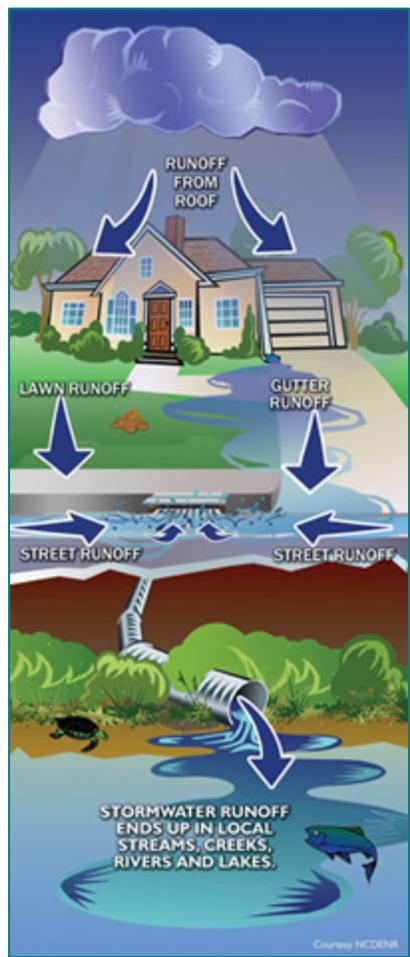


Nonpoint Source

Nonpoint Source



This section of the WRE is intended to assess the current level of existing and planned land use regarding nonpoint source (NPS) pollutant loading. It is also intended to evaluate the land use planning and management processes within the County and municipalities as to their effectiveness in addressing NPS loading issues. The specific NPS impacts are associated with stormwater runoff from urban/suburban development, agricultural runoff, and septic system loading via subsurface flow. Components of each of these sources may be regulated to some degree, but only from an individual permitting perspective. This evaluation and analysis provides a larger, more regional assessment of NPS loading. It provides, as called for in the Models and Guidance Document #26, “preliminary assessment... crafted to provide general insight into this process, and serve as a starting point for future nonpoint source analysis.”

16 Stormwater Programmatic Assessment

According to the State Models and Guidelines document for the WRE, a jurisdiction should provide a stormwater programmatic assessment. This assessment should include a review of all stormwater management requirements and the effectiveness of program implementation. This analysis

should include a review of local ordinances, policies, plan approval requirements, enforcement, as well as other key components of the program.

■ Builders for the Bay Process

Carroll County Government participated in a “Builders for the Bay” roundtable in coordination with the Alliance for the Chesapeake Bay, Home Builders Association of Maryland, and the Center for Watershed Protection (CWP). The purpose of the roundtable in Carroll County was to adapt the principles developed at the national level for local application and to identify local codes and ordinances that act to promote Better Site Design through a consensus-building process. The roundtable process was modeled after the National Site Planning Roundtable and has four basic objectives:

- Reduce overall site impervious cover
- Preserve and enhance existing natural resources

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- Integrate stormwater management
- Retain a marketable product

The first step in the process was an evaluation of the County's existing codes, ordinances, policies, and regulations. The evaluation was performed via Model Development Principles and scored based on national benchmarks for Better Site Design. The evaluation was performed by staff from CWP. The findings in the final evaluation document (July 2008) provided an excellent summary regarding the County's existing efforts:

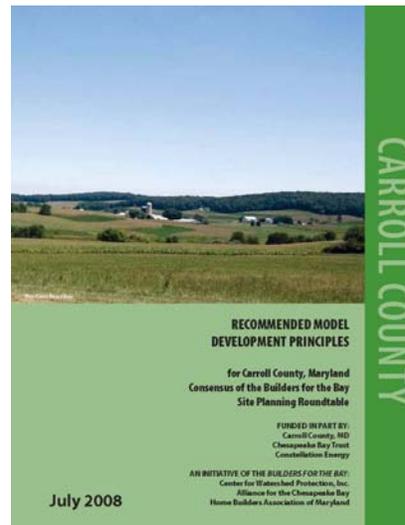
"The results of this review revealed that the County has an existing set of strong developed standards. In particular, the natural resource protection and stormwater management program are some of the best in the state. These programs include strong stream buffers and tree protection as well as requiring all new homes to disconnect their roof tops. In addition, the County's dedicated staff addressed environmentally friendly regulations even before the Roundtable process began."

The roundtable process started September 2007 with a kick-off meeting that allowed all of the members to become acquainted with the Better Site Design principles. At this meeting, members were presented with the results of the in-depth review of the existing county codes, ordinances, and regulations. This meeting produced a detailed analysis of regulatory barriers to environmentally-sensitive site designs for Carroll County. The 35 participants of the roundtable process met several times over the course of eight months. From September 2007 through January 2008, subcommittee meetings were held, separating the participants into four committees based on their strengths and interests. These four committees went hand-in-hand with the four objectives of the roundtable. The committees were:

- Residential Streets and Parking Lots,
- Lot Development,
- Natural Resource Management, and
- Stormwater Management.

In February 2008, the roundtable participants reconvened to collect consensus on each subset of the Model Development Principles for better site plans and discuss their final recommendations. In April 2008, the members met again to discuss implementation principles.

Over the course of eight months, the roundtable composed specific recommendations and rationales based on suggestions from the four subcommittees. Each of the four subcommittees offered specific principles, recommendations, and rationale to minimize the amount of new impervious cover throughout the county and to reduce NPS pollution. The final consensus document was presented to and approved by the Carroll County Board of Commissioners on July 24, 2008. Prior to the presentation to the Commissioners, numerous boards and groups also presented findings. The specific recommendations of



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each subcommittee can be found in the consensus document for the Carroll County Builders for the Bay Site Planning Roundtable.

(<http://ccgovernment.carr.org/ccg/compplan/WRE/default.asp> - Scroll down to document link.)

17 Agricultural BMPs

■ **Carroll County Agricultural Land Preservation Program**

This program, implemented through the County Department of Planning, establishes permanent protection easements, through the purchase of development rights on lands throughout the County. The purchase of easements occurs in the rural region of the county, outside municipal boundaries and DGAs. In addition to the elimination of development potential (residential as well as other permitted uses), the establishment of an easement also requires the implementation of a Total Farm Soil and Water Conservation Plan. These plans are designed and implemented through the local Conservation Partnership to protect and enhance the county's soil and water resources. Therefore, the program provides two vital functions related to NPS loading, the elimination of potential onsite wastewater systems and the development of a conservation plan designed to reduce nutrient and sediment runoff.



Currently, the county has approximately 55,348 acres of permanently preserved land with a goal of 100,000 acres. This acreage places Carroll County among the leaders nationally in preserved land. The Board of County Commissioners has approved programmatic changes and capital funding which will allow for the accelerated purchase of the additional 40,000+ acres of land. This critical programmatic/funding initiative will produce a tremendous restoration and preservation effort toward achieving NPS watershed goals and ultimately the restoration of the Chesapeake Bay.

■ **Conservation Partnership**

The Conservation Partnership is the combined efforts of the Federal Natural Resources Conservation Service, Maryland Department of Agriculture (MDA) and the locally funded/implemented Carroll County Soil Conservation District. The Partnership, which is located in Westminster, provides technical assistance and funding (through various federal/state programs) to local agricultural producers. The overall goal of the Partnership is to provide technical and administrative assistance to agricultural producers to help them implement Agricultural Best Management Practices (BMPs) that enhance/protect soil and water resources.

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The Carroll County Partnership is a continual leader in the State of Maryland for conservation implementation (see the table below, “Maryland Agricultural Cost Share (MACS) Program”). This table indicates the total number of agricultural BMPs installed through the MACS program since 2000. The table also indicates the dollars of State-provided cost share monies received by producers. The local partnership consistently ranks first in the state with the construction of BMPs. The construction of BMPs results in specific reductions of nutrient and sediment runoff from agricultural operations.

**Maryland Agricultural Cost Share Program
Carroll County**

Year	Cost Share Received	Ag BMPs Completed	State of MD Ranking	Cover Crop (Acres)
2000	\$457,841	184	1	1,292
2001	\$642,785	204	1	No Data Available
2002	\$562,277	213	2	1,675
2003	\$546,266	273	1	4,726
2004	\$403,024	177	1	5,982
2005	\$674,809	149	1	1,666
2006	\$579,842	132	1	4,495
2007	\$600,458	140	1	14,796
2008	\$683,092	153	1	10,443

Source: Maryland Department of Agriculture, MACS Annual Reports

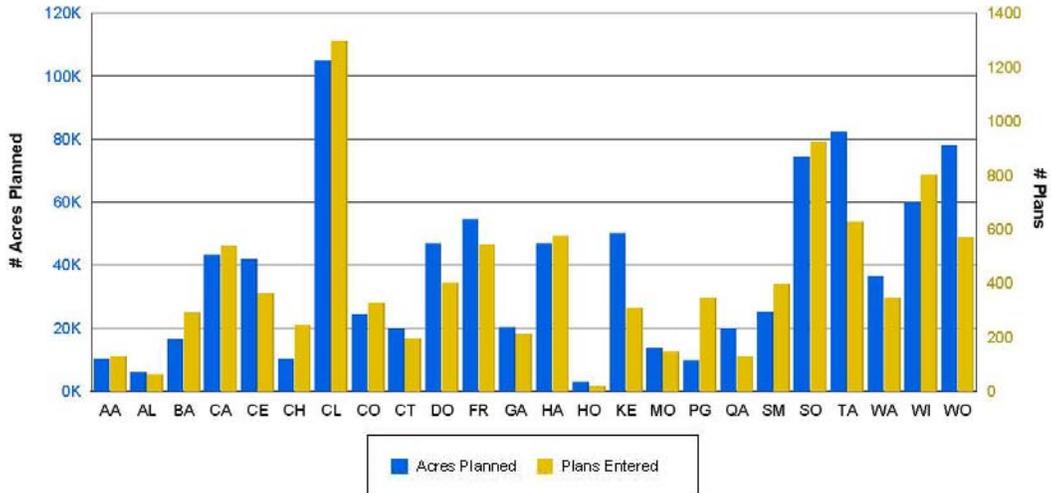
The Partnership is the direct source of cost-share funding and develops, with the producer, a Soil and Water Conservation Plan for farm operations. These plans provide the design and timeframe for the implementation of the above referenced BMPs. The Soil and Water Conservation Plan acts as a comprehensive plan for the farm’s operations. The figured titled “Conservation Tracker Summary” from the Conservation Tracker System managed by the Maryland Department of Agriculture identifies Carroll County (identified as “CL” in the graph) as a leader in total farm acres covered by a Soil and Water Conservation Plan.

It is clear that the combination of the Carroll County Agricultural Land Preservation Program in conjunction with the programs of the local Conservation Partnership provides a state-leading effort to control and reduce agricultural NPS loading. The sustained efforts of the Partnership, along with continued support of the Board of County Commissioners, ensures that the County will lead the state in the restoration, enhancement, and protection of soil and water resources via agricultural conservation measures.



