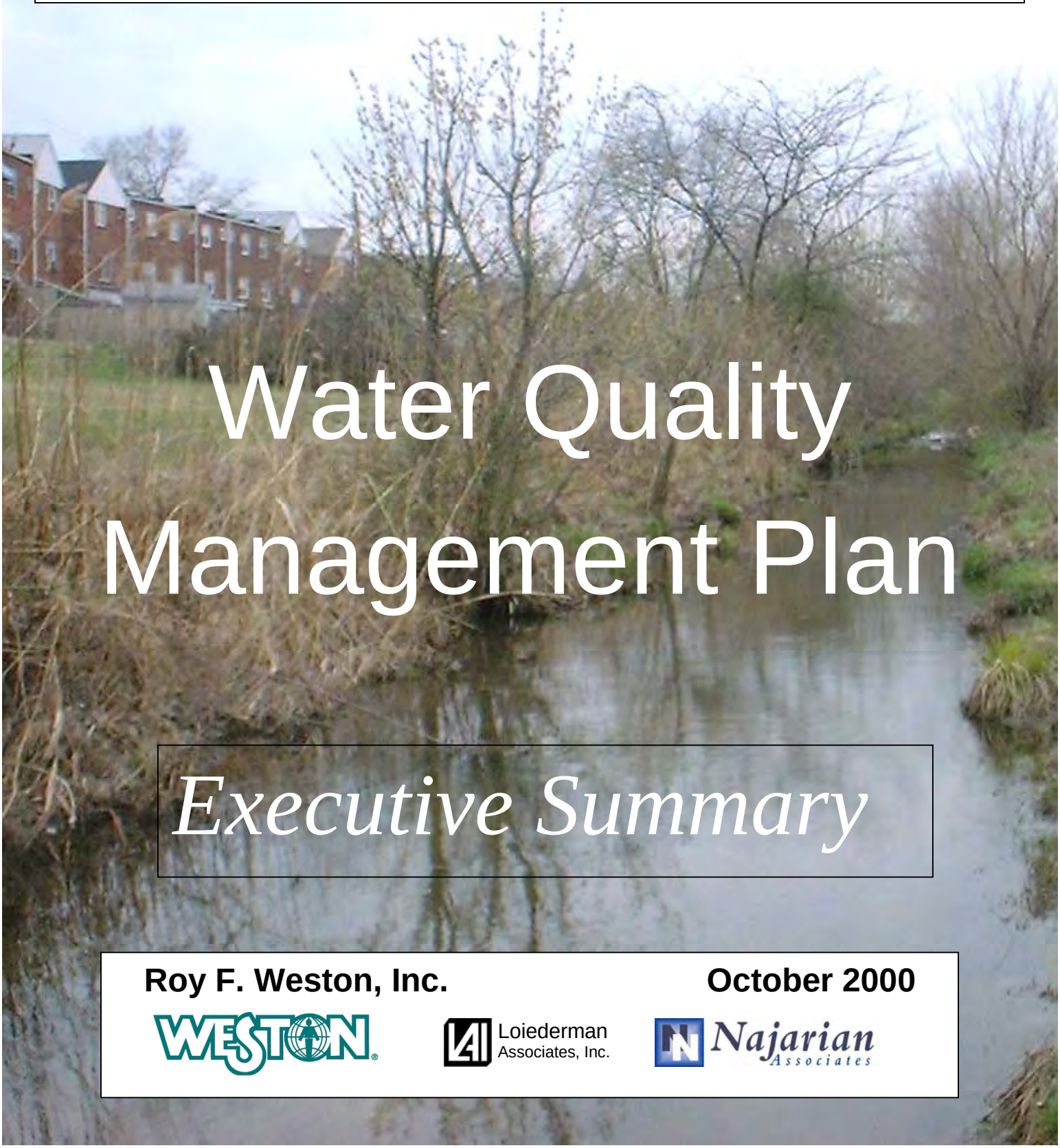
Baltimore Harbor Watershed
Baltimore County
Maryland



Water Quality Management Plan

Executive Summary

Roy F. Weston, Inc.

October 2000

Loiederman Associates, Inc.

Najarian Associates

EXECUTIVE SUMMARY

INTRODUCTION

This report presents the results of the Watershed Management Plan study for the Baltimore Harbor Watershed that was prepared for the Baltimore County Department of Environmental Protection and Resource Management (DEPRM) by Roy F. Weston, Inc., in collaboration with Loiederman Associates, Inc., and Najarian Associates. Preparation of this watershed management plan is part of a larger initiative within the County to enhance surface water quality. This report summarizes the characterization and modeling study for the Baltimore Harbor Watershed, and presents recommendations for Best Management Practices (BMPs) to enhance surface water quality within the study area. The primary focus of this watershed management plan is the control of stormwater runoff to surface waters with a secondary focus on point source discharges.

This plan presents recommendations for structures and practices that will improve the quality of stormwater runoff flowing into the surface waters of the study area. The most practical measures can be chosen for implementation as budget and other resources permit. The recommendations for BMP structures to improve surface water quality are largely dependent on the willingness of individual property owners because not much public land is available for construction of water pollution control devices. One of the primary BMP recommendations in this plan is for all businesses to comply with their NPDES Stormwater Permit requirements. This recommendation is also largely dependent on the willingness of the private sector to devote resources toward improving surface water quality within the Baltimore Harbor Watershed.

Pollution flowing into streams from stormwater runoff is known as *nonpoint source pollution*. Nonpoint source pollution is increasingly recognized as a major cause of degraded water quality in streams and rivers. Agricultural stormwater runoff contributes tremendous levels of nutrients and sediments to receiving waters. Urban stormwater runoff washes nutrients, heavy metals, salts and petroleum products from roadways and paved areas into receiving waters. The goal of this Watershed Management Plan is to provide methods to reduce the level of nonpoint source pollution, which will ultimately result in an improvement in surface water quality.

WATERSHED DESCRIPTION

The Baltimore Harbor Watershed (shown in Figure ES-1) is located immediately east of Baltimore City and includes Bear Creek, Old Road Bay, Shallow Creek and other small tributaries to the Patapsco River and Chesapeake Bay. The Baltimore Harbor Watershed is an aggregation of small tributaries (subwatersheds – shown in Figure ES-2) to the north side of the Patapsco River, immediately upstream of the Chesapeake Bay. Land uses consist primarily of older residential, commercial and industrial development. Some parcels of open space exist, including agricultural and forested areas. Many embayments are lined with recreational boat docks or are occupied by facilities that accommodate commercial shipping. The Bethlehem Steel plant on Sparrows Point is a major feature on the heavily industrialized riverfront.

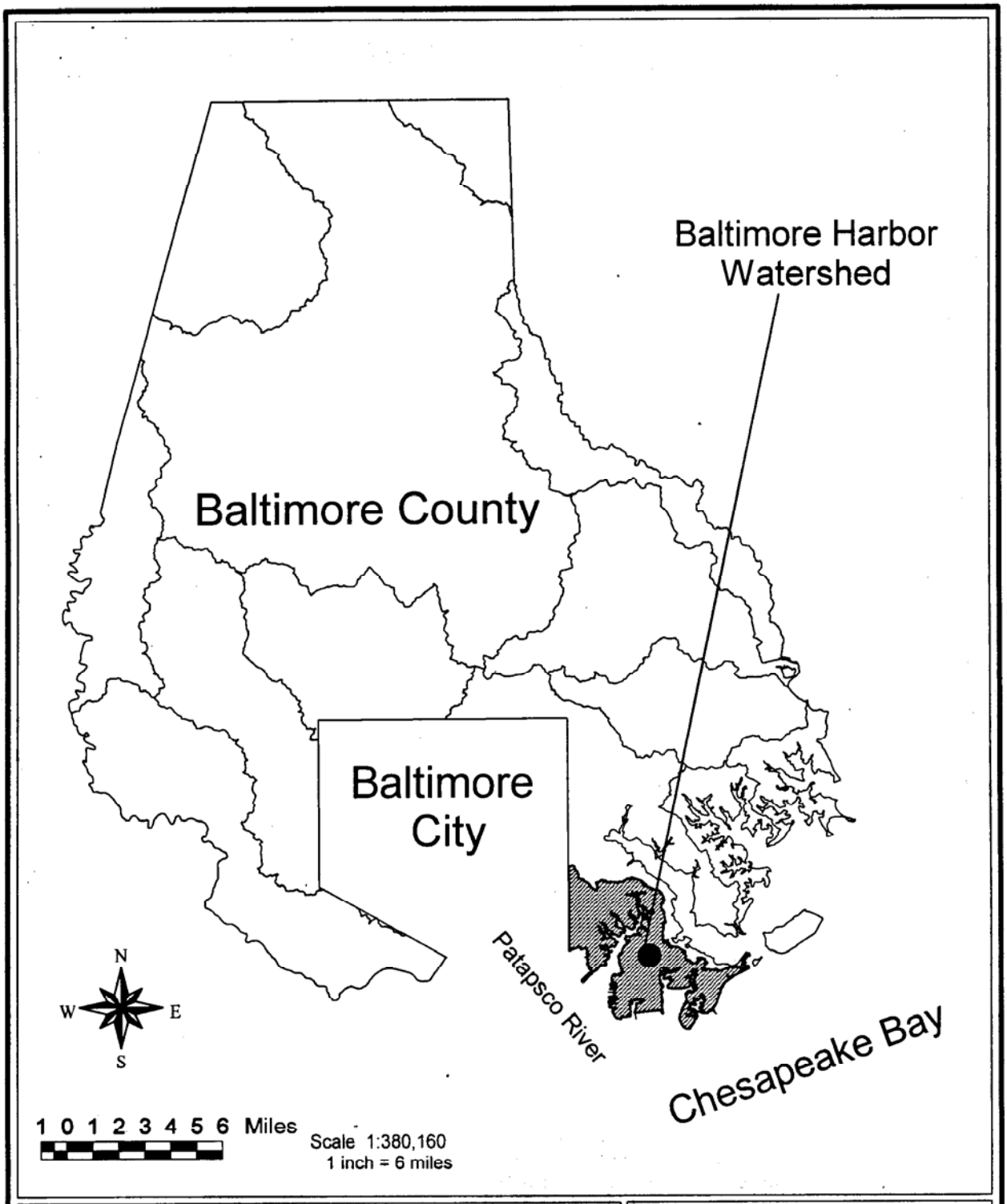


Figure ES-1
Baltimore County, Maryland
Baltimore Harbor Watershed
Regional Location Map

WESTON.

