percent land. With the constructed PIERP expansion project, water would comprise 51 percent and land would comprise 49 percent. This represents a 28 percent decrease in the amount of water and 69 percent increase in the amount of land in the foreground view of Jefferson Island. Because this viewpoint is unique in having its foreground view affected by the construction of the PIERP expansion, a 3D simulation of the view from Jefferson Island to the northeast before and after project construction was created (Figure 5-18).

For the middleground (1/2 – 4 miles), the view was assessed in terms of the angles of total view, water view, land view and constructed island view, with and without the expansion footprint (Figures 5-19 and 5-20). The percentage change in the proportion of middleground view that is water, land, or constructed island with the expansion is shown in Table 5-15. The analysis shows that the biggest change in view occurs at Viewpoint 6 (Jefferson Island). Because of its close proximity to the expansion, Jefferson Island will lose 100 percent of its middleground water view as defined here. Residents of Jefferson will still have open water views of more than 2.5 miles in some directions, but the four mile unrestricted water view to the northeast will be obstructed by the expansion project. Lowes Wharf (Viewpoint 3) also has a significant change in view associated with the expansion. The view of the Chesapeake Bay from this location is constrained by the sides of the enclosing inlet, so the PIERP takes up a larger percentage of the view than it would from points on the mainland shoreline outside the inlet. From the residential viewpoints and Coaches Island (1, 2, 4 5 and 7), the effect is smaller and the reduction in middleground water view is 7-34 percent. In terms of the percent of the view that the PIERP occupies, Viewpoint 3 shows the

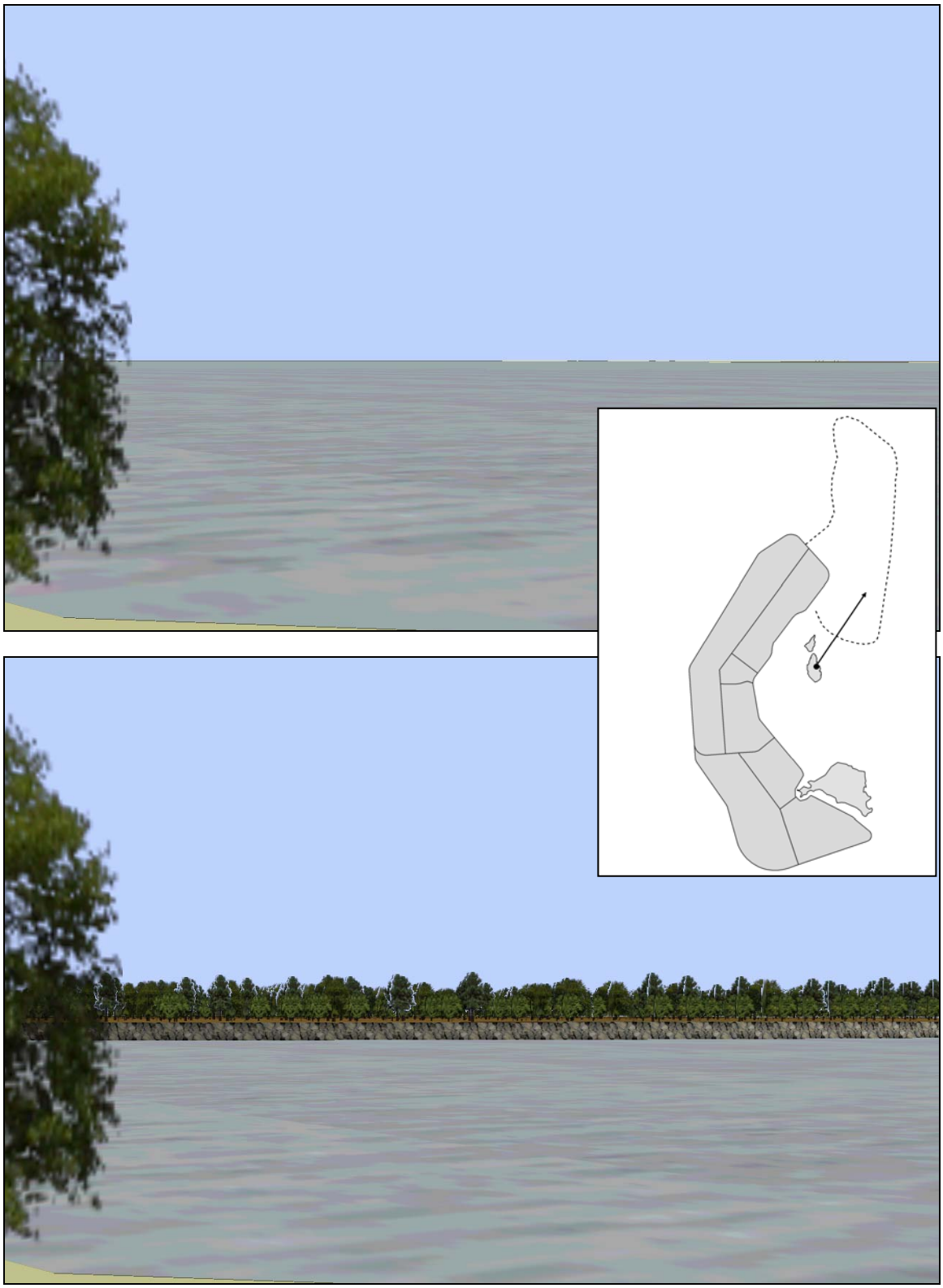
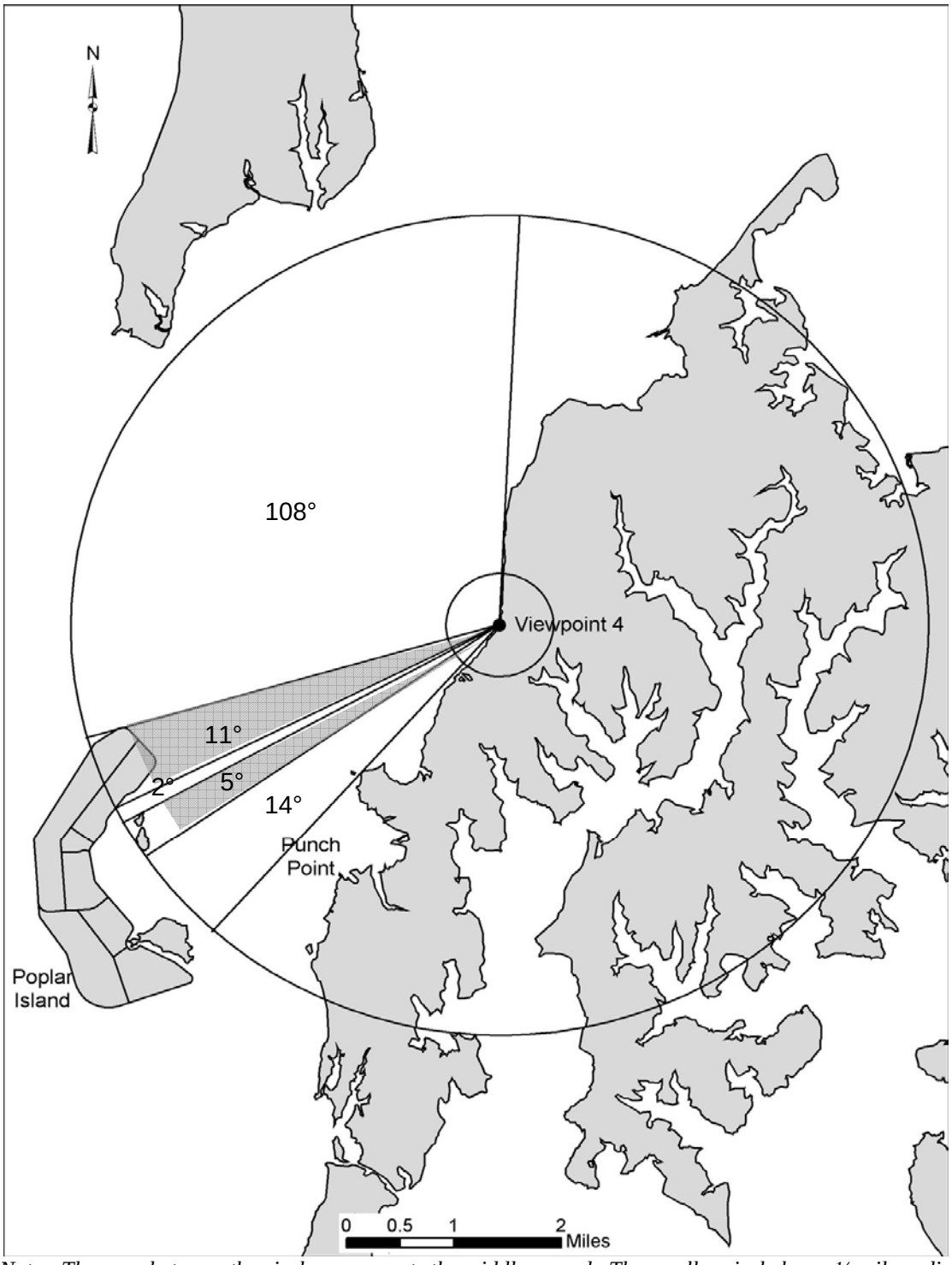
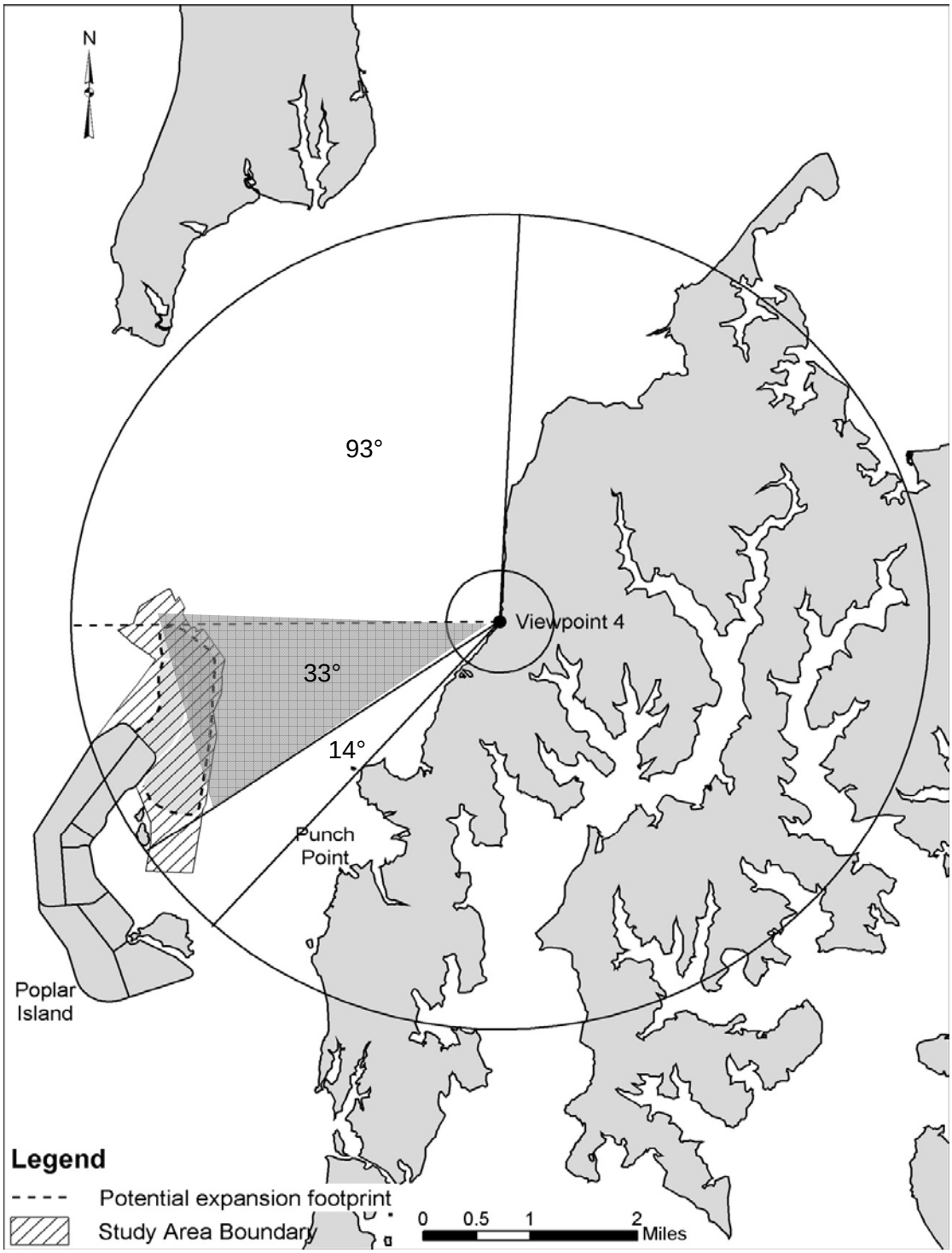


Figure 5-18 Simulated view from Jefferson Island to the northeast, before and after PIERP expansion. Inset map shows location of observer on Jefferson Island and direction of view.



Note: The area between the circles represents the middleground. The smaller circle has a ½ mile radius and represents the foreground. Total middleground view at Viewpoint 4 is 140° (108° + 11° + 2° + 5° + 14°). Total water view in the middleground is 124° (108° + 2° + 14°). The total land view (shaded) is 16° (11° + 5°). This analysis was conducted for each of the 5 viewpoints used in the aesthetics evaluation.

Figure 5-19. Existing Middleground Views for Viewpoint 4



Note: The total middleground view remains 140° with project (93° + 33° + 14°). The project occupies 33° of the view (hatched area). Total water view is now 107° (93° + 14°). This represents a -15% change in water view from without project conditions.

Figure 5-20. Middleground View with Project for Viewpoint 4

Table 5-15. Changes to Middleground Views Associated with Expansion (1/2 To 4 Miles)

Description of View	Viewpoint 1	Viewpoint 2	Viewpoint 3	Viewpoint 4	Viewpoint 5	Viewpoint 6	Viewpoint 7
Total Middleground View (width of view in degrees)	190°	169	88°	140°	167°	256°	210°
Water view – existing conditions	123°(65 %)	96° (57 %)	31° (35 %)	124°(89 %)	154°(92 %)	47° (18 %)	50° (24 %)
Water view – with project	104°(55 %)	72° (43 %)	8° (9 %)	107°(76 %)	143°(86 %)	0° (0 %)	33° (16 %)
Change in water view with project (percent change)	-19°(-15 %)	-24°(-25 %)	-23°(-74 %)	-17°(-14 %)	-11° (-7 %)	-47° (-100%)	-17° (-34%)
PIERP view – existing conditions	67° (35 %)	73° (43 %)	57° (65 %)	11° (8 %)	7° (4 %)	81° (32 %)	160° (76 %)
PIERP view – with expansion project	86° (45 %)	97° (57 %)	80° (91 %)	33° (24 %)	18° (11 %)	143° (56 %)	177° (84 %)
Change in PIERP view with project (percent change)	19° (28 %)	24° (33 %)	23° (40 %)	22°(200 %)	11°(157 %)	62° (77 %)	17° (11 %)
Land view (including PIERP) – existing conditions	67° (35 %)	73° (43 %)	57° (65 %)	16° (11 %)	13° (8 %)	209° (82 %)	57° (27 %)
Land view (including PIERP) – with expansion project	86° (45 %)	97° (57 %)	80° (91 %)	33° (24 %)	24° (14 %)	256° (100 %)	74° (35 %)
Change in land view with project (percent change)	19° (28 %)	24° (33 %)	23° (40 %)	17° (106 %)	11°(85 %)	47° (22 %)	17° (30 %)

greatest impacts because with the expansion, the PIERP occupies 91 percent of the view with the project compared to 65 percent without the project. At Coaches Island (Viewpoint 7), 84 percent of the view will be occupied by the PIERP and the expansion. The expansion represents an 11 percent increase in the amount of the view taken up by constructed island.

