DRAFT

Upper Choptank River Watershed Based Plan Developed to be Consistent with EPA's 319(h) Nonpoint Source Program Grant "A through I Criteria"

Choptank River, Denton MD

Developed in Partnership with
Caroline County Government, University of MD, the CWP,
Caroline County Soil Conservation District and
The Maryland Department of the Environment

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MDE Maryland Department of the Environment

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Introduction

This watershed based plan provides preliminary information to support the incorporation of nutrient tributary strategies into local planning for the area draining to Upper Choptank River watershed (02130404) in Maryland. The watershed plan is structured such that it follows the nine elements for watershed planning established by the U.S. Environmental Protection Agency (EPA) guidance in 2003.[1] It comprises a plan that addresses nonpoint sources of nutrients and supports efforts to incorporate nutrient reducing BMPs into future local planning and restoration efforts. The categories identified below, labeled A – I, reflect grant eligibility guidance from EPA.[2] The section headings in this plan represent abbreviated statements of the nine elements found in EPA's Guidance and address each element in sequential order. Documentation of this information helps ensure that future implementation projects are eligible for Section 319(h) Nonpoint Source Program funding from the federal Clean Water Act.

This watershed plan presents goals and strategies for reducing nonpoint source nitrogen and phosphorus pollutant loads in Maryland's Upper Choptank River watershed. The NPS nutrient reduction goals in this plan are derived from Maryland Tributary Strategy goals because a TMDL has not been approved for this watershed. Information on point sources presented here provides additional watershed context, which is part of a separate State of Maryland strategy for reducing point source nutrient loads in Maryland's Chesapeake Bay drainage area.

Further information on pollution sources can be found in the following documents listed below. These studies are cited to provide additional information for the watershed based plan, however, due to the date of their authorship and potentially different focus from the purpose of this plan, there may be limitations to their use.

1. Upper Choptank River Watershed Characterization (prepared by the Maryland Department of Natural Resources and Caroline and Talbot Counties, 2002)
2. Upper Choptank River Strategic Watershed Restoration Action Plan (prepared by the Maryland Department of Natural Resources and Caroline and Talbot Counties, 2003)
3. Upper Choptank River Watershed Synoptic Sampling (prepared by the Maryland Department of Natural Resources, 2002)

This Plan does not specifically address the portion of the watershed in Delaware. Delaware's portion of the watershed is to be addressed in the Chesapeake Bay Environmental Profile Basin Management found at: http://www.dnrec.delaware.gov/WholeBasin/Pages/index.aspx. For information concerning Delaware's Implementation See Appendix B.

Watershed Location and General Characterization

The Upper Choptank watershed is located on the Eastern Shore of Maryland and is part of the Choptank River basin, see Figure 1. It extends through three Maryland Counties and into Delaware. The majority of the watershed is in Talbot and Caroline Counties, MD, with a very

[1] The full text of EPA's A-I Guidance can be found at: http://www.epa.gov/nps/watershed_handbook/

[2] Nine Key Elements of a Watershed Plan for Nonpoint Sources of Nutrients: This information focuses primarily on nonpoint sources of nutrients. Balancing point sources and nonpoint sources of nutrients is an essential aspect of implementation, which is beyond the scope of this analysis.

small portion located in Queen Anne's County, MD. The major land uses[3] and acreages are summarized in Table 1 and shown in Figure 2.

Table 1: Land Use by Major Categories

Land Use	Acres
Development	12,961
Agriculture*	94,358
Forest	50,657
Water	4,755
Other**	727
Total Area	163,458

* Agriculture is made up of Cropland, Pasture, Orchards, Feeding Operations, Agricultural Buildings, and Row & Garden Crops

** Other land uses include Extractive, Open Urban, Beaches, Bare Rock and Bare Ground

For more information concerning the Upper Choptank Watershed, see the Upper Choptank River Watershed Characterization[4].

[3] Based on Maryland Department of Planning 2002 Land use

[4] Upper Choptank River Watershed Characterization can be found at: [weblink]

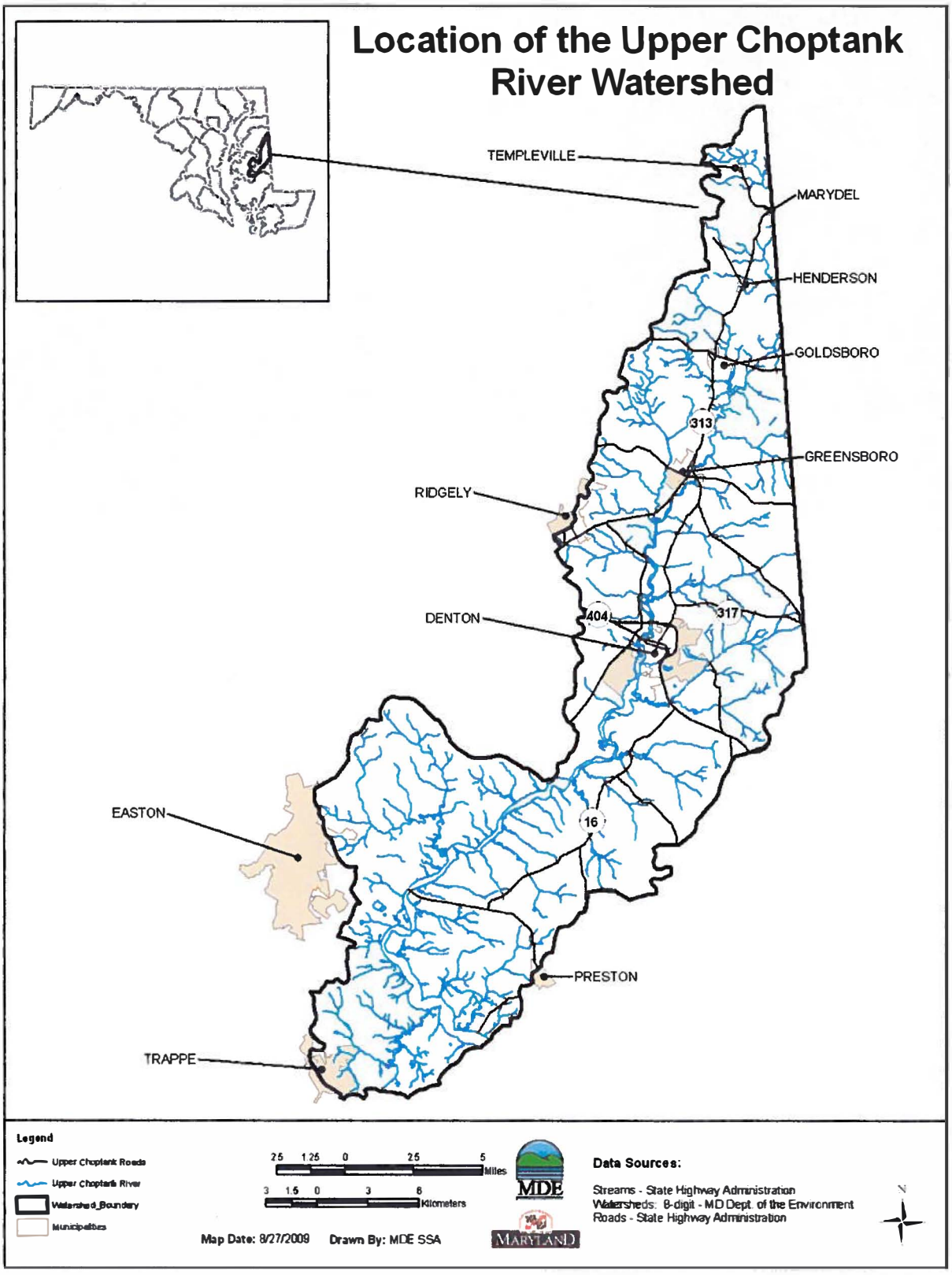

Figure 1: Location of the Upper Choptank Watershed in Maryland

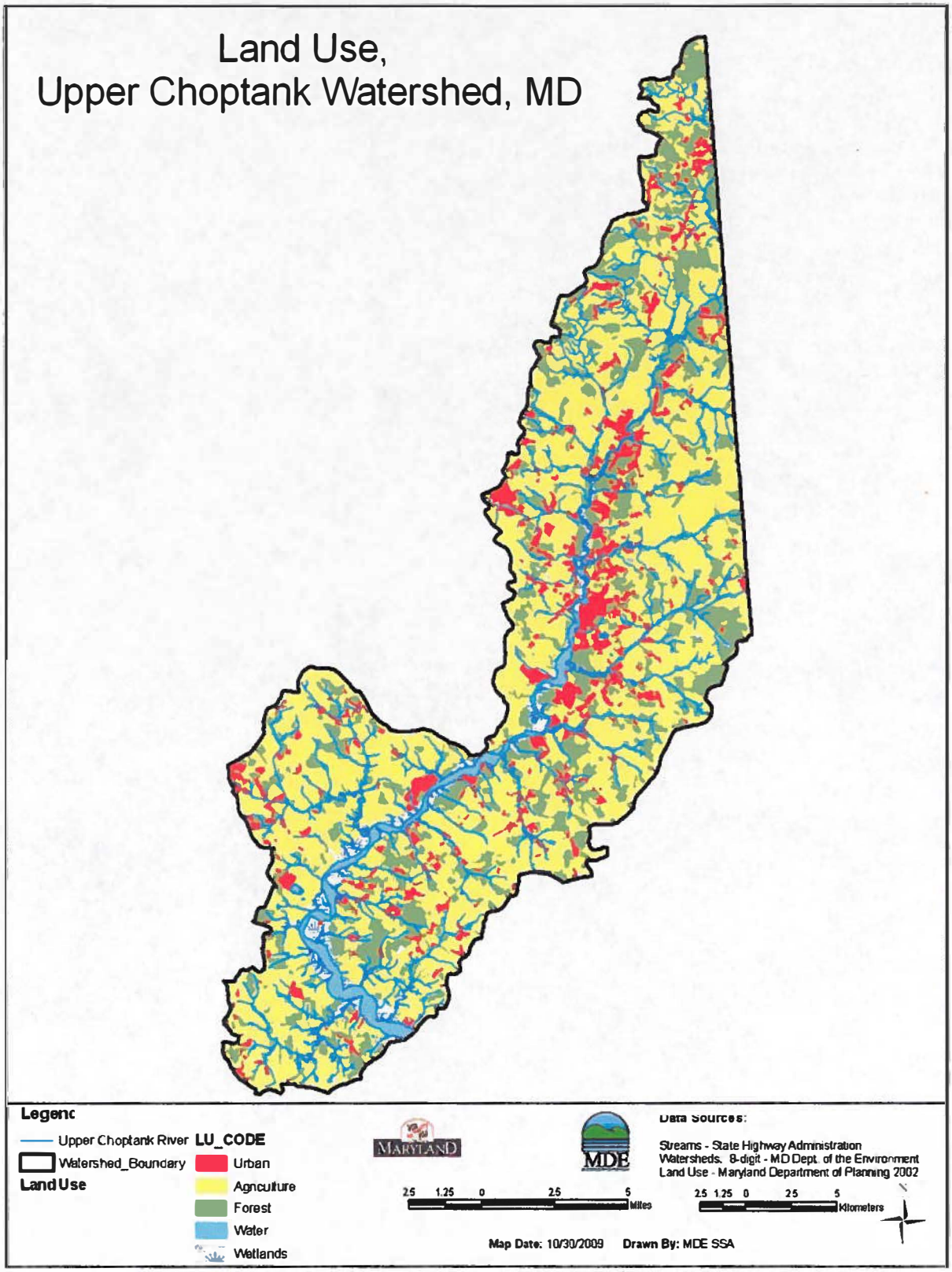

Figure 2: Land Use by Major Categories, Upper Choptank River Watershed in Maryland

A. Causes of Impairment and Pollutant Sources

The Upper Choptank River watershed impairments are associated with both nonpoint sources and point sources. Point sources are described in Appendix A, however, with the exception of the Greensboro WWTP, they are not the focus of this watershed plan.

Nonpoint Source Pollution (NPS)
Nonpoint source pollution generally results from precipitation, land runoff, infiltration, drainage, seepage, hydrologic modification, or atmospheric deposition. As runoff from rainfall or snowmelt moves, it picks up and transports pollutants resulting from human activity, ultimately depositing them into rivers, lakes, wetlands, coastal waters, and ground water.

Pollutant Sources
In the Upper Choptank River watershed, sources of nutrients include all land areas, (forest/wetlands, urban/developed areas, agricultural lands), septic systems and atmospheric deposition.

In general, natural lands like forest and wetlands that are not significantly manipulated by human activities tend to yield relatively low levels of nitrogen and phosphorus to surface waters, compared to lands that are more intensely used by people such as urban/developed land and agricultural land.

Urban areas are those lands which have been developed. These lands can include residential, commercial, industrial, and institutional areas as well as the road surfaces in those lands. Urban nonpoint source pollution (nitrogen and phosphorus) can come from various sources. Stormwater from urban and suburban areas can contribute pollution from fertilizer, and pet waste, as well as fluids and emissions from vehicles.

Agricultural lands are those used for growing crops, animals production and can include areas that are used for other purposes such as pasture and nurseries. These lands can contribute pollution from fertilizers, animal waste, and air emissions.

Septic systems are also called onsite sewage disposal systems (OSDS). Conventional septic systems are not designed to control nutrients. All nutrients that are not pumped out of the septic tank during servicing pass through the system with the effluent into the drainfield. After the effluent enters the soil, phosphorus tends bind to soil particles in the immediate vicinity of the drainfield while nitrogen tends to move with shallow groundwater, eventually reaching surface waters. On average "septic systems annually deliver about 9.5 pounds of nitrogen per person."[5]

Atmospheric deposition can come from emissions into the air from vehicles, industries, power plants, dry cleaners, and gas-powered lawn tools. Sources also can include agricultural sources such as animal feeding operations (such as chicken houses) and manure. There are also natural

[5] Chesapeake Bay Program website: http://www.chesapeakebay.net/landuse_urbansuburban.aspx?menuitem=19557

sources such as "lightning, dust storms, forest fires, plants and trees, erupting volcanoes and wild animals in their natural habitat."[6]

Analysis Methods

The analysis is intended to provide NPS load reductions needed to meet the Tributary Strategy Goal, relative to the 2002 load[7].

The analysis estimates loads using a unit area loading approach. This approach involves multiplying land use acreages by annual loading rates associated with each land use category. These are summed to provide an estimate of average annual terrestrial NPS loads for the watershed. Estimates of septic system loads and the direct deposition of atmospheric loads to the surface water are also considered in the NPS loading analysis. The following explains the computation of these loads in further detail.

Land Use: The land use for the watershed is determined by intersecting the watershed boundary GIS layer with the land use GIS layer for each county. The analysis used 2002 land use data from the Maryland Department of Planning. The various land use types are then consolidated into Mixed Agriculture, Forest/Wetlands and other Herbaceous, Urban Development, Atmospheric Deposition to Open Water and Other Sources.

According to 2002 land use data,[8] the land uses consist of 50,657 acres of forest and wetlands (31%), 94,358 acres of mixed agriculture (58%), 13,576 acres of urban land (8%) and 4,754 acres of open water (3%).

Terrestrial and Atmospheric NPS Loads: The average annual unit loading rates, by land use type, are derived from the EPA Chesapeake Bay Program (CBP) watershed model Version 4.3[9] (for nitrogen and phosphorus). These annual loading rates, expressed in pounds per acre per year, are available for major land use categories (e.g. agriculture, urban, forest, and direct atmospheric deposition to the surface water). See Table X for the Loads by source below.

Septic System Loads: The septic load depends on the number of septic systems. To calculate the number of septic systems, the GIS layer for improved parcels is intersected with the GIS layer for parcels serviced by sewer. The improved parcels *without* sewer service are assumed to have septic systems, which provide a reasonable estimate of the number of septic systems. See Figure X, for the geographic distribution of the Septic Systems. The nitrogen load from septic systems is computed using the following equation:

p/h x 9.5 x 0.5 = Pounds of nitrogen/person/year/septic system delivered to surface water.

Where,

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[6] Chesapeake Bay Program Website:http://www.chesapeakebay.net/airpollution.aspx?menuitem=14693

[7] The 2002 load is the loading estimate used at the time of this analysis.

[8] 2002 Maryland Department of Planning land use data.

[9] Bay Program loading rates are available via the Chesapeake Bay Program Data Hub web site. The analysis used edge of stream loads from Lower Eastern Shore Basin.

p/h is the number of people/household for a given county[10],
9.5 pounds of nitrogen per year per person/household to the septic drain field,
0.4 reflects a 60% loss of nitrogen during transport from the septic field to the surface water.

This value, when multiplied by the number of septic systems, provides an estimate of the total contribution of nitrogen from septic systems in the watershed. To estimate the effect of denitrification septic systems, the load per septic system is halved.