Figures0es.apr FigES-1-Location.layout

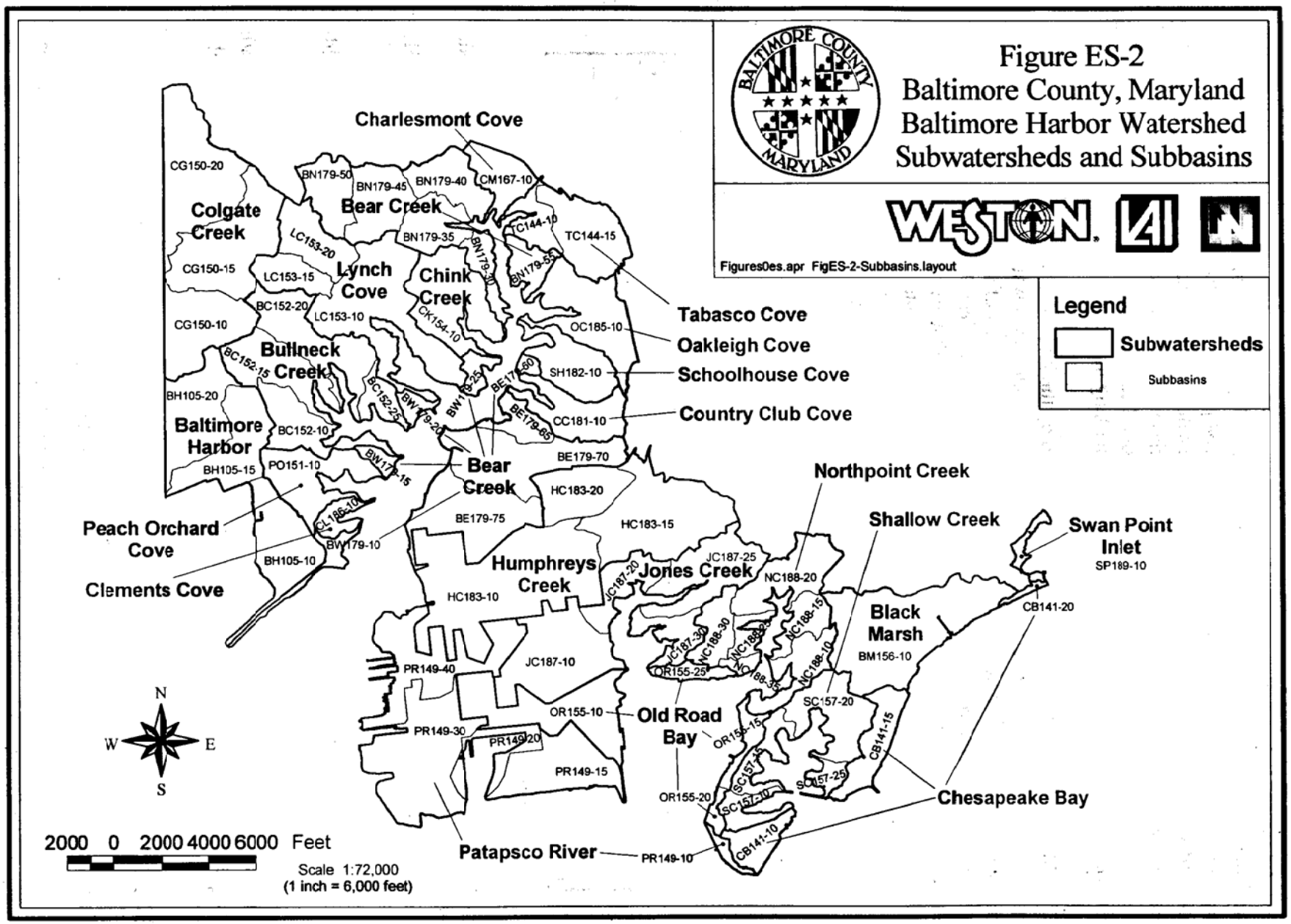


Figure ES-2
Baltimore County, Maryland
Baltimore Harbor Watershed
Subwatersheds and Subbasins
Figures0es.apr FigES-2-Subbasins.layout
Legend
Subwatersheds
Subbasins
Charlesmont Cove
Colgate Creek
Bear Creek
Lynch Cove
Chink Creek
Bullneck Creek
Baltimore Harbor
Bear Creek
Tabasco Cove
Oakleigh Cove
Schoolhouse Cove
Country Club Cove
Northpoint Creek
Shallow Creek
Swan Point Inlet
Peach Orchard Cove
Clements Cove
Humphreys Creek
Jones Creek
Black Marsh
Old Road Bay
Chesapeake Bay
Patapsco River
CG150-20
BN179-50
BN179-45
BN179-40
CM167-10
TC144-10
TC144-15
CG150-15
LC153-20
LC153-15
BN179-35
BN179-30
BN179-55
CK154-10
BC152-20
LC153-10
CG150-10
OC185-10
BC152-15
SH182-10
BH105-20
BC152-25
BW179-20
BE179-60
BE179-65
CC181-10
BC152-10
BW179-15
BE179-70
BH105-15
PO151-10
HC183-20
CL186-10
BE179-75
HC183-15
BW179-10
BH105-10
JC187-25
JC187-20
NC188-20
HC183-10
JC187-30
NC188-30
NC188-25
NC188-15
NC188-10
BM156-10
CB141-20
PR149-40
JC187-10
OR155-25
NC188-35
SC157-20
OR155-10
OR155-15
PR149-30
PR149-20
CB141-15
PR149-15
SC157-15
SC157-25
OR155-20
SC157-20
CB141-10
PR149-10
N
W
E
S
2000 0 2000 4000 6000 Feet
Scale 1:72,000
(1 inch = 6,000 feet)

The Baltimore Harbor Watershed is largely comprised of highly urbanized land uses including large tracts occupied by heavy industry. The watershed has been an industrial location and densely populated for more than 150 years. Industrial point source discharges combined with polluted stormwater runoff over this long history has degraded the quality of the streams draining the watershed. Pollution resulting from past activities within a watershed is known as legacy pollution. The high priority given to developing Total Maximum Daily Loads for the Baltimore Harbor Watershed is, in part, due to the effects of the long industrial history of the area.

Total Maximum Daily Loads (TMDLs) are required by the Federal Clean Water Act. TMDLs are an estimate of the maximum amount of a given pollutant that a water body can assimilate without violating water quality standards. Maryland's current list of water bodies that may require TMDLs is called the 303(d) list after the section in the Clean Water Act that requires it. Table ES-1 shows the stream segments within the study area that are on the 303 (d) list for 1996 with additions in 1998 that have been approved by the Environmental Protection Agency.

Table ES-1
Water Quality Limited Stream Segments

Subwatershed Name	Substance	Source	Priority
Baltimore Harbor	Copper, Cyanide, Nickel	Bethlehem Steel, SCM Hawkins Point	1
Patapsco/Back River	Nutrients	Point, Non-point, natural	6
Baltimore Harbor	Nutrients, toxic substances	unknown	12
Tidal portions of Bear Creek	Zinc, Chromium	Point Source, Non-point source, legacy	High
Tidal Portions of Bear Creek	Polychlorinated Biphenols (PCBs)	Unknown	High

Note: Legacy substances are existing pollutants from past activities that have ceased.
Source: Maryland Department of Environment TMDL web page

TMDLs are currently being drafted for impaired waters in the Patapsco/Back River Watershed, which includes the Baltimore Harbor Watershed. At this time, MDE is in the process of reviewing data for model development. The draft TMDLs will be available for review in 2001. Once the draft TMDLs are reviewed and approved, NPDES permit limits based on TMDLs, known as water quality-based limits must be issued for point source discharges. Control measures for non-point source pollution that have been developed based on the TMDLs should be implemented.

This watershed management plan offers Best Management Practices (BMPs) that target the most intense sources of pollution as well as recommending general strategies for implementation to the entire watershed.

STUDY ELEMENTS

The major tasks undertaken in preparation of this Watershed Management Plan were:

1. The watershed was characterized by collecting all available information on its land use, soils, rainfall and existing stream quality.

2. Pollutant loadings to the tributary streams under existing and future land use conditions were modeled using the Stormwater Management Model version 4.4gu (SWMM, Huber, et al., 1992).
3. The simulated runoff from the SWMM and other parameters were then input to the Simplified Tidal Embayment Model (STEAM; DiLorenzo, et al., 1994) to estimate the concentration response of selected embayments to point source and nonpoint source loadings from contributing drainage.
4. Existing and potential water quality problems were identified and ranked based on the results of the computer simulations of runoff and embayment water quality.
5. Potential sites for locating restorative or preventative measures for reducing and preventing water quality problems in the streams and harbor were identified using aerial photographs and field investigations.
6. A variety of Best Management Practices (BMPs) for stormwater control were evaluated to determine their potential effectiveness on controlling nonpoint source pollution in the study area.
7. A cost benefit analysis was then conducted to determine which BMPs could be effectively and affordably implemented.
8. The study concludes with a summary of BMPs and recommended strategies for enhancing water quality in the streams and embayments of the Baltimore Harbor Watershed.

Stormwater pollution loadings in the Baltimore Harbor Watershed can be managed by requiring structural BMPs for all land re-development (and any new development) and by conversion of existing stormwater management ponds to facilities that provide more pollution control and otherwise retrofitting existing development with BMPs. Although urban nonpoint source pollution is a major water quality concern within the watershed, numerous point source discharges exist that contribute large amounts of pollution to the streams and embayments. Table ES-2 lists the discharges that are permitted under the National Pollutant Discharge Elimination System (NPDES).

The main focus of this study is to identify sources of surface water pollution that can be controlled by installation of pollution control devices and implementation of programs to reduce the sources of pollution so that expensive treatment is not necessary. Tables ES-3 and ES-4 present the (average rainfall year) annual nonpoint source pollutant loadings for each drainage subbasin that was simulated in the Stormwater Management Model (SWMM). The pollutant loadings were then divided by the area of each subbasin to present the contaminant contributions in pounds per acre. Tables ES-5 and ES-6 show these per-acre contributions for each subbasin. These tables have been sorted to show the contribution from the highest 10% of the subbasins for each contaminant marked with three stars (***). The second highest 10% for each contaminant are marked with two stars (**), and the third highest are marked with one star (*). Field investigations were performed in the subbasins that ranked among the highest per-acre (or most concentrated) sources of nonpoint source contamination. Some of these areas are occupied by heavy industry where DEPRM is not able to construct or maintain BMPs. These areas were not investigated in the field. The watershed management plan contains recommendations for BMPs to address sources of pollution that were observed during the field investigations.

Table ES-2

NPDES Permits in Baltimore Harbor Watershed

Permit Type	Facility Name	MD Disch. Permit No.	NPDES Permit No.	Facility Type / Notes	Location	Discharges To:
General Discharge Permit No. MDR000012 for Discharges from Marinas						
	Markels Boat Yard	96MA9106	MDR000012	marina	data unavailable	data unavailable
	Youngs Boat Yard	96MA9126	MDR000012	marina	data unavailable	data unavailable
	Starr Marine Corporation	96MA9156	MDR000012	marina	data unavailable	data unavailable
	Anchor Bay East Marina LLC	96MA9181	MDR000012	marina	data unavailable	data unavailable
General Discharge Permit No. 97-SW for Storm Water Associated with Industrial Activities						
	Advanced Thermal Hydronics Inc. / Hydrotherm Corp. - Reed Financial Inc.	97SW0036	97-SW		10 Maryland Ave, Dundalk	data unavailable
	Montebello Brands, Inc.	97SW0037	97-SW		1919 Willow Spring Rd, Dundalk	data unavailable
	Vulcan Hart Company	97SW0040	97-SW		3600 North Point Blvd, Baltimore	data unavailable
	AMG Resources Corp.	97SW0083	97-SW		2415 Grays Rd, Baltimore	data unavailable
	Maryland Port Administration - Dundalk Marine Terminal	97SW0415		Permit unavailable	2700 Broening Highway, Baltimore	data unavailable
	Daily Express, Inc.	97SW0449		Permit unavailable	Old North Point Road	data unavailable
	P.T. O'Malley Lumber Company, Inc.	97SW0885	97-SW		4242 North Point Rd, Baltimore	data unavailable
	The Nelson Company	97SW0961	97-SW		2116 Sparrows Point Rd, Baltimore	data unavailable
	Tom's Auto Parts	97SW1002	97-SW		2723 North Point Blvd., Baltimore	data unavailable
	Cox Auto Parts, Inc.	97SW1020	97-SW		2719 North Point Blvd., Baltimore	data unavailable
	Dundalk Marine Terminal – I.T.O. Corporation of Baltimore	97SW1111	97-SW		2700 Broening Highway, Baltimore	data unavailable
	G & H Auto Parts – TFC Enterprises Inc.	97SW1143	97-SW		4500 North Point Blvd, Baltimore	data unavailable
	United States Aluminate Co., Inc.	97SW1292	97-SW		701 Chesapeake Ave, Baltimore	data unavailable
	Edgemere Terminals, Inc.	97SW3026	97-SW		8004 Stansbury Rd, Baltimore	data unavailable
	Blue Circle Cement	97SW3034	97-SW		Wharf Road, Gate B, Sparrows Point	data unavailable
	Baltimore Forest Products – Dundalk Marine Terminal	97SW1028		Permit unavailable	2700 Broening Highway	data unavailable
General Groundwater Remediation Permit						
	Budget Fuel Stop Site	99OGR6911		oil contaminated g.w. remediation, permit unavailable	4043 North Point Blvd., Baltimore	data unavailable