To evaluate impacts on long water views, total angle of long water view (>6 miles) with and without the project was measured (Figure 5-21; Table 5-16). Similar to the middleground results, the effects on background views are considerable for Viewpoints 3 and 7 (77 percent and 100 percent reduction in water view), but are much lower for other viewer locations (7-34 percent reductions).

Visual assessment primarily considers the long-term visual impacts of the island once the island is complete and natural vegetation becomes dominant. However, the appearance of the existing PIERP and the proposed raising of existing upland cells will progress from a construction site to an uninhabited vegetated island over a period of many years. The visual effect of the island will change through time as construction proceeds and vegetation matures. To simulate this visual progression, a series of images using 3D GIS software was developed. A single vantage point (Viewpoint 2, Punch Point) was used to illustrate what these changes may look like for a viewer at that location (Figures 5-22 through 5-25).

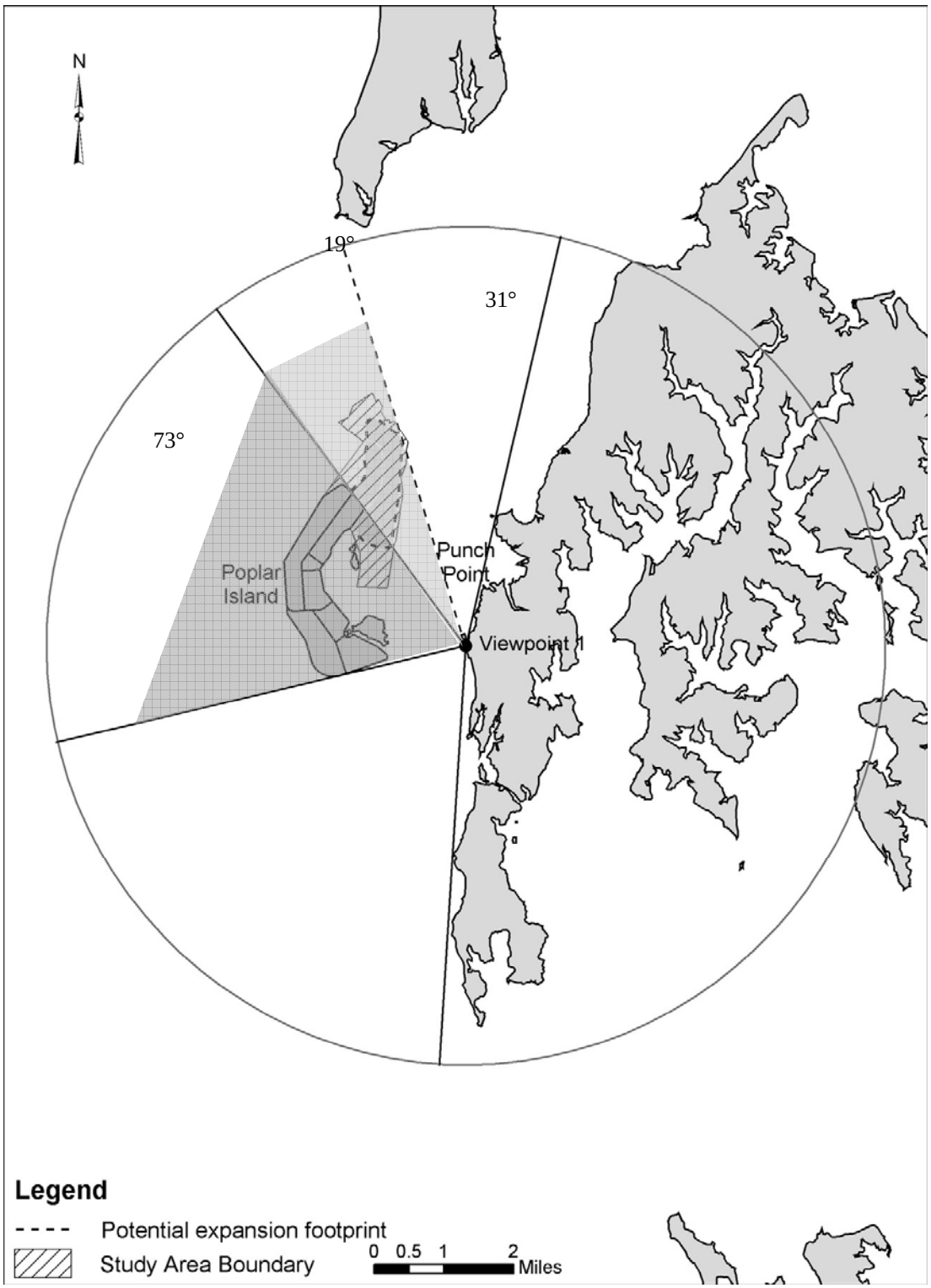
The 3D analyses were also used to assess the visual impact of raising the existing upland dikes 5 ft, from +20 ft MLLW to a final design height of +25 ft MLLW. To consider the visual effect of the dike raising, several vantage points were assessed using an appropriate scale to correspond to real-world dimensions. Even from the closest viewpoints (i.e., on Coaches Island), the effect of the vertical increase was barely perceptible (Figure 5-26). Only areas with foreground views of upland cells 2 and 6 on the existing PIERP are likely to notice the dike height increase, and these areas include Coaches and Jefferson islands and fishing areas to the west of the island.

During inflow, the temporary dike elevation will be +30 ft MLLW. This elevation was not evaluated in the 3D analysis, but it is expected to create insignificant visual impacts to Eastern Shore mainland viewers. Upland dike elevation at the PIERP is currently +23 ft MLLW. Similar to the simulated raising from +20 to +25 ft MLLW, raising the dikes 7 ft to +30 ft MLLW is expected to be barely perceptible except to areas with foreground views of the upland cells.

Southwestern Borrow Area Short-term, adverse impacts associated with dredging equipment are anticipated due to dredging the southwestern borrow area, including aesthetic impacts to both Jefferson and Coaches Islands.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The greater proportion of wetlands in Alternative 2 serves to lessen any aesthetic impacts. Wetland cells have lower dikes and vegetation than upland cells. This lower profile allows these cells to blend in with



Note: The area outside the circle represents long views (>6 miles). The total without-project long view at Viewpoint 1 is 123° (31° + 19° + 73°). The long-view occupied by the project is 19°, or 15%.

Figure 5-21. Long Water Views for Viewpoint 1

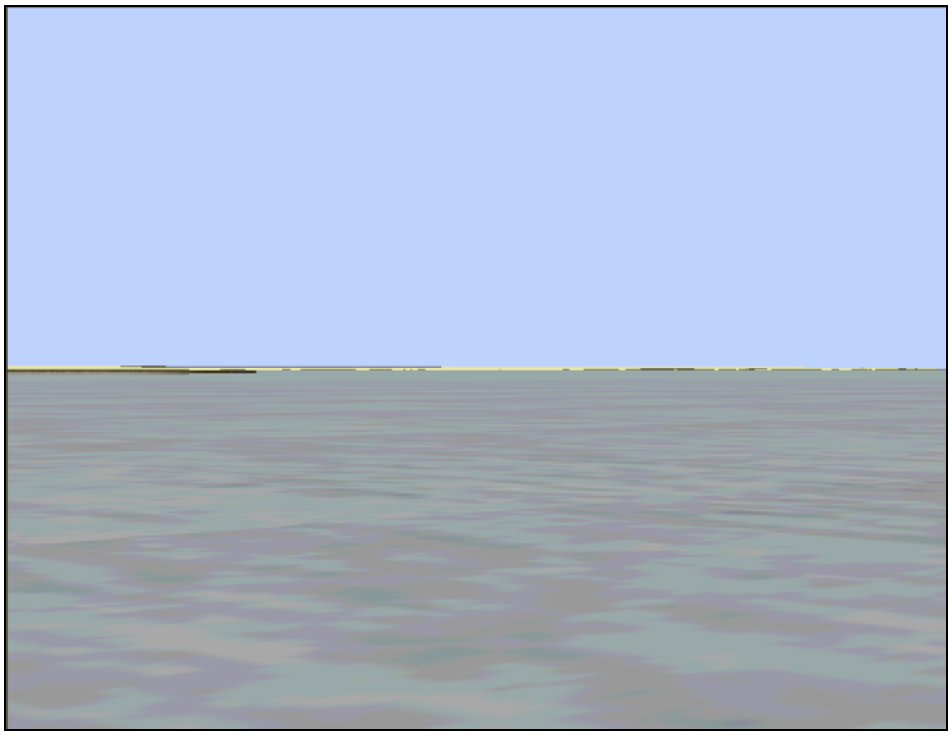


Figure 5-22. View from Punch Point to the Northwest with View of Existing Poplar Island Dikes

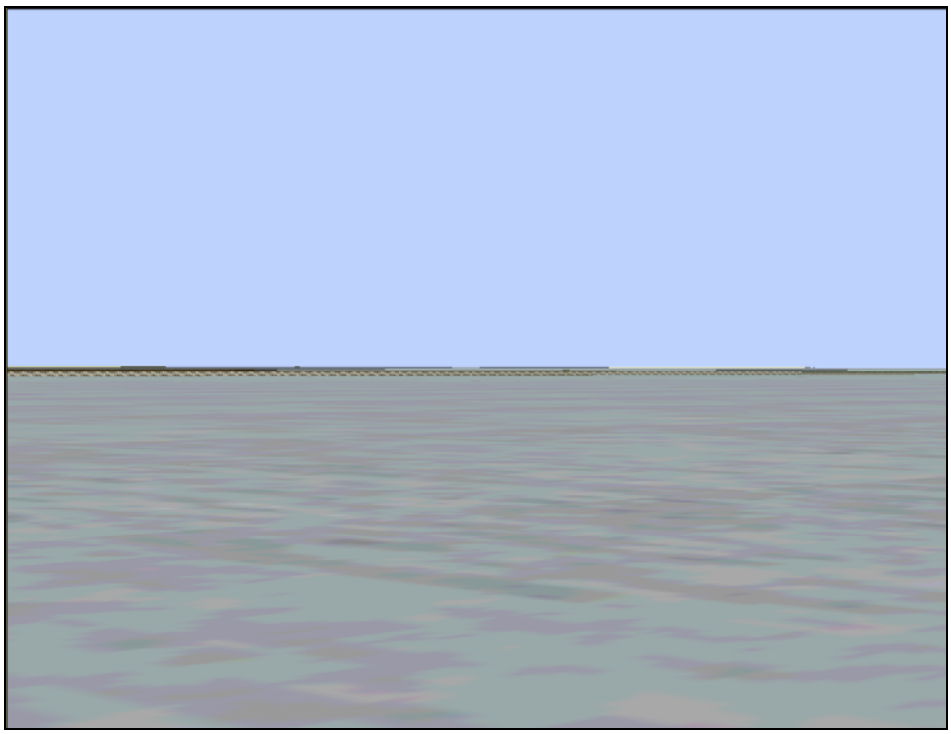


Figure 5-23. View from Punch Point to the Northwest with Northern Lateral Expansion and Vertical Expansion of Existing Uplands

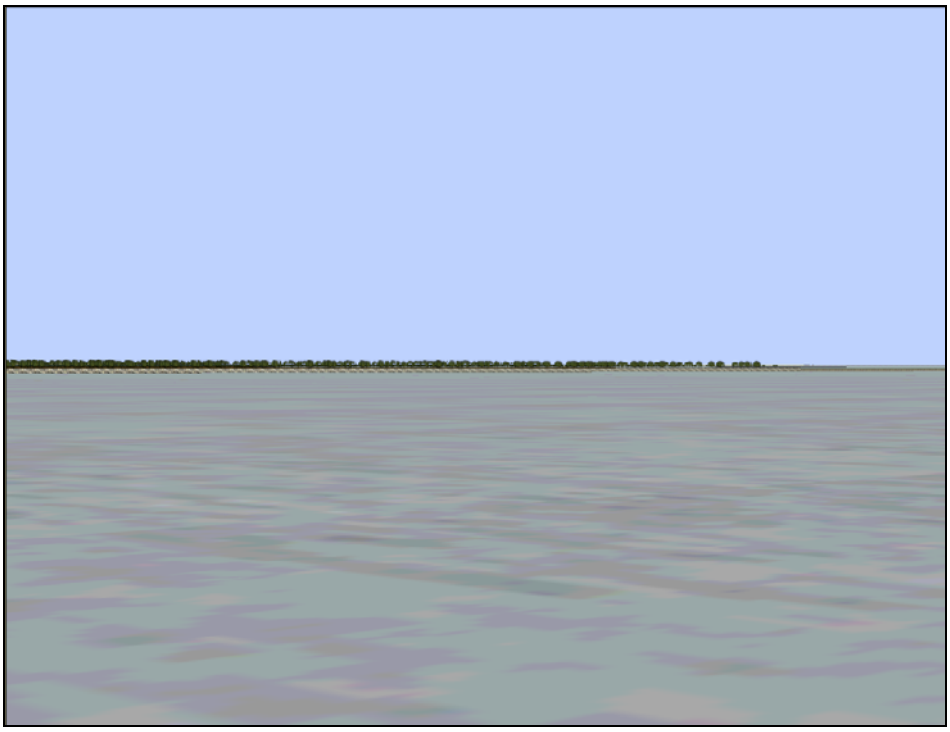
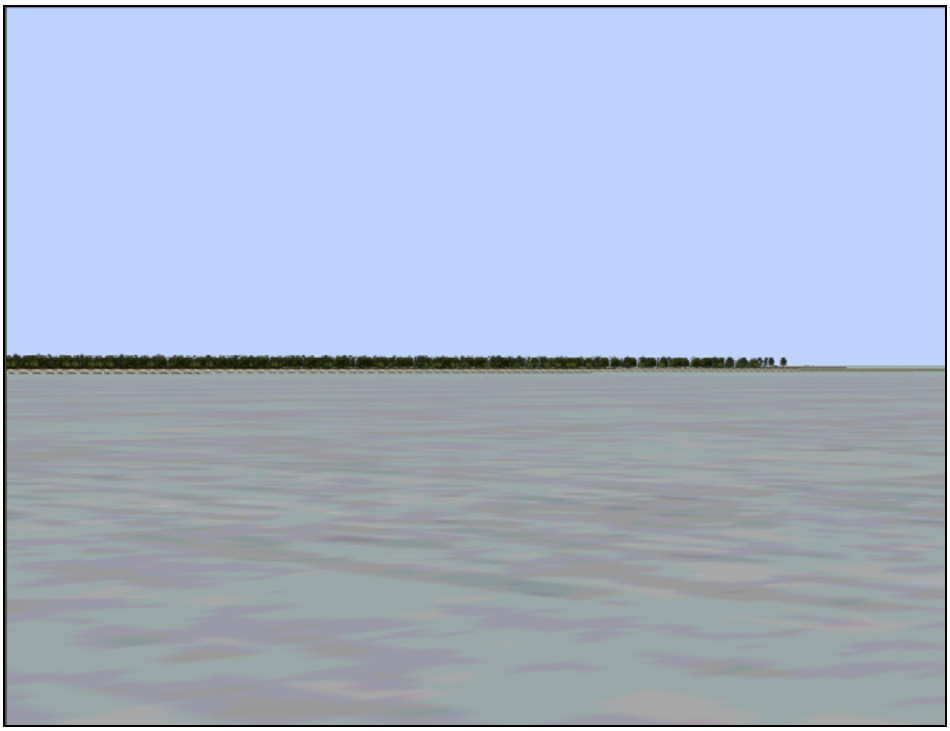


Figure 5-24. View from Punch Point to the Northwest with Northern Lateral Expansion, Vertical Expansion of Existing Uplands, and Initial Planting of Upland Vegetation



Note wetland cells at right in picture (marked by lack of tall vegetation).

