Wicomico Creekwatchers Water Quality Monitoring Report 2006

SUMMARY

This Water Quality Monitoring Report is the fourth annual release of data and analysis conducted by the citizen's group *Wicomico Creekwatchers*.

Wicomico Creekwatchers is a community partnership between the Chesapeake Bay Foundation (CBF), the City of Salisbury and Salisbury University (SU). Its mission is to collect and develop objective, scientifically-credible water quality data by recruiting and mobilizing a grassroots volunteer force that monitors the waters of the Wicomico River and its tributaries on Maryland's Lower Eastern Shore. *Wicomico Creekwatchers* advances efforts of citizens, businesses and public officials to ensure that public policies and other management tools adequately protect and preserve Wicomico River water quality.

Prior to the creation and implementation of this partnership, water quality data for the Wicomico River had been historically sparse and had failed to provide a comprehensive, reliable assessment of the river's health. Since its inception in 2002, *Wicomico Creekwatchers* has begun to establish a set of baseline data for identifying water quality conditions and trends over time. Creekwatcher volunteers monitor 25 sites throughout the Wicomico river system, generating approximately over 1,500 data points on an annual basis. Data collection and sampling are on going.

Creekwatchers John Cawley and Carolyn Laffey and Research Assistant Emily Seldomridge measure the levels of dissolved oxygen in the river in August 2006.

In addition to sampling within the main stem of the river, volunteers collect samples from the following Wicomico tributaries and dammed water features (also known as "impoundments"): Johnson Pond, Parker Pond, Schumaker Pond, the East Prong, Mitchell Pond, Coulbourne Mill Pond, Tony Tank Lake, Allen Pond, Shiles Creek and Rockawalkin Creek.

Information provided in this report can be used to identify river locations where water quality may be deteriorating. Trends in water quality can also be correlated with changes in land use and/or implementation of pollution control strategies occurring within the watershed.

This report summarizes data generated from on-site measurements and analysis of water samples collected within the Wicomico River system from March through November 2006. Following is a selection of key findings:

- **Dissolved Oxygen (DO)** – In this sampling season, all samples were found to be above the threshold of 5.0 mg/L DO. This finding is to be expected since oxygen levels in surface waters are usually found to be within the healthy range. In a tributary such as the Wicomico, which is listed as impaired by the EPA, DO levels near the bottom of the water column can be critically low and their effects on organism can be dramatic. Sporadic sampling in the Wicomico River's mainstem using on-site water quality meters indicated low levels of DO at depth.

- **Water Clarity** – Approximately 87% of the sampling sites indicated relatively poor water clarity during most of the growing season, which may correlate to increased algae in the water column.

- **Chlorophyll-a -** Roughly 48% of Chlorophyll-a values were above healthy levels, suggesting elevated levels of algae within the water column; 10% of Chlorophyll-a values showed dramatic impairment.

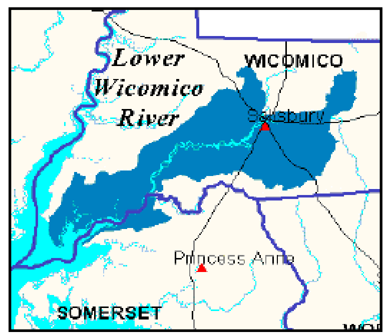
- **Acidity (pH)** - Roughly 40% of samples were below healthy levels of 6.5, showing acidic conditions. Lower pH values could indicate lower levels of CO_2 uptake during photosynthetic activity. Just over 60% of samples were within the healthy range 6.5 – 8.5. No samples indicated base conditions over 8.5.

- **Total Nitrogen & Total Phosphorus -** For total nitrogen, only 18% of monthly data points indicated levels in the healthy range; the remaining 82% indicated moderate to severe impairments. For total phosphorus, 35% of the monthly data points indicated levels in the healthy range. The remaining 65% were impaired to varying degrees. All nitrate monthly means exceeded the threshold level of 0.1 mg/L.

PROGRAM HISTORY & OVERVIEW

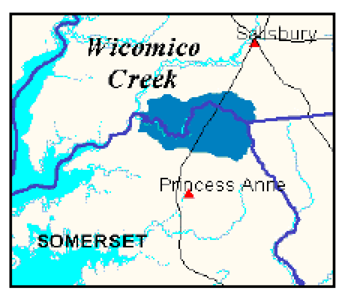
Interest among citizens in the health of the Wicomico River and other Chesapeake Bay tributaries is growing. By federal law, six Mid-Atlantic States, including Maryland, are required to develop and implement strategies for improving water quality in the Chesapeake Bay by 2010 or face severe restrictions in levels and amounts of pollution that can be legally discharged into the estuary.

In 2000, elected officials formally committed to a comprehensive program for removing the Chesapeake Bay from the Environmental Protection Agency's dirty waters list by 2010. The plan, called the *Chesapeake 2000 (C2K) Agreement*, provides a roadmap for actions needed to reduce the amount of pollutants entering the Bay each year to a level that is sufficient to maintain the health of the estuary's living resources, including crabs, oysters and finfish.



Communities throughout the Chesapeake Bay watershed are responding to the call for action sounded in *C2K*. In Talbot County on Maryland's Eastern Shore, citizens working in partnership with CBF, Talbot River Protection Association (TRPA), and the Chesapeake Bay Maritime Museum launched a volunteer-based water quality monitoring program to identify trends in the health of the county's rivers. *Wicomico Creekwatchers* is modeled after that successful program, which receives statewide recognition for its effectiveness in providing water quality data useful for facilitating local watershed management efforts. Recent information on both the Talbot and Wicomico programs can be accessed at www.cbf.org/publications.

In summer 2002, CBF, Salisbury University, and the Salisbury Area Chamber of Commerce began working cooperatively with citizen volunteers to identify sampling locations along the Wicomico River. Program managers selected twenty-eight sampling locations for water quality monitoring (Appendix 2) based on local knowledge of the tributary and equitable distribution throughout the river system. Long-term, regular access to each site was also a deciding factor in site selection in order to ensure that collection locations remain consistent in future years. Three sampling locations were eliminated from the program last year when access became unavailable.



