Metropolitan Washington Council of Governments

Anne Arundel County Draft Phase II Watershed Implementation Plan

January 18, 2011

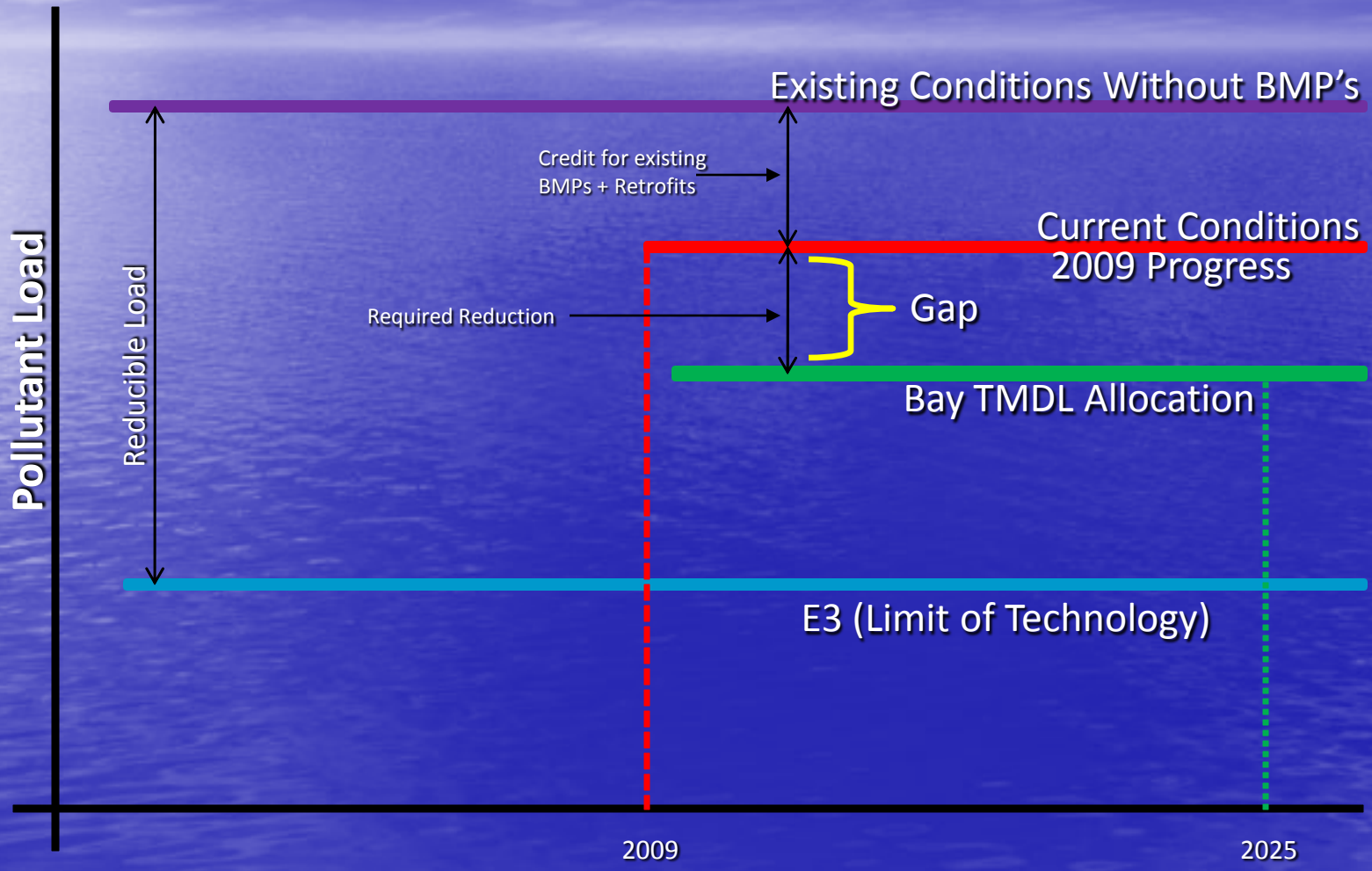
Chesapeake Bay TMDL Pollutants of Concern

Nitrogen

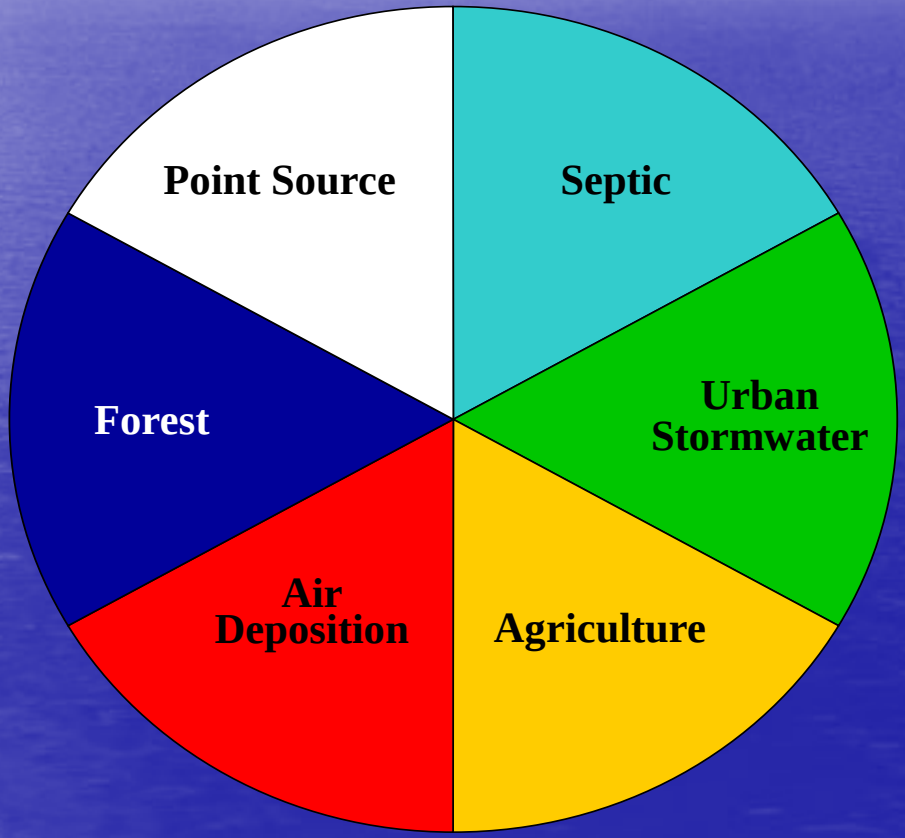
Phosphorus

Sediment

TMDL Allocation and Gap Determination



Maryland Department of Environment Allocation of Existing Load by Source Category to Anne Arundel County



Anne Arundel County Pollutant Load Allocations

Total Nitrogen

Source Sector	Final Target Load			
	2020 Final Target Load	% of Total Load	% Reduction of Reducible Load	% Reduction from 2009 Progress
Urban	500,778	21%	36%	22%
Agriculture	141,996	6%	41%	34%
Septic	314,602	13%	46%	45%
Forest	286,450	12%	-1%	0%
Air	18,447	1%	2%	1%
Major Municipal WWTP	733,843	31%		
Minor Municipal WWTP	23,337	1%		
Major Industrial WWTP	244,882	10%		
Minor Industrial WWTP	61,639	3%		
Federal Major Municipal WWTP	67,002	3%		
Total	**2,392,976**			