Figure 5-25. View from Punch Point to the Northwest with Mature Upland Vegetation in Existing Poplar Island Upland Cells and Northern Lateral Expansion Cells.

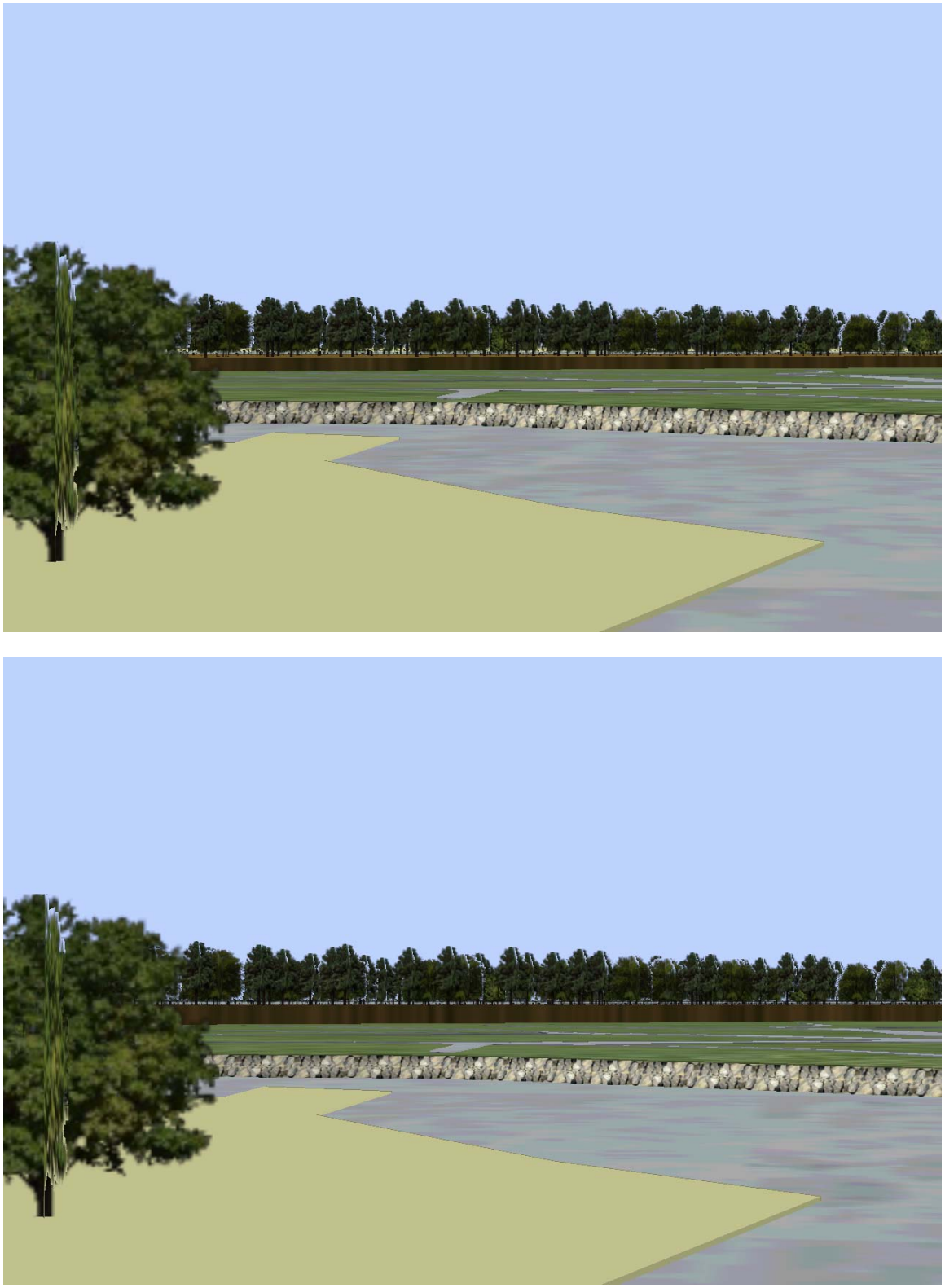


Figure 5-26 Simulated view from Coaches Island toward existing PIERP without (above) and with vertical dike raising.

Table 5-16. Changes to Long Water Views Associated with Expansion (6+ Miles)

	Viewpoint 1	Viewpoint 2	Viewpoint 3	Viewpoint 4	Viewpoint 5	Viewpoint 6	Viewpoint 7
Total long water view (width of view in degrees) without project	123°	88°	30°	70°	97°	34°	35°
Total long water view with project	104°	63°	7°	55°	90°	0°	23°
Percent change in long water views	-15 %	-28 %	-77 %	-21 %	-7 %	-100 %	-34 %

the surrounding landscape. Otherwise, impacts associated with Alternative 2 are the same as discussed above for Alternative 1.

Southwestern Borrow Area No additional impacts are associated with the southwestern borrow area.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands Aesthetic impacts associated with Alternative 3 will be similar to those described above for Alternative 1. Although the habitat design of these alternatives is considerably different, the external appearance would be comparable. The location and length of upland cell dikes would be similar in Alternatives 1 and 3, and therefore, these alternatives will have a similar height profile. Additionally, the breakwaters enclosing the open-water embayment will be similar in height to the adjacent wetland cell dikes.

Southwestern Borrow Area No additional impacts are associated with the southwestern borrow area.

No-Action Alternative

No additional impacts to aesthetics are anticipated with the no-action alternative

5.7.3 Overall Aesthetic Impacts – Lateral Expansion and Vertical Expansion of Existing Upland Cells

Spatial Dominance

From the results of the quantitative GIS analysis, it is evident that the proposed lateral expansion has the potential to be a primary element in the landscape for some sensitive viewpoints (i.e., selected residential areas, waterfront businesses), but from the majority of vantage points, it is anticipated that the island, once completed, will blend into the existing landscape.

The perceived level of dominance of the lateral expansion in the landscape will depend on distance from the island and the observer's sight line to the project. The proposed lateral expansion would be co-dominant with the existing island from the most common viewpoints. Taken as a whole, the existing island restoration project and expansion will be a prevalent feature in the landscape when seen from residences or roads on the adjacent Eastern Shore mainland, vacation homes on Coaches or Jefferson Island, or when viewed by boaters in the vicinity. From about 15 homes and 1 marina and inn (represented by Viewpoint 3), the middleground views will be significantly changed by the project because the proportion of long water views will be reduced. However, none of these homes or the inn will have the island in their foreground views. The effect on views from Jefferson will be severe because impacts will be within the foreground and much of the water view will be lost.

Fishermen using recreational fishing grounds nearby see the PIERP as a dominant feature of the foreground and middleground view, and the effect of the proposed lateral expansion and raising of existing upland cells will be similar to that of the existing PIERP. Most transient

boaters will pass a mile or more to the west of the island, and the expansion will not represent a major change from existing conditions in terms of view. The low dikes associated with the wetland cells at the northern extent of the expansion will not be dominant features in the landscape from vantage points along boat routes.

Scale Contrast

The scale of the proposed project is consistent with other islands along the Eastern Shore. Therefore, viewers seeing the island as part of a background view will not perceive a significant scale contrast. The height of the proposed lateral expansion will be consistent with the existing PIERP. However, the elevation of the upland cells in the lateral expansion is expected to be 10 or more ft higher than the adjacent island remnants and 5-10 ft higher than adjacent Eastern Shore mainland shoreline. The stone-faced dikes on the east side of the proposed lateral expansion will be about half a mile closer to some residences than the existing island and will be a slightly more prominent feature above the waterline in the middleground views. For a viewer on the shore facing the island, the stone dikes represent a small proportion of the visual field but will contrast with other visible mainland shoreline. In addition, the lateral expanse of the dikes covers a considerable proportion of the field of view from several homes and from the Lowes Wharf Marina (Figures 5-27 and 5-28). Overall, the scale contrast of the restored island will be minimal for most viewpoints but moderate for the 15 homes and 1 business on the adjacent mainland shoreline.

The majority of visual impacts from the project are associated with the lateral expansion, therefore raising the existing upland cells of dikes by five ft will be a relatively small component of total visual impacts. The main additional impact will be an increased vertical scale contrast with the adjacent island remnants and the Eastern Shore mainland. The elevation of upland Cells 2 and 6 with the vertical expansion is expected to be 15 or more feet higher than the adjacent island remnants and 10-15 ft higher than adjacent Eastern Shore mainland shoreline. As shown in the visual assessment, this difference will be largely imperceptible to those on the Eastern Shore mainland but may increase the scale contrast for fishermen within ½ mile of the project.

Compatibility

Over the long-term, the modification will be generally harmonious within the setting since it is an extension of the PIERP, which is roughly in keeping with the scale of the historical footprint of Poplar Island. However, the shoreline of the proposed lateral expansion, where rock dikes will be used, will be less meandering than the natural shoreline and thus will contrast with existing natural shoreline, but will not contrast with the existing shoreline of the PIERP. In addition, the island shape associated with the proposed lateral expansion contrasts with the look of other islands and peninsulas in the area. The incompatibility will be most prevalent in foreground views of boaters using nearby recreational fishing areas. The degree of incompatibility will be most pronounced during construction phases and before the vegetation matures in the upland and wetland cells. Over the long-term, the compatibility will be improved by plant growth and coverage. The placement of wetland cells on the northernmost extent of the expansion will lessen the incompatibility of the proposed lateral expansion since the wetlands have a low profile on the horizon compared to upland cells,

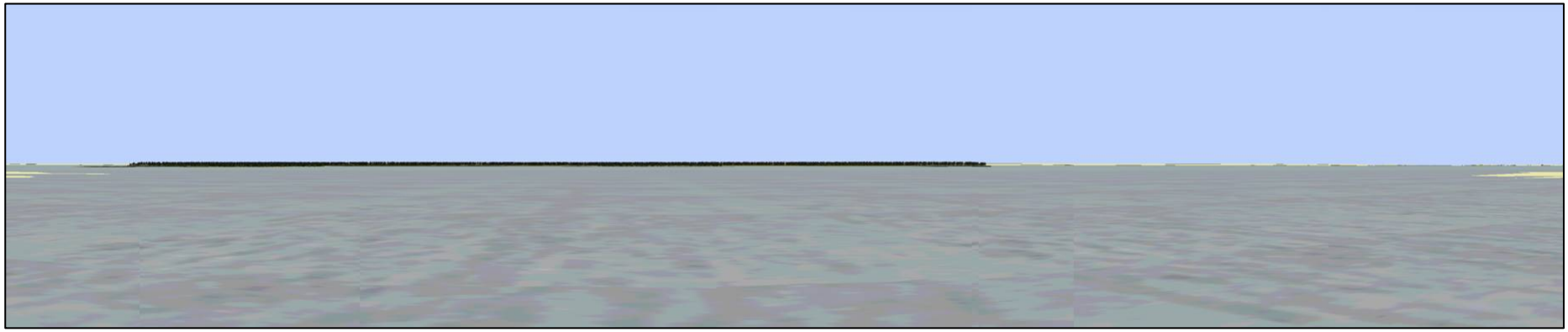


Figure 5-27. Panorama of Existing Poplar Island (Future Condition without Project) from Lowe's Wharf

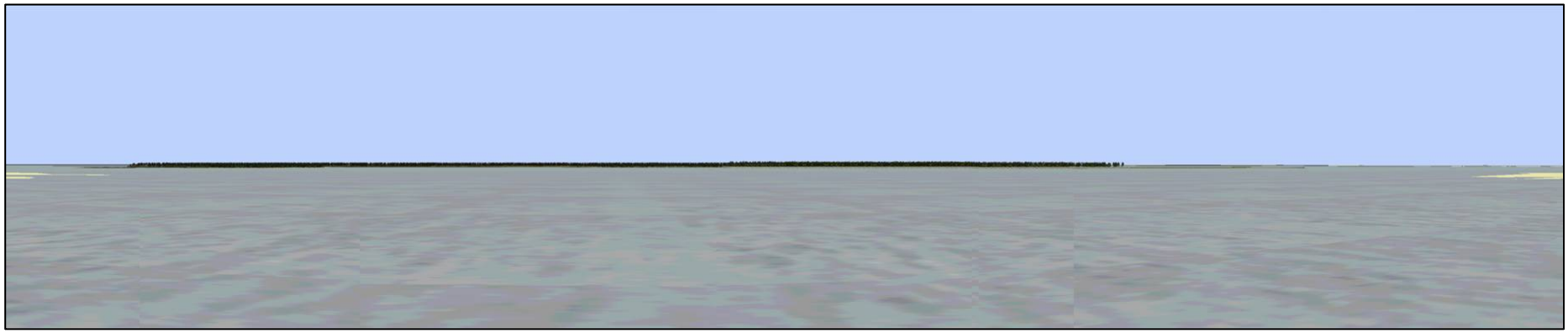


Figure 5-28. Panorama of PIERP with Northern Lateral Expansion and Vertical Expansion of Existing Uplands from Lowe's Wharf

allowing the expansion to blend more effectively into the existing project. Overall, the visual compatibility effects of the project on middleground views from the main boating routes and homes on the shoreline north of Green Marsh Point and south of Bay Shore Road will be minor.

5.8 SUMMARY OF IMPACTS

This section summarizes the major adverse and beneficial impacts to the natural and socioeconomic resources of **Alternative 1** is a 575-acre lateral expansion with 60 percent wetland and 40 percent upland habitat and 5-ft vertical expansion of existing PIERP upland cells, **Alternative 2** is a 575-acre lateral expansion with 50 percent wetland habitat and 50 percent upland habitat and 5-ft vertical expansion of existing PIERP upland cells, **Alternative 3** is a 575-acre lateral expansion with 29 percent wetland habitat, 47 percent upland habitat, and 24 percent open-water embayment habitat, and a 5-ft vertical expansion of the existing PIERP upland cells (recommended plan), and the **No-Action Alternative** as presented in more detail in Table 5-17. Impacts from activities common to all alternatives are discussed in Section 5.3.