Selected sampling sites generally have a water depth of approximately four feet which conforms to the standard sampling protocol. GPS technology provided latitude/longitude coordinates for each site indicated on the site map (Appendix 3).

Graphics of Wicomico River sub-watersheds on this page can be found at MD Department of Natural Resources website: http://mddnr.chesapeakebay.net/

Volunteer recruitment for *Wicomico Creekwatchers* began in summer of 2002. During the hour-long training session, program managers provided sampling instructions (Appendix 5) to all fifty-eight volunteers, demonstrated data collection procedures, and reviewed the overall sampling techniques.

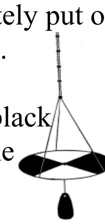
A majority of Creekwatcher volunteers recruited and trained in 2002 remain engaged in the program to date. New volunteers that join the program each year receive training that includes a review of previous years' findings, the mission of the program, as well as information and personal instruction on sampling techniques.

METHODS

Creekwatchers collect water quality data at regular two-week intervals throughout the growing season (March-November). They record site conditions at each location on a Water Quality Sampling Data Sheet (Appendix 4). Parameters measured include tide, weather, wind strength and direction, level of wave action, recent rainfall, and air and water temperature. No samples are collected in December, January, and February, recognizing that biological activity and its effects on water quality is depressed during the winter months.

Creekwatchers collect water samples using a standard oxygen bottle. At his/her sampling site, the volunteer submerges an empty oxygen bottle at least three inches below the water's surface, fills it to the brim, and inserts the stopper. The volunteer insures that no air bubbles are present in the sample, which is immediately put on ice and kept cool until it arrives at Salisbury University laboratories for analysis by student volunteers.

Creekwatchers measure water clarity using a Secchi disk *(at right)*. Each Creekwatcher lowers a black and white disk into the water at the sampling location until it is no longer visible, at which point the distance from disk to water surface is recorded in feet.



Secchi disks are used to measure water clarity (turbidity).

In 2006, 30 mL samples were placed in Nalgene sample bottles, frozen, and transported to University of Maryland's Horn Point Laboratory for analysis of total nitrogen and total phosphorus, and for periodic analysis of Chlorophyll-a to verify SU analysis results.

2006 CHANGES from previous years

This year's *2006 Wicomico Creekwatchers Report* reflects several changes that affect program results. Changes include: advances in the technology used to obtain data, analysis refinements, and program methodology changes.

1) <u>Report Production:</u> In previous years, the annual report summarized analysis of data collected from September through the following August, ending the report cycle when the peak sampling season was still underway. In 2006, program managers shifted the reporting cycle to correspond to the complete growing season (Mar-Nov), so results of the full sampling year could be more clearly presented

2) <u>Data Presentation:</u> Previous years' reports grouped sampling sites into four regions with the intent to reflect geographic and hydrologic similarities. In this year's report, the four categories have been refined in order to better reflect potentially similar regions of the watershed. The four areas are now: Ponds (which includes impoundments in the upper reaches of the watershed), Upper Wicomico, Lower Wicomico and Wicomico Creek. The map of the sampling sites (Appendix 3) and all subsequent graphs indicate monthly mean (average) data points. Sites are represented both individually and as part of four watershed sub-groups, color coded as indicated in Table 1.

3) <u>Advances in Technology:</u> During parts of the growing season, dissolved oxygen in Chesapeake Bay tributaries often reach critically low levels near the bottom of the water column, where the effects on aquatic organisms can be dramatic. In earlier years, the sampling protocol only measured DO near the surface. In 2006, *Wicomico Creekwatchers* received funding from Chesapeake Bay Trust and the Community Foundation of the Eastern Shore for the purchase of DO meters to measure DO throughout the water column. Due to inconsistencies in volunteers' ability to collect DO measurements with the new equipment, this report does not

include readings taken with the new DO meters. However, sporadic sampling within the main stem of the Wicomico River in 2006 did indicate substantially decreased levels of oxygen at depth. DO measurements at depth will be included in 2007 analysis.

4) Sample analysis: In 2006, the program also received funding to include laboratory analysis of total nitrogen (TN) and total phosphorus (TP) by the professional Analytical Services department at University of Maryland's Horn Point Laboratory. Previous years' reports included only nitrate (NO3) and phosphate (PO4) analyses. Though these parameters were measured in 2006, incomplete nitrate and problematic phosphate data resulted in only TN and TP being included in this report. Future TN and TP analysis will be dependent on funding.

2006 RESULTS

Samples were collected every two weeks March through November 2006. Data reported here represents monthly averages for each parameter and each site. Using the criteria identified for healthy water, data collected was analyzed to determine the percentage of data points that fell outside the healthy range for each parameter measured. High percentages by parameter indicate potential water quality problems.

Samples were analyzed for the following:

Dissolved Oxygen: Critical for most aquatic species, dissolved oxygen above 5 mg/L is considered healthy. Dissolved oxygen was analyzed in surface water samples in 2006. Seasonal changes in water salinity levels can influence dissolved oxygen levels. Common causes of low readings include an increase in algae production, which consumes oxygen as algae decompose.

Water Clarity (Turbidity): Light is critical for aquatic plant growth; water clarity indicates the ability of light to penetrate through water. Poor water clarity indicated by a low visual turbidity reading indicates that water is not clear enough for light to penetrate to a depth to support the growth of underwater grasses. Water clarity of 36 inches or greater is considered healthy.

Chlorophyll-a: Chlorophyll is the pigment that allows plants—including algae—to convert sunlight into organic compounds in the process of photosynthesis. Chlorophyll-a is the predominant type found in algae and cyanobacteria (blue-green algae), and its levels are a good indicator of the amount of algae present in the water. In 2006, resources allowed for the re-instatement of Chlorophyll-a analysis.