Total Phosphorus

Source Sector	Final Target Load			
	2020 Final Target Load	% of Total Load	% Reduction of Reducible Load	% Reduction from 2009 Progress
Urban	60,403	36%	50%	38%
Agriculture	20,168	12%	29%	24%
Forest	18,267	11%	0%	0%
Air	1,107	1%	3%	2%
Major Municipal	54,490	32%		
Minor Municipal	3,887	2%		
Major Industrial	3,678	2%		
Minor Industrial	2,790	2%		
Federal Major Municipal	5,025	3%		
Total	**169,815**			

Anne Arundel County TMDL Edge of Stream (EOS) Nitrogen Loads and Allocations by Source Sector

Source Sector	Total Nitrogen Load (lbs/year)			EOS Target Load (1)	Maximum Nitrogen Reducible Load (lbs/year)	Implementing 100% of Maximum Reducible Load
	Existing (3)	Proposed WIP Reductions (lbs/year)	With Proposed draft WIP			
Anne Arundel County Government						
County WWRFs (Major Municipals)	448,123	-122,250	570,372	570,372 (5)	-122,250	TBD
Septic	881,266 (9)	323,223	558,043	558,043 (9)	599,334	
Urban Storm Water	737,516	223,560	513,956	444,582 (7)	TBD	
County Natural Lands	153,937	0	153,937	153,937	0	
Sub-total	**2,220,842**	**Work in Progress**	**TBD**	**1,726,934**	**TBD**	
Non Anne Arundel County Government						
Major Industrial	303,091	Work in Progress	TBD	244,882 (6)	TBD	
Minor Municipal	21,602	Work in Progress	TBD	37,956 (6)	TBD	
Minor Industrial	80,992	Work in Progress	TBD	61,639 (6)	TBD	
Federal Municipal	16,528	Work in Progress	TBD	67,002 (6)	TBD	
Federal Urban Stormwater	29,776 (4)	Work in Progress	TBD	16,437 (7)	TBD	
State Urban Stormwater	90,006	Work in Progress	TBD	24,479 (7)	TBD	
City of Annapolis Urban Stormwater	43,389	Work in Progress	TBD	10,651 (7)	TBD	
Agriculture Lands (USDA/MDA/SCD)	244,009	Work in Progress	TBD	141,996 (8)	TBD	
Other Natural Lands	42,554	0	42,554	42,554	0	
Atmospheric Deposition	18,447	0	18,447	18,447	0	
Sub-total (6)	**890,394**	**Work in Progress**	**TBD**	**666,042**	**TBD**	**TBD**
TOTAL	**3,111,235**	**Work in Progress**	**TBD**	**2,392,976**	**TBD**	**TBD**
Bay TMDL Cap				**2,392,976 (2)**		

**Last updated on January 12, 2011, version 4, developed by Hala Flores, P.E. Reviewed by Ginger Ellis and Ronald Bowen.*

(1) Draft Anne Arundel County Source Sector target allocations (subject to change).

(2) Total Anne Arundel County Base TMDL Cap (Based on MDE draft allocation Dec 29, 2010).

(3) Existing 2009 Load - based on 2007 aerial photography and delineation of landcovers. Source Sector estimates are without existing BMPs.

(4) Federal load is based on 2007 landcover condition and does not account for extensive development of existing open space due to BRAC.

(5) Target load based on ENR load cap.

(6) Target load based on current permitted cap.

(7) Target load based on statistical correlation to achieve fair condition biological health. (Based on TN = 2.7 lbs/Acre and TP = 0.38 lbs/Acre)

(8) Target load based on MDE draft allocation.

(9) Utilizes MDE TN delivery ratios based on proximity to critical area and 1,000 ft. of non-tidal streams.

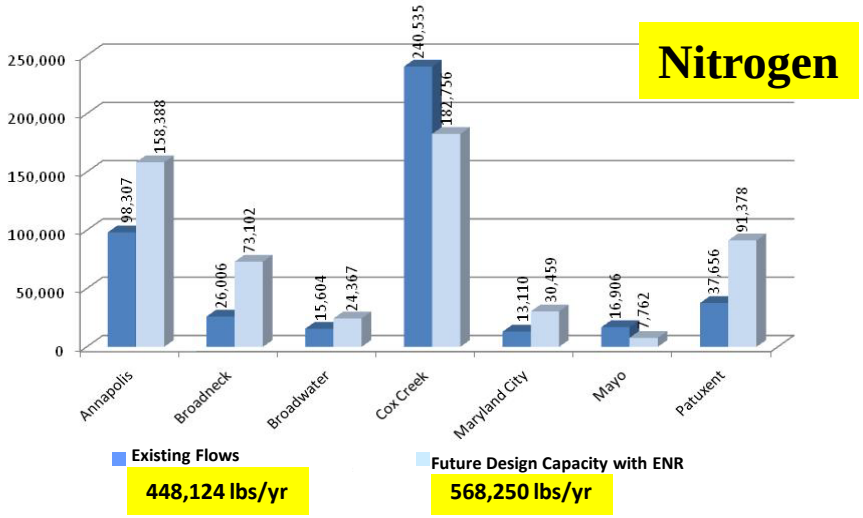
Point Source Water Reclamation Facilities