5.8.1 Adverse Impacts

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

Lateral Expansion and Vertical Expansion of Existing Uplands The most notable significant, adverse impact of the lateral expansion is the permanent loss of 600 acres of open water and bottom habitat within the footprint of the alignment. The loss of open water habitat has a direct impact on finfish species, the blue crab fishery, and indirect impacts to the avian community. Each of these groups will be displaced temporarily, but most species will utilize the area after the construction is complete. The loss of bottom habitat has a direct impact on the benthic community, clams, and blue crabs, and an indirect impact on the potential for SAV recovery within the alignment. Specifically, the permanent loss of approximately 100 acres of shallow-water habitat within the footprint of the alignment is also an impact that may directly affect utilization by fish species for which the area serves as EFH, recreational fisheries and blue crabs, and will indirectly affect the potential for SAV and clams to repopulate this area.

Another adverse impact of the lateral expansion is the alignment would permanently occupy a large portion of view from Coaches and Jefferson Islands. The lateral expansion would also require both commercial watermen and recreational boaters to motor further north to avoid the northern tip of the expansion.

Short-term, adverse impacts of the lateral expansion include an increase in water column turbidity and sedimentation in the construction and dredging areas, although the stone toe of the armored section of the dike will be constructed before the sand dike section to minimize turbidity impacts during construction and dredging. These short-term impacts will directly affect the water quality in the project area and may indirectly affect the phytoplankton and zooplankton communities, the adjacent NOBs, clams, benthics, blue crabs, finfish species,

and SAV species in Poplar Harbor. These impacts are not considered significant because of their short duration and localized effects. TOY restrictions will be in place to protect resources and minimize adverse impacts during dredging and construction activities. Another short-term impact of the lateral expansion is an increase in the duration of project-related noise during perimeter dike construction and general island site operations. Specifically, Jefferson Island will sustain increased noise levels during all construction phases of the project. The noise may impact the owners of the island and the wildlife that currently inhabit this island.

The raising of existing upland cells will delay the development of upland habitat in Cells 2 and 6. The delay is estimated to last approximately three years, increasing the time until the cells are mature. This delay may have an indirect impact on terrestrial species that would utilize these matured habitats, including the avian community and other wildlife. However, some interim environmental benefits will result from the duration of time that the upland cells spend as mudflats. The upland habitat area in Cells 2 and 6 will be reduced by approximately 15 acres from the additional interior fill required to support the height of the dikes. This decrease in habitat is expected to be a minimal impact on the species that will utilize the habitat.

Southwestern Borrow Area Short-term, direct impacts to bottom habitat and water quality, permanent impacts to water depth, and indirect impacts to phytoplankton, zooplankton, clam species, blue crabs, finfish species, and EFH species may occur from Alternative 1. The southwestern borrow will be required for the lateral expansion to construct a 60 percent wetland to 40 percent upland ratio and required as part of the vertical expansion (5-ft raising) of the existing upland Cells 2 and 6. Approximately 91 acres of the borrow area will be excavated for Alternative 1. The impacts associated with the excavation of the borrow area to open water and bottom habitat will be temporary, adverse impacts. The affects of excavating the southwestern borrow area are short-term water quality impacts associated with increased turbidity during dredging. These short-term impacts will directly affect the water quality in the project area and may indirectly affect the phytoplankton and zooplankton communities, clam species, blue crabs, finfish species, and potentially the EFH species summer flounder. Although a substantial volume of sand would be removed from the southwestern borrow area and underlying clays may be exposed locally, dredging would likely leave the majority of the area retaining a sandy substrate, similar to existing conditions. In addition, subsequent reworking of sand by natural processes would likely reduce the area of exposed clays. Dredging the southwestern borrow area could potentially have an impact on clam species, blue crabs, benthic species, and finfish species expected to utilize this area following sand borrow activities. Additionally, the excavation of the southwestern borrow area will increase the water depth in this area an average of approximately 10 ft across the bottom. The depth of dredging for sand in the southwestern borrow area is proposed to a maximum bottom limit of –25 ft MLLW. This permanent increase in water depth may have an impact on blue crab and finfish utilization of this area following excavation activities, particularly in warmer months when deeper areas of the Chesapeake Bay are prone to oxygen depletion. If the southwestern borrow area is excavated below the pycnocline, hypoxic and/or anoxic conditions could occur in the bottom waters, thus decreasing the habitat value for the clams, blue crabs, benthos,

Table 5-17. Matrix of Potential Environmental and Socioeconomics Impacts by Alternative

Environmental Resources	No-Action Alternative	Alternative 1 –Lateral Expansion (60:40 Ratio) and Vertical Expansion, Alternative 2 – Lateral Expansion (50:50 Ratio) and Vertical Expansion, AND Alternative 3 – Lateral Expansion (Open-Water Embayment) and Vertical Expansion	Impacts Common to All Alternatives
Dredged Material (Dredged Material Management Plan Goal)	• Long-term adverse impact - will not meet DMMP goal for capacity	• Long-term, beneficial impact - will help meet DMMP goal • Alternative 1 –69.4 mcy total capacity • Alternative 2 – 70.5 mcy total capacity • Alternative 3 – 27.8 mcy total capacity **Southwestern Borrow Area:** • N/A	• Not applicable
Hydrology/Hydrodynamics	• Long-term adverse impact – continued erosion of Jefferson Island • Long-term adverse impact – continued erosion of Coaches Island • Long-term adverse impact – Eastern shore mainland erosion will continue from Lowes Point south to Knapps Narrows	• No significant impacts on water levels or current velocities in the vicinity of the PIERP. • Long-term, beneficial impact – reduction in erosion of Jefferson Island and would provide shelter to Poplar Harbor • Long-term, beneficial impact – wave heights and erosion will not increase; in most cases, decrease in wave heights and Eastern Shore mainland erosion • Long-term impact - residence time in Poplar Harbor predicted to increase between 8 and 15 hours • Alternative 3 – the open-water embayment produces a substantially longer residence time compared to existing conditions; however, additional modeling results currently pending; will be completed during the next design phase of the project **Southwestern Borrow Area:** • No adverse impacts	• No additional adverse impacts
Physical Characteristics	• No additional beneficial or adverse impacts	• Alternatives 1 and 2 –Long-term significant impact - change from 600 acres of open water habitat to island habitat • Alternative 3 – Long-term impact – change from 470 acres of open water habitat to island habitat • Long term adverse impact - upland cell heights will increase by 5 ft Northern Access Channel/Turning Basin – will impact 30 acres **Southwestern Borrow Area:** • Alternative 1 – will impact 91 acres • Alternative 2 – will impact 49 acres • Alternative 3 – will impact 19 acres • Long-term adverse impact - increase in water depth and bathymetry	**Cell 6 Closure:** • Borrow Area F – will impact 60 acres • Borrow Area G – will impact 35 acres • Southern Access Channel/Turning Basin – will impact 28 acres • Southwestern Borrow Area – will impact 119 acres
Water Quality	• Long-term adverse impact - continued erosion of Jefferson Island and poor water quality from resultant suspended sediments in Poplar Harbor.	• Short-term adverse impact - increase in water column turbidity and sedimentation during construction and dredging • Short-term adverse impact – lateral expansion will increase the life of the project (duration of discharge through spillways) by approximately 6 – 8 years • Short-term adverse impact – fluctuations in ammonia, DO, and pH could impact the water quality of discharges from the expansion cells • Long-term adverse impact – creation of deeper water for northern access channel increases potential for anoxia in warmer months • Alternative 3 - Modeling results for residence time in open-water embayment currently pending; will be completed during the next design phase of the project **Southwestern Borrow Area:** • Long-term adverse impact - creation of deeper water area increases potential for anoxia in warmer months. • Short-term adverse impact - increase in water column turbidity because of dredging	**Cell 6 Closure:** • Long-term adverse impact - creation of deeper water in southern access channel and borrow area increases potential for anoxia in warmer months. • Short-term adverse impact - increase in water column turbidity because of dredging and dike construction
Sediment Quality	• No additional beneficial or adverse impacts	• Long-term adverse impact – potential for change in sediment type and quality in northern access channel as a result of dredging and future shoaling • Alternative 3 – open water embayment may become an area of localized sedimentation, although modeling results are currently pending **Southwestern Borrow Area:** • Long-term adverse impact – potential for change in sediment type and quality as a result of dredging and future shoaling	**Cell 6 Closure:** • Long-term adverse impact – potential for change in sediment type and quality in southern access channel and southwestern borrow area as a result of dredging and future shoaling
Phytoplankton/Zooplankton	• No additional beneficial or adverse impacts	• Short-term adverse impact - increases in turbidity could temporarily and locally depress phytoplankton, and zooplankton communities • Short-term adverse impact – potential for entrainment in sediment slurry during hydraulic dredging and construction activities • Short-term adverse impact – potential for additional release of nutrients from spillways and subsequent algal blooms due to longer period of operations • **Southwestern Borrow Area:** • No significant adverse impacts	• No additional adverse impacts

Table 5-17. Matrix of Potential Environmental and Socioeconomics Impacts by Alternative

Environmental Resources	No-Action Alternative	Alternative 1 –Lateral Expansion (60:40 Ratio) and Vertical Expansion, Alternative 2 – Lateral Expansion (50:50 Ratio) and Vertical Expansion, AND Alternative 3 – Lateral Expansion (Open-Water Embayment) and Vertical Expansion	Impacts Common to All Alternatives
Fisheries	• No adverse impacts • No beneficial impacts because of increased protection of Poplar Harbor and new tidal gut and wetland habitats	• Alternatives 1 and 2 – Significant long-term adverse impact – loss of 600 acres of open water habitat • Alternative 3 – Significant long-term adverse impact – loss of 470 acres of open water habitat, but open-water embayment provides good habitat for finfish, allowing for forage areas in small tributaries and tidal guts in the wetland areas. • Long-term beneficial impact – Poplar Harbor protection, new wetland habitat, and tidal gut as a nursery ground and area of cover for finfish species • Short-term adverse impact – potential to entrain fish larvae during dredging • Short-term adverse impact – less mobile fish species within footprint will be lost during construction. • Short-term adverse impact – increase in water column turbidity during construction and dredging areas • Long-term adverse impact –increase in water depth in northern access channel increases potential for anoxia in warmer months • Alternative 3 – beneficial impact from three proposed small sub-tidal artificial reefs, stone breakwater and submerged reef structures and proposed avian nesting islands **Southwestern Borrow Area:** • Long-term adverse impact –increase in water depth increases potential for anoxia in warmer months	**Cell 6 Closure:** • Long-term adverse impact – increase in water depth in southern access channel and borrow area increases potential for anoxia in warmer months
Essential Fish Habitat (EFH)	• No adverse impacts • No beneficial impacts because of created wetlands and tidal creeks	• Alternatives 1 and 2 – Long-term significant adverse impact – loss of approximately 600 acres of EFH within footprint • Alternative 3 – Long-term significant adverse impact – loss of approximately 470 acres of EFH within footprint • Long-term beneficial impact – created wetlands and tidal creeks will enhance EFH, and may also benefit SAV which is HAPC for flounder and red drum • Long-term adverse impact – increase in water depth in northern access channel increases potential for anoxia in warmer months • Alternative 3 – open-water embayment would preserve approximately 130 acres of EFH with the potential to support shallow water habitat with SAV • Alternative 3 – beneficial impact from three proposed small sub-tidal artificial reefs, stone breakwater and submerged reef structures and proposed avian nesting islands. **Southwestern Borrow Area:** • Long-term adverse impact – increase in water depth increases potential for anoxia in warmer months	**Cell 6 Closure:** • Long-term adverse impact – increase in water depth in southern access channel and borrow area increases potential for anoxia in warmer months
Benthic community	• No adverse impacts • No beneficial impacts due to increased epibenthic habitat	• Alternatives 1 and 2 – Significant long-term adverse impact - loss of approximately 600 acres of bottom habitat within footprint • Alternative 3 – Significant long-term adverse impact - loss of approximately 470 acres of bottom habitat within footprint • Long-term beneficial impact - increased epibenthic habitat from new perimeter dike, and increased benthic habitat in tidal gut • Short-term adverse impact - increase in water column turbidity during construction and dredging areas; potential to bury benthic community adjacent to footprint • Long-term adverse impact – increase in water depth in northern access channel increases potential for anoxia in warmer months • Short-term adverse impact – disturbance of bottom during dredging of northern access channel • Short-term adverse impact - if dredging of northern access channel changes the substrate it may affect benthic community abundance and diversity in repopulating the area **Southwestern Borrow Area:** • Long-term adverse impact – increase in water depth increases potential for anoxia in warmer months • Short-term adverse impact – disturbance of bottom during dredging, which may effect benthic community abundance and diversity in repopulating the area	**Cell 6 Closure:** • Long-term adverse impact – increase in water depth in southern access channel and borrow area increases potential for anoxia in warmer months • Short-term adverse impact – disturbance of bottom during dredging of southern access channel and borrow area • Short-term adverse impact - if borrow areas F and G are excavated down to underlying clay, the change in dominant substrate may effect benthic community abundance and diversity in repopulating the area
Commercial oysters – NOBs	• No additional beneficial or adverse impacts	• Short-term adverse impact - increase in water column turbidity during construction and dredging areas; potential sedimentation on proximal oyster bars • Short-term adverse impact – potential to entrain oyster larvae during dredging **Southwestern Borrow Area:** • No significant adverse impacts	• No additional adverse impacts

Table 5-17. Matrix of Potential Environmental and Socioeconomics Impacts by Alternative

