Regional Advisory Panel Meeting

Brandywine - Christina Healthy Water Fund

Mount Cuba Center, Hockessin, Delaware
September 18, 2014

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AGENDA

Brandywine-Christina Healthy Water Fund Feasibility Study
Regional Advisory Panel Meeting
Mount Cuba Center
Hockessin, Delaware
September 18, 2014
10:00 AM to 1:00 PM

10:00 AM	Welcome and Introductions
10:15 AM	Update from May 30th Regional Advisory Panel Meeting
10:30 AM	Stakeholder Interview Process Update
10:40 AM	Brandywine-Christina Benefit-Cost Analysis
11:00 AM	Next Steps
11:15 AM	Advisory Panel Discussion
12:15 PM	Luncheon

Advisory Panel and Project Team Members

Advisory Panel Members	
Jennifer Adkins	Partnership for the Delaware Estuary
Janet Bowers, Alternate: Barbara D'Angelo	Chester County Water Resources Authority
Jon Capacasa	USEPA, Region 3
William Covaleski	Victory Brewing
Kevin Donnelly	New Castle Conservation District
John Goodall	Brandywine Conservancy
Steve Tambini, Alternate: Ken Najjar	Delaware River Basin Commission
Michael Leff, Alternate: Sarah Low	USDA/Urban Waters Federal Partnership
Robert Molzahn	Water Resources Association of the Delaware River Basin
David Small, Alternate: Frank Piorko	Delaware DNREC
Blaine Phillips	The Conservation Fund
Dawn Rittenhouse	DuPont
Domenic Rocco, Alternate: Rhonda Manning	Pennsylvania DEP, Southeast Regional Office
Donna Siter	Western Chester County Chamber of Commerce
Christian Strohmaier, Alternate: Adam Mowrey	Chester County Conservation District
Bernard Sweeney	Stroud Water Research Center

Project Team Members		
Brian Boutin	The Nature Conservancy- Delaware Chapter	bboutin@tnc.org
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September 18, 2014

Dear Advisory Panel Member:

Thank you for agreeing to participate in our second meeting of the Regional Advisory Panel assembled to discuss the possibilities of a new business model to achieve fishable, swimmable, and potable water quality in the Brandywine-Christina watershed by 2025.

The Nature Conservancy and the University of Delaware Water Resources Agency are collaborating with researchers, public utilities, agricultural extension agents, government agencies, and other non-profits to design a watershed-based funding strategy for the Brandywine-Christina watershed. Water funds, as these strategies are sometimes called, may be new to this area, but the concept is not new. Funds have been implemented successfully elsewhere in the United States and other countries. The Brandywine-Christina study is a year-long process concluding in February 2015, funded by the William Penn Foundation as part of its $35 million investment in the Delaware River Basin.

As part of the study, we have convened a Regional Advisory Panel. The purpose of the panel is to ensure that the study process is well-informed, transparent, and representative of diverse interests in the watershed. Because of your important role in the watershed, we have invited you to serve on the advisory panel. Your input will help the team develop a long-term financial mechanism to ensure a lasting and sustainable investment in the health of the Brandywine-Christina watershed.

We have scheduled our second meeting of the advisory panel for Thursday, September 18, 2014 from 10 AM to 1 PM at the Mt. Cuba Center near Ashland, Delaware. We will provide lunch. Many of you participated in our first meeting on May 30, 2014 at Longwood Gardens, Kennett Square, Pennsylvania.

We hope you will join us to help make this process a catalyst for meaningful and long-term change in the Brandywine-Christina watershed.

Sincerely,

Richard Jones, Jr.
State Director
The Nature Conservancy—Delaware Chapter

Gerald J. Kauffman
Director
University of Delaware—Water Resources Agency

The Brandywine-Christina watershed

UPDATE ON ACTION ITEMS, MAY 30TH REGIONAL ADVISORY PANEL MEETING

ACTION	RESPONSE
Map high priority areas	Presented in cost/benefit analysis.
Review existing plans	Reviewed seven existing management plans; summary included below.
Define a unifying driver	In process through stakeholder interviews.
Itemize existing funding	In process.
Develop a communications and marketing plan	Inventorying existing communications through other organizations; included in planning for continuation of project.