Table ES-2 (Continued)

NPDES Permits in Baltimore Harbor Watershed

Permit Type	Facility Name	MD Disch. Permit No.	NPDES Permit No.	Facility Type / Notes	Location	Discharges To:
Individual Industrial Permits						
	Blue Circle Cement	99DP3302	MD00068225	slag processing	2001 Wharf Road, Sparrows Point	Old Road Bay
	Baltimore Gas and Electric Co. - Riverside Generating Station	99DP0190	MD0001481	electric power generation	Main Street, Dundalk	Patapsco River
	U.S. Filter Recovery Services	96DP2141A	MD0060852	oil recovery and reclamation	Gate G, Beth. Steel Corp, Sparrows Pt.	Humphrey's Creek WWTP
	Pori International, Inc.	96DP2141	MD0060852	oil recovery and reclamation	Gate G, Beth. Steel Corp, Sparrows Pt.	Humphrey's Creek WWTP
	Maryland Port Administration - Dundalk Marine Terminal	93DP3060	MD0066818	groundwater remediation	2700 Broening Highway, Baltimore	Patapsco River
	Air Products and Chemicals, Inc.	96DP2137	MD0060828	industrial gas production	2005 Reservoir Rd., Sparrows Pt.	High Head Reservoir, to Bear Creek
	Signode Supply Corporation	91DP0432	MD0003191	steel & plastic strapping manufacture	4505 North Point Blvd., Baltimore	Unnamed Tributary to Bear Creek
	Baltimore Marine Industries, Inc., Shipyard - Bethlehem Steel Corp.	91DP0398	MD0001180	ship building and repair	Sparrows Point	Patapsco River
	Bethlehem Steel Corporation, Sparrows Point Steel Plant	90DP0064	MD0001201A	integrated steel plant, newest available permit = 79-DP-064A (expired 10/10/89)	Sparrows Point	Patapsco River, Bear Creek, and Old Road Bay
Terminated Permits: Permits included in Baltimore County List which have been terminated, according to MDE (Bob Daniels, 8/23/2000)						
	US Can (was American National Can)	91DP2190		terminated 1995	Sparrows Point	
	Langenfelder, C.J.&Son, Inc.	88DP2545		terminated 1994, now part of Bethlehem Steel permit	Sparrows Point	
	Segram, Joseph E & Sons	89DP1695		terminated 1995	Dundalk	
	Segram, Joseph E & Sons	85DP2214		terminated	Dundalk	
	Baltimore Gas and Electric Co. - Riverside Synthetic Natural Gas Plant	87DP1290		facility no longer exists		
	Baltimore County Sanitary Sewer Sys.	75DP1119		no longer active permit		

Note: Data in this table represents latest available data from DEPRM and MDE, and may not represent current status of all permits.

Table ES-3

Summary of Surface Runoff Pollution Loads to the Patapsco River and Chesapeake Bay from the Baltimore Harbor Watershed Average Year Simulation Results (1), for Existing Land Use

Subwatershed	Area (acres)	Percent DCIA Existing	Percent DCIA Future	Flow (cu.ft/yr)	Pollutant Load (lb/yr) TN	TP	OP	BOD	COD	TSS	PB	CU	ZN	CD
Eastern Group of Subwatersheds														
Black Marsh	519	13%	14%	18,708,531	1,680.0	182.0	101.0	9840	41200	38300	42.100	43.000	94.200	0.943
Chesapeake Bay	238	12%	12%	8,500,343	710.4	83.2	45.9	4747	19840	20030	11.679	12.026	28.780	0.533
Jones Creek	781	36%	54%	36,717,434	4,487.0	616.6	339.1	26790	93920	85900	113.270	23.690	256.600	22.560
Northpoint Creek	562	17%	21%	15,916,745	2,021.0	238.5	131.3	12216	47340	51620	11.014	10.254	47.170	2.567
Old Road Bay	428	56%	59%	27,701,215	3,324.0	540.0	297.2	17718	60580	45500	113.706	12.513	223.280	23.776
Patapsco River	1072	69%	69%	84,428,785	10,271.8	1,775.6	977.0	53905	181070	121220	400.243	32.719	753.960	84.765
Shallow Creek	396	7%	9%	10,145,476	965.6	129.6	71.4	6623	28130	30600	2.860	2.830	12.420	0.709
Swan Point Inlet	30	28%	47%	1,227,637	149.0	15.5	8.5	863	3030	3470	1.050	1.050	4.580	0.262
Western Group of Subwatersheds														
Bullneck Creek	674	36%	44%	28,407,760	4,019.9	478.2	263.4	22890	78270	61610	67.930	28.620	231.580	9.870
Bear Creek (East)	687	51%	63%	39,363,558	4,703.0	816.8	449.3	26629	93528	68054	179.012	15.479	336.663	37.324
Baltimore Harbor	699	63%	68%	51,783,457	6,280.0	990.0	545.0	33160	110200	75800	217.000	28.560	448.000	43.800
Bear Creek (West)	157	29%	50%	5,898,133	773.0	94.2	51.8	4878	17610	14800	13.020	6.040	44.710	1.577
Country Club Cove	175	23%	39%	5,686,814	592.0	104.0	57.3	4730	19200	17600	23.000	4.080	43.200	3.590
Clements Cove	52	39%	48%	4,283,675	332.0	43.3	23.8	1980	7160	5080	5.060	2.430	19.500	0.586
Humphreys Creek	1245	58%	65%	80,912,448	9,320.0	1,470.0	809.0	49380	169500	124900	335.200	62.900	663.000	64.030
Peach Orchard Cove	208	44%	48%	11,513,941	1,420.0	181.0	99.6	7890	27300	20600	23.200	9.220	78.900	3.800
Northern Group of Subwatersheds														
Bear Creek (North)	724	45%	51%	40,709,418	6,143.0	603.1	332.4	31590	92020	73700	114.560	45.730	385.800	18.136
Colgate Creek	953	40%	46%	44,035,659	6,490.0	687.0	377.0	34600	109700	98300	100.300	45.900	343.900	17.590
Chink Creek	271	40%	45%	12,383,095	1,700.0	198.0	109.0	9170	31700	26400	18.300	11.400	77.900	3.040
Charlesmont Cove	121	55%	68%	9,565,734	1,420.0	128.0	70.7	6970	17700	13100	33.700	9.890	102.000	5.760
Lynch Cove	688	43%	51%	34,347,652	5,165.0	548.2	302.0	27450	84880	68600	93.680	37.750	313.000	14.949
Oakleigh Cove	265	52%	59%	17,583,898	2,880.0	252.0	139.0	13900	35000	28500	63.400	21.000	196.000	10.900
Schoolhouse Cove	174	30%	45%	6,766,892	920.0	114.0	62.5	5830	19700	17900	28.800	7.320	67.700	4.430
Tabasco Cove	300	59%	68%	23,366,769	3,580.0	356.0	196.4	17350	44400	34100	98.100	23.020	261.100	18.090
Total Watershed	11418	44%	51%	619,955,069	79,346.7	10,644.8	5,859.4	431099	1432978	1145684	2110.184	497.421	5033.943	393.587

Notes: (1) The "Average" year is based on continuous SWMM/RUNOFF simulations using 1990 BWI rainfall.

Table ES-4

Summary of Surface Runoff Pollution Loads to the Patapsco River and Chesapeake Bay from the Baltimore Harbor Watershed Average Year Simulation Results (1), for Future Land Use

Subwatershed	Area (acres)	Percent DCIA		Flow (cu.ft/yr)	Pollutant Load (lb/yr)									
		Existing	Future		TN	TP	OP	BOD	COD	TSS	PB	CU	ZN	CD
Eastern Group of Subwatersheds														
Black Marsh	519	13%	14%	18,160,056	1,700.0	187.0	103.0	9770	40800	37700	43.000	43.100	95.600	1.180
Chesapeake Bay	238	12%	12%	7,977,449	709.7	82.8	45.6	4715	19460	19910	10.569	10.800	27.170	0.614
Jones Creek	781	36%	54%	49,987,553	6,400.0	888.5	489.6	32740	104900	84500	182.490	31.080	399.500	37.871
Northpoint Creek	562	17%	21%	17,623,421	2,514.0	274.2	150.8	13411	49280	53480	17.100	14.269	66.440	3.768
Old Road Bay	428	56%	59%	29,116,258	3,524.0	555.0	305.0	18326	61010	45770	116.978	13.932	232.760	24.790
Patapsco River	1072	69%	69%	84,405,104	10,285.0	1,776.6	977.6	53939	181210	121290	400.369	32.844	754.510	84.796
Shallow Creek	396	7%	9%	10,373,374	1,099.4	133.1	73.3	6846	27600	29960	5.566	4.536	20.867	1.226
Swan Point Inlet	30	28%	47%	1,822,160	307.0	25.4	14.0	1470	3780	3630	5.730	2.290	18.500	1.040
Western Group of Subwatersheds														
Bullneck Creek	674	36%	44%	34,135,310	4,680.0	584.8	321.7	25940	87370	65710	87.500	31.140	278.800	14.210
Bear Creek (East)	687	51%	63%	47,914,359	5,768.7	994.1	546.9	31034	105710	72950	226.100	19.961	426.550	46.920
Baltimore Harbor	699	63%	68%	54,901,480	6,830.0	1,100.0	605.0	35300	115500	75800	244.800	26.230	498.000	50.600
Bear Creek (West)	157	29%	50%	9,599,477	1,199.0	177.6	97.7	6688	23320	16460	30.760	6.410	77.060	5.711
Country Club Cove	175	23%	39%	8,625,626	993.0	170.0	93.3	6370	23600	19200	39.800	5.550	75.900	7.150
Clements Cove	52	39%	48%	4,603,059	398.0	51.5	28.3	2210	7720	4860	5.520	2.650	23.100	0.725
Humphreys Creek	1245	58%	65%	89,676,831	10,960.0	1,773.0	977.0	57000	188400	132800	393.900	40.820	774.000	82.900
Peach Orchard Cove	208	44%	48%	12,355,117	1,660.0	193.0	106.0	8750	27900	21000	29.600	11.000	98.100	5.050
Northern Group of Subwatersheds														
Bear Creek (North)	724	45%	51%	45,396,648	7,149.0	678.0	373.3	35080	96470	73940	135.640	51.970	459.200	22.425
Colgate Creek	953	40%	46%	50,122,310	7,600.0	796.0	438.0	38900	117000	98600	132.300	52.100	435.000	23.770
Chink Creek	271	40%	45%	13,878,026	1,910.0	225.0	124.0	10300	34500	25900	25.000	12.900	102.000	3.910
Charlesmont Cove	121	55%	68%	10,277,177	1,380.0	173.0	95.5	6750	19300	12800	41.300	7.540	101.000	7.970
Lynch Cove	688	43%	51%	40,432,147	5,965.0	671.4	369.6	30700	93800	67200	115.400	39.950	374.500	19.390
Oakleigh Cove	265	52%	59%	19,110,666	2,970.0	298.0	164.0	14200	37100	28500	72.800	19.800	204.000	13.400
Schoolhouse Cove	174	30%	45%	9,513,096	1,220.0	173.0	95.0	6930	23200	19200	39.500	7.130	85.200	7.370
Tabasco Cove	300	59%	68%	24,885,546	3,420.0	436.0	240.0	16760	47300	33260	108.800	18.080	250.600	21.560
Total Watershed	11418	44%	51%	694,892,250	90,641.8	12,417.0	6,834.2	474129	1536230	1164420	2510.522	506.082	5878.357	488.345

Notes: (1) The "Average" year is based on continuous SWMM/RUNOFF simulations using 1990 BWI rainfall.