Environmental Resources	No-Action Alternative	Alternative 1 –Lateral Expansion (60:40 Ratio) and Vertical Expansion, Alternative 2 – Lateral Expansion (50:50 Ratio) and Vertical Expansion, AND Alternative 3 – Lateral Expansion (Open-Water Embayment) and Vertical Expansion	Impacts Common to All Alternatives
Commercial clamming	• No additional beneficial or adverse impacts	• Long-term adverse impact - loss of potential future clam beds within footprint • Long-term adverse impact – potential if northern access channel dredging changes bottom substrate and affects repopulation the area Alternative 3 – long-term beneficial impact; open-water embayment will help preserve bottom habitat for clams • Short-term adverse impact - increase in water column turbidity during construction and dredging areas; potential to bury clams (no productive beds) adjacent to footprint **Southwestern Borrow Area:** • Short-term adverse impact – disturbance of bottom during dredging, which may effect clams abundance and diversity in repopulating the area	**Cell 6 Closure:** • Short-term adverse impact – disturbance of bottom during dredging • Long-term adverse impact – if borrow areas F and G are excavated down to underlying clay, the change in dominant substrates may effect clams abundance and diversity in repopulating the area
Commercial crabbing	• No additional beneficial or adverse impacts; areas adjacent to the PIERP and Poplar Harbor will continue to be used	• Long-term adverse impact - loss of bottom in heavily utilized in northeast area; the use of which lengthens the crabbing season (some adverse impacts may be offset by opening of additional crabbing areas) • Long-term adverse impact – increase in water depth in northern access channel increases potential for anoxia during warmer months • Long-term beneficial impact - created marsh creeks in the wetland cells will provide valuable habitat for all stages of the crabs' life cycle • Alternative 3 – long-term beneficial impact – open-water embayment will help preserve habitat for juvenile crabs, allowing for forage areas in small tributaries and tidal guts in the wetland areas. • Short-term adverse impact - increase in water column turbidity during construction and dredging areas • Short-term adverse impact – overwintering crabs within footprint will be lost during construction **Southwestern Borrow Area:** • Long-term adverse impact - increase in water depth increases; potential for anoxia in warmer months	**Cell 6 Closure:** • Long-term adverse impact - increase in water depth in southwestern borrow area and southern access channel increases potential for anoxia in warmer months • Short-term adverse impact – overwintering crabs within footprint of borrow area and southern access channel will be lost during dredging
Submerged Aquatic Vegetation (SAV)	• Long-term adverse impact – no additional protection from the northeast will be provided	• No SAV observed in proposed footprint for any Alternatives, but long-term, adverse impact - loss of approximately 100 acres of Tier II/Tier III SWH within the footprints that could potentially support future SAV beds • Long-term, beneficial impact – increase quiescent waters in Poplar Harbor, decrease water column turbidity from Jefferson Island erosion • Short-term, adverse impact - increase in water column turbidity during construction and dredging areas • Alternative 3 – limited Tier II/III SAV habitat around the shoreline areas of the open-water embayment and within the tidal gut areas. **Southwestern Borrow Area:** • No adverse impacts	• No additional adverse impacts
Perimeter Dike and Rock Reef Habitat	• No adverse impacts. • No beneficial impacts because of creation of new dike habitat	• Long-term, beneficial impact - approximately 4.6 miles of new rock dike will be created • Short-term adverse impact – temporary loss of the northeastern reef habitat; northeastern reef will be replaced following construction activities • Short-term adverse impact – permanent loss of existing exterior perimeter dike (along northern portion of Cells 1 and 2) within footprint, which will be offset by construction of additional armored dike • Alternative 3 – beneficial impact from three proposed small sub-tidal artificial reefs, stone breakwater and submerged reef structures and proposed avian nesting islands. **Southwestern Borrow Area:** • No adverse impacts	• No additional adverse impacts
Shallow Water Habitat (SWH)	• No additional beneficial or adverse impacts	• Long-term adverse impact – loss of approximately 100 acres of SWH within footprint for all Alternatives • Alternative 3 –Shoreline areas surrounding the open-water embayment will be shallow, intertidal habitat, and will partially offset SWH loss	• No additional adverse impacts
Shoreline Habitats	• No additional beneficial or adverse impacts	• Long-term beneficial impact – creation of additional remote island habitat • Long-term beneficial impact – additional acres of mudflats/intertidal flats habitat and sparsely vegetated islands will be created • Alternative 3 - long-term, beneficial impact – additional shoreline habitat will be created around open-water embayment	• No additional adverse impacts

Table 5-17. Matrix of Potential Environmental and Socioeconomics Impacts by Alternative

Environmental Resources	No-Action Alternative	Alternative 1 –Lateral Expansion (60:40 Ratio) and Vertical Expansion, Alternative 2 – Lateral Expansion (50:50 Ratio) and Vertical Expansion, AND Alternative 3 – Lateral Expansion (Open-Water Embayment) and Vertical Expansion	Impacts Common to All Alternatives
Wildlife (waterfowl, mammals, reptiles, amphibians)	• No adverse impacts • No beneficial impacts because of creation of new upland/wetland habitat	• Long-term beneficial impact - creation of new upland/wetland habitat areas for a wide variety of avian communities • Long-term beneficial impact – additional nesting areas for the diamondback terrapins, especially with Alternative 3 • Long-term beneficial impact - additional remote island upland/wetland habitat for wildlife species • Long-term beneficial impact - additional quiescent waters in Poplar Harbor will provide habitat for SAV and waterfowl • Short-term beneficial impact – interim benefits associated with upland cell development (due to 5 ft dike raising) • Short-term adverse impact - wildlife utilizing the existing interim habitats available in cells at the PIERP may be temporarily displaced during construction activities • Long-term adverse impact – loss of open water forage and resting area for some avian species • Alternative 3 – beneficial impact - open-water embayment will provide resting and foraging area for waterfowl as well as avian nesting islands and shoreline areas of quiescent waters in open-water embayment may provide additional SAV habitat **Southwestern Borrow Area:** • Short-term impact – temporary loss of open water forage and resting area for some avian species	**Cell 6 Closure:** • Short-term impact – temporary loss of open water forage and resting area for some avian species
Wetlands	• Long term adverse impact – loss of wetland habitat on Jefferson Island due to continued erosion • Long term adverse impact - loss of wetland habitat on Coaches Island due to continued erosion • No beneficial impacts because of increased wetland habitat	• Alternative 1 – long-term beneficial impact – 315 acres of additional wetland habitat created; 25 acres of tidal gut habitat • Alternative 2 – long-term beneficial impact – 275 acres of additional wetland habitat created; 25 acres of tidal gut habitat • Alternative 3 – long-term beneficial impact – 165 acres of additional wetland habitat created; 130 acres of open-water embayment habitat that will be surrounded by shoreline wetlands; 10 acres of tidal gut habitat **Southwestern Borrow Area:** Not applicable.	• Not applicable
Upland vegetation	• Long term adverse impact – loss of terrestrial habitat on Jefferson Island due to continued erosion • Long term adverse impact - loss of terrestrial habitat on Coaches Island due to continued erosion • No beneficial impacts because of increased upland vegetation	• Alternative 1 - long-term, beneficial impact – 235 acres of additional upland habitat created • Alternative 2 - long-term, beneficial impact – 275 acres of additional upland habitat created • Alternative 3 - long-term, beneficial impact – 270 acres of additional upland habitat created **Southwestern Borrow Area:** • Not applicable.	• Not applicable
RTE species	• No adverse impacts • No beneficial impacts because of increased remote island upland/wetland habitat	• Short-term adverse impacts to listed avian species – potential displacement of foraging, feeding, and nesting areas during construction activities • No direct adverse impacts to listed avian species (bald eagle, northern harrier, peregrine falcon, and brown pelican), but permanent loss of open water habitat within footprint of proposed lateral expansion. • No adverse impacts to listed finfish or sea turtle species • Long-term beneficial impact - additional remote island upland/wetland habitat for RTE species • Alternative 3 - provides a trophic link between open water and wetland habitat, thereby creating more diverse habitats **Southwestern Borrow Area:** • Short-term adverse impacts to listed avian species (bald eagle, northern harrier, peregrine falcon, and brown pelican) – temporary loss of open water habitat within southwestern borrow area during construction activities.	**Cell 6 Closure:** • Short-term adverse impacts to listed avian species (bald eagle, northern harrier, peregrine falcon, and brown pelican) – temporary loss of open water habitat within southwestern borrow area and southern access channel during Cell 6 construction activities.
Air quality	• No additional beneficial or adverse impacts.	• Short-term adverse impact – increased emissions from dredging and other equipment during construction • Short-term adverse impact – emissions will not significantly increase, but lateral expansion will increase life of project by approximately 6 – 8 years **Southwestern Borrow Area:** • Short-term adverse impact – increased emissions from dredging during construction	**Temporary Dike Raising to +25 ft**: • Short-term adverse impact – increased emissions from dredging and dike construction activities during Cell 6 closure

Table 5-17. Matrix of Potential Environmental and Socioeconomics Impacts by Alternative

Environmental Resources	No-Action Alternative	Alternative 1 –Lateral Expansion (60:40 Ratio) and Vertical Expansion, Alternative 2 – Lateral Expansion (50:50 Ratio) and Vertical Expansion, AND Alternative 3 – Lateral Expansion (Open-Water Embayment) and Vertical Expansion	Impacts Common to All Alternatives
Noise	• No additional beneficial or adverse impacts	• Short-term adverse impact - fishing areas, 18 improved residential, and 17 unimproved parcels on Eastern shore mainland are most likely to be subjected to periodic noise levels above typical acceptable levels (55dBA) • Short-term adverse impact - recreational boaters may be disturbed by periodic project noise • Short-term adverse impact – noise levels will not be significantly higher than for PIERP, but lateral expansion will increase life of project by approximately 7 years; noise from the exterior dike construction will be limited to approximately 2 years • Short-term adverse impact - wildlife may be temporarily displaced during construction activities **Southwestern Borrow Area:** • Short-term adverse impact – increased noise from dredging during construction	**Temporary Dike Raising to +25 ft and construction of new bulkhead and offloading facilities** : • Short-term adverse impact to wildlife utilizing interim habitats
Light	• No additional beneficial or adverse impacts	• Short-term adverse impact - during construction and inflow a general increase in nighttime lights will be visible to homes and boaters • Short-term adverse impact - lateral expansion will increase life of project by approximately 7 years **Southwestern Borrow Area:** • Short-term adverse impact – increased light from dredging during construction.	**Cell 6 Closure:** • Short-term adverse impact – increased light from dredging and construction activities
Noise / Light – Jefferson and Coaches Islands	• No additional beneficial or adverse impacts	• Short-term adverse impact - sustained noises above background, and noticeable nighttime noise during construction and site operations, such as movement of tugs and barges and operation of pumps - these activities are associated with inflow, and therefore will persist for the duration of the project development; noise from the exterior dike construction will be limited to approximately 2 years • Short-term adverse impact – lateral expansion will increase life of project by approximately 7 years **Southwestern Borrow Area:** • Short-term adverse impact – increased noise/light from dredging during construction	**Cell 6 Closure:** • Short-term adverse impact – increased noise from dredging and construction activities
Hazardous, Toxic, and Radioactive Wastes (HTRW)	• No additional beneficial or adverse impacts	• No adverse impacts • Any UXO potentially discovered during dredged material placement of the proposed expansion will continue to be disposed of in accordance with safety protocols established by the USACE **Southwestern Borrow Area:** • No additional impacts	**Cell 6 Closure:** • No additional adverse impacts • Any UXO potentially discovered during dredged material placement of the proposed expansion will continue to be disposed of in accordance with safety protocols established by the USACE
Navigation/transportation	• No additional beneficial or adverse impacts	• Short-term adverse impacts – temporary increase in barge traffic during dredging and offloading activities has the potential to impact local navigation. • Long-term adverse impacts – lateral expansion will require some commercial and recreation vessels to navigate a longer route around the island **Southwestern Borrow Area:** • No additional impacts	**Cell 6 Closure:** • Short-term adverse impacts – temporary increase in barge traffic during dredging and offloading activities has the potential to impact local navigation
Coastal Zone Management	• No additional beneficial or adverse impacts	• The PIERP is within a critical area; Coastal Zone Consistency Determination required	• No additional adverse impacts
Coastal Barrier Resources Act	• Not applicable - The PIERP is not considered a coastal barrier resource	• Not applicable - The PIERP is not considered a coastal barrier resource	• Not applicable
Chesapeake Bay Critical Areas	• No additional beneficial or adverse impacts	• The PIERP is within a critical area; required agency coordination	• No additional adverse impacts
Floodplains	• No additional beneficial or adverse impacts	• The PIERP is in the 100-year floodplain; no impact is anticipated	• No additional adverse impacts
Wild and Scenic Rivers	• Not applicable – There are no designated wild or scenic rivers in Talbot or Queen Anne's Counties	• Not applicable – There are no designated wild or scenic rivers in Talbot or Queen Anne's Counties	• Not applicable
Prime and Unique Farmland	• Not applicable – There is no prime or unique farmland at the PIERP	• Not applicable – There is no prime or unique farmland at the PIERP	• Not applicable
Cultural Resources	• No additional beneficial or adverse impacts	• No significant adverse impacts **Southwestern Borrow Area:** • No significant adverse impact	• No additional adverse impacts

Table 5-17. Matrix of Potential Environmental and Socioeconomics Impacts by Alternative

Environmental Resources	No-Action Alternative	Alternative 1 –Lateral Expansion (60:40 Ratio) and Vertical Expansion, Alternative 2 – Lateral Expansion (50:50 Ratio) and Vertical Expansion, AND Alternative 3 – Lateral Expansion (Open-Water Embayment) and Vertical Expansion	Impacts Common to All Alternatives
Aquatic Resources – Economics	• No adverse impacts • No beneficial impacts because of improved fish habitat	• Long-term adverse impact – removes future potential clam beds • Short-term adverse impact – space/use conflicts between barges/equipment and commercial fishermen • Long-term beneficial impact – improved fish habitat (increased SAV, rock reefs) and fishing areas • Alternative 3 impacts 130 less acres of open-water habitat compared to Alternatives 1 and 2 **Southwestern Borrow Area:** • Short-term adverse impact – space/use conflicts between barges/equipment and commercial fishermen • Short/long-term adverse impact - may conflict with pound net fisheries if they cannot shift nets to equally productive sites	**Cell 6 Closure:** • Short-term adverse impact – space/use conflicts between barges/equipment and commercial fishermen • Short-term adverse impact - may conflict with pound net cannot be shifted to equally productive sites
Employment, income and revenues	• No adverse impacts • No beneficial impacts because of increased spending from project	• Short -term beneficial impacts - project will generate spending and create jobs, locally and at the state level **Southwestern Borrow Area:** • No adverse impacts	• No additional adverse impacts
Future land and water use	• No additional beneficial or adverse impacts	• No significant impacts **Southwestern Borrow Area:** • No adverse impacts	**Recreation/Education Components:** • Long-term beneficial impact
Environmental justice	• No additional beneficial or adverse impacts	• No adverse impacts to minority or low-income populations **Southwestern Borrow Area:** • No adverse impacts to minority or low-income populations	• No additional adverse impacts
Safety to children	• No additional beneficial or adverse impacts	• No health or safety risks that differentially affect children **Southwestern Borrow Area:** • No health or safety risks that differentially affect children	• No additional adverse impacts
Recreation	• No adverse impacts • No beneficial impacts because of created habitat	• Long-term adverse impact - loss of shallow-water habitat for recreational fishing • Long-term beneficial impact - increased abundance from rock reefs, wetlands or SAV may increase fish catch • Long-term beneficial impact - additional habitat associated with expansion will provide additional avian habitat and create more wildlife viewing opportunities • Long-term beneficial impact - created wetlands may attract ducks and geese and provide improved hunting opportunities • Long-term beneficial impact - possible recreation component in expansion • Short-term adverse impact - barge traffic/dredging will occasionally impede recreational boaters and fishermen • Alternative 3 – water depths within embayment may make area accessible to boaters. However, allowable access to the embayment has yet to be determined and will be a function of safety and environmental concerns **Southwestern Borrow Area**: • Short-term, adverse impact - barge traffic/dredging will occasionally impede recreational boaters and watermen	**Recreation/Education Components:** • Long-term beneficial impact
Aesthetics, impacts to Eastern shore mainland	• No additional beneficial or adverse impacts	• Long-term adverse impact - impacts to Eastern shore mainland property from reduction in long water views (15-16 improved and unimproved parcels) • Short-term adverse impact - impacts associated with equipment and bare ground during site operations **Southwestern Borrow Area:** • Short-term adverse impact - impacts associated with dredging equipment during construction	**Cell 6 Closure:** • Short-term adverse impact - impacts associated with dredging and construction equipment during construction
Aesthetics – Jefferson and Coaches Islands	• No additional beneficial or adverse impacts	• Long-term adverse impact – lateral expansion would permanently occupy significant portion of view from Coaches and Jefferson Islands • Long-term adverse impact - proposed project falls in the foreground of the Jefferson Island viewpoint - due to its close proximity to the proposed expansion, Jefferson Island will lose 100% of its middleground water view • Long-term adverse impact - at Coaches Island an increase (11%) of the view will be occupied by the PIERP and the proposed expansion • Long-term adverse impact - areas with foreground views of upland cells 2/6 (Coaches and Jefferson Islands) notice dike height increase • Short-term adverse impact - impacts to Coaches and Jefferson Islands associated with equipment and bare ground during site operations **Southwestern Borrow Area:** • Short-term adverse impact - impacts associated with dredging equipment during construction	**Cell 6 Closure:** • Short-term adverse impact - impacts associated with dredging and construction equipment during construction

finfish, and EFH species once dredging is complete. The temporary use of the southwestern borrow area may also conflict with pound net and gill net fisheries if nets cannot be shifted to equally productive sites.