Acidity (pH): pH levels are directly related to the health of fish and aquatic plant populations, and, in a healthy system, should be between 6.5 and 8.5. The most common causes of variations include stormwater runoff and air deposition of nitric and sulfuric acids discharged by industries, power plants, and automobiles. Locally, pH increases during phytoplankton blooms, and decreases where decomposition rates are very high.

Total Nitrogen: Nitrogen is an essential nutrient for both plants and animals. It can be found in aquatic systems in several chemical forms, and in both dissolved and particulate forms. Though one form of nitrogen, nitrate, was specifically analyzed, data were incomplete early in the growing season. Both total nitrogen (TN) and nitrate (NO3) results are reported here.

Total Phosphorus: Phosphorus is another key nutrient in the aquatic systems and can occur in dissolved organic and inorganic forms, often attached to particles of sediment. Though the dominant form of phosphorus in the Bay ecosystem, phosphate, was analyzed, data were problematic; only total phosphorus (TP) is reported here.

Though essential to all Bay life, nitrogen and phosphorus in excessive levels can act as damaging pollutants in the Chesapeake. As natural fertilizers, they stimulate algae blooms that block sunlight from reaching deeper waters and, when the algae die, lead to low dissolved oxygen levels.

For purposes of this report, nutrient criteria and guidelines developed and used in Delaware waters will be used for the purposes of comparison with data from the Wicomico Creekwatchers samples. The Delaware Department of Natural Resources and Environmental Control (DNREC) uses the following thresholds to indicate high, moderate and low ranges for total nitrogen (TN), total phosphorus (TP) and Chlorophyll-a (Chl-a) in estuarine waters.[1]

These benchmarks reflect the most current thinking among scientists who are refining criteria for evaluating surface water health based on nitrogen, phosphorus and chlorophyll concentrations. Values in the low to moderate range represent healthier conditions than those in the higher range.

Nutrient Range	TN (mg/L)	TP (mg/L)	Chl-a (ug/L)
Low	<1.0	<0.05	<10
Moderate	1.0 – 3.0	0.05 – 0.1	10 – 50
High	>3.0	>0.1	>50

In the following pages, the graphs for each parameter illustrate values for groups of sites as identified in Table 1.

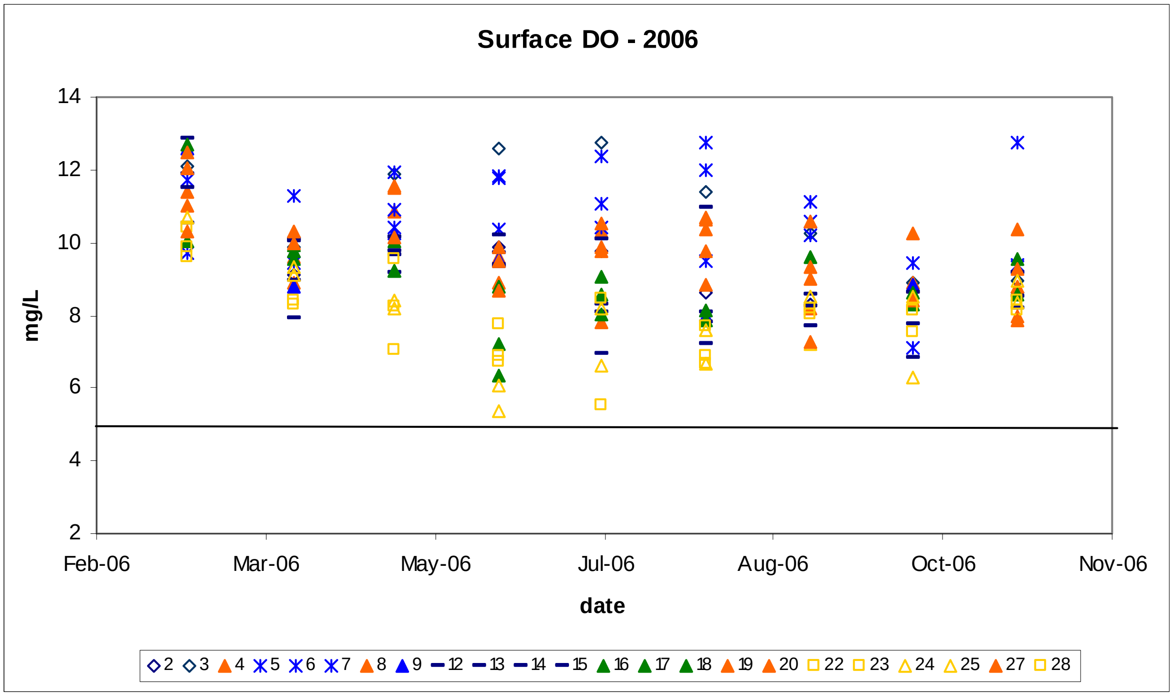
Table 1. Site Listing: Site #, Symbol, Name

Upper Wicomico Sites (orange)					
4	▲	Port Exchange	19	▲	City East Side
8	▲	EastBranch Downtown	20	▲	Shad Point
			27	▲	River Wharf
Lower Wicomico (yellow)					
21	n/a	Nithsdale	24	△	Mount Vernon
22	□	Green Hill	25	△	Shiles Creek
23	□	Geipe	28	□	Whitehaven
Ponds (blue)					
2	◊	TV Station	9	▲	Mitchell Pond
3	◊	South Johnson	12	--	Coulbourne Mill Pond
5	x	Parker Pond	13	--	Fruitland North
6	x	Schumaker Pond East	14	--	Fruitland South
7	x	Schumaker Pond	15	--	Tony Tank Lake
Wicomico Creek (green)					
16	▲	Allen Pond			
17	▲	Wikander's			
18	▲	Wicomico Yacht Club			

[1] State of Delaware. *2006 Assessment, Listing and Reporting Methodologies Pursuant to Sections 303(d) and 305(b) of the Clean Water Act.* April, 2006 http://www.dnrec.state.de.us/water2000/Sections/Watershed/TMDL/305and303.htm. Maryland's Coastal Bays STAC (Scientific and Technical Committee) has established the following thresholds for TN (0.1mg/L) and TP (0.01mg/L).