Table ES-5
Baltimore Harbor Watershed - Existing Conditions
Unit Load Rankings: *** = Rank 1 - 7, ** = Rank 8 - 14, * = Rank 15 - 21

Subbasin	Area (acres)	Flow (cu.ft/ac/yr)	TN (lb/ac/yr)	TP (lb/ac/yr)	OP (lb/ac/yr)	BOD (lb/ac/yr)	COD (lb/ac/yr)	TSS (lb/ac/yr)	PB (lb/ac/yr)	CU (lb/ac/yr)	ZN (lb/ac/yr)	CD (lb/ac/yr)
HC183-20	170.0	*** 84,890	* 8.35	** 1.24	** 0.68	* 41.06	** 142.95	98.83	** 0.3277	*** 0.1118	** 0.6471	** 0.0508
PR149-20	82.2	*** 84,475	*** 10.29	*** 1.79	*** 0.98	*** 53.90	*** 181.29	*** 120.21	*** 0.4039	0.0326	*** 0.7616	*** 0.0855
CL186-10	52.0	*** 82,451	6.39	0.83	0.46	38.11	* 137.81	** 97.78	0.0974	* 0.0468	0.3753	0.0113
TC144-10	87.6	*** 81,804	*** 14.27	* 1.08	* 0.60	*** 64.49	* 140.39	*** 115.28	** 0.3287	*** 0.1087	*** 1.0170	** 0.0570
PR149-15	235.9	*** 80,836	*** 9.88	*** 1.71	*** 0.94	*** 51.71	*** 173.35	*** 115.29	*** 0.3878	0.0312	*** 0.7290	*** 0.0822
PR149-40	317.0	*** 79,854	** 9.72	*** 1.68	*** 0.93	** 50.79	*** 170.68	** 113.26	*** 0.3818	0.0307	** 0.7162	*** 0.0808
CM167-10	121.1	*** 79,016	*** 11.73	* 1.06	* 0.58	*** 57.57	** 146.21	108.21	** 0.2784	*** 0.0817	*** 0.8426	* 0.0476
PR149-30	415.0	** 77,946	** 9.47	*** 1.64	*** 0.90	** 49.64	*** 166.28	* 110.37	*** 0.3711	0.0299	** 0.6988	*** 0.0786
BH105-20	253.4	** 76,820	** 9.83	*** 1.58	*** 0.87	** 50.52	*** 163.80	108.15	*** 0.3600	0.0374	** 0.7223	*** 0.0746
BN179-50	133.0	** 76,608	*** 15.64	** 1.17	** 0.65	*** 71.04	** 147.35	102.99	*** 0.4112	*** 0.1248	*** 1.2404	** 0.0663
TC144-15	212.0	** 76,403	*** 10.99	** 1.23	** 0.68	*** 55.18	** 151.39	** 113.19	** 0.3268	** 0.0637	*** 0.8112	** 0.0618
BE179-75	277.7	** 76,017	** 9.18	*** 1.59	*** 0.88	** 47.90	*** 161.33	106.95	*** 0.3601	0.0293	** 0.6770	*** 0.0763
OR155-10	307.5	** 75,273	** 8.98	*** 1.55	*** 0.86	** 47.16	*** 159.04	106.35	** 0.3513	0.0288	** 0.6635	*** 0.0742
BH105-10	227.5	** 73,107	* 7.65	** 1.24	** 0.69	* 42.90	** 152.09	*** 116.05	* 0.2695	0.0432	* 0.5275	** 0.0527
BH105-15	217.9	* 72,000	** 9.41	** 1.41	** 0.78	** 48.64	** 156.48	100.96	** 0.2960	0.0425	** 0.6654	** 0.0592
HC183-10	674.9	* 68,166	* 8.15	** 1.37	** 0.76	* 42.08	* 142.54	95.42	** 0.3200	0.0430	* 0.6090	** 0.0640
OC185-10	264.8	* 66,411	*** 10.88	* 0.95	* 0.52	*** 52.50	132.19	107.64	* 0.2395	*** 0.0793	*** 0.7403	* 0.0412
BN179-55	78.9	* 63,070	5.92	0.68	0.38	33.33	118.61	107.84	0.0584	0.0384	0.2433	0.0102
LC153-20	149.3	* 58,916	** 9.18	* 0.92	* 0.50	** 46.22	132.64	98.48	* 0.1681	** 0.0666	* 0.5835	* 0.0271
BN179-40	141.6	* 58,772	* 8.19	0.90	0.50	* 42.64	132.73	93.90	0.1313	** 0.0569	* 0.4914	0.0203
BW179-25	41.7	* 57,434	7.51	* 0.94	* 0.52	41.04	* 142.08	96.00	0.0955	* 0.0492	0.4104	0.0137
BE179-70	314.9	55,933	6.70	** 1.17	** 0.64	40.33	** 145.45	** 111.79	* 0.2464	0.0214	* 0.4637	** 0.0511
PO151-10	207.6	55,475	6.84	0.87	0.48	38.01	131.53	99.25	0.1118	* 0.0444	0.3801	0.0183
CG150-10	240.7	55,380	* 7.98	* 0.93	* 0.51	* 42.37	* 135.83	92.22	0.1433	** 0.0552	* 0.5026	0.0217
JC187-10	329.5	53,331	6.28	* 1.09	* 0.60	38.24	* 139.60	* 108.95	* 0.2285	0.0201	0.4309	* 0.0473
BC152-10	161.4	53,114	7.06	0.88	0.48	38.53	* 133.17	90.43	0.0923	* 0.0466	0.3877	0.0131
BN179-45	167.7	51,801	* 8.11	0.79	0.43	* 41.21	121.67	106.76	0.1294	** 0.0585	0.4551	0.0224
BC152-15	197.9	51,594	7.02	0.86	0.47	38.86	132.90	91.97	0.1031	* 0.0486	0.4058	0.0141
LC153-10	437.3	51,287	* 7.75	0.84	0.46	* 41.16	127.38	99.94	0.1464	** 0.0560	* 0.4803	0.0233
HC183-15	399.7	51,225	6.00	0.83	0.46	35.02	122.58	* 109.32	0.1589	0.0373	0.3552	* 0.0305
CB141-20	12.5	49,102	5.08	0.52	0.29	28.59	99.31	** 113.73	0.0368	0.0365	0.1586	0.0091
OR155-20	22.1	48,884	5.24	0.53	0.29	29.27	101.18	*** 116.54	0.0375	0.0373	0.1631	0.0093
JC187-20	119.3	47,718	6.01	0.72	0.39	35.70	118.15	* 109.77	* 0.1642	* 0.0452	0.4014	* 0.0271
CG150-15	337.8	47,128	7.25	0.73	0.40	37.60	113.69	104.51	0.1211	** 0.0512	0.3938	0.0221
NC188-25	47.8	45,757	5.25	0.54	0.29	29.49	101.86	*** 116.50	0.0381	0.0374	0.1654	0.0094

Table ES-5 (Continued)
Baltimore Harbor Watershed - Existing Conditions
Unit Load Rankings: *** = Rank 1 - 7, ** = Rank 8 - 14, * = Rank 15 - 21

Subbasin	Area (acres)	Flow (cu.ft/ac/yr)	TN (lb/ac/yr)	TP (lb/ac/yr)	OP (lb/ac/yr)	BOD (lb/ac/yr)	COD (lb/ac/yr)	TSS (lb/ac/yr)	PB (lb/ac/yr)	CU (lb/ac/yr)	ZN (lb/ac/yr)	CD (lb/ac/yr)
CK154-10	270.7	45,750	6.28	0.73	0.40	33.88	117.12	97.54	0.0676	0.0421	0.2878	0.0112
CB141-10	89.3	45,387	3.71	0.39	0.22	22.62	89.58	89.70	0.0711	*** 0.0731	0.1792	0.0037
BN179-30	73.5	44,208	5.54	0.64	0.35	32.10	113.72	107.33	0.0605	0.0403	0.2408	0.0098
NC188-30	96.2	42,485	5.06	0.51	0.28	27.03	93.37	107.10	0.0355	0.0355	0.1487	0.0087
JC187-30	98.4	42,001	5.28	0.53	0.29	29.58	99.81	** 112.81	0.0505	0.0390	0.1941	0.0107
BW179-15	29.0	41,361	5.32	0.71	0.39	33.27	123.57	91.12	0.0884	0.0414	0.3210	0.0092
BN179-35	128.8	41,010	5.19	0.67	0.37	32.61	120.34	96.27	0.0815	0.0409	0.2950	0.0089
SP189-10	30.0	40,986	4.97	0.52	0.28	28.81	101.16	*** 115.85	0.0351	0.0351	0.1529	0.0087
OR155-25	45.3	40,367	4.73	0.47	0.26	29.37	100.27	106.67	0.0875	0.0426	0.2584	0.0120
JC187-25	234.0	39,808	5.04	0.51	0.28	29.99	102.55	* 110.24	0.0573	0.0335	0.2034	0.0114
CG150-20	374.6	39,469	5.66	0.57	0.32	31.23	103.05	108.92	0.0665	0.0408	0.2400	0.0131
SC157-10	67.0	39,415	3.48	0.41	0.22	25.38	98.98	* 110.63	0.0203	0.0202	0.0884	0.0050
SH182-10	173.8	38,944	5.29	0.66	0.36	33.55	113.37	103.02	* 0.1657	0.0421	0.3896	0.0255
NC188-35	22.5	38,656	4.98	0.51	0.28	27.85	96.09	** 110.77	0.0357	0.0354	0.1548	0.0089
NC188-10	129.5	38,066	4.41	0.54	0.30	26.26	101.93	106.57	0.0259	0.0212	0.1120	0.0055
SC157-15	88.5	36,413	3.96	0.49	0.27	24.29	97.03	106.97	0.0169	0.0167	0.0734	0.0042
BM156-10	519.3	36,024	3.23	0.35	0.19	18.95	79.33	73.75	0.0811	*** 0.0828	0.1814	0.0018
BC152-20	246.8	35,861	5.67	0.62	0.34	32.58	107.37	100.08	0.1171	0.0409	0.3274	0.0191
SC157-25	40.4	34,129	1.60	0.27	0.15	18.37	85.56	91.98	0.0000	0.0000	0.0000	0.0000
PR149-10	22.4	33,850	3.83	0.43	0.24	25.69	96.97	* 109.03	0.0243	0.0241	0.1055	0.0060
CC181-10	175.2	32,460	3.38	0.59	0.33	27.00	109.59	100.46	0.1313	0.0233	0.2466	0.0205
LC153-15	101.1	30,930	4.01	0.45	0.25	25.23	92.79	100.90	0.0453	0.0327	0.1573	0.0069
OR155-15	53.4	30,820	4.38	0.54	0.30	23.21	91.70	100.87	0.0171	0.0170	0.0743	0.0042
CB141-15	136.0	28,189	2.32	0.31	0.17	17.42	77.93	77.93	0.0358	0.0371	0.0794	0.0007
BW179-10	54.2	27,194	3.12	0.39	0.22	23.63	94.15	97.29	0.0380	0.0236	0.1257	0.0046
BW179-20	32.5	25,657	4.22	0.40	0.22	28.44	92.63	88.94	0.1360	* 0.0465	0.3539	0.0151
NC188-20	184.0	14,775	2.10	0.29	0.16	15.76	68.49	73.38	0.0062	0.0056	0.0266	0.0014
SC157-20	200.1	14,503	1.58	0.24	0.13	10.15	47.23	49.98	0.0000	0.0000	0.0000	0.0000
NC188-15	82.0	13,744	2.60	0.35	0.19	15.62	67.46	72.71	0.0059	0.0058	0.0255	0.0015
BC152-25	68.2	11,314	1.32	0.19	0.11	13.78	58.19	60.24	0.0547	0.0201	0.1155	0.0035
BE179-65	77.5	7,392	0.47	0.08	0.05	6.83	31.76	34.21	0.0138	0.0058	0.0261	0.0002
BE179-60	16.8	4,150	0.41	0.07	0.04	5.96	27.91	30.05	0.0204	0.0087	0.0383	0.0003

