MARYLAND ENVIRONMENTAL SERVICE

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December 19, 2002

Dr. Stephen Storms
Maryland Port Administration
Maritime Center II
2310 Broening Highway
Baltimore, MD 21224

REF: MPA Contract No. 500912, PIN No. 600105P
Environmental, Planning, and Technical Services

SUBJ: Task 23: Final Environmental Conditions Report for Reconnaissance Study of Poplar Island Sites for Beneficial Use and Habitat Restoration

Dear Dr. Storms:

Enclosed please find three printed copies and one CD copy of the Final Environmental Conditions Report for Reconnaissance Study of Poplar Island Sites for Beneficial Use and Habitat Restoration submitted by EA, November 2002. Also included is your previously submitted draft copy of the report with your comments.

If you have any questions regarding these reports, please contact me at (410) 974-7261.

Sincerely,

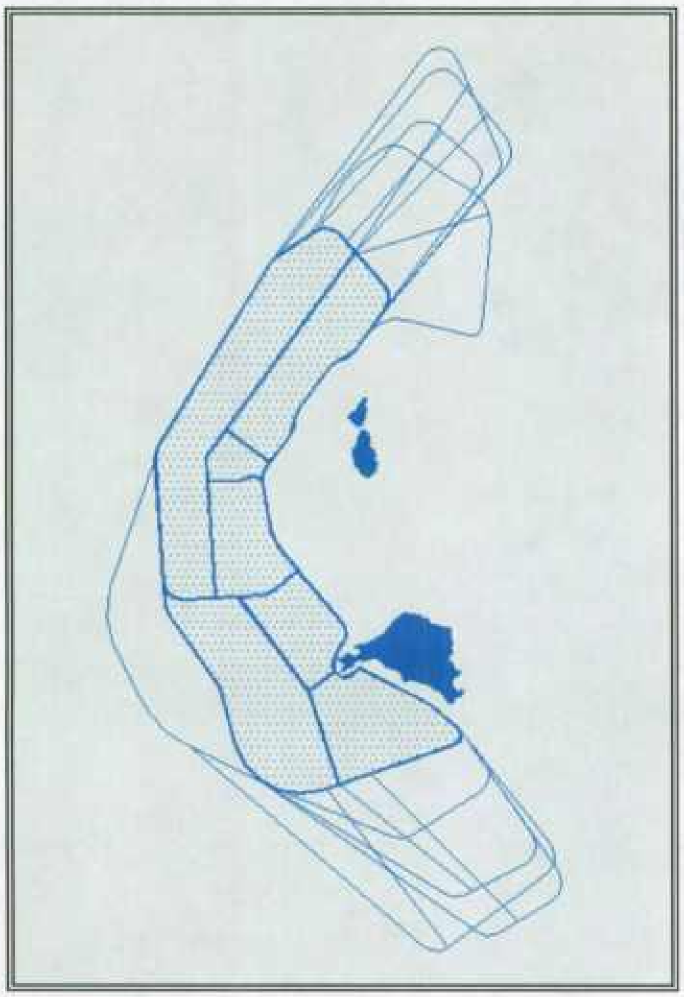
Karen Cushman

Karen Cushman, Project Manager
Environmental Dredging

Enclosures

FINAL

RECONNAISSANCE STUDY OF POPLAR ISLAND SITES FOR BENEFICIAL USE AND HABITAT RESTORATION:



ENVIRONMENTAL CONDITIONS

Prepared for

Maryland Environmental Service
2011 Commerce Park Drive
Annapolis, MD 21401

MES Contract # 02-07-10
MPA Contract # 500912
MPA Pin # 600105-P

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November 2002

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LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CBL	Chesapeake Biological Laboratories
DMMP	Dredged Material Management Program
DNPOP	Dredging Needs and Placement Option Programs
DO	Dissolved Oxygen
EA	EA Engineering, Science & Technology, Inc.
EFH	Essential Fish Habitat
EMAP	Environmental Monitoring and Assessment Program
HMI	Hart Miller Island
MCY	Million Cubic Yards
MDL	Method Detection Limit
MDNR	Maryland Department of Natural Resources
MGS	Maryland Geological Survey
MHT	Maryland Historic Trust
MLW	Mean Low Water
NA	Not Applicable
ND	Non Detect
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOB	Natural Oyster Bar
NTU	Nephelometric Turbidity Units
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenols

RL	Reporting Limit
RTE	Rare, Threatened, and Endangered
SAV	Submerged Aquatic Vegetation
SNS	Shortnose Sturgeon
STL	Severn Trent Laboratories, Inc.
SQG	Sediment Quality Guidelines
SVOC	Semi-Volatile Organic Carbon
SWH	Shallow Water Habitat
TEL	Threshold Effect Level
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
VIMS	Virginia Institute of Marine Science
VOC	Volatile Organic Carbon

EXECUTIVE SUMMARY

Poplar was one of several islands in the Chesapeake Bay proposed for restoration because of its severe rate of erosion and threat of being lost. Poplar is located north of Tilghman Island in the south end of the entrance to Eastern Bay, in Talbot County, Maryland. The Poplar Island Environmental Restoration Plan was constructed as a Federal beneficial use of dredged material by the Baltimore District, U.S. Army Corps of Engineers (USACE). The Maryland Port Administration is the non-Federal sponsor. This report examines the existing conditions of Poplar Island natural resources in the context of six option configurations that are proposed as potential expansions of the current Poplar Island Environmental Restoration Project. Existing conditions data were collected for resources of regional concern from agency database files, published reports, and journal manuscripts. In addition, EA Engineering, Science & Technology, Inc. (EA) has performed a site visit/reconnaissance that assesses potential impacts and needs for further investigations prior for site expansion. These studies were conducted for the Maryland Port Administration under contract to the Maryland Environmental Service.

The six options currently under consideration range from 313 acres (Option 6) to 1,129 acres (Option 4). Options 1, 2, 3, and 5 are all of similar size (749 to 754 acres). All options are proposed to have 50% upland and 50% wetlands. Option 6 is the smallest configuration and proposes a small cell to the north-northeast. This configuration was conceived specifically to be protective of Poplar Harbor from wind-driven waves from the Northeast. It also includes some coastal structures and the potential to build a beach within the harbor. Jefferson Island would fall into the shadow of the proposed expansion and could experience reduced physical energy.

The current use of Poplar Island is for dredged material placement and will eventually be restored to a natural habitat for resident and migrating fauna. No buildings or permanent structures exist on Poplar, although several support structures are planned, Coaches Island has a trailer home and two small outbuildings and Jefferson Island has a house and several outbuildings that are used as a hunting lodge by the owner. A pier site has been established on the eastern side of Poplar in Poplar Harbor, where crew boats and other work and survey boats access the island. Another temporary landing has been established at the southern end of the island where larger vessels and equipment barges dock and unload.

The waters surrounding Poplar are relatively shallow (3-12 feet mean low water (MLW) in most directions. Previous studies have indicated that the substrates are predominantly sand with clays and some finer materials in some areas. Most areas around the island are devoid of submerged aquatic vegetation (SAV) and other cover items although there are rock piles (fish reef structures) along the northern end of the island. Natural Oyster Bars (NOB) lie just outside of Poplar Island in several directions and provide a harder-type substrate and oyster-reef habitat. Poplar Harbor (on the east side of Poplar Island) is protected from wind-driven waves from the south, west and northwest and provides a sheltered area for juvenile finfish and SAV growth. Within the dikes, the placement cells provide pooled water and mud-flats that attract some wildlife. The rocks that armor the existing dikes are encrusted with barnacles and other sessile organisms, including oysters. This is providing oyster reef-type habitat along the entire perimeter of the existing project. Artificial fish reefs have been installed at the north end of Phase I, and are used by various fish species.

Water quality conditions around Poplar Island are relatively good and similar to that of the mid to upper Chesapeake Bay mainstem. In the vicinity of the Island, oxygenation is good throughout the year because of shallow water depths. Because the land around Poplar Island is not urbanized, the water is of good quality. Sediments near the Poplar Island archipelago have been identified as containing some contaminants from industrial and municipal sources as well as from non-point sources. However, analysis of sediment associated polychlorinated biphenol (PCB) congeners and polyaromatic hydrocarbon (PAH) concentrations indicated that all sites were either below detection limits or below threshold effect levels (TEL). Average concentrations for 16 metals analyzed in collected sediments in 2001 indicated that all concentrations were below TEL values in all 12 sites; metal concentrations are comparable to background levels measured in sediments from other areas of the northern Chesapeake Bay.

Fisheries and other aquatic resources are typical of shallow mesohaline area of the Chesapeake Bay. Poplar Island lies within the general area that may provide Essential Fish Habitat for seven species managed by the National Marine Fisheries Service (NMFS), although only summer flounder and bluefish are expected to occur and have been collected around the island. Benthic communities were found to have lower numbers of taxa relative to similar areas of the Bay. Overflight data for SAV monitoring in the Chesapeake Bay, reveal that from the period 1994 to 2001, no SAV are apparent in the waters surrounding Poplar, Coaches, or Jefferson Islands. Several patches were found in 1995 and in 2001 by on-site surveys and SAV appears to be reappearing in higher densities to the east of Poplar Phase I inside Poplar Harbor. Much of the areas proposed for expansion are Shallow Water Habitat (SWH) (<2 meters), although the cells to the southwest are in deeper water. The quality and function of the existing SWH is marginal for some recreationally important species because of the lack of cover features (and is exacerbated by the currently low density of SAV).

Poplar Island is currently a beneficial use of dredged material placement site and habitat restoration project and few terrestrial plants exist on the Islands. Nearby Coaches and Jefferson Islands have saltmarsh and remnant forests. Bird activity on Poplar Island has intensified since Phase I construction has been completed. The birds have acclimated to the construction activities of Phase II and some species are even attempting to nest in or around the existing cells. Horseshoe crabs have also been attempting to nest within the cells, and Diamondback terrapins have been successful in nesting but require human assistance to juveniles to enable their migration to the Bay. One Federally threatened species, the bald eagle, is nesting on Coaches Island and the State endangered royal tern as well as a State threatened least tern were identified in 2001 on Poplar Island. Least terns have nested on the dikes. The Federally endangered shortnose sturgeon (SNS) (*Acipenser brevirostrum*) is expected to only be transient to the Poplar Island Area and the proposed expansion areas.

The area in the vicinity of Poplar Island supports harvesting of oysters, soft shell clams, blue crabs, and finfish. Several NOB lie adjacent to Poplar Island and the proposed expansion areas, but all options were designed to avoid encroachment of the bars. Blue crab harvests in this reach of the Bay are among the highest value fishery at present. Soft-shell clam harvests in the area have been declining over the past several years. Conversely, catches of striped bass and menhaden have been increasing. Although some blue crab overwintering may occur near the site, it is negligible compared to other areas of the Bay.

Tourism and recreational activities are important to Talbot County's economy and the recreational activities near Poplar include fishing, boating, birding, and sightseeing. These activities are generally not centered around Poplar Island because access is restricted. However, charter boat and private recreational fishing occur in the vicinity of the rock reefs of the north end of Phase I. Although Poplar once had significant historic resources, most have been washed away. The archaeological investigations conducted previously covered some of the areas currently proposed for expansion without yielding any objects of significance. Formal consultations with the Maryland Historic Trust would need to occur during feasibility investigations (if conducted) of any proposed option.

Groundwater resources in the areas come predominantly from the Aquia Aquifer. The clay-confining layer between the Bay bottom and the aquifer is expected to be sufficiently thick to protect this resource from contamination from island expansion. Currently sound in the area comes from predominantly natural sources (waves, wind, and birds/wildlife), and daily operation of Phase I of the placement facility. Other anthropogenic sound sources include commercial and recreational boats and construction sounds from completion of Phase II, although the latter will cease when construction is complete. There are dwellings on both Jefferson and Coaches Islands. Aside from these, the nearest dwellings are approximately 1-2 miles away on Green Marsh and Lowes Points.

No liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) would be associated with the site. The proposed project area does not lie within or adjacent to any federal navigation projects.

Short-term impacts to water quality would be expected from construction, and during the placement of dredged material. Construction impacts would be expected to include turbidity-related impacts only. Effects from placement of dredged material could occur as ponded water is discharged during placement, and during dewatering of the dredged material, which allows it to consolidate. Sediment quality of the dredged material to be used for the restoration is expected to be good and only outer channel material would be considered for placement at Poplar Island. No terrestrial resources will be affected by expansion of Poplar Island. Resident wildlife on Poplar or the adjacent islands may be temporarily displaced, but construction of Phase I and Phase II has demonstrated that most wildlife has acclimated quickly to construction and operation activities.

Expansion of Poplar Island will convert 333 to 1,199 of acres Bay bottom (predominantly shallow-water habitat) to upland and marsh habitats. Any benthic communities that exist within the proposed alignment would be buried during construction. For resources, the largest Option (Option 4) is expected to have the greatest potential impact to aquatic resources. This is a trade-off for further protection of the shallow areas to the east, which may be more conducive to SAV propagation when protected from wind-driven waves from the west-southwest. Option 6 is also expected to have the added benefit of protecting Jefferson Island and Poplar Harbor from wind-driven waves from the Northeast.

Fish and mobile invertebrates (e.g. blue crabs) are expected to be able to avoid the area during construction but any trapped within the dike will be lost. If construction occurs during the winter, any blue crabs overwintering within the various footprints will also be lost. However, the project is expected to have an overall positive effect on aquatic resources in the area by further reducing erosion (and the associated turbidity) around Jefferson Island, creating greater areas of quiescence for SAV propagation, and adding 157 to 565 acres of additional wetlands to the area. Alignment 6 would have the added benefit of a beach area that could support horseshoe crab, terrapin, and bird nesting,

Some recreational fishing and boating may occur within some of the options currently and would be permanently displaced by the action. The shallow depths preclude use by sailing vessels. It is expected that fishing will resume around the site after construction and will ultimately be enhanced by island reconstruction, marsh creation, and possible relocation and expansion of artificial fish reefs.

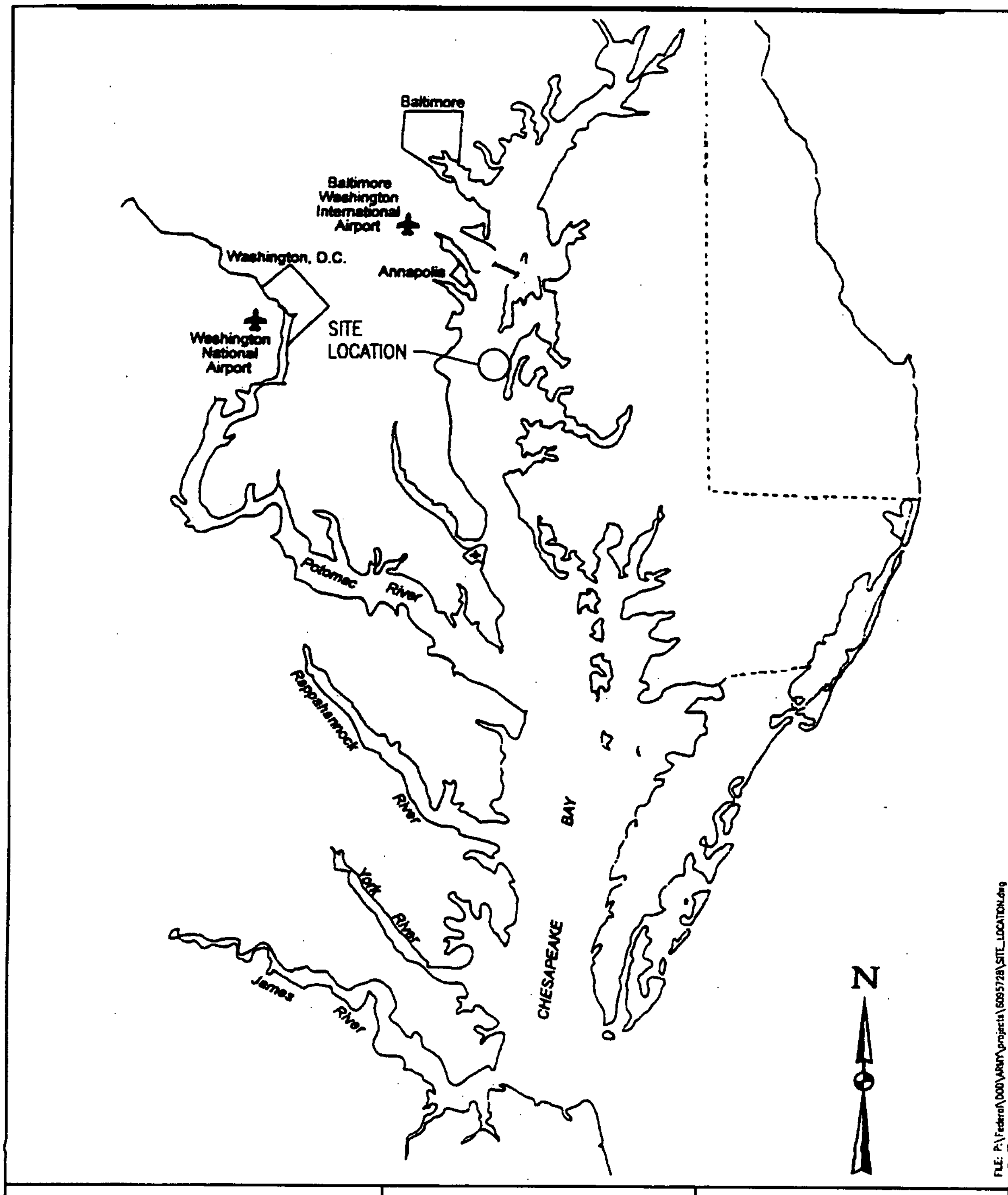
No historical resources are likely to be affected by this action because none are known to occur within the any of the proposed option alignments. Those utilizing Jefferson and Coaches Islands or boating in the vicinity of Poplar Island may experience some noise or aesthetic disturbances during construction, but these will be short-term. Expansion of Poplar Island would extend the current project in various directions, permanently altering the view shed. However, the profile would be consistent with the existing Poplar Island profile. Potential impacts to navigation are expected to be minimal and temporary because the project does not lie adjacent to navigation channels. Barge and tug traffic could temporarily interact with boat traffic in Poplar Island Narrows (on the way to and from the site), but would cease once placement is complete. Longer-term impacts to navigation are expected to be positive because this project would provide needed dredged material placement capacity to maintain navigation channels.

RECONNAISSANCE STUDY OF POPLAR ISLAND SITES FOR BENEFICIAL USE AND HABITAT RESTORATION: ENVIRONMENTAL CONDITIONS

1.0 INTRODUCTION AND SITE DESCRIPTION

This report examines the existing conditions of Poplar Island natural resources in the context of six option configurations that are proposed as potential expansions of the current Poplar Island Environmental Restoration Project. Existing conditions data were collected for resources of regional concern from agency database files, published reports, and journal manuscripts. In addition, EA Engineering, Science & Technology, Inc. (EA) has performed a site visit/reconnaissance (detailed in Appendix A) that assesses potential impacts and needs for further investigations prior to site expansion. These studies were conducted for the Maryland Port Administration under contract to Maryland Environmental Service.

Poplar Island (Poplar) is an island restoration project sponsored by the Maryland Port Administration (MPA) and the United States Army Corp of Engineers Baltimore District. The project design began in 1995 and Poplar was one of several islands in the Chesapeake Bay proposed for restoration because of its severe rate of erosion and threat of being lost. Poplar is located north of Tilghman Island in the south end of the entrance to Eastern Bay, in Talbot County, Maryland (Figure 1-1). Previous studies of the island have been extensive. A prefeasibility study was conducted in 1994 to assess the possibilities of restoring Poplar Island to its historical footprint (MES 1994). This study was integrated with seasonal data collections (EA 1995a,b,c,d) to produce the required National Environmental Policy Act (NEPA) documentation prior to island restoration (USACE 1996). The documents examined the environmental conditions around the remnant islands as well as the coastal engineering and design considerations for restoration of the island with clean dredged material. Since the restoration effort began in 1998, the island's approximate land area has been increased to 1,100 acres throughout two phases of construction. The second phase of dike construction has been completed except for a portion of dike that remains open to allow barge access for placement of dredged material in Phase I cells. Poplar was first considered in 1992 under the Maryland Port Administration's Dredging Needs and Placement Options Program (DNPOP) (now the Dredged Material Management Program (DMMP)) as a beneficial use project after its acquisition from a private owner by the Maryland Environmental Service.



EA ENGINEERING, SCIENCE, AND TECHNOLOGY		POPLAR ISLAND LATERAL EXPANSION CHESAPEAKE BAY, MARYLAND				SITE LOCATION MAP	
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
WWW	WWW	JAP	WWW	NONE	7-17-02	13806.02	1-1

For this investigation, a variety of conceptual configurations with varying wetland and upland elements were developed for a potential lateral expansion of the island; this has been labeled as Poplar Island Modification. Six conceptual modifications are under consideration for extending the present island restoration (Figures 1-2 through 1-7). The six conceptual options consider extending the island's north end, the northeast end, the south end and the eastern side and a combination of these areas. The summary of the acreages for the six proposed alignments is included in Table 1-1. The design acres are displayed as the baseline area (measured at the dike centerline). However, the total footprint will be slightly larger than the design acreage in all cases; this is reflected as the affected area.

Table 1-1. Acreages of baseline and affected Bay bottom areas for Poplar Island proposed alignments.

		Proposed Alignment					
		1	**2**	**3**	**4**	**5**	**6**
Baseline Area	**Upland**	376	377	377	564	374	157
	Wetland	377	377	377	565	375	157
	Total	753	754	754	1,129	749	314
Affected area	**Total**	797	812	809	1,199	797	333

All configurations proposed would be 50% upland and 50% wetland. Each site differs slightly containing one or more potential expansion cells. Option 1 (Figure 1-2) proposes expansion predominately to the south and southwest. Option 2 (Figure 1-3) would involve less expansion to the south but would include a fairly large cell to the north-northeast. Option 3 (Figure 1-4) involves a slightly more moderate northern cell (relative to Option 2) but increased expansion to the south. Option 4 (Figure 1-5) is the largest option and includes the greatest proposed expansion in all directions. Option 5 (Figure 1-6) includes a refinement of the southern-most cell of Option 4 but does not include expansion to the southwest. Option 6 (Figure 1-7) is the smallest configuration and proposes a small cell to the north-northeast. This configuration was designed specifically to be protective of Poplar Harbor from wind-driven waves from the Northeast. It also includes some coastal structures and the potential to build a beach within the harbor. Jefferson Island would fall into the shadow of the proposed expansion and could experience reduced physical energy.