The 2002 loading information is used to estimate the current loads. Figure 2: Land Use by Major Categories, Upper Choptank River Watershed in Maryland, shows the geographic distribution of those land-based NPS sources.

This information when combined with septic systems (Figure 6) and atmospheric loads being deposited to the open water, is compared to the Tributary Strategy NPS loading goal to determine the reduction needed.

Table 2: NPS Nutrient Loads by Source Sector

Land Use/Cover	Nitrogen Load (lbs/yr)	Phosphorus Load (lbs/yr)
Urban/Development	119,231	15,493
Agricultural	1,475,112	103,301
Forest /Wetlands	75,151	1,138
Atmospheric Deposition to Water	47,958	2,693
Other*	972	143
Residential Septic	73,833	-
Total	1,792,257	122,767

* Other Land use sources are Bare Rock and Bare Ground

The estimated average annual nonpoint source load of nitrogen is 1,792,257 lbs/yr, and phosphorus is 122,767 lbs/yr.

Point Source Pollution (PS)
Point sources are described in Appendix A, however, with the exception of the Greensboro WWTP, they are not the focus of this watershed plan.
The Point Sources are shown in Figure X.

The nutrient load to the Choptank from the Greensboro WWTP is, on average, about 10,000 lbs/yr TN and 1,300 lbs/yr TP.

[10] Estimates of people per household are available on the Maryland Department of Planning web site: www.mdp.state.md.us/msdc/dw_popproj.htm

B. Estimate the load reductions expected for the necessary management measures (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time);

Nonpoint Source Reductions

Different loading rates are available for a variety of "what if" scenarios from the EPA Chesapeake Bay Program (CBP) Data Hub. For example, one modeling scenario estimates the loads in 1985, when the CBP began tracking loads. Another scenario simulates the NPS loads under the "what if" scenario of no best management practices (BMPs). Loading rates from two CBP model scenarios are used in this analysis: 1) the 2002 loading scenario, which is the most recent estimate of "current" loads, and 2) the Tributary Strategy loading scenario, which estimates future loads when the Tributary Strategies are fully implemented to meet the Chesapeake Bay Agreement. The Tributary Strategy Scenario was used to generate loading rates and the NPS Goal and reductions.

Based on a preliminary nutrient load reduction analysis, the annual NPS load reductions needed to achieve the nutrient Tributary Strategy Goals are about 704,000 lb/yr (39%) for nitrogen, and 34,500 lb/yr (28%) for phosphorus. The nutrient controls currently envisioned in Maryland's Tributary Strategies are predicted to be sufficient to achieve this goal. These results are summarized in Table 3.

Table 3: NPS Loading, Goals and Reductions

	2002 Load (lb\yr)	Tributary Strategy NPS Goal (lb\yr)	Nutrient Reduction Goal (lb\yr)	Percent Reduction to Meet Tributary Strategy Goal
Total Nitrogen	1,792,257	1,088,000	704,000	39%
Total Phosphorus	122,767	88,300	34,500	28%

Atmospheric reductions associated with deposition to the land surface are not estimated as part of this plan, making this plan's load reduction estimates conservative in that regard.

C. Describe the NPS management measures necessary to achieve the load reductions estimates established under paragraph (b) above and identify the critical areas in which those measures will be needed to implement this plan;

First, the water quality impairment, expressed as high algae (chlorophyll *a* concentrations), is most pronounced at the head of tide, where the main tributary drains into the tidal Choptank River. Consequently, NPS management should be targeted in the upper watershed, which drains the main non-tidal stream that feeds the Upper Choptank estuary. In addition, it makes sense to target implementation to areas near the tidal river shoreline and in riparian corridors. This targeting is particularly relevant for septic systems, which in addition to nutrients also have the potential to cause adverse health consequences in the event of a system failure.

Secondly, Maryland and the Chesapeake Bay Program have agreed upon management measures that appropriately address these pollutants. Because agriculture is the greatest source of nutrients in this watershed, most of the management measures have been targeted at this source.

Developed land is the second largest source of pollutants, and strategies to reduce loads from this source will be focused on stormwater retrofit projects that incorporate regenerative stormwater system techniques, to be located primarily on county and municipal properties. Strategies to reduce nutrient loads from septic systems (the third largest source of nitrogen in the watershed) will focus on denitrification upgrades of systems located in the Critical Area, but will largely be dependent on available funding from the State's Bay Restoration Fund.

Thirdly, BMPs identified in the Chesapeake Bay Tributary Strategies should serve as the NPS management measures for implementing the nutrient Implementation of the Tributary Strategy BMPs proportionate to the land use in the Upper Choptank watershed is predicted to achieve the goal.

For more details about Maryland's Tributary Strategies See:
http://www.chesapeakebay.net/wqctributarymd.htm

The following list begins to quantify the specific BMP types that will be needed to address each sector; however, additional quantification and refinement of management measures will be necessary to geographically locate and target some specific practices. The expected reduction for these measures is approximately 730,000 (lbs/yr) of Nitrogen and 65,000 (lbs/yr) of Phosphorus.

Table 4: Reductions Anticipated from Agricultural Land:

Agriculture	Units	Goal	Reduction	
			Nitrogen (lbs)	Phosphorus (lbs)
Cover Crops	acres/yr	50,000	308,575	10,262
Buffers Forested - Agriculture	acres	1,000	13,833	1,231
Buffers Grassed - Agriculture	acres	5,500	53,841	6,773
Commodity Cover Crops	acres/yr	15,000	92,572	0
Conservation Tillage	acres/yr	20,000	12,769	2,932
Nutrient Management	acres	48,000	149,280	14,400
Precision Agriculture	acres	25,000	39,282	5,407
Retirement of Highly Erodible Land	acres	500	9,777	1,403
Soil Conservation & Water Quality Plans	acres	66,000	42,136	9,676
Wetland - Agriculture	acres	1,200	6,384	1759.2
Drainage Control Structures	structures	65	9,130	0
Pasture				
Stream Protection With Fencing	acres	130	756	84
Stream Protection Without Fencing	acres	32	109	15
Tree Planting - Agriculture	acres	100	575	193
Animal Management				
Animal Waste Management - Livestock	systems	2	1,062	202
Animal Waste Management - Poultry	systems	4	840	168
Runoff Control	systems	8	129	16
Total Agricultural Reductions			741,049	54,520

Agriculture lands that would be suitable for cover crops are identified in yellow on Figure 3. Areas that would be appropriate for pasture fencing are identified on Figure 4.

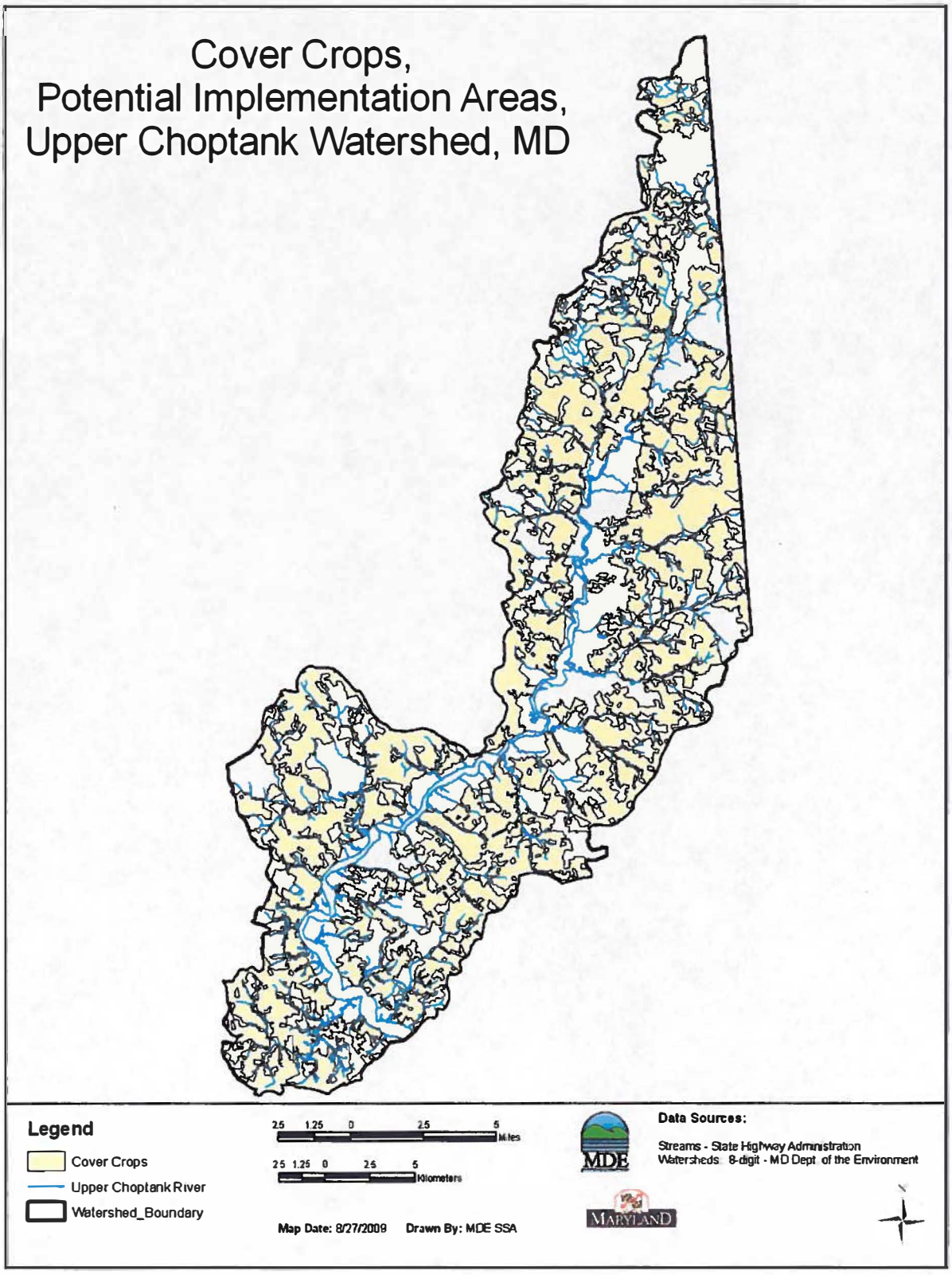

Figure 3: Potential Areas for Cover Crops, Upper Choptank River Watershed in Maryland

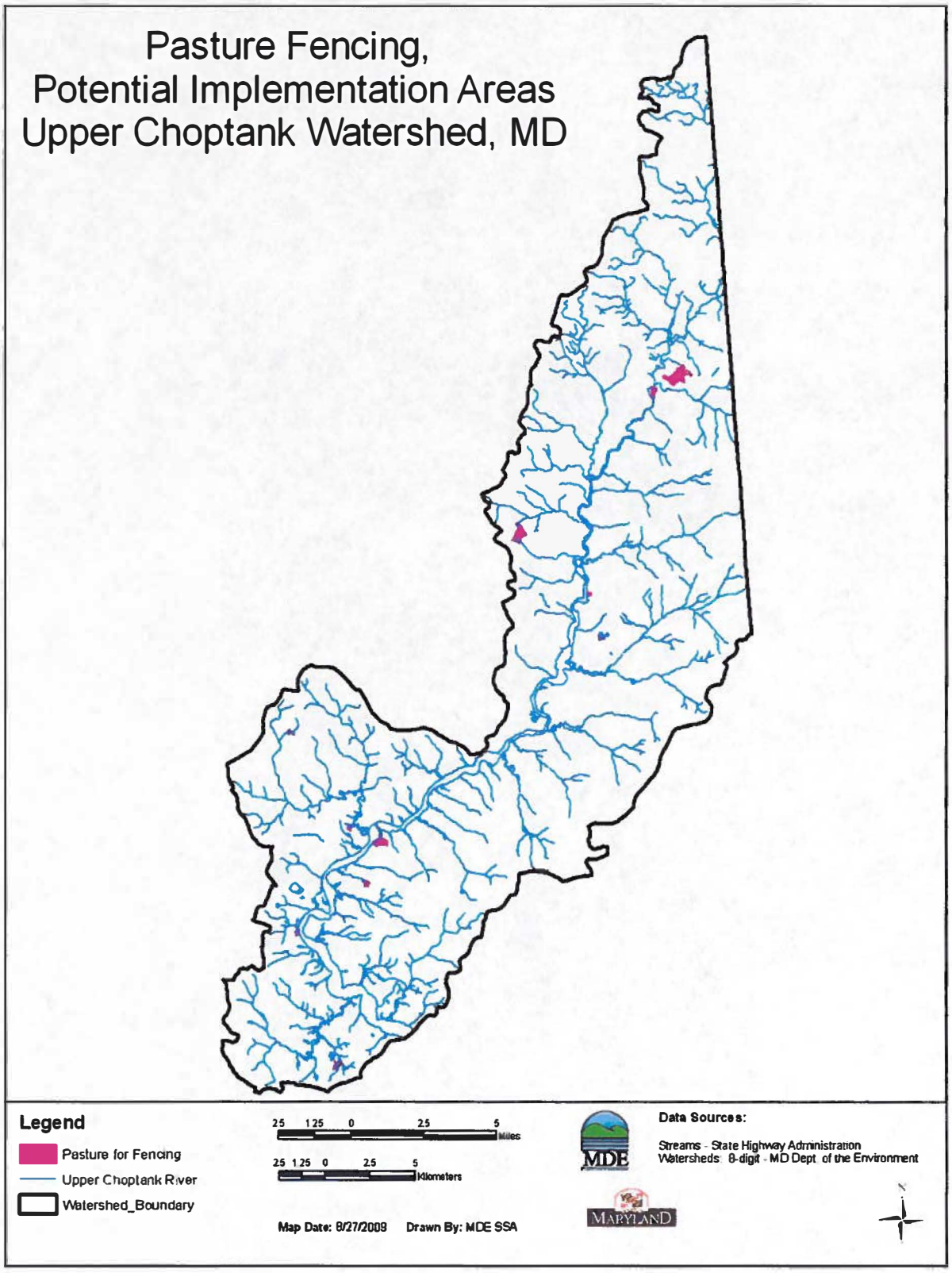

Figure 4: Potential Areas for Pasture Fencing, Upper Choptank River Watershed in Maryland

Table 5: Reductions Anticipated from Urban/Developed Land:

Urban	Units	Goal	Reduction	
			Nitrogen (lbs)	Phosphorus (lbs)
Buffers Forested, Urban	acres	60	139	31
Erosion and Sediment Control	acres/yr	895	2,067	371
Nutrient Management, Urban	acres	12,000	18,843	2,735
Stormwater Management	acres	8,400	30,309	6,592
Total Urban Reductions			51,509	10,669

Areas that would be suitable for enhanced stormwater BMPs are designated in red on Figure 5.