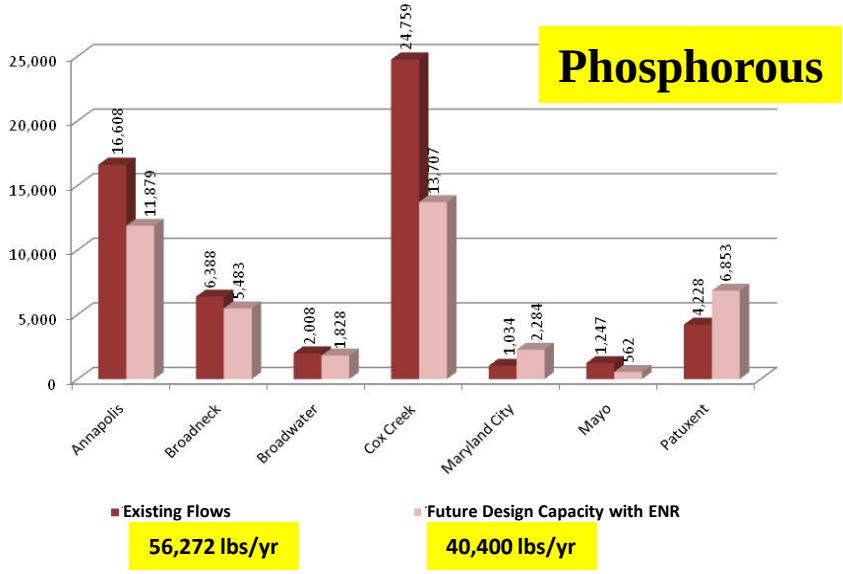
Enhanced Nutrient Removal Upgrades

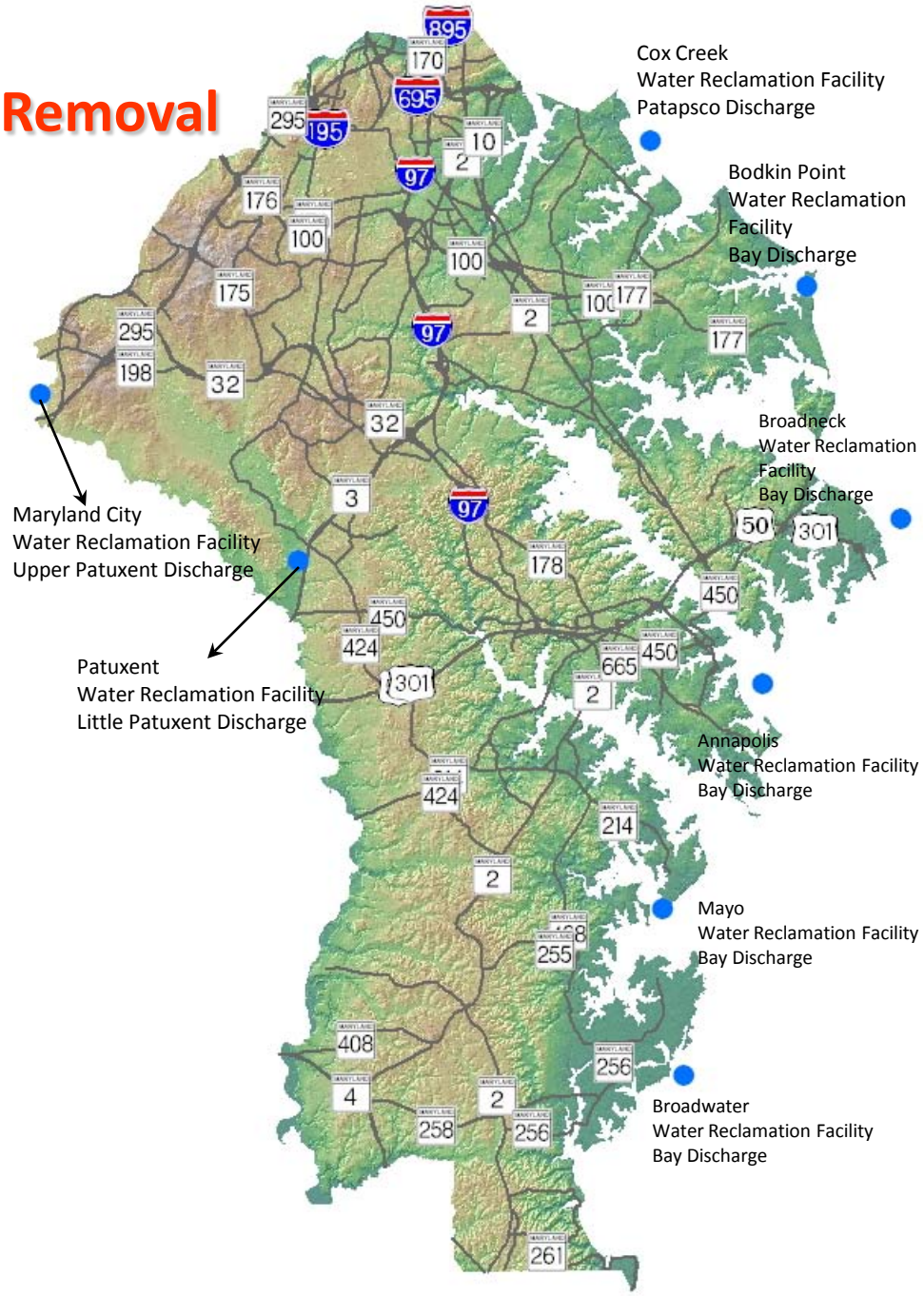
$270,000,000

Anne Arundel County

Point Source Enhanced Nutrient Removal





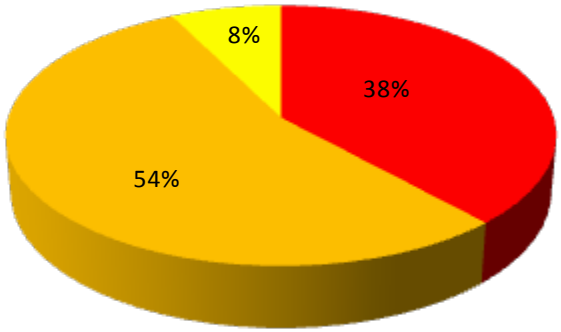


Septic Systems Challenge to Reduce Pollutant Loads

What will be our strategy?

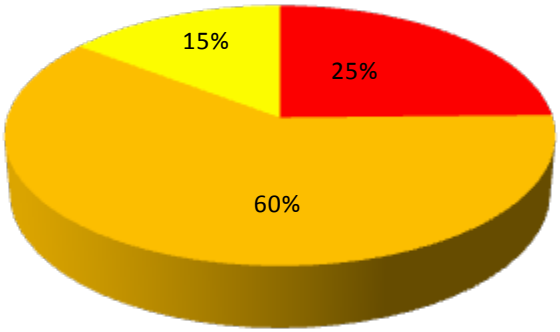
Anne Arundel County
Septic Systems Nitrogen Loads

Before Treatment

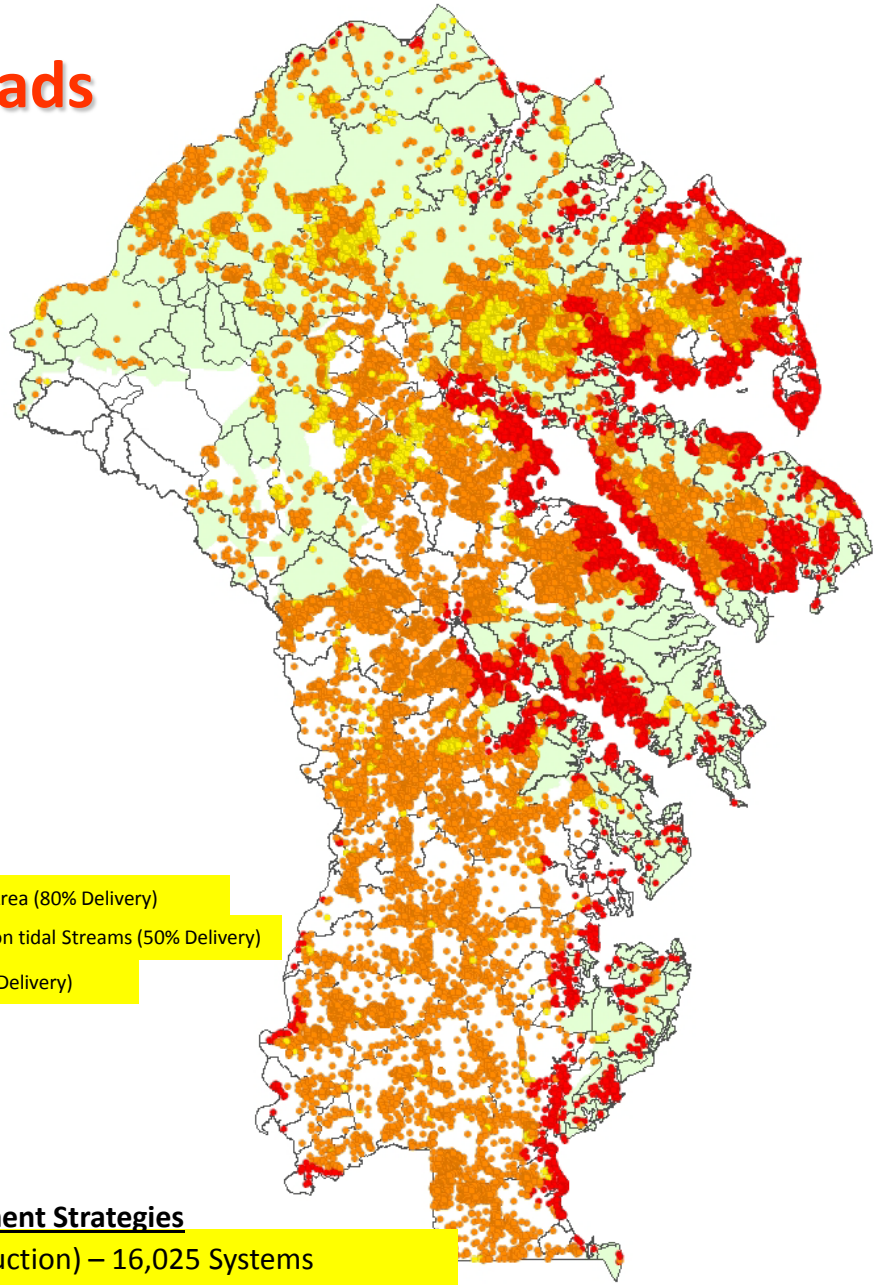


Total Nitrogen = 881,266 lbs/yr

After Treatment



Total Nitrogen = 281,932 lbs/yr



Recommended Septic Treatment Strategies

- Connect to Sewer (93% Reduction) – 16,025 Systems
- Place on Cluster Treatment (93% Reduction) – 8,878 Systems
- Upgrade to Nitrogen Removal (50% Reduction) – 14,148 Systems