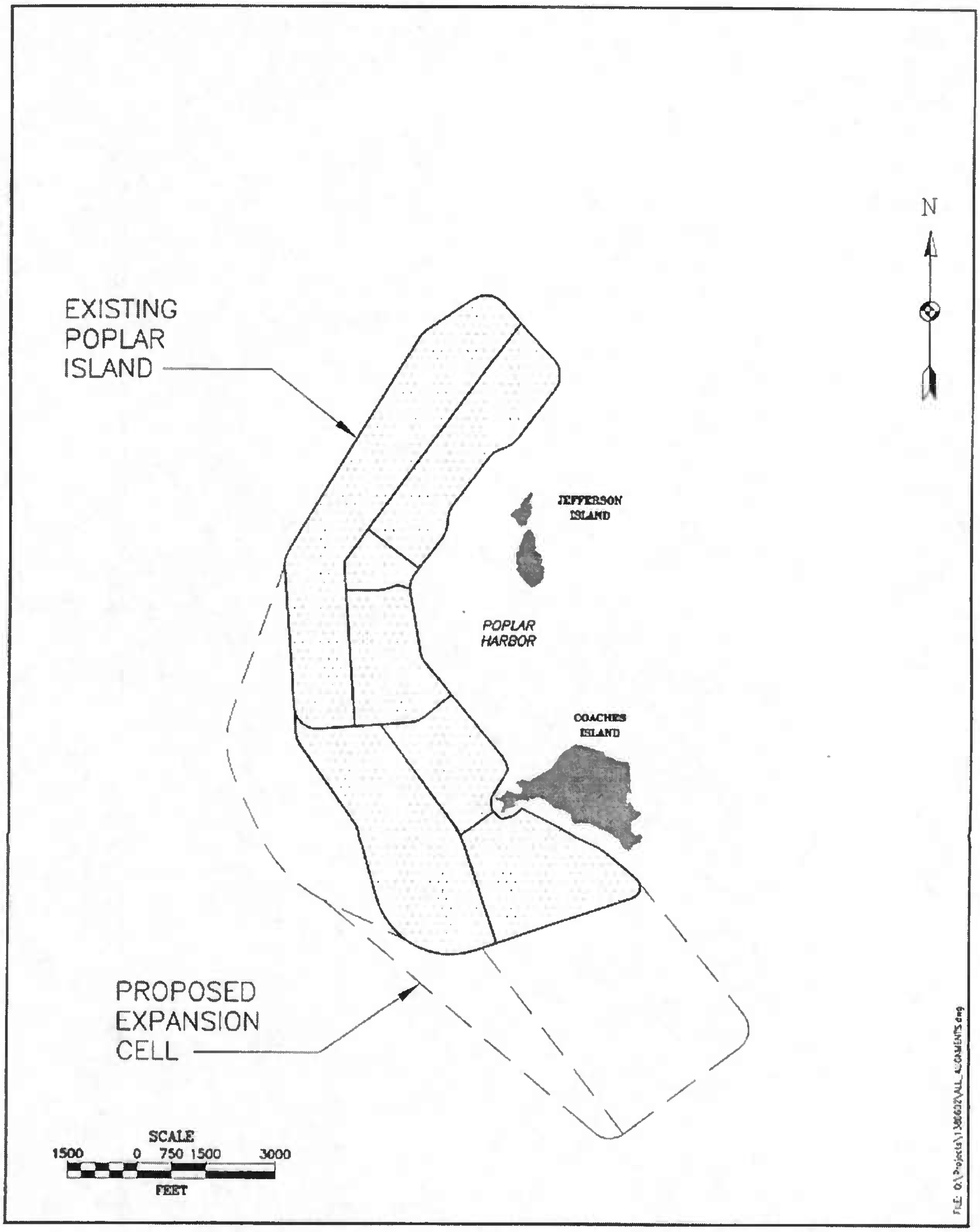


Figure 1–2. POPLAR ISLAND HABITAT RESTORATION CONCEPT 5 OPTION 1

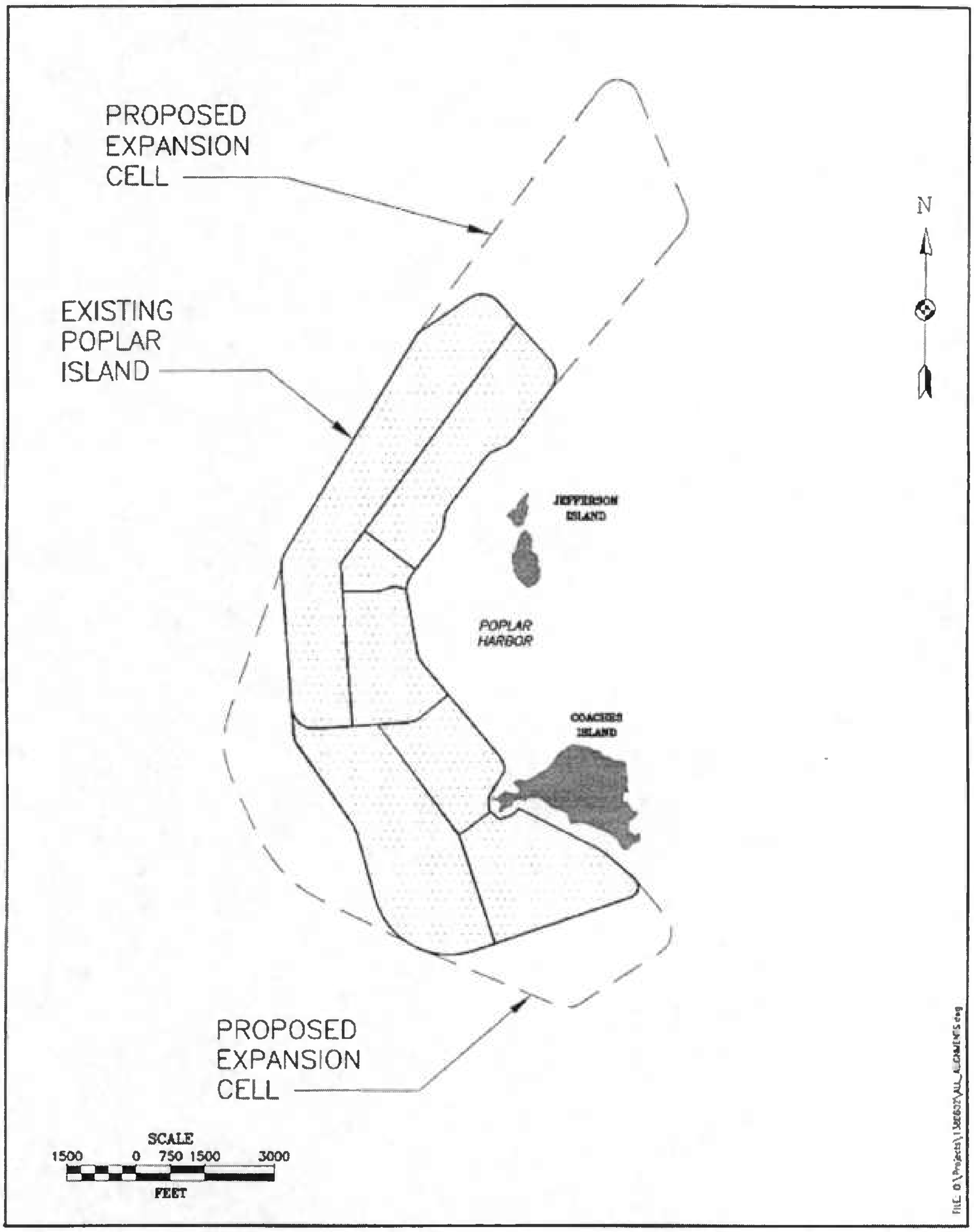


Figure 1-3. POPLAR ISLAND HABITAT RESTORATION CONCEPT 5 OPTION 2

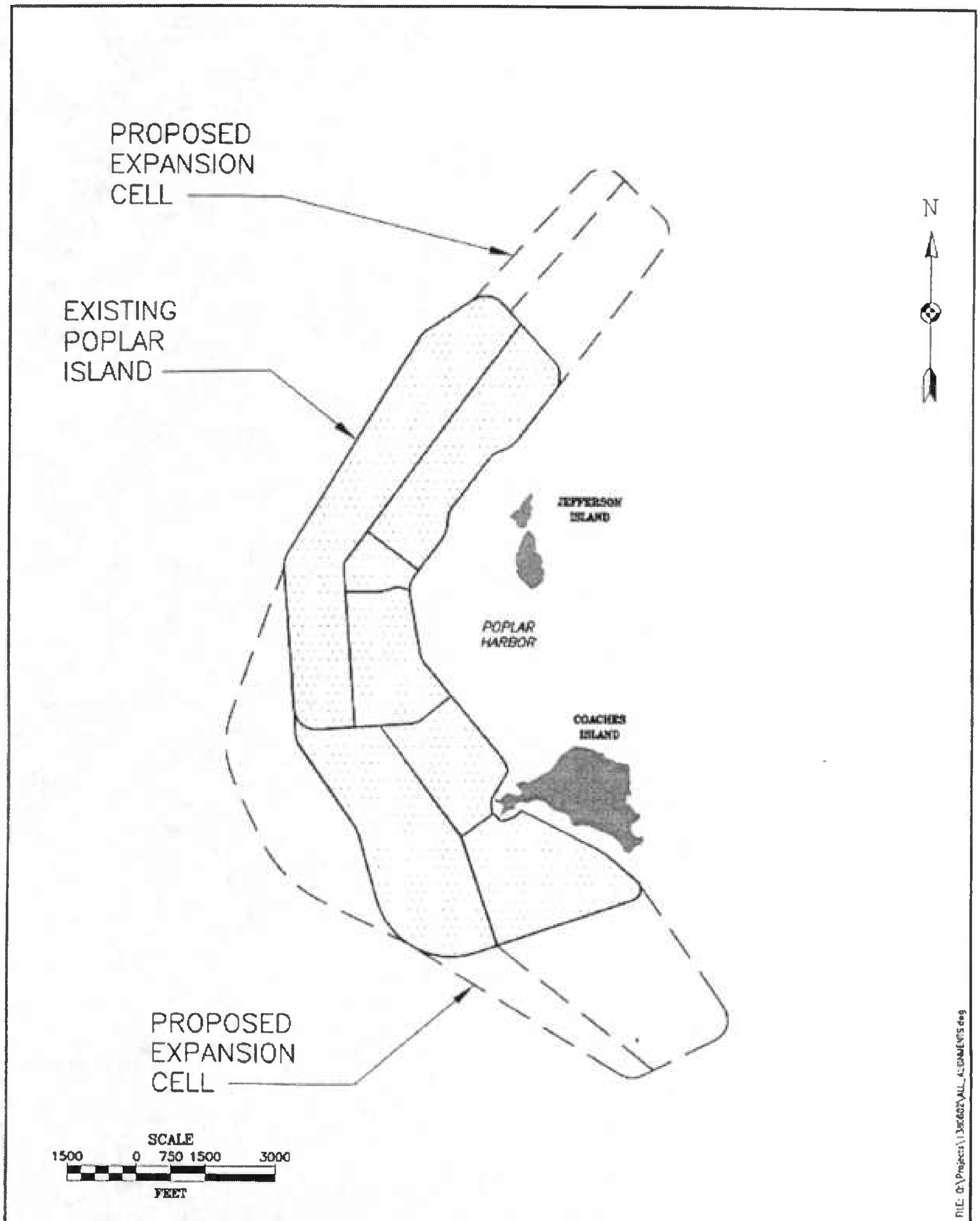


Figure 1-4. POPLAR ISLAND HABITAT RESTORATION CONCEPT 5 OPTION 3

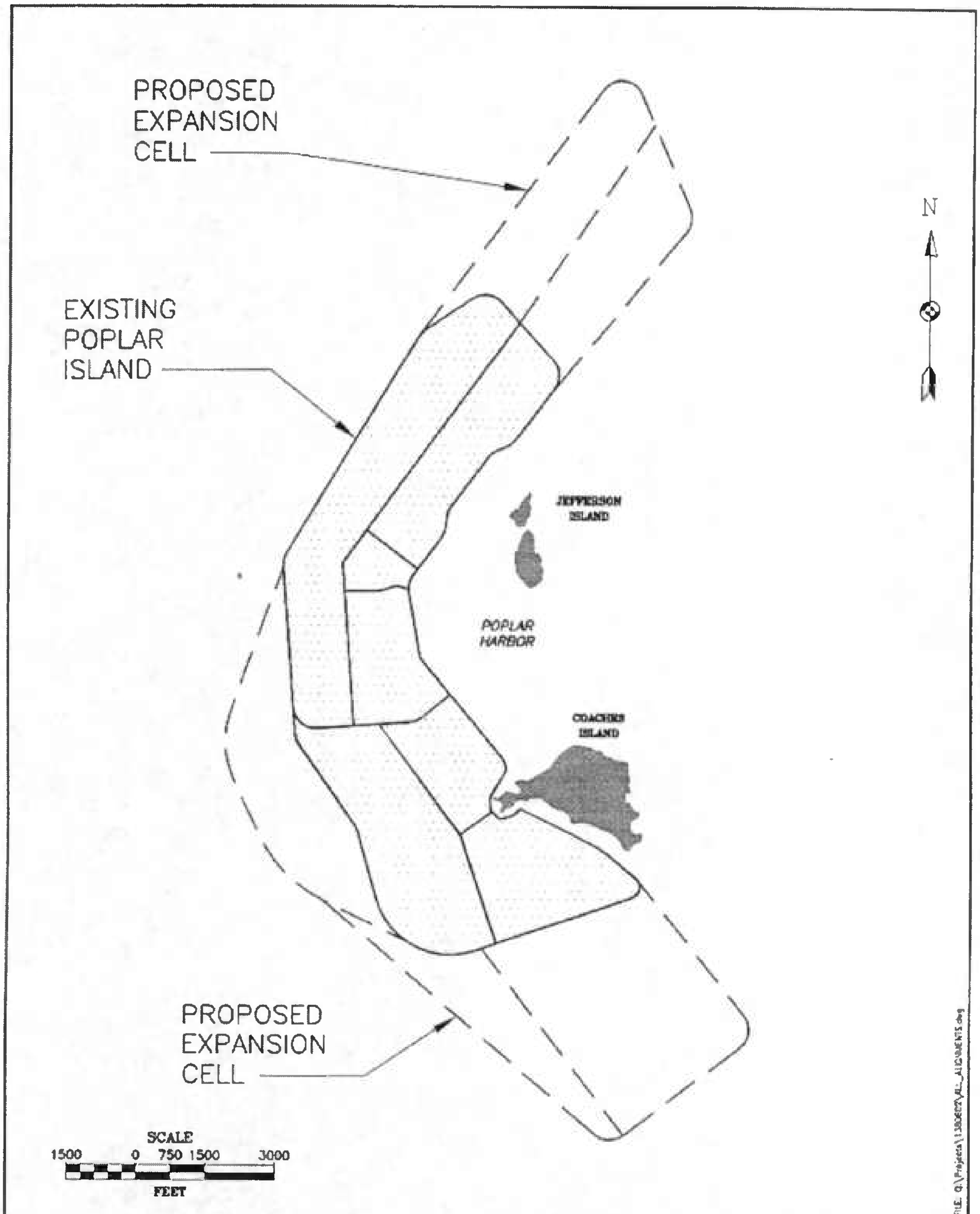


Figure 1–5. POPLAR ISLAND HABITAT RESTORATION CONCEPT 5 OPTION 4

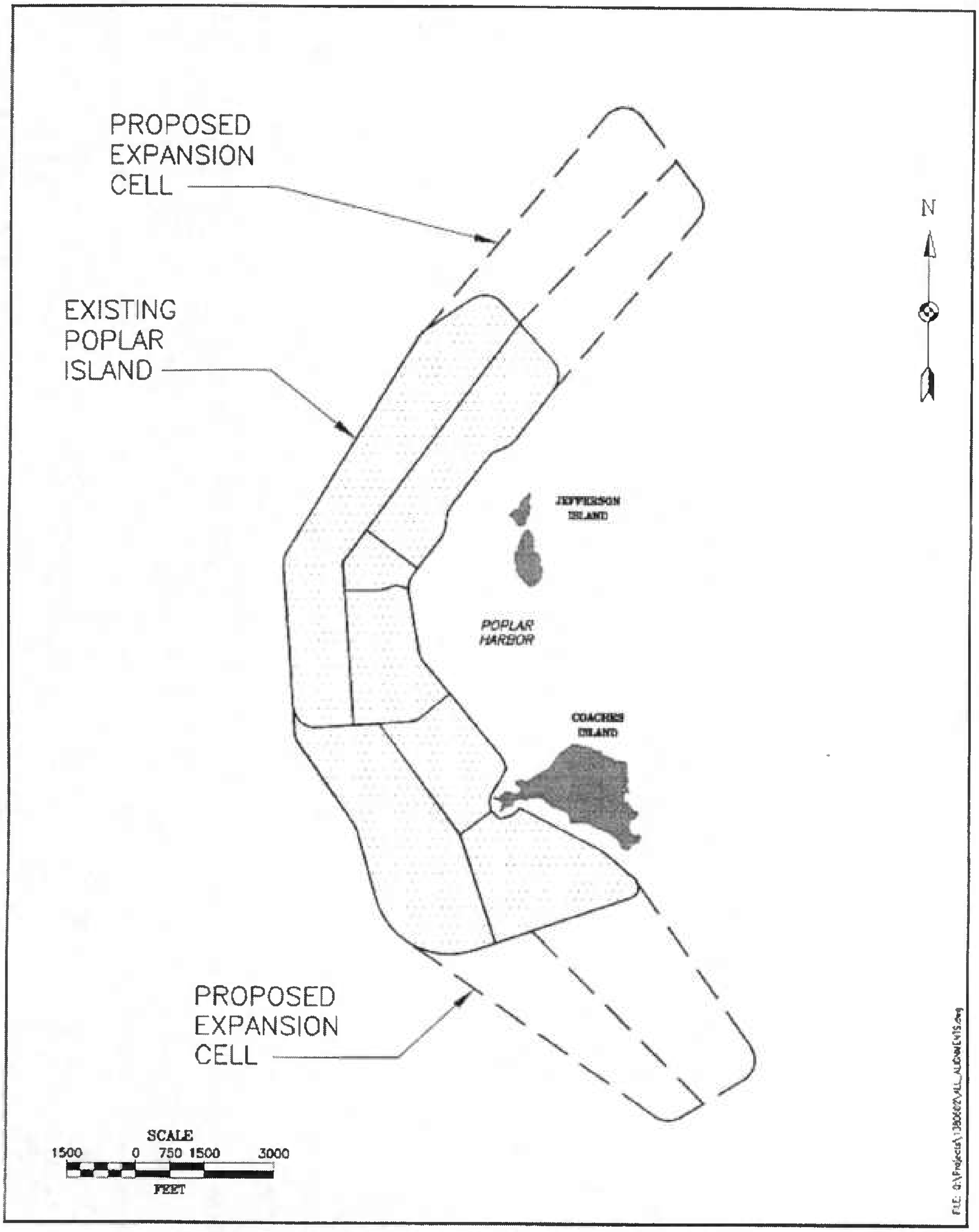


Figure 1-6. POPLAR ISLAND HABITAT RESTORATION CONCEPT 5 OPTION 5

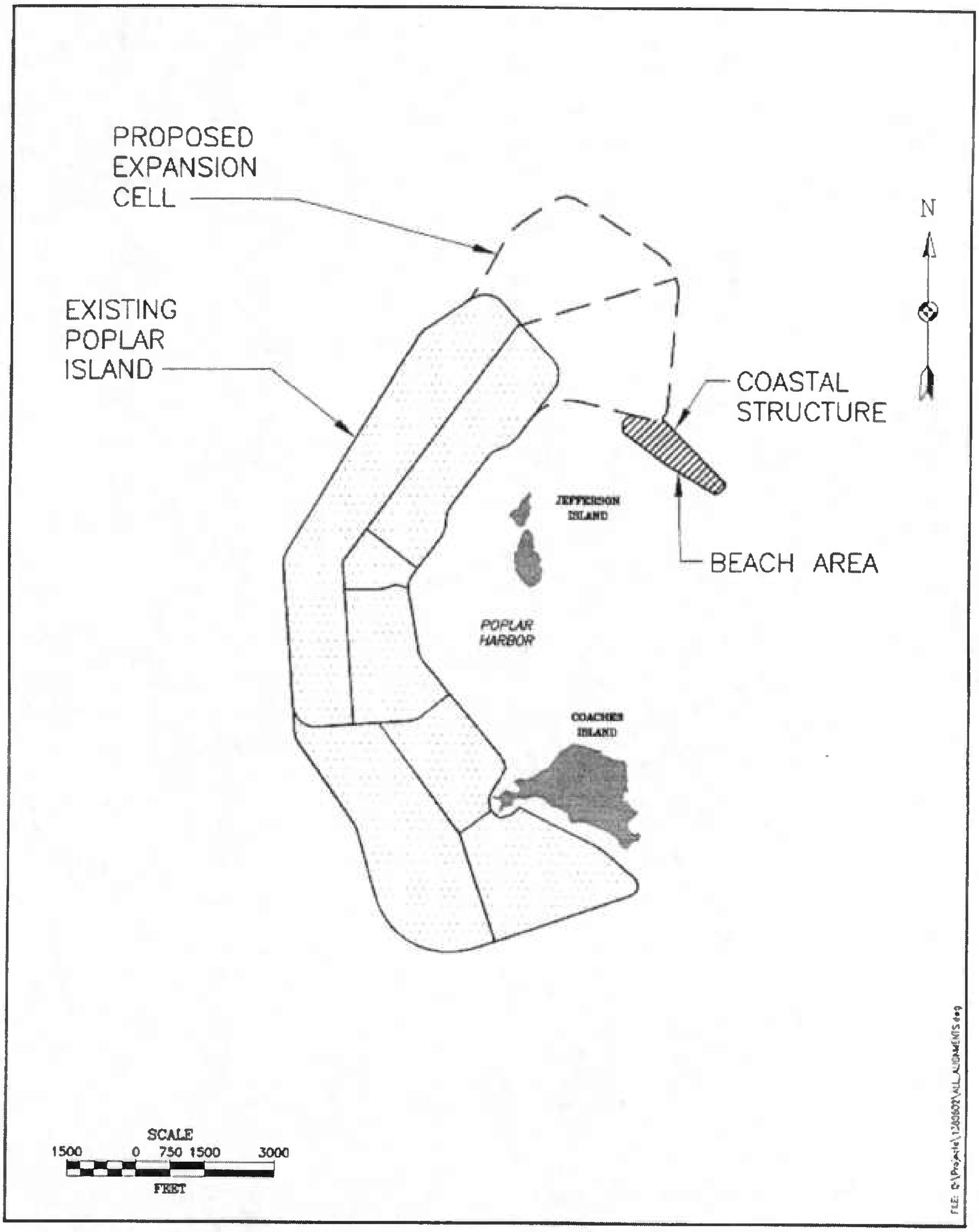


Figure 1–7. POPLAR ISLAND HABITAT RESTORATION CONCEPT 5 OPTION 6

A field reconnaissance of Poplar took place on 14 November 2001 and included a survey of the existing island via a trip around the entire island by boat. During the site visit all natural resources and land uses were noted. Photographs were also taken during the visit and are included as a Photolog (Appendix B).

The current use of the island is for dredged material placement and will eventually be restored to a natural habitat for resident and migrating fauna. No buildings or permanent structures exist on Poplar, however, Coaches Island has a trailer home and two small outbuildings and Jefferson Island has a house, which is used as a hunting lodge by the owner. A pier site has been established on the eastern side of Poplar in Poplar Harbor, where crew boats and other work and survey boats access the island. Another temporary landing has been established at the southern end of the island where larger vessels and equipment barges dock and unload.

2.0 HABITAT DESCRIPTION

Since 1998, the reconstruction of Poplar Island has been a priority of many state and federal agencies in order to develop and implement a recovery plan for the highly eroded chain of islands. The recently constructed island has approximately two miles of shoreline consisting of rip-rap banks. Dike elevations of the upland cells will be approximately 20 feet and the wetland cell dikes will range from 7 to 10 feet. The southeastern tip of Poplar extends around the southern shoreline of Coaches Island, but does not join Coaches. A narrow tidal gut separates Coaches Island from Poplar Island. A second privately owned island (Jeffersons Island) exists in the area known as Poplar Harbor. The Poplar Island archipelago is located on the main stem of the Chesapeake Bay and subjected to severe erosional activity, particularly from the northwest. No trees and little vegetation occur within the diked area, although (nearby) Jefferson and Coaches islands provide both tidal wetland and forest habitat.

The waters surrounding Poplar are relatively shallow (3-12 feet MLW) in most directions. Previous studies have indicated that the substrates are predominantly sand with clays and some finer materials in some areas. Most areas around the island are devoid of SAV and other cover items although there are rock piles (fish reef structures) along the northern end of the island. Natural Oyster Bars (NOB) lie just outside of Poplar Island in several directions and provide a harder-type substrate and oyster-reef habitat. Poplar Harbor (on the east side of Poplar Island) is protected from wind-driven waves from the south, west and northwest and provides a sheltered area for juvenile finfish and SAV growth. Within the dikes, the placement cells provide pooled water and mud-banks that attract some wildlife. The rocks that armor the existing dikes are encrusted with barnacles and other sessile organisms, including oysters. This is providing oyster reef-type habitat along the entire perimeter of the existing project. Artificial fish reefs have been installed at the north end of Phase I, and are used by various fish species.

3.0 WATER AND SEDIMENT QUALITY

3.1 Water Quality

Water quality conditions around Poplar Island have been monitored for almost 20 years by private and state agencies. On average, the water quality in the study area is considered comparable to reference stations in the Chesapeake Bay. This was supported by the surface water assessments conducted as part of the environmental impact statement for island reconstruction (USACE 1996). However, some previous site-specific water quality monitoring has documented elevated nutrients in the waters surrounding Poplar Island in some seasons. Pre-construction assessments indicated that seasonal concentrations of total nitrogen (avg. 1.4 mg/L) and orthophosphorus (avg. 0.012 mg/L) in spring 1996 and fall of 1995, respectively, were significantly higher than other seasonal collections for the same sites (Dalal et al. 1999).

Since construction of Phase I has been completed, monthly water quality from 50-130 samples has been collected from October 2001 through April 2002 for the Poplar Island Environmental Restoration Project (MES 2001-2002). Measured parameters include Total Suspended Solids (TSS), turbidity, Dissolved Oxygen (DO), nutrient concentrations, and priority pollutants and were generally collected from island spillways and bay stations (approximately 30 yards from spillway sites). Current water quality certification limits for TSS (800 mg/L daily maximum and 400 mg/L monthly average) and turbidity (50 NTU monthly average) were used as guidance for operational goals. Although TSS and turbidity concentrations exceeded these limits (33,720 - 147,700 mg TSS/L and 288 - 779 NTU) in spillway 3 more often than all other sites, this spillway is internal and does not discharge directly into the Bay. TSS concentrations in the bay stations were well below (<30 mg/L) set operational goals. Turbidity from spillway 6 exceeded operational goals in five of the seven monthly measurements, ranging from 54 – 127 NTU. Bi-weekly nutrient concentrations for the same sites indicated an increasing trend at the spillway sites than in the Bay and priority pollutants that were measured on a quarterly basis revealed no exceedances above Maryland State water quality standards. Maryland's Chesapeake Bay Water Quality Monitoring Program has been involved with measuring water quality throughout the Bay since 1984. Data from 1995 to 2002 have been summarized by segment and season in the following Tables for key water quality parameters. Segment 4 includes water quality stations CB4.1C (southwest of Kent Point), CB4.1E (south of Kent Point, boundary between CB4 and EE1), CB4.1W (southeast of Horseshoe Point), CB4.2C (southwest of Tilghman Island near Buoy Creek), CB4.2E (southwest of Tilghman Island), CB4.2W (northwest of Plum Point). All stations are generally located either directly north or south of Poplar Island. Selected water quality parameters from this Segment are summarized in Table 4-1.

The water quality in the area of Poplar Island is considered typical of the Mid-Upper Chesapeake Bay. Dissolved oxygen (DO) was high in all months indicating that the water is well oxygenated in this area. Average salinity varied little among seasons although some low quite values were measured during some seasons, probably reflecting rain events. Data on nutrients and productivity (chlorophyll-a) are also presented in Table 4-1. Chlorophyll-a production was somewhat higher during summer and fall, compared to other seasons, which is expected in this area of the Bay (Ruddy 1990). None of the other nutrient parameters exhibited marked seasonal patterns.

Table 3-1. Surficial (0.5m) water quality measurements from Segment 4 of the Chesapeake Bay. Values represent seasonal average, minimum, and maximum for each parameter collected from 1995-2002.

Season	Parameter	Unit	Avg	Max	Min	n
Spring	Chlorophyll a	UG/L	12.14	121.11	0.94	22
	Conductivity	UMHOS/CM	16,188	27,300	5,700	22
	Dissolved Oxygen	MG/L	10.7	15.4	3.3	22
	Dissolved Organic Carbon	MG/L	2.64	3.20	2.33	3
	Ammonium, filtered	MG/L	0.038	0.241	0.003	22
	Nitrite + Nitrate, filtered	MG/L	0.545	1.150	0.026	22
	Nitrite, filtered	MG/L	0.009	0.028	0.002	22
	Particulate Carbon	MG/L	1.439	9.330	0.097	22
	pH	SU	8.2	9.5	7.4	22
	Phaeophytin	UG/L	1.598	8.934	0.000	22
	Particulate Nitrogen	MG/L	0.225	1.240	0.091	22
	Orthophosphate, filtered	MG/L	0.003	0.015	0.001	22
	Particulate Phosphorus	MG/L	0.018	0.071	0.004	22
	Salinity	PPT	9.32	16.63	2.83	22
	Secchi depth	M	1.5	2.8	0.4	22
	Silicate, filtered	MG/L	0.74	1.76	0.02	22
	Total Dissolved Nitrogen	MG/L	0.84	1.45	0.29	22
	Total Dissolved Phosphorus	MG/L	0.01	0.03	0.00	22
	Total Suspended Solids	MG/L	6.32	25.80	1.90	22
	Water Temperature	°C	11.3	20.5	2.2	22
Summer	Chlorophyll a	UG/L	16.8	91.2	3.2	21
	Conductivity	UMHOS/CM	18,582	27,500	12,000	21
	Dissolved Oxygen	MG/L	8.5	15.4	5.3	21
	Dissolved Organic Carbon	MG/L	2.92	3.79	2.28	3
	Ammonium, filtered	MG/L	0.022	0.202	0.003	21
	Nitrite + Nitrate, filtered	MG/L	0.074	0.433	0.001	21
	Nitrite, filtered	MG/L	0.0042	0.0167	0.0002	21
	Particulate Carbon	MG/L	2.049	10.800	0.629	21
	pH	SU	8.3	9.1	7.6	21
	Phaeophytin	UG/L	2.47	11.90	0.00	21
	Particulate Nitrogen	MG/L	0.345	1.280	0.027	21
	Orthophosphate, filtered	MG/L	0.006	0.032	0.001	21
	Particulate Phosphorus	MG/L	0.0293	0.1122	0.0086	21
	Salinity	PPT	10.85	17.31	6.62	21
	Secchi depth	M	1.3	2.8	0.5	21
	Silicate, filtered	MG/L	1.02	1.77	0.08	21
	Total Dissolved Nitrogen	MG/L	0.41	0.82	0.25	21
	Total Dissolved Phosphorus	MG/L	0.0170	0.0441	0.0063	21
	Total Suspended Solids	MG/L	7.3	34.7	1.6	21
	Water Temperature	°C	25.2	30.3	18.5	21

Season	Parameter	Unit	Avg	Max	Min	n
Fall	Chlorophyll a	UG/L	11.8	56.1	1.5	20
	Conductivity	UMHOS/CM	23,702	29,400	9,200	20
	Dissolved Oxygen	MG/L	8.4	11.2	5.4	20
	Dissolved Organic Carbon	MG/L	2.80	3.32	2.33	3
	Ammonium, filtered	MG/L	0.024	0.108	0.003	20
	Nitrite + Nitrate, filtered	MG/L	0.088	0.695	0.001	20
	Nitrite, filtered	MG/L	0.0182	0.1576	0.0002	20
	Particulate Carbon	MG/L	1.207	5.000	0.333	20
	pH	SU	8.0	8.6	7.5	20
	Phaeophytin	UG/L	2.858	21.100	0.000	20
	Particulate Nitrogen	MG/L	0.218	0.877	0.072	20
	Orthophosphate, filtered	MG/L	0.0086	0.0296	0.0015	20
	Particulate Phosphorus	MG/L	0.020	0.077	0.007	20
	Salinity	PPT	14.23	18.07	4.90	20
	Secchi depth	M	1.6	3.0	0.6	20
	Silicate, filtered	MG/L	0.74	1.58	0.07	20
	Total Dissolved Nitrogen	MG/L	0.43	1.01	0.26	20
	Total Dissolved Phosphorus	MG/L	0.0223	0.0463	0.0101	20
	Total Suspended Solids	MG/L	5.8	11.8	1.5	20
	Water Temperature	°C	18.6	27.4	9.3	20
Winter	Chlorophyll a	UG/L	7.94	23.59	3.14	17
	Conductivity	UMHOS/CM	24,851	29,400	9,700	17
	Dissolved Oxygen	MG/L	11.1	13.1	8.6	17
	Dissolved Organic Carbon	MG/L	2.60	2.99	2.14	3
	Ammonium, filtered	MG/L	0.018	0.085	0.003	17
	Nitrite + Nitrate, filtered	MG/L	0.218	0.718	0.009	17
	Nitrite, filtered	MG/L	0.0061	0.0174	0.0010	17
	Particulate Carbon	MG/L	1.029	2.180	0.527	17
	pH	SU	8.0	8.3	7.5	17
	Phaeophytin	UG/L	2.593	5.962	1.000	17
	Particulate Nitrogen	MG/L	0.1686	0.3740	0.0872	17
	Orthophosphate, filtered	MG/L	0.0031	0.0123	0.0007	17
	Particulate Phosphorus	MG/L	0.0145	0.0332	0.0082	17
	Salinity	PPT	15.01	18.07	5.21	17
	Secchi depth	M	1.7	3.0	0.2	17
	Silicate, filtered	MG/L	0.42	1.56	0.01	17
	Total Dissolved Nitrogen	MG/L	0.53	1.15	0.29	17
	Total Dissolved Phosphorus	MG/L	0.0109	0.0197	0.0065	17
	Total Suspended Solids	MG/L	5.7	20.8	2.8	17
	Water Temperature	°C	5.1	11.8	0.9	17

3.2 Sediment Quality

The Chesapeake Bay is located in the Atlantic Coastal Plain physiographic province and is underlain by sequences of clay, silt, sand, and gravel. These geologically unconsolidated sediments date from the Cretaceous, Tertiary, and Quaternary Periods. Sediment samples taken in the vicinity of Poplar Island were found to be a mix of sand and silt/clay. Results of grain size analysis that were conducted in 2001 in association with benthic monitoring are presented in Table 4-2. Results of pre-placement sediment quality monitoring revealed similar sediment compositions.