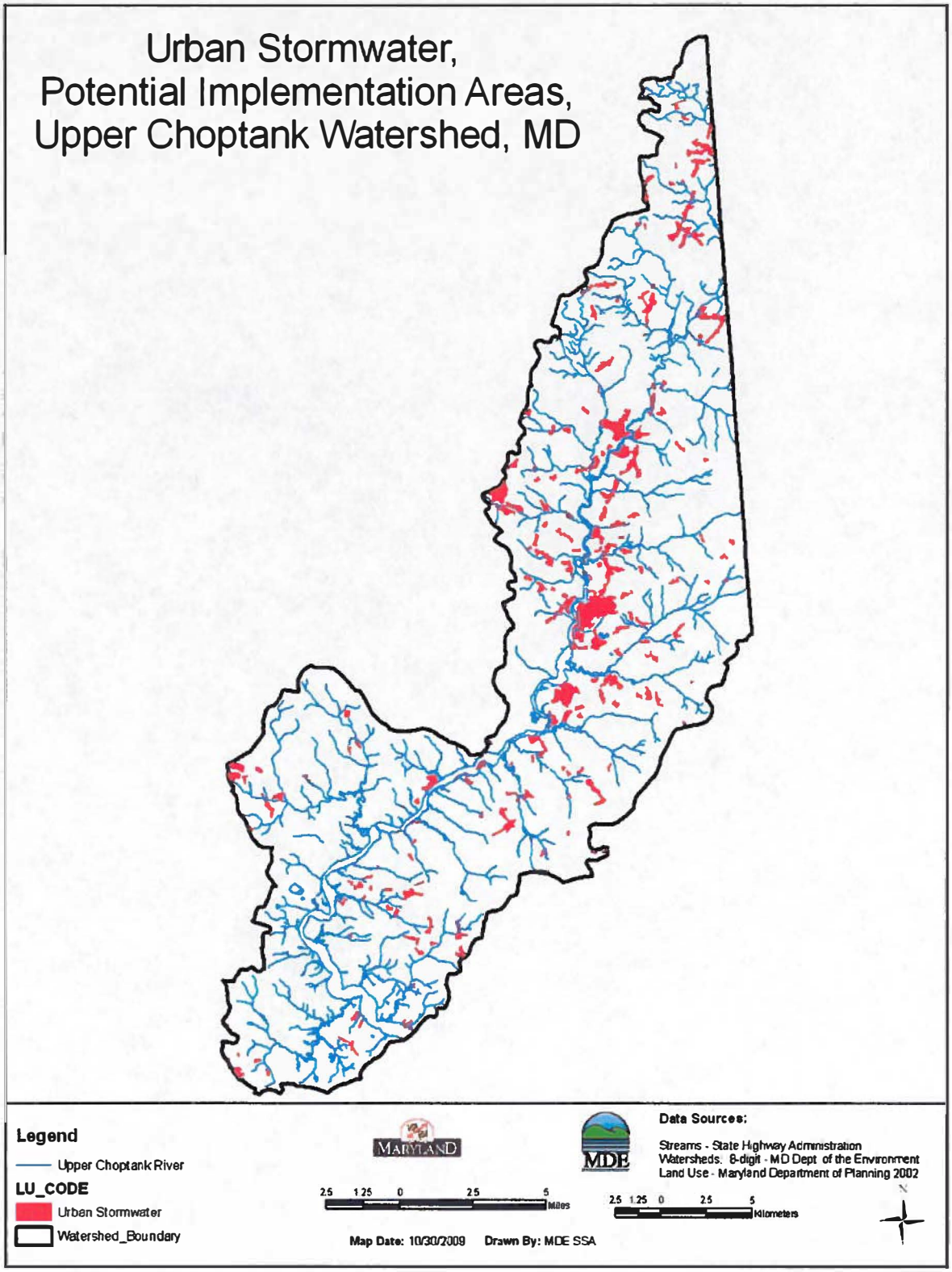

Figure 5: Potential Areas for Stormwater Enhancement, Upper Choptank River Watershed in Maryland

The location of Septic Systems (OSDS) are shown in Figure 6, with designated colors denoting a priority according to proximity to the water's edge and hence indicating an increased pass through rate and delivered load. The red points, which are those systems in the Critical Area, indicate the highest delivered load and would therefore be targeted in the first phase of a phased approach for upgrades. Current loading and strategies in Maryland are based on the location of these systems. Critical Area as defined is an area of land within 1,000 feet of tidal water.[11]

Table 6: Reductions Anticipated from Septics:

Septics	Units	Goal	Reduction	
			Nitrogen (lbs)	Phosphorus (lbs)
Enhanced Septic Denitrification (OSDS)	systems	5,051	25,356	0
Septic Connections to WWTP	systems	750	7,530	0
Total Septic Reductions			32,886	

[11] http://mlis.state.md.us/asp/web_statutes.asp?gnr&8-1807

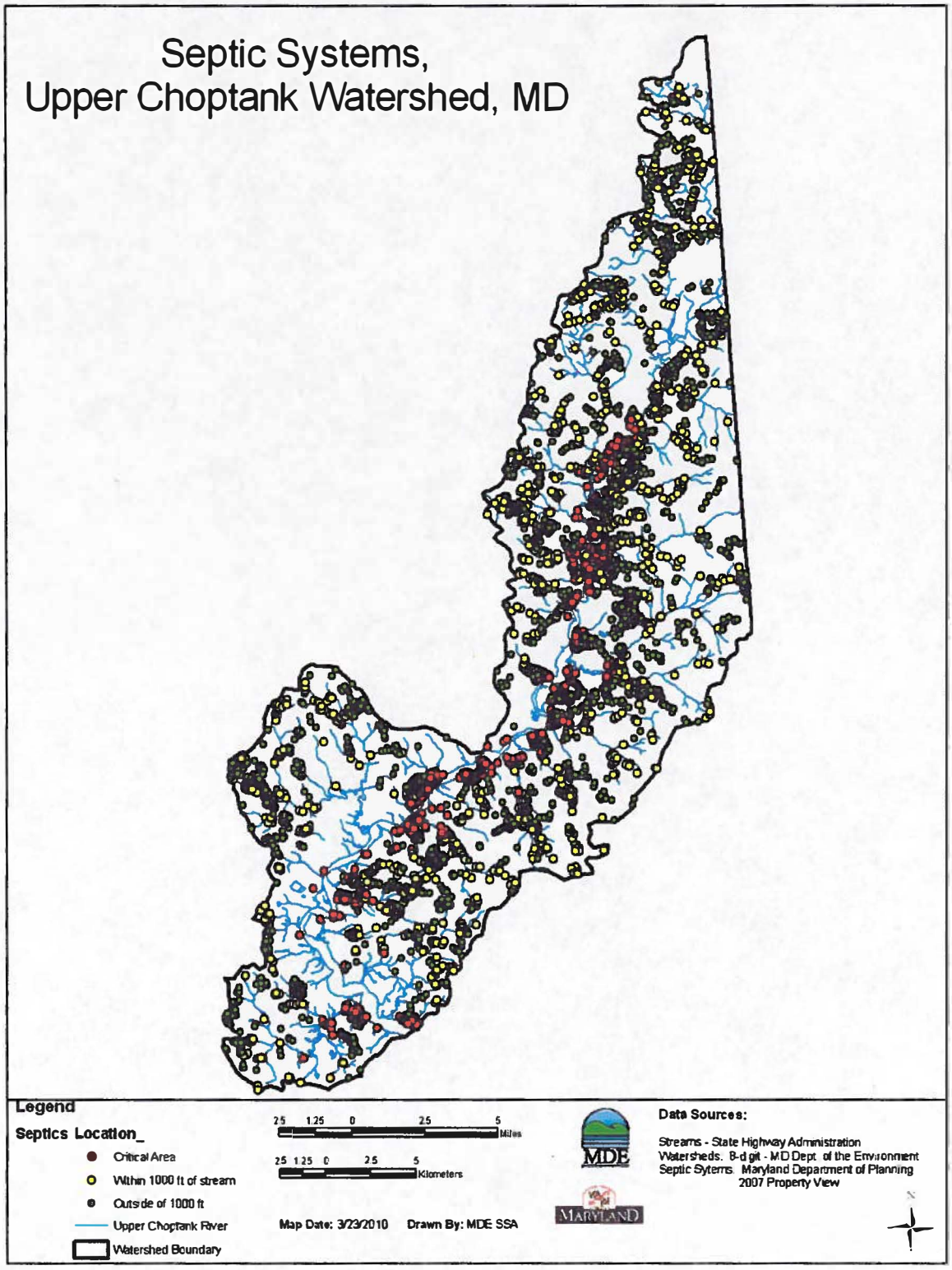

Figure 6: Potential Septic System (OSDS) Denitrification, Upper Choptank River Watershed in Maryland

Table 7: Plan Reductions for NPS Sectors that will meet Nutrient Reduction Goals:

Reduction	Urban	Agriculture	Septic Systems	Total Reductions	Reduction Goal
Nitrogen (lbs)	51,509	741,049	32,886	825,444	704,000
Phosphorus (lbs)	10,669	54,520	0	65,189	34,500

Priority Implementation Areas

Two areas have been prioritized for implementation, Watersheds 021304040494 and 021304040505. These areas are shown in Figure 7. The reason for prioritization include, Caroline County and the Soil Conservation District are willing partners, two of the areas are Tier II (High Quality waters) watersheds which need to implement to protect the water quality from any future impacts, these watersheds are in upstream areas, which mitigates loads/volumes that might cause downstream implementation to fail (top-down approach).

The Caroline County Department of Planning and Codes and Soil Conservation District (SCD) have developed implementation goals for agricultural BMPs in both of these priority watersheds. The implementation goals include the continued installation of BMPs funded annually through the Maryland Agriculture Water Quality Cost-Share (MACS) program, which funds up to 87.5 percent of the cost to install agricultural best BMPs on farms. BMPs funded by the program include traditional and commodity cover crops, streamside grass and forest buffers, drainage ditch water control structures, and systems designed for safe storage and handling of manure. Appendix C contains detailed information about the implementation goals for MACS program-funded agricultural BMPs, including acreage and nutrient reduction goals for each of the priority watersheds.

The SCD office also developed goals for non-traditional BMPs to be implemented on an experimental basis within the next five years. These BMPs are not currently funded through any state or federal cost-share programs; analyses for nutrient/sediment reduction efficiencies for these practices are being conducted in field tests, and reduction estimates are still in the early stages of refinement. Over a period of the next five years, SCD plans to install and test the following BMPs on a trial basis, to determine their feasibility in the two priority watersheds:

Phosphorus Ditch Filters

Year 1: Review and assess available data from on-going research conducted during field testing of P-ditch filters.
Year 2: Identify potential public and private funding sources for development of P-ditch filters cost-share program, establish funding timelines and installation schedules based on funding source requirements/limitations.

Year 3: Develop public education/outreach programs including demonstration and public partner projects, informational mailings, and a web-based public awareness campaign, all of which will be designed to educate farmers about the benefits of P-ditch filters.
Year 4: Target farmers for enrollment in program.
Year 5: Install five phosphorus ditch filters at $6,000 each to serve drainage ditches in priority watersheds. Total linear feet of filtered ditches to be calculated at installation. Establish data monitoring system to track effectiveness of ditch filters, with testing protocols to be approved by qualified institution/agency.

Potential Practices for Poultry Operations
Year 1: Assess feasibility of obtaining funding support from NRCS Environmental Quality Incentives and Chesapeake Bay Watershed Initiative programs (EQIP/CBWI) to establish a test cost-share program for alternative practices for poultry operations, including windrowers, litter savers and litter conveyors. Contact NRCS program manager with descriptions of alternative practices, environmental benefits, approximate costs, and potential producer interest.
Year 2: Identify additional sources of public/private funding for alternative practices for poultry farms, establish funding timelines and installation schedules based on funding source requirements and limitations.
Year 3: Determine availability/feasibility of using Low-interest Loans for Agricultural Conservation (LILAC) program to fund alternative practices. LILAC loans assist Bay watershed farmers with purchasing equipment (at lower interest rates) that will aid in protecting natural resources and safe guarding water quality.
Year 4: Conduct targeted mailing and informational meeting for poultry farmers to discuss environmental benefits and approximate costs of utilizing alternative practices on poultry farms, and to gauge interest in enrollment in a test cost-share program. Goal: purchase of windrower, litter saver, and litter conveyor to be shared by a specified number of poultry farmers located within a short distance (1-5 miles) of each other, to reduce the need for multiple farmers purchasing multiple pieces of equipment. Farmers would share responsibility for maintenance of equipment and ensuring bio-security of equipment before it leaves each farm. Establish protocols, determine legal requirements and financing terms, and execute signed agreements between all participants.
Year 5: Enroll 75% of the poultry producers in each watershed in cost-share/loan funded programs to support utilization of alternative practices on poultry farms.

Wetlands
Years 1 – 3: Utilize GIS data to identify areas of potential wetland restoration/creation on agricultural land. Contact landowners of potential sites, and assess feasibility of wetland restoration/creation on a property-by-property basis, in cooperation with landowners.
Year 2: Implement wetland restoration/creation BMP project on County-owned rural property with access/visibility from public right-of-ways as a partner project between County DPC and SCD, to

facilitate public awareness and education about non-structural BMPs in general and the function of wetlands in particular. Include systems for monitoring/tracking progress and effectiveness, with testing protocols to be approved by qualified institution/agency.

Year 3: Coordinate the demonstration project with the development of a public outreach/education program, including on-site wetlands workshops, exhibits and 'visiting' hours, and a mailing and web-based public awareness campaign.
Years 4 – 5: Establish 25 acres of wetland restoration/creation within each watershed, with on-site water quality data monitoring/tracking systems as permitted by landowners.

Finally, the SCD office is considering the establishment of a 5 to 10-year grant-funded program that would target farm operators who have not previously installed vegetative buffers on their farms. SCD staff have received feedback from a number of farmers indicating that if the standards of the existing buffer cost-share programs were slightly more lenient (i.e., reduced minimum buffer widths, less stringent mowing limits), they would enroll in the program. Farmers enrolled in the program would allow the installation of 20-25' vegetated buffers along each side of in-field streams and ditches that traverse their properties, with the cost of planting to be underwritten by project funders. Maintenance requirements would be more moderate to allow farmers to mow buffers more than once each year. The program's short-term goal of "some is better than none" will result in 25,000 linear feet of 20' grass buffers planted along in-field ditches within the two priority watersheds, a total of 46 acres of buffers. The program's long-term goal will be the gradual enrollment of the program's participants in traditional buffer cost-share programs, as participants begin to adjust to and recognize the value of riparian buffers, and subsequently approve the expansion of their buffers to standard CRP/CREP widths of 35' or more. SCD estimates that developing the program, securing funding and contacting farmers will take three years, and that planting could take place in years 4 – 5.

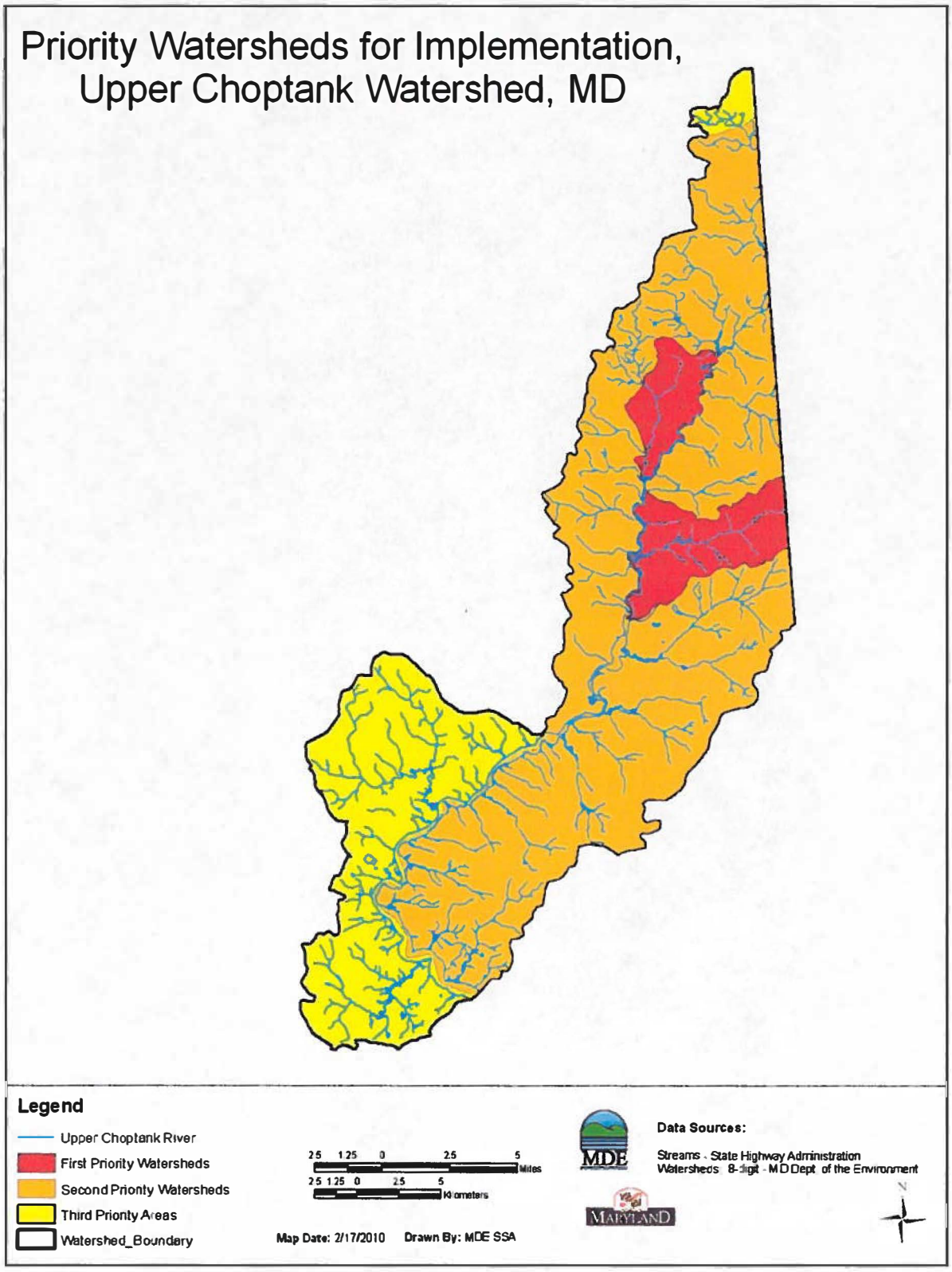

Figure 7: Priority Watershed/Areas, Upper Choptank River Watershed in Maryland

Point Source Reductions
Point source load reductions are not addressed in this NPS load reduction plan because Maryland has a dedicated strategy for point source nutrient load reduction including adding Enhanced Nitrogen Reduction (ENR) at existing and future Wastewater Treatment Plants (WWTPs). However, it is important to note that the septic (OSDS) management measures presented in this plan will be integrated with Caroline County's plans to for upgrading WWTPs, new WWTP construction, service area expansion (eliminating septic systems) and decommissioning of the Greensboro WWTP.