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

The adverse impacts associated with the lateral and vertical expansion of Alternative 2 are the same as discussed above for Alternative 1. The southwestern borrow area will not be required for the 50 percent wetlands and 50 percent uplands creation, but is necessary for the 5-ft vertical dike raising of existing upland Cells 2 and 6.

Southwestern Borrow Area Approximately 49 acres of the southwestern borrow area will be disturbed from activities associated with Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

The adverse impacts associated with the lateral and vertical expansion of Alternative 3 are less than the adverse impacts discussed above for both Alternatives 1 and 2. The open-water embayment will reduce the footprint of the northern lateral expansion by 130 acres and conserve both open-water and Bay bottom habitat because no dredged material will be placed in the open-water embayment and the bottom of the embayment will not be disturbed by construction activities. Therefore, only 470 acres of open-water and Bay bottom habitat will be permanently impacted by Alternative 3. Even so, as stated above for Alternatives 1 and 2, the loss of open water habitat has a direct impact on finfish species, the blue crab fishery, and indirect impacts to the avian community. Each of these groups will be displaced temporarily, but most species will utilize the project area after the construction is complete. The loss of bottom habitat has a direct impact on the benthic community, clams, and blue crabs, and an indirect impact on the potential for SAV recovery within the proposed Alternative 3. Specifically, the permanent loss of approximately 100 acres of shallow-water habitat within the footprint of the alignment for Alternative 3 is also an impact that may directly affect utilization by fish species for which the area serves as EFH, recreational fisheries and blue crabs, and will indirectly affect the potential for SAV and clams to repopulate this area. All other general, adverse impacts associated with Alternative 3 are the same as those discussed above for Alternatives 1 and 2.

Southwestern Borrow Area Approximately 19 acres of the southwestern borrow area will be disturbed because from activities associated with Alternative 3, compared to 91 acres disturbed as part of Alternative 1 and 49 acres disturbed as part of Alternative 2.

No-Action Alternative

The no-action alternative has three primary adverse impacts. Without construction of a PIERP expansion, the capacity goals of the Federal DMMP (USACE, 2005) will not be met. Higher than expected quantities of dredged material would be placed in the existing PIERP project, decreasing placement efficiency, overloading the cells, creating complications related to proper cell habitat development, and shortening the overall life of the existing project.

The second adverse impact of the no-action alternative will be that additional valuable remote island wetland and upland will not be created and available to avian species, juvenile finfish, macroinvertebrates, diamondback terrapins, and other wildlife.

The third adverse impact of the no-action alternative is the lack of protection for Poplar Harbor and Jefferson Island. Without the protection from wave action provided by the lateral expansion, continued rates of erosion for Coaches Island (2.6 ft/yr), Jefferson Island (2.0 ft/yr), the western shoreline of Tilghman Island (4.8 ft/yr), and the Eastern Shore mainland (1.7 to 2.4 ft/yr) (Halka MNDR, 2005) are expected. As a result of the erosion, habitats located on Jefferson and Coaches Island will continue to be lost. Also, no additional quiescent area in Poplar Harbor will be provided for blue crabs, clam species, finfish species, SAV species, and EFH.

5.8.2 Beneficial Impacts

Alternative 1 (60 Percent Wetlands plus 5-ft Raising)

A beneficial impact of the lateral expansion will be to increase dredged material placement capacity to meet the dredged material placement needs outlined in the Federal DMMP (USACE, 2005). The northern lateral expansion will increase the amount of offshore island habitat at the PIERP by approximately 550 acres – 60 percent would be developed into wetland habitat and 40 percent would be developed into upland habitat. Maximizing the wetland proportion to 60 percent wetlands within the lateral expansion alignment is an important goal of the habitat restoration project since wetlands provide a greater environmental benefit for remote island habitats, as compared to uplands (see Section 5.4.7 for a more detailed discussion). Environmental benefits from the expansion increase as the percentage of wetlands for the project increases. Because Alternative 1 (Preferred Alternative) would include 10 percent more wetlands than Alternative 2, the beneficial impacts from wetlands of Alternative 1 exceed those of Alternative 2. Offshore islands are a unique ecosystem component in the Chesapeake Bay watershed because they are preferentially selected by many avian species and diamondback terrapins as resting, foraging, and nesting locations. Although similar vegetative communities may occur on the Eastern Shore mainland, the isolation, relative lack of human disturbance, and reduced number of predators (although predators do exist and management of these predators take place on Poplar Island) make islands more desirable as nesting sites. The success of the existing PIERP is an indication that a multitude of terrestrial and aquatic species will utilize the wetland and upland habitat created through the beneficial use of dredged material, even prior to complete cell development. Additional habitat created by the lateral expansion is expected to increase the overall environmental benefits of the restoration project, as indicated in the ICU analysis. Other beneficial impacts include the additional protection afforded to Coaches and Jefferson Islands the Eastern Shore mainland shoreline as a result of the lateral expansion.

Long-term, beneficial impacts from the expansion include providing additional quiescent areas in Poplar Harbor for blue crabs, clam species, finfish species, and EFH. Protected areas in Poplar Harbor could support the reestablishment of SAV, and provide cover for finfish. Other beneficial impacts include the creation of additional wetland habitat that will be potentially utilized by the avian community and other wildlife and significantly improve

habitat and forage opportunities for juvenile finfish and macroinvertebrates. The incorporation of features to enhance terrapin habitat to encourage increased diamondback terrapin nesting activity is being considered and will be an additional beneficial impact of the project. The tidal gut proposed as part of the lateral expansion will create additional benthic and finfish habitat. Dimensions of the tidal gut would be flexible to accommodate a range of channel depths, including providing a shallower depth and a wider tidal channel that could potentially support the establishment of SAV species once construction is complete. Benefits to fisheries would be expected to be reflected in increased catch rates to commercial and recreational watermen.

Other long-term beneficial impacts from the expansion are associated with the proposed recreational and educational components. The additional wetland and upland island habitat may provide more opportunities to view avian species and wildlife and other recreational activities discussed in more detail in Section 5.4.

Short-term and long-term beneficial impacts associated with the expansion include the increased spending that will create jobs both locally and at the State level. The jobs created as part of the expansion will benefit employment rates, income, and revenues.

The additional beneficial impact of the vertical expansion will be increased placement capacity to meet the dredged material placement needs outlined in the Federal DMMP (USACE, 2005).

Alternative 2 (50 Percent Wetlands plus 5-ft Raising)

The beneficial impacts associated with the lateral and vertical expansion of Alternative 2 are the same as discussed above for Alternative 1, although ten percent less wetlands will be created and ten percent more uplands will be created for Alternative 2.

Alternative 3 (Open-Water Embayment plus 5-ft Raising)

The beneficial impacts associated with the lateral and vertical expansion of Alternative 3 are greater than those discussed above for both Alternatives 1 and 2. Specifically, the open-water embayment will conserve approximately 130 acres of open-water and Bay bottom habitat within the footprint of the lateral expansion because no dredged material will be placed in the open-water embayment and the bottom of the embayment will not be disturbed by construction activities. The lateral expansion with the 130-acre open-water embayment would consist of approximately 29 percent wetland habitat, 47 percent upland habitat, and 24 percent open water habitat. The conservation of open-water habitat will benefit finfish species, the blue crab fishery, and will benefit the avian community, including listed avian species that utilize open-water habitat, although open water is not a limiting resource in the vicinity of Poplar Island. When construction is complete, it is anticipated that the embayment will provide a necessary trophic link between the wetland cells and the open water habitat. The open-water embayment would provide forage access and refugia in the small tributaries and tidal guts in the wetland cells for juvenile fish species, juvenile blue crabs, and diamondback terrapins. The open-water embayment would also provide more diverse habitat types within the northern lateral expansion including deep and shallow subtidal zones, an open water pelagic zone, mudflat habitat, tidal guts throughout the wetland cells, submerged

reef habitat, and rock reef habitat. Another beneficial impact of Alternative 3 includes the fact that the open-water embayment habitat will be available sooner because this habitat is being conserved compared to the habitat proposed for creation in Alternatives 1 and 2. In addition, the 130-acre open-water embayment should create quiescent conditions that could potentially support additional SAV beds along the shorelines and HAPC preferred by EFH species, other finfish species, and waterfowl.

The conservation of bottom habitat will have a beneficial impact on the benthic community, clams, and blue crabs. The habitat in the created wetland cells will export both detritus and micronutrients via the tributaries and tidal guts into the open-water embayment, thus enhancing the existing benthic community within the open-water embayment and providing more forage opportunities and refugia for EFH species and other finfish. Because 130 acres of open-water within the open-water embayment will not disturbed as part of the northern lateral expansion, it is anticipated that the existing benthic community (which is currently dominated by a single species of suspension feeder) may eventually become both more stable and more diverse.

Additional, beneficial impacts to diamondback terrapin nesting habitat are also anticipated for Alternative 3. Although the details of the internal dikes surrounding the open-water embayment are not known at this time, the marsh shoreline within the embayment could potentially provide additional nesting habitat for the diamondback terrapin, similar to the habitat that the "notch" area and Poplar Harbor are currently providing. The proposed 10-acre tidal gut located at the southern end of the expansion footprint adjacent to existing wetland Cell 1 will also potentially provide suitable terrapin nesting habitat.

No-Action Alternative

The primary benefit of the no-action alternative will be no loss of open water habitat, Chesapeake Bay bottom habitat, or shallow water habitat within the footprint of the alignment. None of the anticipated short-term impacts associated with the perimeter dike construction, dredging for the northern access channel or site operations for the lateral and vertical expansion would occur; and additional sand borrow from the southwestern borrow would not be necessary to support expansion of the PIERP.

5.9 CUMULATIVE IMPACTS

5.9.1 Definition

Cumulative impacts are those combined effects on quality of the human environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what Federal or non-Federal agency or person undertakes such other actions [40 CFR 1508.7, 1508.25(a), and 1508.25(c)]. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or taking place within a defined area or region, or from these minor impacts combined with major impacts. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis. Thus the cumulative impacts of an action can be viewed as the total effects on a

resource, ecosystem, or human community of that action and all other activities affecting that resource.

'Effects' include both direct effects and indirect effects, as defined in Section 5.2. Consistent with the CEQ regulations, effects and impacts are used synonymously (USEPA, 1999). Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

5.9.2 Sources of Cumulative Impacts

Activities warranting greatest attention in the cumulative impacts subsection are those activities that in combination with the proposed expansion at Poplar Island would potentially magnify what are perceived by resource agency personnel and the public as the most significant impacts of the proposed work in the Mid-Bay Region of the Chesapeake Bay. These activities meriting particular scrutiny include: 1) conversion of significant areas of open water and Chesapeake Bay bottom habitat, including shallow water habitat, to island habitat, 2) creation and/or restoration of Chesapeake Bay tidal wetlands, and 3) alterations to aesthetics and visual qualities of existing viewshed conditions. Other categories of environmental and socioeconomic impacts also warrant scrutiny for comprehensiveness as listed in the discussion of 'effects' presented above. To fairly assess and evaluate the cumulative impacts of anthropogenic influences in these categories, it is also appropriate to incorporate consideration of how ongoing pertinent natural processes interact with human activities.

Recent and reasonably foreseeable human actions that have converted or would convert open water habitat to island upland and tidal wetland habitat include the existing PIERP, the proposed lateral expansion of the PIERP, the proposed placement area of remote island habitat at James Island in the Mid-Bay region, the proposed protection of Barren Island, the proposed SAV and wetlands protection and restoration measures at Smith and Tangier Islands, and the wetland restoration in Dorchester County (Blackwater NWR) (USACE, 2005). The cumulative areal impact of these USACE projects would total approximately 3,803 acres of open water habitat lost and approximately 4,168 acres of bottom habitat lost and/or disturbed. However, these same projects would also create/restore/protect approximately 3,571 acres of wetland habitat and approximately 1,770 acres of upland habitat. These losses and gains are discussed in more detail by resource and by project in Section 5.9.3 below.

Federal and State laws generally restrict filling of open water to protect the Chesapeake Bay ecosystem, other than for some reclamation of lands lost to recent erosion. Consequently, there are no other public or private actions foreseeable at this time that would contribute substantially to the cumulative open water impacts of the USACE projects described above, including the proposed expansion at Poplar Island. Historically, more than 10,000 acres of

large island habitat have been converted to open water in the Mid-Bay region since European settlement (Kearney and Stevenson, 1991; Leatherman, 1992; Wray *et al*., 1995).

Because of the value imparted to tidal wetlands by society, this resource is largely being protected from direct loss by anthropogenic influences. Consequently, although development and dredging historically caused the loss of substantial tidal wetlands in the Chesapeake Bay, this is not occurring today nor is it likely to occur in the foreseeable future. Still, anthropogenic tidal wetlands losses result as an indirect consequence of shoreline stabilization practices that interrupt the flow of sediments necessary to create and maintain tidal marsh substrates and/or that prevent landward migration of these ecosystems as sea level rises are likely occurring on a significant scale in the Chesapeake Bay (Titus *et. al*, 1998) and most likely, the mid-Bay as well. Inventory data to characterize tidal wetlands trends in the Mid-Bay is available, but no recent characterization of trends has been made. However, based on trends through the 1990s (Tiner *et. al*, 1994), it is likely that a net loss is occurring.

The island restoration/creation projects described in the paragraphs above could also be considered to have some cumulative effect on visual and aesthetic qualities of the region. However, the views of people and land or water are limited by the distance to the horizon. Since most of these projects are tens of miles apart, the cumulative aesthetic and visual impacts of the proposed work would likely only be a valid concern when the area is viewed from high altitudes.