PRIORITY ACTIONS FROM BRANDYWINE-CHRISTINA WATERSHED PLANS

Report	Watershed	Priority Actions
Christina Basin Pollution Control Strategy [1]	Christina, White Clay, Red Clay, Brandywine watersheds – DE	*Stormwater management* • Increase urban tree canopy. • Identify areas where stormwater retrofits will effectively reduce sediment and nutrients. *Open space preservation and protection* • Protect existing wooded/vegetated open space areas. • Require management plans for community open space areas that are designed for water quality protection, including reduced nutrient loading. • Require forested riparian buffers of adequate and proper widths sufficient to reduce or eliminate nonpoint source pollution for all new development. • Implement stream restoration projects. • Acquire/conserve additional open space and retain conservation easements. • Reforest watersheds and headwaters. *Agriculture* • Nutrient management plans • Cover crops • Pasture stream fencing • Grassed filter strips • Grassed waterways • Forested riparian buffers • Pasture and hay planting
Wilmington Source Water Protection Plan[2]	Brandywine watershed – PA and DE	• Agricultural mitigation (stream bank fencing; conservation and nutrient management plans) • Agricultural preservation • Forest preservation • Open space preservation • Riparian buffer and forest reforestation • Stormwater runoff mitigation
White Clay Creek, Red Clay Creek, Brandywine Creek Watershed Action Plans and Brandywine Creek Watershed Conservation Plan[3]	White Clay, Red Clay, Brandywine watersheds – PA and DE	• Reduce stormwater runoff to mitigate flooding, erosion and sedimentation, to restore water quality and riparian habitats (manure management, fencing, conservation plans, stormwater improvement projects and retrofits, stream restorations, monitoring). • Protect and expand forested riparian buffer networks, particularly for first order streams (protect existing buffers, establish new buffers). • Protect and enhance cultural, recreational, and historic resources (including open space preservation).

Priority Actions from Brandywine-Christina Watershed Plans (Cont.)

Report	Watershed	Priority Actions
Upper East Branch Brandywine Creek Watershed Conservation Plan 2004[4]	Brandywine watershed - PA	• Protect and maintain high quality streams and improve conditions as necessary. • Preserve priority tributary watersheds. • Protect and restore degraded and threatened streams. • Further analyze significantly degraded streams for appropriate site-specific restoration activities. • Protect high quality of priority watershed reserve areas. • Protect priority wetland reserve areas. • Protect the Downingtown drinking water supply. • Address flooding hot-spots in Downingtown and identify stormwater retrofit needs. • Reforest most riparian areas within 100 feet of streams. • Preserve priority agricultural lands. • Protect an integrated system of forest and riparian hubs and corridors.
White Clay Creek Watershed Management Plan[5]	White Clay watershed - PA and DE	• Improve and conserve water quality and water quantity. • Conserve open space, woodlands, wetlands and geologic features. • Protect native plant and animal species. • Preserve cultural, historical and archaeological sites. • Enhance outdoor recreation opportunities. • Encourage environmental education and watershed awareness. • Protect and improve water quality and stream habitat through floodplain and wetland protection. • Protect and improve water quality and stream habitat through riparian forest buffer enhancement. • Protect and improve water quality and stream habitat through sediment and stormwater management. • Protect and improve water quality and stream habitat through slope protection. • Sustain biodiversity through habitat linkage and management. • Encourage dedication, purchase and stewardship of open space. • Address stream bank stabilization, water-quality enhancement and restoration of fish and wildlife habitat on an integrated, comprehensive, watershed-wide basis.

1. Delaware Tributary Action Teams, Delaware Department of Natural Resources and Environmental Control (DNREC) and University of Delaware, Water Resources Agency
2. City of Wilmington, Delaware and Crockett Consulting
3. Brandywine Valley Association (BVA), Chester County Water Resources Authority (CCWRA), Red Clay Creek Valley Association (RCVA), Chester County Planning Commission, Camp Dresser and McKee, Gaadt Perspectives, LLC
4. Brandywine Conservancy and Upper East Branch Steering Committee
5. White Clay Wild and Scenic Study Task Force and National Park Service Northeast Region

Benefit-Cost Analysis
Brandywine-Christina Healthy Water Fund

Objective

Prepare a subwatershed-based benefit-cost analysis to define revenue and investment needs for a future Brandywine-Christina Healthy Water Fund. The objective of the water fund is to incentivize restoration of the watershed to meet Clean Water Act fishable, swimmable, and potable goals by 2025.

Methods

1. **Water Quality Monitoring:** Review stream water quality monitoring data for stations operated by the Delaware DNREC and U.S. Geological Survey (Figure 1 and 2).

2. **SPARROW Model: Utilize USGS model** (Figure 3) to estimate annual nitrogen loads from atmospheric, wastewater, urban/suburban, and agriculture sources and apply TMDL load reductions.

3. **TMDL Load Reductions:** Summarize Total Maximum Daily Load reductions by subwatershed for nitrogen (Table 1 and Figure 4) and sediment (Table 3 and Figure 6) promulgated by EPA, DNREC, and PADEP in 2006.

4. **Estimate Costs:** Estimate annual costs to reduce TMDL loads for nitrogen (Table 2 and Figure 5) and sediment (Table 3 and Figure 7) by 2025. Employ unit costs of N and TSS load reductions based on the literature:
    - Atmospheric Deposition ($75/lb N reduced)
    - Wastewater Treatment ($28/lb N reduced)
    - Urban/Suburban ($100/lb N reduced)
    - Agriculture Conservation ($5/lb N reduced)
    - Sediment ($0.2/lb sediment reduced)

5. **Summarize Costs:** Calculate annual costs based on two scenarios:
    A. Assume load reduction costs are spread evenly across the four sources.
    B. Invest in least cost practices first based on marginal abatement cost principles

Results

Annual least cost of load reductions in the Brandywine-Christina watershed range from $6.7 million for nitrogen to $13.8 million for sediment. Restoration costs are complimentary as agricultural conservation practices for nitrogen reduction also reduce sediment (and phosphorus and pathogens/bacteria).