For example, this strategy will apply to Denton's treatment plant, which is scheduled to be upgraded to ENR technology by 2011. The total cost for this upgrade is $3,600,000. The State strategy also has a dedicated funding mechanism to support the upgrades. More information is available on the ENR strategy at: http://www.mde.state.md.us/Water/CBWRF/ENR.asp

Per amending and the approval of the [Water and Sewer Plan], the County intends to create a regional wastewater collection and conveyance system. The North Caroline County Regional Wastewater Project is a wastewater treatment plant and regional wastewater collection and conveyance system that will serve the towns of Greensboro, Goldsboro, Henderson, Marydel, Templeville and nearby areas of Caroline County. A collection and conveyance system will be provided in the towns of Goldsboro, Henderson, Marydel and Templeville and the surrounding County. The wastewater will be conveyed to a new Enhanced Nutrient Removal (ENR) wastewater treatment (WWTP) plant located in Greensboro, north of the town's existing WWTP.

D. Estimate the sources of technical and financial assistance needed, and/or authorities that will be relied upon, to implement this plan;

A balanced description of the "cost" of meeting a goal should consider two things. First, part of the cost of implementation is the additional cost of preventing loading from increasing in the future. Strictly speaking, this implies that society must "pay" in perpetuity to preserve water quality. In addition to costs associated with "holding the line" on new nutrient sources, operating and maintenance costs for BMPs and treatment plants must also be paid for in perpetuity.

Nonpoint Source Costs
Some of the costs of NPS controls must be stated in terms of a time-horizon, because annual operations or maintenance costs are in perpetuity. This suggests the need for sustainable funding systems as a long-term strategy.

A rough cost estimate of planning and implementing the NPS elements of the Plan in the Upper Choptank River is about $124 million with an annual cost for yearly BMPs at $29 million. If the cost of septic system upgrades is removed, the cost of NPS reductions is reduced by about half to about $69 million. See Table X below.

For agricultural practices, most of the capital costs are covered by federal programs and the Maryland Cost Share Program. Most of the planning is done by employees of the Soil Conservation Districts.

Table 8: Costs Associated with Reductions Anticipated from Agricultural Land:

Agriculture	Units	Goal	Costs/unit	Total Cost
Cover Crops	acres/yr	50,000	$40	$2,000,000
Buffers Forested - Agriculture	acres	1,000	$1,000	$1,000,000
Buffers Grassed - Agriculture	acres	5,500	$140	$770,000
Commodity Cover Crops	acres/yr	15,000	$20	$300,000
Conservation Tillage	acres/yr	15,000	$17	$255,000
Nutrient Management	acres	48,000	$30	$1,440,000
Precision Agriculture	acres	25,000	$28	$700,000
Retirement of Highly Erodible Land	acres	500	$120	$60,000
Soil Conservation & Water Quality Plans	acres	66,000	$280	$18,480,000
Wetland - Agriculture	acres	1,200	$3,500	$4,200,000
Drainage Control Structures	structures	65	$1,000	$65,000
Pasture				
Stream Protection With Fencing	acres	130	$1,000	$130,000
Stream Protection Without Fencing	acres	32	$670	$21,440
Tree Planting - Agriculture	acres	100	$615	$61,500
Animal Management				
Animal Waste Management - Livestock	systems	2	$63,533	$127,066
Animal Waste Management - Poultry	systems	4	$26,627	$106,508
Runoff Control	systems	8	$7,058	$56,464

Table 9: Costs Associated with Reductions Anticipated from Urban/Developed Land:

	Units	Goal	Costs/unit	Total Cost
Urban				
Buffers Forested, Urban	acres	60	$1,200	$72,000
Erosion and Sediment Control	acres/yr	895	$5,800	$5,191,000
Nutrient Management, Urban	acres	12,000	$6	$72,000
Stormwater Management	acres	8,400	$3,500	$29,400,000

Table 10: Costs Associated with Reductions Anticipated from Septics:

Septics	Units	Goal	Costs/unit	Total Cost
Enhanced Septic Denitrification	systems	5,051	$12,800	$64,652,800

For urban practices, it is envisioned that, eventually, developers will pay to offset future net increases in nutrients. Currently, developers pay to meet a basic level of stormwater management, and have been doing so since about 1985. For lands developed prior to 1985 that do not have stormwater management the Tributary Strategies envision about 40% of that land being retrofitted with urban stormwater controls.

Septic system upgrades to nitrogen removing systems are a costly part of the plan (nearly one-third of the total NPS cost). About 40-60% (this percentage varies) of the revenue from septic system owners paying into the Bay Restoration Fund is intended to pay for these upgrades; however, given the high cost, and questions regarding the efficacy of upgrading all systems, this element of the plan may be revisited in the future. For further information on implementation funding efforts by the Maryland Department of the Environment, see http://www.mde.state.md.us/water/cbwrf/osds/imp.asp

Listed below are Federal and State funding sources that are available for a variety of BMP implementation areas.

Grants & Financial Assistance Opportunities at MDE

- http://www.mde.state.md.us/AboutMDE/grants/index.asp
- Available funding opportunities:
  - Nonpoint Source Program (319): http://www.mde.state.md.us/Programs/WaterPrograms/319NPS/index.asp
  - Bay Restoration Fund Enhanced Nutrient Removal: http://www.mde.state.md.us/Water/CBWRF/ENR.asp
  - Maryland's Nitrogen-Reducing Septic Upgrade Program: http://www.mde.state.md.us/water/cbwrf/osds/
  - Biological Nutrient Removal Program: http://www.mde.state.md.us/Programs/WaterPrograms/Water_Quality_Finance/wqfa_bnr.asp
  - Water Quality: http://www.mde.state.md.us/Programs/WaterPrograms/Water_Quality_Finance/home/index.asp
  - Public and private restoration projects: http://www.mde.state.md.us/Programs/WaterPrograms/Wetlands_Waterways/aboutwetlands/funding.asp

DNR Grants and Loans Center

- http://dnr.maryland.gov/land/grantsandloans/index.asp
- Available funding opportunities:
  - DNR Technical and Financial Assistance Programs: http://dnr.maryland.gov/land/grantsandloans/grants.asp
    - Forest Stewardship: http://www.dnr.state.md.us/forests/programapps/stewcon.asp
    - Maryland Environmental Trust—Land Trust Assistance Program: http://www.dnr.state.md.us/met/landtrustsasst.html

- Maryland Landover Incentive Program: http://www.dnr.state.md.us/wildlife/Habitat/LIP/index.asp

MDA Financial Assistance

- http://www.mda.state.md.us/resource_conservation/financial_assistance/index.php
- Available funding opportunities:
  - Maryland Agricultural Water Quality Cost-Share (MACS) Program: http://www.mda.state.md.us/resource_conservation/financial_assistance/macs/index.php
  - Conservation Reserve Enhancement Program (CREP): http://www.mda.state.md.us/resource_conservation/financial_assistance/crep/index.php
  - Cover Crop Program: http://www.mda.state.md.us/resource_conservation/financial_assistance/crep/index.php
  - Manure Transport Program: http://www.mda.state.md.us/resource_conservation/financial_assistance/manure_management/index.php
  - Maryland's Low Interested Loans for Agricultural Conservation (LILAC): http://www.mda.state.md.us/pdf/2008_lilac.pdf
  - Maryland Income Tax Subtraction Modification for Conservation Equipment: http://www.mda.state.md.us/pdf/taxsubtraction.pdf http://www.mda.state.md.us/pdf/taxform2.pdf http://www.mda.state.md.us/pdf/taxform3.pdf

U.S. Government Grant Finder:

http://www.grants.gov/

Redbook Online:

http://www.mdredbookonline.com/

USDA Rural Development:

http://www.rurdev.usda.gov/Home.html

Environmental Quality Incentives Program (EQIP):

http://www.nrcs.usda.gov/programs/eqip/

Conservation Reserve Program (CRP):
http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp

E. Develop an information/education component to enhance public understanding of the project and encourage their participation in selecting, designing, and implementing the NPS management measures that will be implemented;

The stakeholder outreach strategy for the watershed is intended to support the plan goals and priorities, as well as to meet the needs of all stakeholders involved in the WIP process. Relevant stakeholders involved include county government and planning representatives, public works/roads departments, wastewater operators or departments, county NRCS, local environmental health departments, Federal and State representatives from EPA, MDE and DNR, as well as private landowners.

Outreach strategies that have been used and will be used in the future for public information, education and participation are listed as follows:

Caroline County Choptank River Forum was established as a means to provide information to the public and to facilitate stakeholder and public input in the watershed planning process. It was also developed to openly discuss problems with the watershed and ways to alleviate them. The Choptank River Forum will continue to meet annually or bi-annually to discuss progress toward reaching milestones in implementing Best Management Practices, as well as to aid in adaptive management decisions.

Another means to gather public input and participation in the watershed planning process will involve the internet. A website will be used to post the plan online after the draft has been submitted to EPA for comments. Public input will be gathered and considered between the draft and final phase of the plan. Other information that will be available on the website will include BMP implementation strategies, presentations to local stakeholders, dates, times and locations of any environmental events held for public outreach, as well as demonstration projects throughout the watershed.

The Choptank Tributary Team meets every month to provide information, education and outreach to the public about the watershed, as well as current and future volunteer efforts to support watershed management activities. Members of the team include people from various backgrounds such as farmers, watermen, local watershed groups, local business owners, and state and county employees.

Caroline County Department of Planning and Codes will continue to hold stakeholder meetings to explain the WIP process and how they can help meet water quality goals for the watershed. Meetings with local municipalities will be held to develop demonstration projects within municipal boundaries for public awareness and participation of watershed stewardship. These demonstration projects will be lead by Caroline County Department of Planning and Codes and in various situations will be supported by local and state agencies such as Caroline Soil Conservation District, Maryland Department of the Environment and Maryland Department of Natural Resources. Caroline County Department of Planning and Codes will also hold various environmental events and workshops to provide information about urban BMP's such as rain

barrels, rain gardens, composters and nutrient management practices and how to implement these practices on your own.

F./G. Schedule implementation of management measures identified in this plan that is reasonably expeditious; Describe measurable milestones (e.g., amount of load reductions, or improvement in biological or habitat parameters) for determining whether NPS management measures or other control actions are being implemented;

NPS Implementation

Maryland's NPS implementation strategy was built explicitly on the Chesapeake Bay Tributary Strategies. Significant technical thought and stakeholder consideration is invested in the Tributary Strategies, which set quantified BMP implementation targets that are demonstrated to meet the Chesapeake Bay loading goals State-wide and for each of Maryland's ten basins. This Strategy can be used as a basis for watershed planning at different scales. Working together, State and Local governments can develop plans for more localized implementation.

The NPS implementation will occur in several Phases. Phase 1 and Phase 2 implementation will occur within the First Priority Watersheds. This will include implementation in the Agricultural Sector and planning and programmatic changes in the Urban Sector. Phase 3 implementation is expected to occur in other areas of the Upper Choptank. Phase 4 implementation is expected to occur in the remaining areas of Caroline County. Separate Phasing for each BMP is shown in Table 11. Goals for each phase are the totals that are to be implemented by the end of the phase period.

Table 11: Phased Approach to NPS BMP Planning and Implementation

BMP	Units	Phase 1 (1-2 years)	Phase 2 (2-5 years)	Phase 3 (5-10 years)	Phase 4 (10-20 years)
Agriculture					
Cover Crops	acres/yr	5,000	12,500	25,000	50,000
Buffers Forested - Agriculture	acres	100	250	500	1,000
Buffers Grassed - Agriculture	acres	550	1,375	2,750	5,500
Commodity Cover Crops	acres/yr	1,500	3,750	7,500	15,000
Conservation Tillage	acres/yr	2,000	5,000	10,000	20,000
Nutrient Management	acres	4,800	12,000	24,000	48,000
Precision Agriculture	acres	2,500	6,250	12,500	25,000
Retirement of Highly Erodible Land	acres	50	125	250	500
Soil Conservation & Water Quality Plans	acres	6,600	16,500	33,000	66,000
Wetland - Agriculture	acres	120	300	600	1,200
Drainage Control Structures	structures	7	16	33	65
Pasture					
Stream Protection With Fencing	acres	13	33	65	130
Stream Protection Without Fencing	acres	3	8	16	32
Tree Planting - Agriculture	acres	10	25	50	100

Animal Management					
Animal Waste Management - Livestock	systems	Planning	Planning	1	2
Animal Waste Management - Poultry	systems	Planning	1	2	4
Runoff Control	systems	1	2	4	8
Urban					
Buffers Forested, Urban	acres	6	15	30	60
Erosion and Sediment Control	acres/yr	90	224	448	895
Nutrient Management, Urban	acres	1,200	3,000	6,000	12,000
Stormwater Management	acres	840	2,100	4,200	8,400
Septics					
Septic Denitrification	systems	505	1,263	2,526	5,051
Septic Connections to WWTP	systems	75	188	375	750

Agricultural implementation is a mix of capital projects (riparian reforestation or animal fencing projects) and annual practices (cover crop planting and annual implementation of nutrient management plans). The bulk of the agricultural measures should be completed by about 2025, with maintenance and annual practices being implemented continually thereafter.

Urban Stormwater Retrofit implementation is occurring at a pace of about 10% for each five-year cycle of the NPDES stormwater permit. In principle, about 20% of the goal should have been achieved by this time, implying about a decade remaining to achieve the 40% goal, i.e., about 2025.

Septic System Retrofits implementation priority is currently for systems in the Critical Area. The Upper Choptank has 1,102 systems in the Critical Area. Because of the uncertainty of the available funding for the remaining system upgrades, an exact completion date for all the systems is not possible though is expected to occur within the next 25 years.

Atmospheric Deposition reductions depend on the pace of implementation of the Clean Air Act and Maryland's Healthy Air Act. Within the context of implementing the Chesapeake Bay Agreement nutrient reductions, the federal government has accepted responsibility for advancing this goal. No date certain has been set for achieving the goal.

Point source implementation

The North Caroline County Regional project will be constructed in phases: Phase 1 will consist of sewers serving Goldsboro, a pumping station and force main to serve Greensboro, decommissioning of the existing Greensboro WWTP and construction of the new ENR WWTP with an initial capacity of 540,000 gpd. In Phase 2, sewers will be extended to Marydel and the MHP WWTPs will be decommissioned. Sewers will be extended to Templeville in Phase 3. In Phase 4 sewers will be provided in Henderson. Beyond Phase 4, the new WWTP can be expanded to 814,000 gpd to accommodate growth proposed near Goldsboro and Greensboro, with costs borne by developers.

The upgrading of the Denton treatment plant to ENR, is scheduled to occur by 2011 (4 mg/l TN concentration).

Milestones

The first set of measurable milestones is evidence of annual increases in BMP implementation, under the presumption that BMPs decrease nutrient loads. In addition to tracking the numbers of BMPs, it is also possible to estimate load reductions based on literature values of their effectiveness. Although specific numbers are not provided, the rate of annual increase should be sufficient to reach the goal by the target of roughly 2030. This will vary by BMP type.

To support this set of milestones, Maryland has a mature NPS BMP tracking system. The tracking information is generated by the record keeping requirements of Maryland's State laws governing erosion and sediment control, and stormwater management, Maryland's treatment plant permitting, and Maryland's Agricultural Cost Share program. This information is has been consolidated and reported to the Chesapeake Bay Program for many years. The State also has Two-year milestones which are tracked through the Governor's BayStat process. This information is provided through the BayStat website.

The second set of measurable milestones includes chemical, physical and biological indicators of progress, which include formal water quality standards as well as informal measures. Two formal standards that indicate the effects of nutrients are used as water quality endpoints for nutrient TMDLs. The 30-day average concentration of chlorophyll *a* must be less than 50 ug/l in the poorly flushed areas of the tidal river, and dissolved oxygen must be 5 mg/l or greater throughout the tidal river.

It takes a long time to see the effects of NPS management measures in the tidal waters that drain a large watershed. Also, some practices need time to become fully effective, e.g., riparian forest buffers take time to grow. In addition, nutrients from many years ago can take a long time to flush out of the shallow groundwater after sources have been reduced. Complicating matters, climatic variability masks our ability to see changes. Thus, in order to observe intermediate progress, a variety of other parameters can be used.