Sediments serve as a sink and a source for natural materials, as well as contaminants that adsorb to fine particulate fractions, which may be deposited and buried within sediments. Sediment disturbance through construction, dredging or storm events can re-mobilize contaminants and particulates from the sediment into the water column and pose a risk to aquatic organisms. Contaminants originate from both point source (e.g., industrial and municipal effluents) and non-point source (e.g., stormwater runoff, agricultural runoff, and atmospheric deposition) and watersheds in urbanized areas such as the Chesapeake Bay can contain significantly higher concentrations of contaminants such as metals, pesticides, PAHs, and PCBs.

Sediments near the Poplar Island archipelago have been identified as containing some contaminants from industrial and municipal sources as well as from non-point sources. Analytes from sediment samples taken on February 2001 and analyzed by Maryland Geological Survey (MGS), Severn Trent Laboratories (STL), and Chesapeake Biological Laboratories (CBL) for particle size composition, pesticides, metals, PAHs, PCBs, and dioxins (EA 2001 Summary Data are included in Appendix C).

Analysis of sediment associated PCB congeners and PAH concentrations indicated that all sites were either below detection or below threshold effect levels (TEL). None of the detected concentrations for which sediment quality criteria exist exceeded published sediment quality guideline values for marine sediments. Particle size composition indicated greater than 90% sand for a majority of the sites, which would support the low concentrations of organic compounds in the sediment. Average concentrations for 16 metals analyzed in collected sediments in 2001 indicated that all concentrations were below TEL values in all 12 sites; metal concentrations are comparable to background levels measured in sediments from other areas of the northern Chesapeake Bay (EA 2001).

Table 3-2. Particle size composition of sediments collected from Poplar Island during the modification site reconnaissance.

Sample	Grain Size					Material Description
	% Cobble	% Gravel	% Sand	% Silt	% Clay	
Poplar-M001	0.0	0.0	97.2	1.2	1.6	Greenish-grey, poorly graded sand, little shell
Poplar-M002	0.0	0.1	97.1	1.1	1.7	Brownish-greenish-grey, poorly graded sand, little shell
Poplar-M003	0.0	0.1	96.4	1.8	1.7	Brownish-greenish-grey, poorly graded sand, trace shell
Poplar-M004	0.0	0.0	97.8	0.8	1.4	Brownish-greenish-grey, poorly graded sand, trace shell
Poplar-M005	0.0	0.0	98.2	0.6	1.2	Greenish-brown, poorly graded sand, trace shell
Poplar-M006	0.0	0.0	57.5	36.6	5.9	Brownish-grey, silty fine sand, trace clay and shell
Poplar-M007	0.0	0.1	91.4	6.0	2.5	Dark grey, poorly graded sand, trace shell
Poplar-M008	0.0	0.2	97.2	0.8	1.8	Brownish-grey, poorly graded sand, little shell
Poplar-M009	0.0	0.0	97.6	0.6	1.8	Brown and grey, poorly graded sand, trace shell
Poplar-M010	0.0	0.0	96.4	1.1	2.5	Greyish-brown, poorly graded sand, trace shell

4.0 BIOLOGICAL RESOURCES

4.1 Fish

Many fish species support valuable commercial and recreational fisheries in the Chesapeake Bay and its tributaries. The upper sections of the Bay also support a diverse fish community beyond those recognized as commercial or recreational resources. A list of finfish species that occur or could potentially occur in Eastern Bay is presented in Table 4-1. Species that spend their entire life cycle in the Bay are included as well as migratory species and species only occasionally encountered in the Bay. The list includes such important commercial species as striped bass and white perch that are discussed further in Sections 5.0 and 6.0.

More recent studies around Poplar Island were conducted in 2001 to assess nekton species populations (NOAA 2001). Declines in blueback herring and sand shrimp were observed in shallow water habitats within Poplar Harbor from earlier surveys conducted in 1995-96, while increases in abundances for weakfish, Atlantic croaker, bay anchovy, spot, and Atlantic menhaden were noted from earlier surveys.

Table 4-1. Fish species commonly found in mesohaline areas of the Chesapeake Bay.

Species Common Name	General Distribution					
		Seasonal				
	Resident	Fall	Winter	Spring	Summer	Occasional
Bull shark						J, A
Sandbar shark						J
Cownose ray					J, A	
Shortnose sturgeon						J, A
Atlantic sturgeon						J,A
American eel				L, J		A
Blueback herring		J	J	J, A	J, A	
Hickory shad						J, A
Alewife		J	A	J, A	J, A	
American shad			A	J, A	J, A	
Atlantic menhaden		A, L	J	E, L, A	J, A	
Atlantic herring			A	A	J, A	
Gizzard shad						J, A
Threadfin shad						J, A
Striped anchovy						J, A
Bay anchovy		E,L J,A	J,A	E,L J,A	E,L,J,A	
Chain pickerel						J, A
Inshore lizardfish						J, A
Oyster toadfish	X					
Skilletfish	X					
Halfbeak						J, A
Atlantic needlefish		J,A		E,A	E,L J, A	
Sheepshead minnow	X					
Banded killifish						J, A
Mummichog	X					

Species Common Name	General Distribution					
	Resident	Seasonal				Occasional
		Fall	Winter	Spring	Summer	
Striped killifish	X					
Rainwater killifish	X					
Rough silverside						J,A
Inland silverside	X					
Atlantic silverside	X					
Fourspine stickleback	X					
Threespine stickleback	X					
Lined seahorse	X					
Dusky pipefish						J, A
Northern pipefish	A					
Northern searobin						J, A
White perch						J, A
Striped bass	X (J)					
Black sea bass						J, A
Yellow perch						A
Silver perch						J, A
Spotted seatrout		J		J	J, A	
Weakfish		J		L,J	L, J A	
Spot		J		J	J, A	
Atlantic croaker		J		J	J, A	
Black drum		J			J, A	
Red drum		J				
Striped mullet						J, A
White mullet						J, A
Northern stargazer						A
Striped blenny	X					
Feather blenny	X					
Darter goby						J, A
Naked goby	X					

Species Common Name	General Distribution					
	Resident	Seasonal				Occasional
		Fall	Winter	Spring	Summer	
Seaboard goby						J, A
Green goby	X					
Spanish mackerel						J, A
Harvestfish						J, A
Butterfish						J, A
Summer flounder		J, A		J, A	J, A	
Windowpane						J, A
Winter flounder		A	A, L	L, J	J	
Hogchoker	X					
Blackcheek tonguefish						J, A
Northern puffer						J, A

Resident= non-mobile, habitat specific; Seasonal= pelagic migratory;
Occasional= limited by salinity or habitat, occurrence unlikely.
Lifestages: E=Egg; L=Larvae; J=Juvenile; A=Adult, X= All Lifestages Resident

Sources: Hildebrand and Shroeder 1928; Lippson and Lippson 1984; Lippson 1973; Setzler-Hamilton 1987; White 1989. Dovel 1971; Funderburk *et al.* 1991; Lippson and Moran 1975; EA 1995 a, b, c, & d; MD DNR Juvenile index and commercial landings databases, EPA Environmental Monitoring and Assessment Program (EMAP) database (1995), Heck & Thoman 1984, Murdy et al. 1997.

A seasonal monitoring study was conducted in the fall 1994 through summer 1995 to assess fish (finfish and shellfish) species inhabiting the Poplar Island study area (EA 1995a,b,c,d). Results of the monitoring study are presented in Table 4-2.

Table 4-2. Fish and crab species collected from ottertrawls, crabpots, seines, and gill nets during seasonal monitoring of Poplar Island: fall 1994 – summer 1995.

Common Name	Individuals Collected: Number and Lifestage			
	Fall 1994	Winter 1995	Spring 1995	Summer 1995
Alewife	--	1(A)	6	3(J)
Atlantic croaker	--	--	--	18
Atlantic herring	--	4(A)	1	--
Atlantic menhaden	--	1(A); 2(J)	149(A); 10(E)	120(A,J)

Common Name	Individuals Collected: Number and Lifestage			
	Fall 1994	Winter 1995	Spring 1995	Summer 1995
Atlantic needlefish	--	--	--	3(A)
Atlantic silverside	38	14	365; 1(L)	10,468(A,J)
Bay anchovy	119	1(J)	3(J); 1(E)	728(A); 1(J)
Blue crab	16	--	4(J)	37(J)
Blueback herring	--	1(J)	--	2(J)
Bluefish	--	--	--	3
Feather blenny	--	--	--	1(J); 4(L)
Hogchoker	--	--	--	7(E)
Naked goby	--	--	--	3(L)
Northern pipefish	--	--	4(J)	2; 3(J)
Northern searobin	--	--	--	1
Oyster toadfish	--	--	--	6(J)
Scup	--	--	--	1
Skilletfish	--	--	--	1(J)
Spot	2	--	2	85
Striped anchovy	--	--	--	4
Striped bass	1	1(J)	8	92(J)
Striped killifish	6	--	14	8
Summer flounder	--	--	--	2
Weakfish	--	--	--	5
Winter flounder	--	1; 2(L)	--	13(J)

Lifestages: (E)=Egg; (L)=Larvae; (J)=Juvenile; (A)=Adult.
UL: Unknown lifestage, unless otherwise reported.
--No specimens collected during this period.

4.1.1 Essential Fish Habitat

The Magnuson-Stevenson Fishery Conservation and Management Act recently required that essential fish habitat (EFH) areas are identified for each fishery management plan and that all Federal agencies consult with the National Marine Fisheries Service (NMFS) on all Federal actions that may adversely affect EFH. The EFH areas have been designated by the Fishery Management Councils and were published in March 1999 by NMFS as the "Guide to Essential Fish Habitat in the Northeastern United States, Volume V: Maryland and Virginia." EFH as defined in 50 CFR part 600 " those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity".

Based upon the screening tools provided on the EFH website maintained by NMFS at (www.nero.nmfs.gov), it was determined that Poplar Island lies within a general area that may provide EFH for nine species managed by NMFS. The species of concern are summer flounder (*Paralicthys dentatus*), windowpane flounder (*Scopthalmus aquosus*), bluefish (*Pomatomus saltatrix*), cobia (*Rachycentron canadum*), red drum (*Sciaenops ocellatus*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), Atlantic butterfish (*Perprilus triacanthus*), and black ses *bass (Centropristus striata*). Of these, only bluefish and summer flounder were collected during fisheries surveys of the area (Table 4-2). Formal consultations for EFH would need to be conducted with NMFS if a feasibility phase of study is conducted. However, some inferences about the potential for essential fish habitat can be derived from the literature and previous studies in the region. A general analysis of impacts on each species is included in Section 9.

4.2 Plankton Production

Plankton production in the Chesapeake Bay is an important indicator of other water quality parameters such as nitrogen and phosphorus loading and water clarity (phytoplankton), as well as providing food sources (zooplankton) for finfish larvae. Seasonal averages of phytoplankton have been summarized for Segment 4, Station 4.3C, which is located east of Dares Beach near Buoy R64 in the mainstem of the Chesapeake Bay (Table 4-3). Based upon the chlorophyll-a concentrations outlined previously (Table 4-1), the Poplar Island area exhibits typical plankton production for this reach of the Bay (Ruddy 1990).

Table 4-3. Average seasonal phytoplankton counts from Chesapeake Bay Program water quality monitoring for Segment 4. Values represent average, minimum, and maximum numbers (81 genera) collected during 1995-2001.

Season	Average (no. plankton/L)	Minimum (no. plankton/L)	Maximum (no. plankton/L)
Winter	852,983	12,149	25,821,825
Spring	1,558,793	6,075	110,476,797
Summer	1,773,436	6,075	265,297,751
Fall	1,310,949	8,678	191,555,786

4.2.1 Ichthyoplankton

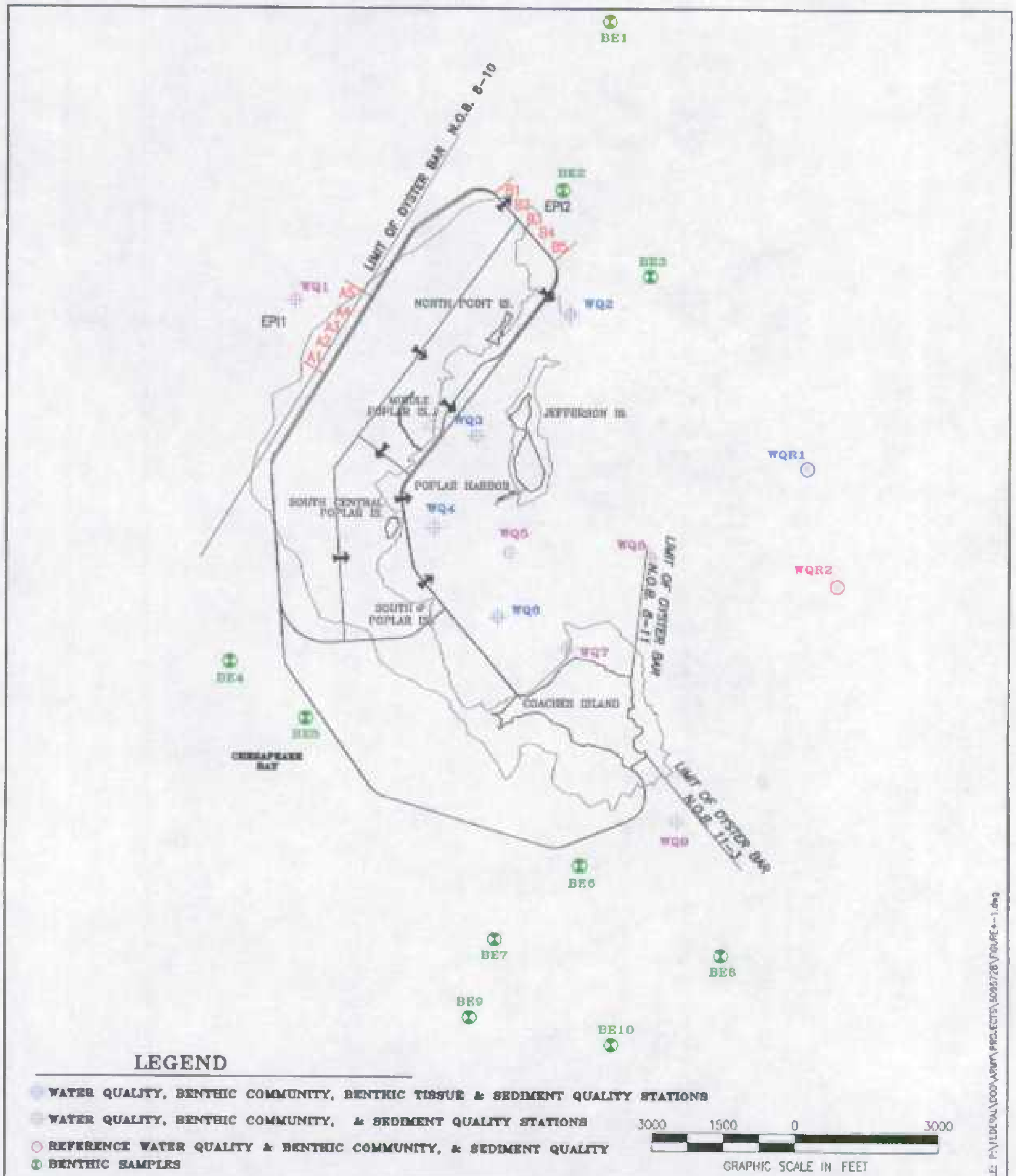
Seasonal monitoring of ichthyoplankton was conducted from 1994-1995 and showed an increasing trend of juvenile, eggs, and larvae collected in the spring and summer months. Plankton tows were conducted in the fall and winter and revealed no ichthyoplankton for fall samples, while winter samples revealed minimal collections of juvenile winter flounder and Atlantic menhaden. Spring and summer samples provided the most ichthyoplankton, as expected, and results indicated that eggs, larvae, and juveniles of bay anchovy, Atlantic menhaden, Atlantic silverside, skilletfish, northern pipefish, feather blenny, naked goby, and hogchoker were all collected in plankton nets.

4.3 Benthos

The benthic community represents an important ecological component in an aquatic system, providing functional roles in food processing for higher trophic levels. The animals that live on and within the bottom sediments serve as food to many higher organisms in the waters of the Chesapeake Bay and its tributaries, which may include finfish, blue crabs and some species of waterfowl. Various sites located inside and outside the proposed island alignment were monitored seasonally for benthos in 1994-1995 (Figure 4-1) (USACE/MPA 1996, EA 1995a,b,c,d). Comparisons of historic benthic community assemblages to seasonal monitoring of Poplar Island in 1994 and 1995 indicated that while diversity and dominant taxa (Polychaetes and Amphipods) were similar to earlier studies, total taxa and density calculations were higher for Poplar Island. Similar comparisons with US EPA's Environmental Monitoring and Assessment Program (EMAP) studies conducted in 1992 revealed that Poplar Island had lower numbers of taxa (USACE/MPA 1996). Overall, however, benthic abundance values for Poplar Island remain in the normal range of other reported Bay surveys, but diversity and number of taxa are somewhat lower. Pre-placement epibenthic monitoring in October 2000 indicated that organisms located outside the dike structure are relatively abundant and are important food sources for finfish and shellfish species that forage in the area (EA 2001). Some species, such as the American oyster, *Crassostrea virginica*, soft shell clam, *Mya arenaria*, and the razor clams, *Ensis directis* and *Tagelus plebeius*, are also important commercially, as well as ecologically.

Baseline assessments for benthic community structure and tissue contamination were conducted in 1995 and 1996 to determine whether changes due to Island restoration activities would have a detrimental effect on the biological communities that surround Poplar Island (Dalal et al. 1999, MES 2000). Tissue residue analyses for pesticides, metals, PAHs, and PCBs indicated that bioconcentration of PCBs and metals in oyster tissues were within the normal range for Chesapeake Bay benthic communities. Although PAH and pesticide analyses of benthic tissues resulted in concentrations above minimum detection limits, there was no significant difference in tissue concentrations from reference sites in the Bay.

Mean B-IBI scores for Poplar Island stations were above the minimum criteria set for Chesapeake Bay restoration projects for 1996 samples only; however consideration of metric scores as a function of significantly different water quality parameters from one year to the next may provide insight into these reductions of metric scores measured during other years (Dalal et al. 1999).



EA ENGINEERING, SCIENCE, AND TECHNOLOGY		POPLAR ISLAND LATERAL EXPANSION PROJECT CHESAPEAKE BAY, MARYLAND			WATER QUALITY, BENTHIC COMMUNITY, BENTHIC TISSUE & SEDIMENT QUALITY STATIONS		
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
WWW	WWW	WWW	WWW	NONE	12-05-01	61401.23	4-1

During the site reconnaissance of Poplar Island in 2001, benthic collections were conducted for 10 locations around Poplar Island (Figure 4-1) using a standard 9 x 9-in Ponar grab sampler. Table 4-4 provides a summary of benthic community metrics and scores used to calculate the B-IBI for Poplar Island sites. Overall, total B-IBI scores were low (ranging from 1.8 to 2.2) for all stations sampled at Poplar Island in October 2001 except for PIM-006 and PIM-007, which had total B-IBI scores of 3.0. Scores of 3.0 or greater were considered as meeting the Chesapeake Bay Restoration Goal (Ranasinghe et al. 1994). PIM-006 and PIM-007 were the only stations sampled in October 2001 to meet the Chesapeake Bay Restoration Goal. The mean total B-IBI score for the combined Poplar Island sites was 2.1. A complete taxonomic list of macroinvertebrates, mean densities for each station, a summary of additional benthic community metrics, tabled threshold values for metrics used to score the Chesapeake Bay B-IBI, and a feeding guild and life history information for collected benthos are included in the Site Reconnaissance Field Report provided in Appendix A.

Table 4-4. Summary of benthic community metrics and scores used to calculate the B-IBI, October 2001, Poplar Island.

Metric	Metric Values									
	PIM-001	PIM-002	PIM-003	PIM-004	PIM-005	PIM-006[c]	PIM-007	PIM-008	PIM-009	PIM-010
Abundance (#/m^2)[a]	121,686	140,760	42,010	209,528	25,588	11,730	7,338	19,100	90,311	164,424
Shannon-Weiner Diversity[a][b]	0.099	0.133	0.495	0.050	0.198	1.548	1.482	0.796	0.266	0.068
Pollution-Sensitive Taxa Abundance (%)	0.1	0.2	0.9	0.05	0.3	--	21.0	2.0	0.2	0.2
Pollution – Indicative Taxa Abundance (%)	0.02	0.2	0.1	0.01	0.1	--	0.4	0.2	0.01	0.02
Carnivore/Omnivore Abundance (%)	0.8	0.7	10.0	0.3	1.2	78.7	77.0	20.2	4.7	0.6

Metric	B-IBI Scores									
	PIM-001	PIM-002	PIM-003	PIM-004	PIM-005	PIM-006[c]	PIM-007	PIM-008	PIM-009	PIM-010
Abundance (#/m^2)[a]	1	1	1	1	1	1	1	1	1	1
Shannon-Weiner Diversity[a][b]	1	1	1	1	1	3	1	1	1	1
Pollution-Sensitive Taxa Abundance (%)	1	1	1	1	1	--	3	1	1	1
Pollution – Indicative Taxa Abundance (%)	5	5	5	5	5	--	5	5	5	5
Carnivore/Omnivore Abundance (%)	1	1	1	1	1	5	5	3	1	1
B-IBI[d]	1.8	1.8	1.8	1.8	1.8	3	3	2.2	1.8	1.8

(a) Includes all species collected.
(b) Log used was log base e
(c) PIM-006 is classified as high mesohaline mud; therefore, pollution-sensitive taxa abundance and pollution-indicative taxa abundance were not included in the calculation of the B-IBI.
(d) Mean of the metric scores.

4.4 Submerged Aquatic Vegetation (SAV)

Virginia Institute of Marine Science (VIMS) overflight data for SAV monitoring in the Chesapeake Bay, reveal that from the period 1994 to 2001, no SAV are apparent in the waters surrounding Poplar, Coaches, or Jefferson Islands. Previous investigations conducted in associations with the EIS for island construction indicated that Poplar Island supported diverse SAV beds in 1978, but that only remnants of these beds were present in 1984. Studies of SAV in other areas of the Bay have indicated that distributions and densities are cyclic. To ground-truth the overflight data, a SAV survey of the waters surround the (then) remnant islands was conducted in spring and summer 1995 (EA b,c 1995) . Surveys revealed no specific seasonal trends of SAV, however spring and summer sampling events indicated two sparsely populated study areas of widgeon grass (stem count: 26) and horned pondweed (stem count: 15) that were not apparent in overflight photos. In July 2001, horned pondweed (*Zannichellia palustris*) was identified near Spillway 6 and short form sago pondweed (*Potamogeton pectinatus*) was sited near Middle Poplar Island (VIMS 2001). No SAV was observed on North Point during these same surveys. Similarly, the USFWS surveyed the area around the islands in the summer of 2001 and found several small areas of SAV between Poplar Island and Jefferson Island (Murphy 2001). Recent observations by MES staff indicated that horned pondweed was growing between spillways 5 & 6, and some SAV had been identified between Poplar and Jefferson Islands (pers. Comm. Karen Cushman, MES, 2002a).

4.5 Terrestrial Vegetation & Upland Community Types

Currently the Poplar Island archipelago is comprised of three islands. Of these, Jefferson and Coaches Islands support saltmarsh and remnant pine forest communities. Coaches Island also has a freshwater pond and bog. These lie outside all of the proposed options but are expected to provide potential sources of vegetation and wildlife to populate the reconstructed areas of Poplar Island after filling.

Poplar Island is currently an active beneficial use of dredged material placement facility and the only vegetation that currently exists is the saltmarsh vegetation that was contained on the remnant islands when they were enclosed within the dikes, and pioneer species that have begun to take hold in some areas post construction. The elevated roadways along the dikes are currently used by some birds for resting and nesting. The Murden Memorial, which was dedicated on June 17, 2002, is currently in place and has been vegetated with indigenous grasses, shrubs and trees. Salt meadow grass and smooth cordgrass have also been planted in the Poplar Island notch (located off of Cell 4, near Coaches Island).

4.6 Wetlands

In fall of 1994, the four remnant islands of Poplar Island (North Point, South Central, Middle Poplar, and South Poplar) were found to possess low and high marsh areas with North Point Island and South Central Poplar Island also having Saltbush communities present. There is no live woodland tree cover and the majority of the plants identified on these islands are herbaceous plants that occur in brackish marsh and saltmarsh habitats. These remnant islands are currently enclosed within the dikes of the reconstructed Poplar Island and will act as rootstock for the habitat restoration phase of the project.

Based on the habitat development plan conducted in 1995, wetland and upland configurations will be used to support various mammals, birds, reptiles, fish, and invertebrates that may use the site (Environmental Concern 1995). Projected wetland and upland partitioning will consist of 555 acres of uplands and 555 acres of wetlands (20% high marsh and 80% low marsh). Low marsh habitat will be dominated by smooth cordgrass and tidal ponds, while high marsh areas will consist of salthay, various sedges, and tidal ponds. Upland habitat will consists of various plants including forested areas, miscellaneous shrubs, and freshwater ponds. This plan not only provides beneficial options for habitat improvement following dredged material placement but also presents estimated costs for design of wetland and upland habitats as well as control of invasive plant species (which is ongoing).