Septic System Strategic Plan

Proposed Alternative Solutions

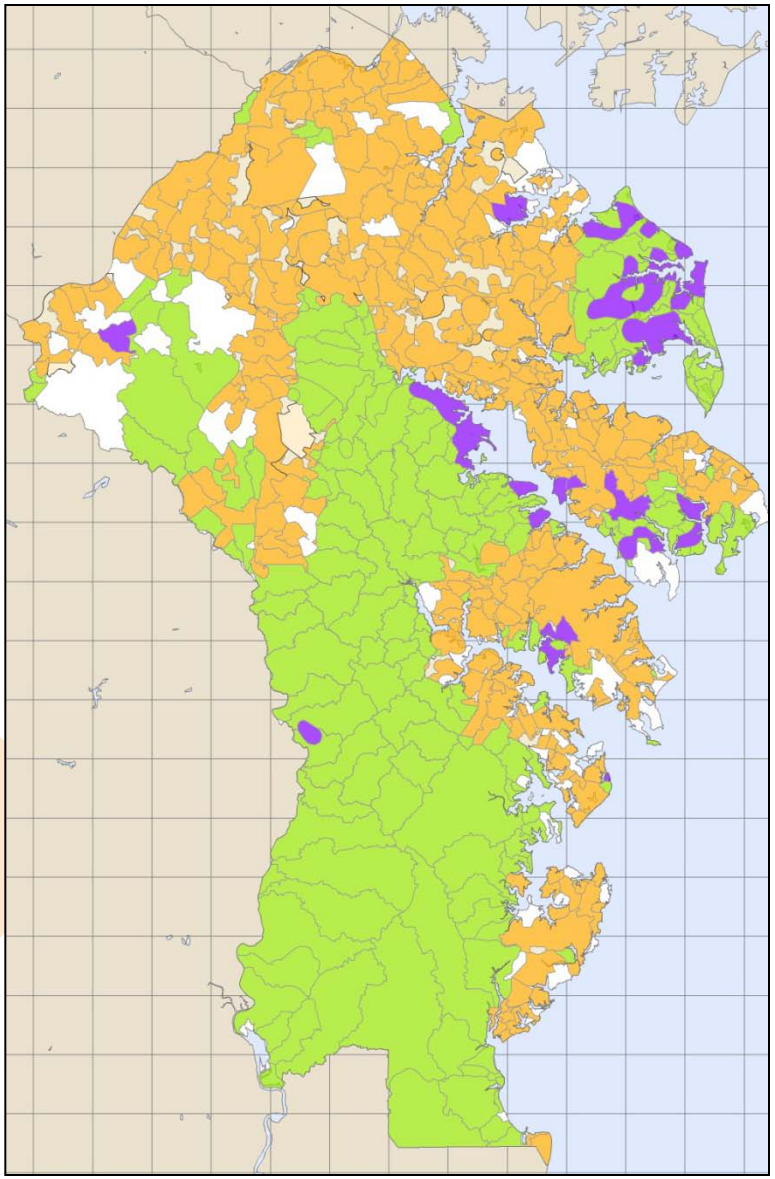
Public Sewer Extension

Cluster Treatment Systems

OSDS Nitrogen Reduction Units

Low Priority Areas

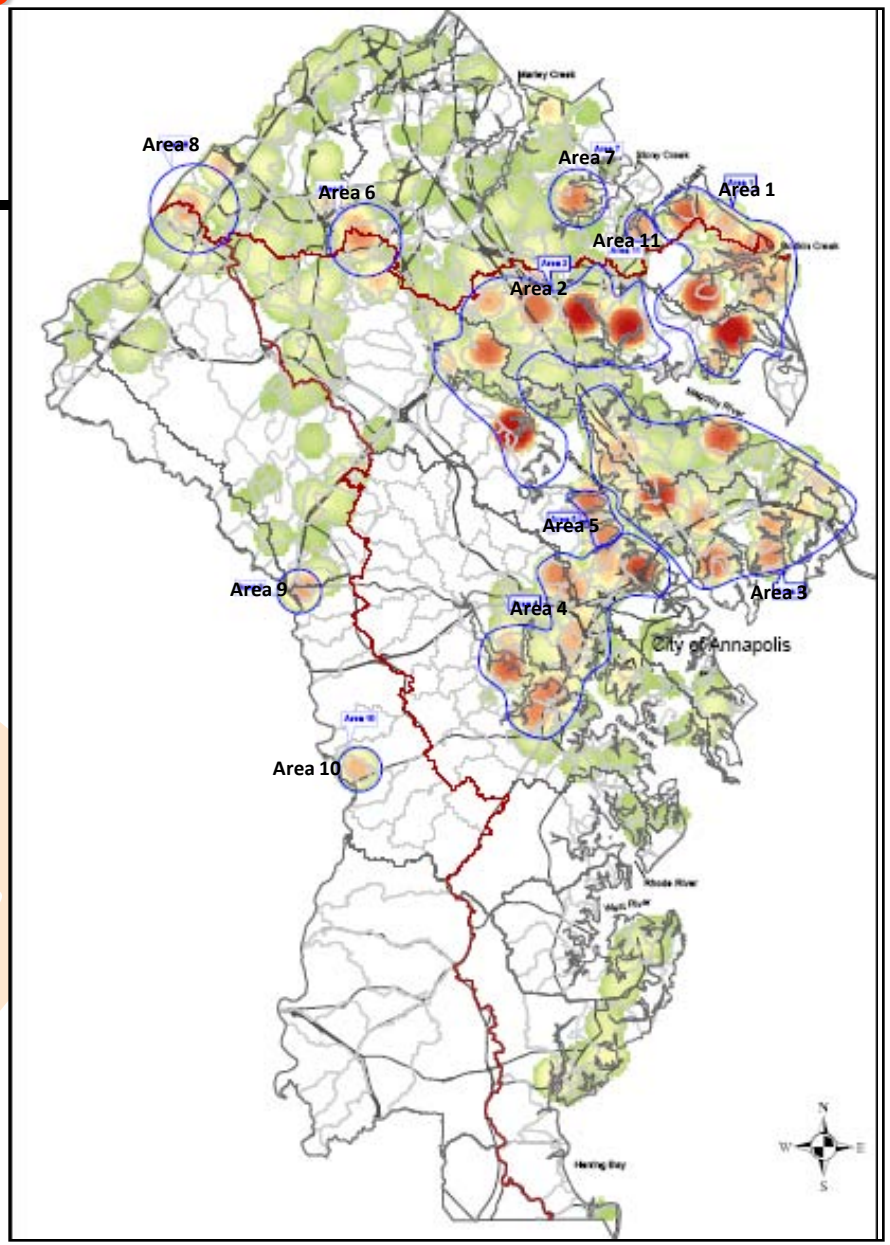
Not Applicable



WIP Septic Load Reduction Targeted Management Areas

Recommended Treatment Alternative

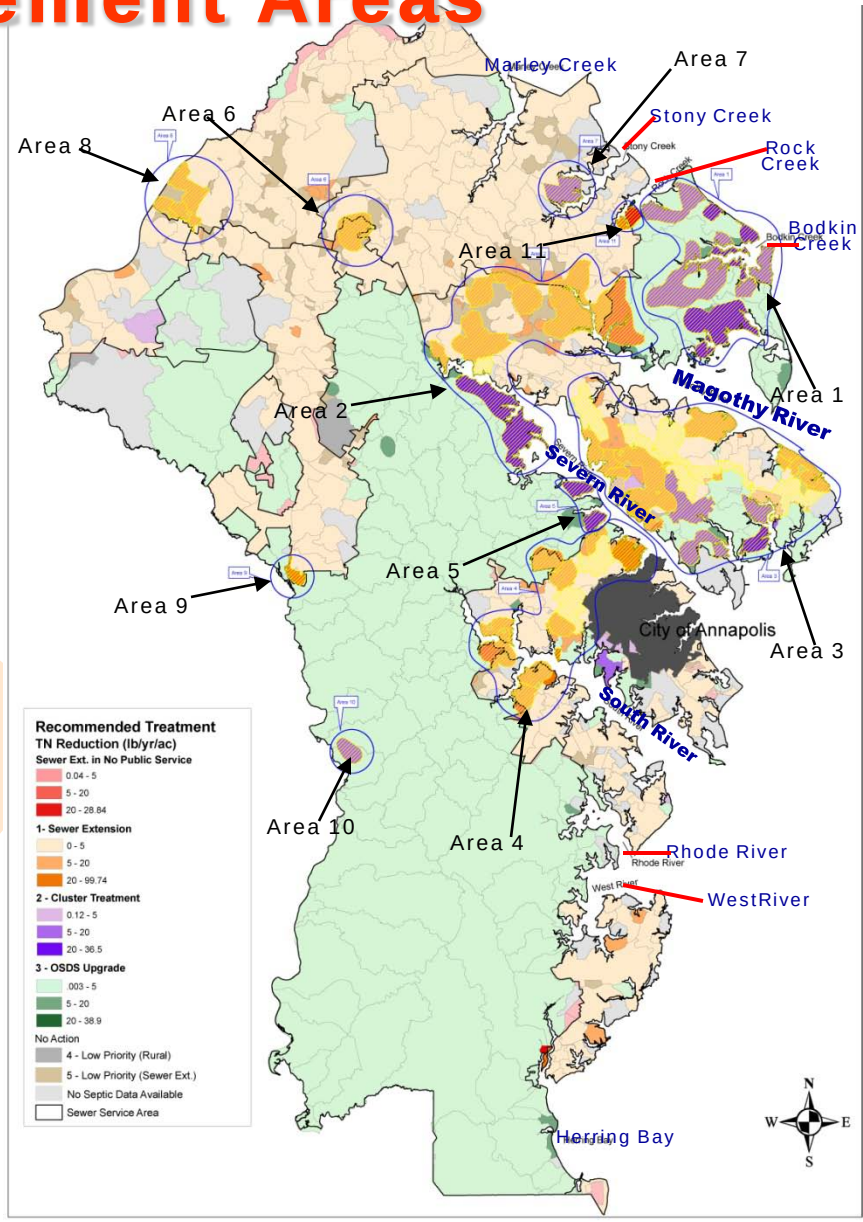
Area #	# OSDS	Treatment Type	SSA	Watershed
1	4,644	Cluster	Rural	Bodkin/Magothy/Patapsco Tidal
2	6,925	Sewer Extension	Broadneck	Magothy/Severn
3	3,849	Sewer Extension	Broadneck	Magothy/Severn
4	2,545	Sewer Extension	Annapolis	Severn/South
5	617	Cluster	Rural	Severn
6	626	Sewer Extension	Broadneck	Severn/Patapsco Tidal
7	147	Sewer Extension	Cox Creek	Patapsco Tidal
8	305	Sewer Extension	Baltimore City	Little Patuxent/Patapsco Non-Tidal
9	61	Sewer Extension	Patuxent	Upper Patuxent
10	281	Cluster	Rural	Upper Patuxent
11	233	Sewer Extension	Cox Creek	Patapsco Tidal
Total	20,233			



WIP Septic Load Reduction Targeted Management Areas

Potential TN Load Reduction

Area #	# OSDS	Existing TN Load	Load after Treatment at 4 mg/L	TN Lbs Removed
1	4,644	85,733	13,129	72,604
2	6,925	119,349	20,135	99,214
3	3,849	75,030	12,129	62,901
4	2,545	62,135	10,303	51,832
5	617	12,967	1,639	11,328
6	626	5,710	1,595	4,115
7	147	6,829	1,151	5,678
8	305	5,972	1,193	4,779
9	61	4,830	967	3,863
