Appendix D

Watershed Treatment Model for the Port Tobacco Watershed Restoration Action Strategy

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Port Tobacco Watershed Restoration Action Strategy

1.0 Introduction

The Watershed Treatment Model (WTM) is a spreadsheet-based model to quantify watershed treatment options, including structural and non-structural practices (Caraco, 2002). The model was used to estimate pollutant loads for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and bacteria for the three target subwatersheds and the entire watershed. The following scenarios were evaluated:

1. Existing Land Use and Treatment Practices
2. Existing Land Use and Proposed Restoration Practices

The model has two basic components: Pollutant Sources and Treatment Options. The *Pollutant Sources* component of the WTM estimates the load from primary land uses (i.e. residential, commercial, agriculture) and secondary sources (i.e. active construction, managed turf, channel erosion, illicit connections) in a watershed without treatment measures in place. The *Treatment Options* component of the model estimates the potential reduction in this uncontrolled load if various treatment measures (both structural and nonstructural) are used.

Pollutant source calculations are based on the Simple Method (Schueler, 1987) where impervious cover is used to estimate primary loads from various urban land uses. Specific concentration assumptions used for urban/suburban loading estimates in the WTM model are based on values for different land uses summarized in the National Stormwater Quality Database, a summary of national stormwater data from over 200 communities nationwide (Pitt *et. al.,* 2003). Estimated runoff volumes are multiplied by pollutant concentration data to compute stormwater loads. All loads are computed based on an annual time step.

Treatment options include the existing management practices and future management practices components of the WTM. The pollutant removal efficiencies associated with various structural and nonstructural urban stormwater management practices are based on existing research and studies in the National Pollutant Removal Performance Database for Stormwater Treatment Practices (Winer, 2000) and research compiled in the WTM (Caraco, 2002). Existing practice information is based on data provided by Charles County and CWP field observations. These inputs are summarized below. Proposed treatment practices are based on site specific and programmatic recommendations developed in the WRAS. The modeled practices include:

- Structural stormwater practices (ponds, bioretention, etc)
- Buffer plantings
- Stream repair
- Education about lawn care, pet waste, and septic systems
- Septic system repair and upgrade
- Sanitary sewer overflow prevention
- Increased erosion and sediment control enforcement

A unique feature of the WTM is the inclusion of *treatability* and *discount* factors. Treatability is the fraction of a source that can be treated by a practice. For structural practices, treatability is the drainage area; for education programs, it reflects the fraction of the population that can be reached. The model uses discount factors to account for maintenance and design criteria and to avoid double counting management practices that occur in series. For example, discount factors address imperfect practice application and maintenance, inability of educational programs to reach all citizens, and inadequate funding to implement all practices.

Caveats
There are many simplifying assumptions made by the WTM, and the model results are not calibrated to measured pollutant loads or other modeling efforts. Therefore, the results of the model simulations should be compared on a relative basis rather than used as absolute values.

The application of existing and future treatment practices is based on limited GIS data, best professional judgment, and default values associated with the WTM. A series of modeling assumptions were made on loading rates, existing and current practice application, and stormwater program implementation that may or may not be valid.

2.0 Input Data and Assumptions

This section provides a brief summary of the input data used in the WTM. It is organized by pollutant sources (primary and secondary sources) and treatment options (existing and future practices). Data assumptions for each section are also listed.

2.1 Pollutant Sources

Primary Sources
Primary sources are based on 2002 land use data from the Maryland Department of Planning. Impervious cover estimates were assigned to each land use based on factors derived in *Impervious Cover and Land Use in the Chesapeake Bay Watershed* (Cappiella and Brown, 2001). Active construction was estimated based on field observations. The MDP land use data was adjusted to account for US 301. The US 301 right of way was subtracted from other land uses. Stormwater runoff was calculated based on this land use and an annual rainfall of 44.1 inches. Table D-1 reports the primary source input data used in the WTM.

Table D-1 Primary Source Inputs for WTM -Land Use for Port Tobacco and Subwatersheds

Land Use	Impervious Cover Coefficient by Land Use	Port Tobacco Watershed Area (Acres)	Hoghole Subwatershed Area (Acres)	Jennie Run Subwatershed Area (Acres)	La Plata Subwatershed Area (Acres)
Residential		**Acres**	**Acres**	**Acres**	**Acres**
LDR	14%	4279	443	510	702
MDR	28%	672		3	181
HDR	41%	23			4
Open Urban Land	2%	114		63	10
Commercial	72%	630	43	108	161
Institutional	34%	368	26	55	93
Roadway	55%	171		36	44
Extractive		175		103	41
Forest/Brush	0%	15648	2106	1302	1289
Pasture		5663	467	362	609
Open Water	100%	2036	47		
Active Construction		273	7	16	66
Total		30052	3139	2558	3200

Secondary Sources

Secondary source loads are basically calculated as a product of flow and concentration. Refer to Caraco (2002) for detail on how loads are specifically calculated for each type of secondary source. Secondary sources that were present in the watershed and quantifiable based on existing data were considered. In most cases, this involved using GIS data provided to the Center by the County or based on default values of the WTM. Tables D-2, D-3, and D-4 describes input data and assumptions for secondary sources.