Watershed	Nitrogen	Sediment
Brandywine Creek	$1,822,736	$821,866
Red Clay Creek	$1,720,894	$4,378,400
White Clay Creek	$2,701,154	$8,619,200
Christina River	$520,903	
Brandywine/Christina	**$6,765,687**	**$13,819,466**

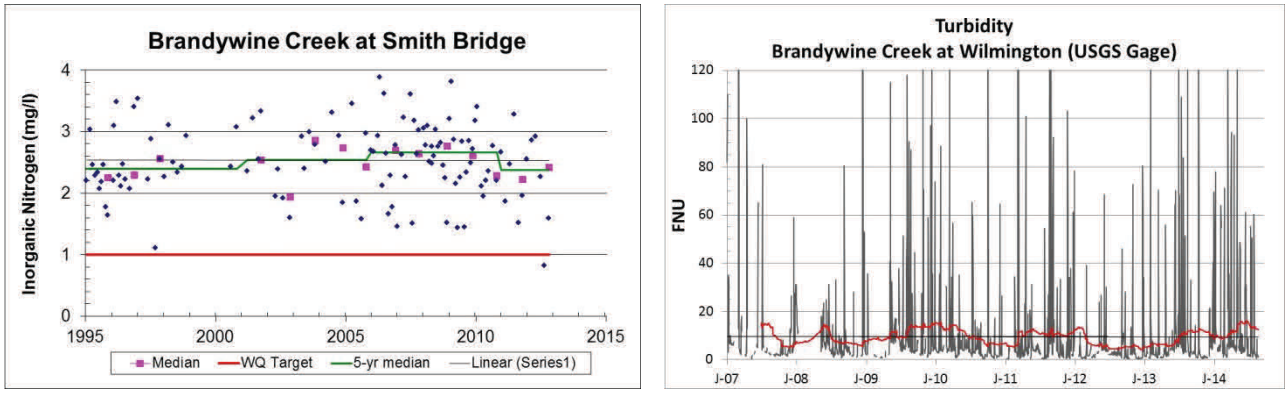


Figure 1. Stream water quality monitoring data along the Brandywine Creek

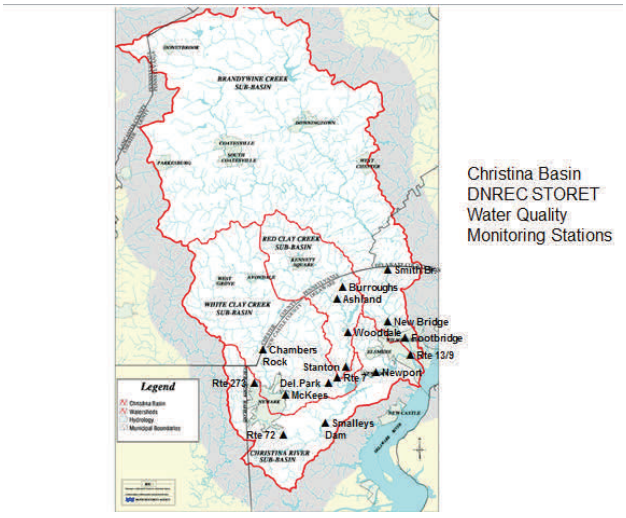


Figure 2. Stream water quality monitoring stations in the Brandywine-Christina watershed in Delaware