10	281	3,716	772	2,944
11	233	4,958	628	4,330
Totals	20,233	387,229	63,640	323,589



WIP Septic Load Reduction
Targeted Management Areas

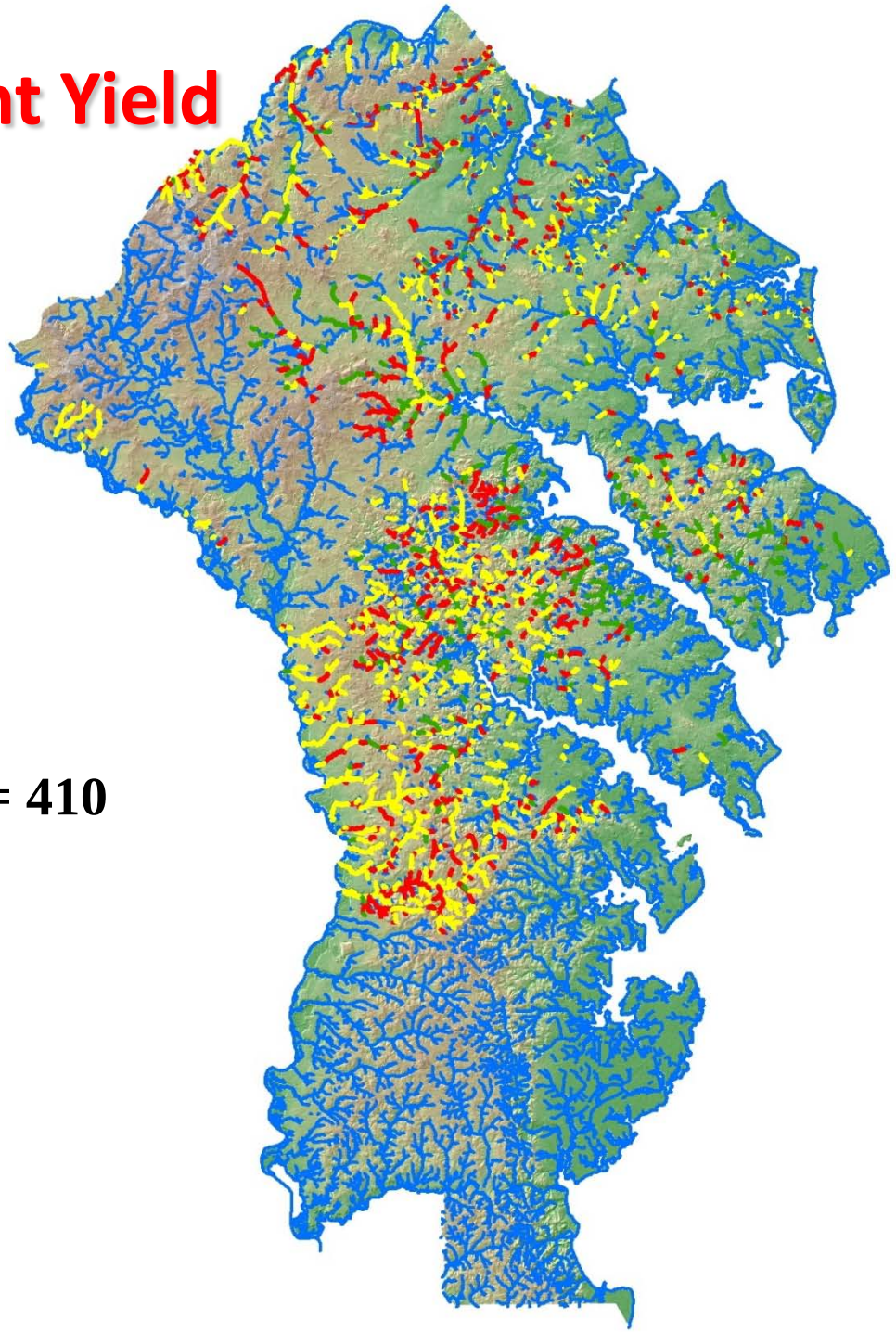
Area #	# OSDS	Existing TN Load	Treatment at 4 mg/L	TN Lbs Removed	Treatment Type	SSA	Watershed	Cost Per unit	Cost
1	4,644	85,733	13,129	72,604	Cluster	Rural	Bodkin/Magothy/Patapsco Tidal	$36,203.00	$168,126,732.00
2	6,925	119,349	20,135	99,214	Sewer Extension	Broadneck	Magothy/Severn	$38,000.00	$263,150,000.00
3	3,849	75,030	12,129	62,901	Sewer Extension	Broadneck	Magothy/Severn	$38,000.00	$146,262,000.00
4	2,545	62,135	10,303	51,832	Sewer Extension	Annapolis	Severn/South	$38,000.00	$96,710,000.00
5	617	12,967	1,639	11,328	Cluster	Rural	Severn	$36,203.00	$22,337,251.00
6	626	5,710	1,595	4,115	Sewer Extension	Broadneck	Severn/Patapsco Tidal	$38,000.00	$23,788,000.00
7	147	6,829	1,151	5,678	Sewer Extension	Cox Creek	Patapsco Tidal	$38,000.00	$5,586,000.00
8	305	5,972	1,193	4,779	Sewer Extension	Balto City	Little Patuxent/Patapsco Non-Tidal	$38,000.00	$11,590,000.00
9	61	4,830	967	3,863	Sewer Extension	Patuxent	Upper Patuxent	$38,000.00	$2,318,000.00
10	281	3,716	772	2,944	Cluster	Rural	Upper Patuxent	$36,203.00	$10,173,043.00
11	233	4,958	628	4,330	Sewer Extension	Cox Creek	Patapsco Tidal	$38,000.00	$8,854,000.00
Totals	20,233	387,229	63,640	323,589					$758,895,026.00