Note: This table is sorted in descending order of flow; flow parameter is not included in ranking analysis.

Table ES-6
Baltimore Harbor Watershed - Future Scenario
Unit Load Rankings: *** = Rank 1 - 7, ** = Rank 8 - 14, * = Rank 15 - 21

Subbasin	Area (acres)	Flow (cu.ft/ac/yr)	TN (lb/ac/yr)	TP (lb/ac/yr)	OP (lb/ac/yr)	BOD (lb/ac/yr)	COD (lb/ac/yr)	TSS (lb/ac/yr)	PB (lb/ac/yr)	CU (lb/ac/yr)	ZN (lb/ac/yr)	CD (lb/ac/yr)
BN179-50	133.0	*** 89,453	*** 18.42	* 1.35	* 0.74	*** 79.7	* 154.1	103.0	*** 0.4661	*** 0.1413	*** 1.4359	*** 0.0782
CL186-10	52.0	*** 88,598	7.66	0.99	0.54	42.5	* 148.6	93.5	0.1062	* 0.0510	0.4446	0.0140
BH105-10	227.5	*** 86,398	** 9.93	*** 1.72	*** 0.95	** 51.9	*** 175.0	*** 116.0	*** 0.3886	0.0317	** 0.7341	*** 0.0822
CM167-10	121.1	*** 84,893	*** 11.40	** 1.43	** 0.79	*** 55.8	** 159.4	105.7	* 0.3412	** 0.0623	*** 0.8343	* 0.0658
PR149-20	82.2	*** 84,398	** 10.29	*** 1.79	*** 0.98	*** 53.9	*** 181.3	*** 120.2	*** 0.4039	0.0326	*** 0.7616	*** 0.0855
TC144-15	212.0	*** 83,180	*** 10.56	** 1.57	** 0.86	*** 53.3	** 162.7	109.9	*** 0.3768	0.0452	*** 0.7829	** 0.0773
TC144-10	87.6	*** 82,738	*** 13.47	* 1.18	* 0.65	*** 62.3	* 146.1	** 113.7	* 0.3299	*** 0.0969	*** 0.9656	* 0.0589
HC183-20	170.0	** 82,627	** 9.88	*** 1.72	*** 0.94	** 51.8	*** 174.1	** 115.3	*** 0.3889	0.0313	** 0.7295	*** 0.0824
PR149-15	235.9	** 80,774	* 9.88	*** 1.71	*** 0.94	** 51.7	*** 173.8	** 115.3	*** 0.3878	0.0312	** 0.7290	*** 0.0822
PR149-40	317.0	** 79,763	* 9.72	*** 1.68	*** 0.93	** 50.8	*** 170.7	** 113.3	*** 0.3818	0.0307	** 0.7162	*** 0.0808
JC187-20	119.3	** 79,749	*** 10.31	* 1.42	* 0.78	** 52.0	* 157.5	*** 116.5	* 0.3276	* 0.0504	** 0.7214	* 0.0666
PR149-30	415.0	** 77,881	* 9.47	*** 1.64	*** 0.90	* 49.6	*** 166.3	110.4	** 0.3711	0.0299	** 0.6988	*** 0.0786
JC187-10	329.5	** 77,555	9.01	** 1.56	** 0.86	47.3	** 158.4	105.3	** 0.3551	0.0285	* 0.6677	** 0.0750
BH105-20	253.4	** 77,176	** 9.91	** 1.59	** 0.87	** 50.9	*** 164.2	108.1	** 0.3623	0.0380	** 0.7302	** 0.0750
OR155-10	307.5	* 76,369	* 9.11	** 1.58	** 0.87	* 47.8	** 160.0	106.4	** 0.3578	0.0288	* 0.6732	** 0.0758
BE179-75	277.7	* 76,045	* 9.18	*** 1.59	*** 0.88	* 47.9	** 161.3	107.3	** 0.3601	0.0290	* 0.6770	** 0.0763
BE179-70	314.9	* 75,325	* 9.05	** 1.57	** 0.86	* 47.6	** 160.1	106.7	** 0.3557	0.0286	* 0.6669	** 0.0749
HC183-10	674.9	* 74,261	8.83	** 1.53	** 0.84	46.2	* 155.6	103.1	** 0.3467	0.0279	0.6519	** 0.0733
BW179-10	54.2	* 72,794	8.82	* 1.39	* 0.76	47.6	** 163.4	** 114.1	* 0.2640	0.0377	0.5834	* 0.0539
OC185-10	264.8	* 72,178	*** 11.22	1.13	0.62	*** 53.6	140.1	107.6	* 0.2750	*** 0.0748	*** 0.7705	* 0.0506
BH105-15	217.9	* 72,020	* 9.45	* 1.41	* 0.78	* 48.6	* 156.5	101.0	* 0.2964	0.0431	* 0.6700	* 0.0592
BN179-55	78.9	69,266	7.25	0.83	0.46	39.0	130.5	104.4	0.0910	0.0493	0.3700	0.0148
LC153-20	149.3	67,178	*** 10.99	1.06	0.58	*** 53.1	142.7	95.1	0.2177	*** 0.0790	*** 0.7436	0.0350
BN179-40	141.6	65,045	** 9.95	1.01	0.56	* 49.1	138.4	94.6	0.1899	*** 0.0702	* 0.6524	0.0309
CG150-10	240.7	64,965	** 10.01	1.08	0.59	** 49.8	145.4	90.1	0.1932	** 0.0685	* 0.6688	0.0306
HC183-15	399.7	63,822	8.31	* 1.13	* 0.62	42.5	134.6	109.1	0.2347	0.0418	0.5254	0.0485
BW179-20	32.5	63,477	7.76	* 1.31	* 0.72	44.0	* 152.3	* 112.3	* 0.3044	0.0339	0.5847	* 0.0600
SP189-10	30.0	60,835	** 10.25	0.85	0.47	* 49.1	126.2	*** 121.2	0.1913	*** 0.0765	0.6176	0.0347
LC153-10	437.3	60,379	8.67	1.04	0.57	45.3	142.2	96.5	0.1793	** 0.0558	0.5580	0.0302
PO151-10	207.6	59,528	8.00	0.93	0.51	42.2	134.4	101.2	0.1426	** 0.0530	0.4727	0.0243
BW179-25	41.7	57,424	7.54	0.95	0.52	41.0	142.3	95.8	0.0960	0.0494	0.4104	0.0138
SH182-10	173.8	54,748	7.02	1.00	0.55	39.9	133.5	* 110.5	0.2273	0.0410	0.4903	0.0424
OR155-25	45.3	54,605	7.13	0.65	0.36	36.9	111.3	*** 119.0	0.0950	* 0.0523	0.3335	0.0188
BC152-10	161.4	53,451	7.12	0.89	0.49	38.9	133.2	90.4	0.0941	0.0473	0.3952	0.0136
BC152-15	197.9	53,152	7.23	0.89	0.49	39.9	135.9	90.5	0.1081	* 0.0498	0.4265	0.0147

Table ES-6 (Continued)
Baltimore Harbor Watershed - Future Scenario
Unit Load Rankings: *** = Rank 1 - 7, ** = Rank 8 - 14, * = Rank 15 - 21

Subbasin	Area (acres)	Flow (cu.ft/ac/yr)	TN (lb/ac/yr)	TP (lb/ac/yr)	OP (lb/ac/yr)	BOD (lb/ac/yr)	COD (lb/ac/yr)	TSS (lb/ac/yr)	PB (lb/ac/yr)	CU (lb/ac/yr)	ZN (lb/ac/yr)	CD (lb/ac/yr)
BN179-45	167.7	52,593	8.29	0.81	0.44	41.9	122.9	106.2	0.1330	** 0.0595	0.4682	0.0231
CK154-10	270.7	51,274	7.06	0.83	0.46	38.1	127.5	95.7	0.0924	0.0477	0.3768	0.0144
CG150-15	337.8	51,028	7.55	0.83	0.46	39.1	120.2	104.5	0.1409	0.0491	0.4234	0.0268
BN179-35	128.8	50,627	6.70	0.81	0.45	37.4	129.7	100.2	0.0862	0.0463	0.3494	0.0127
CC181-10	175.2	49,234	5.67	0.97	0.53	36.4	134.7	109.6	0.2272	0.0317	0.4332	0.0408
CB141-20	12.5	48,681	5.26	0.53	0.29	29.2	100.1	** 113.7	0.0416	0.0376	0.1738	0.0099
BC152-20	246.8	48,392	7.05	0.82	0.45	38.1	122.0	104.9	0.1467	0.0470	0.4173	0.0263
NC188-35	22.5	48,294	7.47	0.66	0.37	37.9	109.4	** 114.3	0.1117	** 0.0552	0.3804	0.0214
OR155-20	22.1	47,861	5.19	0.53	0.29	29.2	101.2	*** 116.1	0.0374	0.0371	0.1626	0.0093
BN179-30	73.5	47,329	6.31	0.70	0.38	35.4	119.3	107.5	0.0838	0.0462	0.3142	0.0134
CG150-20	374.6	46,042	7.05	0.68	0.37	36.6	110.5	* 111.1	0.1020	* 0.0507	0.3497	0.0196
JC187-25	234.0	45,633	7.18	0.64	0.35	34.3	101.7	106.4	0.0953	* 0.0513	0.3234	0.0183
NC188-25	47.8	44,932	5.25	0.54	0.29	29.3	101.6	*** 116.1	0.0381	0.0374	0.1654	0.0093
BC152-25	68.2	44,616	5.28	0.92	0.51	34.6	130.0	107.2	0.2155	0.0300	0.4046	0.0383
NC188-30	96.2	43,172	4.97	0.51	0.28	27.9	96.5	* 111.3	0.0358	0.0355	0.1549	0.0089
JC187-30	98.4	43,038	5.28	0.55	0.30	29.6	102.7	* 111.8	0.0416	0.0373	0.1799	0.0095
CB141-10	89.3	42,819	3.83	0.41	0.22	23.2	89.7	92.8	0.0613	** 0.0627	0.1668	0.0045
SC157-15	88.5	41,564	5.15	0.52	0.29	26.4	94.0	103.7	0.0382	0.0317	0.1401	0.0083
BW179-15	29.0	41,458	5.35	0.71	0.39	33.4	123.9	91.1	0.0887	0.0418	0.3231	0.0093
NC188-10	129.5	41,114	5.36	0.56	0.31	27.1	96.5	100.4	0.0409	0.0332	0.1591	0.0084
SC157-10	67.0	39,849	3.91	0.44	0.24	26.9	101.1	* 111.8	0.0309	0.0239	0.1217	0.0069
LC153-15	101.1	39,594	5.29	0.57	0.31	29.5	101.9	106.8	0.0445	0.0371	0.1929	0.0095
OR155-15	53.4	39,355	5.35	0.52	0.28	24.5	84.8	95.6	0.0346	0.0354	0.1321	0.0081
PR149-10	22.4	36,215	4.42	0.47	0.26	27.2	98.8	* 112.2	0.0299	0.0297	0.1300	0.0074
BM156-10	519.3	34,968	3.27	0.36	0.20	18.8	78.6	72.6	0.0828	*** 0.0830	0.1841	0.0023
BE179-65	77.5	33,751	3.70	0.65	0.36	28.4	113.7	102.5	0.1485	0.0261	0.2801	0.0235
SC157-25	40.4	30,779	1.47	0.25	0.14	17.0	79.1	84.8	0.0000	0.0000	0.0000	0.0000
BE179-60	16.8	27,698	4.87	0.46	0.25	31.8	101.4	96.0	0.1550	* 0.0525	0.4085	0.0179
CB141-15	136.0	26,070	2.22	0.29	0.16	16.8	75.0	75.0	0.0337	0.0348	0.0743	0.0006
NC188-20	184.0	19,561	3.64	0.43	0.23	19.1	76.1	81.5	0.0180	0.0155	0.0620	0.0039
NC188-15	82.0	16,041	3.09	0.41	0.22	17.8	75.4	81.2	0.0087	0.0083	0.0376	0.0021
SC157-20	200.1	13,895	1.61	0.24	0.13	10.1	46.5	49.3	0.0006	0.0006	0.0016	0.0001