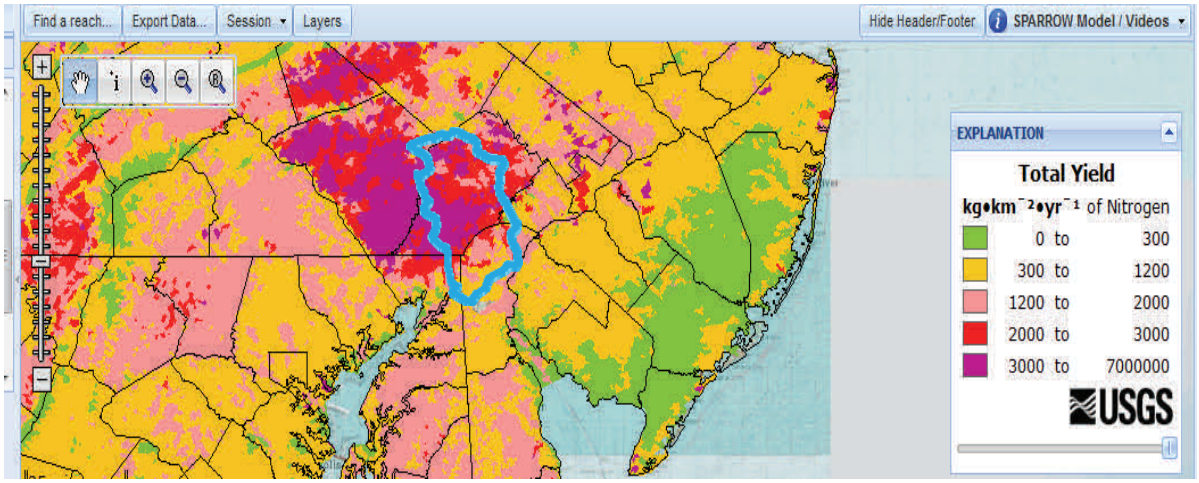


Figure 3. Nitrogen loads from the USGS SPARROW model

Table 1. TMDL load reductions for nitrogen set by EPA in 2006

Subwatershed	Area (sq. mi.)	N Load (kg/day)	N Allocation (kg/day)	% N Reduction
Brandywine Creek				
B01	18.4	394	245	38%
B02	27.7	336	269	20%
B03	16.9	759	692	9%
B08	33.0	508	417	18%
B16	26.5	255	249	2%
B17	6.1	45	38	16%
Red Clay Creek				
R01	17.5	285	169	41%
R02	7.4	127	67	47%
R04	12.5	80	43	46%
White Clay Creek				
W01	10.2	158	80	49%
W02	15.8	236	120	49%
W03	18.8	266	168	37%
W04	14.3	211	106	50%
W08	10.1	72	55	24%
Christina River				
C01	20.9	208	166	20%
C04	9.2	32	30	6%
C06	21.9	78	74	5%

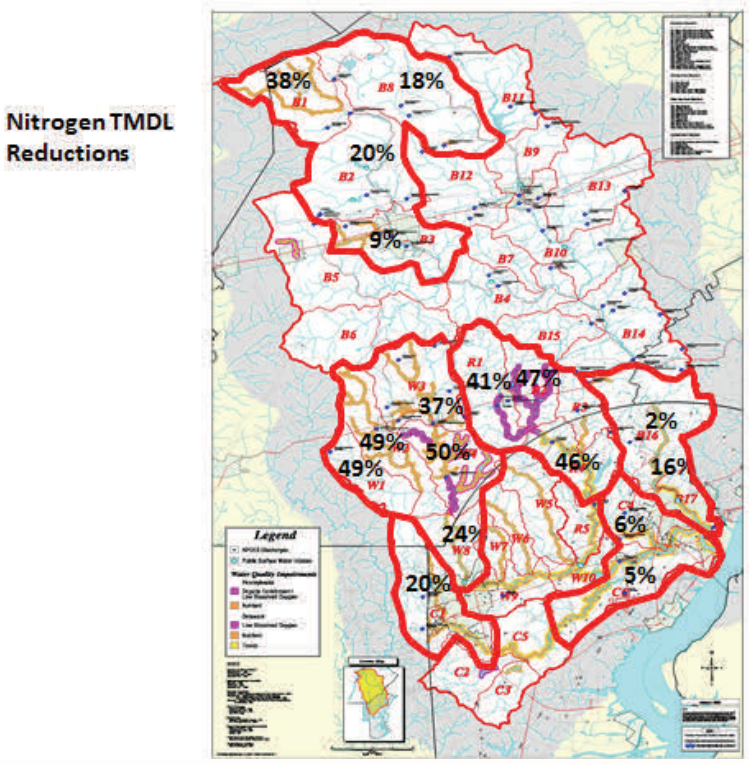
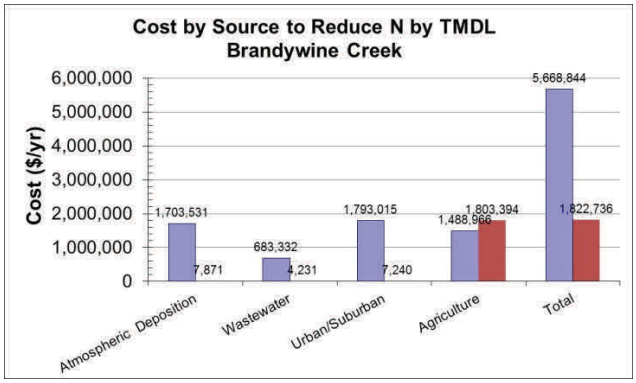
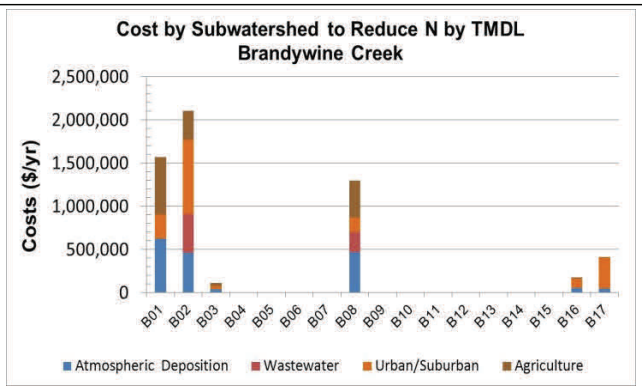