4.7 Avian and Terrestrial Species and Habitat

Many bird species have been documented in the Chesapeake Bay and more specifically around the Poplar Island archipelago, where more than 1,000 individuals, mainly shorebirds, sea ducks, and gulls, have been observed utilizing Cells 1, 2, and 3 (MES 2001). A seasonal monitoring study was conducted in the fall 1994 through summer 1995 to assess avifauna either observed or inhabiting the Poplar Island study area. During this study, colonial waterfowl nesting rookeries were identified for Middle Poplar and Coaches Island. The four remnant Islands of Poplar Island (North Point Is, Middle Poplar Is., South Central Is., and South Is.) were surveyed for avifauna. A quantitative account of identified species has been generalized within a larger group that include waterfowl, wading birds, shore birds, gulls, and terns, while Table 4-5 provides specific individuals within the larger group to provide a more thorough listing of identified avifauna, Table 4-6.

Table 4-5. Avian species identified in the Poplar Island archipelago and listed by group.

Group	Common Name	Scientific Name
Waterfowl	Mallard	*Anas platyrynchos*
	Canada goose	*Branta canadensis*
	Bufflehead	*Bucephala albeola*
	Oldsquaw	*Clangula hyemalis*
	Mute swan	*Cygnus olor*
	American coot	*Fulica americana*
	Common loon	*Gavia immer*
	White-winged scoter	*Melanitta fusca*
	Hooded merganser	*Lophodytes cucullatus*
	Common eider	*Somateria mollissima*
	American black duck	*Anas rubripes*
	Greater scaup	*Aythya marila*
	Canvasback	*Aythya valisneria*
Wading	Great blue heron	*Ardea herodius*
	Little blue heron	*Egretta caerulea*
	Double-crested cormorant	*Phalacrocorax auritus*
	Great egret	*Casmerodius albus*
	Snowy egret	*Egretta thula*
	Cattle egret	*Bubuleus ibis*
Shorebirds	Dunlin	*Calidris alpina*

Group	Common Name	Scientific Name
	Semi-palmated sandpiper Willet	*Calidris pusila* *Cataoptrophorus semipalmatus*
Marshbirds & Songbirds	Red-winged blackbird Sharp-tailed sparrow Marsh wren Northern cardinal Killdeer Common flicker Swamp sparrow Mockingbird Downy woodpecker Belted kingfisher Gray catbird Barn swallow Brown-headed cowbird American woodcock Common grackle Bank swallow Eastern bluebird Chipping sparrow Common yellow throat	*Agelaius phoeniceus* *Ammodramus causdacultus* *Cisthorus paslustris* *Cardinalis cardinalis* *Charadrius vociferus* *Colaptes auratus* *Melospiza georgiana* *Mimus polyglottos* *Picoides pubescens* *Ceryle alcyon* *Dumetella carolinensis* *Hirundo rustica* *Molothrus ater* *Philohela minor* *Quiscalus quiscula* *Riparia riparia* *Sialia sialis* *Spizella passerina* *Geothlypis trichas*
Gulls & Terns	Herring gull Ring-billed gull Great black-backed gull Laughing gull Least tern Common tern Gull-billed tern	*Larus argentatus* *Larus delawarensis* *Larus marinus* *Larus atricilla* *Sterna antillarum* *Sterna hirundo* *Gelochelidion nilotica*
Predators & Scavengers	Common crow Black vulture American crow Fish crow Bald eagle Osprey	*Corvus brachyrynchos* *Coragyps atratus* *Corvus brachyrhynchos* *Corvus ossifragus* *Haliaeetus leucocephalus* *Pandion haliaetus*

Table 4-6. Avian species identified on Poplar Island during timed observations: fall 1994 – summer 1995. Federal or state species of concern are highlighted in the footnote.

Common Name	Number of Individuals Identified			
	Fall 1994	Winter 1995	Spring 1995	Summer 1995
Waterfowl	53	24	459	511
Wading Birds	---	---	53	47[c]
Shorebirds	---	1	4	3
Marshbirds & Songbirds	---	---	15	9
Gulls & Terns	469	13	155[a]	129[d]
Predatory Birds	1	---	17[b]	17[e]

[a]Two laughing gull citings.
[b]Four bald eagle citings.
[c]One little blue heron citing.
[d]Eight gull-billed tern, one laughing tern, and seven least tern citings.
[e]One bald eagle citing.
--No specimens collected during this period.

More recent observations of bird inhabitants for the Poplar Island archipelago that occurred on June 6, 2001 provide an update to some of the reported data listed in Table 4-7 (pers. Comm. Richard Bailey, MES, 2002). Several brown pelicans and a rarely seen white pelican were observed on Poplar Island during recent surveys. Quantitative and qualitative information have been summarized for over 30 species that were observed and identified in the Phase I wetland cells.

Five osprey pair and associated nests were identified in spring 2001 in Cell 1 and near Spillway 2. Nests contained approximately 3-4 eggs each and follow-up surveys indicated that the birds had fledged the following June.

Waterfowl such as the Canada goose, mute swan, and mallard were observed with pairing adults and young. The double-crested cormorant was noted as having the greatest number of nests than other nests identified for herring gull, common tern, least tern, and osprey. Identifications of a willet (shorebird), laughing gull, and black tern were recorded as their first summer being observed on Poplar Island. Surveys of identified least tern nests (from June 6, 2001 citings) indicated that on July 9, 2001, all eggs had either hatched or been washed away by rainwater. August 2001 surveys indicated approximately 15 nests still on the island and located in Phase II colony, however no additional follow up regarding their viability is noted.

Table 4-7. Bird observations conducted by Eugene Scarpulla on Poplar Island, June 6, 2001.

Group	Common Name	Number observed	Comments
Waterfowl	Canada goose	23	13 adult; 10 downy young
	Mute swan	66	50 adult; 16 downy young
	American black duck	2	
	Mallard	50	38 male; 6 female; 6 young
Wading	Double-crested cormorant	739	~400 nests on Jefferson Is.
	Great blue heron	17	
	Great egret	1	
Shorebirds	American avocet	1	Female in breeding plumage
	Willet	7	Eastern: 6 adult; 1(1st summer)
	Sanderling	4	
	Semipalmated sandpiper	139	
	White-rumped sandpiper	8	
	Dunlin	9	
	Short-billed dowitcher	2	*Griseus*
Marshbirds & Songbirds	Semipalmated plover	12	
	Killdeer	3	
	Barn swallow	16	
Gulls & Terns	Laughing gull	11	5 adult; 5 (1st summer)
	Ring-billed gull	3	
	Herring gull	255	~20 nests
	Great black-backed gull	282	
	Royal tern	2	
	Common tern	355	~150 nests
	Least tern	20	~5 nests
	Black tern	1	1st summer
Predators & Scavengers	Osprey	14	Adult; 7 nests
	Fish crow	6	
	Crow sp.	10	

Personnel from state and local agencies are beginning to document sick and dying birds that inhabit Poplar Island. On October 3, 2001, the first group of dead birds (ducks) was found inside of Cell 2 and collected for laboratory analysis of botulism and the cyanobacterium, *Microcystis*, which was identified in water samples (pers. Comm. Jennifer Harlan, MES, 2002). A week later more birds were identified as sick or dying and tissue samples from selected gulls were collected for laboratory analysis of botulism and the cyanobacterium, *Microcystis*, which was also identified in water samples (pers. Comm. Jennifer Harlan, MES, 2002). By the end of the month, 87 birds had been found dead and included mute swan (5), various shorebirds (5), pintail (2), mallard (28), green/black wing teal (11), Canada goose (1), and various gulls (35). While no top predator bird species (e.g. bald eagle) have been affected to date, moderate risk may exist for these species because they will at times consume sick and dying avian prey. Although autopsies from birds inhabiting Poplar Island were inconclusive, scientists have identified Avian botulism Type C and/or *Microcystis* as two potential contributors to the bird mortality.

Surveys conducted in spring 2002 indicated that least terns returned and colonized one of the habitat islands in Cell 4 and common terns returned and are nesting in Cell 3, Cell 1, and North Point. Snowy/cattle egrets and various types of sea gulls are nesting on Middle Poplar Island, double crested cormorants are nesting on habitat next to Middle Poplar, and mute swans and osprey are also nesting on the island (pers. Comm. Jennifer Harlan, MES, 2002).

Terrapins have successfully nested but required human assistance to juveniles to enable their migration to the Bay. During surveys conducted on June 4, 2002, Diamondback terrapin nests were found and marked for identification. Follow up surveys of the same nests indicated that there were as many as 39 terrapin nests with eggs (pers. Comm. Jennifer Harlan, MES, 2002).

4.8 Rare, Threatened and Endangered Species

Recent surveys, conducted during 1994-2001, of aquatic and terrestrial habitats have indicated the presence of some federal and state listed fauna near Poplar Island. One Federally Threatened species, the bald eagle was sighted near Poplar Island in the spring of 1995 and a pair has been nesting on Coaches Island. Additionally, state endangered royal tern as well as a state threatened least tern were identified in 2001 on Poplar Island, and noted that approximately 5 nest sites were observed for the least tern (Scarpulla 2001). Eight gull-billed terns (state threatened) were sited during quarterly monitoring studies in 1994-1995 (EA 1995 a,b,c,d). No other rare, threatened or endangered species were observed during site visits to the Poplar Island archipelago.

Recently, the USFWS and NMFS have cited shortnose sturgeon (SNS) (*Acipenser brevirostrum*), a Federally listed endangered species, as a concern within the Chesapeake Bay. USFWS also has expressed concerns about wild (as opposed to hatchery raised) Atlantic sturgeon (*Acipenser oxyrhynchus*), which has been recorded in the Bay, as a species of concern. Previous consultations on the distribution of shortnose sturgeon (federally endangered) indicated that the fish are perhaps only transient to the area (USACE 1996). In 1996, USFWS initiated a Reward Program for incidental catches of sturgeon in commercial gear. As of January 2002, no SNS have been captured in the vicinity of Poplar Island. The closest collections were one individual in a gillnet off Holland point and two individuals taken in pound nets on the western shore of Kent Island (5 and 8 miles from the site, respectively). One wild Atlantic Sturgeon was captured in commercial gillnets near Poplar Island in 2000 (MES 2000).

4.9 Shallow Water Habitat

Shallow water areas provide nursery grounds for certain fish species, hunting, and foraging opportunities for waterfowl and predatory fish, and resting areas for certain species of waterfowl. Shallow water habitat is water not more than 13 feet below mean low water depths (U.S. EPA 1997). Many wildlife species use shallow water habitats exclusively because life history requirements cannot be met in deeper portions of the Bay. These areas also provide fishing, hunting, wildlife observation, and other recreational opportunities for people. SAV requires shallow water (i.e. water δ6 feet) for successful establishment. Around Poplar Island, the photic zone is approximately 6 feet and light penetrates the entire water column. Much of the areas being considered for island expansion are 3 to 6 feet and would be considered shallow water habitat. This varies, based upon configuration and will be analyzed in Section 9.2.2.

5.0 COMMERCIAL FISHERY

The area in the vicinity of Poplar Island supports oyster harvesting, soft shell clams, blue crabs, and finfish. Poplar Island is located in Segment 4 of the Chesapeake Bay (south of the Bay Bridge to the Patuxent River).

Commercial fish landings from the Chesapeake Bay Program have been summarized for the previous six years for Segment 4 (where available) and presented in Table 5-1. Table 5-2 provides pounds and dollars for commercial fisheries but are not specific to individual Bay segments.

Table 5-1. Commercial landings of finfish and shellfish from the Chesapeake Bay: 1995-2000. Values represent total pounds reported.

Commercial Fishery	Year	CB Segment 4
Blue Crab	1995	8,038,718
	1996	6,663,188
	1997	9,278,642
	1998	6,027,585
	1999	6,629,975
Oyster	1995	65,900
	1996	109,721
	1997	67,782
	1998	279,532
	1999	267,760
	2000	49,241
Striped Bass	1995	336,155
	1996	330,424
	1997	571,399
	1998	588,501
	1999	595,716

Table 5-2. Total pounds and dollars for commercial fisheries in the Chesapeake Bay: 1995-2001

Commercial Fishery	Year	Pounds	Total Dollars
Blue Crab, Hard	1995	39,546,771	$ 34,354,160.60
	1996	35,276,956	$ 24,619,982.17
	1997	38,664,142	$ 29,547,134.10
	1998	24,446,222	$ 24,165,040.61
	1999	30,085,914	$ 26,022,596.09
	2000	18,875,234	$ 21,230,871.27
	2001	21,073,910	$ 21,757,414.46
Blue Crab, soft	1995	1,633,801	$ 4,628,190.24
	1996	1,743,627	$ 7,470,387.59
	1997	1,495,733	$ 6,864,190.96
	1998	1,231,351	$ 5,724,881.35
	1999	1,484,121	$ 7,734,516.05
	2000	1,363,638	$ 7,050,446.71
	2001	1,594,218	$ 9,077,290.39
Bluefish, unclassified	1995	28,472	$ 14,105.91
	1996	27,908	$ 8,112.67
	1997	42,239	$ 14,051.05
	1998	66,013	$ 21,261.18
	1999	92,157	$ 25,342.38
	2000	35,362	$ 7,712.80
	2001	67,179	$ 43,541.14

Commercial Fishery	Year	Pounds	Total Dollars
Clam, Soft	1995	450,093	$ 2,505,655.50
	1996	319,434	$ 1,476,412.64
	1997	252,231	$ 1,680,477.00
	1998	227,936	$ 1,532,017.10
	1999	148,161	$ 1,011,630.53
	2000	162,512	$ 975,787.12
	2001	60,723	$ 343,229.90
Drum, Black	1995	3,331	---
	1996	12,275	$ 4,594.40
	1997	35,565	$ 11,661.69
	1998	780	$ 789.15
	1999	30	$ 10.80
Drum, Red	1995	6	---
	1996	175	$ 43.75
	1997	20	$ 12.00
	1998	336	$ 252.00
	1999	344	$ 244.24
	2000	826	$ 569.94
	2001	727	$ 237.16
Eel, Common	1995	249,479	$ 562,760.23
	1996	360,162	$ 124,456.46
	1997	309,444	$ 157,340.07
	1998	256,802	$ 371,124.34
	1999	256,544	$ 385,781.41
	2000	207,168	$ 217,574.54
	2001	242,789	$ 303,256.29
Flounder, Winter	1995	3,634	$ 5,741.59
	1996	1,835	$ 3,009.20
	1997	951	$ 1,214.34
	1998	1,013	$ 729.05
	1999	1,182	$ 1,668.98
	2000	3,421	$ 8,585.99
	2001	724	$ 3,300.73
Flounder, Summer	1995	18,430	$ 35,835.90
	1996	41,071	$ 76,861.87
	1997	25,890	$ 56,265.32
	1998	34,852	$ 74,281.13
	1999	27,157	$ 59,683.96
	2000	49,989	$ 88,460.68
	2001	38,769	$ 76,175.45
Herring	1995	134,319	$ 13,801.97
	1996	134,575	$ 15,450.08
	1997	195,326	$ 31,353.68
	1998	150,098	$ 16,367.60
	1999	98,282	$ 8,121.53
	2000	141,881	$ 12,574.69
	2001	194,967	$ 42,593.14
King Mackerel and Cero	1998	60	$ 9.00

Commercial Fishery	Year	Pounds	Total Dollars
Kingfish	1996	8	---
	2000	1,500	$ 1,065.00
Mackerel, Atlantic	1995	70	---
	1996	250	$ 25.00
	1997	479	$ 239.50
	1998	136	$ 32.70
	1999	140	$ 49.00
	2000	963	$ 336.07
	2001	112	$ 31.36
Menhaden, Atl & Gf	1995	4,131,292	$ 421,647.17
	1996	3,731,672	$ 367,667.64
	1997	3,317,600	$ 322,497.97
	1998	2,777,503	$ 259,267.56
	1999	4,343,450	$ 353,361.60
	2000	3,842,897	$ 466,611.37
	2001	3,832,870	$ 291,582.16
Spanish Mackerel	1995	1,806	$ 1,033.30
	1996	1,275	$ 610.10
	1997	2,211	$ 1,994.81
	1998	8,665	$ 9,833.80
	1999	17,137	$ 17,117.70
	2000	23,266	$ 24,456.61
	2001	17,713	$ 17,782.37
Spot	1995	110,204	$ 46,591.44
	1996	63,896	$ 35,890.62
	1997	65,846	$ 39,586.86
	1998	126,982	$ 53,767.82
	1999	80,425	$ 36,665.38
	2000	98,018	$ 48,278.21
	2001	152,017	$ 80,702.08
Striped Bass	1995	1,194,447	$ 1,823,526.88
	1996	1,487,655	$ 2,400,051.61
	1997	2,118,759	$ 2,922,060.15
	1998	2,426,500	$ 3,165,592.50
	1999	2,274,781	$ 3,558,495.57
	2000	2,261,284	$ 3,457,230.97
	2001	1,660,205	$ 2,767,276.56
White Perch	1995	1,200,233	$ 929,785.80
	1996	1,514,044	$ 906,317.50
	1997	2,133,715	$ 930,875.55
	1998	1,390,031	$ 858,986.31
	1999	1,518,643	$ 759,211.82
	2000	1,863,362	$ 901,459.27
	2001	1,884,643	$ 805,704.69

Commercial Fishery	Year	Pounds	Total Dollars
Yellow Perch	1995	83,394	$ 67,234.87
	1996	55,961	$ 40,937.54
	1997	104,861	$ 147,202.09
	1998	135,986	$ 186,012.59
	1999	203,057	$ 343,588.45
	2000	103,726	$ 172,882.05
	2001	127,230	$ 219,044.72
Oysters	1995	1,300,195	$ 3,536,224.97
	1996	843,364	$ 2,733,524.99
	1997	1,504,714	$ 4,704,580.87
	1998	2,451,115	$ 7,592,196.45
	1999	2,429,928	$ 6,888,274.30
	2000	2,355,938	$ 7,153,952.66
	2001	641,070	$ 1,931,497.86

5.1 Oysters

Poplar Island is adjacent to three oyster bars, officially designated as natural oyster bar (NOB) 8-10 (west) and NOB 8-11 and NOB 11-3 (east). In addition, NOB 11-2 lies within 0.5 mile to the south (Figure 5-1). None of these bars is known to be naturally productive (pers. Comm. Kelly Greenhawk, MdDNR, 2002). Oyster harvest data are not recorded for individual bars but by Bay segment. Commercial harvesting of oysters has generally declined since 1962 in most reaches of the Bay. Segment 4 commercial landing numbers were 6.4 million in 1970 and 21,000 in 1993. However, in parts of Segment 4, commercial harvests increased slightly in 1998 and 1999 (Table 5-1).

5.2 Soft Shell Clams and Razor Clams

The soft-shell clam, *Mya arenaria*, represents a significant fishery in the middle, or mesohaline portion of the Chesapeake Bay. It is found in relatively shallow water, in various soft substrates, but more prominently in sandy areas. Previous studies in the vicinity of Poplar Island indicated that soft clamming was among the most important commercial harvests for Talbot County but that densities may be somewhat depressed in the immediate area of the site (USACE 1996). Table 5-2 indicates that soft clam harvests have fallen steadily within the Bay since 1995. Clamming is not permitted within the boundaries of Natural Oyster Bars so harvesting immediately adjacent to some parts of Poplar Island would not be possible.

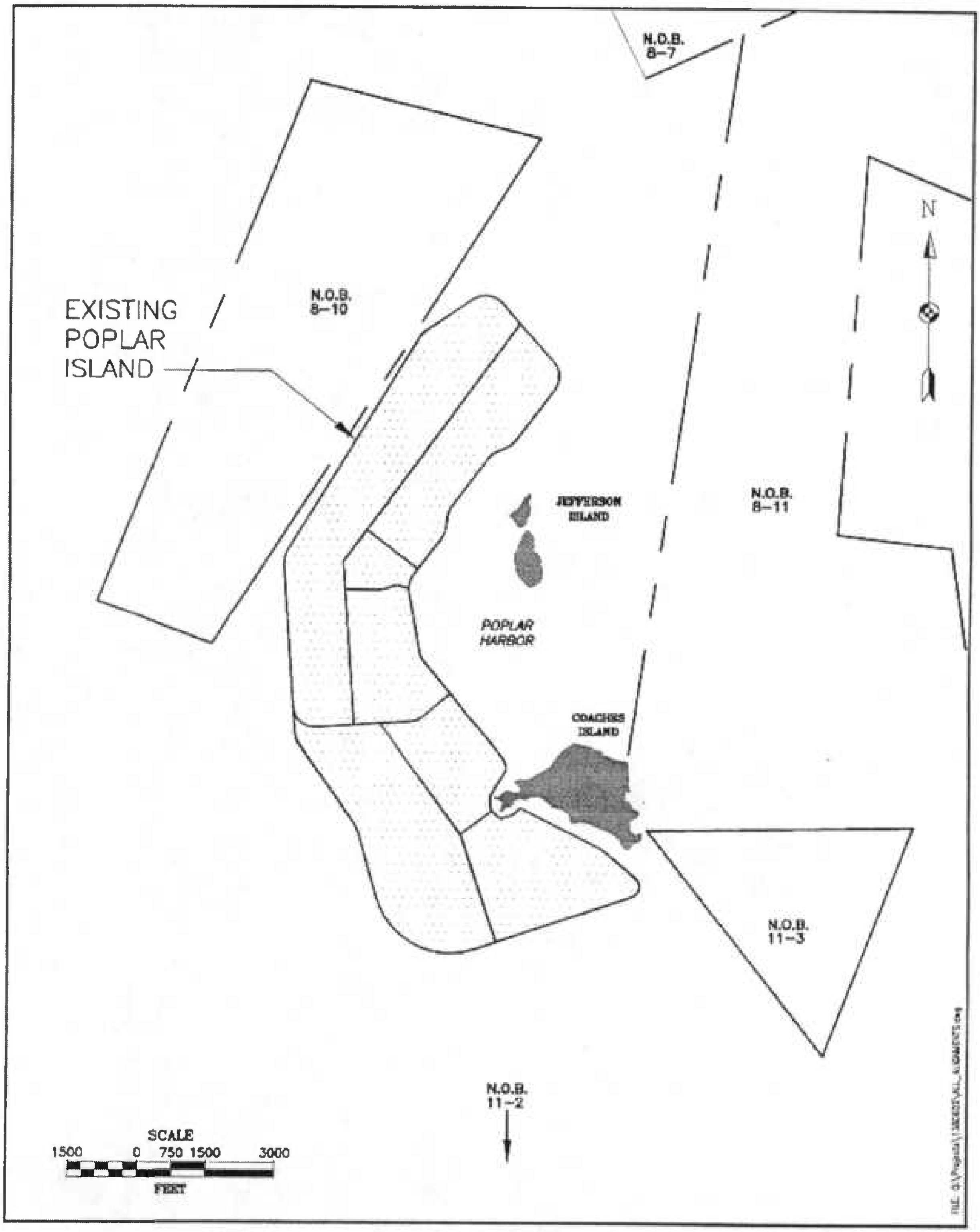


Figure 5-1. OYSTER BAR IN THE VICINITY OF POPLAR ISLAND, MD

Previous investigations of the island (prior to reconstruction) indicated that several areas were very productive for harvesting razor clams (*Ensis* spp.). Local watermen identified a large area immediately south of Coaches Island and another to the north/northeast of Jefferson Island as important razor clam harvesting areas (USACE 1996). Razor clams support a bait fishery and are not harvested for human consumption.

5.3 Blue Crabs

The blue crab supports one of the dominant commercial fisheries in the middle reaches of the Chesapeake Bay. Blue crab landings for Segment 4 are displayed in Table 5-1 and represent the highest landings by pound of any commercial species. Hard crabs are harvested primarily by crab pots (traps) in the vicinity of Poplar Island. For the period report (1995 to 1999), landed pounds peaked in 1997 (9,278,642) but have fallen off somewhat Bay-wide. Commercial crabbing occurs regularly in the waters surrounding the Poplar Island archipelago.

Blue Crabs overwinter throughout the Chesapeake Bay, although the majority of crabs overwintering in Maryland waters are males and juveniles. The MDNR has been estimating overwintering crab densities in various areas of the Bay since 1990. In the Upper Bay (area of lower salinity), depths greater than 40 feet tend to be the most significant overwintering areas. In the middle reach of the Maryland waters of the Bay (Bay Bridge to the Poplar Island), areas shallower than 40 feet can be important for overwintering.

The range in depth at Poplar Island is -6 to -10 ft (-1.8 to -3 m). During 1992 – 2000, crab densities in the mid-Bay (from the Bay Bridge to Poplar Island) during the winter, at depths <40 feet, ranged from 2.46 (2000) to 20.11 (1996) crabs/1000 m^2. In addition, from 1992 – 2000, the crabs captured, at depths <40 feet, comprised 0.70% (1998) to 3.28% (1992) of all crabs captured Baywide during the study. This represents 0.23×10^{-5}% to 0.88×10^{-5}% of the average estimated Baywide blue crab population during 1991-1997.

5.4 Finfish

Of the finfish commercially harvested in the Chesapeake Bay, only striped bass landings are summarized by segment. Striped bass landings in this segment have increased steadily since 1999 reflecting the overall recovery of the population. Population trends and annual recruitment of this species have been sufficiently robust to support both commercial harvests and growing sport-fishing pressure.

Of the species that are managed (tracked) on a Bay-wide basis, Atlantic menhaden is clearly the dominant finfish in terms of pounds landed annually. White perch constitute the second most significant fishery with Atlantic croaker landings being equally significant in some years (Table 5-1). The majority of white perch and striped bass are captured in gill nets, with fewer caught in pound nets, fyke nets, or by hook and line. The menhaden fishery is solely a pound-net fishery and is among the most significant fishing activity in the vicinity of Poplar Island. There are several licensed pound nets in the vicinity of Poplar Island and some are still actively fished. During previous investigations of the water around Poplar Island, menhaden dominated the gillnet collections in the spring and summer (EA 1995c-d). Striped bass and Atlantic croaker also contributed significantly to the summer collections (EA 1995d).

6.0 RECREATIONAL RESOURCES

The Poplar Island region of the Chesapeake Bay supports a wide variety of recreational activities, including: fishing, hunting, power and sail boating, bird watching, and sightseeing. The Bay is the focal point of these activities, which, in turn, support a significant tourist industry. As a result, the state of Maryland places a high value upon this resource and supports its aesthetic appeal by the general public (EA/MES 1996).

Poplar Island is currently being managed as a beneficial use of dredged material placement facility and habitat restoration project. Recreational activities are restricted on the island. Jefferson and Coaches Islands are privately owned and support seasonal recreational activities, particularly hunting and fishing. The waters that surround these three islands are popular recreational fishing and crabbing areas. Tilghman Island has a large charter fishing fleet which operations during the spring through fall period. Recreational fishing is encouraged near Poplar Island and several fish habitat reefs (rock piles) have been placed along the northern shoreline to provide enhanced habitat. Recreational fishing is not restricted and occasional fishing has been observed.

Recreational boating is one of the most significant recreational activities in Talbot County and the waters around Poplar Island have traditionally supported a variety of boating activities. Some of the waters adjacent to Poplar Harbor are too shallow for deep draft sailing vessels. However, the channel east of the archipelago (Poplar Island

Narrows) is a popular thoroughfare for both power and sailing vessels traveling between Knapps Narrows/Choptank River and Kent Island/Eastern Bay. During the winter months, sea duck hunting is a popular activity, and many licensed gunning rigs operate in the area.

Poplar Island was once a well-known bird rookery where herons, egrets, cormorants, and other species utilize the remnant islands during nesting season, especially during spring and fall migration periods. Currently, most bird-watching activity is centered around Coaches and Jefferson Islands, although bird utilization of the placement cells at Poplar Island is increasing as construction activities are diminishing.