Urban Stormwater Challenge to Reduce Pollutant Loads

What will be our strategy?

Stream erosion is the major source of sediment transported to our tidal waterways.

Perennial Stream Sediment Yield



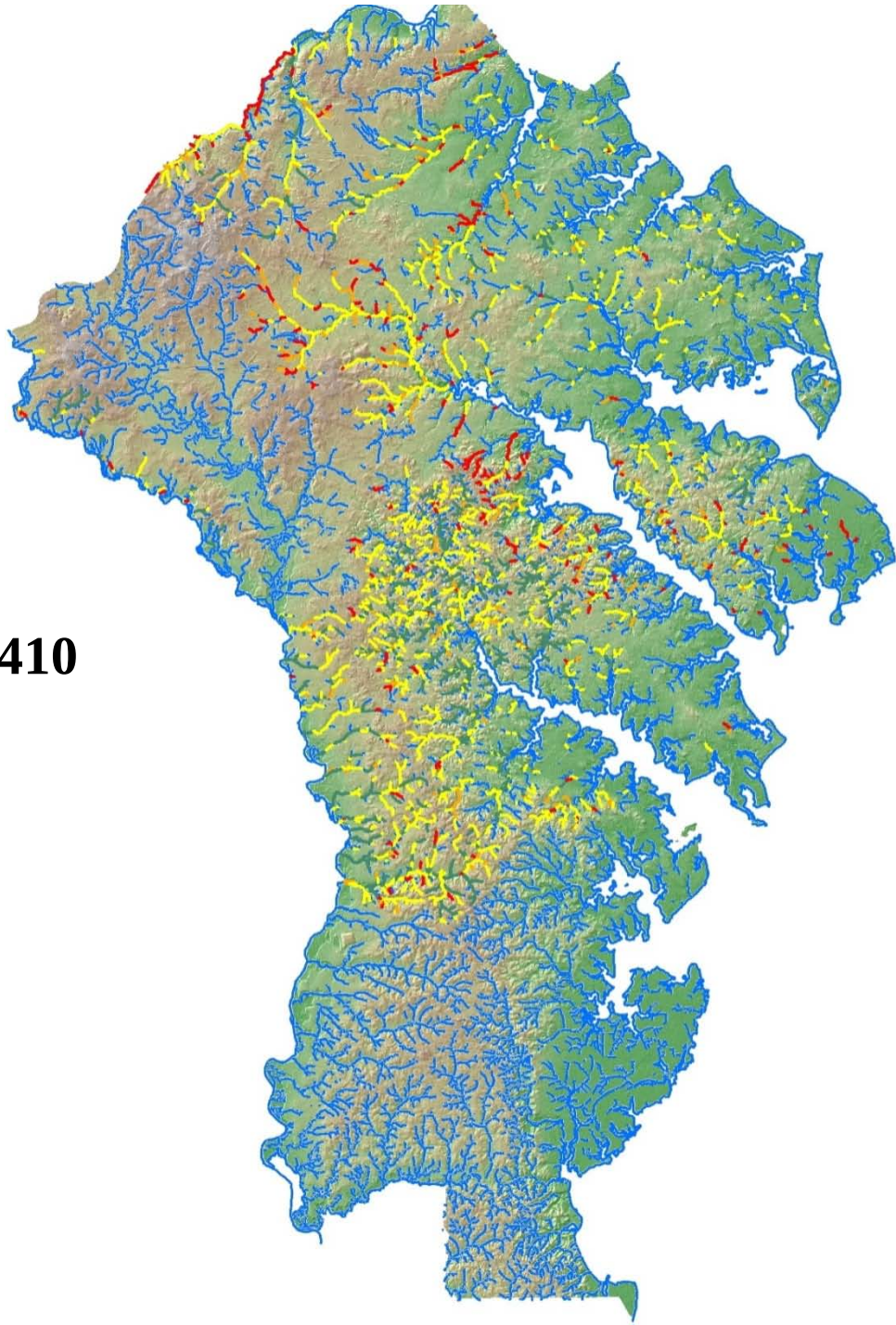
Assessed Perennial Stream Miles = 410

Sediment Yield	Miles
High	134
Moderate	210
Low	66

Physical Habitat Quality

Severely degraded habitat quality

Minimally degraded habitat quality



Assessed Perennial Stream Miles = 410

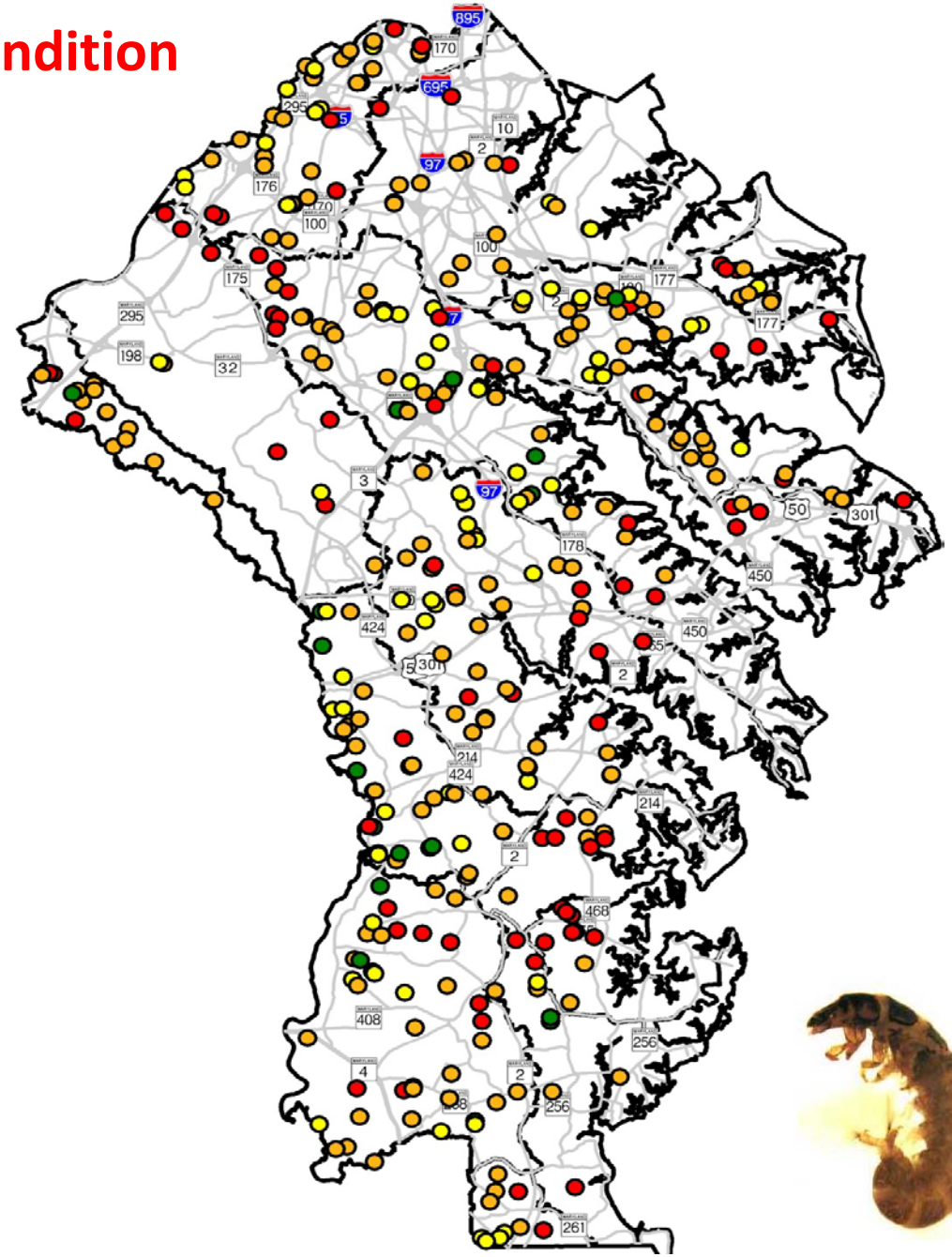
Habitat Quality	Miles
Severely Degraded	218
Degraded	16
Partially Degraded	102
Minimally Degraded	74
Not Assessed To-Date	--

Anne Arundel County
Perennial Streams Biological Condition