Table D-2. Secondary Sources Input Data and Assumptions

Input	Assumptions
Planning Horizon	CWP used a 20-year planning horizon, based on the *2006 Charles County Comprehensive Plan* that projects to 2025.
General Sewage Information	CWP calculated the number of dwelling units by tallying the residential Maryland Property View data points in the Port Tobacco watershed. Based on information in Table 2-3 of the *1997 Charles County Comprehensive Plan*, the population per household was expected to be 2.87 in 2000 and 2.74 for 2010. Using a linear interpolation, the 2006 population per household is 2.76. To estimate water demand, CWP used Table 3A and 3B in the Appendix of the *Charles County Comprehensive Water and Sewer Plan* to find the average water demand for planned communities and public-municipal facilities in 2010. The average for all facilities in these two categories is approximately 90 gpcd.
Septic Systems	For working septic systems, the model's default effluent values of 0 mg/L for TP, TSS and FC were used (Caraco 2002). For TN, 48 mg/L was used. This is based on a 20% efficiency (EPA 2002) applied to the 60 mg/L raw sewage default value (Caraco 2002). The model default failure rate of 30% failure rate was used. This was compared to information provided by Charles County about septic systems built before current percolation test standards. Approximately 47% (1162 of 2450) of these pre-1990 systems are located in areas of high water table and poorly suited soils (Wiggen 2006). 1990 was used as a cut-off date because this is when implementation of wet seasion perc testing and 4 foot separateion from the water table requirements began (Williams 2006). It is assumed that some additional failures will occur in other areas due to poor maintenance. For failing septic systems, effluent values of 49.2 mg/L TN, 1mg/L TP and 40 mg/L TSS were used. This is based on an assumption that 10% septic failures result in overland flow while 90% are subsurface flow (Caraco 2002).

SSOs	Digital sanitary sewer data was not available for the Port Tobacco watershed in Charles County. As a result, we estimated the sanitary sewer length to be 7.87 miles based on land use estimates from a previous study, entitled, *The Potomac River Source Water Assessment of Maryland Plants*. Using this study, we calculated sanitary sewer length for low (57 ft/acre) and high (118 ft/acre) density residential land uses where sanitary sewer data was available, and applied the resulting ratios to the remaining study area where data was unavailable. We used an interpolated value for medium density residential sanitary sewer lengths (88 ft/acre). High density estimates are used for industrial, commercial, and institutional land uses. The number of sanitary sewer overflows is based on a default number of 140 overflows per 1000 miles of sewer (Caraco 2002). Since there is a known overflow in the La Plata subwatershed, this number was adjusted to reflect approximately 7 overflows per year.
Illicit Connections	Default values of 0.1% of residents and 10% of businesses with illicit connections were used. (Caraco 2002)
Channel Erosion	Since the subwatersheds are primarily forested and rural, CWP assumed the whole Port Tobacco watershed and Hoghole Run had sediment loads of 200 lbs/acre/yr. For the more developed Jennie Run and La Plata tributaries, CWP assumed a sediment load of 300 lbs/acre/yr (Caraco, 2002).
Hobby Farms and Livestock	Although population estimates were not available, horses were noted in La Plata tributary and in the larger Port Tobacco watershed during field work. These were not included in the model, as horse manure loading rates were not available.
Marinas	The *Charles County Comprehensive Water and Sewer Plan* (Table 4B in the Appendix) states that there are two marinas in the Port Tobacco watershed, the Port Tobacco Marina (Hoghole subwatershed) and the Goose Bay Marina (Lower Port Tobacco West subwatershed), each with 250 boat slips. At the time of the fieldwork Port Tobacco Marina had a portable pump-out unit in use, while the Goose Bay Marina used subsurface discharge. It is assumed that at each marina 250 boat slips are served by one pump-out facility, of which 90% of visitors are willing to use. CWP assumed each marina has a season length of 240 days and they are occupied for half of that time.
Road Sanding	A road sand application rate of 1.66 tons/lane mile/year was used based on Maryland State Highway Administration data presented in *The Potomac River Source Water Assessments for Maryland Plants* (Becker and O'Melia, et al, 2002). CWP estimated sanded lane length based on a road type description included in the Charles County road GIS layer. Additionally, CWP assumed that half of the roads in the watershed are open section. Charles County's NPDES reports note the use of solar salt.

Non-Stormwater Point Sources	Four wastewater treatment plants (WWTPs) are located in the Port Tobacco watershed. The name, location, flow and TP and TN loads used for the Thunderbird, Mt. Carmel, and College of Southern MD WWTPs are from the technical memorandum "Significant Nutrient Point Sources in the Port Tobacco Watershed" that was included in the nitrogen and phosphorus TMDL prepared for the watershed (MDE, 1999). Information for the La Plata WWTP was obtained from NPDES Discharge Monitoring Reports (MES 2005 and 2006). The flow rate and effluent concentrations were averages between the two reports. As TSS and bacteria concentrations were not available for the other WWTPs, the permit values for the La Plata plant were used as placeholders. Table D-3 summarizes this information.

Note: Some of the assumptions reference previous versions of updated reports. That is because the existing conditions were modeled prior to the release of the updated version.