7.0 HISTORICAL RESOURCES

Poplar Island was settled in 1632 as a result of expansion from Kent Island approximately 3 miles north. From 1637 until the 18th century it was a thriving plantation. In 1777, the island was raided by the British, who took all the livestock and burned every residence. Poplar Island figured prominently in both the Revolutionary War and the War of 1812, the British Navy took possession of the island as a rendezvous point. From the early 1800's, Poplar Island supported agricultural production. By 1820, it had a population of 60 residents, and several stores and a school had been established to serve this resident population. By 1870, Poplar Island was beginning to suffer from the serious effects of erosion that would continuously diminish its landmass. By WWI, the small Poplar Island village of Valliant, with a population of 45 was the first cluster of habitation. The harsh living conditions and dwindling amount of arable land forced the last permanent resident from the island in 1929 (MES 1994).

After the last full-time resident left Poplar Island, it became home to several small hunting shacks and, in the late 1930s, was the vacation home of Presidents Roosevelt and Truman. The presidential retreat house burned in 1946, and the island again supported only small hunting cabins. A 1952 aerial survey indicated that Poplar Island had been reduced to 115 acres. This was just over 11 percent of the 1640 land area, estimated at over 1,000 acres. Currently two part-time residences, one on Jefferson Island and one on Coaches Island, persist despite continued erosion (MES 1994).

Evaluations of historical resources of the remnant islands and Coaches Island prior to restoration activities indicated that South Poplar and Coaches Island had no historic resources following an investigation. North Point Island contained relatively few historic resources including period artifacts that had been buried. South Central Poplar Island contained historic post holes and period artifacts including ceramics, glass, and brick remnants. Middle Poplar Island contained the most historic resources among the island groups. Investigations revealed unreported historic sites that included a well shaft and hand pump as well as portions of its surrounding brick architecture. Additionally historic artifacts were observed that included glassware, Tableware, and a brick floor (Goodwin and Associates 1994).

Since 1995, the remnant islands have been enclosed within the dikes of the dredged material placement cells, and the bottom around the placement cells has been disturbed for dike construction. Since the area is already disturbed, Poplar and the areas immediately adjacent would be of little-to-no archaeological value. The Phase I investigations conducted in 1995 covered some of the areas currently proposed for expansion without yielding any objects of significance. Formal consultations with the Maryland Historic Trust (MHT) would need to occur during feasibility investigations (if conducted) regarding any proposed option.

8.0 OTHER

8.1 Ground Water

In Maryland, the predominant aquifer systems (from shallowest to deepest) are the Chesapeake (eastern shore only), the Aquia group (including the Aquia and Piney Point-Nanjemoy subaquifers), the Severn-Magothy, and Potomac Group (including the Patapsco and Patuxent subaquifers). Confining layers, usually of clay or fine sand separates these aquifers. Kent Island and surrounding parts of Queen Anne's and Talbot counties rely on the Aquia Aquifer as the main drinking water source.

The Aquia Aquifer is the source groundwater for Poplar Island (pers. Comm. Brian Walls, USACE, 2002) and generally subcrops (is exposed below the water surface) beneath a thin veneer of Pleistocene sediments, and crops out as bluffs along the banks of rivers and creeks. It also subcrops beneath the Chesapeake Bay and the mouth of the Chester River where a paleochannel truncates the Aquia either partially or completely. The subcrop area trends southward down the Bay along the entire extent of Kent Island.

In some places, the upper confining bed is absent and the Aquia Aquifer subcrops, or there is direct contact between the Aquia and the overlying unconfined aquifer known as the Piney Point Aquifer (the other major aquifer of the group). In the deeper areas (i.e., the old paleochannel), the Aquia Aquifer is in contact with highly permeable channel deposits, which are overlain by fine-grained deposits rich in organic material. According to Drummond (1988), the fine-grained, lower permeability Bay-bottom sediments, which in places separate the Aquia from the Chesapeake Bay, are also part of the upper confining bed.

The facilities at Poplar Island are serviced by a well located below the longitudinal dike between Cell 3, 5 and 6. Its major utilization is for public utility use (drinking water) with a small proportion allocated to an agricultural test cell that is being irrigated with a drip system (2-3 gallons/minute for 2 hours/day) (pers. Comm. Jeff Methias, MES, 2002).

The Aquia Aquifer serves as the primary drinking water source for Kent Island and adjacent areas of Kent, Queen Anne's, and Talbot Counties. A steady decline in the elevation of the Aquia Aquifer by several meters from the mid-1950s to 1984 has occurred, and high chloride concentrations in wells screened in the aquifer near the Chesapeake Bay have been recorded. A number of factors make the Aquia Aquifer susceptible to brackish-water intrusion: the aquifer is shallow in the vicinity of the Chesapeake Bay, incised paleochannels have disrupted the existing impermeable confining layers, and high pumping rates for drinking water have caused recharge of the aquifer from the Bay. Because of the increasing demand placed on this aquifer, MGS initiated an investigation to provide a better understanding of the hydrogeologic system (Drummond 1988).

Water-level changes over time show the response of an aquifer system to various influences (e.g., pumpage from wells, droughts, and rainfall). Seasonal water-level changes in wells screened on Kent Island indicate that the seasonal trend is probably caused by seasonal fluctuations in evapotranspiration and precipitation. The correlation of water levels with evapotranspiration and precipitation suggests that the Aquia Aquifer is recharged locally, at least in part, and that there is a hydraulic connection with the overlying unconfined Piney Point Aquifer.

8.2 Aesthetics and Noise

Currently sound sources in the area come from predominantly natural sources (waves, wind, and birds/wildlife) and daily operation of Phase I of the placement facility. Other anthropogenic sound sources include commercial and recreational boats, and noise from construction equipment located on the island for the completion of Phase II. Most of the construction noise has ceased with the completion of Phase II construction, although minor noises from earth moving equipment will continue through filling and management activities.

As a result of the variety of recreational activities in the Poplar Island area, there is a high value placed upon aesthetic resources. Many areas of Talbot County have little or low-density shoreline development. The viewshed around the Poplar Island archipelago is currently a combination of typical remote undeveloped Chesapeake Bay shoreline (Coaches and Jefferson Islands) and the riprapped dikes of Poplar Island. There are dwellings on both Jefferson and Coaches Islands (EA/MES 1999). Aside from these, the nearest dwellings are approximately 1-2 miles away on Green Marsh and Lowes Points.

8.3 CERCLA Liability

Preliminary evaluations of Poplar and the proposed concept areas have indicated that no hazardous, toxic or radioactive substances exist within the project area. Therefore, no liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) would be associated with the site.

8.4 Critical Habitat

Poplar Island and the proposed expansion areas do not have any designated critical habitat areas identified within the footprints according to 50 CFR or COMAR (08.19.01.03). Critical habitat areas include those set aside to protect and maintain endangered species to promote the long-term survival of the species that is considered critical under Natural Resources Article, §4-2A-06 or 10-2A-06, Annotated Code of Maryland.

8.5 Navigation

Neither Poplar Island nor any of the proposed expansion areas lie within or adjacent to any federal navigation projects. Poplar Island is approximately 2 nautical miles from the main shipping channels of the Chesapeake Bay (MES 1994). Use of the site for the placement of dredged material would support maintenance of regional navigation projects.

8.6 Hazmat: Unexploded Ordnance (UXO)

Unexploded ordnance (UXO) consists of any munitions, weapon delivery system, or ordnance items that may contain explosives, propellants, and/or chemical agents and that are armed or remain unexploded. All UXO present a potential hazard and can appear intact, in parts or in fragments. All shapes, size, and types of explosive ordnance may have been used in the Chesapeake Bay region, and may potentially be encountered during the dredging of channels and anchorages. Small UXO, including hand grenades and projectiles have been occasionally deposited by hydraulic placement at containment facilities. 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. Approximately nine hand grenades were discovered near the inflow last January and again in May of 2002 (pers. Comm. Richard Bailey, MES, 2002). A total of 63 UXO were found in the south end of Cell 2, while excavating oyster shell from the inflow point. These UXO were deposited there sometime during the previous dredging project (pers. Comm. Karen Cushman, MES, 2002b).

9.0 POTENTIAL IMPACTS

The restoration of Poplar Island has been assessed in various documents that describe the feasibility of using dredged material beneficially for wetland and upland habitats. This study focuses on the evaluation of various footprints for possible site expansion that will eventually support the goals of private, state, and federal agencies involved in this project.

Six configurations have been provided as options for expanding Poplar Island and include varying wetland/upland configurations (Section 1). Habitat restoration for Options 1, 2, 3, and 5 include equal acreage for upland and wetland cells (374-375 acres each), for a total footprint of 797-812 acres. Option 4 offers outward expansion of the island with an additional 188 acres each of wetland and upland habitats for a total of 1199 acres. Option 6 along the northern end of Poplar Island, would constitute the smallest expansion area (333 acres) but would include coastal structure and be placed to reduce erosional forces occurring within Poplar Harbor. Jefferson Island would fall into the shadow of the proposed expansion and could experience reduced physical energy.

The potential impacts of these proposed expansion configurations are detailed in the following sections. Where possible, differences among the various alignments are compared among the options.

9.1 Water and Sediment Quality

Water quality (particularly turbidity and suspended solids) will likely be affected in the short term from the construction activities around Poplar Island and placement of dredged material. However, a study conducted in 1994 evaluated the beneficial uses of dredged material and suggested that while water quality would be reduced (i.e. increases in turbidity) during the reconstruction of the footprint, the goal in preventing further erosion with the use of elevated dike structures would subsequently reduce sediment loadings into the Chesapeake Bay (Andrews, Miller & Assoc., Inc. 1994). In addition, turbidity monitoring during Phase I and Phase II construction indicated that turbidity never exceeded the monthly average or daily maximum levels within the mixing zone established by Maryland Department of the Environment.

Effects from placement of dredged material could occur as ponded water is discharged during placement, and during dewatering of the dredged material, which allows dredged material to consolidate. These effects would be expected to include discharge of water with some suspended solids content, or turbidity, and the discharge water would be expected to contain elevated concentrations of nitrogen, compared to background waters. This is a short-term condition also, only lasting during the inflow period each year. Monitoring would be conducted during discharge, and long term monitoring would be anticipated to verify no long-term negative effects.

Sediment quality of the dredged material is expected to be good. Beneficial uses of dredged material require good quality sediments for implementation. Only material from east of the North Point-Rock Point line would be suitable for placement at Poplar Island, so negative impacts due to sediment quality are not anticipated.

The dredged material that is placed within the site would be of a different grain-size than the existing sediments within the concept area. To the extent that substrates are excavated as borrow material for dike construction, the material would be replaced with dredged material during filling. However, all sediments used would be suitable for habitat restoration and marsh and upland habitat creation.

It is not anticipated that any one option (alignment) would be significantly different in terms of potential impacts to water or sediment quality. It is expected that Alignment #6 would provide added protection to Poplar Harbor and Jefferson Island from wind-driven waves from the north-northeast. This is expected to reduce erosion of Jefferson Island and turbidity within Poplar Harbor.

9.2 Biological Resources

9.2.1 Benthic community

Any benthos within the project area at the time of construction would be lost. Fish and mobile invertebrates (e.g. blue crabs) are expected to be able to avoid the area during construction but any trapped within the dike would also be lost. If construction occurs during the winter, any blue crabs overwintering within the 333 to 1199 acres footprint (affected area) would be lost.

Because alignments 1,2,3, & 5 are of nearly equal size, overall impacts to the benthic community are expected to be similar among these options. Alignment #4, with the largest footprint, would impact the largest area of Bay bottom and the benthic community. Alignment #6 constitutes less than half of the area of the next largest Alignments and would affect this resource the least.

Most stations sampled in October 2001 demonstrated high overall abundances but relatively low B-IBI scores (Section 4, Appendix A). Only PIM-006 and PIM-007 meet the Chesapeake Bay restoration goals. These stations are located south of Phase I/II and within or adjacent to the proposed expansion cells for Options 1-5. Expansion in that direction could have a greater affect on a high quality benthic community than Option 6.

9.2.2 SAV and Shallow Water Habitat

Because the waters surrounding Poplar Island are generally less than 6 feet in most areas, expansion of Poplar Island will affect from 333 to approximately 1,100 acres of shallow water habitat (SWH), depending upon the option. In this area, SWH also corresponds to the Tier I and Tier II SAV recovery areas. The cell to the southwest in options 1-4 lies in the deepest water and would not constitute SWH. SWH will be converted to marsh and upland habitats. The quality and function of the existing SWH is marginal for some recreationally important species because of the lack of cover features (and is exacerbated by the currently low density of SAV). Because of the significant difference in acreages among the options, there will be a significant difference is affect to SWH among the options. Option 4 would impact the largest amount of bottom and thus the greatest amount of SWH. Conversely, Option 6 would convert the least amount of Bay bottom (and SWH).

The construction and subsequent placement of dredged material will not affect current densities of SAV because all occurrences lie outside of the proposed Option footprints. Most options are expected to contribute significantly to further protection of Tier I and Tier II SAV habitat by providing protection from wind-driven waves from the west-northwest. Options 6 would specifically protect Poplar Harbor and the current SAV and Tier I/II habitat from wind and waves from the northeast.

9.2.3 Licensed Oyster Bars/Designated Beds/Fossil Shell Areas

No fossil shell resources are known to occur within any of the proposed expansion Options, so no impacts to this resource are expected. All option alignments have been designed to specifically avoid all charted oyster bars adjacent to Poplar Island. Options 1-4 include cells that would lie adjacent to NOB 8-10 and some temporary disturbances of the bottom adjacent to the bar can be expected as a result of construction activities if any of these options are constructed.

No other designated shellfish areas lie within any of the options. Previous investigations (USACE 1996) have indicated that soft clams are harvested from an area just north of Jefferson Island, which would partially lie within the area proposed for Option 6. Similarly, razor clam harvest areas were identified south of Coaches Island in an area that would generally lie within the southern expansion cells of Options 1-5. Of these, Option 2 would impact the smallest razor clam area. Viability and current use of this area must be confirmed with MDNR in order to confirm any impacts to these shellfisheries.

9.2.4 Rare, Threatened, and Endangered Species

No bald eagles or osprey were nesting on the Island during site visits and no evidence of an eagle's nest was found. However, since state listed species (royal tern, least tern, and gull billed tern) were sighted on Poplar Island in 1994-95 and 2001, and additional nesting sites were identified for the least tern, it is possible that expansion of the site will temporarily displace some RTE species (Scarpulla 2001 and EA 1995a,b,c,d). No one option is expected to constitute a significantly larger potential disturbance than any other option because all of the current RTE that have been observed are utilizing the site during normal site operations and during Phase II construction. It is expected that the expansion areas would ultimately provide additional habitat for RTE avian species. Further consultations with USFWS and MDNR about the status of listed avifauna in the vicinity of the proposed project would need to continue through the construction phases of study.

SNS are expected to be transient to Poplar Island. However, further consultations with NMFS and USFWS about the status of SNS in the vicinity of any proposed expansion would need to continue through the feasibility phases of study, if undertaken.

9.2.5 Wetlands

None of the proposed expansion areas for Poplar Island lie within or are expected to impact existing wetland areas on Poplar, Jeffersons, or Coaches Islands. The proposed expansion options for Poplar Island would increase the total wetlands areas from 157 acres (Option 6) to 564 acres (Option 4).

9.2.6 Avian and Terrestrial Species and Habitat (Heron rookeries, water and shore bird habitat)

Terrestrial resources on Poplar, Jeffersons, or Coaches Islands would be largely unaffected by construction of the placement facilities because most construction would be in the water. Some disturbance of birds currently utilizing the islands may occur during construction, but would be short term. Bird observations made during construction of Phase I and Phase II indicated that avifauna became acclimated to construction and operations activities very quickly. It is expected that any expansion of Poplar Island would add additional terrestrial habitats that will support avian feeding and nesting/rookery needs. The largest option (Option 4) would have the greatest potential to enhance this resource. However, Option 6 may incorporate a breakwater/sand beach complex that could provide nesting areas for beach-nesting birds (e.g. terns, black skimmers) as well as diamondback terrapins.

9.3 Commercial Fishery

Any commercial harvesting that currently takes place within the expansion areas would be permanently displaced by marsh and upland construction. Crabbing occurs within the proposed configuration areas and the project will impact crabbing activities in these areas adjacent to the Island until the dredged material placement project is completed. It is expected that the Options with proposed expansion to the south would potentially impact commercial finfish harvesting more than Option 6 because pound-net harvesting is known to occur south of Coaches Island. However, previous studies have indicated that crabbing may be more prevalent north of Jefferson Island and Option 1 is the only Option not proposed to expand into that area.

Oyster harvesting does not occur within any of the proposed expansion areas because all options were designed specifically to avoid oyster beds. Soft clamming activity adjacent to Poplar is minimal at present due to ongoing construction activities and relatively low densities immediately adjacent to the island. The extent of commercial utilization will need to be confirmed during the next phase of study (if undertaken).

9.3.1 Essential Fish Habitat

Coordination with NMFS on EFH for other regional projects has indicated that Poplar Island lies within the general reach of EFH for nine species: windowpane flounder, bluefish, summer flounder, Spanish mackerel, king mackerel, cobia, red drum, Atlantic butterfish, and black sea bass (Section 4.1). Of these, windowpane flounder (juveniles and adults), bluefish (juveniles and adults), summer flounder (juveniles, adults, and larvae), Spanish and king mackerel (juveniles, adults, larvae, and eggs), cobia (juveniles, adults, larvae, and eggs), red drum (juveniles, adults, larvae, and eggs), black sea bass (juveniles and adults) and Atlantic butterfish (juveniles, adults, larvae, and eggs) are of potential concern in the mainstem of the Chesapeake Bay. However, consultations with NMFS have indicated that bluefish and summer flounder would be the species of particular concern at Poplar Island (pers. Comm., John Nichols, NMFS, 2002).

Summer flounder are known to occur near Poplar but this is near the upper limit of their natural range within the Bay. Cobia, Spanish mackerel, king mackerel, red drum, and windowpane are more common in the southern part of the Bay, off the western shore of Virginia, and are more oriented to an oceanic environment and salinity range. Cobia, windowpane, and Spanish mackerel do occur in mesohaline portions of the Bay occasionally, but generally as older juveniles or adults in warmer months. Red drum generally occurs in mesohaline reaches of the Bay as juveniles. No impacts to spawning, egg, or larval habitat of the bluefish are projected because spawning does not occur in the Chesapeake Bay, and the eggs and larvae do not occur near Poplar Island, rather spawning and larval development occur in the ocean. In the Maryland and Virginia area, peak spawning occurs in July in the Atlantic Ocean over the outer continental shelf (Murdy 1997). Juveniles and adults generally occur in the Bay from May to October, although adults in spawning condition would remain offshore during spawning season (summer).

Bluefish were collected during summer sampling events in 1995 (EA 1995c) and continue to support commercial landings (Table 5-1 Bluefish do not begin their migration into the mesohaline reaches of the Bay until May in most years. Adults are not typically bottom feeders and are strong swimmers that can easily avoid turbid conditions. Juveniles prefer shallower waters but are expected to be able to avoid dredging and construction activities. Any adults or young that may be in the area during construction would be displaced.

Adult summer flounder overwinter in the ocean and only enter the Bay in late spring. Larvae and young juveniles migrate into the Bay in October and prefer shallower waters; they typically overwinter and grow in the southern portion of the Bay. Older juveniles are generally distributed inshore and in estuarine areas throughout their range during the spring, summer, and fall. During colder months they move into deeper (oceanic) waters and can be found offshore with adults.

Summer flounder were collected in summer surveys near Poplar Island in 1994 (EA 1995c) and have supported commercial landings in since 1962 (Table 5-1). No impacts to spawning or summer flounder eggs are projected because spawning occurs during the offshore ocean migration (from late summer to mid-winter), and the early lifestages do not occur in the vicinity of the proposed project. Adults are obligate bottom feeders and but are also strong swimmers that should be able to avoid the construction areas. Juveniles prefer shallower waters and may be less able to avoid dredging and construction activities. Some impacts to this lifestage are possible due to construction.

The migratory pattern of windowpane flounder is similar to many other migrating fish species, which enter the Bay in the spring and summer as juveniles and adults and leave with the onset of winter. The windowpane flounder is an identified as food fish during portions of the year and is caught from March until November (although most are too small to be commercially valuable). Windowpane spawning occurs from April through December in the Mid-Atlantic Bight over the continental shelf, but peaks in May and October off Maryland and Virginia. Egg, larval, and the early juvenile forms occur in the ocean. Windowpane flounder prefer sandy substrate and are frequently seen near shores, partly buried in the sand. Windowpane do not typically occur north of Bloodsworth Island at the Maryland-Virginia border (pers. Comm., John Nichols, NMFS, 2002) and no impacts are expected to this species.

Cobia is a larger fish (up to 100 lbs.) that can often be found around bottom structures such as pilings and wrecks. It is predominantly an oceanic species that utilizes the higher salinity reaches of the Bay as nursery habitat. Juveniles and adults are found occasionally in mesohaline reaches of the Bay, particularly in summer and early fall. Spawning occurs from mid-June to mid-August near the Bay mouth or just offshore and larvae are predominantly an oceanic species. Adults enter the Bay in late May and out-migrate in mid-October. Since the species mainly occurs in the southern part of the Bay, the potential for project impacts to any life stage is minimal.

Red drum is one of the larger species of drum fish, weighing up to 83 lbs. They are bottom-feeding fish, with the young preferring grassy (SAV) or mud bottoms. Adults are also found over oyster reefs. Red drum spawn in late summer and fall. During this period they migrate out of estuaries and lagoons and move into deeper water near the mouths of bays and inlets to spawn. Along the Atlantic Coast, spawning occurs in the nearshore coastal waters from late summer through fall, with the young of the year appearing in the Bay from August through September. This species is found as far north in the Bay as the Patuxent and Choptank Rivers and is rare in the proposed project area.

King mackerel occur all along the Atlantic seaboard and are regularly off the coast of Virginia and North Carolina and not usually found in the Chesapeake Bay. King mackerel is primarily open water schooling fish. They are a coastal migratory species and which are generally found in the northern part of their range in summer and in south Florida in winter. Spawning occurs over the middle and outer portions of the Atlantic continental shelf from July through September. All lifestages are predominantly oceanic although adults would enter the mouths of estuaries to forage in higher salinity reaches. Since no life stages of this species have ever been reported near the project area no impacts to this species are expected.

Spanish mackerel range from the Gulf of Maine to the Yucatan Peninsula and are most abundant from the mouth of the Chesapeake Bay region to south Florida. They seasonally migrate along the Atlantic coast to the Gulf of Mexico. Spanish mackerel prefer polyhaline regions (18-30 ppt) but can also be found in mesohaline (5-18 ppt) waters. Spanish mackerel occurs in the Bay when water temperatures near the Bay mouth exceed about 17°C and become abundant at about 20°C (Chittenden et al. 1993). Spawning occurs in the higher saline waters near the mouth of the Bay from late spring through late summer (Murdy, 1997). Larvae occur in inland waters of higher salinity and juveniles also utilize nearshore coastal waters. Spanish mackerel adults have been known to occur north of the bay bridge in years when salinities within the Bay are high they are highly transient and occurrences in the vicinity of the site would be incidental (pers. Comm. John Nichols, NMFS, 2002). Because these fish are strong swimmers, they should be able to avoid construction activities and no impacts are expected.

Black Sea bass spawn over the continental shelf from May through October within the Mid-Atlantic Bight. Larvae are generally found in offshore waters and marine portions of estuaries. Larvae become demersal and later life stages are generally associated with structured habitat (e.g. wrecks, sponge beds, rocks). This is generally an offshore species although juveniles and adults can be found inshore in waters with salinities greater than 18 ppt in warmer months (May through October). In Chesapeake Bay, this species is generally not found in Maryland waters (pers. Comm. John Nichols, NMFS, 2002).

Atlantic butterfish spawn offshore over the Continental Shelf or in the marine portions of estuaries from Maine to the Carolinas in late spring. This is a pelagic species that prefers areas of deeper water and larval, juvenile, and adult lifestages generally occur in waters greater than 30 ft. Therefore, this species is most common offshore and only utilizes the deeper, saltier reaches of estuaries. In Chesapeake Bay, Atlantic butterfish generally do not occur within Maryland waters (pers. Comm. John Nichols, NMFS, 2002).

All nine species of concern are predatory fish and predominantly sight feeders. Summer flounder are obligate bottom feeders that prey on a variety of shrimp, small fish, and other benthic invertebrates. Red drum are also bottom feeders and have similar prey preferences but also prey on crabs of various sizes. Black sea bass are predominantly demersal as young and adults and not as highly migratory as many of the other species of concern in this region. Of these more bottom-associated species, only summer flounder and bluefish are expected to occur near the proposed project with any regularity.

The reduction of benthic macroinvertebrate communities as a result of island expansion construction temporarily reduces the size of the biomass available for consumption by finfish. This may impact benthic-feeding finfish populations such as winter and summer flounder that may use these areas as feeding grounds in the winter and spring. While most fish experience reduced metabolism and reduced need for food in the winter, the loss of benthic organisms could result in fish being displaced to nearby areas to feed and possible increased competition for benthic food resources in other areas.

Cobia, both mackerel species, butterfish, and bluefish are strong swimmers and voracious predators that feed throughout the water column. Of this more pelagic species, bluefish are expected to occur near the project with any regularity. Smaller individuals feed on a wide variety of fishes and invertebrates and larger individuals feed almost exclusively on fishes, particularly Atlantic menhaden, bay anchovies, and Atlantic silversides. All of these prey species were found in fishing surveys adjacent to Poplar Island throughout most of the year, but were more prevalent in warmer months (EA 1995b,c). Therefore, some feeding displacement will occur as a result of this action. It is expected that demersal (bottom-dwelling) species (such as flounders) potentially would be impacted more by the proposed project than pelagic (water-column) species, but the juvenile and adult lifestages of both groups that may occur near the project are expected to leave the immediate area during construction activities. Because there is only minimal SAV occurrence at Poplar Island presently, Poplar Island is not considered a Habitat of Particular Concern (HAPC) for any of the species managed under the Magnason-Stevenson Act within the Bay at the present time (pers. Comm. John Nichols, NMFS, 2002).

9.4 Recreational Resources

Any recreational boating that does occur within the proposed Options would be permanently displaced by the action although most displacement has already occurred during Phase I and Phase II construction. The shallow depths preclude use by sailing and some power vessels. For the recreation that is occurring, Option 4 (the largest Option) is expected to impact this resource most while Option 6 (with the smallest footprint) would have the least impact. It is expected that fishing would resume around the site after construction and would ultimately be enhanced by island expansion and marsh creation. None of the other recreational activities currently enjoyed should be affected by the reconstruction, although some waterfowl hunting opportunities may be displaced temporarily during construction activities.

9.5 Historical Resources

There were no historical resources identified within any of the Poplar Island expansion areas during the Phase I and Phase II archaeological investigations of the remnant islands prior to Phase I and Phase II construction, so little potential for impact to this resource exists. This finding will have to be confirmed with MHT if further study of any option is conducted.

9.6 Other

9.6.1 Groundwater

The sediments under Poplar Island include several confining layers that are at least 30 feet thick over the nearest groundwater resources in the area, which keep the Bay and Aquia hydraulically separated. Although oxidation of sediments can cause acidification in dredged material placement sites, studies at Maryland's other island placement facility (Hart Miller Island or HMI) since 1986 have indicated that little acidification of groundwater wells is occurring. Migration of trace metals is not expected at HMI or Poplar Island because measured pH values in groundwater wells have been within neutral ranges. In conjunction with the tremendous separation between the site and the Aquia, groundwater impacts from the expansion of Poplar Island are not expected.