Benthic Index for Biotic Integrity (BIBI) Score

Number of Samples - 376

- **Good** - 5%
- **Fair** - 23%
- **Poor** - 49%
- **Very Poor** - 23%



Degraded Stream Conditions

Dynamics of Erosion of Headwater Streams

- Incised Channels
- Accelerated Sediment Transport
- Phosphorus Contribution
- Lost Groundwater Hydrology
- Loss of Floodplain / Wetland Functions

Step Pool Stormwater Conveyance (SPSC) Restoration Strategy

Newly Reconstructed Stormwater Outfall


Six Year Evolution to Forest Ecosystem

Stormwater Edge of Stream Core Implementation Strategy

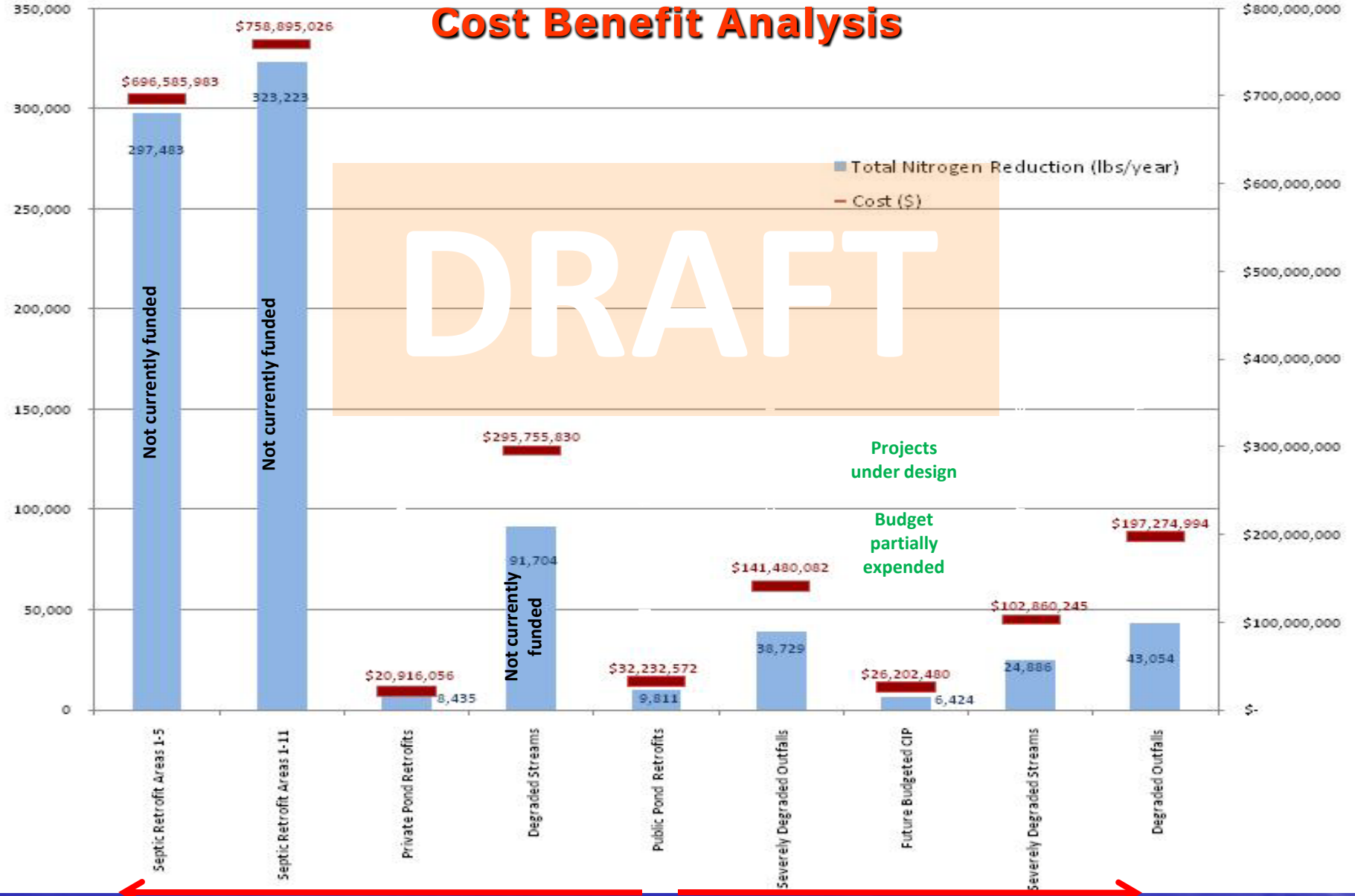
- Stream Channel Restoration
- Ephemeral Channel Restoration
- Stormwater Outfall Restoration
- Stormwater Pond Restoration