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Conservation Tracker Summary
as of 8/6/2009 9:36:04AM



<u>District</u>	<u># Plans</u>	<u>PLANNED ACRES</u>	<u>CROP ACRES</u>	<u>WOODLAND ACRES</u>	<u>PASTURE ACRES</u>
Allegany	61	6,018.0	1,084.0	3,468.1	873.2
Anne Arundel	130	10,149.6	3,893.5	3,526.8	952.4
Baltimore Co.	290	16,412.9	10,251.2	3,336.2	1,751.7
Calvert	537	43,193.2	12,625.5	21,051.4	1,995.2
Caroline	328	24,279.0	24,121.2	8,277.7	237.0
Carroll	1,296	104,826.7	57,370.2	16,613.8	11,116.5
Catoctin	197	19,691.7	10,873.6	2,596.8	3,332.3
Cecil	360	41,797.0	27,512.2	9,759.5	2,285.5
Charles	243	10,346.4	8,624.1	351.4	363.8
Dorchester	402	46,906.2	16,187.5	5,619.3	75.9
Frederick	543	54,581.4	28,720.6	7,371.8	9,414.7
Garrett	212	20,085.4	7,242.3	7,415.3	4,001.9
Harford	573	46,913.6	19,432.4	14,131.0	8,604.3
Howard	20	3,025.9	1,574.4	534.3	643.9
Kent	308	50,080.6	38,093.3	10,860.6	781.8
Montgomery	148	13,723.4	8,454.5	4,159.6	1,859.5
Prince George's	347	9,639.8	8,647.2	12,675.5	1,380.9
Queen Anne's	128	20,019.5	13,291.8	4,942.4	481.5
Somerset	924	74,354.6	33,522.5	25,649.0	751.0
St. Mary's	398	25,175.2	12,696.8	19,288.4	838.8
Talbot	628	82,289.8	51,358.8	17,577.8	752.2
Washington Co.	346	36,480.6	18,324.0	6,571.3	7,870.6
Wicomico	800	59,919.2	34,994.1	19,611.6	886.8
Worcester	567	77,994.3	30,495.4	26,958.1	332.3
Total	9,786	897,904.0	479,391.1	252,347.7	61,583.7

Source: MDA, MACS

■ Forest Conservation Enhancement

The County and its municipalities have adopted several enhancements to the State Forest Conservation requirements which provide support to water quality goals. Since the adoption of the Carroll County Forest Conservation ordinance in the early 1990s, all forest areas remaining on developed sites have been retained via a perpetual protection easement. This has allowed Carroll County to retain, in long-term protection, an average of 82 percent of onsite forest. This places Carroll as one of two leaders in the state related to forest retention associated with development. Approximately 3.75 times more acres are placed in easement, overall, than cleared for development.

The County has also pioneered the use of forest banking. Banking is a process where a landowner agrees to reforest property, places a permanent protection easement on the new woodlands, and then sells acreage from the planted area to developers in need of mitigation. This process is between private entities. The County approves the sites, ensures the recordation of easements, and tracks bank status. The County directs reforestation banking on priority areas where water quality benefits are maximized. There have been hundreds of acres established using this specific mitigation option. The ability to target sensitive areas through the bank approval process has allowed the County to maximize water quality benefit associated with mitigation. In many cases, areas which were once productive agricultural lands or exhausted pastures have now become revitalized forest lands.

■ Stream Buffer Preservation

In order to mitigate the impacts of development on surface water resources, the County implemented stream buffer requirements in 1993. The initial effort required the preservation, via a perpetual easement, of all lands within 100 feet of a stream when property was subdivided for land development. In 2004, the Board of County Commissioners formally adopted stream buffer regulations as part of a comprehensive Water Resource Management Ordinance (Chapter 218). The enhanced requirements use a variable width calculation to delineate the buffer boundary. This buffer is required on all development projects (not just subdivision) and provides a permanent easement dedicated to the Board of County Commissioners. The new variable width buffer calculation incorporates site-specific features, including wetlands and steep slopes.



The delineation and permanent preservation of stream buffers provides one of the very best techniques for the mitigation/restoration of NPS pollution associated with land

development. The County and municipalities have permanently preserved 1,234 acres of riparian stream buffers associated with land development activities.

18 Estimated Existing Nutrient Loads

■ Nonpoint Source Spreadsheets (summary)

The Nonpoint Source Spreadsheet (NPSS) is a loading analysis model used to assess the nonpoint source pollution loadings entering receiving waters. The methodology used in the NPSS was provided by the State and allows for a consistent comparison of current and future NPS loads. NPS pollutants in the model reflect estimated nitrogen and phosphorus entering receiving waters from stormwater runoff and septic systems. The NPSS is used to estimate the amount of nitrogen and phosphorus (or nutrients) in pounds/year by watershed. The load estimates are determined by assigning different loading rates for each type of land use and for septic systems. This tool produces results that allow the user to compare the relative change in loadings between different land use scenarios. The NPSS also estimates the amount of impervious cover and open space.

The NPSS was a collaborative effort by MDE, MDP, and Carroll County Government. MDP supplied the Land Use/Land Cover (LULC) data by water basin for 2002 and 2007 and projected the future LULC data scenarios. The Land Use/Land Cover data indicates how the land was actually being used or what type of vegetation or agricultural use was in place at the time the data was assembled. MDE tailored the NPSS to Carroll County and assigned loading rates and impervious cover ratios to each MDP LULC category at the MDE 6-digit watershed level. MDE obtained the loading rates from the Chesapeake Bay Program (CBP) Watershed Model (WSM) Phase 4.3. The CBP Watershed Model estimates nutrient and sediment loads delivered to the Chesapeake Bay and has been in use since 1982. The model uses rainfall, evaporation, and meteorological data to estimate runoff and subsurface flow for all the watershed land uses. The CBP is currently refining the WSM, with a draft of Version 5.0 currently available.

Methodology

The spreadsheet consists of initial and future assessments of nutrient loads related to proposed land use changes. This information allows for comparison of various scenarios. MDP generated the initial LU/LC acreages for the county and future projections using their Growth Simulation Model to estimate population and land use changes over time.

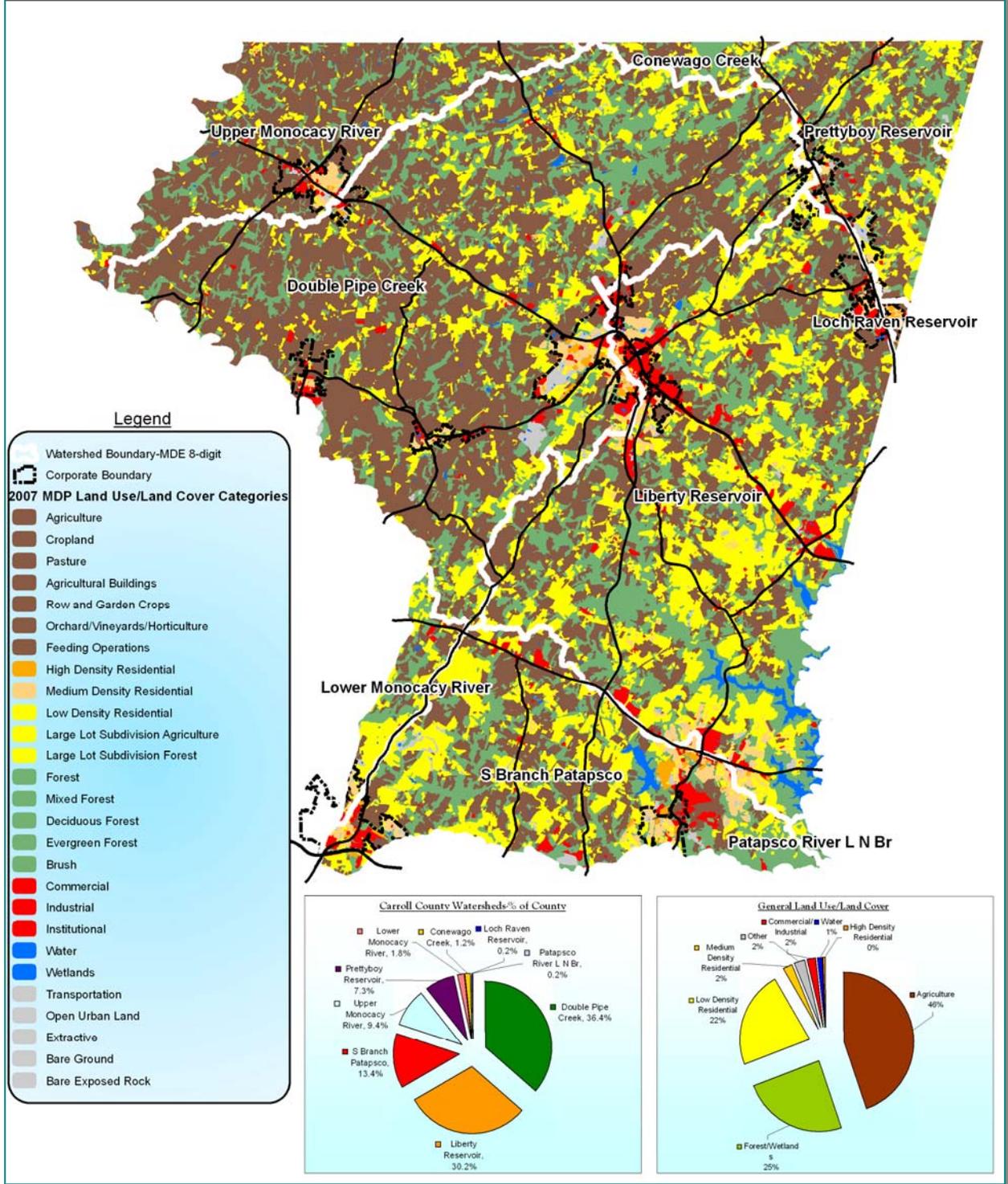
For this plan, Carroll County's NPSS compares four scenarios, defined as follows:

1. **Current Condition** - 2007 LULC and 2007 BMPs– This estimates loading based on 2007 LULC, while using BMPs in place as of 2007, which is the most current data available.

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2007 Land Use/Land Cover Map

Carroll County, MD



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2. **Baseline Condition** - 2007 Land Use and Full Implementation of Tributary Strategies – This scenario also uses the 2007 LULC but assumes that the Tributary Strategies have been fully implemented (excluding denitrifying septic systems) in all watersheds. The State uses this scenario as a baseline condition.
3. **Future Scenario 1** - Buildout with Existing Zoning and Full Implementation of Tributary Strategies – This future scenario estimates buildout based on the County and municipal zoning (prescribed permitted use in the zoning regulations) in place at the time. The County’s medium-range BLI estimates were used to calculate future septic systems.
4. **Future Scenario 2** - Buildout with Existing Land Use Designations and Full Implementation of Tributary Strategies – This future scenario estimates buildout based on the County existing land use designations, adopted in the 2000 Carroll County Master Plan and community comprehensive plans. The County’s medium-range BLI estimates were used to calculate future septic systems. (Land use designations are used within GABs, and zoning was used outside GABs. The zoning classifications and land use designations outside GABs are roughly equivalent. The land use designations identify the uses envisioned through the comprehensive planning process. These designations are actually implemented through the zoning regulations. As a growth management measures, many of the municipalities change the zoning of an area to match the adopted land use designation upon annexation of an area. Therefore, the land use designation often envisions a higher level or more intensive use for the future annexation areas.)