The current groundwater well was replaced by MES due to an historically low pump rate (5 gal/minute) and includes a new ¾ horsepower pump system located deeper in the well. The new well pump rate is 13 gal/minute sustained and is located on the longitudinal dike between Cell 3, 5 and 6. Its major utilization is for public utility use (drinking water) with a small proportion allocated to an agricultural test cell that is being irrigated with a drip system (2-3 gallons/minute for 2 hours/day) (pers. Comm. Jeff Methias, MES, 2002). This well constitutes a new consumptive water use within the Aquia Aquifer

Potential contamination of groundwater is always a concern for dredged material island placement sites. In this case the clay substrates that underlie the surficial sands should be sufficient to prevent any dissolved contaminants from leeching into groundwater sources; no impacts to this resource are expected.

9.6.2 Aesthetics and Noise

Aesthetics and noise are two public concerns during dredging and dredged material placement activities. An increase in noise and a slight increase in air emissions is projected as a result of engine exhaust from dredges and from tugs involved in dredged material placement activities (MES 1997a). There may be some noise and artificial light disturbances during construction and filling. (Lights are used during nighttime operations). However, Poplar Island is sufficiently far from most fixed receptors (dwellings) such that the only disturbances would be to the residences on Jefferson and Coaches Islands and in the area of Lowe's Wharf or those recreating near the area during construction. Jefferson and Coaches Islands are currently only occupied intermittently. The public use of the waters around Poplar Island for their recreational benefits may experience some viewshed disturbances during construction, but these would be relatively short-term. The construction of a beneficial use project would expand the footprint of the island, permanently altering the view shed. Although potential changes in viewshed are a concern, views are not considered a property right under state law.

Turbidity is expected to increase, if only for the short term, during construction and following dredged material placement for any of the proposed options.

9.6.3 CERCLA Liability

There would be no CERCLA liability. Since Poplar Island has no designated critical habitat areas there would be no affect from construction/placement activities for any of the configurations. Negative impact to navigation is expected to be minimal because so few boats can utilize the shallow waters immediately adjacent to the island. Longer-term impacts to navigation are expected to be positive because this project would provide needed dredged material placement capacity to maintain navigation channels.

9.7 Project Benefits

Project expansion is expected to have an overall positive effect on most natural resources in the area by adding more potential bird nesting habitat (uplands) and more tidal wetlands. In addition, construction of any of the options is expected to enhance the more quiescent areas east of the island and be more conducive to SAV growth. Option 6 was designed specifically for this purpose as well as to protect Poplar Harbor from further erosion. The proposed coastal structure and associate beach are expected to provide nesting habitat for horseshoe crabs, terrapins, and beach-nesting birds. Any expansion of Poplar Island would add to Maryland's dredged material placement capacity and ultimately benefit regional shipping, commerce, and navigation.

10.0 FUTURE STUDY NEEDS

Data gaps have been identified in several areas. If this site moves forward, the following studies are recommended:

- Continued monitoring of SAV in area.
- Continued coordination on SNS and other RTE species
- Continued Essential Fish Habitat Coordination with NMFS.
- Commercial harvesting near the site, particularly the currently productive and seeded areas of the NOB.
- Coordination with Maryland Historic Trust to confirm cultural/historical findings.
- Feasibility level data collection.

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APPENDIX A

Site Reconnaissance Field Report: Poplar Island, 2001

INTRODUCTION

Poplar Island (Poplar) is an island restoration project started by the United States Army Corps of Engineers Baltimore District in 1995 and was one of several islands in the Chesapeake Bay slated for reconstruction because of its severe rate of erosion and threat of being lost. Poplar is located north of Tilghman Island in the south end of the entrance to Eastern Bay, in Talbot County, Maryland. Since the reconstruction effort began in 1995, the island's approximate land area has been increased to 1,100 acres throughout two phases of construction. The second phase of construction has been completed, while phase one is now accepting clean dredged material from the Chesapeake Bay. An additional phase of construction is now being considered and labeled as Poplar Island Modification where six conceptual modifications with varying wetland and upland elements are under consideration by federal and state agencies for extending the footprint of the island reconstruction project. The six conceptual options/configurations consider extending the island's north end, the northeast end, the south end and the eastern side and a combination of these areas. A site field reconnaissance of Poplar took place on 14 November 2001 and included a survey of the existing island via a trip around the entire island by boat. During the site visit all natural resources and land uses were noted and photographs were taken and included in a photo log (Appendix B).

The recently constructed island (i.e. added dike structures around the perimeter to reduce the rate of erosion occurring on the Poplar Island archipelago) has approximately two miles of shoreline consisting of rip-rap banks. Bank elevations are approximately 8-12 feet in height. The southeastern tip of Poplar extends to Coaches Island, but does not join Coaches as it remains privately owned. A narrow canal separates Coaches Island from Poplar Island. A third island, called Jefferson Island, exists in the area known as Poplar Harbor and is also privately owned.

The current designated use of Poplar Island is for dredged material placement and will eventually be restored to natural wetland and upland habitats for resident and migrating fauna. No buildings or permanent structures exist on Poplar, however, Coaches Island has a trailer home and two small outbuildings and Jefferson Island has a house which is used as a hunting lodge by the owner. A docking site has been established on the eastern side of Poplar in Poplar Harbor, where crew boats and personnel boats access the island. Another docking area has been established at the southern end of the island where larger vessels and equipment barges dock and unload.

FIELD AND LABORATORY METHODS

Benthic samples were taken at ten stations around the existing island. Each station was assigned an identification number 001 through 010. All station location numbers contain the prefix PIM (i.e. PIM001 through PIM010) to identify them as Poplar Island Modification stations and samples. The location of each station was recorded using NAD83 projection in Maryland State Plane Coordinates using a Trimble® Pro XR with Omnistar satellite differential correction. Generally, Stations PIM001, PIM002 and PIM003 are located north of the island; Stations PIM006, PIM007, PIM008, PIM009 and PIM010 are located south of the island; Stations PIM004 and PIM005 are west of the island.

Benthic grab samples were collected using a standard size ponar, which samples an area of substrate 0.05 m^2. The ponar was deployed from a small boat at each of the ten stations a minimum of three times. Because benthic samples were collected in triplicate, it was necessary to collect three samples that were similar in volume. After each deployment of the ponar, the sample was transferred to a shallow holding bin. The three samples were then compared to determine their similarity, if each sample did not contain a similar volume of substrate material, repeat deployments were conducted until the three similar samples were obtained. The three replicate samples at each station were then washed in the field through a 500 micron sieve and placed into a 1 liter polyethylene jar. Samples were then labeled, preserved with a 10% formaldahyde solution, and at the end of the field investigation, delivered to EA's Biological Laboratory for processing.

Grain size samples were collected at all ten stations (PIM001 through PIM010). Grain size samples were collected from a separate grab sample taken at each of these five stations. Grain size samples were placed into a 120-ml pre-cleaned borosilicate glass jar, labeled and placed in an ice filled cooler until being sent to the appropriate laboratory for analysis.

Field Benthic Sampling

Triplicate grab samples were collected at 10 locations around Poplar Island using a standard 23 x 23-cm Ponar grab sampler. One additional grab was collected at each site for analysis of grain size and total organic carbon (TOC). Each replicate benthic sample was sieved in the field through a 500 micron screen to remove fine sediment particles. Individual replicates were transferred to labeled bottles and preserved in the field using buffered 10 percent formaldehyde solution stained with rose bengal.

Sediment Sampling for Grain Size and TOC

Separate sediment samples were collected for grain size and TOC analysis from each of the 10 previously identified benthic stations. The sediment samples were stored in certified clean containers and refrigerated at 4°C during storage. Samples were obtained using a standard 23 × 23-cm Ponar grab sampler. Samples were transported to Severn-Trent Laboratories–Baltimore (STL–Baltimore) in Sparks, Maryland for physical testing of the sediment for grain size distribution and TOC analysis. Grain size analyses were conducted according to American Society for Testing and Materials (ASTM) standard methods. TOC analyses were conducted according to American Public Health Association (APHA) guidelines (APHA 1992).

In Situ Water Quality Measurements

In situ water quality measurements were obtained in the field at the benthic infaunal and epibenthic sampling locations using YSI 3800 instrumentation. The *in situ* water quality measurements included temperature, pH, salinity, dissolved oxygen, and turbidity.

Sample Storage and Transport

Benthic infaunal communities were sampled at 10 locations in the vicinity of Poplar Island. Benthic samples collected during each workday were preserved in a buffered 10 percent formaldehyde solution in the field and stored in appropriate containers out of direct sunlight on the work boat. Grain size and TOC samples were stored on ice in cooled, insulated containers at 4°C on the work boat. After completion of benthic sampling, the samples were transported to EA in Sparks, Maryland, where they were logged and stored until laboratory processing. Samples were sorted and sub-sampled in EA's Biological Laboratory, then they were sent to Cove Corporation for taxonomic identification to the lowest practical taxonomic level. Grain size and TOC samples were transported to EA in Sparks, Maryland, logged and stored in a refrigeration unit (maintained at 4°C) until delivered to STL–Baltimore for processing and analysis. Before the samples were sent to the laboratories, appropriate Chain of Custody documentation was completed.

Laboratory Processing Benthic Infaunal Samples

In the laboratory, each benthic infaunal sample was washed with tap water through a 0.5-mm sieve to remove the preservative in preparation for lab processing. Due to the large number of organisms in the samples, the samples were sub-sampled. The sub-samples were placed in a shallow white pan and the organisms were separated from other sample material and placed in vials. The samples were sorted by major taxonomic groups and were submitted to Cove Corporation for identification to the lowest practical taxonomic level.

Data Analysis: Benthic Index of Biotic Integrity

Benthic invertebrates are used extensively as indicators of estuarine environmental status and trends because numerous studies have demonstrated that benthos respond predictably to many kinds of natural and anthropogenic stress (Weisberg et al. 1997). The Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) developed by Weisberg et al. (1997) was used to evaluate the benthic community. The metrics were designed to characterize the response of the benthic community to stresses. The B-IBI combines individual metrics and assigns a score to each of the metrics to describe the benthic community and to provide an assessment of benthic community condition. Methodology followed guidance provided in both Weisberg et al. (1997) and Interstate Commission on the Potomac River Basin (ICPRB) (1999).

In order to calculate the B-IBI, each station was classified by salinity and substrate type. Salinity at Poplar Island in October 2001 ranged from 14 to 18 ppt, classifying the stations as high mesohaline (≥12-18 ppt; Weisberg et al. 1997). All benthic stations had a silt/clay content of less than 40 percent (except for PIM-006), which would classify them as sand habitat (Table A-1). PIM-006 had a silt/clay content of 42.5 percent, which would classify it as mud. According to the ICPRB (1999), substrate habitat is defined as sand if the average silt/clay value is between 0 and 40 percent and as mud if greater than 40 percent. Therefore, all of the Poplar Island benthic infaunal stations were classified as high mesohaline sand, except for PIM-006, which was classified as high mesohaline mud.

Table A-1. Particle size composition of sediments collected from Poplar Island during the modification site reconnaissance.

Sample Number	Grain Size					Material Description
	% Cobble	% Gravel	% Sand	% Silt	% Clay	
Poplar-M001	0.0	0.0	97.2	1.2	1.6	Greenish-grey, poorly graded sand, little shell
Poplar-M002	0.0	0.1	97.1	1.1	1.7	Brownish-greenish-grey, poorly graded sand, little shell
Poplar-M003	0.0	0.1	96.4	1.8	1.7	Brownish-greenish-grey, poorly graded sand, trace shell
Poplar-M004	0.0	0.0	97.8	0.8	1.4	Brownish-greenish-grey, poorly graded sand, trace shell
Poplar-M005	0.0	0.0	98.2	0.6	1.2	Greenish-brown, poorly graded sand, trace shell
Poplar-M006	0.0	0.0	57.5	36.6	5.9	Brownish-grey, silty fine sand, trace clay and shell
Poplar-M007	0.0	0.1	91.4	6.0	2.5	Dark grey, poorly graded sand, trace shell
Poplar-M008	0.0	0.2	97.2	0.8	1.8	Brownish-grey, poorly graded sand, little shell
Poplar-M009	0.0	0.0	97.6	0.6	1.8	Brown and grey, poorly graded sand, trace shell
Poplar-M010	0.0	0.0	96.4	1.1	2.5	Greyish-brown, poorly graded sand, trace shell

The metrics included in the B-IBI for the high mesohaline sand and high mesohaline mud classification are as follows:

- **The Shannon-Weiner Diversity index** (H') - incorporates both the species richness and evenness of a population and was calculated as:

$$H' = -\sum_{i=1}^{S} p_i \log_e p_i \quad .$$

where, p_i is the proportion of individual belonging to the i^{th} of S species in the sample (Ludwig and Reynolds 1988).

The Shannon-Wiener index is a popular measure of community diversity for two reasons: (1) $H' = 0$ if and only if there is one species in the sample, and (2) H' becomes maximum when species are equally abundant (i.e., $p_1 = p_2 = p_3 \ldots = p_i$). Since H' is a combination of species richness and evenness, a given H' can result from various combinations of species richness and evenness. Therefore, it is impossible to interpret H' without knowing the relative importance of species richness and evenness. Values of the Shannon-Wiener index typically range from 0 to 5, with a low value representing low diversity and possibly degraded conditions. Some areas naturally exhibit low diversity characteristics because of stress exerted on the populations resulting from physical environmental conditions. The value of calculating a diversity index is that it provides a method to evaluate changes in the benthic community over time.

- **Abundance** – Total abundance was calculated as total number of organisms per square meter. This metric is included in both the high mesohaline sand and high mesohaline mud classification for the B-IBI.

- **Pollution-Indicative Taxa Abundance** – This metric was calculated as the percentage of total abundance represented by pollution-indicative taxa. This metric is included only in the high mesohaline sand classification for the B-IBI.

- **Pollution-Sensitive Taxa Abundance** – This metric was calculated as the percentage of total abundance represented by pollution-sensitive taxa. This metric is included only in the high mesohaline sand classification for the B-IBI.

- **Carnivore/Omnivore Abundance** – This metric was calculated as the percentage of total abundance represented by carnivore/omnivore taxa. This metric is included in both the high mesohaline sand and high mesohaline mud classification for the B-IBI.

Table A-2 presents the metrics and the thresholds used to score each metric of the B-IBI. The IBI approach involves scoring each metric as 5, 3, or 1, depending on whether its value at a site approximates, deviates slightly, or deviates greatly from conditions at reference sites (Weisberg et al. 1997). The final B-IBI score is derived by summing individual scores for each metric and calculating an average score (IBI value). The B-IBI is an extension of an effort to establish benthic restoration goals for the Chesapeake Bay (Weisberg et al. 1997). The Chesapeake Bay Restoration Goal Index (RGI) (Ranasinghe et al. 1994) was patterned after the same approach used to develop the Index of Biotic Integrity (IBI) for freshwater systems (Karr et al. 1986). A Chesapeake Bay RGI value of 3 represents the minimum restoration goal. RGI values of less than 3 are indicative of a stressed community. Values of three or more indicate habitats that meet or exceed the restoration goals (Ranasinghe et al. 1994).

Table A-2. Threshold values for metrics used to score the Chesapeake Bay B-IBI for Poplar Island.

Metric	Scoring Criteria for High Mesohaline Sand		
	5	3	1
Shannon-Weiner Diversity[(a)]	≥2.2	1.7-2.2	<1.7
Abundance (#/m^2)	≥1500-3000	1000-1500 or ≥3000-5000	<1000 or ≥5000
Pollution-Indicative Taxa Abundance (%)	≤10	10-25	>25
Pollution-Sensitive Taxa Abundance (%)	≥40	10-40	<10
Carnivore/Omnivore Abundance (%)	≥35	20-35	<20

Metric	Scoring Criteria for High Mesohaline Mud		
	5	3	1
Shannon-Weiner Diversity[(a)]	≥2.1	1.4-2.1	<1.4
Abundance (#/m^2)	≥1500-2500	1000-1500 or ≥2500-5000	<1000 or ≥5000
Carnivore/Omnivore Abundance (%)	≥25	10-25	<10

[(a)] Converted to log base e

Source: Weisberg et al. 1997 and ICPRB 1999

In order to calculate the B-IBI, feeding guilds and life histories of the benthic fauna were assigned to each species. Feeding guilds were derived from ICPRB (1999) and life histories were derived from Weisberg et al. (1997). A summary of the feeding guilds and life histories of the benthic fauna collected at Poplar Island is presented in Table A-3.

Table A-3. Feeding guild and life history information for benthic macroinvertebrates collected from Poplar Island, October 2001.

TAXA	FEEDING GUILD[(a)]	LIFE HISTORY[(b)]
CNIDARIA (sea anemones)		
Edwardsia elegans	Carnivore/omnivore	--
PLATYHELMINTHES (flatworms)		
Stylochus ellipticus[(d)]	Not assigned	--
Planariidae[(d)]	Not assigned	--
Turbellaria[(d)]	Not assigned	--
Turbellaria sp. A[(d)]	Not assigned	--

TAXA	FEEDING GUILD[a]	LIFE HISTORY[b]
NEMERINEA (unsegmented worms)		
Amphiporus bioculatus	Not assigned	--
Micrura leidyi	carnivore/omnivore	--
Carinoma tremaphorus	carnivore/omnivore	--
GASTROPODA (snails)		
Acteocina canaliculata	carnivore/omnivore	--
Sayella chesapeakea	carnivore/omnivore	--
Haminoea solitaria	carnivore/omnivore	--
Rictaxis punctostriatus	carnivore/omnivore	--
Epitonium rupicola	carnivore/omnivore	--
BIVALVIA (clams and mussels)		
Gemma gemma	Suspension	--
Macoma balthica	Interface	pollution-sensitive
Macoma mitchelli	Interface	--
Mulinia lateralis	Suspension	pollution-sensitive
Mya arenaria	Suspension	pollution-sensitive
Lyonsia hyalina	Interface	--
ANNELIDA (segmented worms)		
POLYCHAETA (bristle worms)		
Glycinde solitaria	Deep deposit	pollution-sensitive
Heteromastus filiformis	Carnivore/omnivore	--
Neanthes succinea	Carnivore/omnivore	--
Pectinaria gouldii	Interface	--
Eteone heteropoda	Interface	--
Eteone foliosa	Deep deposit	--
Streblospio benedicti	Deep deposit	pollution-indicative
Marenzellaria viridis	Carnivore/omnivore	pollution-sensitive
Mediomastus ambiseta	Interface	pollution-sensitive
Leitoscoloplos spp.	Interface	pollution-indicative
Spionidae	Deep deposit	--
Paraprionospio pinnata	Carnivore/omnivore	pollution-indicative
Tharyx sp. A	Interface	--
Paraonis fulgens	Deep deposit	--
Sigambra tentaculata	Carnivore/omnivore	--
OLIGOCHAETA (aquatic earthworms)		
Tubificoides spp.	deep deposit	Pollution-indicative

TAXA	FEEDING GUILD[a]	LIFE HISTORY[b]
CRUSTACEA		
AMPHIPODA (beach fleas; scuds)		
Ameroculodes spp. complex	Interface[c]	--
Microprotopus raneyi[d]	interface	--
Lepidactylus dytiscus	interface	--
ISOPODA (isopods)		
Edotea triloba[d]	Carnivore/omnivore	--
Cyathura polita	Carnivore/omnivore	pollution-sensitive
CUMACEA (cumacean shrimp)		
Cyclaspis varians	Interface	--
BRANCHIURAN (barnacles)		
Balanus improvisus[d]	Not assigned	--
MYSIDACEA (mysid shrimp)		
Americamysis almyra[d]	Not assigned	--
Americamysis bigelowi[d]	Not assigned	--
Neomysis americana[d]	Not assigned	--
INSECTA	Carnivore/omnivore	--
UROCHORDATA (tunicates)		
Ascidiacea	Not assigned	--

(a) Feeding guides taken from Ranasinghe et al. (1993) and the Interstate Commission on the Potomac River Basin (ICPRB) (1999).
(b) Life histories taken from Weisberg et al. (1997).
(c) Feeding guild for *Monoculodes* sp. was used; same family, Oedicerotidae.
(d) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999 and Ranasinghe et al. 1993).

Other Benthic Community Metrics

Four additional metrics were selected to further characterize the benthic community:

- **Total Number of Taxa** is the total number of distinct taxa. This metric reflects the health of the community through a measurement of the variety of taxa present.

- **Evenness (e)** is how the species abundances (e.g., the number of individuals, biomass, etc.) are distributed among the species (Ludwig and Reynolds 1988). Evenness is a measure of how similar the abundances of different species are. When there are similar proportions of all species, then evenness is one, but when the abundances are very dissimilar (some rare and some common species), the value increases (Geneseo 1996).

The equation for Evenness is:

$$e = \frac{\overline{H}}{\log S}$$

where: $\overline{H}$ = Shannon-Weiner Index value
S = number of species

- **Species richness (d)** is the number of species in the community dependent on the sample size (Ludwig and Reynolds 1988). The equation for Species Richness[a] Index is:

$$d = \frac{S-1}{\log N}$$

where: S = number of species
N = number of individuals

(a) This index expresses the variety of component of species diversity at each station as a ratio between the total number of species (taxa) and the total number of individuals. Basically, it removes the abundance variability among stations so that interstation comparisons are possible. This index expresses variety independent of an evenness index, which is incorporated in general indices of diversity.

- Diversity indices incorporate both species richness and evenness into a single value. **Simpson's Dominance Index (c)**, which varies from 0 to 1, gives the probability that two individuals drawn at random from a population belong to the same species (Ludwig and Reynolds 1988). The equation for Simpson's Dominance Index is:

$$c = \sum (ni / N)^2$$

where: ni = importance value for each species
N = total of importance values

Island Vegetation

Vegetation on Poplar during this survey was very sparse because of the ongoing construction and dredged placement activities.

RESULTS

Benthic Infaunal Community

A taxonomic list of the benthic macroinvertebrates collected from Poplar Island in October 2001 is presented in Table A-4. Mean densities for each benthic macroinvertebrate collected at each station is presented in Table A-5.

Table A-4. Taxonomic list of benthic macroinvertebrates collected with a ponar from Poplar Island, October 2001[a].

TAXA
CNIDARIA (sea anemones)
Edwardsia elegans (burrowing anemone)
PLATYHELMINTHES (flatworms)
Planariidae[b]
Stylochus ellipticus[b] (oyster flatworm)
Turbellaria
Turbellaria sp. A
NEMERINEA (unsegmented worms)
Amphiporus bioculatus
Micrura leidyi (red ribbon worm)
Carinoma tremaphorus
GASTROPODA (snails)
Acteocina canaliculata (barrel bubble snail)
Sayella chesapeakea
Haminoea solitaria (solitary bubble snail)
Rictaxis punctostriatus
Epitonium rupicola
BIVALVIA (clams and mussels)
Gemma gemma (gem clam)
Macoma mitchelli
Macoma balthica (baltic clam)
Mulinia lateralis (coot clam)
Lyonsia hyalina
Mya arenaria (soft-shelled clam)
ANNELIDA (segmented worms)
POLYCHAETA (bristle worms)
Glycinde solitaria (chevron worm)
Heteromastus filiformis (capitellid thread worm)
Neanthes succinea
Pectinaria gouldii (trumpet worm)
Eteone heteropoda (freckled paddle worm)
Eteone foliosa
Streblospio benedicti (barred-gilled mud worm)
Marenzellaria viridis

TAXA
Mediomastus ambiseta
Leitoscoloplos spp.
Paraprionospio pinnata (fringe-grilled mud worm)
Paraonis fulgens
Sigambra tentaculata
Tharyx sp. A
Spionidae
OLIGOCHAETA (aquatic earthworms)
Tubificoides spp.
CRUSTACEA
AMPHIPODA (beach fleas; scuds)
Ameroculodes spp. complex
Microprotopus raneyi[b]
Lepidactylus dytiscus
ISOPODA (isopods)
Edotea triloba (mounded-back isopod)[b]
Cyathura polita (slender isopod)
CUMACEA (cumacean shrimp)
Cyclaspis varians
BRANCHIURAN (barnacles)
Balanus improvisus (bay barnacle)[b]
MYSIDAE (mysid shrimp)
Neomysis americana[b] (opposum shrimp)
Americamysis almyra[b]
Americamysis bigelowi[b]
INSECTA
UROCHORDATA (tunicates)
Ascidiacea

[a]Common names taken from Chesapeake Bay Program (CBP) (1992).
[b] Species not meeting B-IBI macrofaunal criteria (ICPRB 1999 and Ranasinghe et al. 1993).

Table A-5. Mean densities (#/m2) of benthic macroinvertebrates collected with a ponar from Poplar Island, October 2001.

TAXON	STATION									
	PIM-001	**PIM-002**	**PIM-003**	**PIM-004**	**PIM-005**	**PIM-006**	**PIM-007**	**PIM-008**	**PIM-009**	**PIM-010**
CNIDARIA (sea anemones)										
Edwardsia elegans (burrowing anemone)	87.72							6.12		
PLATYHELMINTHES (flatworms)										
Planariidae [(a)]				75.48					14.28	
Stylochus ellipticus [(a)] (oyster flatworm)	87.72	26.52		20.4	14.28	61.2	6.12	34.68	6.12	
Turbellaira sp. A				40.8						
Turbellaria	55.08									
NEMERTINEA (unsegmented worms)										
Amphiporus bicalatus	6.12	81.6	61.2	34.68	6.12		6.12	46.92	55.08	34.68
Carinoma tremaphorus	6.12				142.8	20.4	6.12			
Micrura leidyi (red ribbon worm)	34.68	34.68		20.4	14.28	40.8	34.68	6.12	6.12	14.28
GASTROPODA (snails)										
Acteocina canaliculata (barrel bubble snail)	102	285.6	3284.4	299.88	116.28	7582.68	4616.52	3453.72	2645.88	469.2
Epitonium rupicola			6.12							
Gastropoda		0.3								
Haminoea solitaria (solitary bubble snail)	136.68	148.92	618.12	148.92		381.48	210.12	102	1381.08	230.52
Rictaxis punctostriatus			14.28			148.92	75.48	6.12	6.12	
Sayella chesapeakea		6.12		14.28				26.52	20.4	
BIVALVIA (clams and mussels)										
Gemma gemma (gem clam)	120141.7	138230.4	37223.88	208298.3	24847.2	142.8	177.48	14661.48	85680	162981.7
Lyonsia hyalina							40.8			
Macoma balthica (baltic clam)					6.12	157.08	14.28			
Macoma mitchelli		0.612	14.28		6.12	55.08	67.32	14.28		20.4
Mulinia lateralis (coot clam)	40.8	34.68	108.12	34.68	46.92	265.2	108.12	108.12	46.92	128.52
Mya arenaria (soft-shelled clam)				6.12						
ANNELIDA (segmented worms)										
POLYCHAETA (bristle worms)										
Eteone foliosa					20.4	6.12				

Table A-5. Mean densities (#/m2) of benthic macroinvertebrates collected with a ponar from Poplar Island, October 2001.