Table D-3 Known Non-Stormwater Point Sources in the Port Tobacco Watershed

Name	Flow (mgd)	TN Conc. (mg/L)	TP Conc. (mg/L)	TSS Conc. (mg/L)	Bacteria (MPN/ mL)
La Plata WWTP	0.9023	8	0.3	0.5	1.5
Thunderbird Apartment and Bel Alton	0.0093	18	2	30	14
College of Southern Maryland	0.0275	18	1	30	14
Mount Carmel WWTP	0.017	18	2	30	14

Table D-4 Secondary Pollutant Source assumptions in Port Tobacco

Assumption	Port Tobacco	Hoghole Run	Jennie Run	La Plata
Dwelling Units	6206	278	493	1425
Unsewered Dwelling Units(% of total)	57%	100%	58%	58%
Unsewered Dwelling Units(#) – Equals number of septic systems	3537.42	278	286	826
Miles of Sanitary Sewer	27.07	0	3.94	7.87
Fraction of WS Population Illicitly Connected	0.001	0.001	0.001	0.001
# of Illicit Connections	6.206	0.278	0.493	1.425
Number of Businesses	665	43	129	169
Fraction of Businesses with Illicit Connections	0.01	0.01	0.01	0.01
Stream Length (miles)	105.1	11.6	10.0	11.7
Channel Erosion Method 1				
Annual Sediment Loading Rate (Tons/Acre/Year)	0.1	0.1	0.15	0.15
Total Annual Sediment Load (Tons/Year)	3005	313	381	470
Bank Erosion Rate (tons/mi/year)	10.65	11.54	19.82	20.12
"Natural" Bank Erosion Rate (tons/mi/year)	100	100	100	100
A-Soils	2%	1%	2%	5%
B-Soils	36%	34%	39%	37%
C-Soils	49%	51%	44%	47%

Table D-4 Secondary Pollutant Source assumptions in Port Tobacco				
Assumption	**Port Tobacco**	**Hoghole Run**	**Jennie Run**	**La Plata**
D-Soils	13%	13%	15%	11%
Lawn (acres)	3422	303.4	400	595
Marina berths	500	250	0	0
Typical occupancy (fraction of season)	0.5	0.5	--	--
Road Sand Application (lbs/year)	679,139	57,934	78,252	122,740
Fraction of Roads that are Open Section	50%	50%	50%	50%
Non-Stormwater Point Sources	Location			
La Plata WWTP	X			X
Thunderbird WWTP	X			
College of Southern MD WWTP	X			
Mount Carmel WWTP	X		X	

2.2 Treatment Options

Existing Management Practices

The existing management practices included in the WTM were based on information provided by the County and Center field observations. The Center used best professional judgment when applying discount factors to adjust the load reduction of existing practices. Table D-5 summarizes the assumptions used for applying existing management practices.

Table D-5 Existing and Future Management Practices	
Input	**Assumptions**
Education Programs	The presence of education programs was based on the Charles County 2004 NPDES report. We assumed that pet waste education reaches only 4% of the population, based on the Charles County website that provides information on proper tips and etiquette for dog park users. We assumed that lawn care education is conducted by the Charles County Cooperative Extension Service through local television cable spotlights and workshops. CWP assumed that the combination of these outreach methods reaches only 10% of the population.
Erosion and Sediment Control (ESC)	A 70% ESC program efficiency was assumed, based on a program that emphasizes erosion control measures, including practices that limit clearing and grading or use of phased construction methods, and requires advanced erosion and sediment control measures to reduce the concentration of sediment in runoff leaving the site (Caraco, 2002). We assumed 100% of all construction sites require ESC measures; this does not capture construction projects under 5000 square feet, but sites of that size were not included in the land use data. Based on observation of the ESC program and knowledge that until Summer 2006 there was only one inspector, we selected a low compliance number to account for the few inspectors and low maintenance number to account for the multiple practices seen with failing, un-maintained devices.

Street Sweeping	We assumed only streets in existing or planned sewer service areas are swept. This assumption was then used to determine the extent of streets swept. Residential roadways, parking lots and other roadway areas were multiplied by the percentage of each subwatershed located in existing or planned sewer service areas. It is assumed these areas are swept annually and that no parking restrictions or operator training are required or in place. In addition, we assumed that no street sweeping occurs outside of the Waldorf and La Plata development boundaries.
Impervious Cover Disconnection	The level of rooftop disconnection was based on field observation. In the Jennie Run subwatershed, CWP assumed that 75% of residential parcels and 25% of commercial parcels employ rooftop disconnection techniques. In the Hoghole Run subwatershed, CWP assumed that 95% for residential and 50% for commercial. In the La Plata we assumed 50% for residential and 10% for commercial. For the entire Port Tobacco watershed CWP assumed that 75% of residential and 25% of commercial parcels employ rooftop disconnection techniques.
Stormwater Management	The presence of existing stormwater management facilities was based on the GIS data included with the 2004 Charles County NPDES report. This provided the location, type, drainage area and impervious cover for stormwater facilities in the Port Tobacco watershed. Additional stormwater treatment practices were identified during fieldwork, but these were not included in the model. The County conducts maintenance inspections of stormwater management facilities on a triennial basis; therefore the maintenance discount factor for 'Maintenance specified but poorly enforced' was used (Charles County 2004).
Riparian Buffer	No design guidance for buffers was found, so it was assumed that the buffer is a setback. We assumed there are restrictions about activities that can occur within the buffer but that no education or enforcement exists. Riparian buffer length was calculated the using the length of stream located outside the stream reaches identified as having an Impacted Buffer in the SCA. According to the methodology for the SCA assessment, IB reaches are defined as reaches with a riparian buffer less than 50 feet, which was therefore used as the riparian buffer width.
Catch Basin Cleanouts	The Center assumed that if catch basins are present in the Port Tobacco watershed, they are concentrated in the La Plata and Waldorf development districts. Within these areas, the Center assumed the acreage treated by catch basins in each subwatershed is approximated by the roadway imperviousness in each subwatershed. The Center assumed that catch basins are cleaned annually and poor disposal practices are employed.