Note: This table is sorted in descending order of flow; flow parameter is not included in the ranking analysis.

BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are watershed management strategies that use a variety of techniques to minimize the amount of nonpoint source pollution that is discharged from the local watershed into the receiving waters. BMPs can be divided into two general categories: structural and non-structural. As the names suggest, nonstructural controls rely on non-build methods to reduce levels of pollution entering the system. Structural controls involve the construction of a structure to physically remove pollution. The goal of this evaluation is to determine which combination of BMPs would most efficiently and cost effectively reduce the input of nonpoint source pollution into the Baltimore Harbor Watershed.

Nonstructural Controls

Nonstructural controls act by decreasing the level of pollution produced (source controls) or by removing pollution before it enters the receiving system. Source control BMPs are commonly included in municipal stormwater management programs, and are included in NPDES stormwater permit conditions. More detailed information on designing and implementing these programs is provided in Baltimore County NPDES permit applications, annual reports, and the 2000 Maryland Stormwater Design Manual.

Ordinances restricting density and land use are effective non-structural BMPs often applied in developing areas. Since the existing land use in the Baltimore Harbor Watershed is highly urbanized or protected within North Point State Park, land development and density restrictions are not widely applicable to the study area.

It was observed that residents within the study area are detached from their environmental surroundings and seem to tolerate the degraded condition of many of the watercourses. This watershed management plan recommends a greater regulatory presence to police the business and industrial sector of the community and a stepped-up public education program to promote involvement of residents.

Nonstructural BMPs considered for use in the Baltimore Harbor Watershed are described below.

Public Education

Public education and participation are essential elements of source control BMPs. Public education is needed in order to bring about the behavioral changes necessary to reduce discharges of pollution to surface waters. Citizens should learn proper disposal of litter, yard waste, used motor oil, antifreeze and other household wastes, as well as some background on water ecology and how storm drains discharge directly into water bodies. Industries, municipalities and homeowners can learn how to use fertilizers, pesticides, and landscaping techniques correctly to maintain their lawns and gardens without polluting the water. An example of these behavioral changes is finding alternative methods for organizationally sponsored carwashes, which are common fundraising methods. These should be held on grassy

areas, using biodegradable soaps. Also, schools should encourage the practice of "adopting" nearby stormwater management ponds, so that the students can study field biology and understand the stormwater management process. An extensive program for community education and outreach exists within the DEPRM. Contact Jeanne Armacost (410-887-4488 X251) for further information on existing public education programs, including curbside recycling, storm drain stenciling, publications, school education, household hazardous waste (e.g., paint and oil) collection days, and others. The Baltimore County DEPRM also promotes state programs such as the Treemendous Program and The Baltimore County Sustainable Landscapes Program. Each spring and fall, the Treemendous Program makes trees available at reasonable cost to non-profit organizations. The County delivers the trees free of charge to be planted on community property.

Baltimore County's "Lets be Partners" program is available to groups such as scouts, businesses, schools, civic and homeowners associations, Elks Club and church groups. The "Lets Be Partners" program provides lectures and direction towards implementing environmentally friendly practices at work and at home. The Baltimore County Sustainable Landscapes Program is a program that evaluates landscaping on business properties and encourages the use of native plants as well as preserving wetlands and existing trees and vegetation. Baltimore County also sponsors the "Green Schools" program that allows students to evaluate and bring change to their school surroundings. Schools must fulfill a checklist and implement practices such as buying recycled paper and improving landscaping to become a designated "Green School".

Many observations of trash and debris (including yard wastes) were made during the field investigations that were performed for this study. A stepped up community education program that targets the neighborhoods along the water courses is recommended to be implemented on a watershed-wide basis. The focus of the program should be to get neighborhood residents to take ownership of the streams in their communities and care for them by not tolerating their degradation with litter. In addition to obvious litter, residents should be educated to properly dispose of yard wastes and optimize applications of fertilizer. The County may consider continuing the practice of providing compost bins and providing ongoing educational efforts to promote environmentally friendly composting practices. Neighborhood stream clean-up and storm drain stenciling days could also be organized under this program.

Institutional Measures

Institutional measures such as ordinances that limit or regulate land use activities can be effective pollution source reduction tools. The point source NPDES Permit Program is the primary example of an institutional measure with the goal of reducing the source pollutants from non-stormwater industrial discharges.

Law Enforcement Involvement

Increased County Police involvement in enforcing existing environmentally-based regulations, particularly regarding placing various materials into storm drains and stormwater management ponds, and trespassing and vandalism of these facilities should be encouraged. Many stormwater

management ponds are the only wooded areas left around subdivisions, and have become youth hangouts. The ponds then become undesirable to the residents. Vandalism to stormwater management ponds occurs at a great expense to taxpayers, and wastes administrative and maintenance time that could be spent on other facilities. At this time, there is little awareness or concern by the Police regarding these issues, which they often consider as trivial, and unrelated to public safety. Furthermore, DEPRM does not maintain round the clock enforcement, which often precludes gathering of any valuable evidence at the time of the violation. Once a commitment from the Police is secured through efforts by DEPRM, the public should be informed that they can rely on them to respond immediately to violations and possibly even take enforcement action. Experience has shown that citizens are reluctant to confront trespassers and vandals for fear of retaliation, and in general are unaware that they can summon the local Police for such matters. On the other hand, experience has also shown that the Police are reluctant to get involved in potential violations of environmental issues. The County Police should be trained to recognize and deal with the local environmental issues, which should be included in their routine enforcement duties. Greater Police involvement would also lessen the risk of other types of crimes being committed in these often-secluded areas, and would be a valuable tool in maintaining the public's continuing participation. "No Trespassing" signs with instructions to call the police should be installed at many stormwater management ponds. These signs should also state the purpose of the stormwater management pond and that it drains to the Chesapeake Bay.

Best Management Practices for Golf Courses

Two of the embayments that ranked highly as being susceptible to pollutants receive surface drainage from golf courses. The golf courses are located adjacent to Schoolhouse Cove and Country Club Cove on the Eastern Shore of Bear Creek. A review of the pollution control measures in practice at these golf courses is recommended to potentially reduce contaminated runoff to the coves.

One of the largest concerns about golf courses are the large inputs of fertilizer, pesticides, fungicides, and other chemicals that are required to maintain vigorous and attractive greens. Chemical application rates can rival and even exceed those used in intensive agriculture. The actual rate of fertilizer and pesticide application rates at a particular golf course can vary considerably, depending on the soil, climate, and management program. Given such intensive use of chemicals, golf courses clearly have the potential to deliver pollutants to ground and surface waters. This Watershed Management Plan for the Baltimore Harbor Watershed recommends that the BMPs at golf courses located within the watershed be evaluated and upgraded to reflect the susceptibility of the surface water bodies to which they discharge runoff.

Best Management Practices for Marinas

At least nine marinas are located along Bear Creek, Jones Creek and North Point Creek. The Maryland Clean Marina Initiative has published the Maryland Clean Marina Guidebook (MDNR, 1998). The Maryland Clean Marina Initiative promotes and celebrates the voluntary

adoption of measures to reduce pollution from marinas and recreational boats. Designated "clean marinas" are recognized as environmentally responsible businesses. Marina operators sign a pledge to do their part to keep Maryland's waterways free of harmful chemicals, excess nutrients and debris. Marina operators signing the Clean Marinas Pledge perform a self-assessment of their facility and then schedule a confirmation visit. A Clean Marinas Initiative staff member then visits the marina and verifies the self-assessment in order to designate the marina as a "Clean Marina." Currently, two of the 18 certified "Clean Marinas" within Maryland are located in the Baltimore Harbor Watershed. They are Anchor Bay East marina in Dundalk and Young's Boat Yard in Edgemere. This watershed management plan recommends that the remaining marinas within the watershed be contacted and urged to participate in this very important program.

Structural BMPS

This watershed management plan focuses on identification of areas where actual implementation of BMP retrofit projects is feasible. The following characteristics of the Baltimore Harbor Watershed make it more practical to target hot spots for BMP implementation as opposed to planning regional water quality enhancement structures:

- The Study area is not comprised of large dendritic drainage systems. It is comprised of many small subbasins draining directly to tidal embayments.
- The study area is currently highly urbanized with large industrial and commercial components.

The following types of structural BMPs are recommended for implementation within the study area:

Detention Basin BMPs

Detention basins are effective BMPs for reducing the levels of pollution and sediment from stormwater runoff by temporarily detaining a portion of stormwater runoff in a basin for a specified length of time. Stormwater is slowly released into the receiving stream through a controlled discharge, such as a perforated riser or low flow weir. Pollutants are removed through the settling of particulates and solids from the water. Detention basins are effective in reducing peak stormwater discharges, controlling floods and preventing downstream channel scouring. Often detention basins have a section of the basin separated from the main part of the basin by a wall or dike; called a forebay that receives the incoming stormwater. Forebays capture larger debris and sand deposits, which accumulate quickly, which eases routine cleaning and other necessary maintenance in the basins.

Two common types of detention basin BMPs are used to control stormwater runoff pollution: wet detention and dry detention.

Wet Detention Basins. Commonly known as "wet ponds," wet detention basins provide pollutant removal through the use of a permanent pool between storm events. Wet ponds provide additional capacity above the permanent pool for detaining stormwater runoff. The pond slowly releases the extra water over a period of days, returning to its normal depth.