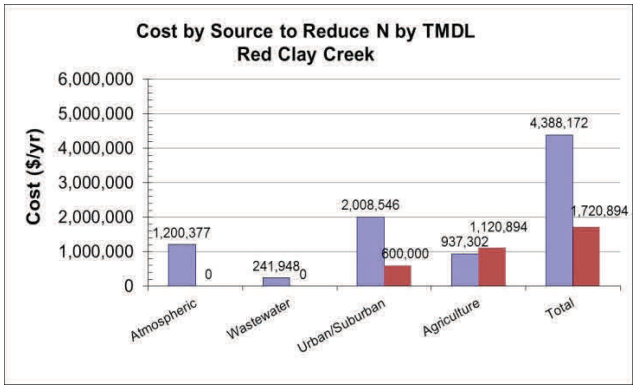
Figure 4. Nitrogen load reductions required by TMDL set by EPA in 2006

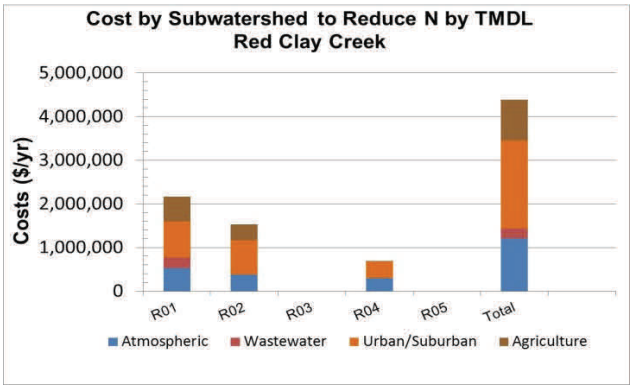
Table 2. Annual cost of nitrogen load reductions in Brandywine-Christina watershed

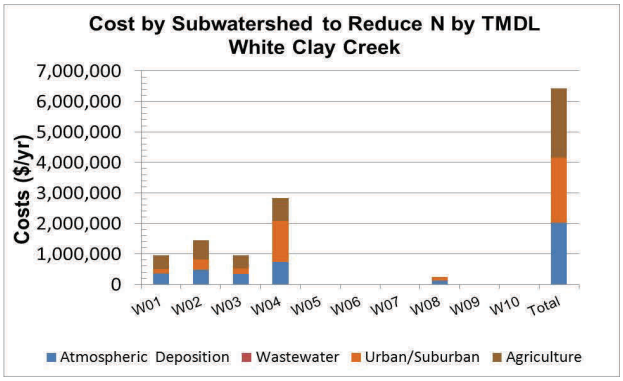
Watershed	Load	Atmos.	WWTP	Urban	Ag	TMDL		Atmos. ($/yr)	WWTP ($/yr)	Urban ($/yr)	Ag ($/yr)	Cost ($/yr)
	ton/yr	ton/yr	ton/yr	ton/yr	ton/yr	%		$75/lb N	$28/lb N	$100/lb N	$5/lb N	
BRC	**A**											
B01	72	4	0	1	67	38%		627,105	0	273,971	668,088	1,569,164
B02	49	3	8	4	34	20%		461,744	450,258	855,797	335,800	2,103,599
B03	4	0	0	0	4	9%		41,919	0	31,170	38,819	111,907
B08	51	3	4	1	43	18%		470,105	233,074	167,963	426,925	1,298,067
B16	2	0	0	1	2	2%		54,893	0	106,697	15,447	177,037
B17	2	0	0	2	0	16%		47,766	0	357,417	3,888	409,070
								1,703,532	**683,332**	**1,793,015**	**1,488,967**	**5,668,844**
	B											
B01	72.4	0.0	0.0	0.0	72.4	41%		3,772	0	2,805	724,315	730,892
B02	49.0	0.0	0.0	0.0	48.8	29%		1,855	0	227	488,363	490,445
B03	4.2	0.0	0.0	0.0	4.4	10%		724	0	546	43,976	45,245
B08	50.8	0.0	0.1	0.0	50.0	21%		1,288	4,146	3,294	500,487	509,215
B16	2.4	0.0	0.0	0.0	2.6	4%		232	85	368	26,260	26,945
B17	2.5	0.0	0.0	0.0	2.0	80%		0	0	0	19,994	19,994
						Max Ag		**7,871**	**4,231**	**7,240**	**1,803,394**	**1,822,736**
RCC	**A**											
R01	69	3	4	4	57	41%		524,772	241,948	834,012	569,768	2,170,498
R02	42	3	0	4	36	47%		377,681	0	789,817	358,463	1,525,962
R04	5	2	0	2	1	46%		297,924	0	384,717	9,071	691,712
								1,200,377	**241,948**	**2,008,546**	**937,302**	**4,388,172**
	B											
R01	69	0	0	0	69	49%		0	0	0	685,931	685,931
R02	42	0	0	0	42	55%		0	0	0	417,311	417,311
R04	5	0	0	3	2	90%		0	0	600,000	17,652	617,652
						Max Ag		**0**	**0**	**600,000**	**1,120,894**	**1,720,894**
WCC	**A**											
W01	48	2	0	1	45	49%		358,731	0	136,954	451,178	946,863
W02	68	3	0	2	63	49%		478,743	0	339,005	634,637	1,452,385
W03	47	2	0	1	44	37%		333,552	0	186,016	435,168	954,735
W04	87	5	0	7	75	50%		733,726	0	1,340,347	750,805	2,824,878
W08	1	1	0	1	0	24%		117,226	0	130,744	0	247,970
I								**2,021,978**	**0**	**2,133,067**	**2,271,787**	**6,426,831**
	B											
W01	48	0	0	0	48	53%		0	0	0	484,380	484,380
W02	68	0	0	0	68	53%		0	0	0	684,314	684,314
W03	47	0	0	0	47	40%		0	0	0	472,468	472,468
W04	87	0	0	0	86	57%		0	0	0	859,993	859,993
W08	1	0	0	1	0	0%		0	0	200,000	0	200,000
						Max Ag		**0**	**0**	**200,000**	**2,501,154**	**2,701,154**
CHR	**A**											
C01	18	2	0	5	11	20%		237,219	0	907,919	113,854	1,258,992
C04	2	0	0	1	0	6%		33,536	0	253,096	2,601	289,233
C06	2	0	0	1	0	5%		34,075	0	257,468	0	291,542
								304,830	**0**	**1,418,483**	**116,455**	**1,839,768**
	B											
C01	18	0	0	0	18	32%		3,591	0	18,742	180,432	202,765
C04	2	0	0	0	1	35%		1,406	0	10,625	14,565	26,596
C06	2	0	0	1	0	5%		34,075	0	257,468	0	291,542
						Max Ag		**39,072**	**0**	**286,835**	**194,997**	**520,903**