For example, evidence of renewed stream bank stability, and thus less loss of nutrient-bearing sediment, is one measure of interim progress. Another example is decreased nitrates in non-tidal streams during base-flow conditions. This can indicate reduced concentrations in the groundwater near farm fields that have implemented nutrient management plans. The Synoptic Surveys of Nutrients provide a baseline against which to measure progress (See Section A). This information can also be used to target implementation to those areas of greatest concentrations.

Evidence of decreased fecal bacteria is an indirect indicator of progress in the tidal waters, because nutrients are often associated with bacteria. The Upper Choptank River drains to shellfish waters (Use II), routine State monitoring of the tidal waters for bacteria is conducted. In non-tidal waters, bacteria can be one of the first quantifiable signs of progress when farm animals are moved out of a stream.

Evidence of decreased water temperature in non-tidal streams can be used quantify the effects of improved riparian vegetative cover before evidence of nutrient reductions are observed. Further, the negative effect of nutrients on dissolved oxygen is counteracted as the water temperature is reduced.

H. Develop a set of criteria that can be used to determine whether loading reductions are being achieved and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised;

As noted in Section F/G, formal standards for the tidal nutrient TMDLs are as follows:

- The 30-day average concentration of chlorophyll *a* to should less than 50 ug/l in the tidal river, and
- Dissolved oxygen must be 5 mg/l or greater throughout the tidal river at all times.

These are the ultimate criteria by which to judge the success of the nutrient reduction plan.

An intermediate measure is the set of BMPs estimated to achieve the reduction goals needed to achieve the Tributary Strategy Goals. An estimate of the number of BMPs can be inferred from the Tributary Strategy based on the proportions of land uses in the Upper Choptank watershed. This is being done for urban retrofits within the context of developing the basin implementation plan for the Choptank River. Data is presently available to do this for most of the agricultural BMPs.

The following process is recommended for determining if the plan needs to be revised. First, BMP implementation tracking information can be compared with BMP implementation goals to determine when the goal has been achieved. This comparison can made after the 2-5 years/Phase 2. If during this comparison it is shown that interim goals are not being met, a revision of the plan may be necessary. Because of groundwater lag times, and the lag time for riparian buffers to mature, ultimate water quality improvements will not be observed until several years after the control measures are fully implemented. USGS information regarding groundwater lag times should be consulted to estimate the groundwater lag time in this region.

Second, State monitoring occurs in both the non-tidal and tidal waters. Tidal monitoring will account for ground water lag-times and climatic variability. This information will be compared to the tidal water quality standards noted above.

Thirdly, the Chesapeake Bay TMDL is in development and it is anticipated that there will be new Load Limits. Any changes in the reductions needed would account for the Plan to be revised. Also, there is the Watershed Implementation Plan development which can also require this Plan to be revisited.

Criteria for updating the load reduction analysis: If the water quality does not meet standards, field validation of BMP implementation should be undertaken. If this BMP validation process

verifies that the BMPs have been fully implemented, then the NPS reduction plan should be revised. This should include additional source assessments to ensure no significant sources of nutrients have been overlooked.

If the Chesapeake Bay Program research results in a change of BMP reduction effectiveness, then the NPS reduction analysis should be updated to reflect those changes.

Criteria for updating the water quality standards: If new information becomes available that demonstrates the water quality standards need to be revised, then that information should be documented and provided to MDE's Science Services Administration. Several specific criteria are listed below:

- If water quality standards change, then the TMDL should be considered for revision.
- If a significant error is found in the TMDL analysis, then it should be considered for revision.
- If NPS reduction analyses indicate it is infeasible to achieve the water quality standards, and it is infeasible to reduce point sources, then the validity of the TMDL analysis should be assessed. If the analysis is validated, the water quality standards should be revisited.

I. Implement a monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (g) immediately above.

Maryland has adopted a five-year watershed cycling strategy to manage its waters. Pursuant to this strategy, the State is divided into five regions, and management activities will cycle through those regions over a five-year period. This continuing cycle ensures that, every five years of intensive monitoring will be performed. Thus, the watershed cycling strategy establishes an evaluation process that assures accountability. The State's monitoring programs are described in Maryland's Water Quality Monitoring Strategy.[12]

The State's routine monitoring includes the following elements:

- Maryland Biological Stream Survey
- Maryland Core and Trend Monitoring Stations
- Bacteria Monitoring
- Fish and Shellfish Tissue Monitoring for Toxic Substances
- Watershed Cycling Monitoring

In addition, MDE is responsible for consolidating BMP implementation information that is shared with the Chesapeake Bay Program annually. This information provides an intermediate measure of implementation progress as noted in (g) and (h) above.

Monitoring stations will be set up throughout the watershed in locations that are easily accessible for appropriate water quality sampling. In most instances these stations will take place within a stream that intersects county and state road right-of-ways, as well as on county and state owned properties. No water quality sampling will take place on private property without the consent of

[12] The current Strategy is located at: http://www.mde.state.md.us/assets/document/water/WQPlanning_MonitoringStrategy_Sep04.pdf

the owner. If water quality samples are taken on private property, it would be to test the effectiveness of a site specific BMP on a smaller drainage scale.

Water sampling shall occur at the end of each spring and fall to measure progress toward milestones and to support adaptive management decisions. Site specific sampling will take place before and after the implementation of BMP's at stream base flow conditions, to assess their effectiveness in reducing nutrient loads. Number of monitoring stations shall be determined by placement of BMP's as well locations of main sub watershed outfalls into the Choptank River.

RERERENCES

Maryland Department of the Environment, May 2006, "Maryland's 2006 TMDL Implementation Guidance for Local Governments", http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/TMDL_implementation_2006_guidance_document.asp

Maryland Department of Natural Resources, May 2003, "Upper Choptank River Watershed Characterization", http://dnr.maryland.gov/watersheds/wras/docs/ucr/strat/ucr_strategy.pdf .

DATA SOURCES

Chesapeake Bay Program Data hub

- http://www.chesapeakebay.net/dataandtools.aspx?menuitem=14872

GIS Data Sources:

- 2009 MDP Land Use data
- 2009 MDE Maryland On-Site Septic Disposal Systems [For Septic loads]
- Estimates of people per household are available on the Maryland Department of Planning web site: www.mdp.state.md.us/msdc/dw_popproj.htm

Appendix A

Point Source Pollution (PS)
Sources permitted to discharge at specific locations from pipes, outfalls, and conveyance channels are "point" sources and are regulated through National Pollutant Discharge Elimination System (NPDES) permits.

The Upper Choptank has two major municipal treatment plant with a discharge flow exceeding 500,000 gallons per day (Easton - planned design capacity of 4 million gallons per day and Denton – designed capacity of 0.8 mgd), three minor municipal treatment plants Cedar Mobile Home Park, Greensboro, and North Caroline High School) and four other permitted discharges (industrial).

The Easton treatment plant has been upgraded to use biological nitrogen removal (BNR), which typically reduces nitrogen concentrations from about 18 mg/l to 8 mg/l. Easton is has incorporated enhanced nutrient removal (ENR), which reduced nitrogen concentrations to about 4 mg/l. The treatment plant has a Nitrogen Load Cap of 48, 729 (lbs/yr) and Phosphorus Cap of 3,655 (lbs/yr). The Denton plant has been upgraded to use biological nitrogen removal (BNR). The plant is scheduled to incorporate enhanced nutrient removal (ENR) by 2011. The treatment plant will have a Nitrogen Load Cap of 9,746 (lbs/yr) and Phosphorus Cap of 731 (lbs/yr) when the plant is upgraded to ENR.

The Greensboro treatment plant has a design capacity at 0.28 mgd and goals for Nitrogen at 15, 967 (lbs/yr) and Phosphorus at 2,101 (lbs/yr). The plant typically runs at about 0.18 mgd. The Cedar Mobile Home Park and North Caroline High School treatment plants have TSS and BOD limits but not Nitrogen or Phosphorus Goals. This information is summarized in Table 13 below.

Table 13:Municipal and Industrial PS (2009 data); Upper Choptank River Basin Code 02130404

FACILITY NAME	NPDES Number	MDE Code	Exp Date	Lat	Long	Type	Status
CEDAR MOBILE HOME PARK WWTP	MD0057487	00DP1669B	02/28/06	390620	754530	mun	Active
DENTON WWTP	MD0020494	05DP0537	08/31/12	385220	754915	mun	Active
GREENSBORO WWTP	MD0020290	05DP0597	11/30/11	385840	754805	mun	Active
NORTH CAROLINE HIGH SCHOOL WWTP	MD0023621	05DP0657	01/31/12	385439	755017	mun	Active
EASTON UTILITIES - W.W.T.F.	MD0020273	07DP0579	08/31/12	384453	760029	mun	Active
FIL (US) INC.	MD0001007	05DP0290	04/30/11	385345	755108	ind	Active
CHOPTANK ELECTRIC COOPERATIVE	MD0066761	05DP3046	10/31/11	385336	755037	ind	Active
R & R AQUAFARMS, LLC		07DP3568	12/18/11	384354	754712	ind	Active
MULHOLLAND HARPER COMPANY	MD0069621	06DP0047	01/31/12	385340	755045	ind	Active

FACILITY NAME	Permit Limits				Permit Limits Concentration				
	TN (lbs/y)	TP (lbs/y)	TSS (lbs/y)	BOD5 (lbs/y)	Flow (mgd)	TN (mg/l)	TP (mg/l)	BOD5 (mg/l)	TSS (mg/l)
CEDAR MOBILE HOME PARK WWTP	Report		1,387	1,387	0.015			30	30
DENTON WWTP	29,239	4,745	73,000	73,000	0.800	12	2	30	30
	9,746	731				4	0.3		
GREENSBORO WWTP	9,867	1,644	16,450	16,450	0.180	18	3	30	30
	15,967	2,101	25,500	25,550	0.280				
NORTH CAROLINE HIGH SCHOOL WWTP			1,570	1,570	0.017			30	30
EASTON UTILITIES - W.W.T.F.	48,729	3,655	365,000	249,080	4.000	4	0.3	20.4	30
FIL (US) INC.					N/A				
CHOPTANK ELECTRIC COOPERATIVE					Report				
R & R AQUAFARMS, LLC					Report	Report	Report	Report	30
MULHOLLAND HARPER COMPANY					Report				

Point Source Costs

The estimated cost to construct a regional wastewater treatment facility to serve the four towns in northern Caroline County is $35 million. Caroline County is actively pursuing funding for this project through a number of public agencies, including the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, Maryland Department of the Environment, and Maryland Department of Housing and Community Development.

The upgrade of Denton treatment plant to ENR will be funded through Maryland's Bay Restoration Fund. These funds are raised through a fee on people's water and sewer bills. Owners of septic systems are also billed. For more information on this program, see: http://www.mde.state.md.us/Water/CBWRF/index.asp . For progress and schedule of the upgrades, see, http://www.mde.maryland.gov/assets/document/BRF-Attach1ENRProjectEstandCashflow101905.pdf

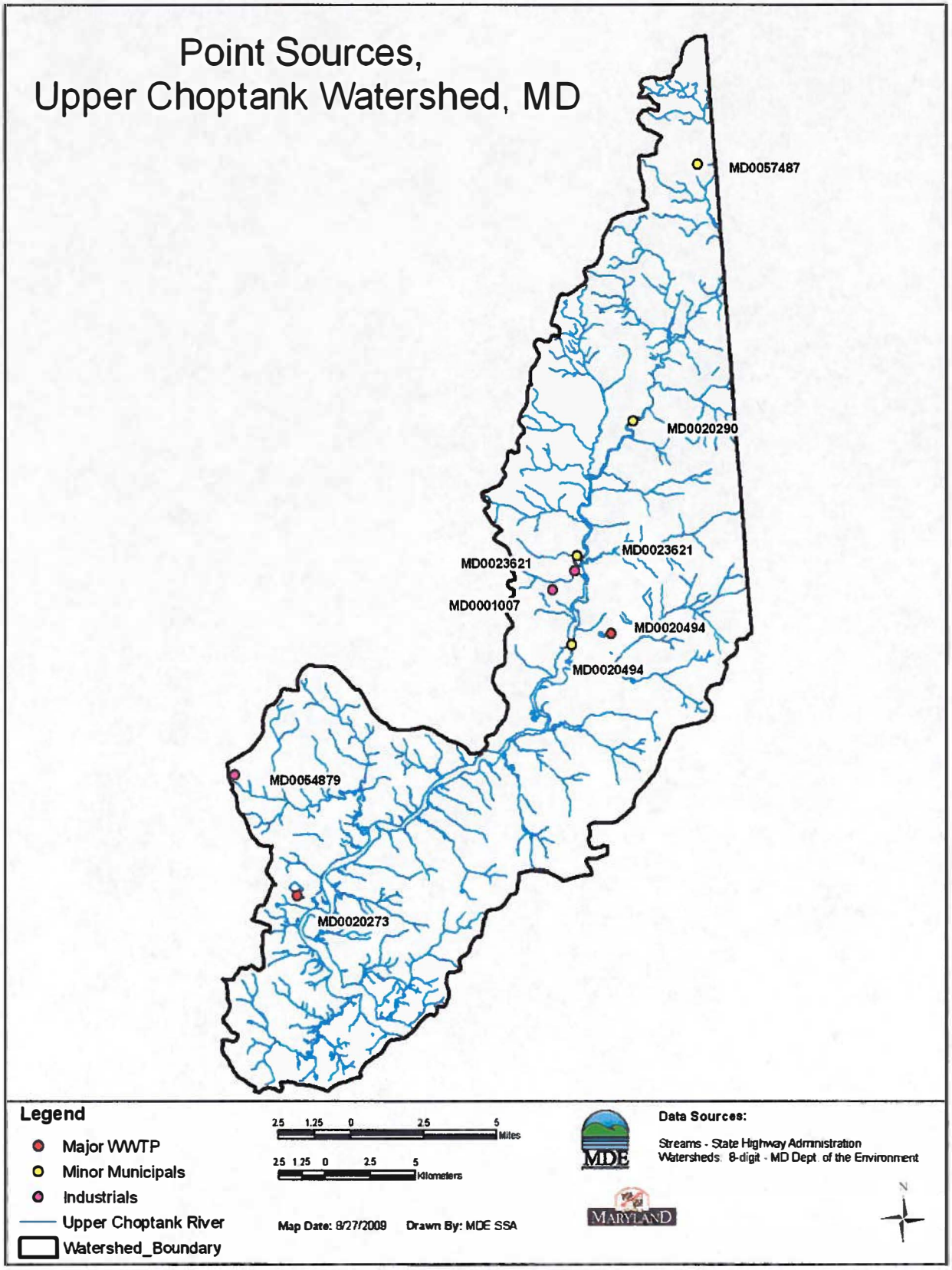

Figure X: Map showing the Point Sources and Wastewater Treatment Plants

Appendix B: Educational / Outreach Materials

Status of the Choptank River:
A discussion of the current health of the watershed

Tuesday, June 23, 3009

6 to 9 pm.

Health and Public Service Building
403 South Seventh Street, Room 110
Denton, Maryland

Contact Information (by order of presentation)

Caroline County Planning,
Codes and Engineering Department
403 South 7th Street, Suite 210
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jdingding@umd.edu

Terry Higgins
higginte@dmv.com

Dr. Ken Staver

Dr. Staver is a Research Associate at Wye Research and Education Center, University of Maryland College of Agriculture and Natural Resources, where he earned his Ph.D. in Agricultural Engineering in 1994. He as worked at the Center since 1984 conducting research on water, nutrient and energy flows in Coastal Plain watersheds. The emphasis of his work has been on the development of strategies to minimize negative environmental impacts of agricultural activities while maintaining agricultural productivity and enhancing soil and water resources. More recently, he has focused more on nutrient and energy flows at larger scales, and the potential of biofuel production to increase overall nutrient use efficiency in agricultural systems and to reduce net carbon emissions. He also is an owner/operator of a grain farm in Queen Anne's County where he lives with his wife and three children.

Bill Wolinski

Bill Wolinski is a registered Professional Engineer in the State of Maryland and the State of Washington. He has an undergraduate degree in Chemistry from the University of Rochester and a Master's Degree in Environmental Engineering from Johns Hopkins University. He was Water Quality Manager for the City of Baltimore for seventeen years from 1974 to 1991. He served as Environmental Engineering Manager for the City of Kent Washington for fourteen years from 1991 to 2005. He has been serving as an Environmental Engineer for Talbot County Department of Public Works for the past four years. His professional work has been primarily in the area of regional water quality management with an emphasis on living aquatic resources.

A great big thanks to all our presenters, to the Choptank River Tributary Team, and Department of Natural Resources Tributary Strategies for their support!