Dry Detention Basins. Dry detention basins capture first-flush runoff and provide increased detention time to increase solids settling and suspended pollutant removal. These controls are called 'dry' because the basins are allowed to dry out between storm events; there is no permanent pool of standing water.

Infiltration (Exfiltration) Controls

Infiltration devices such as infiltration trenches and dry wells help replenish groundwater and reduce stormwater runoff volumes and peak flows. Infiltration BMPs require permeable soils and reasonably deep water tables. The 2000 Maryland Stormwater Design Manual requires that these devices be located at least two feet above the water table. Soil permeability and depth to groundwater conditions within the Baltimore Harbor Watershed typically limit the use of these devices.

Constructed Wetlands

As described by Hammer (1992), constructed wetlands are "engineered systems designed to simulate natural wetlands and to exploit their water purification function for human use and benefits. Constructed wetlands consist of former upland environments that have been modified to create poorly drained soils and wetlands flora and fauna for the primary purpose of contaminant or pollutant removal from wastewaters or runoff."

Constructed wetlands are effective BMPs because the unique combination of physical, chemical, and biological properties in the system facilitates sedimentation, filtration, biodegradation, uptake of metals and nutrients, and groundwater recharge. The use of constructed wetlands for stormwater management is an emerging technology that has been increasingly used over the last two decades. Constructed wetlands are even more effective when combined with other BMPs to minimize initial runoff volumes and flow rates.

Grassed Swales

Grassed swales are shallow, earthen channels used to convey stormwater, which are covered with a dense growth of wetland grass. Pollutants are removed through settling, filtration through grass and infiltration into the soil. Stormwater runoff volume may also be reduced through infiltration; however, the amount of infiltration depends on the velocity of the water and the permeability of soil in the system. Swales are used primarily in residential developments, at the outlets of road culverts, and as highway medians. Swales can be a type of pretreatment for

downstream BMPs because swales often lead into larger concrete lined channels or other stormwater control structures.

Filtration Devices

Filtering systems capture and temporarily store storm flow, and pass it through a filter bed of sand, organic matter, soil, or other media. Filtered runoff may be collected and returned to the conveyance system, or allowed to partially exfiltrated into the soil. Design variations include: surface sand filter, underground sand filter, perimeter sand filter, pocket sand filter, and bioretention. Filtering systems are usually designed to treat the first flush of stormwater flow from a rain event, which contains the highest concentration of pollutants.

Filters are normally used to treat stormwater runoff from large buildings, access roads and parking lots. As the name implies, filters work by filtering stormwater through beds of porous material. Small filters are installed underground in trenches or pre-cast concrete boxes. Large sand filters are aboveground, self-contained sand beds that can treat stormwater from drainage areas as much as five acres in size.

Pollutant removal for sand filters varies depending on the site and climate. Overall removal for sediment and trace metals is better than removal of more soluble pollutants because the filter functions by simply straining small particles out of the stormwater.

Oil & Grit Separators or Storm Treatment Systems

Oil/Grit separators are designed to remove petroleum compounds, grease, and coarse sediments from stormwater; however, these separators also remove floatable debris. Several different types of oil/grit separators are commonly used for stormwater treatment.

The first type, oil-water separators, are usually installed at industrial sites. Oil-water separators separate oil from stormwater using a variety of skimming and pumping techniques. There are many different designs of oil-water separators available, and the installation, use, and maintenance requirements of these devices vary by design.

A second type of oil and grease removal device is the oil and grease trap catch basin, also called an ‘oil and grit separator’. Catch basins are underground chambers that efficiently remove oils, grease, floatables, and coarse sediment. Oil and grit separators are often located in parking lots, car washes, gas stations, and loading docks to catch the oil and fuel that leak from automobiles and trucks.

A third type of oil/grit separator is a skimmer and control structure located at the outlet of a sediment basin (forebay). Generally, this type of device has one of two designs. The first design has multiple chambers that pools the stormwater and allows particulates to settle. Oils float to the surface and are skimmed off and held in the catch basin. Stormwater then flows into the storm sewer or into another stormwater pollution control device. These devices are relatively small and

inexpensive, and can be placed at multiple locations throughout a drainage system. The second design is an open sedimentation basin with a skimmer plate extending below the ponding control elevation at the outlet. Using this method, coarse sediments fall to the bottom of the basin, while oils, greases and floatables are retained in the basin by the skimmer.

Another popular method of removing oil and grit from stormwater is through a device known as a catch basin insert. Such an insert is easily placed over the opening of the outlet pipe of a catch basin. It allows water to flow underneath it, skimming the floating oil, grease, and trash off the top, and allowing sediment to fall to the bottom. Catch basin inserts can be purchased ready to use from manufacturers.

Oil/grit separators are inexpensive when compared with other BMPs, and can be easily installed in most areas. Oil/grit separators can be effectively used as pretreatment for other BMPs. For example, a separator often precedes a detention pond to remove coarse sediment and oils, which results in decreased maintenance costs in the detention pond. However, oil/grit separators are not effective at removing other pollutants besides oil, grease, floatables, and coarse sediments. Oil/grit separators require regular inspection and cleaning (at least twice a year) to remove accumulated pollutants. Wastes removed from these systems may have high concentrations of metals and hydrocarbons and should be tested to determine proper disposal methods. Waste disposal costs should be included in the annual maintenance budget.

Vegetated Filter Strips

Vegetated filter strips are sections of land with low slopes, designed to accept runoff as overland sheet flow. They may appear in any vegetated form, from grassland to forest, and, like swales, are designed to facilitate infiltration into the ground. They help to spread out and slow down the water, and they provide pollutant removal through detention, filtration by vegetation, and infiltration. Filter strips provide a small reduction in runoff volume, and contribute to groundwater recharge. They can reduce the size and cost of downstream control facilities, preserve riparian zones, and help to stabilize streambanks.

Vegetated filter strips are commonly located upgrade of waterways and wetlands, alongside paved surfaces, and at outlets of other stormwater management structures. They are often something as simple as a lawn area between a roadway and a stream.

Stream Restoration

Stream restoration is a collection of vegetative and mechanical methods for stream bank stabilization and channel restoration. These methods help to prevent the stream from eroding its banks, and adding sediment and other pollution to the stream. They assist the natural processes that maintain the stream channel and banks, and allow them to maintain their pre-development functions of conveying clean water downstream while providing habitat for a wide range of plants and animals.

Stream bank stabilization protects critical sections of a stream bank where standard vegetative practices (i.e. seeding) are not feasible, or offer insufficient protection. It protects stream banks from excessive erosion, which adds sediment pollution to the water body, and can destabilize the banks and adjacent structures.

RECOMMENDED BMPS

Field investigations were performed in the drainage areas contributing the most concentrated sources of pollution to the surface waters. Table ES-7 presents a list of the recommended BMPs in each of the investigated drainage areas with their annualized cost and the estimated amount of Total Phosphorus and Total Suspended Solids that can be removed at each location.

Within the selected subbasins, the land area treated by the proposed BMPs ranged from 2.5 to 31.6%. Based on the total watershed loads in the simulated stormwater runoff, removals of 0% to 16% of TP and 5% to 30% of TSS were estimated for existing land use. The fraction of TP and TSS removal was naturally greater if only the treated areas were considered. Table ES-8 presents a summary of the TP and TSS removal estimates for each of the selected subwatersheds. Estimates of the water quality benefits that will result from implementation of the non-structural BMPs have not been quantified.

A very generalized estimate of the pollutant reduction and costs to implement BMPs on a watershed-wide basis was made using averages of the calculated values for the selected subwatersheds. Siting structural BMPs throughout the entire watershed may not be feasible due to the existing degree of development found therein. It was assumed that structural BMPs would remove 8% of the TP and 17% of the TSS load. These assumptions were used to estimate the potential annual reductions of TP and TSS that are presented in Table ES-9. Non-structural BMPs will produce additional pollutant reductions and are more suited to implementation in this highly urbanized watershed.

Average costs associated with implementing the structural BMPs in the selected subwatersheds were applied to the remaining subwatersheds and are presented in Table ES-10. The cost of siting BMPs in the Baltimore Harbor and Patapsco River subwatersheds was not considered because these are almost entirely held by private industry. The avenue for improving the quality of stormwater runoff from these subwatersheds is through review and strict implementation of the NPDES Stormwater Permit requirements. Costs were not estimated for the Black Marsh or Chesapeake Bay subwatersheds because they are largely park land. Conservation measures to preserve these undeveloped lands are the best method of maintaining uncontaminated stormwater runoff.

Table ES-7

Cost - Benefit Comparison of Suggested BMPs

Subwatershed	Model Subbasin	Fig. No. / Location ID	Recommended BMP	Impervious Acres Treated	Annualized Cost	Annual TP Removed		Annual TSS Removed	
						Existing LU (lbs/yr)	Future LU (lbs/yr)	Existing LU (lbs/yr)	Future LU (lbs/yr)
Tabasco Cove	TC144-15	5-2, A	Retrofit existing dry det. pond	11	$760	4.35	4.54	940.61	973.34
Tabasco Cove	TC144-15	5-2, B	Install 6 check dams to enhance detention and wetlands function of swale	2.8	$660	0.40	0.42	228.16	236.10
Tabasco Cove	TC144-15	5-2, C	Expand existing wetland/detention pond to control the untreated runoff from the lot.	1.8	$10,020	0.71	0.74	153.92	159.27
Tabasco Cove	TC144-15	5-2, C	Extended detention pond or modular treatment system with oil/grit separator	1.8	$2,100	0.71	0.74	153.92	159.27
Tabasco Cove	TC144-15	5-2, D	Modular treatment with oil/grit separator	2	$1,320	2.84	2.97	199.19	206.12
Tabasco Cove	TC144-15	5-2, D	Grass filter strip	2	$780	0.28	0.30	162.97	168.64
Tabasco Cove	TC144-15	5-2, D	Extended Detention Pond	2	$14,670	0.79	0.83	171.02	176.97
Tabasco Cove	TC144-15	5-2, E	Grass Filter Strip	1	$490	0.14	0.15	81.49	84.32
Tabasco Cove	TC144-15	5-2, F	Constructed Wetland Swale	0.5	$450	0.47	0.50	40.24	41.64
Tabasco Cove	TC144-10	5-2, H	Grass filter strip	1	$1,690	0.11	0.11	143.29	145.72
Tabasco Cove	TC144-15	5-2, I	Vegetated sand filters	2.8	$4,680	1.07	1.13	345.94	357.90
Tabasco Cove	TC144-10	5-2, J	Detention pond	2.3	$13,630	0.06	0.06	345.84	351.70
Charlesmont Cove	CM167-10	5-3, K	Replace/Repair underground detention tank	14.7	$19,490	4.30	4.59	873.40	895.89
Charlesmont Cove	CM167-10	5-3, K	Constructed Wetland	5	$1,990	3.51	3.75	279.60	286.80
Charlesmont Cove	CM167-10	5-3, K	Storm sewer retrofits	16	$5,300	N/A	N/A	N/A	N/A
Charlesmont Cove	CM167-10	5-3, K	Streambank stabilization	16	$3,730	N/A	N/A	N/A	N/A
Charlesmont Cove	CM167-10	5-3, K	Stream clean-up	0	N/A	N/A	N/A	N/A	N/A
Charlesmont Cove	CM167-10	5-3, L	3 Modular Treatment Systems w/oil-grit separators	1.8	$3,000	1.81	1.94	303.08	311.19
Charlesmont Cove	CM167-10	5-3, M	Channel stabilization w/3 check dams	2	$330	0.20	0.22	275.53	282.90