MDE developed the “default” NPSS and established the loading rates and impervious percentages for each land use category. The spreadsheet uses three inputs that include land use acreages, number of residential septic systems, and non-residential acreage relying on septic systems. By changing these three inputs based on future projections, changes in nutrient loadings can be directly compared. Each scenario is summarized by watershed.

Inputs

Inputs into the NPSS model came from various sources, these inputs include:

(LULC Acreages - The LULC data were supplied by MDP and were generated statewide by interpretation of high altitude aerial photography flown in 2002 and 2007. Land uses generally greater than 10 acres in size were classified into 31 categories. For comparison purposes, these 31 categories were placed into one of five general land use types: Development, Agriculture, Forest, Water, and Other.

MDP also supplied the future LULC projections for each of the buildout scenarios. These were created using the MDP’s Growth Model and projected future land use acreage based on the County/municipal adopted zoning and master/comprehensive plan. The default spreadsheet consisted of 2002 LULC data, but the County worked with MDP staff to update to 2007 LULC data.

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Loading Rates - The nitrogen and phosphorus loading rates were determined by MDE using data from the CBP Watershed Model. Each of MDP's 31 land use categories are assigned two separate loading rates, one for the impervious portion and one for the pervious portion of lands. Each LULC category was assigned an impervious factor taken from a report completed by the CWP. The default spreadsheet originally consisted of 2002 loading rates, but the County worked with MDE to update to 2007 loading rates.

Residential Septic Systems - Initial and future residential septic systems were estimated by the County using the most recently adopted sewer service areas, address points, existing use of land, and BLI data (future septic only).

Non-Residential Septic Acreages - Initial and future non-residential septic acreages were estimated by the County. The initial acreages were determined using the most current sewer service areas and existing land use data. The future septic acreages were determined by identifying undeveloped buildable lands that were zoned or designated for business, commercial, or industrial uses.

The loads were calculated using the following formulas.

1. To determine the nitrogen (N) and phosphorus (P) loads from each individual LULC category, where each LULC category is assigned a pervious and impervious loading rate for N and P and an impervious percentage set by the State:

$$\text{Acres} \times (\text{Impervious Loading Rate}) \times (\text{Percent impervious}) + \text{Acres} \times (\text{Pervious Loading Rate}) \times (\text{Percent Pervious})$$

2. To determine nitrogen loads associated with residential septic systems in a given watershed:

$$\text{Total \# of septic systems} \times 9.5 \text{ lbs/person/year} \times \text{average persons/household} \times 0.4 \text{ (transport factor)}$$

3. To determine the non-residential septic loads:

$$\text{Nonresidential acres} \times 9.5 \text{ lbs/person/year} \times .892 \text{ (which is the Equivalent Dwelling unit per acre)} \times \text{mean household size} \times 0.4 \text{ (transport factor)}$$

Since the intent of the analysis is to compare the relative change in loadings, the same loading rate is used for initial and future land use. Both the initial and future estimates use the Tributary Strategies loading rates, which assume full BMP implementation. The Maryland Tributary Strategies BMPs include enhanced stormwater management, erosion and sediment control, riparian buffers, and nutrient management plans. These strategies are built into the model to ensure that the loading outputs will reflect only land use pattern changes.

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The State has provided this default nutrient loading spreadsheet as a starting point and guidance tool. Each jurisdiction was encouraged to modify and refine the spreadsheet as needed to reflect more accurate estimates and additional land use scenarios with future updates of the WRE. With the assistance of MDP and MDE, the County updated the NPSS to include 2007 LULC data and 2007 loading rates. The default spreadsheet summarized the results into the three 6-digit watersheds; 99 percent of Carroll is comprised of two of these watersheds. However, to provide data at a smaller basin level, data were analyzed and presented at the MDE 8-digit watershed level and aggregated by 6-digit watersheds. BLI estimates were used to calculate future residential septic systems.

The results for each land use scenario were summarized at both the 6- and 8-digit watershed levels. For this document, county totals, terrestrial totals, and septic system totals were compared for each scenario. Total nitrogen and phosphorous derived from development for each scenario is modeled for comparison.

■ Potomac Watershed (6-digit)

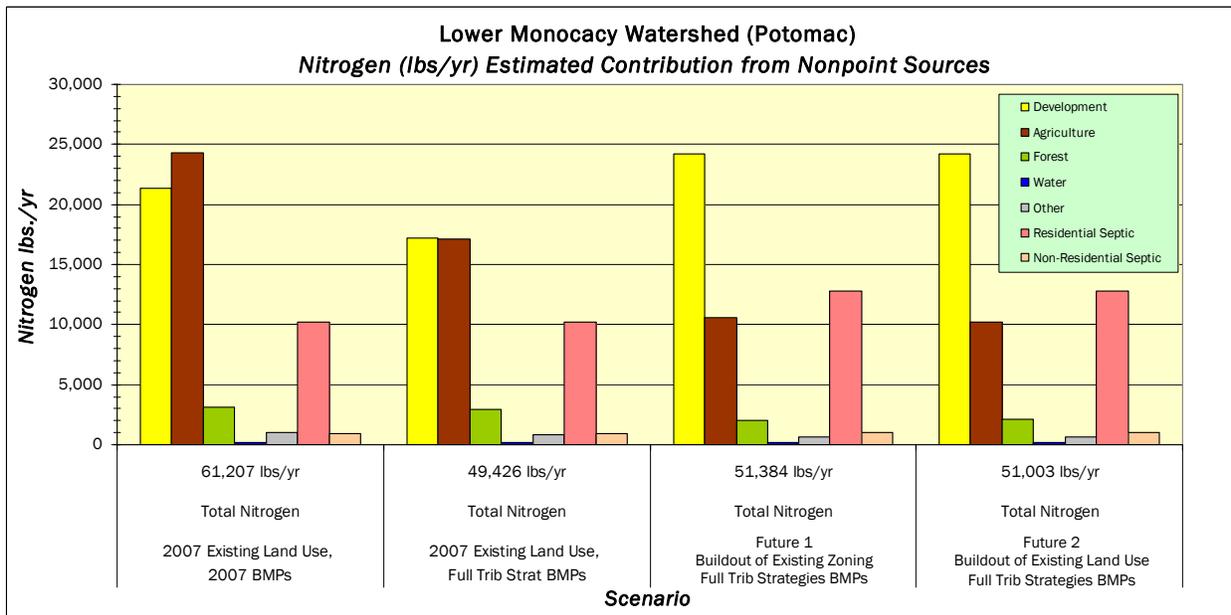
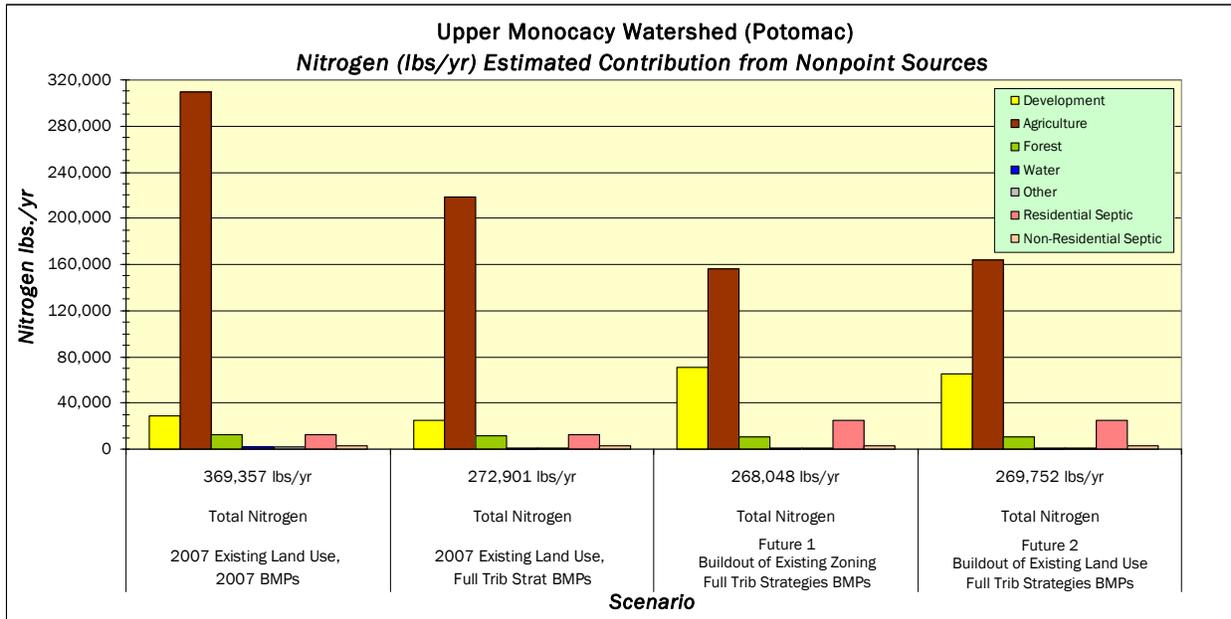
At the 6-digit watershed level, nitrogen loads are projected to decrease if the existing land use plan is implemented along with the Tributary Strategy BMPs. Phosphorus loads decrease consistently with each scenario, from the current baseline scenario through the implementation of the existing land use plan. Nitrogen loads decrease nearly 24 percent from the 2007 Tributary Strategies with BMPs scenario. Total phosphorus loads decrease by 12 percent from the 2007 Tributary Strategies with BMPs scenario to the implementation of the 2007 Existing Land Use scenario.