Draft Urban Stormwater Retrofit Scenarios
Anticipated Pollutant Reduction and Cost

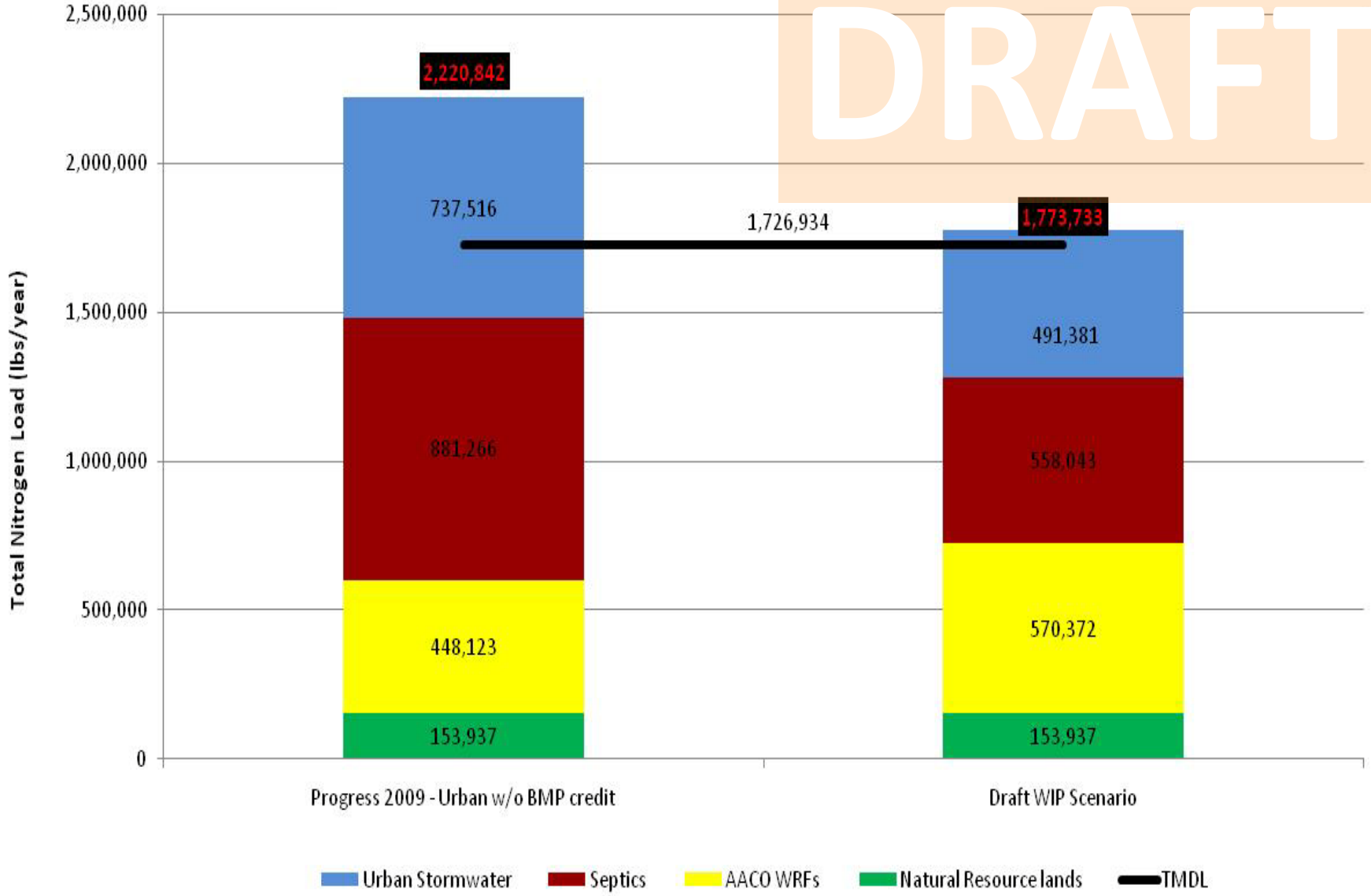
Retrofit Type	Quantity	Units	Description	Total Contributary Drainage Acres	Impervious Acres Retrofit	Pollutant Reduction			Preliminary Cost ($)	TN Cost/lb	TP Cost/lb
						TN (lbs/year)	TP (lbs/year)	TSS (Tons/year)			
Private Pond Retrofits	101	# of Ponds	Retrofit of all extended detention private ponds approved prior to 2002.	2,189	996	8,435	1,597	185	$ 21,926,272	**2599**	**13,734**
Public Pond Retrofits	92	# of Ponds	Retrofit of all extended detention public ponds approved prior to 2002.	3,374	1,012	9,811	1,799	198	$ 33,789,361	**3444**	**18,787**
Future Budgeted CIP	35	Projects	This scenario quantifies the benefits of implementing future CIP restorations with approved budget	2,172	759	6,940	1,277	140	$ 26,202,480	**3776**	**20,515**
Degraded Streams	70	Miles	Retrofit of degraded channels based on physical habitat assessment	47,194	8,109	91,704	18,021	2,443	$ 382,093,567	**4167**	**21,203**
Severely Degraded Streams	24	Miles	Retrofit of severely degraded channels based on physical habitat assessment	13,303	2,204	24,886	4,922	660	$ 107,703,198	**4328**	**21,881**
Severely Degraded Outfalls	927	# of Outfalls	Retrofit of outfalls within the 1st quartile subwatersheds ranked for restoration using filtering BMP (SPSC system).	10,661	4,249	38,729	7,120	796	$ 176,521,853	**4558**	**24,793**
Degraded Outfalls	997	# of Outfalls	Retrofit of outfalls within the 2nd quartile subwatersheds ranked for restoration using filtering BMP (SPSC system).	14,866	4,401	43,054	7,962	875	$ 246,136,043	**5717**	**30,914**
Completed Projects	149	Projects	This scenario quantifies the benefit for CIP restorations performed since 2002 and up to 2009	4,463	1,337	10,421	15,698	19,558	N/A	**N/A**	**N/A**
Total				**93,760**	**21,731**	**223,560**	**42,697**	**5,297**	**$ 994,372,774**	**N/A**	

Proposed Urban Stormwater and Septic Retrofit Scenarios for *Total Nitrogen*

Cost Benefit Analysis



Nitrogen TMDL and Watershed Implementation Plan



Ultimate Goals

- Restored Stream Stability
- Restored Hydrology within Floodplains & Streams
- Restored Biological Health of Streams
- Compliance with Water Quality Standards

What is the Potential Cost to Anne Arundel County

Point Source	$270,000,000
Septic	$758,900,000
Urban Stormwater	$994,400,000
	$2,023,300,000

Disclaimer

The information in this presentation is "DRAFT" work in progress. It is fully anticipated that the defined Anne Arundel County load allocation will change as well as the draft target loads for individual source sectors. These changes once implemented by regulatory agencies will have corresponding impacts on projected existing loads, strategies for load reduction and associated cost estimates.

Current cost estimates are raw costs based on present time value of money. The estimates do not reflect the cost impacts associated with timing of the capital investments/improvements over the duration of the implementation schedule.

We hope the information presented provides valuable insight into the complexity and magnitude of what will be required to pursue compliance with the Chesapeake Bay TMDL allocation as well as local watershed TMDL's.