TAXON	STATION									
	PIM-001	**PIM-002**	**PIM-003**	**PIM-004**	**PIM-005**	**PIM-006**	**PIM-007**	**PIM-008**	**PIM-009**	**PIM-010**
Etone heteropoda (freckled paddle worm)	454.92	210.12	20.4	6.12		40.8	14.28	14.28	87.72	6.12
Glycinde solitaria (chevron worm)	67.32	218.28	265.2	55.08	20.4	938.4	687.48	250.92	102	163.2
Heteromastus filiformis (capitellid thread worm)	46.92	699.72	163.2	61.2	122.4	224.4	87.72	95.88	75.48	55.08
Leitoscoloplos spp.	14.28	14.28	6.12	6.12	20.4	6.12			6.12	
Marenzellaria viridis					6.12	6.12				
Mediomastus ambiseta						646.68	728.28	26.52	6.12	
Neanthes succinea	102	95.88		20.4		61.2	14.28			26.52
Paraonis fulgens					26.52					
Paraprionospio pinnata (fringe-grilled mud worm)						67.32	26.52			
Pectinaria gouldii (trumpet worm)	157.08	259.08	108.12	20.4		326.4	326.4	67.32	40.8	
Sigambra tentaculata						6.12				
Spionidae								6.12		
Streblospio benedicti (barred-gilled mud worm)	6.12				1.428	393.72				14.28
Tharyx sp. A							6.12			
OLIGOCHAETA (aquatic earthworms)										
Tubificoides spp.	6.12	230.52	26.52	14.28		75.48	6.12	40.8		14.28
CRUSTACEA										
AMPHIPODA (beach fleas; scuds)										
Ameroculodes spp. complex	116.28	61.2	40.8	320.28	136.68		14.28	40.8	116.28	218.28
Microprotopus raneyi [(a)]			6.12							6.12
Lepidactylus dytiscus					20.4					
BRANCHIURAN (barnacles)										
Balanus improvisus [(a)] (bay barnacle)		14.28	26.52					40.8		
CUMACEA (cumacean shrimp)										
Cyclaspis varians		6.12				6.12	6.12	6.03	6.12	
ISOPODA (isopods)										

Table A-5. Mean densities (#/m2) of benthic macroinvertebrates collected with a ponar from Poplar Island, October 2001.

TAXON	STATION									
	PIM-001	PIM-002	PIM-003	PIM-004	PIM-005	PIM-006	PIM-007	PIM-008	PIM-009	PIM-010
Edotea triloba (mounded-back isopod) [(a)]	6.12	81.6	6.12	6.12		26.52	20.4	34.68	6.12	
Cyathura polita (slender isopod)				14.28						34.68
MYSIDAE (mysid shrimp)										
Mysidae						20.4				
Neomysis americana [(a)] (opposum shrimp)	6.12		6.12	14.28			26.52			
Americamysis almyra[(a)]						14.28	6.12			
Americamysis bigelowi[(a)]						6.12				
INSECTA										
Insecta		6.12								6.12
UROCHORDATA (tunicates)										
Ascidiacea								6.12		

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI)

A summary of the benthic community metrics and scores used to calculate the B-IBI for the October 2001 collection at Poplar Island is presented in Table A-6. Abundance (total number of organisms per square meter) was high ranging from 7,338/m^2 at PIM-007 to 209,528/m^2 at PIM-004, which resulted in B-IBI scores of 1. The Shannon-Weiner Diversity values were low, ranging from 0.05 at PIM-004 to 1.5 at PIM-006. All stations received a B-IBI score of 1 for the Shannon-Weiner Diversity metric. The abundance of Pollution-Sensitive taxa varied ranging from 0.05 percent at PIM-004 to 21 percent at PIM-007, resulting in B-IBI scores of 1 at all stations except for PIM-007, which received a score of 3. The abundance of Pollution-Indicative taxa was below 1 percent for all stations resulting in all stations receiving a score of 5. The abundance of Carnivore/Omnivore varied and ranged from 0.3 percent at PIM-004 to 78.7 percent at PIM-006, resulting in scores ranging from 1 to 5.

Table A-6. Summary of benthic community metrics and scores used to calculate the B-IBI, October 2001, Poplar Island.

Metric	Metric Values									
	PIM-001	PIM-002	PIM-003	PIM-004	PIM-005	PIM-006[c]	PIM-007	PIM-008	PIM-009	PIM-010
Abundance (#/m^2)[a]	121,686	140,760	42,010	209,528	25,588	11,730	7,338	19,100	90,311	164,424
Shannon-Weiner Diversity[a][b]	0.099	0.133	0.495	0.050	0.198	1.548	1.482	0.796	0.266	0.068
Pollution-Sensitive Taxa Abundance (%)	0.1	0.2	0.9	0.05	0.3	--	21.0	2.0	0.2	0.2
Pollution-Indicative Taxa Abundance (%)	0.02	0.2	0.1	0.01	0.1	--	0.4	0.2	0.01	0.02
Carnivore/Omnivore Abundance (%)	0.8	0.7	10.0	0.3	1.2	78.7	77.0	20.2	4.7	0.6

Metric	B-IBI Scores									
	PIM-001	PIM-002	PIM-003	PIM-004	PIM-005	PIM-006[c]	PIM-007	PIM-008	PIM-009	PIM-010
Abundance (#/m^2)[a]	1	1	1	1	1	1	1	1	1	1
Shannon-Weiner Diversity[a][b]	1	1	1	1	1	3	1	1	1	1
Pollution-Sensitive Taxa Abundance (%)	1	1	1	1	1	--	3	1	1	1
Pollution –Indicative Taxa Abundance (%)	5	5	5	5	5	--	5	5	5	5
Carnivore/Omnivore Abundance (%)	1	1	1	1	1	5	5	3	1	1
B-IBI[d]	1.8	1.8	1.8	1.8	1.8	3	3	2.2	1.8	1.8

(a) Includes all species collected.
(b) Log used was log base e
(c) PIM-006 is classified as high mesohaline mud; therefore, pollution-sensitive taxa abundance and pollution-indicative taxa abundance were not included in the calculation of the B-IBI.
(d) Mean of the metric scores.

The scores for each of the metrics at each station were averaged to determine the total B-IBI for each station. Scores of 3.0 or greater are considered as meeting the Chesapeake Bay Restoration Goal. Total B-IBI scores were low (1.8 – 2.2) for all stations sampled at Poplar Island in October 2001 except for PIM-006 and PIM-007, which had total B-IBI scores of 3.0. PIM-006 and PIM-007 were the only stations sampled in October 2001 to meet the Chesapeake Bay Restoration Goal.

Benthic Community Assessment

Abundance (total number of organisms per square meter) was high at Poplar Island in the October 2001 collection. Abundance ranged from 7,338/m^2 at PIM-007 to 209,528/m^2 at PIM-004. Bivalvia and Gastropoda were the most dominant groups found at the benthic stations. The bivalves numerically dominated the community at PIM-001 (98.7 percent), PIM-002 (98.2 percent), PIM-003 (88.9 percent), PIM-004 (99.4 percent), PIM-005 (97.3 percent), PIM-008 (77.4 percent), PIM-009 (94.9 percent), and PIM-010 (99.2 percent). The dominant bivalve was the clam *Gemma gemma.* The gastropods dominated at PIM-006 (69.2 percent) and PIM-007 (66.8 percent). The dominant gastropod was the snail *Acteocina canaliculata.*

The Shannon-Weiner Diversity values were low at Poplar Island, ranging from 0.05 at PIM-004 to 1.5 at PIM-006. The abundance of pollution-sensitive taxa varied ranging from 0.05 percent at PIM-004 to 21 percent at PIM-007. The abundance of pollution-indicative taxa was below 1 percent for all stations. The abundance of carnivore/omnivore taxa also varied and ranged from 0.3 percent at PIM-004 to 78.7 percent at PIM-006.

Overall, total B-IBI scores were low (ranging from 1.8 to 2.2) for all stations sampled at Poplar Island in October 2001 except for PIM-006 and PIM-007, which had total B-IBI scores of 3.0. Scores of 3.0 or greater were considered as meeting the Chesapeake Bay Restoration Goal (Ranasinghe et al. 1994). PIM-006 and PIM-007 were the only stations sampled in October 2001 to meet the Chesapeake Bay Restoration Goal. The mean total B-IBI score for the combined Poplar Island sites was 2.1.

The low B-IBI scores may be related to a combination of factors: physical disturbance from dike construction in the vicinity of Poplar Island; below normal precipitation for the months of September and October preceding the 30, 31 October 2001 sampling event; and the predominance of one species (*Gemma gemma*) at PIM-001, PIM-002, PIM-003, PIM-004, PIM-005, PIM-008, PIM-009, and PIM-010. The National Oceanic and Atmospheric Administration (NOAA) reported that the average precipitation in the vicinity of Poplar Island in September 2001 was below normal (2.2 in.) and in October it was much below normal (0.9 in.) (NOAA 2002). September 2001 was classified as one of the 35 driest such periods on record and October 2001 was classified as one of the 10 driest such periods on record.

It is anticipated that the B-IBI values will increase over time, as the communities reestablish and stabilize. The infaunal communities at Poplar Island will continue to be monitored every other year, and B-IBI trends will be evaluated to assess the success of community reestablishment.

Other Benthic Community Metrics

Four additional metrics were calculated to further characterize the benthic community: the total number of taxa collected at each station, the Simpson's Dominance Index, Species Richness, and Evenness (Table A-7).

Table A-7. Summary of additional benthic community metrics[a], October 2001, Poplar Island.

	Station									
Metric	**PIM-001**	**PIM-002**	**PIM-003**	**PIM-004**	**PIM-005**	**PIM-006**	**PIM-007**	**PIM-008**	**PIM-009**	**PIM-010**
Total # of Taxa[b]	17	18	15	17	17	23	22	20	16	16
Simpson's Dominance Index	0.975	0.964	0.791	0.988	0.943	0.432	0.419	0.622	0.901	0.983
Species Richness	2.04	2.11	2.06	2.03	2.06	3.62	3.58	2.77	1.90	1.59
Evenness	0.03	0.04	0.17	0.02	0.07	0.46	0.45	0.25	0.09	0.02

(a) Includes all species collected.
(b) Excludes species not meeting B-IBI macrofaunal criteria

A total of 35 separate benthic taxa (only species meeting B-IBI macrofaunal criteria were included) were collected in October 2001 at Poplar Island (Table A-4). The annelids comprised the most taxa (16); bivalves (6); crustaceans (4); gastropods (4); nemerineans (3); cnidaria (1); urochordata (1); and insecta (1). The total number of taxa varied at Poplar Island, ranging from 15 taxa at PIM-003 to 23 taxa at PIM-006.

Simpson's Dominance Index values varied at Poplar Island in October 2001, ranging from 0.419 at PIM-007 to 0.988 at PIM-004 (Table A-7). Dominance values were high at PIM-001 (0.975), PIM-002 (0.964), PIM-003 (0.791), PIM-004 (0.988), PIM-005 (0.943), PIM-009 (0.901), and PIM-010 (0.983). These stations were dominated by the clam, *Gemma gemma.*

Species Richness was similar at all stations ranging from 1.59 at PIM-010 to 3.62 at PIM-006 (Table A-7). Evenness ranged from 0.02 at PIM-004 and PIM-010 to 0.46 at PIM-006.

Stations PIM-006 and PIM-007 have the highest number of total taxa, the highest species richness and evenness values, and the lowest values for dominance.

Benthic Abundance Trends

Bivalvia and gastropoda were the most dominant groups found at the benthic stations. Bivalvia dominated at PIM-001 (98.7 percent), PIM-002 (98.2 percent), PIM-003 (88.9 percent), PIM-004 (99.4 percent), PIM-005 (97.3 percent), PIM-008 (77.4 percent), PIM-009 (94.9 percent, and PIM-010 (99.2 percent). The dominant bivalve was the clam *Gemma gemma.* The gastropods dominated at PIM-006 (69.2 percent) and PIM-007 (66.8 percent). The dominant gastropod was the snail *Acteocina canaliculata.* Annelida were the third most dominant group found at the benthic stations. They were found at all stations with the highest abundance occurring at PIM-006 (23.9 percent) and PIM-007 (25.8 percent). The dominant annelids were the polychaetes *Glycinde solitaria* and *Mediomastus ambiseta.* Both of these polychaetes are pollution sensitive taxa.

Precipitation Data

The months preceding the October 2001 sampling event at Poplar Island exhibited below to much below normal precipitation events. The National Oceanic and Atmospheric Administration (NOAA) reported that the average precipitation in September 2001 was 2.2 inches and in October it was 0.9 inches in the vicinity of Poplar Island (NOAA 2002). September 2001 was classified as below normal (one of the 35 driest such periods on record) and October 2001 was classified as much below normal (one of the 10 driest such periods on record).

Poplar Island Wildlife

Several species of birds were identified by sight or sound within and around the island. Those reported on the island were Great blue heron (*Ardea herodias*), Black scoter (*Melanitta nigra*), Long-tailed duck (*Clangula hyemalis* - formerly known as Oldsquaw), Bufflehead (*Bucephala albeola*), cormorants, and gulls. All of the waterfowl species were observed in open water areas off shore of the island. The Black scoters were observed on the west side of the island, Buffleheads and Great blue herons were observed in Poplar Harbor on the east side of the island, and Long-tailed ducks and gull species were observed at various locations around the entire island. Cormorants were observed flying, swimming and roosting in trees on Jefferson Island. Many more species of birds are expected to live on the island or use the area during migration.

No reptiles or amphibians were observed during the site visit, however, it is possible that when construction is completed that diamondback terrapin (*Malaclemys terrapin*) will use the area during warmer months.

No mammals were observed during the reconnaissance visit to Poplar Island, however, white-tailed deer (*Odocoileus virginianus*) are known to inhabit Coaches Island and have been observed by the same biologist conducting the site visit while conducting other field work at the prior construction phases of Poplar Island.

Aquatic Habitat and Resources

The waters surrounding Poplar are relatively shallow (3-12 feet MLW) in most directions. Previous studies have indicated that the substrates are predominantly sand with clays and some finer materials in some areas. Most areas around the island are devoid of SAV and other cover items although there are rock piles (fish reef structures) along the northern end of the island. Natural Oyster Bars (NOB) lie just outside of Poplar Island in several directions and provide a harder-type substrate and oyster-reef habitat. Poplar Harbor (on the east side of Poplar Island) is protected from wind-driven waves from the south, west and northwest and provides a sheltered area for juvenile finfish and SAV growth. Within the dikes, the placement cells provide pooled water and mud-banks that attract some wildlife. The rocks that armor the existing dikes are encrusted with barnacles and other sessile organisms, including oysters. This is providing oyster reef-type habitat along the entire perimeter of the existing project.

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APPENDIX B

Poplar Island Photo Log, 2001

Poplar Island – Sediment at PIM-008 (1530). Sand-silt substrate with a dark anoxic color.

Poplar Island – Sediment at PIM-007 (0947). Silt with fine sand, dark color.

Poplar Island – Sediment at PIM-010 (1650). Fine sand-silt with small shell fragments.

Poplar Island – Ponar dropping at PIM-005 (1053). Sand with silt and some shell fragments.

Poplar Island – Sediment at PIM-006 (0845). Mostly silt with some very fine sand particles.

Poplar Island – Sediment at PIM-001 (1255). Fine sand-silt with many shell fragments.

Poplar Island – Sediment at PIM-002 (1420). Sand-silt composition with clam and shell fragments.

Poplar Island – Modification P2. Looking east towards dike from benthic monitoring site 004.

Poplar Island – Sediment at PIM-003 (1500). Sand-silt sediment with clam and shell fragments.

Poplar Island – Modification P3. Sitting near the edge of the dike for modification looking to an area of potential modification on the west side of the island.

Poplar Island – Modification P1. Looking north towards dike from benthic monitoring site 005.

Poplar Island – Modification P5. At benthic monitoring site 001 looking south towards Poplar Island.

Poplar Island – Modification P6. Looking west from benthic monitoring site 002 towards the northwest tip of Poplar Island .

Poplar Island - Modification P11. Looking northwest towards Jefferson Island, sitting at the edge of Poplar Island.

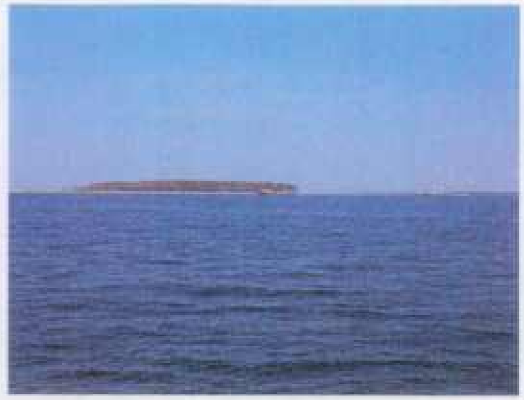
14. Poplar Island – Modification P8. At monitoring site 003 looking west towards Poplar Island.

Poplar Island – Modification P12. Looking west/southwest towards Coaches Island.

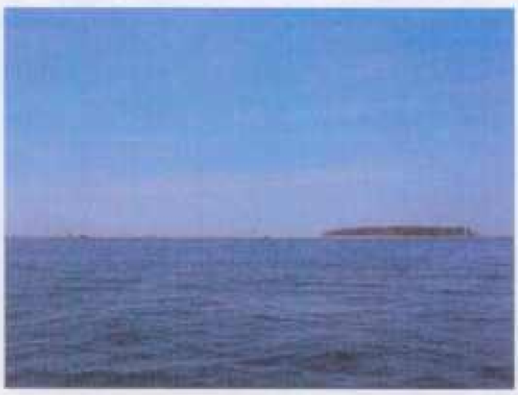
15. Poplar Island - Modification P10. Looking south towards Jefferson Island.

Poplar Island – Modification P13. Looking northwest towards Coaches and Poplar Islands riprap.

Poplar Island – Modification P14. Looking west towards Poplar dike at the construction of Phase II.



Poplar Island – Modification P18. Looking northeast from benthic monitoring site 007 towards Poplar and Coaches Islands, during Phase II Construction.



Poplar Island – Modification P15.Looking northwest from benthic site 009 towards Poplar and Coaches Islands.

Poplar Island – Modification P20. Looking east/northeast from benthic monitoring site 006 towards Poplar and Coaches Islands.

Poplar Island – Modification P16. Looking north towards Poplar and Coaches Islands from benthic monitoring site 008.

Poplar Island – Modification P21. Looking northwest towards the corner of the new dike on Poplar Island from benthic monitoring site 006.

Poplar Island – Modification P22. Looking north at riprap on southern dike on Poplar and Coaches Islands from benthic monitoring site 010.

Poplar Island – Modification P23. Looking west towards the southwest corner of Phase II on Poplar Island from benthic monitoring site 010.

Poplar Island – Modification P24. Looking east towards the southeast corner of Phase II on Poplar Island from benthic monitoring site 101.

Poplar Island – Modification P25. South of Coaches Island looking Northwest at the cut between Poplar and Coaches Island.

Poplar Island – Modification P27. South of Coaches Island looking NNW at Coaches Is. In foreground and Jefferson Island in background.

Poplar Island – Modification P31. North end of Coaches Is. Looking west toward the north end of the cut that separated Poplas and Coaches.

Poplar Island – Modificaion P33. From Poplar Harbor looking west at Terns on sandy shoreline on Poplar Island.

Poplar Island – Modification P40. Looking northeast at north end of Jefferson Island, from Poplar Harbor.

Poplar Island – Modification P35. Looking at the west side of Jefferson Island from Poplar Harbor.

Poplar Island – Modification P41. Looking at north end of Poplar Island.

Poplar Island – Modification P39. West side of Jefferson Island, looking at Cormorant nesting site.

Poplar Island – Modification P42. Commercial Crabber working crab pots along northwest shore of Poplar Island.

APPENDIX C

Sediment Quality Data: Poplar Island, February 2001

Maryland Geologic Survey (MGS) data: Physical properties for sediment samples collected during pre-placement baseline study.

	UNITS	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
SAND	%	98.3	53.3	61.9	93.9	77.9	75.3	75.5	89.0	95.8	97.4	98.5
SILT	%	1.1	31.2	25.6	3.1	17.0	16.1	10.6	6.4	2.8	2.0	1.1
CLAY	%	0.6	15.5	12.5	3.0	5.1	8.5	13.8	4.6	1.4	0.6	0.4
SILT-CLAY	%	1.7	46.7	38.1	6.1	22.1	24.6	24.4	11.0	4.2	2.6	1.5
MOISTURE CONTENT	%	19.1	35.2	27.1	21.9	22.9	27.2	18.6	22.8	21.8	19.8	18.5
BULK DENSITY	%	2.1	1.7	1.9	2.0	2.0	1.9	2.1	2.0	2.0	2.0	2.1

Severn Trent Laboratories (STL) data: Physical properties for sediment samples collected during pre-placement baseline study.

	UNITS	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
CLAY	%	3.0	19.6	12.1	5.7	8.0	7.3	17.2	6.3	2.6	2.4	2.6
COBBLES	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRAVEL	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAND	%	95.3	49.9	49.7	88.2	70.2	75.4	71.7	96.0	96.4	96.0	96.7
SILT	%	1.5	30.6	38.2	6.1	21.8	17.3	11.1	3.7	0.9	1.6	0.7
SPECIFIC GRAVITY	N/A	**1.88**	**1.80**	**1.84**	**1.93**	**1.71**	**1.42**	**1.65**	**1.87**	**1.56**	**1.63**	**1.60**
%MOISTURE	%	**26.3**	**43.1**	**36.0**	**31.7**	**30.9**	**31.7**	**25.3**	**32.4**	**28.9**	**26.6**	**26.4**
LIQUID LIMIT	N/A	**NP**	**27**	**21**	**21**	**26**	**20**	**19**	**NP**	**23**	**18**	**19**
PLASTIC LIMIT	N/A	**NP**	**21**	**19**	**NP**	**NP**	**NP**	**16**	**NP**	**NP**	**NP**	**NP**

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.
ND = not detected in any of three replicate samples.
NA = not applicable.

Severn Trent Laboratories (STL) data: Average concentrations for general chemistry parameters of sediment collected during pre-placement baseline study.

ANALYTE	UNITS	RL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
AMMONIA (NH_3), AS N	MG/KG	1.34	**19.00**	**53.40**	**29.90**	**19.30**	**23.70**	**21.80**	**11.10**	**35.50**	**23.90**	**18.30**	**27.80**
AVS/SEM	UMOLE/G	--	**0.327**	**0.0607**	**0.136**	**0.0456**	**0.155**	**0.189**	**0.235**	**0.2**	**0.144**	**0.767**	**0.0618**
BIOCHEMICAL OXYGEN DEMAND	MG/KG	175	**380**	**1000**	**1290**	**1170**	**610**	**843**	**323**	**882**	**797**	**343**	**847**
CARBON, TOTAL ORGANIC	MG/KG	958	**5910**	**41300**	**10800**	**4910**	**9830**	ND	ND	ND	**7830**	**7210**	**15000**
CHEMICAL OXYGEN DEMAND	MG/KG	273	**3900**	**38700**	**30800**	**6530**	**5970**	**18500**	**11400**	**12100**	**7130**	**3300**	**2830**
CYANIDE, TOTAL	MG/KG	0.065	**0.111**	**0.087**	ND	ND	**0.098**	ND	ND	ND	**0.091**	**0.105**	**0.104**
NITRATE + NITRITE AS N	MG/KG	0.035	**4.100**	**4.530**	**3.880**	**2.670**	**1.500**	**0.242**	**0.323**	**5.250**	**4.100**	**4.430**	**3.170**
NITROGEN, TOTAL KJELDAHL AS N	MG/KG	34.1	**108.0**	**228.0**	**257.0**	**203.0**	**288.0**	**200.0**	**257.0**	**267.0**	**212.0**	**99.7**	**33.3**
PHOSPHORUS	MG/KG	6.86	**49.60**	**225.00**	**96.80**	**47.20**	**82.10**	**80.30**	**51.30**	**65.90**	**48.50**	**40.30**	**42.70**
SULFIDE	MG/KG	28.6	**18.5**	**33.6**	**148.0**	**138.0**	**59.0**	**33.1**	ND	**84.3**	**19.2**	ND	**40.9**

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.

ND = not detected in any of three replicate samples.

RL = average reporting limit.

NA = not applicable.

Average metal concentrations of sediments collected during pre-placement baseline study.

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
ALUMINUM	MG/KG	0.16	**6.37**	**28.40**	**24.10**	**10.10**	**17.30**	**19.70**	**24.80**	**15.50**	**10.20**	**3.86**	**3.38**
ARSENIC	MG/KG	0.65	**0.80**	**2.06**	**0.62**	**0.82**	**0.81**	**0.82**	**0.80**	**0.82**	**1.32**	**1.04**	**1.26**
CADMIUM	MG/KG	0.017	**0.021**	**0.025**	**0.035**	**0.022**	**0.092**	**0.025**	**0.021**	**0.027**	**0.038**	**0.020**	**0.021**
CHROMIUM	MG/KG	0.07	**5.55**	**26.60**	**22.30**	**10.20**	**16.20**	**15.80**	**27.00**	**10.70**	**7.03**	**2.89**	**2.73**
COBALT	MG/KG	0.39	**2.31**	**5.37**	**5.03**	**2.88**	**4.70**	**3.66**	**3.42**	**2.94**	**2.07**	**1.22**	**1.19**
COPPER	MG/KG	0.03	**2.35**	**8.78**	**7.24**	**2.89**	**5.38**	**6.00**	**5.48**	**4.89**	**3.77**	**2.31**	**1.99**
IRON	MG/KG	8	**2920**	**12600**	**11700**	**6040**	**9050**	**7580**	**7280**	**4980**	**3440**	**1670**	**1720**
LEAD	MG/KG	0.11	**3.79**	**12.30**	**9.70**	**4.32**	**6.55**	**8.32**	**10.00**	**6.81**	**5.02**	**2.94**	**2.41**
MANGANESE	MG/KG	0.1	**70.9**	**244.0**	**105.0**	**55.8**	**91.7**	**88.1**	**44.7**	**74.6**	**47.1**	**40.1**	**44.1**
MERCURY	UG/KG	0.27	**2.88**	**13.20**	**11.30**	**4.44**	**8.91**	**9.84**	**17.30**	**7.79**	**4.38**	**4.50**	**3.73**
METHYL MERCURY	UG/KG	0.007	**0.019**	**0.223**	**0.076**	**0.018**	**0.021**	**0.088**	**0.061**	**0.054**	**0.01**	**0.008**	**0.02**
NICKEL	MG/KG	0.07	**3.18**	**12.40**	**11.80**	**7.02**	**10.70**	**8.89**	**11.90**	**6.84**	**5.12**	**2.70**	**2.23**
SELENIUM	MG/KG	0.42	**0.51**	**0.61**	**0.57**	**0.53**	**0.52**	**0.53**	**0.52**	**0.53**	**0.52**	**0.50**	**0.50**
SILVER	MG/KG	0.073	**0.104**	**0.105**	**0.121**	**0.091**	**0.090**	**0.095**	**0.096**	**0.154**	**0.090**	**0.134**	**0.086**
TIN	MG/KG	0.04	**0.22**	**1.18**	**0.83**	**0.26**	**0.53**	**0.80**	**1.35**	**0.71**	**0.46**	**0.18**	**0.15**
ZINC	MG/KG	0.33	**19.10**	**52.20**	**42.70**	**22.70**	**36.40**	**36.60**	**31.30**	**31.10**	**21.70**	**16.60**	**11.00**

*Source: Buchman 1999[1].

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.

ND = not detected in any of three replicate samples.

MDL = method detection limit.

Severn Trent Laboratories (STL) data: Average PCB congener concentrations (μg/kg) of sediment collected during pre-placement baseline study.