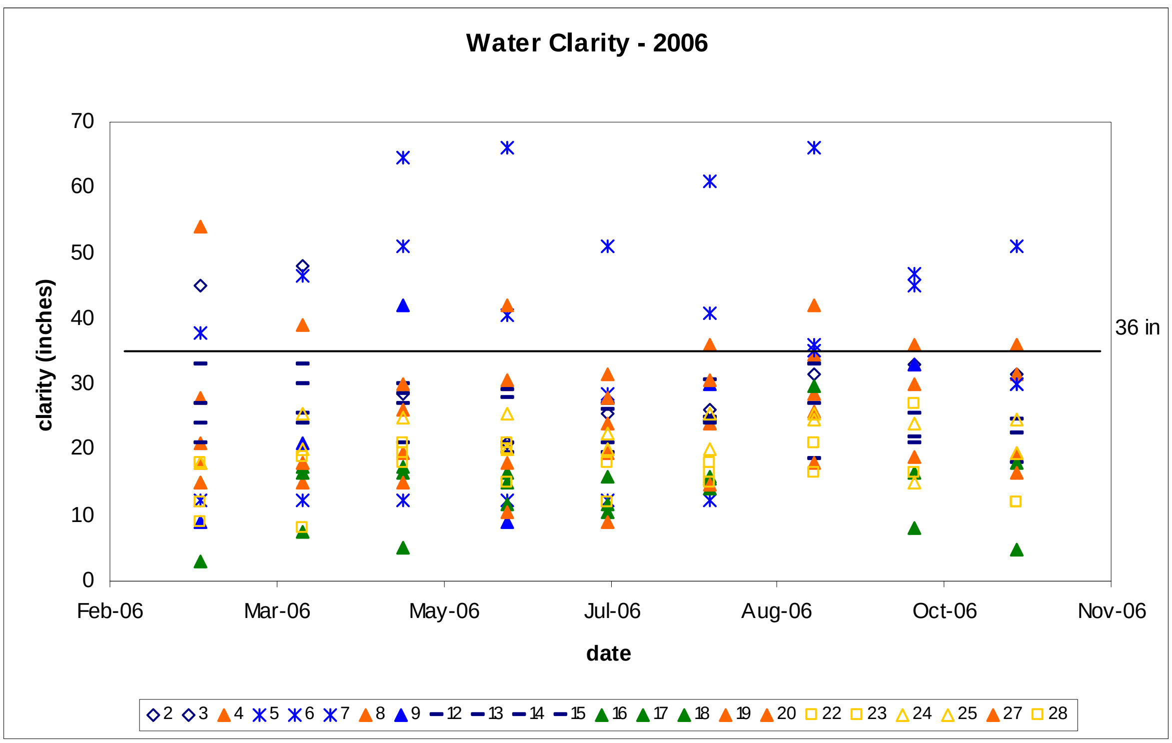
Dissolved Oxygen (DO): Figure 1 represents monthly average of surface DO for all sampling sites. All samples were above the threshold of 5.0 mg/L DO.

Figure 1. Dissolved Oxygen at each numbered sampling site, with site groupings color-coded as noted in Table 1.



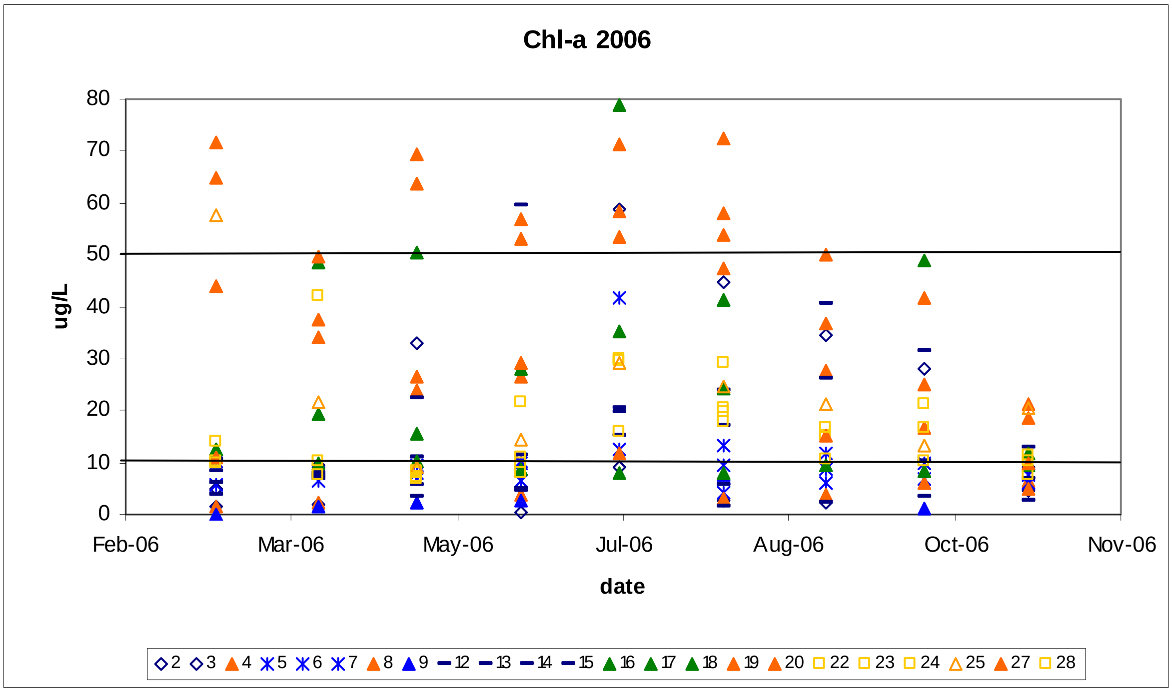
Turbidity/Water Clarity: Figure 2 depicts average monthly water clarity data. Approximately 87% of monthly means were less than 36 inches, indicating relatively poor water clarity in most sites during most of the growing season. Roughly 13% of monthly water clarity values were at least 36 inches, representing healthy conditions.