Guest Speaker Biographical Information

Doug Abbott

Doug Abbott of Easton Utilities is the Superintendent of Easton's Enhanced Nutrient Removal Wastewater Treatment Facility. There he is responsible for overseeing the day-to-day operation and maintenance. Doug holds a State of Maryland Class 5A Wastewater System Superintendent certification and has over 30 years experience in water and wastewater systems operation. Prior to his employment with Easton Utilities, Doug provided consulting services to water and wastewater utilities throughout the US and in developing countries. As a native of Oxford, an avid fisherman and obsessed sailor, Doug has a personal interest in protecting the Choptank River and the Chesapeake Bay.

Adam Noble Corry, R.S.

Mr. Corry has been employed with Caroline County Environmental Health Services for four years and is currently the BRF Project Manager. He has a bachelor of science degree from Salisbury University in Environmental Studies. He is also an avid outdoorsman and a Tidewater Environmental Health Association member at large.

Jennifer Dindinger

Ms. Dindinger is a Regional Watershed Restoration Specialist for the Sea Grant Extension Program. She works on Maryland's Eastern Shore assisting local governments and watershed organizations with funding and implementing restoration projects that produce a measurable improvement in water quality.

Prior to accepting this position, Ms. Dindinger was the Communications and Outreach Coordinator for the Harry R. Hughes Center for Agro-Ecology, Inc. She holds a Master's degree in Environmental Policy from Bard College and is a graduate of the Advocacy Leaders program of the Maryland Association of Nonprofit Organizations. In addition to her professional work, she is an active volunteer in her community.

Paul Emmart, Esq.

Paul Emmart works in the TMDL Implementation Section of the Water Quality Protection & Restoration Program at MDE.

He has a legal background as well as a master's degree in environmental science from Johns Hopkins University.

Tom Fisher

Tom Fisher is a professor at the Horn Point Laboratory, Center for Environmental Science, University of Maryland, where he has worked for more than 20 years. Fisher has published many papers regarding the Choptank River and Chesapeake Bay. The most recent was *Historical changes in water quality at German Branch in the Choptank River basin,* which was co-authored with A.J. Sutton and A.B. Gustafson. Fisher earned his Ph.D. at Duke University in Biological Oceanography. He completed post-doctoral studies in Environmental Science from North Carolina State University and Estuarine Ecology from Duke University.

Scott Getchell

Mr. Getchell is the Director of Public Works for the Town of Denton and has been with the town for 10 years. Also an Environmental Technologies Specialist with Maryland Center for Environmental Training (MCET), Mr. Getchell is a Maryland certified water and wastewater operator/superintendent with over 20 years experience in municipal utility operations and management. Throughout his career, he has operated and managed several water and wastewater treatment collection/distribution systems. He has been involved with many projects such as well construction, wastewater treatment plant construction and upgrading, pump station construction and upgrading, water and sewer line installation and replacements, radio read water meter implementation, and various other utility and public works related projects.

Terry Higgins

Terry Higgins, a resident in the Delaware portion of the Upper Choptank River Watershed since 1964, is professionally and personally committed to the ongoing improvement in the Choptank's water quality. Terry, by academic training and profession, is an Environmental Scientist having served as a faculty member at Dover's Wesley College from 1961 to 2000. Awarded the title of Professor Emeritus of Environmental Sciences, he currently serves as an environmental advocate for a diverse group of church, civic, and environmentally related activities including membership on Delaware's Upper Chester and Choptank Rivers' Tributary Action Team.

Dr. Heath Kelsey

Dr. Kelsey is a researcher with the EcoCheck Program, a partnership between University of Maryland Center for Environmental Science and NOAA Chesapeake Bay Office. Prior to working with EcoCheck, he was an ecological modeler for three years at NOAA's Cooperative Oxford Lab. Heath received his PhD in Environmental Health Sciences from the University of South Carolina Arnold School of Public Health in 2006. Research interests include nonpoint source pollution modeling, Geographic Information Systems, land use and water quality interactions, public health, and coastal management issues.

Steve Luckman

Mr. Luckman has a bachelor of arts degree from Johns Hopkins University in Chemistry and a master of arts degree in Environmental Engineering. He has been with the Maryland Department of the Environment, NPDES Discharge Permits Division for 29 years, including 20 years as Division Chief. In discharge permits, the Division is responsible for implementing the point source part of the Chesapeake Bay Tributary Strategy, as well as the Total Maximum Daily Loads (TMDLs) for impaired waterbodies. Earlier in Luckman's career, he was in charge of the water quality laboratories for the Baltimore City drinking water supply program.

John Shepard

John Shepard has served as the District Manager at the Caroline Soil Conservation District for the Maryland Department of Agriculture, Office of Resource Conservation since 2001. John works closely with Maryland farmers, landowners, developers and various state, federal and local agencies to plan and implement conservation practices and programs that balance crop and livestock production with the need to protect natural resources. John holds a BS degree in Agri-Business from Delaware State University and has spent his professional career with the Natural Resources Conservation Service, Caroline Soil Conservation District and the Maryland Department of Agriculture as a Soil Conservation Technician, Soil Conservation Planner and Public Drainage Coordinator, respectively.

Schedule of Speakers

Welcome
Caroline County Commissioners Jack Cole and Jeff Ghrist

Introduction
Allison Dungan, *Caroline County Department of Planning Codes and Engineering*

Eco Check Report Card: Why did the Choptank Receive a Grade of D?
Dr. Heath Kelsey, *UMCES Eco Check Program*

Agricultural Best Management Practices
Tom Fisher, *Horn Point Laboratory*
John Shepard, *Caroline Soil Conservation District*

Bay Restoration Fund Septic Programs
Adam Corry, *Caroline County Environmental Health*
Bill Wolinski, *Talbot County Department of Public Works*

Waste Water Treatment Plants: BNR to ENR
Scott Getchell, *Town of Denton Public Works*
Doug Abbott, *Easton Utilities*

Maryland Department of the Environment Q & A
Paul Emmart, *Science Services Administration*
Steve Luckman, *Water Management Administration*

Land Use, Conversion, & Watershed Impacts
Dr. Ken Staver, *University of MD Wye Research Center*

Maryland & Delaware Tributary Team Report
Jennifer Dindinger, *Choptank Tributary Team (MD)*
Terry Higgins, *Choptank Tributary Action Team (DE)*

Conclusion
Allison Dungan, *Caroline County Planning*

Please Join Us

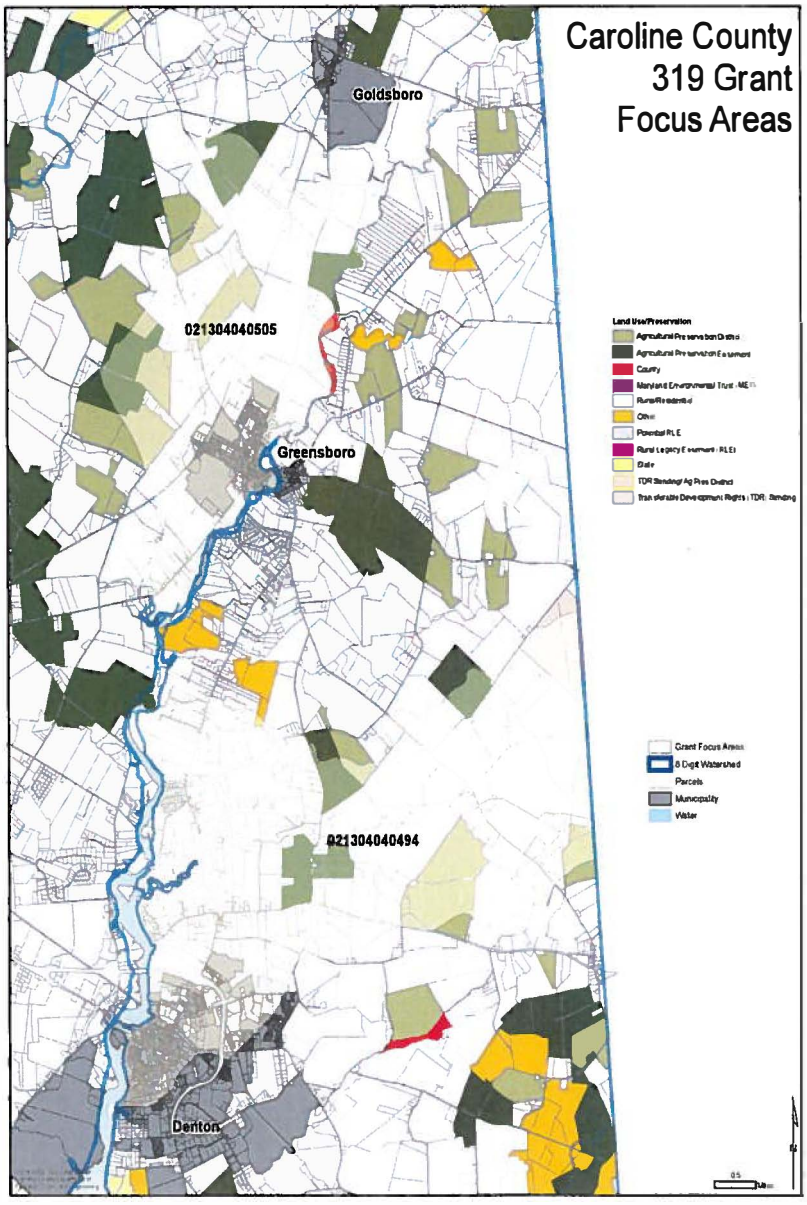
For

Choptank River Subwatershed Planning; Kick-Off Meeting

Wednesday 21, 2009
7 – 9 PM
Denton, MD

The meeting will be held in Yoga Room of the Denton Armory building at 107 South 4th Street.

Call or email Allison Dungan at the Caroline County Planning, Codes, and Engineering Dept. to RSVP.
410-479-8117
adungan@co.caroline.md.us



Agenda:

- Center for Watershed Protection: Watershed Planning 101.
- Dr. Tom Fisher: Choptank River Water Quality Studies
- Caroline Soil Conservation and Planning Departments: Characterizing the selected watersheds.
- Group Discussion: What are the goals for this planning exercise?

Proposal on Rainwater Harvesting and Backyard Composting

For
The Caroline County, MD
Summer 2010

NORSEMAN
ENVIRONMENTAL PRODUCTS

Table of Contents

*Please note, for conservation purposes no divider tabs have been included with this proposal.

Truck Load Sale Overview

We at Norseman Environmental Products feel that the best way to distribute backyard compost bins and rainwater collection barrels to a large number of residents, with minimum time and resources, is with a one-day-only distribution event. These events are held at easy to find and well known locations that have ample parking and easy access. The events are typically held on a Saturday and are heavily promoted to generate maximum awareness and maximum success.

The primary objective of a truckload sale event is to distribute the maximum number of Earth Machine™ backyard compost bins and SYSTERN Rain Barrels in one day. This will maximize the speed of implementation and strength of resident participation in the community's overall organic waste diversion and water conservation program(s). The promotion and dollar allocation to funding an event such as this one will greatly influence both the implementation and success of the event and similar subsequent initiatives within the community.

Residents are encouraged to come on a "first come, first served basis, while supplies last", to purchase or receive these products. This creates an atmosphere of urgency, and prevents residents from "putting off" composting and water conservation to a later date.

Our years of experience, coupled with your promotional assistance and cooperation will guarantee success for your community, resulting in a strong economic and environmental payback.

Promotional Awareness Plan

For
Caroline County , MD

Targeted number of single family households	35,000
Target number of Earth Machine™ compost bins	500
Target number of Rain Barrels	585
Number of Sites	One (1)
Event Date	July 17th. 2010

TARGETED TIMELINE

Eight (8) Weeks Pre-Event

- Media kits will be provided to ***Caroline County*** for distribution to:
    - Garden and rotary clubs in target area
    - Local Recycling Associations
    - Community newspapers
    - Community radio stations
    - Community calendars and local cable television stations
    - Community Workshops, Garden Shows, Environmental workshops

- Promotional Units – six (6) units will be made available for promotional purposes in the electronic media kit. A suggestion would be to use them as give-aways through a local radio station. A certificate will be made available for winners to pick up their Earth Machine™ or SYSTERN unit at the Truck Load Sale site the day of the event.

- Six (6) Point-of-Purchase (P.O.P) displays – Three Earth Machine™ units and three SYSTERN units, each with a plastic brochure holder and poster explaining facts about composting and rainwater harvesting will be made available for display at high traffic municipal locations.

- 2,000 Handouts – four color, 3-3/4" x 10" handouts will also be included with the P.O.P displays. Artwork will also be provided via email for any desired additional printing.

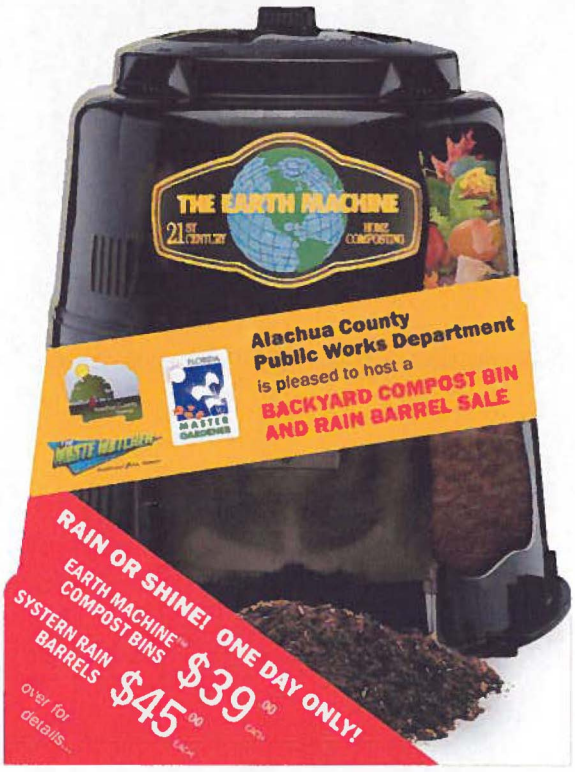
MEDIA ADVERTISING CAMPAIGN

Four-Color Die Cut Flyer:
(see options below)

Approximately 34,700 inserts printed and circulated in The Easton Star Democrat, Queen Anne's County Record-Observer, Caroline County Times-Record and Kent Island Bay Times a few days prior to the event.

Display

One ½ Page Full Color display ad will be placed in The Queen Anne's County Record Observer and The Caroline County Times-Record Newspapers a few days prior to the event.



Event Day Organization

Sale Date: **Saturday July 17th. 2010** **9:00am - 3:00pm**

Possible Site Location:

Chesapeake College*
*It is the responsibility of the client to secure the site location for the sale date above

Event Management:

Kristi Ferguson, Marketing Manager

David Weidenfeller, Sales Liaison

Site Management:

Site Manager will arrive the day before the event to meet their respective shipment of bins, survey the site(s), check the site items, and position the truck. They will also be on hand one – one and a half hours before the start time on the event day to re-check the set-up and then remain to supervise the day's proceedings.

Products Included in Each Site:

We will provide a minimum total of 1,000 units to the event. All unsold units, skids, and other event equipment will be picked up and removed at the end of the sale. All debris will be cleaned up at the conclusion of the sale. We suggest that ***Caroline County*** take at least one skid (25) of Earth Machine™ Compost Bins and one skid (15) of SYSTERN Rain Barrels, if any are remaining, for the purpose of having them available for those residents who missed the sale.

Record Keeping:

Norseman Environmental Products will provide a three-part receipt which details resident name, address and telephone number. Residents fill in their information and take part 2 to claim their composter. Part 2 of the receipt is kept by ***Caroline County***, Part 3 of the receipt is kept by the resident.

Handling and Processing of Monies:

Norseman Environmental Products will be responsible for collection and processing of monies (unless otherwise agreed). Credit card and check payments are advertised to minimize the total amount of cash at the event for the safety of our sales/site manager and their event support staff.

Security

A Norseman Environmental Products supervisor will be on hand at all times. In addition, Norseman Environmental Products will hire a security guard from a recognized agency to be present at each site for the protection of cashiers and monies.

Insurance

Norseman Environmental Products Limited shall provide the necessary insurance coverage for all sites and personnel. Please refer to the sample form enclosed.

On Site Staff

- Eight (8) personnel* will be on hand at the site for:
  - Processing receipts
  - Processing payment
  - Distribution of compost bins and rain barrels
  - Elderly/disabled assistance

*It is the responsibility of the client to arrange site staff for the sale date above. Please work with your Sales Liaison well in advance of the sales event date for adequate staffing.

- All site staff will be provided with "Every Day is Earth Day" T-shirts to lend excitement and organization to the event.
- Snacks, drinks and lunch will be provided for the staff and security personnel.
- Staff will be required to arrive at the site between 1 to 1.5 hours prior to the event start time for set-up and training.