Future Management Practices

Future management practices included in the WTM were based the recommendations in this report. These were quantified to the extent possible and full implementation was assumed. Realistically, not all restoration projects will be recommended for implementation, and not all recommendations will be implemented. Therefore the load reductions seen with the application of future management practices is considered a best case scenario.

Best professional judgment was applied to the selection of discount factors to adjust the load reduction of future practices. Table D-6 summarizes the assumptions used for applying future management practices.

Table D-6 Future Management Practices	
Input	**Assumptions**
Education Programs	A newspaper campaign for pet waste and lawn care education would reach 30% of the population.
Erosion and Sediment Control (ESC)	Future management conditions reflects an increased number of inspectors and frequency of inspections, raising the compliance and maintenance discount factors to 90%.
Stormwater Retrofits	The proposed retrofits were added to the existing stormwater management. The drainage areas to these sites can be found in Appendix C.
Riparian Buffer Planting	The lengths of buffer planting projects were added to the existing buffer length. See Appendix C for proposed project lengths.
Channel Stabilization	The lengths of stream repair projects are listed in the tables in Appendix C.
SSO Repair/Abatement	A goal of 100% correction of sanitary sewer overflows was modeled, and a 75% success rate was selected. This accounts for repair of the known overflow on Centennial Street, while assuming that any system will continue to have periodic overflows.
Septic System Education, Repair, Upgrade	System education would reach 40% of the population through brochures mailed to all owners, local cable programs, and a newspaper campaign. The fraction of the population willing to change their behavior was assumed to be 47% based the septic system survey by PTRC. If a mandatory inspection of septic function were instated, 60% of owners with failing systems would be willing to make repairs with no incentive. Based on the septic survey, 50% would be willing to upgrade the nitrogen removal system with a cost share program..

3.0 Results

Results are presented for total nitrogen (TN), total phosphorus (TP), total suspended sediment (TSS), and bacteria loads from primary and secondary sources with existing management practices (Table D-7) and with the recommended future management practices. While a numerical value in lbs/year is generated by the WTM, it is more appropriate to evaluate relative load changes via the percent of total load reduction.

Table D-7 Existing Loads for the Port Tobacco Watershed				
	N Load (lbs/year)	**P Load (lbs/year)**	**TSS Load (lbs/yr)**	**Bacteria Load (billion/year)**
Port Tobacco (whole watershed)	209,043	15,317	6,007,114	1,955,045
Hoghole Run	15,711	1,331	626,164	314,182
Jennie Run	16,293	1,365	762,189	259,990
La Plata	41,205	2,602	938,878	396,899

3.1 Pollution Sources

A key results from the Watershed Treatment Model is the relative pollutant loads from various sources and the pollutant load reductions from proposed practices. Interpretation of these results should focus on the anthropogenic (human-caused) pollutant loads. A background level of nutrients, sediment and bacteria is a natural phenomenon. The load of TN, TP, TSS, and bacteria attributed to forest and open water does not represent a problem to be solved. The anthropogenic sources of these loads has increased their presence in the River to levels that are out of balance.

Runoff from urban land, rural land, and septic systems are the most significant anthropogenic sources of all pollutants in the Port Tobacco Watershed. Active construction sites and increased stream bank erosion contribute significantly to the sediment load. Wastewater treatment plants contribute to the nutrient loads. Sanitary sewer overflows play a role in the bacteria load. The pollutant sources for the Port Tobacco watershed and the three target subwatersheds are summarized in Table D-8. The sources for the Port Tobacco Watershed as a whole are summarized in Figures D-1 to D-4.