Figure 2. Water clarity at each numbered sampling site, with site groupings color-coded as noted in Table 1.



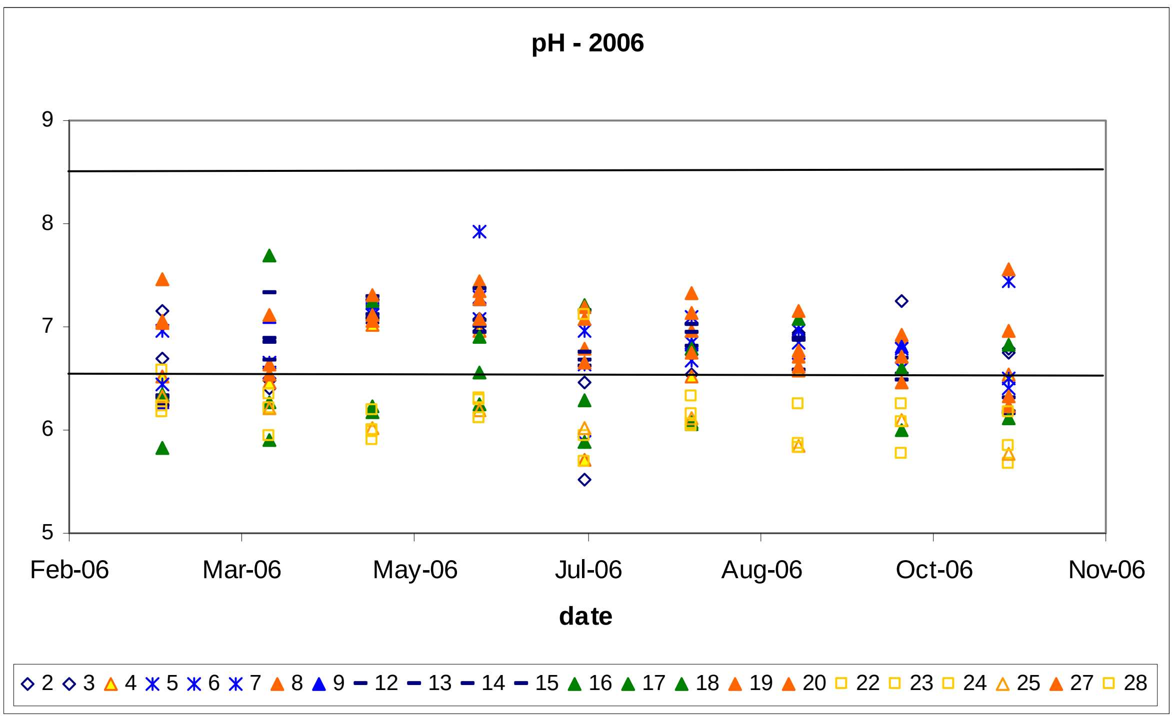
Chlorophyll-a: Figure 3 depicts mean Chlorophyll-a values. In 2006, 42% of mean Chlorophyll-a values were less than 10ug/L (micrograms/Liter) and are considered healthy. Roughly 48% of Chlorophyll-a values were between 10ug/L and 50ug/L, suggesting elevated levels of algae within the water column. Only 10% of Chlorophyll-a values were greater than 50ug/L, representing the least healthy conditions.

Figure 3. Chlorophyll-a at each numbered sampling site, with site groupings color-coded as noted in Table 1.



Acidity (pH): Figure 4 depicts pH levels in samples taken throughout the growing season. Just over 60% of samples were within the healthy range 6.5 – 8.5. Roughly 40% of samples were below 6.5; no samples were above 8.5. Lower pH values could indicate lower levels of CO_2 uptake during photosynthetic activity.

Figure 4. Acidity (pH) at each numbered sampling site, with site groupings color-coded as noted in Table 1.



Total Nitrogen, Nitrate, and Phosphorus (TN / NO3 / TP): Figures 5, 6 and 7 depict total nitrogen, nitrate, and total phosphorus, respectively. For total nitrogen, only 18% of monthly means were in the healthy range of less than 1.0 mg/L. Approximately 49% of monthly means were in the intermediate range between 1.0 and 3.0 mg/L, while 33% of monthly means were in the least healthy range of greater than 3.0 mg/L.

All nitrate monthly means exceeded the threshold level of 0.1 mg/L. Based on the scientific literature and the recommendation of Dr. Thomas R. Fisher at the University of Maryland Center for Environmental Science, *Wicomico Creekwatchers* establishes a conservative benchmark for healthy levels of nitrate at 0.1 mg/l in the 2006 sampling year. Analysis of data collected and reported in earlier years reflects this recommendation.

For total phosphorus, only 16% of monthly mean values were in the unhealthy range of greater than 0.1 mg/L. Approximately 49% of monthly mean values were in the intermediate range between 0.1 and 0.05 mg/L, and 35% of monthly means were in the healthy range of less than 0.05 mg/L.

Figure 5. Total nitrogen at each numbered sampling site, with site groupings color-coded as noted in Table 1.