**Total Estimated Nitrogen and Phosphorus Loads
For Each 8-Digit Watershed in the Potomac Basin**

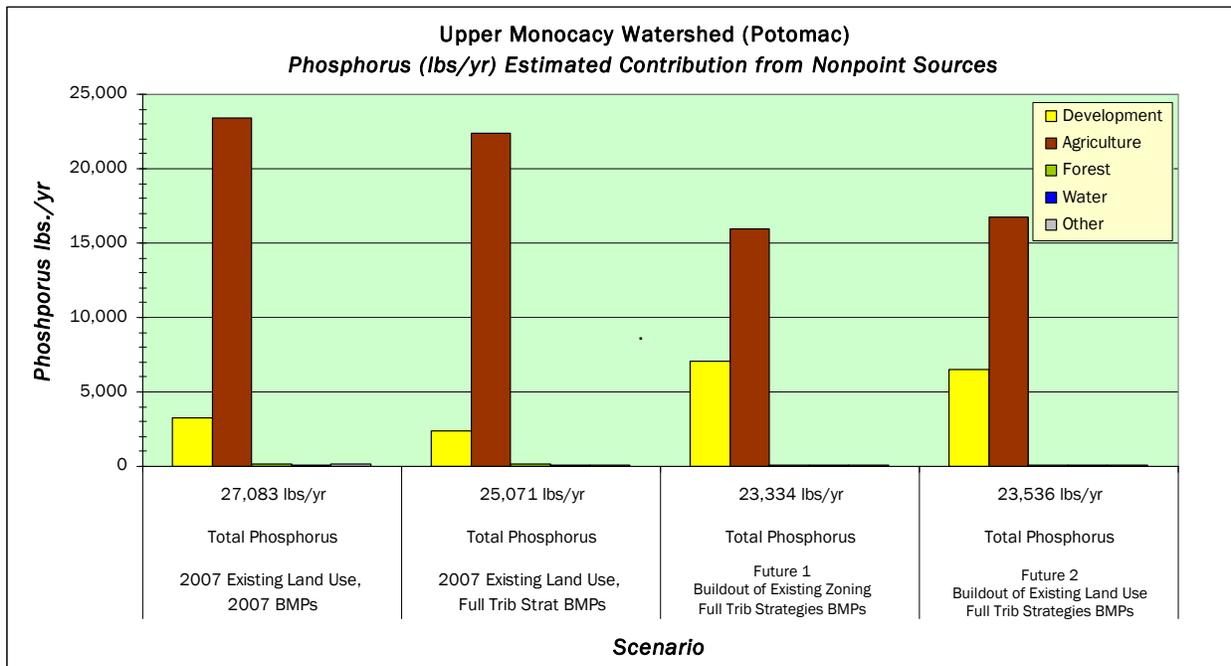
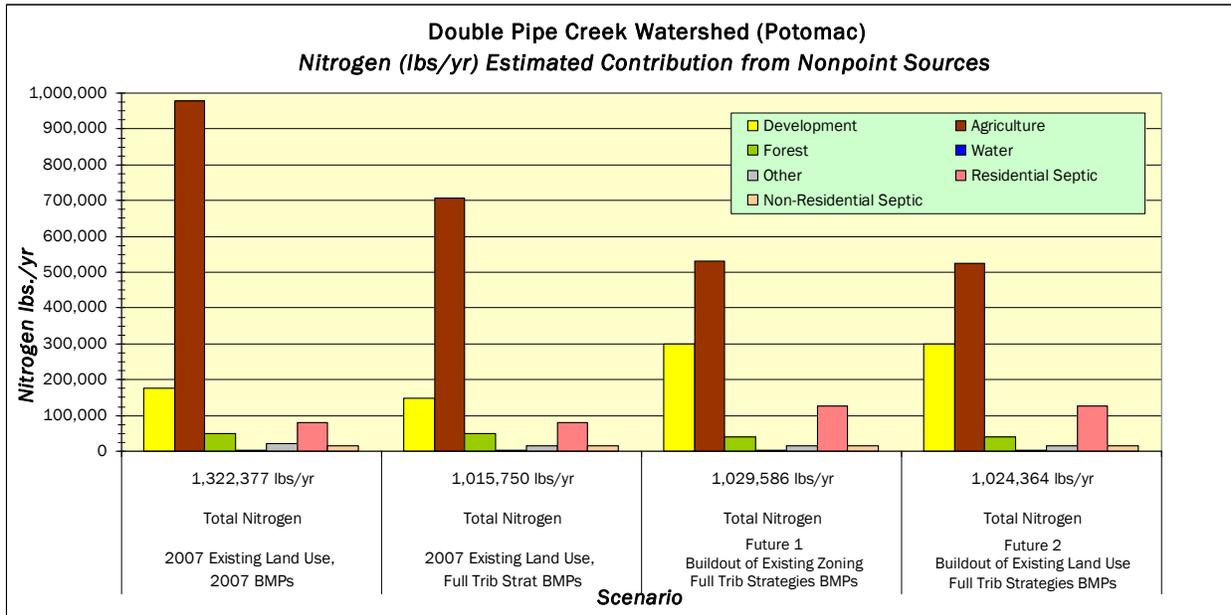
	2007 LU, 2007 BMPs (Lbs/Yr)		2007 LU, Trib Strat BMPs (Lbs/Yr)		Existing Zoning Trib Strat BMPs (Lbs/Yr)		Existing Land Use Trib Strat BMPs (Lbs/Yr)	
	Nit	Phos	Nit	Phos	Nit	Phos	Nit	Phos
Upper Monocacy	369,357	27,083	272,901	25,071	268,048	23,334	269,752	23,536
Lower Monocacy	61,207	4,531	49,426	3,463	51,384	3,444	51,003	3,405
Double Pipe Creek	1,322,377	102,720	1,015,750	89,492	1,029,586	86,304	1,024,364	85,801
Potomac Total	1,752,941	134,334	1,338,077	118,026	1,349,018	113,082	1,345,119	112,742

Source: NPSS, Data provided by MDP and Carroll County Comprehensive Planning, May 2009

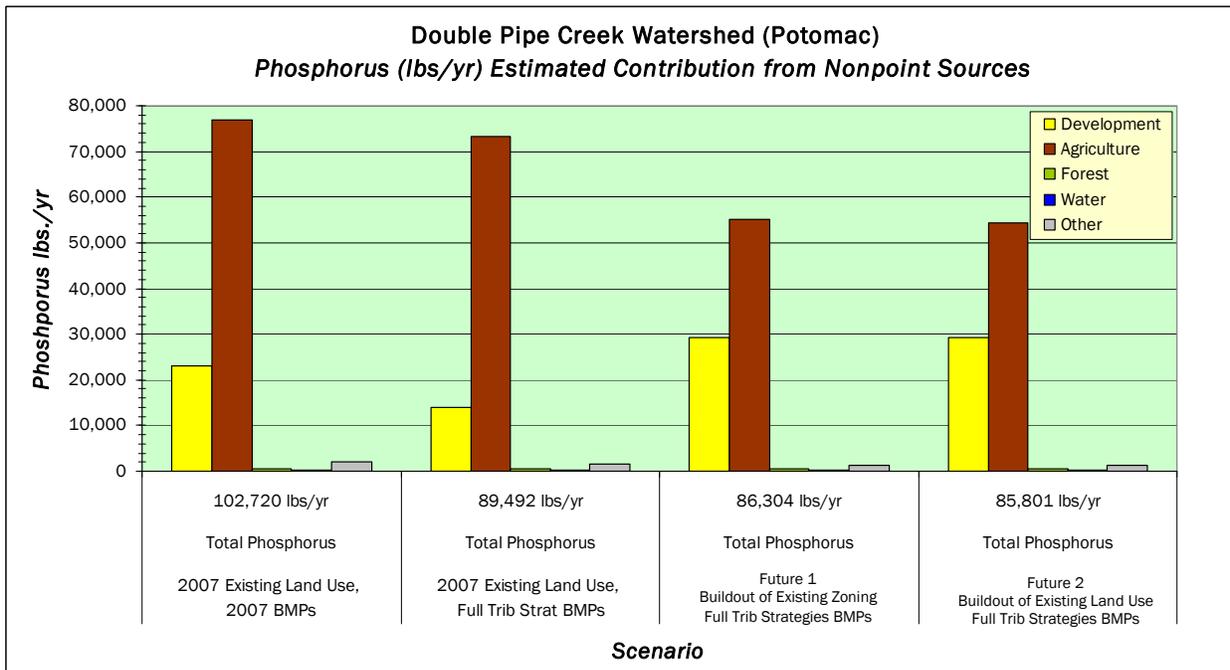
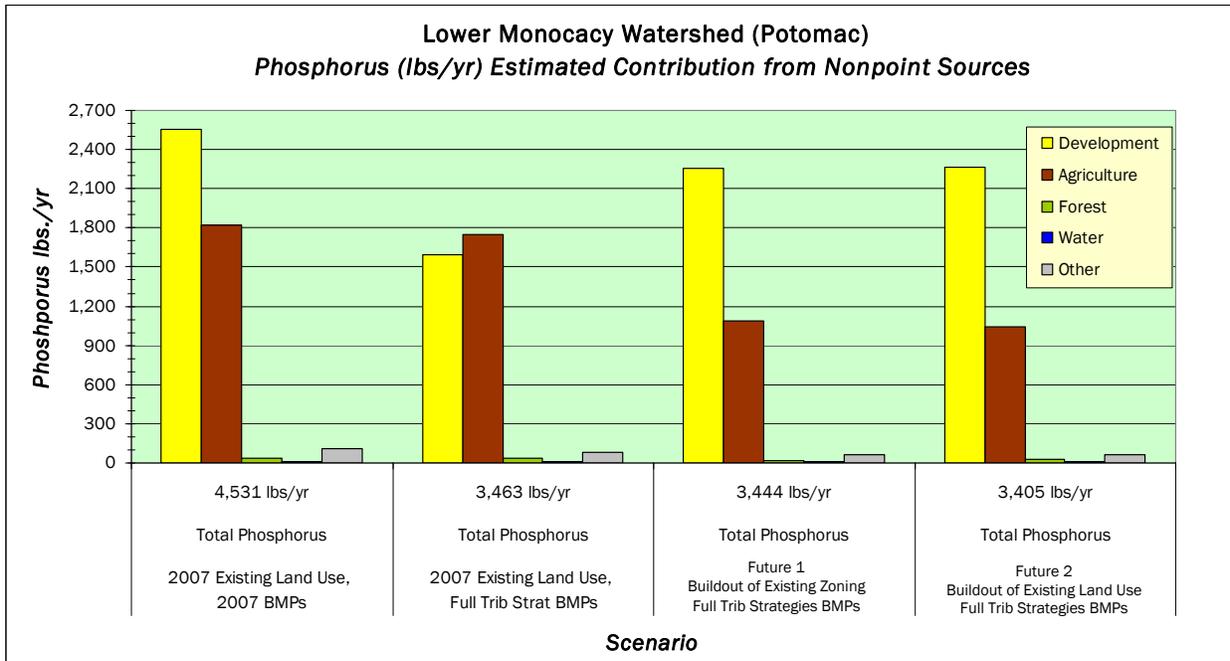
Water Resources Element



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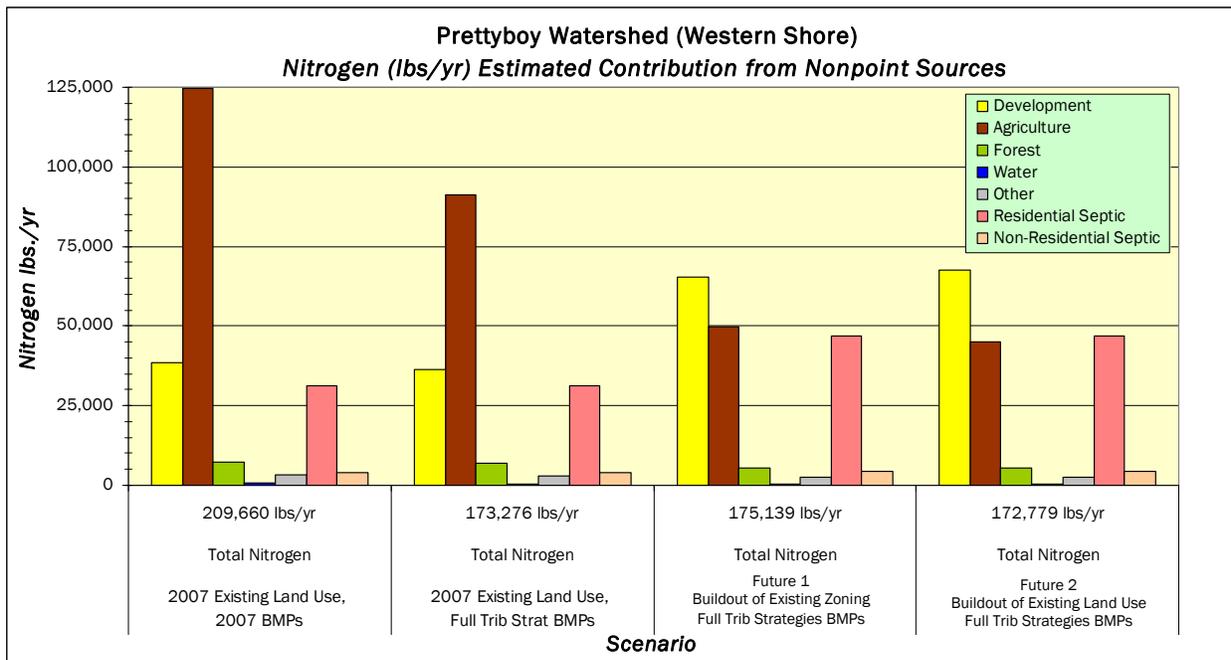
■ Upper Western Shore Watershed (6-digit)

At the 6-digit watershed level, current nitrogen and phosphorous loads will decrease if the existing land use plan is implemented in conjunction with full tributary strategies BMPs. The full implementation of either existing zoning or land use scenarios would only produce a slight increase of approximately 2 percent for nitrogen and 4 percent for phosphorous over the 2007 Land Use with Tributary Strategy BMPs.