Figure D-1. Port Tobacco Watershed Nitrogen Sources

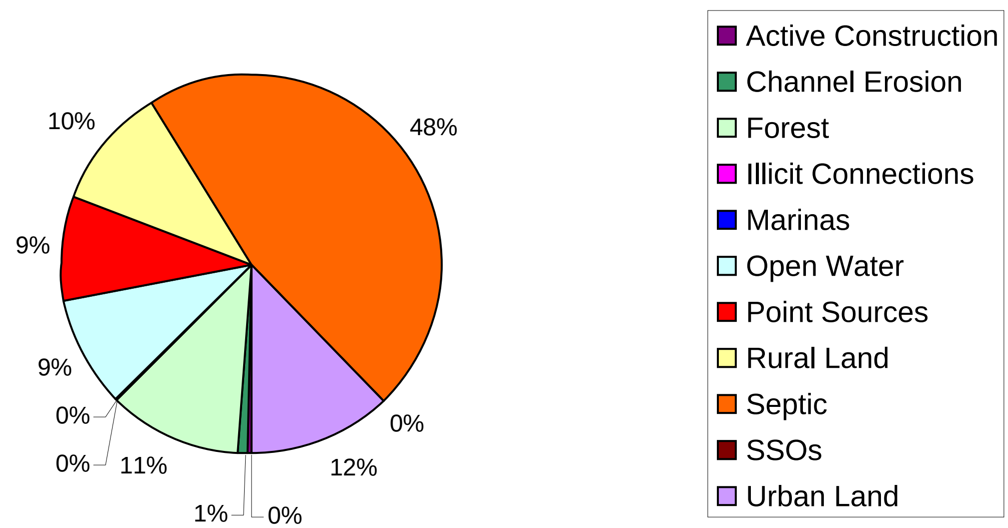


Figure D-2. Port Tobacco Watershed Phosphorus Sources

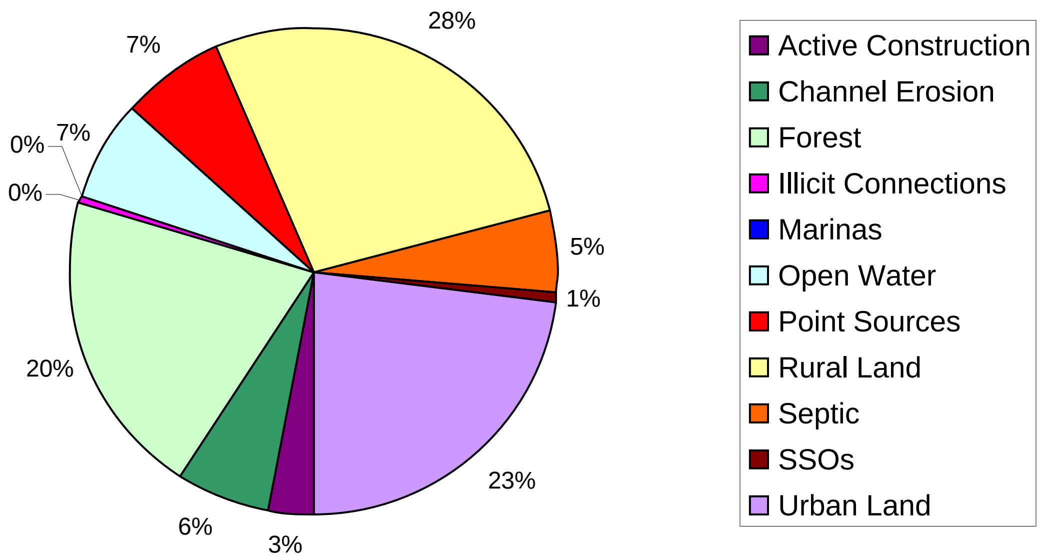


Figure D-3. Port Tobacco Watershed Total Suspended Solids Sources

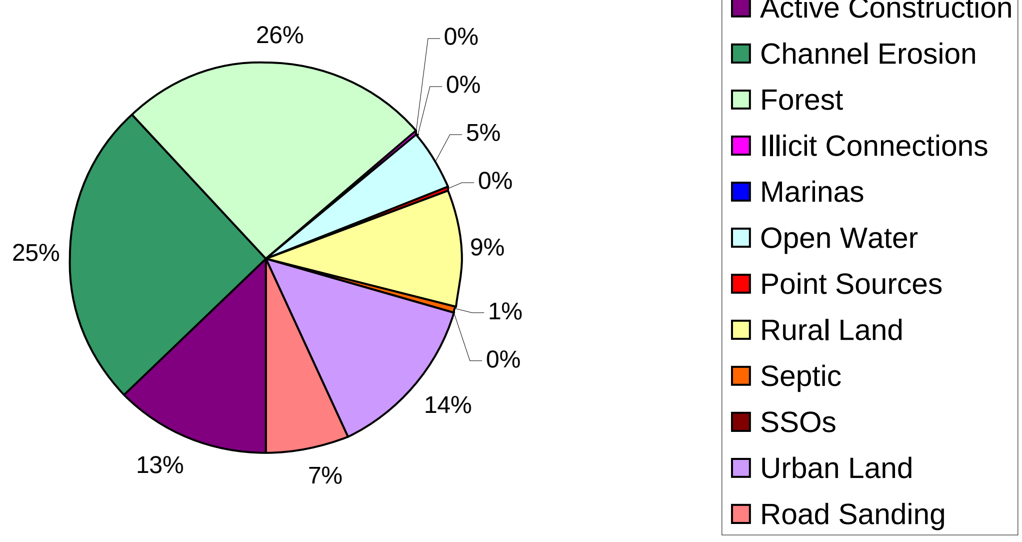
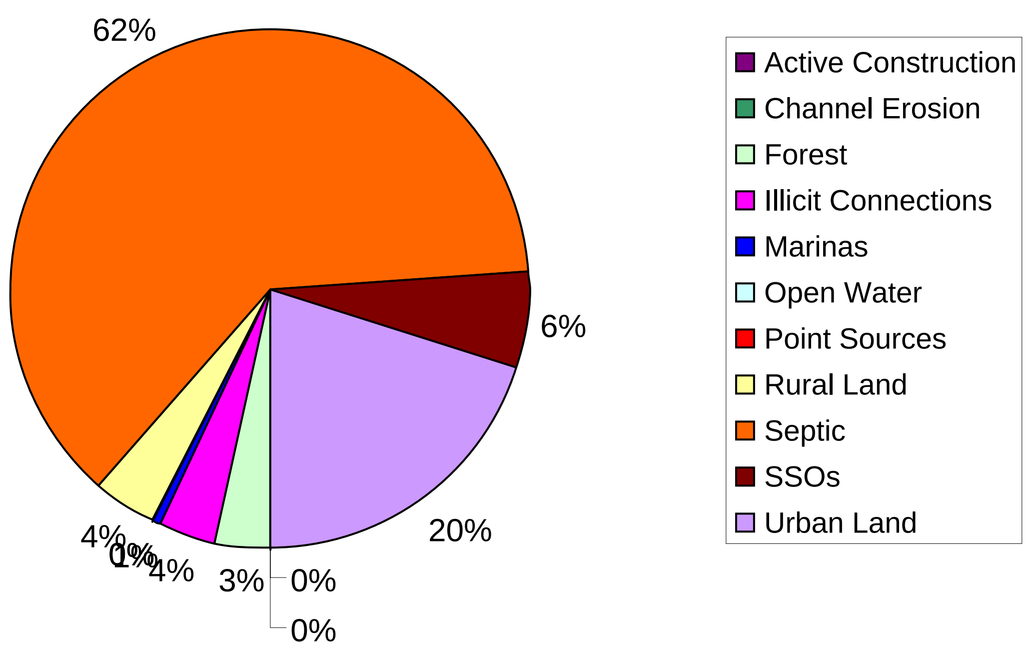