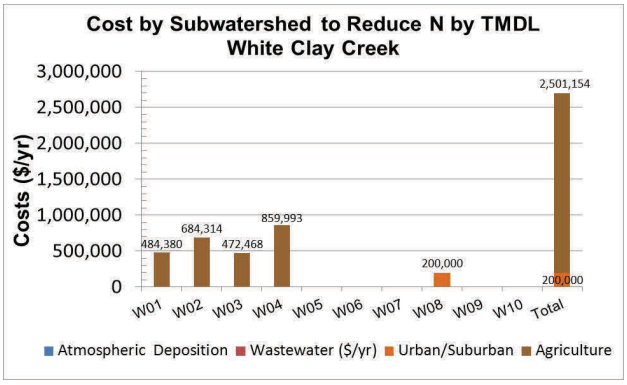


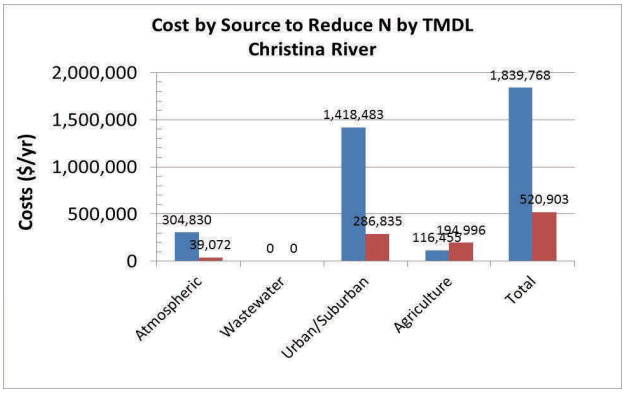












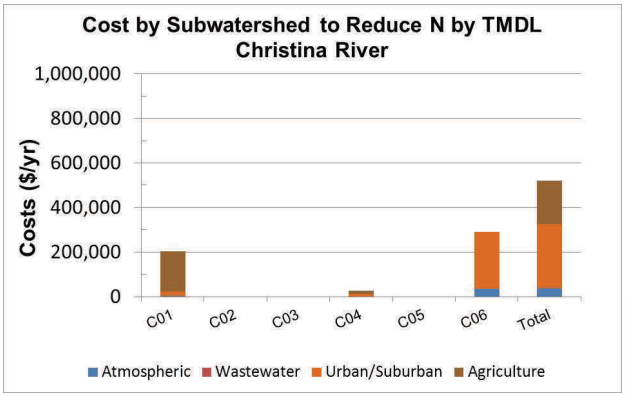


Figure 5. Costs by subwatershed to reduce nitrogen by TMDL for the Brandywine-Christina watershed

Table 3. Annual cost of sediment load reductions in Brandywine-Christina watershed