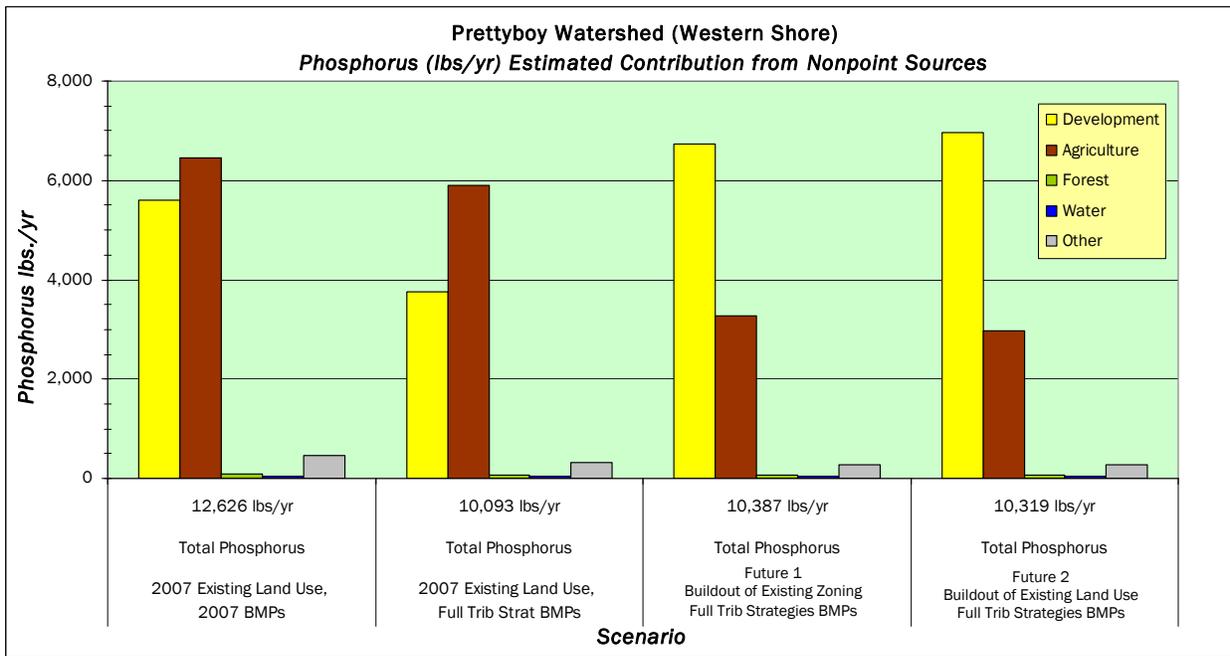
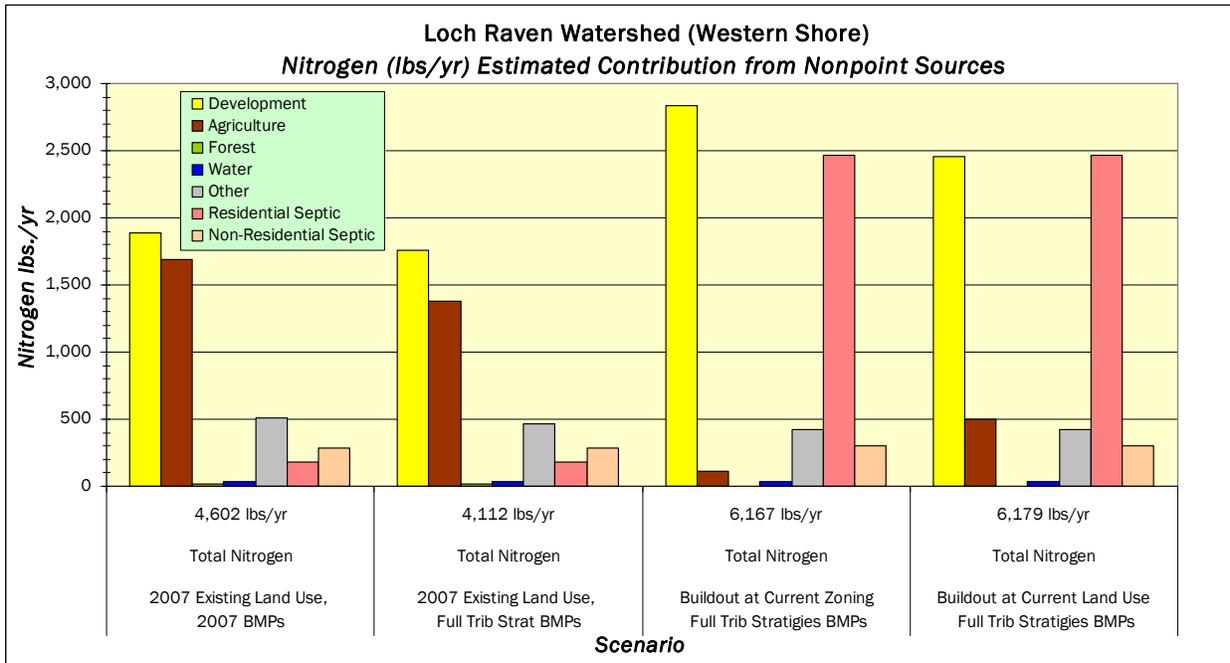
**Total Estimated Nitrogen and Phosphorus Loads
For Each 8-Digit Watershed in the Upper Western Shore**

	2007 LU, 2007 BMPs (Lbs/Yr)		2007 LU, Trib Strat BMPs (Lbs/Yr)		Existing Zoning Trib Strat BMPs (Lbs/Yr)		Existing Land Use Trib Strat BMPs (Lbs/Yr)	
	Nit	Phos	Nit	Phos	Nit	Phos	Nit	Phos
Prettyboy	209,660	12,626	173,276	10,093	175,139	10,387	172,779	10,319
Loch Raven	4,602	442	4,112	328	6,167	335	6,179	331
Western Shore Total	214,262	13,068	177,388	10,421	181,306	10,722	178,958	10,650

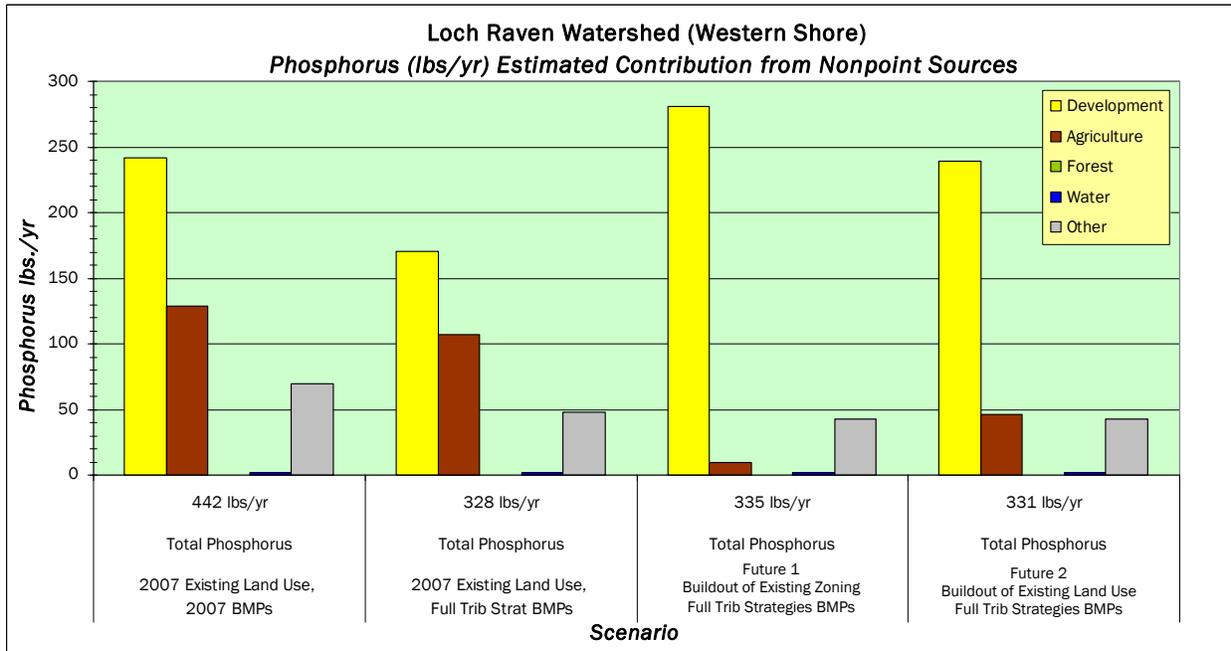
Source: NPSS, Data provided by MDP and Carroll County Comprehensive Planning, May 2009



Water Resources Element



Water Resources Element



■ Patapsco/Back River Watershed (6-digit)