5.9.3 Duration of Impacts

Depending on the expansion alternative chosen and the efficiency with which the project is filled, construction of the expansion project is planned to begin in 2009/2010, eleven years before PIERP's current planned completion (i.e., final planting) in 2021. Because much of the newly proposed work will occur concurrent with PIERP, implementation of the lateral and vertical expansion will extend the life of the project, and the anticipated impacts from the project, until 2028.

Long-term impacts will extend beyond the life cycle of the existing and proposed expansion project. These impacts are defined as those permanent changes to resources that occur during sometime within the construction, site operations, and cell development period and extend indefinitely into the future. Permanent impacts from the lateral and vertical expansion of the open-water embayment (Alternative 3) include the loss of approximately 470-acres of Chesapeake Bay bottom and open-water habitat, increases to the water depth in the southwestern sand borrow area and northern and southern access channel areas to a maximum water depth of –25 ft MLLW, increased wetland, upland, and remote island habitat, increased recreational opportunities, and the protection of Jefferson Island, Coaches Island, and Poplar Harbor from erosion.

It is assumed that once PIERP and the proposed lateral expansion are completed, these projects would be maintained and then remain as part of the landscape of the Mid-Bay region. Because of the created, armored island shorelines, the projects could potentially endure rises in sea-level and the associated erosion and wetlands drowning that is occurring to natural

islands in the Bay. The PIERP and the proposed lateral expansion could presumably persist well into the future, although they would be expected to change somewhat over time.

5.9.4 Aquatic Resources

5.9.4.a Open Water Habitat The cumulative spatial effect of the lateral expansion and raising the existing upland cells was evaluated in terms of the regional loss of open water habitat. Within the region of the middle Chesapeake Bay the existing PIERP has removed approximately 1,140 acres of open water habitat, and 15 miles to the south of PIERP, the proposed restoration of James Island would remove approximately 2,072 acres of open water habitat. The proposed protection of Barren Island could potentially fill about 94 acres of open water, and the proposed SAV and wetlands protection and restoration measures at Smith and Tangier Islands may impact 24 and 3 acres of open water, respectively. The lateral expansion of PIERP will permanently remove between approximately 470 and 600 additional acres of open water habitat in the Mid-Bay region, depending upon the alternative selected. The selection of Alternative 3 incorporates an open-water embayment, which will conserve and protect approximately 130 acres of open-water habitat within the footprint of the northern lateral expansion, thereby impacting approximately 470 acres of open-water habitat.

The open-water habitat lost during the construction of the projects discussed above would result in a cumulative, long-term regional loss of approximately 3,803 to 3,933 acres of Chesapeake Bay bottom, depending upon the alternative selected (Table 5-18). The cumulative loss of approximately 3,803 to 3,933 acres of open water habitat would be considered significant.

Table 5-18. Cumulative Open Water Habitat Losses for Proposed Projects in the Mid-Bay Region

	Open Water Habitat Losses (acres)
Existing PIERP	1,140
PIERP Proposed Lateral Expansion	470[1] - 600[2]
James Island	2,072
Barren Island	94
Tangier Island	3
Smith Island	24
TOTAL	**3,803 - 3,933**

[1]Alternative 3 permanently impacts approximately 470 acres of open-water habitat.
[2]Alternatives 1 and 2 permanently impacts approximately 600 acres of open-water habitat.

5.9.4.b Bottom Habitat The cumulative spatial effect of the lateral expansion and raising the existing upland cells was also evaluated in terms of the regional loss of bottom habitat. Within the region of the middle Chesapeake Bay, the existing PIERP has removed approximately 1,140 acres of bottom habitat. The proposed lateral expansion of PIERP will permanently remove between approximately 470 and 600 additional acres of Bay bottom habitat in the Mid-Bay region, depending upon the alternative selected. In addition, a total of

approximately 242 acres (119 acres in southwestern borrow area + 60 acres in Borrow Area F + 35 acres in Borrow Area G + 28 acres in the southern access channel and turning basin) of bottom habitat will be disturbed by actions required to complete the existing PIERP. A maximum total of approximately 761 acres of bottom habitat would be disturbed by the recommended plan, which includes dredging activities required for actions to complete the existing PIERP (Table 5-19).

Table 5-19. Chesapeake Bay Bottom Habitat Loss/Disturbed by Each Expansion Alternative (approximate) for the PIERP

	Bay Bottom Loss/Disturbed (acres)		
	Alternative 1 (60% Wetlands, 40% Uplands and 5-ft Raising)	**Alternative 2 (50% Wetlands, 50% Uplands and 5-ft Raising)**	**Alternative 3 (Open-Water Embayment and 5-ft Raising)**
Lateral and Vertical Expansion			
PIERP Lateral Expansion	600*	600*	470*
Dredging in the Southwestern Borrow Area	91	49	19
Dredging in the Northern Access Channel and Turning Basin	30	30	30
TOTAL	**721**	**679**	**519**
Actions to Complete Existing PIERP			
Dredging in the Southwestern Borrow Area	119	119	119
Dredging in Borrow Area F	60	60	60
Dredging in Borrow Area G	35	35	35
Dredging in the Southern Access Channel and Turning Basin	28	28	28
TOTAL	**242**	**242**	**242**
GRAND TOTAL (Expansion plus Actions to Complete Existing Project)	**963**	**921**	**761**

**These activities are maximum acreages that will be a loss of Bay bottom habitat; all other acreages represent temporary bottom habitat disturbance.*

The proposed restoration of James Island would remove approximately 2,072 acres of Chesapeake Bay bottom habitat within the proposed alignment, and would disturb an additional 101 acres of Chesapeake Bay bottom during the dredging of the access channel (Table 5-20). Proposed environmental restoration projects at Barren Island would remove approximately 94 acres of Chesapeake Bay bottom habitat for habitat creation and breakwater construction (Table 5-20).

Other small regional projects may also disturb Chesapeake Bay bottom. A small shoreline protection project at Barren Island will cover a negligible amount of bottom with breakwaters. In addition, several small channel dredging or shoreline protection projects within the Mid-

Bay region will disrupt small areas of bottom habitat. Maintenance dredging routinely occurs in a number of small tributaries and harbors within the mid-section of the Bay (Bay Bridge south to VA State line) including: Honga River, Knapps Narrows, Tilghman Island Harbor (Dogwood Harbor), Pocomoke River, Wicomico River, Nanticoke River, Smith Island, Deale Island, Crisfield, Potomac River (mainstem portions and tributaries), Herring Bay, Fishing Creek, Annapolis Harbor / Back Creek, and St. Jerome's Bay. However, the bottom area lost from small channel dredging and shoreline protection is minor compared to the losses incurred by the island restoration projects at the PIERP and James Island.

Table 5-20. Cumulative Chesapeake Bay Bottom Habitat Loss/Disturbed by Proposed Projects in the Mid-Bay Region

	Bay Bottom Loss/Disturbed (acres)
Existing PIERP	1,140
Actions Required to Complete Existing PIERP	242*
PIERP Lateral Expansion Footprint	470[1] - 600[2]
Sand Borrow for PIERP Lateral and Vertical Expansion	49[1] - 121[2]
James Island	2,072
James Island Access Channel	101*
Barren Island	94
TOTAL	**4,168 to 4,370**

**These activities are maximum acreages that will disturb bottom habitat*

[1]Alternative 3 impacts approximately 470 acres of open-water habitat and disturbs approximately 49 acres because of dredging activities.

[2]Alternatives 1 and 2 impact approximately 600 acres of open-water habitat and disturbs approximately 121 and 79 acres, respectively, because of dredging activities.

5.9.4.c Shallow Water Habitat The cumulative spatial effect of the lateral expansion and raising of existing upland cells was also evaluated in terms of the regional loss of shallow water habitat (habitat with water depths that are less than -6.5 ft MLLW). SWH within the conceptual alignment for the recommended expansion plan encompasses approximately 100 acres. A maximum of 300 acres of shallow water habitat lies within the proposed Study Area for James Island, resulting in a net loss of approximately 400 acres of SWH within the Mid-Bay region, a small portion of the total SWH for the Middle Bay region. Although there will be a net loss of SWH, a portion of this habitat does not currently support SAV. The restoration projects, cumulatively, should enhance remaining SWH to improve quiescent conditions that are conducive to supporting SAV. Additionally, Alternative 3 includes an open-water embayment, which should create quiescent conditions within the proposed lateral expansion that could potentially support additional SAV beds and HAPC along the shoreline of the embayment.

5.9.4.d Essential Fish Habitat (MSFCMA Species) No substantial, adverse impacts to EFH species are anticipated as a result of the project. With regard to cumulative effects to EFH species (including summer flounder, bluefish, and red drum), summer flounder is the only species that may be directly adversely affected by cumulative impacts associated with other on-going projects in the vicinity of the PIERP expansion area. Other dredging and placement actions occur in the immediate vicinity of the project area. Periodic maintenance dredging is conducted in small navigation channels including: Knapps Narrows, the Honga River, and the Chester River and would result in displacement of flounder and forage resources immediately after dredging activities. In addition to maintenance dredging activities, the State of Maryland and USACE-Baltimore District are currently evaluating restoration of two islands south of PIERP for a potential Mid-Bay Island Restoration project. If either Mid-Bay project moves forward, up to 2,000 acres of additional EFH may be converted to uplands/wetlands within 30 miles of PIERP in areas that are known to support summer flounder. There are also periodic maintenance dredging and placement activities associated with other portions of the Baltimore Harbor and Channels Federal project in the Patapsco River, the Swan Point Channel, Tolchester Channel, and the approach channels to the Chesapeake & Delaware Canal. Activities north of the Bay Bridge, however, should have little additional impact on the species because summer flounder are typically very rare or absent in these regions. These projects should not create significant cumulative effects to juvenile or adult bluefish because of the ubiquitous distribution and opportunistic feeding habits of this species within the Chesapeake Bay. In addition, these projects should not create significant cumulative effects to juvenile red drum because red drum are mobile (relative to dredging activities) and have opportunistic feeding habits. Red drum are present within the Chesapeake Bay for only a short period of the year, so interactions with any dredging activities would be relatively low.

The cumulative impacts to most MSFCMA species will be positive. Although open water will be lost adjacent to the PIERP and for development of a Mid-Bay Island if both projects move forward, they will result in the creation of nearly 1,300 acres of additional wetlands in the Mid-Bay region. Tidal creeks and marshes are important nursery habitat, particularly for red drum, but also for juvenile bluefish and summer flounder as well as a wide variety of their forage species. More importantly both projects are being designed to protect Tier II SAV habitat. Recovery of SAV adjacent to the PIERP and James Island would be a significant positive cumulative affect on HAPC for summer flounder and red drum in this reach of the Chesapeake Bay. Additionally, Alternative 3 includes an open-water embayment, which would conserve approximately 130 acres of EFH within the footprint of the northern lateral expansion.

The principal stressors associated with population declines of these EFH species are likely overfishing and regional water quality degradation from eutrophication (see Appendix D). Privately-owned commercial fishing gear, such as hydraulic escalator dredges used to harvest soft-shell clams, can also detrimentally impact bottom habitat used by finfish and EFH species. Cumulative impacts of these actions are not known for the Chesapeake Bay at this time. Management of fishing is the single most important factor in maintaining the health of bluefish, red drum, and summer flounder at this time.

5.9.4.e Commercial Fisheries Although an area of approximately 4,168 acres of bottom habitat and associated fishing grounds is a considerable amount of bottom area, this permanent loss would not be expected to have major cumulative impacts on fisheries of the region. The island restoration areas near Poplar and James islands have been sited to minimize fisheries impacts by avoiding oyster bars and prime fish habitat. The type of habitat being impacted by these projects is not unique in the Mid-Bay region. It is expected that fish and fishermen will be able to shift to new regions outside the footprints of the island restoration projects. Given the distance between the two island restoration projects, it appears unlikely that any single fisherman would be negatively impacted by both projects. It is theoretically possible that a reduction in available fishing locations could cause fishermen to compete for unclaimed fishing areas in the waters between Poplar and James Islands. However, we have no specific evidence to suggest this would occur and interviews with fishers indicate they are currently traveling a maximum of eight to ten miles from port to set nets (Harms Engineering, 2004), and travel to the area between James and Poplar Islands would require a doubling of that travel distance.

One secondary impact of displacement from fishing grounds is increased pressure on adjacent productive areas. This can cause depletion of non-mobile resources (i.e. clams), although clamming in all of these areas is currently depressed due to disease. Increased fishing pressure in adjacent areas (to compensate for lost harvest areas) is also expected for more mobile resources (finfish and blue crabs) adjacent to both the PIERP and James Island if both projects are developed. However, since the resources that utilized those fishing areas will also be displaced, no cumulative impact is expected on the populations.

5.9.5 Water Quality

The cumulative effects to water quality as a result of the lateral expansion and raising of existing upland cells are expected to be minimal. The primary cumulative water quality impacts are related to spillway discharges and concentrations of TSS, nutrients, and other constituents within the discharges. Although expanding the island will increase the overall number of spillways that potentially discharge into Poplar Harbor and the Chesapeake Bay, the overall yearly volume of dredged material placed and managed at the site will remain steady (approximately 3.2 mcy per year). Therefore annual discharge volumes are not expected to increase as a result of the expansion study. Importantly, the lateral expansion will increase the duration that discharges will occur in the Poplar Harbor vicinity by approximately 12 years. If the raising of existing upland cells occurs in addition to the lateral expansion, the discharges from the existing PIERP would be protracted for an additional 14 years, and would occur concurrently with discharges from the expansion area. But because the overall inflow is not projected to increase, there should be no cumulative impact to water quality as a result of dike raising. Results of recent studies (EA, 2004a) have indicated no significant changes to water quality in the Poplar region as a result of dredged material placement and subsequent dewatering. It is not expected that expansion of the facility will influence the overall water quality in the immediate vicinity of the island.

Restoration of a second island (James Island) within the middle Chesapeake Bay will introduce a second source of discharge points into the Chesapeake Bay. However, if

operations at PIERP progress optimally, yearly placement will be completed at PIERP prior to initiation of placement at James Island, thus minimizing discharges from two facilities concurrently. Again, the overall yearly volume of dredged material placed and managed will not vary significantly (approximately 3.2 mcy per year). Therefore annual discharge volumes into the middle Bay regionally are not expected to change.

5.9.6 Wetland and Upland Habitat

The cumulative spatial effect of the lateral expansion and raising of existing upland cells was additionally evaluated in terms of the regional gain of remote island wetland and upland habitat. Within the region of the middle Chesapeake Bay, erosional processes have resulted in a significant loss of remote island habitat over the past several hundred years. More than 10,000 acres of island habitat have been lost to erosion and inundation since European settlement in the mid-Bay region (Kearney and Stevenson, 1991; Leatherman, 1992; Wray *et al*., 1995). A substantial loss of wetlands was incurred as consequence of the acres of island loss, since most remote islands in the Chesapeake Bay supported tidal wetland habitat.