Subwatershed	Area (sq. mi.)	Load (lb/yr)	Allocation (lb/yr)	Reduction (lb/yr)	% Reduction	Cost ($0.20/lb/yr)
Brandywine Cr.						
B01 (WB Honeybrook)	18.4	1,612,000	447,271	1,164,729	72%	$232,946
B02 (WB Hibernia)	27.7	34,529	18,469	16,060	47%	$3,212
B03 (WB Coatesville)	16.9	1,224,575	564,509	660,066	54%	$132,013
B05 (Buck Run)	25.5	900,163	588,599	311,564	35%	$62,313
B08 (EB Struble Lake)	33.0	400,697	338,063	62,634	16%	$12,527
B10 (EB West Chester)	20.8	1,378,751	601,447	777,304	56%	$155,461
B14 (Chadds Ford)	24.5	982,872	438,438	544,434	55%	$108,887
B15 (Pocopson Creek)	9.2	954,767	382,228	572,539	60%	$114,508
						821,866
Red Clay Creek						
R01 (West Branch)	17.5	29,468,000	14,092,000	15,376,000	52%	$3,075,200
R02 (East Branch)	9.9	14,448,000	7,932,000	6,516,000	45%	$1,303,200
						$4,378,400
White Clay Creek						
W01 (West Branch)	18.4	10,708,000	6,190,000	4,518,000	42%	$903,600
W02 (Middle Branch)	27.7	22,360,000	9,618,000	12,742,000	57%	$2,548,400
W03 (EB abv. Avondale)	16.9	29,446,000	9,776,000	19,670,000	67%	$3,934,000
W04 (EB below Avondale)	17.1	14,834,000	8,668,000	6,166,000	42%	$1,233,200
						$8,619,200

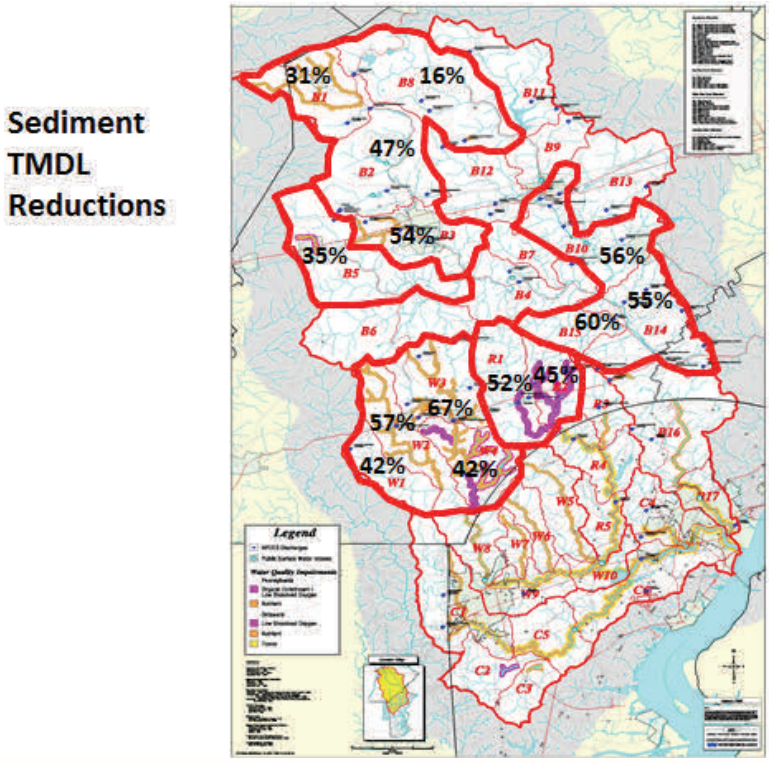
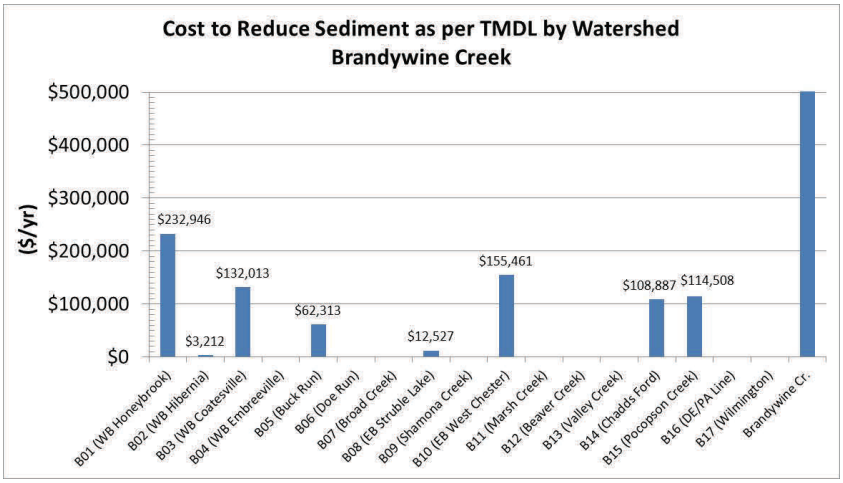
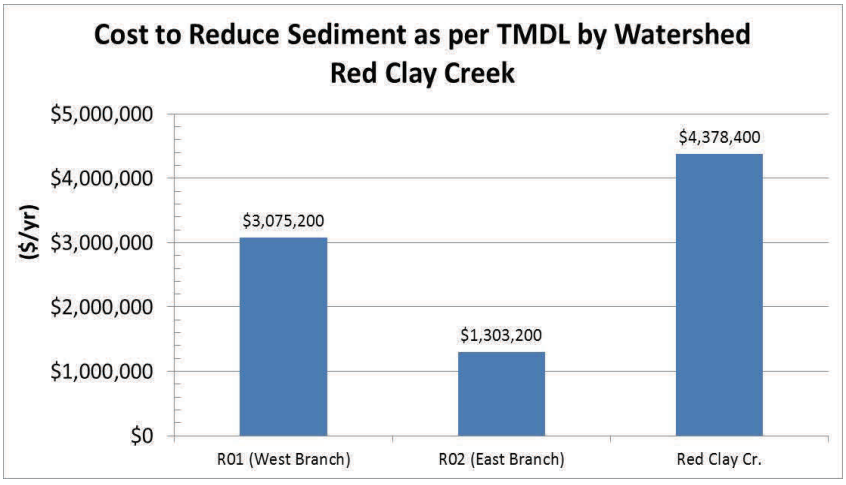