On Site Hardware

Norseman Environmental Products will provide the following to each site:

- A Truckload Sale banner for dramatic site identification
- All items required for the efficient running of the event:
  - Tables and chairs
  - Signage
  - Awnings and Canopies
  - Cash/Receipt Boxes
  - Pylons
  - Pens
  - Ropes

Site Layout

Sign Up

- The sign up area is for residents to fill in their receipt details, facilitate payment or for gift certificate redemption, depending on the event option(s) chosen.
- Norseman Environmental Products will provide a three-part receipt. This receipt details the resident's name, address and telephone number. Part 2 (yellow copy) of this receipt is submitted to you at the end of the sale for your records and/or follow-up.
- Norseman Environmental Products also assumes responsibility for the collection and processing of all monies.

Staging

It is important, if possible, for the staging area to be blocked on one or two sides where possible by a natural boundary.

The staging area is designated for:

- Preparing products for resident pick-up
- Storage of sufficient products to keep up with demand
- Purchase pick-up

Education

Included with every Earth Machine™ will be:

- "Home Composting Handbook" - a comprehensive booklet describing the latest in backyard composting techniques. (see sample) Assembly instructions are also illustrated in the handbook.

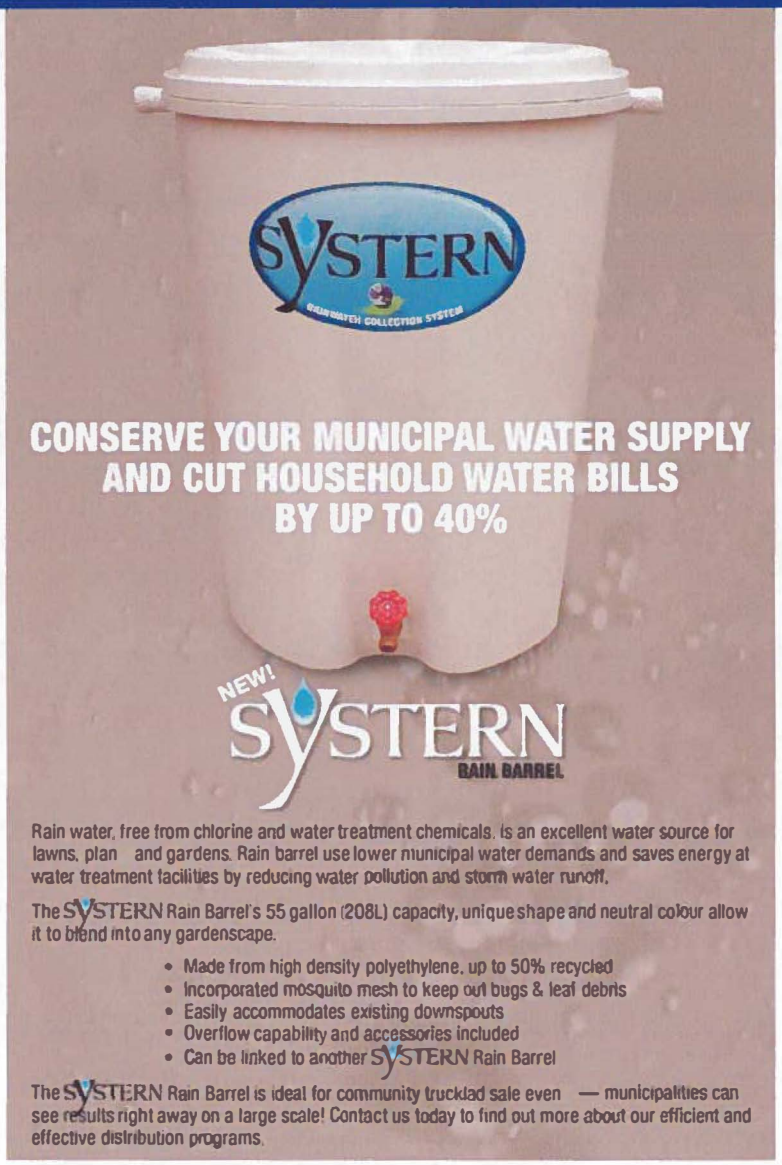
A Norseman Environmental Products specialist will be on hand at the site to answer residents' questions on composting, The Earth Machine™, harvesting rain water and our new SYSTERN Rain Barrel.

Compost Turner
$15.00, including tax
Turns compost without resorting to the traditional back-breaking job of removing and reloading by shovel or pitchfork. Simply plunge the Compost Turner into the compost pile; as it is withdrawn, the heavy-duty blades open to aerate and turn the compost. Sturdy, professional quality. 34 in. (86 cm) long

Kitchen Scrap Pail
$7.00, including tax
The Kitchen Scrap pail is made for easy, mess-free scraping of food waste (refer to Home Composting Handbook for food scraps that DO NOT go into the Earth Machine™).Strong, durable plastic, wide design, handle for easy carrying and emptying into the Earth Machine™. Snap latch, tightly securing the lid. Easy to clean and dishwasher safe. 1.9 gallon (7 litre) capacity.

An accessories booth at each site where residents can purchase compost turners and kitchen buckets.

Rain Barrel



Included with every SYSTERN will be:

- Assembly instructions and an accessory kit including overflow hose and spigot

Let's work together to get your residents using their water smarts! Rainwater harvesting is another essential step a community can take to reduce their collective environmental footprint. Together a community can:

- recharge their ground water supply
- mitigate flooding from aging and over burdened storm sewer systems
- lower the cost of water treatment and the amount of energy used to treat storm water
- reduce chemical runoff into the sewer systems thereby reducing water pollution in their area as well.

Pricing

Truckload Sale Event Pricing

The Earth Machine™: $ 45.00 per bin including 6.00% tax
The SYSTERN Rain Barrel: $ 55.00 per bin including 6.00% tax

The advertising plan for this option includes circulation of approximately 34,700 diecuts in The Easton Star Democrat,The Queen Anne's County Record Observer, The Caroline County Times-Record, and The Kent Island Bay Times as well as a ½ page display ad in The Queen Anne's County Record Observer and The Caroline County Times-Record.

Confirmation

Confirmation of Acceptance

Caroline County has received Norseman Environmental Products' proposal for an Earth Machine™ Backyard Compost Bin and SYSTERN Rain Barrel Truckload Sale for July 17th. 2010 and hereby confirms its approval to proceed as outlined with the option indicated below:

Event Pricing

Machine™ $45.00 per bin including 6.00% tax
rel : $55.00 per bin including 6.00% tax

_____ Initial

Name: _____ _____
(Print) (Signature)

Title: _____ Date: _____

Please fax back to:
Kristi Ferguson, Marketing Manager
Norseman Environmental Products
An ORBIS Company
Fax: 416.745.4478

How to Build and Install a Rain Barrel

What is a Rain Barrel?

A rain barrel collects and stores rainwater from your rooftop to use for watering lawns and gardens. Water collected in a rain barrel would normally flow through your downspout, onto a paved surface, and eventually into a storm drain. Storm drains direct water into our local rivers and streams.

Why Use Rain Barrels?

- Save $$$! Lower water and sewage bills by using FREE rainwater.
- **Reduce the amount of stormwater runoff** entering rivers and streams. Stormwater carries pollutants such as sediment, chemicals, oil, salt and bacteria.
- **Conserve water** during hot, dry summer months.
- Storing rainwater for garden and lawn use help **recharge groundwater.**

INSTRUCTIONS

STEP 1. Cut holes in Barrel

- Cut lower drain hole using 1 1/4 inch bit or hole saw. The hole should be on the side of the barrel no more than 2 to 4 inches from the bottom.
- Cut upper drain hole according to where you want the overflow to be located (back, rt. side, lft. side, front). Use a 1 1/2 inch hole saw or paddle bit.
- Cut top hole for atrium grate in the top, center of the barrel. The hole should be 4 inches. Use a jig saw or 4 inch hole saw.
- Paint your barrel to cover any blemishes or to compliment your home.

STEP 2. Set up barrel and modify downspout

- Place barrel on flat, level surface. Use cinder blocks or other sturdy material to raise the barrel off the ground. This will increase water pressure and allow space for a watering can to slide underneath the spigot.
- Modify your downspout by disconnecting a section or cutting the existing downs ut with a hack saw to a height which will allow the barrel to be positioned below. Attach a gutter elbow or use a downspout adapter and 4 inch corrugated pipe to route water into the barrel. *You may want to save the cut piece of downspout to reconnect the gutter during the winter months if you choose to store your barrel.*

STEP 3. Assemble parts

- Screw the Ix 3/4 inch bushing into the lower drain hole. Unscrew, then wrap tightly with teflon tape and finish with waterproof sealant (required). Screw bushing back in tightly but avoid stripping the hole in the barrel.
- Immediately screw spigot into bushing in lower drain hole. Teflon tape and waterproof sealant are recommended for this connection. You should hold bushing in place with a pair of pliers while screwing in the spigot to avoid stripping the hole in the barrel.
- From the inside of the barrel, place the 1 1/4 inch male threaded coupling through the upper drain hole with threads out. From the outside, screw the 1 1/4 inch barbed fitting onto the coupling. Use waterproof sealant if desired. Attach 1 1/4 inch drain line to the upper drain hole and direct away from your home or back into the downspout.
- Drop atrium into 4 inch hole and line with screen. Secure screen with sealant if desired.
- Position gutter elbow so that it drains into atrium grate or fit 4 inch corrugated pipe directly onto the atrium.

You're ready to begin catching rain water!

SUPPLIES

Parts

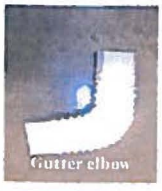
- A 55-gallon drum or heavy duty trash can
- One 4" diameter atrium grate
- One 1" x 3/4" PVC male threaded bushing
- One 3/4" brass spigot/hose bib
- 5' (or longer) section of 1 1/4" drain hose, drain line, or sump pump line
- One 1 1/4" female barbed fitting
- One 1 1/4" male threaded coupling
- Fiberglass screen or mosquito netting
- One gutter elbow or downspout adapter with 4" corrugated drain line.

Tools

- Drill and hole saw or paddle bit
- Router or jig saw
- Hacksaw
- Pliers

Other

- Silicon caulking
- Teflon tape (optional)
- 1-2 cans spray paint (optional)
- Cinder blocks or landscaping blocks



dep west virginia department of environmental protection

Parts List

Barrel Parts

3/4" PVC adapter
Female thread/
male slip

3/4" PVC elbow
Male thread/
female slip

4" piece of 3/4"
PVC pipe

3/4" brass spigot

4" atrium grate

Fiberglass screen or
mosquito netting

55 gallon food grade plastic
barrel with 3/4" threaded bung

Overflow and Downspout Modification Parts

Overflow and downspout modification parts will vary depending on your needs and preferences

Downspout
adapter

4" corrugated drain
pipe

Downspout elbow

Overflow. Drain hose,
drain line, sump
pump line with
adapter or additional
downspout

Appendix C: Priority Implementation Areas (Denton & Greensboro Watersheds)

Best Management Practices:

COVER CROPS reduce erosion and the leaching of nutrients to groundwater by maintaining a vegetative cover on cropland and holding nutrients within the root zone.

AGRICULTURAL RIPARIAN GRASS BUFFERS are linear strips of grass or other non-woody vegetation maintained between the edge of fields and streams, rivers or tidal waters that help filter nutrients, sediment and other pollutant from runoff.

AGRICULTURAL RIPARIAN FOREST BUFFERS are linear wooded areas along rivers, stream and shorelines. Forest buffers help filter nutrients,sediments and other pollutants from runoff as well as remove nutrients from groundwater.

NUTRUENT MANAGEMENT PLAN (NMP) implementation (crop) is acomprehensive plan that describes the optimum use of nutrients to minimize nutrient loss while maintaining yield. A NMP details the type, rate, timing, and placement of nutrients for each crop.

LAND RETIREMENT takes marginal and highly erosive cropland out of production by planting permanent vegetative cover such as shrubs, grasses, and/or trees.

AGRICULTURAL WETLAND RESTORATION activities re-establish the natural hydraulic condition in a field that existed prior to the installation of subsurface or surface drainage.

CONSERVATION PLANS are a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality, and to prevent deterioration of natural resources on ali or part of a farm.

ANIMAL WASTE MANAGEMENT systems are practices designed for proper handling, storage, and utilization of wastes generated from confined animal operations and include a means of collecting, scraping or washing wastes and contaminated runoff from confinement areas into appropriate waste storage structures.

A WATER CONTROL STRUCTURE controls the direction or rate of flow of water and maintains a desired water surface elevation. This process creates positive effects on the water budget, especially on volume and application rates. Controling rate of flow can help in the natural denitrification process of nutrients. Other effects are infiltration, evaporation, transpiration, deep percolation, and ground water recharge.

BIORENTENTION and bioswales are filtering practices that capture and temporarily store water and pass it through a filter of sand, organic matter and vegetation which promotes pollutant treatment and groundwater recharge.

SEPTIC CONNECTIONS/hookups represent the replacement of traditional septic systems with connection to and treatment at wastewater treatment plants (WWTPs).

SEPTIC BAT upgrades are used in the replacement of traditional septic systems with more advanced systems that have additional nitrogen removal capabilities

BMP descriptions are practices that are credited in the Chesapeake Bay Watershed Model (Phase 4.3). These Descriptions are located in BMP Handbook, Chesapeake Bay Trib Strategies.

AGRICULTURAL BMP NUTRIENT REDUCTIONS

BMP	Acres	TN Reduction (lbs/ac)	TP Reduction (lbs/ac)
Cover Crop	176.88	1091.61	36.30
CRP-Grass Buffer	205.46	2011.30	253.01
CRP-Forest Buffer	9.7	134.18	11.94
Nutrient Management Plans*	5,615.55	17,464.370	1,684.666
SCWQ Plans	2,807.78	1792.57	411.62
Poultry Waste Storage Structures*	6	1,260.000	252.000
Animal Composting Facilities*	5	1,050.000	210.000
Heavy Use Area Pads*	20	4,400.000	0.000
TOTAL	8,826	29,204.03	2,859.55

DEVELOPED LAND BMP NUTRIENT REDUCTIONS

BMP	Units	TN Reduction (lbs/ac)	TP Reduction (lbs/ac)
Septic-BAT Upgrades	3	31.24	
TOTAL	3	31.24	

DEPARTMENT OF NATURAL RESOURCES BMP NUTRIENT REDUCTIONS

BMP	Acres	TN Reduction (lbs/ac)	TP Reduction (lbs/ac)
CREP-Forest Buffer	10	138.33	89.380
TOTAL	10	138.33	89.38

POSSIBLE FUTURE AGRICULTURAL BMP NUTRIENT REDUCTIONS

BMP	Acres/Units	TN Reduction (lbs/ac)	TP Reduction (lbs/ac)
Cover Crop	5,223.51	32,236.86	14,243.267
CRP-35ft Grass Buffers	57.2	559.95	97.272
CRP-Forest Buffer*	15	207.49	134.070
Land Retirement**	20.00	14,709.427	148.946
Wetland Creation***	5.00	26.601	53.203
SCWQ Plans	2,807.78	1,792.57	411.620
Water Control Structures	4	561.818	
TOTAL	8,128	50,094.71	15,088.38

*Forest Buffers are to be located near streams where a 100ft buffer does not exist. Planted at a minimum of 35ft
** Land Retirement is on a site-to-site analysis, based on drainage problem areas and highly erodible soils
*** Created Wetlands are to be located on retired lands adjacent to forest stands, existing wetland areas and floodplains

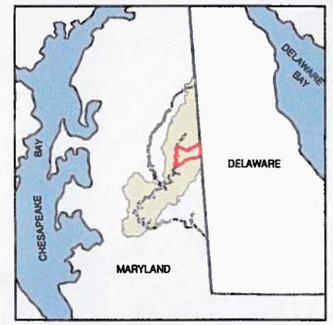
POSSIBLE FUTURE DEVELOPED LAND BMP NUTRIENT REDUCTIONS

BMP	Acres/Units	TN Reduction (lbs/ac)	TP Reduction (lbs/ac)
Urban Forest Buffer	1.46	3.03	1.86
Bioretion storm water retrofit	7.06	41.59	72.61
Bioswale	2.8	16.25	31.12
Septic-BAT Upgrades*	189	93.37	
Septic Connection to sewer**			
In Critical Area	10	208.24	
Within 1000ft of Stream	3	39.05	
Other	15	117.14	
TOTAL	217	457.79	105.59

* BAT Upgrade of House OSDS in Critical Area
** Connect Houses in Town Growth Areas to Sanitary Sewer System

Denton Watershed

(HUC 12 #-021304040494)



VICINITY MAP
SCALE: 1:1,000,000
CREATED BY CAROLINE COUNTY DEPARTMENT OF PLANNING & CODES

Developed in Partnership with
Caroline County Government, University of MD, the CWP,
Caroline County Soil Conservation District and
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November, 2010