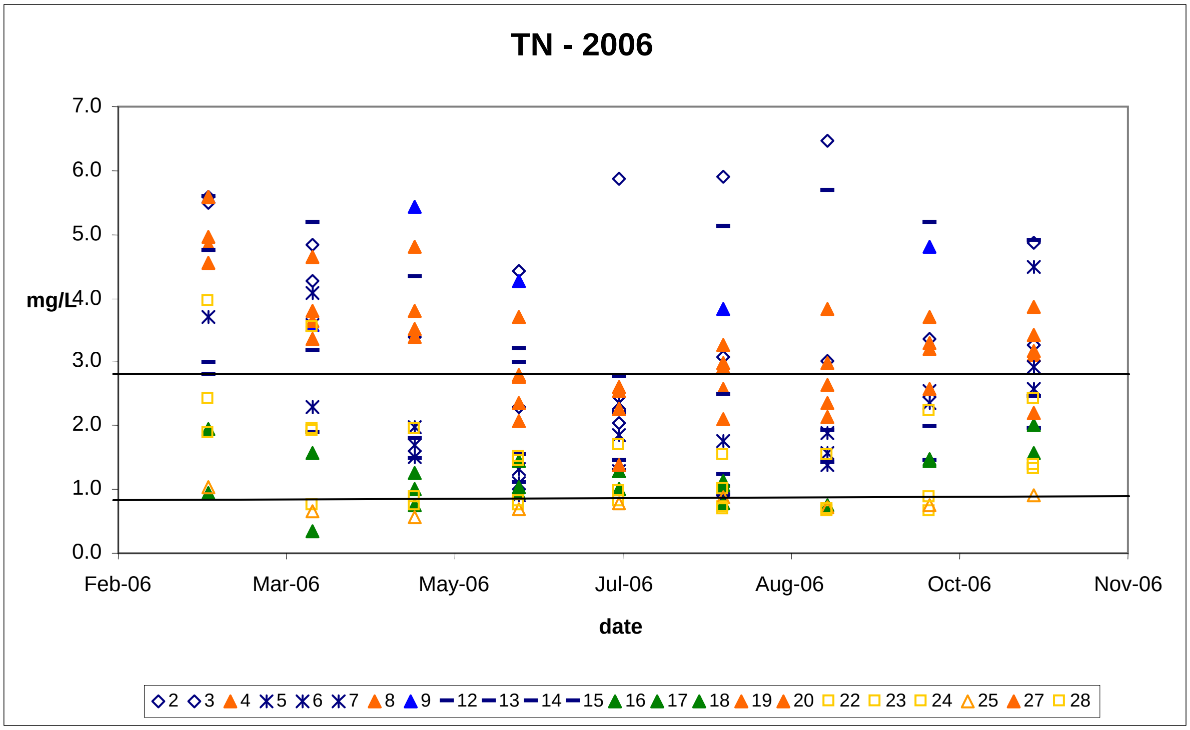


Figure 6. Nitrate at each numbered sampling site, with site groupings color-coded as noted in Table 1.

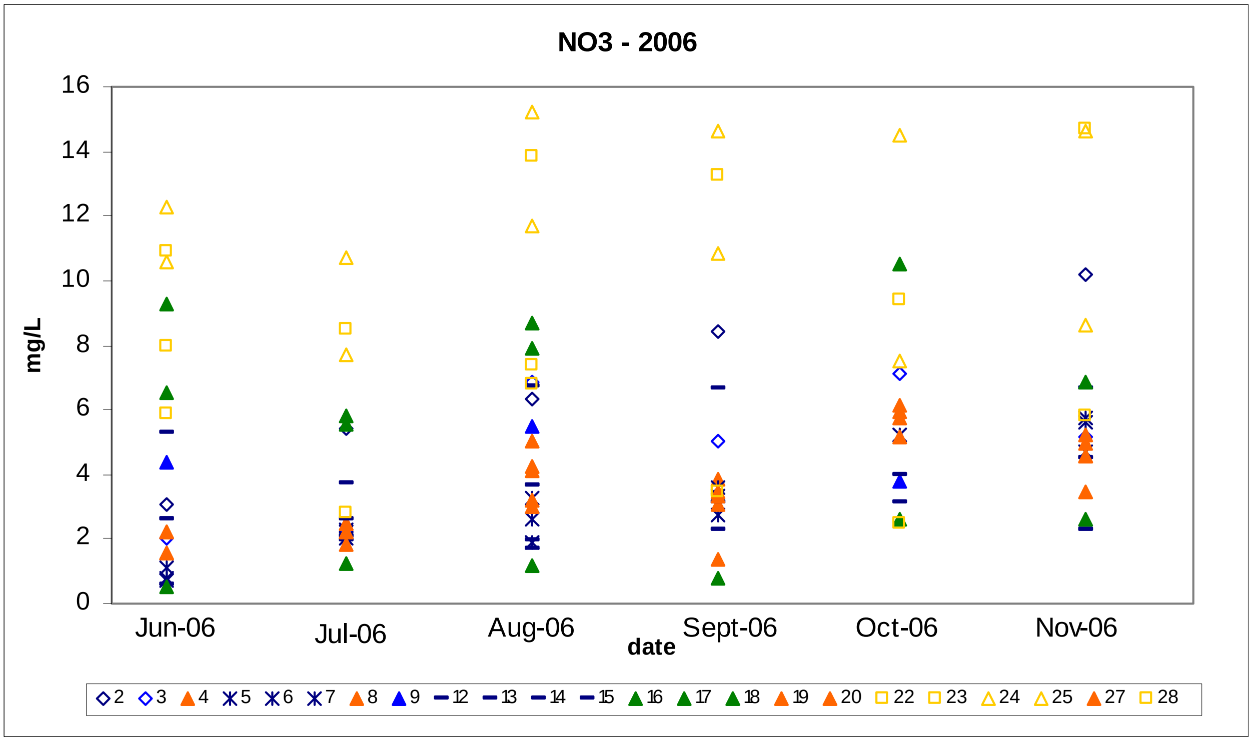
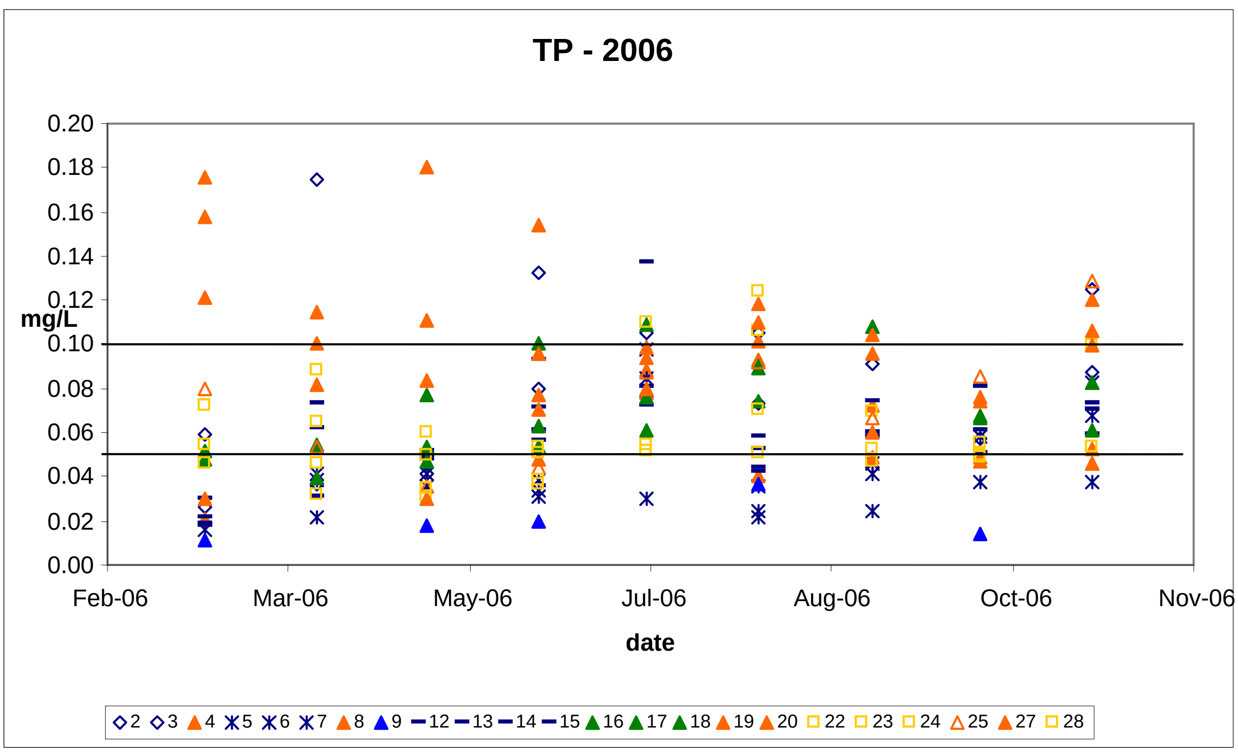