Figure D-4. Port Tobacco Watershed Bacteria Sources



3.2 Effects of Existing Management Practices

Examining the effects of existing management practices is useful for watershed management, because it lets the managers know what is working. In the Port Tobacco watershed, rooftop disconnection yield the biggest load reductions for TN, TP, and TSS. For bacteria, marina pump-outs have the biggest effect, followed closely by rooftop disconnection. For nitrogen, lawn care education is significant. For phosphors reduction marina pump-outs and structural stormwater management practices play roles. For sediment, erosion and sediment control is the runner up, followed by riparian buffers. The load reductions for each subwatershed are summarized in Table D-9 and D-10.

The WTM indicates that the most effect existing load reduction technique is impervious cover disconnection. This represents patterns of the past where rooftop runoff is not directly connected to the storm drain system, instead discharging to a pervious area. Impervious cover disconnection for roofs, roads, and parking lots reduces the amount of runoff by increasing infiltration and reduces pollutant loads as particles drop out. This finding indicates that it is important for development to reduce the amount of impervious cover and disconnect these impervious areas from direct discharge to the storm drains. This relates to Objective D – Better Site Design.

3.3 Effect of Future Management Practices

The application of future management practices results in a decrease in pollutant loads in each subwatershed, when compared to the pollutant loads with existing treatment practices applied. Tables D-11 and D-12 show the reductions beyond those with existing practices. The top reducers are listed below by pollutant for the overall watershed.

Nitrogen

- Septic System Upgrades to improve nitrogen removal efficiency from 20% to 50%, undertaken by at least 20% of septic owners with the help of a cost share.
- Lawn care education that reaches 30% of the population with a message about when and how to fertilize.

Phosphorus

- Repair of failing septic systems, triggered by mandatory inspection.
- Erosion and sediment control program upgrades that includes weekly inspections and inspector training.
- Education reaching 40% of septic system owners that spurs better maintenance.
- Construction of all recommended stormwater retrofits.
- Lawn care education that reaches 30% of the population with a message about when and how to fertilize.
- Pet waste education that reaches 30% of the pet-owning population, instructing pet owners to pick up pet waste and bag it for the trash or flush it.
- Sanitary sewer repair that reduces overflows by 75%.

Sediment

- Erosion and sediment control program upgrades that includes weekly inspections and inspector training.
- Construction of all recommended stormwater retrofits.

Bacteria

- Repair of failing septic systems, triggered by mandatory inspection.
- Education reaching 40% of septic system owners that spurs better maintenance.
- Sanitary sewer repair that reduces overflows by 75%.

Table D-9 % Load Reductions from Existing Practices																
	Hoghole Subwatershed				Jennie Run Subwatershed				La Plata Subwatershed				Port Tobacco Watershed			
Existing Management Practices	**TN**	**TP**	**TSS**	**Bacteria**	**TN**	**TP**	**TSS**	**Bacteria**	**TN**	**TP**	**TSS**	**Bacteria**	**TN**	**TP**	**TSS**	**Bacteria**
Lawn Care Education	1.0%	0.3%	-	-	1.2%	0.4%	-	-	0.7%	0.3%	-	-	0.8%	0.3%	-	-
Pet Waste Education	-	-	-	-	-	0.1%	-	-	-	0.1%	-	-	-	0.1%	-	-
Erosion and Sediment Control	-	0.1%	0.3%	-	-	0.2%	0.5%	-	-	0.4%	1.8%	-	-	0.3%	1.2%	-
Street Sweeping	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Street Sweeping - Sanding	-	-	-	-	-	-	-	-	-	-	0.1%	-	-	-	0.1%	-
Impervious Cover Disconnection	1.8%	4.2%	1.9%	2.9%	2.3%	5.0%	2.3%	4.3%	1.3%	4.7%	2.8%	2.4%	1.9%	5.2%	3.0%	4.2%
Structural Stormwater Management Practices	-	-	-	-	-	-	-	-	-	-	-	-	0.1%	0.4%	0.2%	0.3%
Riparian Buffers	0.2%	0.1%	0.5%	-	0.2%	0.1%	0.4%	-	0.1%	0.1%	0.3%	-	0.1%	0.1%	0.4%	-
Marina Pumpouts	1.1%	2.8%	0.2%	27.2%	-	-	-	-	-	-	-	-	0.2%	0.5%	-	5.6%
Total Reduction	**4.1%**	**7.6%**	**2.9%**	**30.1%**	**3.8%**	**5.7%**	**3.3%**	**4.3%**	**2.2%**	**5.7%**	**5.2%**	**2.4%**	**3.1%**	**6.8%**	**4.9%**	**10.1%**