Figure 6. Sediment load reductions required by TMDL set by EPA in 2006





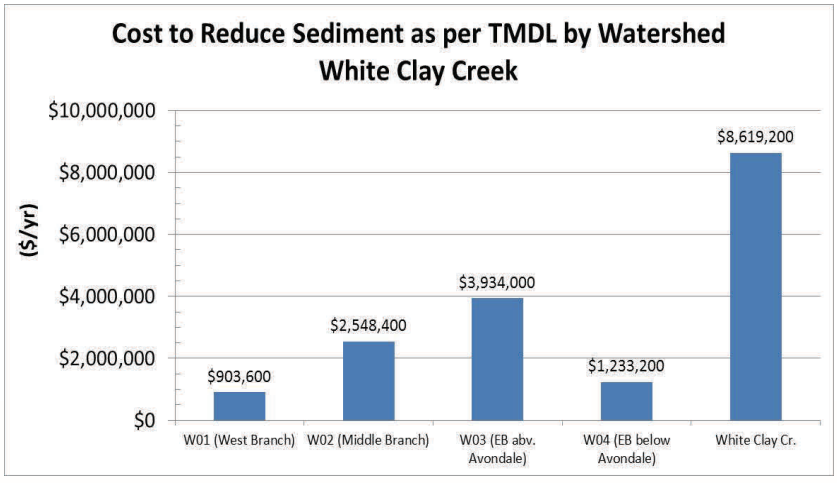


Figure 7. Costs by subwatershed to reduce sediment by TMDL for the Brandywine-Christina watershed

SUMMARY OF SELECT CASE STUDIES

Program Name	Location	Acres Enrolled/ Protected	Funding Source	Revenue
N. Everglades & Estuaries PES Program	Lake Okeechobee watershed, FL	171,000 acre-feet of storage created	Water Management District budget allocation	$46 million committed through 2016
Edwards Aquifer Protection Program	San Antonio, TX	116,683 acres	1/8 cent sales tax approved	$225 million since 2000
Upper Neuse Clean Water Initiative	Raleigh and Durham, NC	6,170 acres, 63 miles of stream	Raleigh: 1 cent per 100 gallons per month in water rate; Durham: 1 cent per cubic foot in water rate	$17.7 million since 2005
New York City Source Water Protection Program	Catskill, NY (East Branch/West Branch Delaware River)	156,690 acres acquired or under easement; 93% of farms with Whole Farm Plans	NYC-DEP budget allocation	$186 million to date; $300 million committed 2007-2017
Eugene Water and Electric Board VIP	Eugene, OR (Mackenzie River)	N/A	1% utility rate increase to fund initial program	$200,000 to $250,000 annually anticipated
Denver Forest to Faucet Partnership	Denver, CO (South Platte River)	4,700 acres treated	14 cents per household per month or 4 cents per 1,000 gallons of water withdrawn	$16.5 million from USFS; $16.5 million from Denver Water
Truckee River Fund	Lake Tahoe, CA/ Reno, NV	101 watershed projects completed	2% of utility annual budget	$9,200,000 since 2004
Central Arkansas Water	Near Little Rock, AR	1800 acres	Utility rate includes watershed protection fee based on meter size; averages 45 cents per month	Fee raises approximately $1 million per year
Saugatuck River Watershed Partnership	Fairfield County, CT	Opened up 7 miles of river to fish passage	Annual contributions of $5000 from larger municipalities; $1000 from smaller municipalities	$306,624 in contributions (municipal, private individual and foundation); $243,849 in federal grants
Rhode Island Water Resources Board	Providence, RI (Narragansett Bay)	2,410 acres protected	Initial state budget allocation; 10 cents per 1,000 gallons surcharge	$18,343,382 allocated for source water protection since 1991
New Jersey Water Supply Authority	Raritan and Ma-nasquan River basins; Delaware & Raritan Canal basin, NJ	4,000 acres protected	Source water protection component to water rate; $24 per million gallons	$112,536 for 2014
Portland Water District	Portland, ME	1,500 acres	Budget allocation	$175,000 annual allocation; $500,000 in NRCS grant, $500,000 in-kind match
Fondo para la Protec-cion del Aqua (FONAG)	Quito, Ecuador	1.2 million acres	Voluntary; 2 % of Quito water utility revenue	$8 million in fund
Agua Por la Vida	East Cauca Valley, Columbia	19,000 acres	Voluntary contributions from water users	$3,891,340 through Dec 2013; $4,700,000 with matching funds through Dec 2010

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