Figure 7. Total phosphorus at each numbered sampling site, with site groupings color-coded as noted in Table 1.



CONCLUSIONS

In many Chesapeake Bay tributaries, excessive nitrogen and phosphorus pollution has substantially decreased water quality and aquatic habitat values. Excessive nutrients can stimulate too much algae growth, diminish water clarity, and ultimately reduce dissolved oxygen levels within the water. These changes reduce a water body's aesthetic and recreational values and impair its ability to support healthy populations of aquatic organisms.

Data collected in the Wicomico River watershed during 2006 indicate that this system is over-enriched by nitrogen and phosphorus pollution. More than three-quarters of sites show moderate to high levels of total nitrogen and almost two thirds of sites show moderate to high levels of total phosphorus. Almost half of sites sampled show elevated Chlorophyll-a levels and most sites had poor water clarity throughout the growing season.

Expected seasonal patterns of analyzed parameters were not visible, indicating a system under ongoing influence from activities within the watershed, such as wastewater treatment outflows, industrial discharges, air pollution, run-off from landscaped and urban areas and agriculture, septic system effluent, and other anthropogenic sources that negatively affect water quality. Unless such land-based pressures can be adequately remedied, water quality in the Wicomico River watershed will not likely see improvement.

CHESAPEAKE BAY FOUNDATION
HEART OF THE CHESAPEAKE PROJECT

Salisbury UNIVERSITY

Wicomico Creekwatchers gratefully acknowledges 2006 funding support from the Chesapeake Bay Trust, the Community Foundation of the Eastern Shore and the City of Salisbury.

<u>Appendix 1</u>: Distribution List

City of Salisbury Building, Housing and Zoning Department
City of Salisbury – Office of the Mayor and City Council
City of Salisbury Public Works Department
Congressman Wayne Gilchrest
Delegate James Mathias, Jr.
Delegate D. Page Elmore
Delegate Norman H. Conway
Delmarva Poultry Industry
Delmarva Water Transport Committee
Friends of the Nanticoke River
Great Salisbury Committee
Lower Eastern Shore Tributary Team
Lower Shore Land Trust
Maryland Department of Agriculture
Maryland Department of the Environment
Maryland Department of Natural Resources
Maryland Department of Planning
Nanticoke Watershed Alliance
Nanticoke Watershed Preservation Group
Pemberton Historical Park
Salisbury Area Chamber of Commerce
Salisbury University Biology Department
Salisbury-Wicomico Economic Development, Inc.
Salisbury Zoo
Senator J. Lowell Stoltzfus
Somerset Board of County Commissioners
Somerset County Department of Solid Waste and Drainage
Somerset County Division of Planning and Zoning
Somerset County Economic Development Commission
Somerset County Health Department, Environmental Health
Somerset County Planning Commission
Somerset County Public Library
Somerset County Department of Tourism
The Nature Conservancy Nanticoke Field Office
Tri-County League of Women Voters
Ward Wildfowl Museum of Art
Wicomico County Council
Wicomico County Department of Planning, Zoning and Community Development
Wicomico County Department of Public Works
Wicomico County Department of Parks, Recreation and Tourism
Wicomico County Farm Bureau
Wicomico County Free Library
Wicomico County Health Department, Environmental Health Division
Wicomico County Planning Commission
Wicomico Environmental Trust
University of Maryland Center for Environmental Science
University of Maryland Cooperative Extension Wicomico County
Urban Salisbury