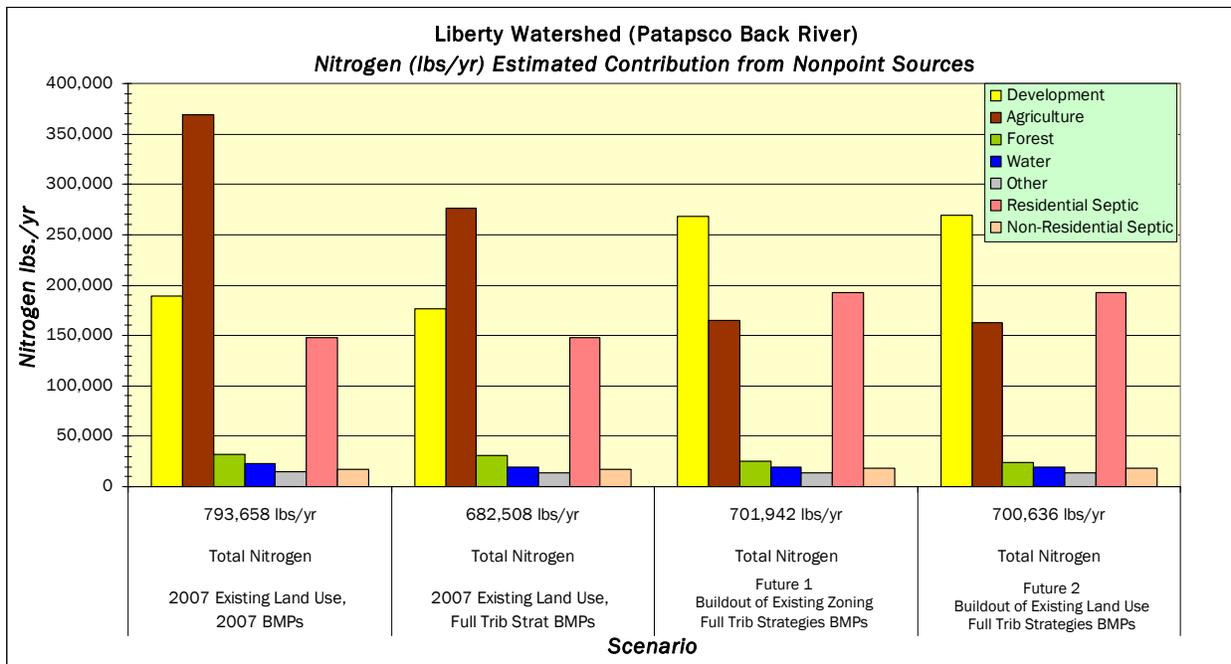
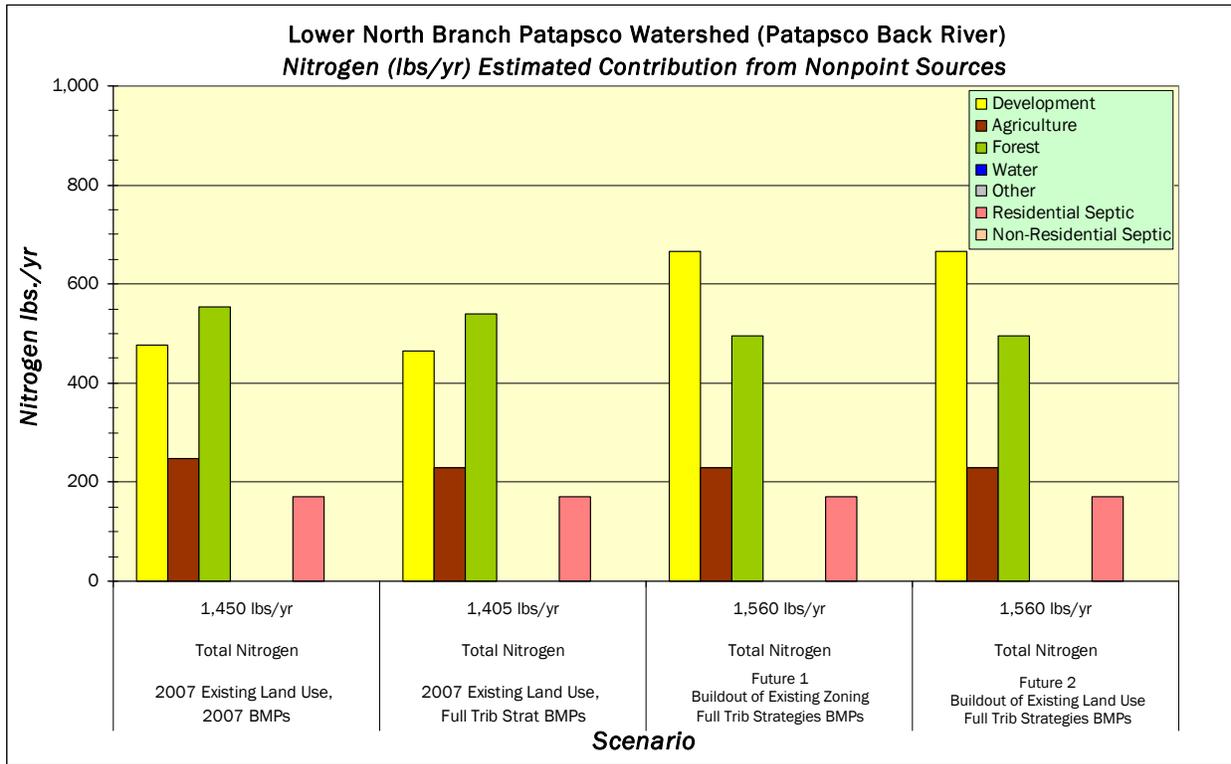
At the 6-digit watershed level, current nitrogen and phosphorous loads will decrease if the existing land use plan is implemented in conjunction with full tributary strategies BMPs. The full implementation of either existing zoning or land use scenarios would only produce a slight increase of approximately 2 percent for nitrogen and 4 percent for phosphorous over the 2007 Land Use with Tributary Strategy BMPs.

**Total Estimated Nitrogen and Phosphorus Loads
For Each 8-Digit Watershed in the Patapsco/Back River Basin**

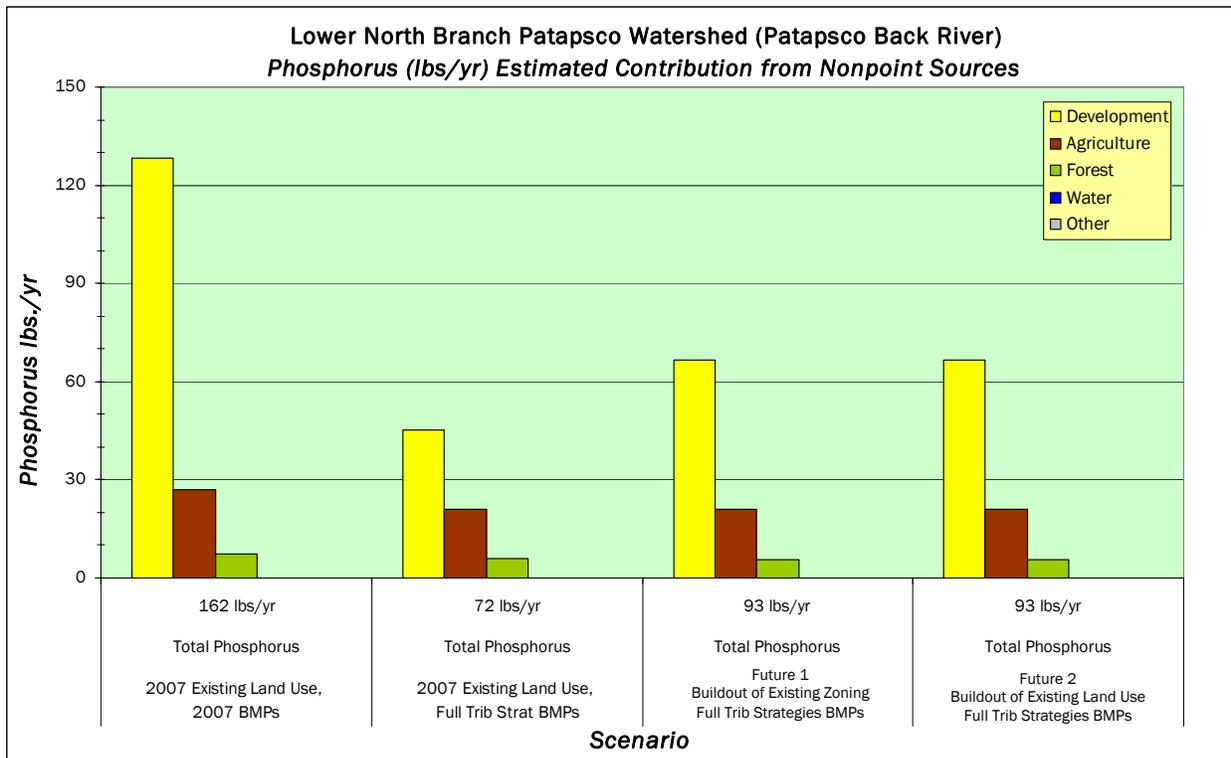
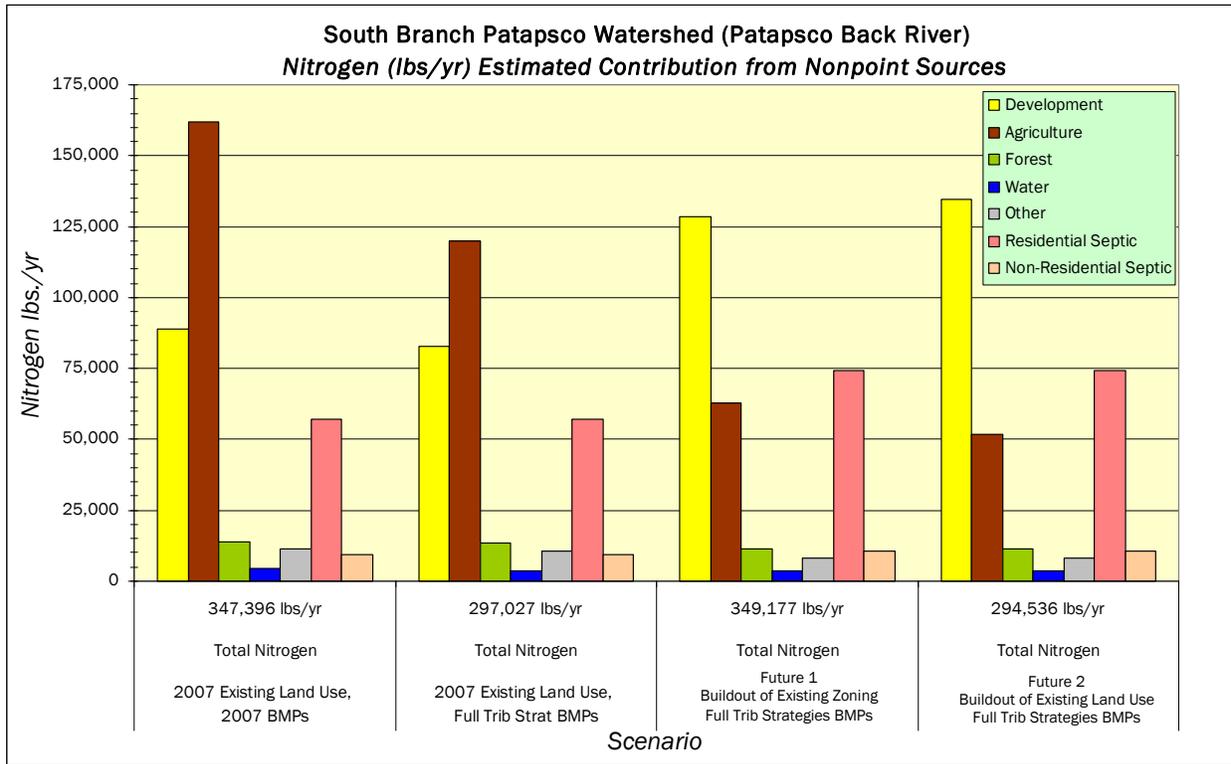
	2007 LU, 2007 BMPs (Lbs/Yr)		2007 LU, Trib Strat BMPs (Lbs/Yr)		Existing Zoning Trib Strat BMPs (Lbs/Yr)		Existing Land Use Trib Strat BMPs (Lbs/Yr)	
	Nit	Phos	Nit	Phos	Nit	Phos	Nit	Phos
Lower North Branch Patapsco	1,450	162	1,405	72	1,560	93	1,560	93
Liberty	793,658	52,037	682,508	39,871	701,942	41,830	700,636	41,744
S Branch Patapsco	347,396	23,354	297,027	17,923	299,434	18,724	294,536	18,646
Patapsco/Back Total	1,142,504	75,553	980,940	57,866	1,002,936	60,647	996,732	60,483