Table ES-7 (Continued)

Cost - Benefit Comparison of Suggested BMPs

Subwatershed	Model Subbasin	Fig. No. / Location ID	Recommended BMP	Impervious Acres Treated	Annualized Cost	Annual TP Removed		Annual TSS Removed	
						Existing LU (lbs/yr)	Future LU (lbs/yr)	Existing LU (lbs/yr)	Future LU (lbs/yr)
Charlesmont Cove	CM167-10	5-3, N	Modular treatment with oil/grit separator	2	$1,000	2.02	2.16	336.76	345.77
Charlesmont Cove	CM167-10	5-3, N	Clean and restore existing wetlands and create constructed wetlands to treat runoff	5.5	$17,300	3.70	5.38	748.35	437.80
Charlesmont Cove	CM167-10	5-3, O	Culvert/swale maintenance	3.2	$110	N/A	N/A	N/A	N/A
Charlesmont Cove	CM167-10	5-3, O	Modular treatment with oil/grit separator	3.2	$1,000	3.23	4.69	538.81	315.22
Charlesmont Cove	CM167-10	5-3, P	Underground detention	4	$5,310	1.12	1.63	578.27	338.30
Oakleigh Cove	OC185-10	5-4, R	Cleaning Maintenance	1.5	$90	N/A	N/A	N/A	N/A
Oakleigh Cove	OC185-10	5-4, S	Channel Maintenance	0	$180	N/A	N/A	N/A	N/A
Oakleigh Cove	OC185-10	5-4, S	Modular Treatment System w/oil-grit separators	1	$770	0.93	0.99	188.10	187.51
Oakleigh Cove	OC185-10	5-4, T	Extended detention	14.7	$9,220	3.79	4.04	2374.05	2366.55
Oakleigh Cove	OC185-10	5-4, U	Extended detention	3.6	N/A	0.93	1.35	581.40	330.17
Oakleigh Cove	OC185-10	5-4, W	Swale Maintenance/Tree removal	0	$120	N/A	N/A	N/A	N/A
Oakleigh Cove	OC185-10	5-4, X	Modular Treatment Sys. w/oil-grit separators	0.7	$1,000	0.65	0.69	131.67	131.25
Bear Creek	BN179-50	5-5, Y	Remove Trees and Vegetation	0	$120	N/A	N/A	N/A	N/A
Bear Creek	BN179-50	5-5, Z	Direct parking lot runoff to ext. detention	7	$19,910	2.21	2.42	770.53	724.71
Bear Creek	BN179-50	5-5, Z	12 catchbasins retrofitted with water quality inserts	2	$15,490	0.00	0.00	51.80	48.72
Bear Creek	BN179-50	5-5, AA	Streambank stabilization stream clean-up	0	$570	N/A	N/A	N/A	N/A
Bear Creek	BN179-50	5-5, AB	Streambank stabilization stream clean-up	0	$3,420	N/A	N/A	N/A	N/A
Bear Creek	BE179-75	5-6, AC	Vegetated Buffers	4	$6,830	0.57	0.57	347.00	347.65
Jones Creek	JC187-20	5-8, AH	Extended detention	3	$3,090	1.10	1.35	128.78	111.95
Jones Creek	JC187-20	5-8, AH	Clean-up Maintenance	0	$200	N/A	N/A	N/A	N/A
Jones Creek	JC187-10	5-8, AI	Constructed Wetland	0.5	$3,830	0.21	0.54	13.91	17.56

Table ES-8

Summary of Pollutant Removals in Subbasins with Suggested BMPs

Subwatershed		**Tabasco Cove**		**Charlesmont Cove**	**Oakleigh Cove**	**Bear Creek**	**Jones Creek**	
Subbasin(s)		**TC144-10**	**TC144-15**	**CM167-10**	**OC185-10**	**BN179-50**	**JC187-20**	**JC187-10**
Subbasin Area	(acres)	88	212	121	265	133	119	330
Area Treated by Suggested BMPs	(acres)	3.3	27.7	38.2	20	9	3	0.5
% of Subbasin Area Treated	(%)	3.8%	13.1%	31.6%	7.5%	6.8%	2.5%	0.2%
Total Phosphorus, Existing Land Use								
Uncontrolled Load from Total Subbasin	(lbs/yr)	95	261	128	252	156	85.6	360
Uncontrolled Load from Treated Area	(lbs/yr)	4.0	42.6	43.8	20.6	11.3	4.4	0.3
Controlled Load from Treated Area	(lbs/yr)	3.8	30.8	23.9	14.3	9.1	3.3	0.1
Load Removed by Treatment	(lbs/yr)	0.2	11.8	19.9	6.3	2.2	1.1	0.2
% of Treated Area Load Removed	(%)	4%	28%	45%	31%	19%	25%	60%
% of Total Subbasin Load Removed	(%)	0%	5%	16%	2%	1%	1%	0%
Total Phosphorus, Future Land Use Scenario								
Uncontrolled Load from Total Subbasin	(lbs/yr)	103	333	173	298	179	169	515
Uncontrolled Load from Treated Area	(lbs/yr)	4.0	44.5	52.3	23.4	12.4	5.4	0.9
Controlled Load from Treated Area	(lbs/yr)	3.8	32.2	27.9	16.4	10.0	4.1	0.4
Load Removed by Treatment	(lbs/yr)	0.2	12.3	24.4	7.1	2.4	1.4	0.5
% of Treated Area Load Removed	(%)	4%	28%	47%	30%	19%	25%	60%
% of Total Subbasin Load Removed	(%)	0%	4%	14%	2%	1%	1%	0%
Total Suspended Solids, Existing Land Use								
Uncontrolled Load from Total Subbasin	(lbs/yr)	10100	24000	13100	28500	13700	13100	35900
Uncontrolled Load from Treated Area	(lbs/yr)	583.8	2,999.1	4,523.5	3,800.0	1,165.5	151.5	17.4
Controlled Load from Treated Area	(lbs/yr)	94.6	521.7	589.7	524.8	343.2	22.7	3.5
Load Removed by Treatment	(lbs/yr)	489.1	2,477.5	3,933.8	3,275.2	822.3	128.8	13.9
% of Treated Area Load Removed	(%)	84%	83%	87%	86%	71%	85%	80%
% of Total Subbasin Load Removed	(%)	5%	10%	30%	11%	6%	1%	0%
Total Suspended Solids, Future Land Use Scenario								
Uncontrolled Load from Total Subbasin	(lbs/yr)	9960	23300	12800	28500	13700	13900	34700
Uncontrolled Load from Treated Area	(lbs/yr)	593.7	3,103.4	3,689.0	3,494.6	1,096.2	131.7	22.0
Controlled Load from Treated Area	(lbs/yr)	96.2	539.8	475.1	479.1	322.8	19.8	4.4
Load Removed by Treatment	(lbs/yr)	497.4	2,563.6	3,213.9	3,015.5	773.4	111.9	17.6
% of Treated Area Load Removed	(%)	84%	83%	87%	86%	71%	85%	80%
% of Total Subbasin Load Removed	(%)	5%	11%	25%	11%	6%	1%	0%

Note: Area Treated and Load Removed includes only those suggested BMPs with Removal Efficiencies reported on Tables 7-7 to 7-16.

Table ES-9

Potential Pollutant Removal for All Subwatersheds

Subwatershed Name	Area (acres)	TP		TSS	
		Existing Load (lbs/yr)	Potential Removal (lbs/yr)	Existing Load (lbs/yr)	Potential Removal (lbs/yr)
Baltimore Harbor	699	990.0	79.2	75,800	12,886.0
Bear Creek	1568	1,514.1	121.1	156,554	26,614.2
Black Marsh	519	182.0	14.6	38,300	6,511.0
Bullneck Creek	674	478.2	38.3	61,610	10,473.7
Charlesmont Cove	121	128.0	10.2	13,100	2,227.0
Chesapeake Bay	238	83.2	6.7	20,030	3,405.1
Chink Creek	271	198.0	15.8	26,400	4,488.0
Clements Cove	52	43.3	3.5	5,080	863.6
Colgate Creek	953	687.0	55.0	98,300	16,711.0
Country Club Cove	175	104.0	8.3	17,600	2,992.0
Humphreys Creek	1245	1,470.0	117.6	124,900	21,233.0
Jones Creek	781	616.6	49.3	85,900	14,603.0
Lynch Cove	688	548.2	43.9	68,600	11,662.0
Northpoint Creek	562	238.5	19.1	51,620	8,775.4
Oakleigh Cove	265	252.0	20.2	28,500	4,845.0
Old Road Bay	428	540.0	43.2	45,500	7,735.0
Patapsco River	1072	1,775.6	142.0	121,220	20,607.4
Peach Orchard Cove	208	181.0	14.5	20,600	3,502.0
Schoolhouse Cove	174	114.0	9.1	17,900	3,043.0
Shallow Creek	396	129.6	10.4	30,600	5,202.0
Swan Point Inlet	30	15.5	1.2	3,470	589.9
Tabasco Cove	300	356.0	28.5	34,100	5,797.0
Total Watershed	11418	10,645	851.6	1,145,684	194,766.3

Note: Existing Loads based on "Average" year (1990 BWI rainfall) SWMM/RUNOFF simulations
Source: Baltimore County GIS data - WESTON modified Subwatershed Coverage

Table ES-10

Potential Annualized Cost of Implementing Structural BMPs on a Watershed-wide Basis

Subwatershed Name	Subwatershed Area (acres)	Estimated Annualized Cost
Baltimore Harbor	699	n/a
Bear Creek	1568	$346,769
Black Marsh	519	n/a
Bullneck Creek	674	$149,171
Charlesmont Cove	121	$26,779
Chesapeake Bay	238	n/a
Chink Creek	271	$59,871
Clements Cove	52	$11,492
Colgate Creek	953	$210,827
Country Club Cove	175	$38,753
Humphreys Creek	1245	$275,312
Jones Creek	781	$172,821
Lynch Cove	688	$152,104
Northpoint Creek	562	$124,291
Oakleigh Cove	265	$58,568
Old Road Bay	428	$94,745
Patapsco River	1072	n/a
Peach Orchard Cove	208	$45,911
Schoolhouse Cove	174	$38,436
Shallow Creek	396	$87,600
Swan Point Inlet	30	$6,625
Tabasco Cove	300	$66,281
Total Watershed	11418	$1,966,356

Source: Baltimore County GIS data – WESTON modified Subwatershed Coverage

SUMMARY

Implementing structural BMPs throughout the Baltimore Harbor Watershed may not be feasible due to the highly urbanized land uses that exist within its boundaries. However, this watershed can greatly benefit from non-structural BMPs such as:

1. Public education to involve residents in taking ownership of their surroundings by :
    - Practicing pollution source reduction techniques in their routine activities
    - Participating in stream clean-up activities
    - Reporting vandalism and illegal discharges into the stormwater control structure system.
2. Review of facilities that should be regulated by NPDES Stormwater Permits by:
    - Ensuring that all facilities requiring permits are in compliance
    - Review BMPs implemented under the NPDES Permit requirements and improve practices where necessary
3. Implement requirements for BMPs to improve stormwater runoff quality for all property redevelopment projects.
4. Review and improve the fertilizer and pest management practices used on the golf courses.
5. Implementation of BMPs at all marinas and boat docking facilities.

Structural BMPs should be implemented in areas where concentrated runoff from commercial and industrial land uses are present.