Major environmental restoration projects have affected or have the potential to affect the future acreages of remote island habitat within the middle Chesapeake region. Upon completion, PIERP will create approximately 1,140 acres of remote habitat, consisting of approximately 570 acres of upland and 570 acres of wetlands. For the expansion of the PIERP, Alternative 1 will add approximately 315 acres of wetlands and 235 acres of uplands, Alternative 2 will add approximately 275 acres of wetlands and 275 acres of uplands, and Alternative 3 will add approximately 165 acres of wetlands and 270 acres of upland habitat. Assuming that the James Island project will include a habitat distribution of 55 percent wetlands and 45 percent uplands, an additional approximately 1,140 acres of wetland habitat and 930 acres of upland habitat will be created.

Besides the projects discussed above, a proposed shoreline protection project at Barren Island will minimize additional loss of remote habitat and protect 94 acres of wetlands and associated SWH and SAV beds. In addition to remote island habitat loss and subsequent wetland losses, the mainland shorelines have also incurred a substantial loss of tidal wetlands. A proposed wetland restoration project at Blackwater NWR (in and around Dorchester County, MD) has the potential to restore approximately 1,000 acres of wetlands, although the habitat is and would not be geographically separate from the mainland and will therefore not considered remote island habitat. The Smith Island Ecosystem Restoration Project will protect approximately 216 acres of wetlands and will create/restore approximately 24 acres of wetlands (create/restore a total of 240 acres), while protecting the existing SAV beds. The Tangier Island Aquatic Ecosystem Restoration Study would protect approximately 359 acres of wetlands and restore approximately three acres of wetlands (protect/restore a total of 362 acres). These latter projects would also greatly slow the rate of erosion along the shorelines of these islands, protecting substantial acreage of existing tidal wetlands from erosion. Other small regional restoration projects (i.e., county projects, etc.) also provide contributions to overall wetland gains throughout the Mid-Bay region.

A total of between approximately 3,571 and 3,721 acres of wetlands would be protected/created/restored and a total of between approximately 1,735 and 1,770 acres of uplands would be protected/created/restored as a result of the projects discussed above (Table 5-21). In addition to wetland and upland habitat, Alternative 3 also includes conserving approximately 130 acres of open-water habitat within the footprint of the proposed lateral alignment. The ICUs that correspond to the wetland and upland habitat types also indicate that the restored islands will provide significant cumulative environmental benefits.

Table 5-21. Approximate Acres of Habitat Protected/Created/Restored in the Mid-Bay Region

	Approximate Acres of Habitat Protected/Created/Restored	
	Wetland	**Upland**
Existing PIERP	570	570
PIERP Proposed Lateral Expansion*	165 - 315	235 - 270
James Island	1,140	930
Barren Island	94	--
Tangier Island	362	--
Smith Island	240	--
Blackwater Wetland Restoration**	1,000	--
TOTAL	3,571 – 3,721	1,735 – 1,770

**Range includes acreages of Alternatives 1 through 3; Alternative 3 also includes conserving 130 acres of open-water habitat.*

***This project restores wetlands only – does not create remote island habitat.*

5.9.7 Air Quality

The air quality impacts are expected to be short-term, affecting the project area only during construction phase activities (i.e., dike construction, site operations, inflow, and cell development). Although concurrent construction phase activities at other island restoration/dredged material placement sites have the potential to create adverse cumulative air quality impacts, they are not expected to. Air emissions associated with dredging and barging material through the middle Bay region will remain fairly constant because the average yearly dredging need (approximately 3.2 mcy) varies only slightly each year. It is not anticipated that multiple island restoration projects will be fully operational concurrently within the Middle Bay region. The most economically efficient site plan would allow a yearly inflow event to end the project life cycle at PIERP, and would allow the subsequent year inflow to be completely placed at a new site. Thus, eliminating the need and expense of fully operating two sites simultaneously. Dike construction activities will likely be underway at James Island concurrently with site operations, inflow, crust management, and cell development at PIERP. These cumulative air emissions will only last during the overlap period of construction and completion of project inflow at PIERP.

5.9.8 Noise and Light

The majority of noise and light impacts are short-term impacts affecting those using or living in areas adjacent to the projects. The long-term increase in light is modest at PIERP and the lateral expansion will introduce a few additional permanent navigational lights, largely in keeping with current waterway lighting.

Short-term noise and light effects are felt predominantly by those living adjacent to the project, although visitors and recreators in the water, and to a lesser extent on land, may also experience undesirable levels of noise and light. Development activities associated with the proposed lateral expansion and raising the existing upland cells will be experienced by many of the same homes and businesses that have borne the noise and light impacts of PIERP development. While noise and light complaints have been modest, some residents have noted that an extension of these effects for a longer period of time would be undesirable (Mendelsohn USACE, 2004b).

The noise and light impacts of the existing PIERP are expected to continue for some time into the future and the effect of the expansion will be to introduce new periods of intense noise (i.e., during rock placement) and extend noise and light associated with inflow, grading and planting further into the future. Figure 5-29 shows how these effects are distributed in time. Noise effects will persist throughout the development phase, but light effects will only extend until inflow is complete in 2021 for the lateral expansion and to 2022 for the lateral plus vertical expansion. These noise impacts represent an extension of impacts approximately seven years beyond 2015, when inflow would have been completed for PIERP.

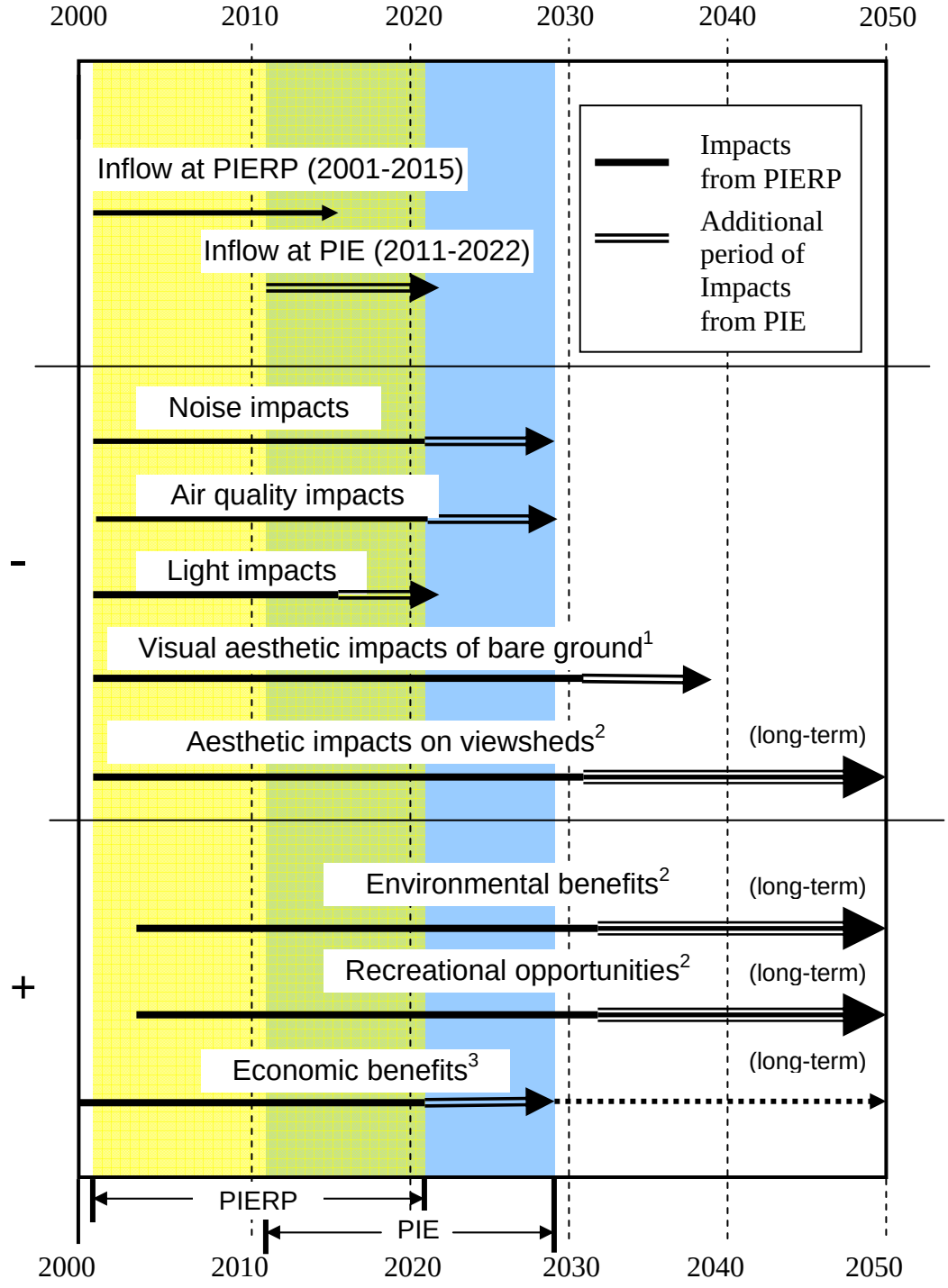
5.9.9 Socioeconomics - Employment, Income and Revenues

The cumulative economic benefits of the employment and other economic activity generated by the project will be significant. As shown in Table 5-22, the Statewide impacts of building both the expansion at PIERP and the restoration of James Island are expected to generate an average of over 700 jobs annually (assuming a 12-year building period) from the direct activities associated with island construction and the indirect jobs created through purchases to supply construction. This total does not include jobs relating to the dredging or transportation of dredged material. Total annual business sales would be expected to exceed $64 million on average.

5.9.10 Aesthetics

Cumulative effects of aesthetic impacts were evaluated by considering both short-term and long-term effects. For the short-term effects, the period during which the island would remain largely unvegetated, with and without the proposed expansion, was evaluated. This indicator, representing the time during which the island will appear barren, was chosen because the effect of seeing an island under construction and its associated barren appearance is the most widespread visual impact that accumulates through time with the proposed expansion project.

Figure 5-29. Past and Projected Future Impacts of PIERP and Poplar Island Expansion (lateral expansion and vertical expansion of existing uplands).



Notes on Figure 5-29:

Colored rectangles show time period of each project's development from construction, through inflow, grading and planting. Inflow at PIERP started in 2001 and, with no dike raising, planting is projected to be complete in 2021. For the lateral expansion, inflow through planting will last from 2011 through 2029.

1. In 2031, all upland cells at PIERP are expected to have mature woody shrubs and small trees (i.e., 10 years since planting). An additional 15 years or more will be needed before trees mature.
In 2039, upland cells at PIE are expected to have mature shrubs and small trees. The raising of existing upland cells only increases the time until mature vegetation by one year, but it increases the amount of unplanted upland area in 2030 by 315 acres.

2. Some impacts and benefits will exist without the expansion, however, the expansion increases the magnitude of the effect. The combined effect of PIERP + PIE is shown as a 3-line arrow.

3. Employment and other economic benefits were calculated only for the period of the restoration projects, but economic benefits from tourism and other island-related uses will persist into the future.

Table 5-22. Summary of State Economic Impacts for Poplar and James Islands
(12-year period of development, spending on dredging, transport and placement not considered)

	Total Dollars or Jobs (FTEs)
I. Direct Impacts	
Total Spending[1]	$431,641,000
Average Annual Spending[2]	$35,970,000
Average Annual Employment[3]	428
II. Economic Impacts[4]	
Impact Category	
Total Jobs (FTEs)[5]	774
Labor Income	$26,171,000
Employee Compensation	$22,927,000
Proprietors Income	$3,244,000
Indirect Business Taxes	$1,958,000
Other Property Type Income	$7,338,000
Value Added	$35,468,000
Business Sales	$64,289,000

Notes on Table 5-22:

[1] Direct spending by task over the 12 year project life was estimated as part of the Federal DMMP (USACE, 2005)

[2] Average annual cost per task over 12 year project life (not adjusted for annual fluctuations in spending per task)

[3] Direct employment per task was estimated based on surveys of experts, secondary sources, and comparable industrial sectors.

[4] Average annual economic impacts over 12 year project life

--- Includes direct, indirect and induced economic impacts of both State and Federal spending in Maryland

--- Direct, indirect and induced impacts were estimated using the IMPLAN regional economic modeling system

[5] These numbers represent the average number of full-time equivalent (FTE) jobs in each task over the 12 year project. The number of person-years associated with each task, therefore, is the value shown here multiplied by 12. The jobs associated with some tasks will be primarily in early years and the jobs associated with some tasks will be in later years.

The cumulative effect of permanently adding area to the island was considered in the previous aesthetic view analysis (Section 5.7.2). In that analysis, sensitive locations (i.e., homes, businesses and public access points) were assessed in terms of the proportion of waterview that was constructed island or the proportion that was open water, with and without the project. That analysis noted that areas near Lowes Wharf and homes on the surrounding shoreline saw significant decreases in the proportion of views that were water and increases in the proportion of views that were the constructed island.

To assess the change in the time period during which adjacent land and water users will observe bare ground as the dominant land cover on the island, a time threshold was defined to compare the with and without project conditions. That threshold was the time at which all the upland cells would have vegetation older than ten years. According to the environmental benefit analysis conducted for this report, about ten years after woody shrubs are planted, they become attractive habitat for many bird species. Therefore, after 10 years, it was assumed that the woody shrubs will be well-established and small trees will have filled in much of the bare ground. Evaluating the vegetation in upland cells was the focus because these areas are visible over a much larger area than wetland cells. This threshold is a fairly conservative assumption of when visual impacts will be minimized since all the wetland cells will have been planted and most will have established vegetation by the time the last upland cells are planted.

Based on the expected timeline of planting, the existing PIERP project, or without project condition would reach the threshold in 2031. In comparison, the lateral and vertical expansion will reach that threshold in 2038. The projects represent an approximately seven year extension of the visual impacts associated with observing an island dominated by bare ground cover.

5.9.11 Recreation and Education

Recreational and educational opportunities are affected in the short-term by the proposed project in two main ways. First, impacts to water users associated with barge traffic and island construction will continue as long as inflow activities are underway. Inflow is expected to persist for about 12 years longer with the lateral expansion and 14 years longer with the lateral and vertical expansion project. Second, the recreational and educational benefits associated with visitors to the island are potentially affected by the new construction.

Recreational and educational benefits on the island are associated with birdwatching trips, other wildlife viewing, and volunteer opportunities to participate in or learn about habitat restoration, even during island construction activities. Because group tour vehicles travel along the existing dikes, neither expansion project would be expected to prevent tours except, perhaps, during short periods.

Overall, because neither expansion alternative prevents access, the cumulative short-term impacts of the proposed lateral expansion on visitation is expected to be minor. It is likely that different species will be dominant through time and new species will be attracted as vegetation matures. The proposed plan to both expand laterally and raise PIERP's upland cell

dikes will delay the development of upland habitat by four years for Cell 2 and seven years for Cell 6 which will delay the opportunity to see certain species but may also extend the time to see other species.

The long-term effects on recreation and education are all expected to be positive. The lateral expansion offers the potential to enhance the recreational options through development of nature trails or other educational options under discussion, which are expected to be developed within a few years of final planting. In Figure 5-29, the period of expected recreational opportunities of PIERP alone and the combined opportunities of PIERP and the expansion (depicted with 3-line arrow) are shown. Recreational and educational benefits from both projects are expected to persist well into the future.