Appendix 2: Sampling Site Description

Site Number	Site Name	Site Location (Lat./Long.)	Site Number	Site Name	SiteLocation (Lat./Long.)
Upper Wicomico (orange)			**Wicomico Creek** (green)		
4 ▲	Port Exchange	N38^{0} 21. 874' W75^{0} 36. 382'	16 ▲	Allen Pond	N38^{0} 17. 00.0' W75^{0} 41. 28.2'
8 ▲	East Branch Downtown	N38^{0} 21. 741' W75^{0} 35. 067'	17 ▲	Wikander's	N38^{0} 16. 87' W75^{0} 43. 719'
19 ▲	City East Side	N38^{0} 21. 015' W75^{0} 37. 133'	18 ▲	Wicomico Yacht Club	N38^{0} 17.112' W75^{0} 45.178
20 ▲	Shad Point	N38^{0} 20. 285' W75^{0} 37.481'			
27 ▲	River Wharf	N38^{0} 21. 540' W75^{0} 36. 150'			
Lower Wicomico (yellow)					
21 n/a	Nithsdale	N38^{0} 20. 480' W75^{0} 40. 470'			
22 □	Green Hill	N38^{0} 19. 835' W75^{0} 44. 166'			
23 □	Geipe	N38^{0} 18. 02.4' W75^{0} 45. 31.5'			
24 ∆	Mount Vernon	N38^{0} 14. 945' W75^{0} 49. 886'			
25 ∆	Shiles Creek	N38^{0} 16. 286' W75^{0} 48. 788'			
28 □	Whitehaven	N38^{0} 16. 095' W75^{0} 47. 411'			
			Ponds (blue)		
2 ◊	TV Station	N38^{0} 23.025' W75^{0} 34.935'	9 ▲	Mitchell Pond	N38^{0} 21. 53.4' W75^{0} 36. 46.9'
3 ◊	South Johnson	N38^{0} 22.772' W75^{0} 35.856'	12 --	Coulbourne Mill Pond	N38^{0} 19. 44.8' W75^{0} 35. 32.8'
5 x	Parker Pond	N38^{0} 20. 750' W75^{0} 32. 832'	13 --	Fruitland North	N38^{0} 19. 570' W75^{0} 36. 148'
6 x	Schumaker Pond East	N38^{0} 20. 946' W75^{0} 33. 795'	14 --	Fruitland South	N38^{0} 19. 00.0' W75^{0} 35. 59.2'
7 x	Schumaker Pond	N38^{0} 21.106' W75^{0} 34.207'	15 --	Tony Tank Lake	N38^{0} 20. 265' W75^{0} 36. 869'

Appendix 4: Data Sheet

Wicomico Creekwatchers

Water Quality Sampling Data Sheet

Site Number ______ Date: ______ Time: ___________

Observers ____

Tide

1	**High**
2	**Middle Falling**
3	**Low**
4	**Middle Flooding**

Weather

1	**Clear**
2	**Partly Cloudy**
3	**Overcast**
4	**Light Rain**
5	**Rain**
6	**Heavy Rain**
7	**Fog**
8	**Snow**

Wind

1	**Still**
2	**Light Wind**
3	**Medium Wind**
4	**Heavy Wind**

Wind Direction

1	**N**
2	**NE**
3	**E**
4	**SE**
5	**S**
6	**SW**
7	**W**
8	**NW**

Water Surface

1	**Calm**
2	**Ripples**
3	**Choppy**
4	**Heavy Chop**

Rainfall in Previous 48 Hours

1	**None**
2	**Trace**
3	**Light**
4	**Moderate**
5	**Heavy**
6	**Monsoon**

Air Temperature ________

Water Temperature ___________

Secchi Disk Depth _______

Bottomed Out

1	**No**
2	**Yes**

Water Sample Bottle Number _________

Observations: ______________________

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<u>Appendix 5</u>: Sampling Instructions

Wicomico Creekwatchers
Sampling Instructions

1. At your sampling site, use the Water Quality Sampling Data Sheet to record the following:

   - ✓ Site Number
   - ✓ Date
   - ✓ Time
   - ✓ Observers
   - ✓ Tide Conditions
   - ✓ Weather Conditions
   - ✓ Wind Conditions
   - ✓ Wind Direction
   - ✓ Water Surface Conditions
   - ✓ Rainfall in Previous 48 Hours

2. <u>Air Temperature</u>: Use the thermometer to measure the air temperature and record it on the data sheet.

3. <u>Water Temperature</u>: Use the thermometer to measure the water temperature and record it on the data sheet. Insert the thermometer just under the water's surface, wait one minute before removing and record the measurement.

4. <u>Secchi Disk Depth</u>: Use the secchi disc to measure water clarity. Lower the disc into the water until you can no longer see it. Look away for a moment, then slowly raise the disc to the point where it just becomes visible. Note the mark on the rope closest to the water's surface. Marks are at 3-inch intervals. Record the secchi disk depth in feet and inches on the data sheet.

   If the disc hits river bottom during lowering and you can still see it, record the secchi disc depth and circle "2 Yes" under "Bottomed Out" on the data sheet. Otherwise circle "1 No."

5. <u>Water Samples</u>: On the data sheet, record the number located on the water sample bottle. Submerge the bottle 3 inches below the water's surface, top end up, until it fills. Remove the bottle from the river and insert the stopper. IF ANY AIR BUBBLES ARE PRESENT AFTER INSERTING THE STOPPER, EMPTY THE BOTTLE AND REPEAT THE PROCEDURE.

   After collecting the water sample, bring it and the completed data sheet to CBF's Salisbury Office as soon as possible. Use a cooler or refrigerator to keep water samples cool during transport or short-term storage. When you arrive at CBF, exchange your water sample bottle and data sheet with new ones.

6. <u>Observations</u>: Note anything you think might be of interest to those compiling and analyzing the data you have collected.