Source: NPSS, Data provided by MDP and Carroll County Comprehensive Planning, May 2009

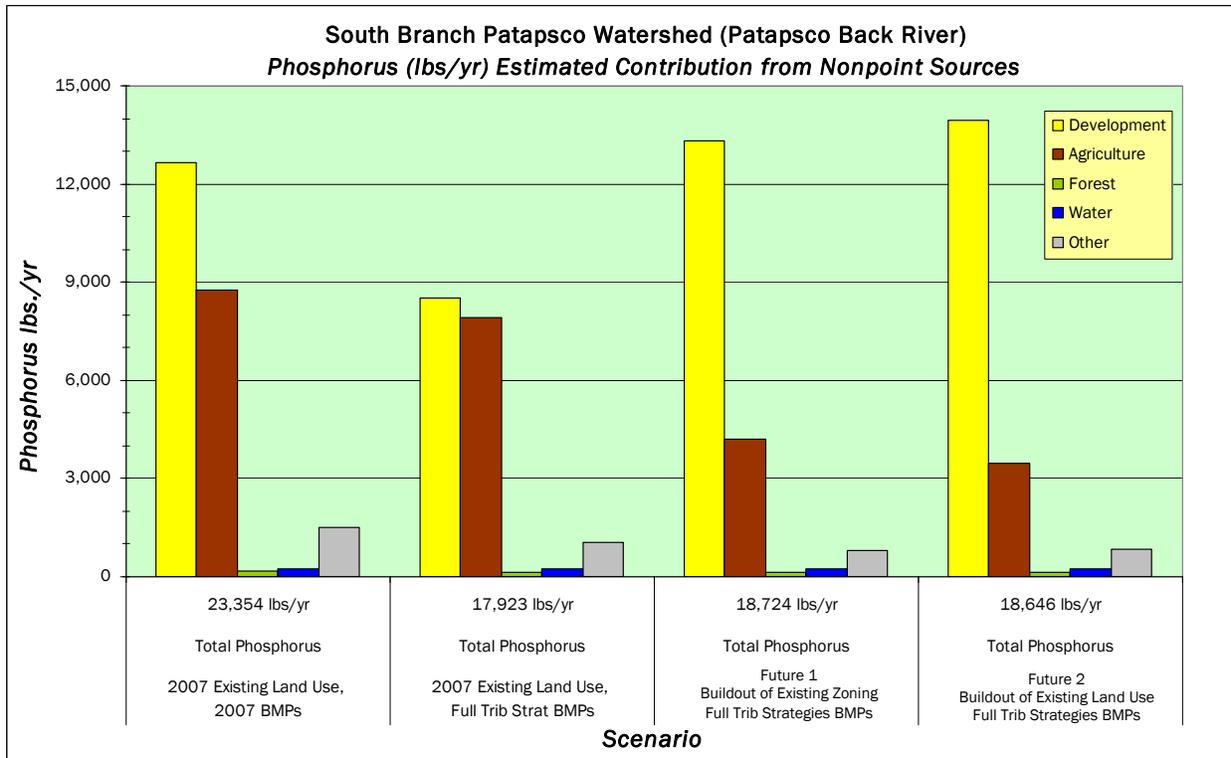
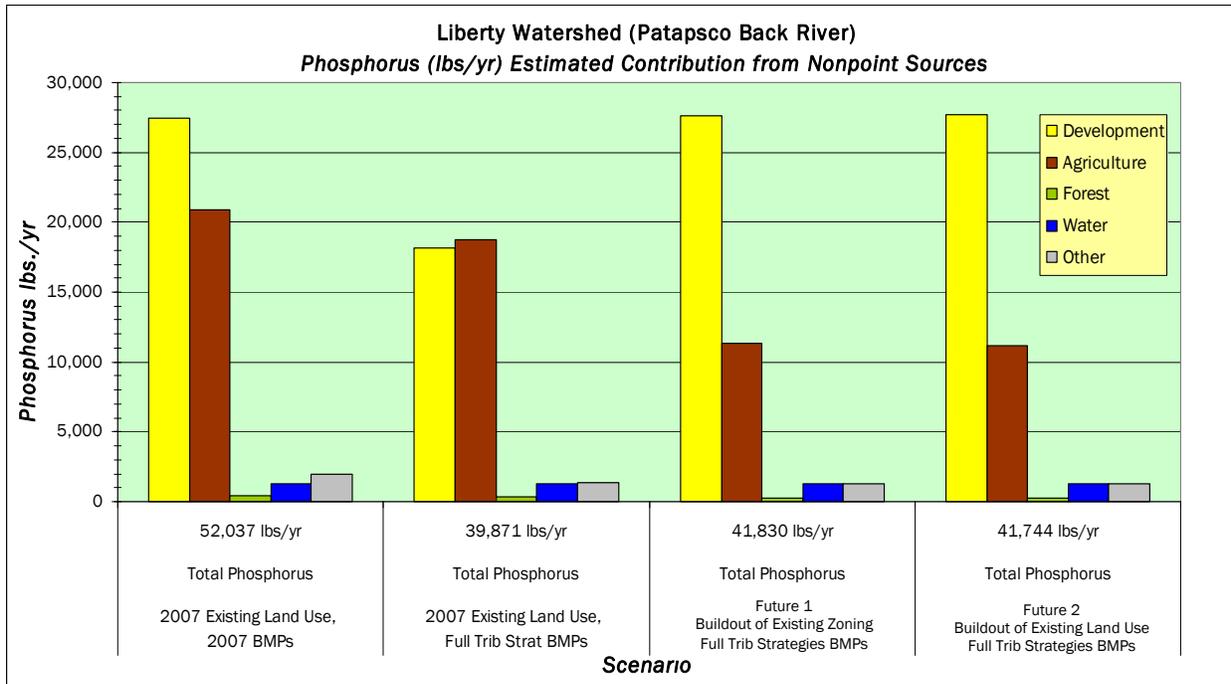
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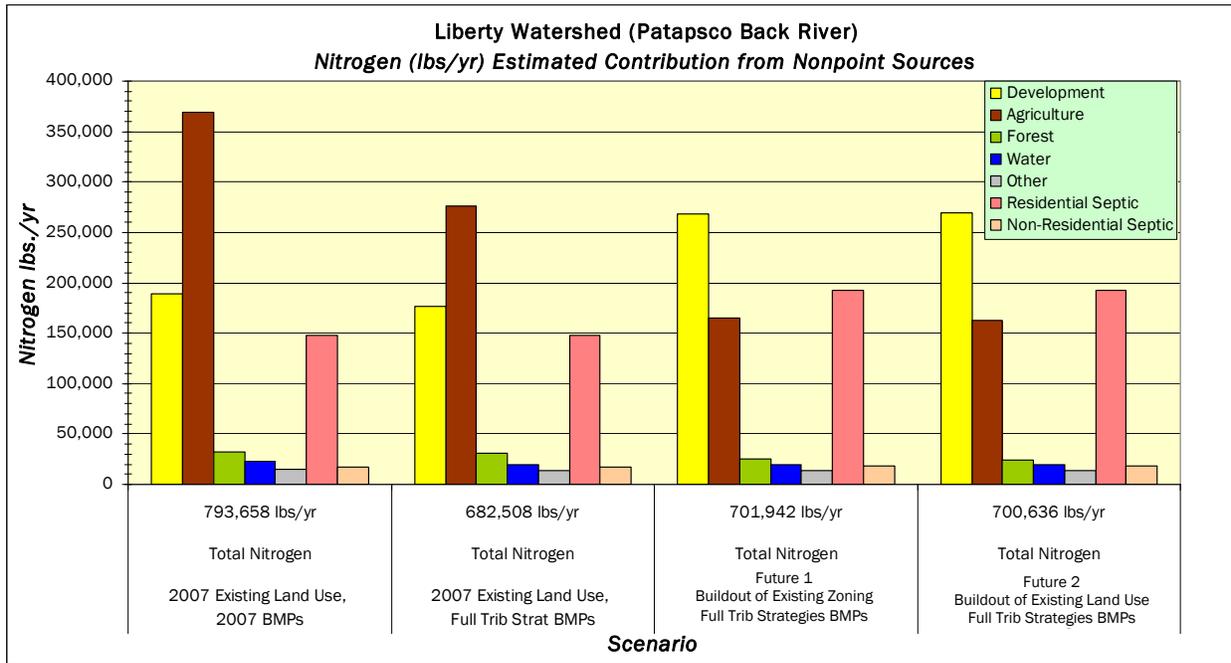
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■ Susquehanna Watershed (6-digit)