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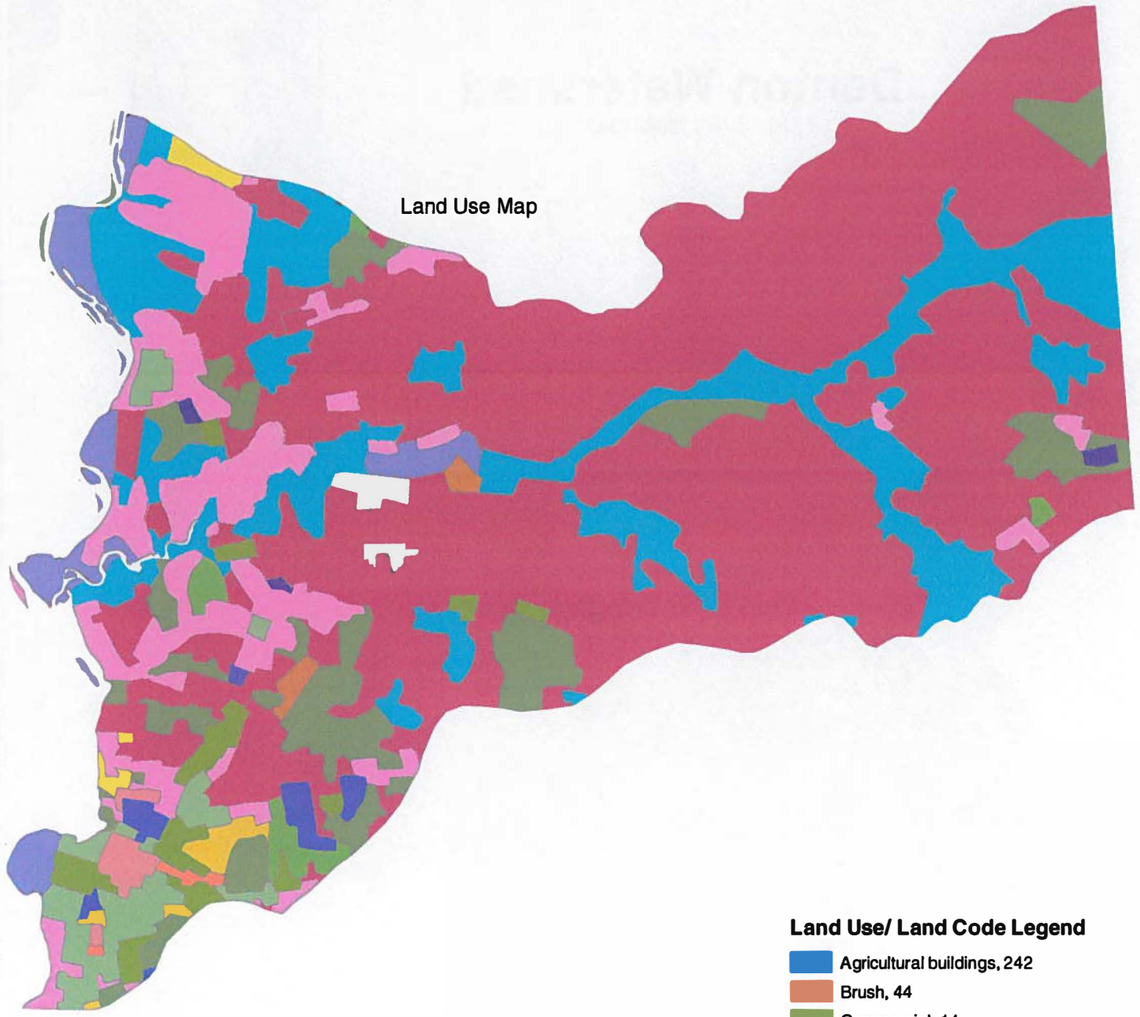
Land Use Map



LAND USE/LAND COVER TOTALS		
LAND USE/LAND COVER	ACREAGE	PERCENTAGE OF WATERSHED
Cropland	5,615.55	54.61%
Forest	2,375.58	23.10%
Low-density residential	944.18	9.18%
Water	295.72	2.88%
Wetlands	265.77	2.58%
Medium-density residential	245.56	2.39%
Commercial	193.92	1.89%
Open urban land	51.70	0.50%
Institutional	88.26	0.86%
High-density residential	55.79	0.54%
Pasture	40.25	0.39%
Brush	37.67	0.37%
Extractive	36.41	0.35%
Feeding operations	22.05	0.21%
Industrial	15.48	0.15%
TOTAL	10,284	

COMBINED LAND USE NUTRIENT REDUCTION RATES		
COMBINED LAND USE	TOTAL NITROGEN (lb/acre/yr)	TOTAL PHOSPHORUS (lb/acre/yr)
Barren land	15.398	8.272
Extractive	7.675	4.248
Feeding operations	840.472	81.915
Forest	1.728	0.127
Harvested forest	12.366	0.926
Nursery	127.671	89.345
Pasture/hay	7.478	2.057
Row Crops	21.281	2.932
High impervious urban	8.291	2.553
High pervious urban	9.233	1.041
Low impervious urban	8.288	2.551
Low pervious urban	9.237	1.036

TOTAL NITROGEN (TN) AND TOTAL PHOSPHORUS (TP) LOADS		
LAND USE DESCRIPTION	TOTAL TN LOAD (lbs/yr)	TOTAL TP LOAD (lbs/yr)
Cropland	119,505	16,465
Forest	4,105	302
Low-density residential	7,825	2,409
Water		
Wetlands	459	34
Medium-density residential	2,035	626
Commercial	1,608	495
Open urban land	428	132
Institutional	732	225
High-density residential	463	142
Pasture	218	32
Brush	65	5
Extractive	279	155
20% of Feeding operations	3,707	361
80% of Feeding operations	375	52
Industrial	18,536	1,807
SEPTICS		
In Critical Area	4,662	
Within 1000ft of Stream	4,444	
Other	496	
TOTAL LOAD	169,943	23,241
Total Load w/reductions	140,569.51	20,291.88
Total Load w/future reductions	90,017.01	5,097.91
Total Reductions	50,552.50	15,193.97

Land Use/ Land Code Legend

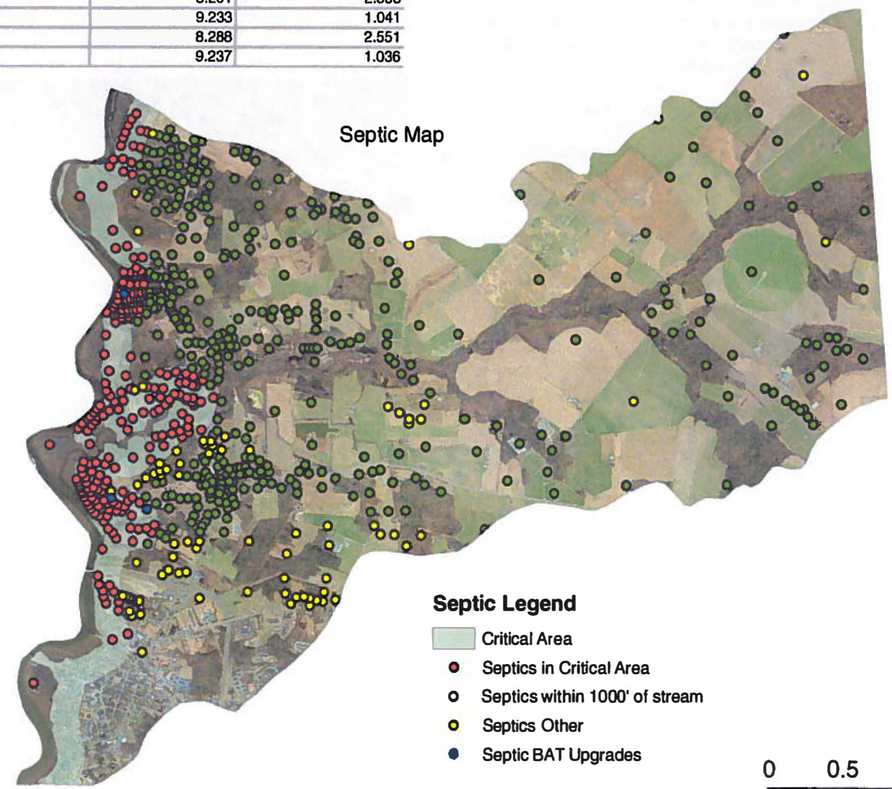
- Agricultural buildings, 242
- Brush, 44
- Commercial, 14
- Cropland, 21
- Deciduous forest, 41
- Evergreen forest, 42
- Feeding operations, 241
- High-density residential, 13
- Industrial, 15
- Institutional, 16
- Low-density residential, 11
- Medium-density residential, 12
- Mixed forest, 43
- Open urban land, 18
- Orchards/vineyards/horticulture, 23
- Pasture, 22
- Wetlands, 60

N

0 0.25 0.5 1 Miles

CREATED BY CAROLINE COUNTY DEPARTMENT OF PLANNING & CODES
November 30, 2010

Septic Map



Septic Legend

- Critical Area
- Septics in Critical Area
- Septics within 1000' of stream
- Septics Other
- Septic BAT Upgrades

0 0.5 1 Miles

Best Management Practices:

COVER CROPS reduce erosion and the leaching of nutrients to groundwater by maintaining a vegetative cover on cropland and holding nutrients within the root zone.

AGRICULTURAL RIPARIAN GRASS BUFFERS are linear strips of grass or other non-woody vegetation maintained between the edge of fields and streams, rivers or tidal waters that help filter nutrients, sediment and other pollutant from runoff.

AGRICULTURAL RIPARIAN FOREST BUFFERS are linear wooded areas along rivers, stream and shorelines. Forest buffers help filter nutrients,sediments and other pollutants from runoff as well as remove nutrients from groundwater.

NUTRUENT MANAGEMENT PLAN (NMP) implementation (crop) is acomprehensive plan that describes the optimum use of nutrients to minimize nutrient loss while maintaining yield. A NMP details the type, rate, timing, and placement of nutrients for each crop.

LAND RETIREMENT takes marginal and highly erosive cropland out of production by planting permanent vegetative cover such as shrubs, grasses, and/or trees.

AGRICULTURAL WETLAND RESTORATION activities re-establish the natural hydraulic condition in a field that existed prior to the installation of subsurface or surface drainage.

CONSERVATION PLANS are a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality, and to prevent deterioration of natural resources on all or part of a farm.

ANIMAL WASTE MANAGEMENT systems are practices designed for proper handling, storage, and utilization of wastes generated from confined animal operations and include a means of collecting, scraping or washing wastes and contaminated runoff from confinement areas into appropriate waste storage structures.

A WATER CONTROL STRUCTURE controls the direction or rate of flow of water and maintains a desired water surface elevation. This process creates positive effects on the water budget, especially on volume and application rates. Controling rate of flow can help in the natural denitrification process of nutrients. Other effects are infiltration, evaporation, transpiration, deep percolation, and ground water recharge.

BIORENTENTION and bioswales are filtering practices that capture and temporarily store water and pass it through a filter of sand, organic matter and vegetation which promotes pollutant treatment and groundwater recharge.

SEPTIC CONNECTIONS/hookups represent the replacement of traditional septic systems with connection to and treatment at wastewater treatment plants (WWTPs).

SEPTIC BAT upgrades are used in the replacement of traditional septic systems with more advanced systems that have additional nitrogen removal capabilities

BMP descriptions are practices that are credited in the Chesapeake Bay Watershed Model (Phase 4.3). These Descriptions are located in BMP Handbook, Chesapeake Bay Trib Strategies.

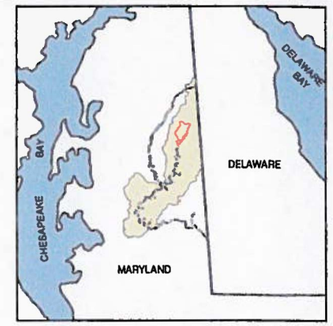
GREENSBORO HUC 12 (021304040505) NON POINT SOURCE NUTRIENT REDUCTIONS - 2010		
BMPS THRU 2010	TN REDUC LBS	TP REDUC LBS
AG Buffers	4,105.08	531.14
AG Cover crops	1,762.97	418.73
AG Water control structures	45	0
AG Nutrient Management Plar	11,350.90	1,094.94
AG Conservation Plans	1,165.02	267.35
Urban BMPs (Stormwater)	161.65	52.62
Urban BMPs (Forest)	5.75	0.27
TOTAL THROUGH 2010	**18,596.37**	**2,365.05**
Sources: Maryland Departments of Agriculture and Environment, 2010		
All BMP efficiencies except AG NMP Phase 5.3 Chesapeake Bay Model; AG NMP efficiencies Phase 4.3 model/MDA Beth Horsey		

GREENSBORO HUC 12 (021304040505)	TOTAL NON POINT SOURCE	
Non Point Source Loads	85,609.83	12,669.69
Non Point Source Reductions	18,596.37	2,365.05
TOTAL	**67,013.45**	**10,304.64**

GREENSBORO HUC 12 NON POINT SOURCE BMP GOALS		
BMPS GOALS	TN REDUC LBS	TP REDUC LBS
AG CRP	785.30	268.75
AG COVER CROP	19,117.01	635.35
AG WATER CONTROL	1125	N/A
AG SCWQP	1,165.02	267.35
AG RETIREMENT OF HEL	82.82	5.25
URBAN STORMWATER	531.23	245.11
URBAN FOREST	1,057.07	210.10
BAT SEPTICS (CA)	2,790.42	N/A
TOTAL GOALS	**26,653.88**	**1,631.91**

Greensboro Watershed

(HUC 12 #-021304040505)



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November, 2010

MDE

Land Use Map

GREENSBORO HUC 12 (021304040505) LAND USE ACREAGES		
Land Use Description	Acres	Percentage of Watershed
Cropland	3649.81	65.0%
Deciduous forest	1241.98	22.1%
Low-density residential	331.72	5.9%
Medium-density residential	176.48	3.1%
Pasture	68.38	1.2%
Commercial	33.59	0.6%
Institutional	24.1	0.4%
Water	19.98	0.4%
High-density residential	18.25	0.3%
Industrial	17.82	0.3%
Bare ground	12.89	0.2%
Open urban land	11.05	0.2%
Wetlands	5.41	0.1%

Source: 2009 Maryland PropertyView Land Use/Land Cover Data

CHESAPEAKE BAY MODEL PHASE 5.3 LAND USE LOADING		
Land Use	Nitrogen (lb/acre/yr)	Phosphorus (lb/acre/yr)
Barren land	15.4	8.272
Extractive	7.68	4.248
Feeding operations	840.47	81.915
Forest	1.73	0.127
Harvested forest	12.37	0.926
Nursery	127.67	89.345
Pasture/hay	7.48	2.057
Row Crops	21.28	2.932
High impervious urban	8.29	2.553
High pervious urban	9.23	1.041
Low impervious urban	8.29	2.551
Low pervious urban	9.24	1.036

GREENSBORO HUC 12 (021304040505) TOTAL NUTRIENT LOAD		
Non Point Source Loads	67,013.45	10,304.64
Septic Load	4,807.74	N/A
TOTAL	**81,993.01**	**11,680.86**

GREENSBORO HUC 12 (021304040505) NON POINT SOURCE TOTAL NUTRIENT LOADS - 2010			
LAND USE	Acres	TN LOAD (LBS)	TP LOAD (LBS)
Bare ground	12.89	198.51	106.65
Commercial	33.59	278.5	85.75
Cropland	3,649.81	77,672.33	10,700.52
Deciduous forest	1,241.98	2,146.68	158.13
High-density residential	18.25	151.29	46.58
Industrial	17.82	147.73	45.48
Institutional	24.1	199.83	61.53
Low-density residential	331.72	2,749.34	846.1
Medium-density residential	176.48	1,462.67	450.13
Open urban land	11.05	91.62	28.19
Pasture	68.38	511.35	140.63
Water	19.98	0	0
Wetlands	5.41	0	0
TOTAL	**5,611.45**	**85,609.83**	**12,669.69**

GREENSBORO HUC 12 (021304040505) TOTAL NITROGEN LOAD FROM SEPTIC SYSTEMS		
SEPTIC	# of systems	TN LOAD (LBS)
Critical Area SEPTICS	134	2,790.42
Streams SEPTICS	149	1,939.24
Other	10	78.09
TOTAL	**293**	**4,807.74**

Land Use/ Land Code Legend

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- Feeding operations, 241
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N

0 0.25 0.5 1 Miles

CREATED BY CAROLINE COUNTY DEPARTMENT OF PLANNING & CODES
November 30, 2010

Septic Map

Septic Legend

- Critical Area
- Septics_Critical_Area
- Septic BAT Upgrades
- Septics within 1000' stream
- Septics Other

0 0.5 1 Miles