Table D-10 Load Reductions from Existing Practices																
	Hoghole Subwatershed				Jennie Run Subwatershed				La Plata Subwatershed				Port Tobacco Watershed			
Existing Management Practices	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**
Lawn Care Education	202	4	-	-	266	5	-	-	396	8	-	-	2277	46	-	-
Pet Waste Education	4	-	-	31	6	1	-	55	18	2	-	160	80	10	-	696
Erosion and Sediment Control	3	1	1829	-	6	3	4114	-	24	10	17013	-	98	43	69938	-
Street Sweeping	-	-	-	-	1	-	38	-	4	1	150	-	9	1	372	-
Street Sweeping - Sanding	-	-	-	-	-	-	306	-	-	-	1247	-	-	-	3360	-
Impervious Cover Disconnection	363	54	12084	17186	500	74	17410	23665	744	115	26051	35527	5192	794	180425	247212
Structural Stormwater Management Practices	-	-	-	-	-	-	8	34	-	-	-	-	166	58	9247	16320
Riparian Buffers	35	2	2829	-	39	2	3274	-	40	2	3182	-	329	16	26809	-
Marina Pumpouts	216	36	1439	163296	-	-	-	-	-	-	-	-	432	72	2877	326592
Total Reduction	**822**	**97**	**18182**	**180513**	**819**	**85**	**25149**	**23754**	**1226**	**138**	**47643**	**35687**	**8581**	**1040**	**293028**	**590820**

Table D-11 % Load Reductions from Future Practices																
	Hoghole Subwatershed				Jennie Run Subwatershed				La Plata Subwatershed				Port Tobacco Watershed			
Future Management Practices	**TN**	**TP**	**TSS**	**Bacteria**	**TN**	**TP**	**TSS**	**Bacteria**	**TN**	**TP**	**TSS**	**Bacteria**	**TN**	**TP**	**TSS**	**Bacteria**
Lawn Care Education	2.0%	0.6%	-	-	2.5%	0.7%	-	-	1.4%	0.7%	-	-	1.6%	0.6%	-	-
Pet Waste Education	0.1%	0.2%	-	-	0.2%	0.4%	-	0.1%	0.2%	0.6%	-	0.1%	0.2%	0.4%	-	0.1%
Erosion and Sediment Control	0.1%	0.5%	1.7%	-	0.2%	1.0%	3.1%	-	0.2%	2.5%	10.6%	-	0.2%	1.6%	6.7%	-
Structural Stormwater Management Practices	0.1%	0.2%	0.3%	-	0.1%	0.1%	0.1%	0.2%	0.6%	3.0%	2.9%	2.3%	0.1%	0.6%	0.5%	0.7%
Riparian Buffers	0.1%	-	0.1%	-	-	-	-	-	-	-	-	-	-	-	0.1%	-
Septic System Education	0.1%	0.9%	0.1%	9.0%	0.1%	0.8%	0.1%	10.0%	0.1%	1.4%	0.2%	10.9%	0.1%	1.0%	0.1%	11.7%
SSO Repair/ Abatement	-	-	-	-	-	-	-	-	0.5%	2.0%	0.2%	15.2%	0.1%	0.4%	-	5.4%
Septic System Inspection/Repair	0.2%	2.9%	0.2%	28.6%	0.2%	2.6%	0.2%	31.8%	0.2%	4.6%	0.5%	34.7%	0.2%	3.1%	0.3%	37.4%
Septic System Upgrade	9.6%	0.5%	-	5.3%	9.2%	0.5%	-	5.9%	10.3%	0.9%	0.1%	6.5%	8.8%	0.6%	0.1%	7.0%
Channel Protection	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Reduction	**10.2%**	**5.4%**	**2.4%**	**43.0%**	**9.9%**	**5.4%**	**3.5%**	**48.0%**	**12.2%**	**15.0%**	**14.6%**	**69.5%**	**9.8%**	**7.8%**	**7.8%**	**62.3%**