ANALYTE	UNITS	RL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
BZ# 8*	UG/KG	0.10219	0.087	0.1	ND	ND	0.17	0.0833	ND	ND	0.133	0.0833	0.183
BZ# 18*	UG/KG	0.10219	ND	0.082	ND	ND	ND	ND	ND	ND	ND	ND	0.0733
BZ# 28*	UG/KG	0.03784	ND	0.064	ND	ND	0.029	0.232	0.044	0.074	0.0415	0.0443	0.0528
BZ# 44*	UG/KG	0.1125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 49	UG/KG	0.17386	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 52*	UG/KG	0.10028	ND	ND	ND	ND	0.0733	ND	ND	ND	ND	ND	ND
BZ# 66*	UG/KG	0.05723	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 77*	UG/KG	0.08383	ND	0.086	ND	ND	ND	ND	ND	ND	ND	ND	0.0597
BZ# 87	UG/KG	0.04295	ND	0.03	ND	ND	ND	0.045	0.051	0.041	ND	ND	ND
BZ# 101*	UG/KG	0.0594	ND	ND	ND	ND	ND	0.27	0.159	0.255	0.0773	ND	0.106
BZ# 105*	UG/KG	0.18409	0.14	0.23	ND	ND	ND	0.32	0.217	0.145	ND	ND	0.18
BZ# 118*	UG/KG	0.07067	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 126*	UG/KG	0.05014	ND	0.058	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 126*	UG/KG	0.04909	0.047	0.168	ND	ND	0.13	0.0893	0.126	0.152	0.147	0.105	0.153
BZ# 138*	UG/KG	0.04398	0.045	0.033	ND	ND	ND	ND	ND	0.03	ND	ND	0.0467
BZ# 153*	UG/KG	0.03811	ND	0.031	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 156	UG/KG	0.08187	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 169*	UG/KG	0.09721	ND	ND	ND	ND	ND	0.135	0.191	ND	ND	ND	ND
BZ# 170*	UG/KG	0.07262	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 169*	UG/KG	0.08894	ND	ND	ND	ND	ND	ND	ND	0.068	ND	ND	ND
BZ# 184	UG/KG	0.05211	ND	0.034	ND	ND	ND	0.205	0.206	0.093	ND	ND	ND
BZ# 184	UG/KG	0.0572	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 187*	UG/KG	0.06137	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 195	UG/KG	0.08894	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BZ# 206	UG/KG	0.13295	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND
BZ# 209	UG/KG	0.16364	ND	ND	ND	ND	ND	ND	7.04	ND	ND	ND	ND
TOTAL PCB (ND=0)	UG/KG		0.39	1.17	0	0	0.713	1.99	1.53	1.35	0.766	0.357	1.39
TOTAL PCB (ND=1/2 DL)	UG/KG		1.65	2.41	1.38	1.38	1.9	3.13	2.67	2.37	1.94	1.66	2.44

* = PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998).
** Source: Buchman 1999[1].
NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.
ND = not detected in any of three replicate samples.
RL = average reporting limit.

Marine sediment quality guidelines (SQGs).

Chemical Name	Units	Threshold Effects Level (TEL)	Probable Effects Level (PEL)
METALS			
ARSENIC	MG/KG	7.24	41.6
CADMIUM	MG/KG	0.676	4.21
CHROMIUM	MG/KG	52.3	160.4
COPPER	MG/KG	18.7	108.2
LEAD	MG/KG	30.24	112.18
MERCURY	MG/KG	0.13	0.696
NICKEL	MG/KG	15.9	42.8
SILVER	MG/KG	0.73	1.77
ZINC	MG/KG	124	271
CHLORINATED PESTICIDES			
CHLORDANE	UG/KG	2.26	4.79
4,4-DDD	UG/KG	1.22	7.81
4,4-DDE	UG/KG	2.07	374.17
4,4-DDT	UG/KG	1.19	4.77
DIELDRIN	UG/KG	0.715	4.3
GAMMA-BHC	UG/KG	0.32	0.99
PAHs			
2-METHYLNAPHTHALENE	UG/KG	20.21	201.28
ACENAPHTHENE	UG/KG	6.71	88.9
ACENAPHTHYLENE	UG/KG	5.87	127.87
ANTHRACENE	UG/KG	46.85	245
BENZO(A)PYRENE	UG/KG	88.81	763.22
BENZO[A]ANTHRACENE	UG/KG	74.83	692.53
CHRYSENE	UG/KG	107.77	845.98
DIBENZ(A,H)ANTHRACENE	UG/KG	6.22	134.61
FLUORANTHENE	UG/KG	112.82	1493.54
FLUORENE	UG/KG	21.17	144.35
NAPHTHALENE	UG/KG	34.57	390.64
PHENANTHRENE	UG/KG	86.68	543.53
PYRENE	UG/KG	152.66	1397.6
PAHs, TOTAL	UG/KG	1684.06	16770.4
PCBs			
PCBs,TOTAL	UG/KG	21.55	188.79
SEMIVOLATILE ORGANIC COMPOUNDS			
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	182.16	2646.51

Source: Buchman 1999[1]

Chesapeake Bay Laboratories (CBL) data: Average PCB congener concentrations of sediment collected during pre-placement baseline study.

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
PCB# 1	UG/KG	0.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 3	UG/KG	1.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 4,10	UG/KG	0.15	ND	ND	ND	ND	ND	ND	0.09	ND	ND	ND	ND
PCB# 6	UG/KG	0.04	ND	ND	ND	ND	ND	0.04	ND	ND	ND	ND	ND
PCB# 7,9	UG/KG	0.02	ND	0.02	0.01	0.02	0.02	ND	ND	ND	ND	ND	ND
PCB# 8,5	UG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 12,13	UG/KG	0.02	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND
PCB# 16,32	UG/KG	0.1	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 17	UG/KG	0.03	ND	0.11	0.04	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 18	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 19	UG/KG	0.03	ND	0.04	ND	ND	ND	0.04	ND	ND	ND	ND	ND
PCB# 22	UG/KG	0.01	0.06	0.29	0.13	0.13	0.14	ND	ND	0.11	0.12	0.07	0.09
PCB# 24	UG/KG	0.03	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 25	UG/KG	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 26	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 28	UG/KG	0.08	0.04	0.08	ND	ND	0.06	ND	ND	0.06	0.05	0.05	0.06
PCB# 29	UG/KG	0.01	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 33,21,53	UG/KG	0.08	ND	0.084	ND	ND	ND	0.1	ND	ND	ND	ND	ND
PCB# 37,42	UG/KG	0.03	0.02	0.05	0.04	0.03	0.03	ND	0.02	0.02	ND	ND	ND
PCB# 40	UG/KG	0.02	ND	0.04	0.03	0.02	0.02	ND	ND	0.01	ND	ND	ND
PCB# 41,64,71	UG/KG	0.11	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 44	UG/KG	0.03	ND	0.08	0.03	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 45	UG/KG	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 45	UG/KG	0.1	ND	ND	ND	ND	ND	ND	0.1	ND	0.1	ND	ND
PCB# 48,47	UG/KG	0.03	ND	ND	ND	ND	ND	0.11	ND	ND	ND	ND	ND
PCB# 49	UG/KG	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 51	UG/KG	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 52	UG/KG	0.23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 56,60	UG/KG	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
PCB# 63	UG/KG	0.03	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND
PCB# 66,95	UG/KG	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 70,76	UG/KG	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 74	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 81,87	UG/KG	0.03	ND	ND	ND	ND	0.03	0.07	0.02	0.05	0.05	0.04	0.04
PCB# 82	UG/KG	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 83	UG/KG	0.01	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 85	UG/KG	0.02	ND	0.03	ND	0.01	ND	ND	ND	ND	ND	ND	ND
PCB# 99	UG/KG	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 99	UG/KG	0.0152	ND	0.023	0.015	ND	###	ND	ND	ND	ND	ND	ND
PCB# 97	UG/KG	0.01	ND	0.02	0.01	ND	ND	ND	ND	ND	0.01	ND	ND
PCB# 99	UG/KG	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 100	UG/KG	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 101	UG/KG	0.02	ND	0.03	0.01	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 107	UG/KG	0.01	ND	0.01	0.01	0.01	0.01	ND	ND	ND	ND	ND	ND
PCB# 110,77	UG/KG	0.02	ND	0.07	0.04	ND	0.02	0.03	ND	ND	ND	ND	ND
PCB# 118	UG/KG	0.02	ND	0.059	0.015	ND	0.01	ND	ND	ND	ND	ND	ND
PCB# 119	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 123,149	UG/KG	0.02	ND	0.043	0.025	0.013	0.02	0.02	ND	ND	ND	ND	ND
PCB# 128	UG/KG	0.01	ND	0.013	0.009	ND	0.01	ND	ND	ND	ND	ND	ND
PCB# 129,178	UG/KG	0.02	ND	0.031	ND	0.012	ND	ND	ND	ND	ND	ND	ND
PCB# 134,144	UG/KG	0.01	ND	0.013	ND	0.009	0.01	ND	ND	ND	ND	ND	ND
PCB# 1[illegible]1	UG/KG	0.06	ND	0.16	0.062	0.077	0.07	ND	ND	0.08	ND	0.04	0.054
PCB# 136	UG/KG	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 137,130,176	UG/KG	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 141	UG/KG	0.03	ND	0.054	ND	0.02	ND	ND	ND	ND	ND	ND	ND
PCB# 146	UG/KG	0.06	ND	0.095	0.038	ND	0.05	ND	ND	ND	ND	0.06	0.056
PCB# 151	UG/KG	0.02	ND	0.039	0.016	0.013	0.01	ND	ND	ND	ND	ND	ND
PCB# 132,153,105	UG/KG	0.11	ND	0.224	0.154	0.127	0.16	0.2	ND	0.17	0.1	0.14	0.12
PCB# 1[illegible]7	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 158	UG/KG	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 163,138	UG/KG	0.02	ND	0.065	0.027	ND	0.05	0.02	ND	0.02	ND	ND	ND

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
PCB# 170,190	UG/KG	0.04	ND	ND	**0.05**	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 172,197	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 174	UG/KG	0.02	ND	**0.02**	**0.026**	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 177	UG/KG	0.02	ND	**0.054**	**0.053**	ND	**0.05**	ND	ND	ND	**0**	ND	ND
PCB# 180	UG/KG	0.02	ND	**0.033**	**0.043**	**0.014**	**0.05**	ND	ND	**0.03**	ND	ND	ND
PCB# 183	UG/KG	0.03	ND	**0.02**	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 198	UG/KG	0.02	ND	**0.024**	**0.013**	**0.017**	**0.03**	ND	ND	ND	ND	ND	ND
PCB# 187,182	UG/KG	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 198	UG/KG	0.03	ND	ND	ND	ND	**0.02**	ND	ND	ND	ND	ND	ND
PCB# 191	UG/KG	0.03	ND	ND	**0.033**	ND	**0.03**	ND	ND	ND	ND	ND	ND
PCB# 193	UG/KG	0.06	ND	ND	ND	ND	**0.05**	**0.08**	ND	**0.04**	**0**	ND	ND
PCB# 198	UG/KG	0.02	ND	**0.015**	**0.014**	ND	**0.02**	ND	ND	**0.01**	ND	ND	ND
PCB# 198	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 198	UG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 201	UG/KG	0.03	ND	ND	**0.026**	**0.037**	**0.03**	ND	ND	ND	ND	ND	ND
PCB# 202,171,156	UG/KG	0.02	ND	**0.04**	**0.042**	ND	**0.03**	ND	ND	ND	**0**	ND	ND
PCB# 203,196	UG/KG	0.03	ND	**0.039**	ND	**0.051**	**0.03**	ND	ND	ND	ND	ND	ND
PCB# 205	UG/KG	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 206	UG/KG	0.04	ND	**0.071**	**0.074**	**0.029**	ND	**0.11**	ND	ND	ND	ND	ND
PCB# 207	UG/KG	0.02	ND	**0.019**	**0.022**	**0.022**	**0.03**	ND	ND	**0.02**	ND	ND	ND
PCB# 208,195	UG/KG	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB# 209	UG/KG	0.03	ND	ND	ND	ND	ND	**0.03**	ND	ND	ND	ND	ND
TOTAL PCBs (ND=0)	UG/KG		**0.069**	**2.09**	**0.983**	**0.578**	**0.96**	**0.81**	**0.08**	**0.55**	**0.5**	**0.36**	**0.335**
TOTAL PCBs (ND=1/2DL)	UG/KG		**3.21**	**4.79**	**3.84**	**3.53**	**3.83**	**3.85**	**3.2**	**3.52**	**3.5**	**3.37**	**3.38**

*Source: Buchman 1999[1].

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample; mean concentrations may be lower than MDL if congener was not detected in each of the three replicates.

ND = not detected in any of three replicate samples.

MDL = method detection limit.

PCB congeners appearing as pairs or triplets coeluted and are reported as sums.

APPENDIX C
Sediment Quality Data: Poplar Island, February 2001

Chesapeake Bay Laboratories (CBL) data: Average PAH concentrations for sediments collected during pre-placement baseline study.

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
1METHYLANTHRACENE	UG/KG	1.15	2.39	6.36	14.9	8.55	4.65	2.19	ND	20.6	3.5	2.79	2.16
1METHYLFLUORENE	UG/KG	1.06	1.82	5.99	10.1	6.36	2.92	ND	ND	19.5	3.7	5.22	3.71
1METHYLNAPHTHALENE	UG/KG	0.85	0.79	1.22	1.9	1.46	1.36	0.664	ND	6.25	2.68	ND	1.22
1METHYLPHENANTHRENE	UG/KG	3.85	3.50	ND	4.32	4.09	2.61	ND	ND	10.1	ND	ND	ND
2METHYLANTHRACENE	UG/KG	8.99	[redacted]	ND	ND	7.43	5.98	ND	ND	30.8	ND	ND	ND
2METHYLNAPTHALENE	UG/KG	1.3	1.5	3.1	1.5	4.9	1.7	ND	ND	10.4	1.5	1.3	2.0
2METHYLPHENANTHRENE	UG/KG	0.87	0.99	3.25	4.72	1.57	1.97	0.837	ND	6.99	2.19	1.15	2.81
3,6-DIMETHYLPHENANTHRENE	UG/KG	2.47	2.24	2.10	5.65	4.97	ND	ND	ND	20	5.73	3	ND
3METHYLCHOLANTHRENE	UG/KG	0.21	[redacted]	ND	ND	[redacted]	ND	ND	ND	ND	ND	ND	ND
4,5-METHYLPHENANTHRENE	UG/KG	0.24	[redacted]	ND	ND	[redacted]	ND	ND	ND	ND	ND	ND	ND
9,10-DIMETHYLANTHRACENE	UG/KG	8.07	[redacted]	ND	6.2	[redacted]	ND	ND	ND	15.6	8.88	6.65	ND
9METHYLANTHRACENE	UG/KG	3.34	6.15	4.10	5.16	3.59	ND	ND	ND	37.30	5.86	7.54	2.89
ACENAPTHENE	UG/KG	4	[redacted]	ND	4.3	6.7	ND	ND	ND	7.05 a	6.51	ND	ND
ACENAPTHYLENE	UG/KG	1.1	1.7	1.7	3.2	1.6	1.6	ND	ND	4.0	4.6	1.7	1.5
ANTHANTHRENE	UG/KG	1.51	1.48	4.44	4.52	1.37	5.72	1.60	ND	9.26	2.19	1.99	2.56
ANTHRACENE	UG/KG	1.16	[redacted]	1.02	1.91	[redacted]	ND	ND	ND	40.10	ND	ND	1.92
AZULENE	UG/KG	1.06	2.06	ND	ND	4.05	1.51	ND	ND	3.90	1.39	ND	2.04
BENZ[A]ANTHRACENE	UG/KG	14.4	[redacted]	ND	ND	[redacted]	ND	ND	ND	ND	ND	ND	ND
BENZO[A]FLUORENE	UG/KG	3.07	[redacted]	ND	4.38	3.83	ND	ND	ND	8.95	5.18	3.37	2.34
BENZO[A]PYRENE	UG/KG	2.39	2.10	3.73	14.50	5.40	3.88	ND	1.60	49.90	4.78	ND	3.03
BENZO[B]FLUORANTHENE	UG/KG	1.06	1.75	9.58	20.60	55.30	3.36	3.06	0.89	34.50	4.32	1.12	3.66
BENZO[B]FLUORENE	UG/KG	1.32	1.60	1.60	4.64	7.31	2.05	ND	ND	10.60	7.98	1.58	4.22
BENZO[E]PYRENE	UG/KG	1.74	1.47	2.79	7.12	10.90	1.74	1.76	0.94	10.10	2.85	1.28	4.93
BENZO[G,H,I]PERYLENE	UG/KG	0.42	0.41	2.11	2.71	0.62	0.61	2.03	ND	7.95	0.40	0.49	1.55
BENZO[K]FLUORANTHENE	UG/KG	1.49	2.44	2.18	14.10	24.60	4.82	1.22	0.86	29.50	4.54	1.61	2.25
BIPHENYL	UG/KG	0.35	[redacted]	1.03	0.73	0.36	ND	ND	ND	1.76	0.37	0.25	0.37
CHRYSENE + TRIPHENYLENE	UG/KG	0.56	0.77	4.48	3.58	2.17	2.36	1.75	ND	5.03	1.64	1.37	2.64
CORONENE	UG/KG	0.24	0.87	0.71	0.71	0.81	0.37	ND	ND	8.57	0.44	0.65	0.45
DIBENZ[A,H+A,C]ANTHRACENE	UG/KG	0.55	[redacted]	ND	0.70	0.48	ND	ND	0.31	6.21	1.08	ND	0.82

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
DIMETHYLBENZ[A]ANTHRACENE	UG/KG	2	**3**	**4**	**5**	**5**	**2**	ND	ND	**15**	**6**	**5**	**5**
FLUORANTHENE	UG/KG	2.27	**2.56**	**10.30**	**8.93**	**4.26**	**5.08**	**5.56**	ND	**7.25**	ND	**2.11**	ND
FLUORENE	UG/KG	1.79	**1.85**	**4.59**	**2.52**	**3.64**	**1.20**	ND	ND	**17.60**	**2.19**	**1.94**	**1.25**
INDENO[1,2,3-C,D]PYRENE	UG/KG	0.42	**0.64**	**3.45**	**3.38**	**0.96**	**1.41**	**0.69**	**0.23**	**14.90**	**1.11**	**0.84**	**0.33**
NAPTHACENE	UG/KG	2.82	**0.75**	**2.30**	**2.52**	**0.99**	**0.87**	**0.47**	**0.99**	**2.46**	**0.79**	**0.73**	**0.48**
NAPTHALENE	UG/KG	0.23	**1.89**	ND	**5.66**	[redacted]	**1.16**	ND	ND	**13.60**	**4.04**	**1.15**	**2.41**
PERYLENE	UG/KG	1.9	**2.1**	**9.4**	**11.7**	**6.1**	**1.8**	**5.4**	**1.4**	**21.7**	**2.7**	**1.7**	**2.4**
PHENANTHRENE	UG/KG	0.49	**2.86**	**9.87**	**6.82**	**3.48**	**3.83**	**3.27**	**0.49**	**7.65**	**2.43**	**3.05**	**2.36**
PYRENE	UG/KG	2.95	[redacted]	**10.20**	**6.14**	**3.10**	**6.42**	**6.45**	ND	**7.57**	**3.92**	**2.19**	**3.23**
TOTAL PAHs (ND=0)	UG/KG		**44.6**	112	185	**188**	64.1	35.3	3.49	515	101	54.3	59
TOTAL PAHs (ND=1/2DL)	UG/KG		**73.4**	138	207	**208**	92.1	69.3	43.9	530	121	81.1	88.8

*Source: Buchman 1999[1].

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.

ND = not detected in any of three replicate samples.

MDL = method detection limit.

Chesapeake Bay Laboratories (CBL) data: Average chlorinated pesticide concentrations for sediments collected during pre-placement baseline study.

ANALYTE	UNITS	MDL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
2,4-DDD	UG/KG	0.02	0.03	0.36	0.07	0.03	0.07	0.08	0.02	0.10	0.02	0.02	0.03
2,4-DDE	UG/KG	0.02	0.01	0.02	0.03	0.01	0.02	ND	0.02	0.02	0.01	ND	ND
2,4-DDT	UG/KG	0.03	ND	0.03	0.03	0.03	0.04	ND	0.02	0.03	ND	ND	0.02
4,4-DDD + CIS-NONACHLOR	UG/KG	0.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4-DDE	UG/KG	0.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4-DDT	UG/KG	0.48	ND	0.70	0.32	0.49	ND	0.38	ND	0.35	0.39	ND	ND
ALDRIN	UG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ALPHA-BHC	UG/KG	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENFLURALIN (BENEFIN)	UG/KG	0.09	ND	ND	ND	0.06	ND	ND	0.13	0.07	ND	ND	ND
CHLORPYRIFOS	UG/KG	0.12	ND	0.35	ND	ND	ND	0.10	ND	ND	ND	ND	ND
CIS-CHLORDANE	UG/KG	0.02	ND	0.02	0.04	0.03	0.02	ND	ND	ND	ND	ND	ND
DACTHAL (DCPA)	UG/KG	0.02	0.02	0.08	0.05	0.04	0.05	0.12	0.03	0.05	0.02	0.01	ND
DIAZINON	UG/KG	0.22	ND	0.24	0.24	ND	ND	0.39	0.19	0.22	ND	ND	ND
DIELDRIN	UG/KG	0.01	0.02	0.10	0.09	0.03	0.04	0.05	0.01	0.03	0.05	0.02	0.02
ENDOSULFAN I	UG/KG	0.04	ND	0.05	0.10	0.12	0.10	0.05	ND	0.04	ND	ND	ND
ENDOSULFAN II	UG/KG	0.01	0.11	0.29	0.29	0.11	0.17	0.15	0.05	0.17	0.11	0.13	0.09
ENDRIN	UG/KG	0.02	ND	0.03	0.04	0.03	0.06	0.05	0.09	0.05	0.05	0.02	ND
GAMMA-BHC	UG/KG	0.01	0.02	0.08	0.02	0.03	0.01	0.03	0.01	0.02	0.01	0.01	0.01
HEPTACHLOR	UG/KG	0.03	0.03	ND	0.02	0.05	0.05	0.24	0.03	0.04	0.03	0.03	0.04
HEPTACHLOR EPOXIDE A	UG/KG	0.01	0.01	0.03	0.02	0.01	0.01	0.02	0.02	0.01	0.01	ND	0.01
HEPTACHLOR EPOXIDE B	UG/KG	0.01	0.01	0.03	0.02	0.01	0.01	0.01	0.02	0.01	ND	ND	ND
HEXACHLOROBENZENE	UG/KG	0.01	0.01	0.02	0.01	0.01	0.01	0.03	ND	0.01	ND	ND	ND
METHOXYCHLOR	UG/KG	1.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MIREX	UG/KG	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OXYCHLORDANE	UG/KG	0.01	0.01	0.02	ND	ND	ND	ND	ND	ND	0.01	0.01	0.01
OXYFLUOREN	UG/KG	0.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRANS-CHLORDANE	UG/KG	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRANS-NONACHLOR	UG/KG	0.19	0.12	ND	ND	0.19	ND	ND	ND	ND	ND	ND	ND
TRIFLURALIN	UG/KG	0.03	0.15	0.27	0.20	0.21	0.24	0.13	0.08	0.12	0.13	0.14	0.11

*Source: Buchman 1999[1].

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.

ND = not detected in any of three replicate samples.

MDL = method detection limit.

Severn Trent Laboratories (STL) data: Average dioxin and furan congener concentrations for sediments collected during pre-placement baseline study.

ANALYTE	UNITS	RL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
2,3,7,8-TCDD	NG/KG	0.125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDD	NG/KG	0.0924	**0.084**	ND	**0.0827**	ND	ND	**0.088**	ND	ND	**0.0588**	ND	**0.0764**
1,2,3,4,7,8-HXCDD	NG/KG	0.178	ND	ND	**0.0853**	ND	ND	**0.126**	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDD	NG/KG	0.186	ND	ND	**0.211**	ND	**0.0749**	**0.228**	ND	**0.114**	**0.073**	**0.0904**	**0.0754**
1,2,3,7,8,9-HXCDD	NG/KG	0.175	ND	ND	**0.261**	**0.0824**	**0.0556**	**0.262**	ND	**0.132**	**0.0685**	**0.113**	**0.0781**
1,2,3,4,6,7,8-HPCDD	NG/KG	--	**0.994**	**4.02**	**5.47**	**1.75**	**2.14**	**6.14**	**3.26**	**3**	**1.26**	**1.98**	**1.65**
OCDD	NG/KG	--	**24.3**	**109**	**154**	**56.5**	**71**	**158**	**40.5**	**98.9**	**38.7**	**53.5**	**47.3**
2,3,7,8-TCDF	NG/KG	0.0788	ND	ND	**0.0489**	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDF	NG/KG	0.0518	**0.0577**	ND	**0.0562**	ND	ND	**0.108**	ND	ND	**0.0728**	ND	**0.0737**
2,3,4,7,8-PECDF	NG/KG	0.0525	**0.0749**	**0.0621**	**0.102**	**0.0725**	**0.0366**	**0.136**	**0.0328**	**0.0396**	**0.0987**	**0.077**	**0.0971**
1,2,3,4,7,8-HXCDF	NG/KG	0.0779	**0.0768**	ND	**0.0847**	**0.0454**	ND	**0.113**	ND	ND	**0.0677**	**0.066**	**0.0794**
1,2,3,6,7,8-HXCDF	NG/KG	0.0759	**0.0728**	ND	**0.0782**	**0.0485**	ND	**0.129**	ND	ND	**0.0796**	**0.0585**	**0.0751**
2,3,4,6,7,8-HXCDF	NG/KG	0.0925	**0.0696**	ND	**0.0651**	**0.0466**	**0.043**	**0.146**	ND	ND	**0.0818**	**0.0723**	**0.0672**
1,2,3,7,8,9-HXCDF	NG/KG	0.103	**0.0754**	ND	**0.0626**	ND	ND	**0.167**	ND	ND	**0.0738**	**0.0435**	**0.0583**
1,2,3,4,6,7,8-HPCDF	NG/KG	0.118	**0.109**	**0.113**	**0.139**	**0.095**	**0.0881**	**0.323**	**0.215**	**0.112**	**0.157**	**0.175**	**0.126**
1,2,3,4,7,8,9-HPCDF	NG/KG	0.132	ND	ND	**0.0619**	ND	ND	**0.128**	ND	ND	**0.0571**	ND	ND
OCDF	NG/KG	0.229	**0.231**	**0.235**	**0.143**	ND	**0.126**	**0.863**	**0.903**	**0.132**	**0.148**	**0.155**	**0.147**
DIOXIN TEQ (ND=0)	NG/KG	--	**0.112**	**0.164**	**0.326**	**0.105**	**0.11**	**0.289**	**0.0759**	**0.146**	**0.131**	**0.117**	**0.164**
DIOXIN TEQ (ND=1/2)	NG/KG	--	**0.237**	**0.381**	**0.439**	**0.188**	**0.226**	**0.439**	**0.283**	**0.266**	**0.229**	**0.214**	**0.239**

*Source: Buchman 1999[1].

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.

ND = not detected in any of three replicate samples.

RL = average reporting limit.

Severn Trent Laboratories (STL) data: Average volatile (VOC) and semi-volatile (SVOC) concentrations in sediments collected during pre-placement baseline study.

VOC-ANALYTE	UNITS	RL	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQR1	WQR2
METHYLENE CHLORIDE	UG/KG	2.23	**4.33**	**3.50**	**5.63**	**2.00**	**7.33**	**5.50**	**4.50**	ND	**5.67**	**5.67**	**6.33**
SVOC-ANALYTES													
DI-N-BUTYL PHTHALATE	UG/KG	46	ND	ND	ND	ND	**44**	ND	ND	ND	ND	ND	ND
PHENOL	UG/KG	66.1	ND	**46.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND

*Source: Buchman 1999[1].

NOTE: Shaded and bold values represent mean concentrations for analytes detected in at least one sample.

ND = not detected in any of three replicate samples.

RL = average reporting limit.

[1]Buchman, M.F. 1999. *NOAA Screening Quick Reference Table*, NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration. 12 pp.