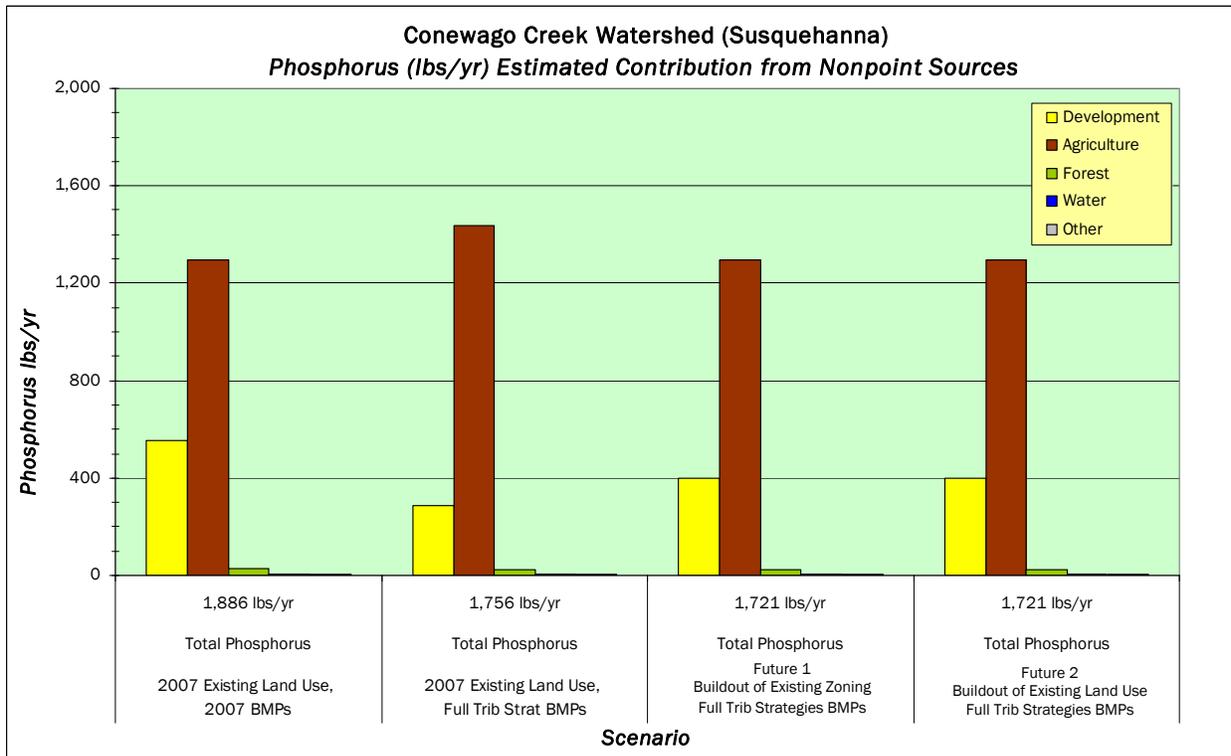
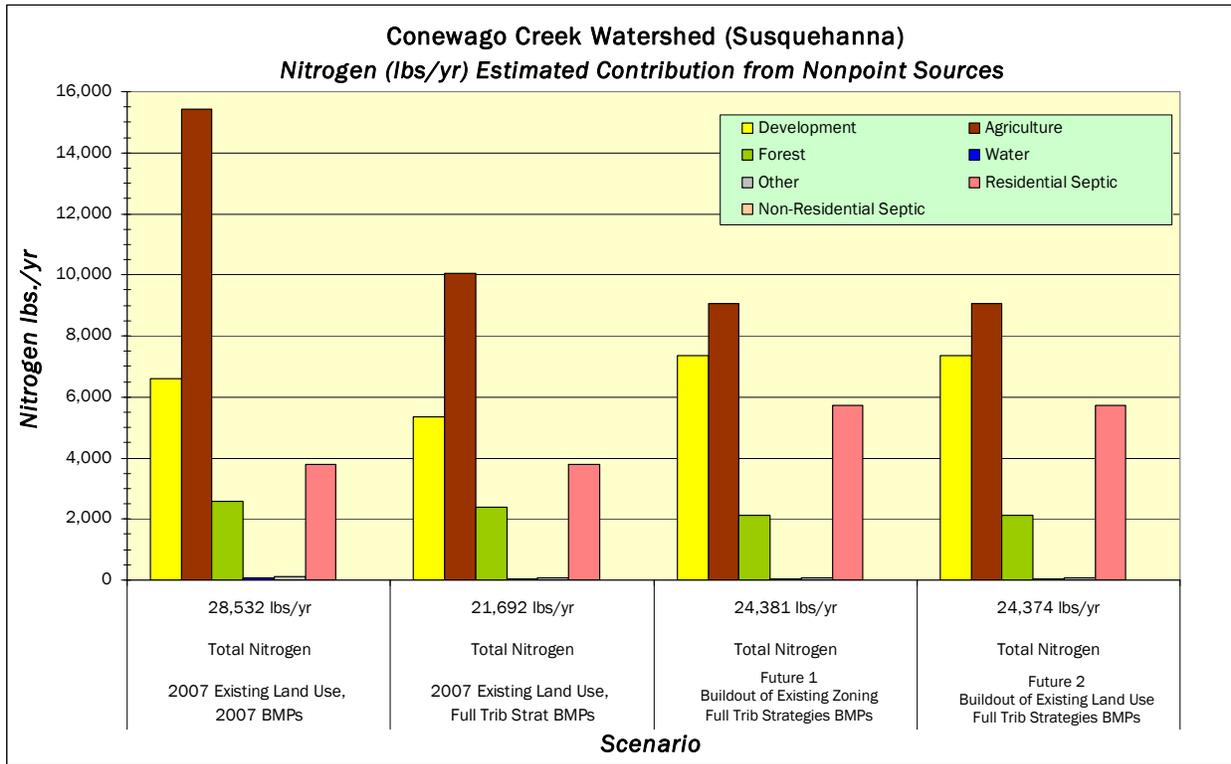
At the 6-digit watershed level, current nitrogen and phosphorous loads will decrease if the existing land use plan were to be implemented in conjunction with full Tributary Strategy BMPs. The full implementation of either existing zoning or land use scenarios would only produce a slight increase of approximately 12 percent for nitrogen and a slight decrease of 2 percent for phosphorous over the 2007 Land Use with Tributary Strategy BMPs.

**Total Estimated Nitrogen and Phosphorus Loads
For Each 8-Digit Watershed in the Susquehanna Basin**

	2007 LU, 2007 BMPs (Lbs/Yr)		2007 LU, Trib Strat BMPs (Lbs/Yr)		Existing Zoning Trib Strat BMPs (Lbs/Yr)		Existing Land Use Trib Strat BMPs (Lbs/Yr)	
	Nit	Phos	Nit	Phos	Nit	Phos	Nit	Phos
Conewago Creek	24,746	1,886	17,907	1,756	18,666	1,721	18,659	1,721
Susquehanna Total	24,746	1,886	17,907	1,756	18,666	1,721	18,659	1,721

Source: NPSS, Data provided by MDP and Carroll County Comprehensive Planning, May 2009

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■ **Countywide Summary**

Below is a chart showing the total NPS nitrogen and phosphorus loads and the total contribution from development.

Countywide Total Estimated Nitrogen and Phosphorus Loads

	2007 LU, 2007 BMPs (Lbs/Yr)	Baseline 2007 LU, Trib Strat BMPs (Lbs/Yr)	Existing Zoning Trib Strat BMPs (Lbs/Yr)	% Change from baseline	Existing Land Use Trib Strat BMPs (Lbs/Yr)	% Change from baseline
Total Terrestrial N Load	2,713,008	2,080,956	1,990,390	-4.35%	1,977,934	-4.95%
N from Residential Septic (EDUs)	342,770	342,770	487,084	42.10%	487,084	42.10%
N from Non-Residential Septic (EDUs)	49,808	49,808	52,442	5.29%	52,442	5.29%
Total Septic N Load	392,578	392,578	539,526	37.43%	539,526	37.43%
Total Nitrogen Load	3,134,453	2,514,312	2,551,926	1.50%	2,539,468	1.00%
Total Phosphorus Load	224,841	188,069	186,172	-1.01%	185,596	-1.31%

Combining all 6-digit watersheds in the county results in an overall decrease in nitrogen and phosphorous loads from the 2007 land use through the modeled scenarios. The breakdown of nitrogen loads from differing sources indicates a predicted decrease in total terrestrial loads, significant increase from total septic loads, with an overall minor increase in total nitrogen loads (<3%). The results for phosphorous only slightly change with a 1 percent decrease.

Countywide nitrogen loads by general land use categories:

The graphs titled “Nitrogen (lbs/yr) Estimated Contribution from Nonpoint Sources,” shown previously, provide a breakdown of nitrogen loads for the 8-digit watersheds for the modeled scenarios. The contribution and change in each source for the watersheds varies significantly. In just about every watershed, the contribution from agricultural sources decreases. In contrast, the contribution from development increases with future scenarios. In some watersheds, the contribution from residential septic systems increases dramatically.

Countywide phosphorus loads by general land use categories:

The graphs titled “Phosphorus (lbs/yr) Estimated Contribution from Nonpoint Sources,” provide a breakdown of phosphorous loads for the 8-digit watersheds for the modeled scenarios. A similar trend is seen in agriculture and development as with nitrogen loads. Since the only sources are from agricultural and development, no contribution from septic system loading is modeled.

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Countywide totals for Nitrogen and Phosphorus:

The following table provides a summary of calculated and modeled nutrient loadings totaled for Carroll County and its municipalities. These estimates become an important tool for land use planning, justification, and decision making.

Summary of Total Countywide Nutrient Loadings

	2007 LU, 2007 BMPs (Lbs/Yr)	Baseline 2007 LU, Trib Strat BMPs (Lbs/Yr)	Existing Zoning Trib Strat BMPs (Lbs/Yr)	Existing Land Use Trib Strat BMPs (Lbs/Yr)
Total NPS Nitrogen Load	3,134,453	2,514,312	2,551,926	2,539,468
Total NPS Phosphorus Load	224,841	188,069	186,172	185,596

For the receiving waters in Carroll County without a nutrient TMDL, a determination of the suitability of receiving waters cannot be made. However, for waterbodies with nutrient TMDLs, a preliminary assessment can be made, but the pollution forecasts, although capable of comparing the relative benefits of different land use plans, are not precise enough to allow for a direct comparison to nutrient TMDLs. Carroll County recognizes though that waterbodies with nutrient TMDLs can only be considered suitable receiving waters if future nutrient impacts are offset. This WRE includes a description of aggressive measures already in place for pollution control efforts and recommendations to help achieve that goal. Future refinements of the pollution forecast should allow for direct comparison to nutrient TMDLs as information becomes available.

The County and several of the municipalities are currently reviewing their community comprehensive plans. The results and findings of the WRE process have provided and are providing staff and their decision makers invaluable information regarding modifications to land use plans. An example is the Town of Manchester. The Town utilized information from capacity management plan worksheets, as well as other findings from initial WRE work, as support for the retraction of their Municipal GAB. This allows for their projected future growth area to align with estimated water, sewer, and other infrastructure capacities. Several other municipalities have incorporated similar recommendations within their strategies located in the Individual Municipal Systems sections of this document.

The determination of impacts either positive or negative to NPS loadings in Carroll County is a complicated issue. The modeled numbers above project significant improvements in loadings from 2007 Land Use if full implementation of Tributary Strategies occurs. This is, for all practical purposes, not a realistic scenario within the short term. If it is unrealistic, then using the Baseline 2007 Land Use with Tributary Strategy BMPs scenario becomes a true hypothetical exercise. The baseline scenario is an approximate 17-20 percent reduction in NPS nutrient loading countywide. The two additional scenarios, while exhibiting a slight increase, maintain this estimate. Therefore, it can be stated, based on hypothetical modeling, that existing County and municipal land use designations and/or zoning projected to buildout will not significantly increase loadings from the baseline estimate.

The County and its municipalities have historically developed and adopted programs and methods related to managing nonpoint source loadings. In fact, as was highlighted via the

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Builders for the Bay effort, the County's stormwater management program is considered to be one of the leaders in the state. This effort will be continued and strengthened with the future adoption of the Stormwater Management Act of 2007 requirements. The County and its municipalities are also currently exploring techniques, programs, and methods through land use planning and zoning to reduce NPS loadings. High on the priority list is reducing development outside GABs (reduction in potential septic systems loadings) while promoting growth in the municipalities within water and sewer capacities.

The refinement of programs and techniques combined with enhancement of land use planning within and among the County and its municipalities provides the best possible scenario for continued improvements in NPS loading reductions.

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