Table D-12 Load Reductions from Future Practices																
	Hoghole Subwatershed				Jennie Run Subwatershed				La Plata Subwatershed				Port Tobacco Watershed			
Future Management Practices	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (lbs/yr)**	**Bacteria (billion/yr)**
Lawn Care Education	404	8	-	-	532	11	-	-	792	16	-	-	4555	91	-	-
Pet Waste Education	23	3	-	203	41	5	-	359	119	16	-	1039	520	68	-	4523
Erosion and Sediment Control	15	6	10518	-	33	15	23657	-	137	60	97825	-	563	248	402141	-
Structural Stormwater Management Practices	20	3	1684	180	12	2	788	1044	339	73	27173	33198	383	99	32514	39874
Riparian Buffers	10	-	693	-	3	-	253	-	6	-	360	-	70	2	4432	-
Septic System Education	14	12	474	53747	15	12	487	55282	42	35	1408	159791	181	151	6026	683906
SSO Repair/ Abatement	-	-	-	-	-	-	-	-	295	49	1965	223025	414	69	2759	313113
Septic System Inspection/Repair	45	38	1511	171533	47	39	1555	176432	135	112	4494	509972	577	481	19233	2182679
Septic System Upgrade	1927	7	282	32020	1982	7	290	32934	5729	21	839	95195	24522	90	3590	407433
Channel Protection	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Reduction	**2055**	**70**	**15161**	**257682**	**2133**	**81**	**27030**	**266051**	**6802**	**366**	**134063**	**1022220**	**27230**	**1206**	**470695**	**3631529**

Table D-8 Pollution Sources as a Percentage of Total Loads for Existing Conditions																
Pollution Source	Hoghole Run Subwatershed				Jennie Run Subwatershed				La Plata Subwatershed				Port Tobacco Watershed			
	TN	TP	TSS	Bacteria	TN	TP	TSS	Bacteria	TN	TP	TSS	Bacteria	TN	TP	TSS	Bacteria
Urban Land	12%	20%	8%	13%	24%	37%	19%	35%	13%	33%	21%	18%	12%	23%	14%	20%
Active Construction	-	1%	3%	-	-	2%	6%	-	-	5%	20%	-	-	3%	13%	-
SSOs	-	-	-	-	-	-	-	3%	1%	2%	-	18%	-	1%	-	6%
Illicit Connections	-	-	-	2%	-	1%	-	3%	-	1%	-	3%	-	-	-	4%
Channel Erosion	2%	12%	40%	-	2%	15%	46%	-	1%	7%	31%	-	1%	6%	25%	-
Marinas	-	-	-	30%	-	-	-	-	-	-	-	-	-	-	-	1%
Road Sanding	-	-	6%	-	-	-	6%	-	-	-	8%	-	-	-	7%	-
Point Sources	-	-	-	-	4%	7%	-	-	21%	16%	-	-	9%	7%	-	-
Rural Land	12%	27%	7%	3%	8%	18%	5%	3%	5%	19%	7%	2%	10%	28%	9%	4%
Forest	21%	33%	34%	4%	12%	17%	17%	3%	4%	10%	13%	1%	11%	20%	26%	3%
Septic	51%	5%	-	48%	48%	4%	-	53%	54%	8%	1%	58%	47%	5%	1%	62%
Open Water	3%	2%	1%	-	-	-	-	-	-	-	-	-	9%	7%	5%	-

Table XX Pollution Sources Loads for Existing Conditions

Pollution Source	Hoghole Run Subwatershed				Jennie Run Subwatershed				La Plata Subwatershed				Port Tobacco Watershed			
	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Bacteria (billion/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Bacteria (billion/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Bacteria (billion/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Bacteria (billion/yr)
Urban Land	2,378	254	52,271	79,424	5,276	551	145,198	193,948	7,441	813	189,106	270,044	33,599	3,546	815,060	1,160,991
Active Construction	28	12	19,946	-	63	28	44,865	-	260	114	185,523	-	1,068	470	762,652	-
SSOs	-	-	-	-	25	4	165	18,765	347	58	2,312	262,383	487	81	3,246	368,369
Illicit Connections	15	3	106	9,820	29	8	215	17,777	74	16	517	49,993	317	68	2,215	217,230
Channel Erosion	351	155	251,067	-	496	218	354,197	-	394	173	281,623	-	2,125	935	1,517,502	-
Marinas	24	4	160	181,440	-	-	-	-	-	-	-	-	48	8	320	36,288
Road Sanding	-	-	36,209	-	-	-	48,602	-	-	-	75,466	-	-	-	421,102	-
Point Sources	-	-	-	-	930	100	1,550	3	11,531	384	1,823	25	24,880	1,066	6,276	29
Rural Land	2,333	350	46,658	18,197	1,809	271	36,183	14,111	3,044	457	60,887	23,746	28,317	4,247	566,333	220,870
Forest	4,198	420	209,880	25,186	2,572	257	128,623	15,435	2,328	233	116,386	13,966	31,297	3,130	1,564,832	187,780
Septic	10,152	63	2,519	285,889	10,442	65	2,591	294,054	30,182	187	7,489	849,953	129,181	801	32,055	3,637,798
Open Water	607	24	7,349	-	-	-	-	-	-	-	-	-	26,056	1,018	315,521	-

Table XX: Total Loads for Existing Conditions

	TN	TP	TSS	Bacteria
	lb/year	lb/year	lb/year	billion/year
Hoghole	20,086	1,285	626,164	599,954
Jennie	21,642	1,503	762,189	554,094
La Plata	55,601	2,435	921,133	1,470,110
PT Watershed	277,374	15,370	6,007,114	5,829,354