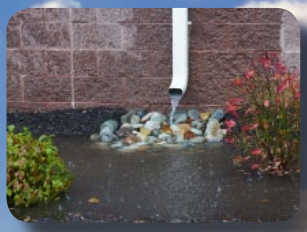
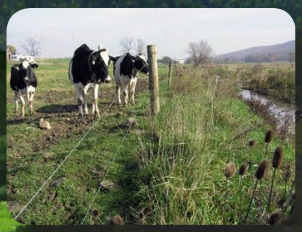
Susquehanna River Basin Commission





State of the SUSQUEHANNA

2013 REPORT

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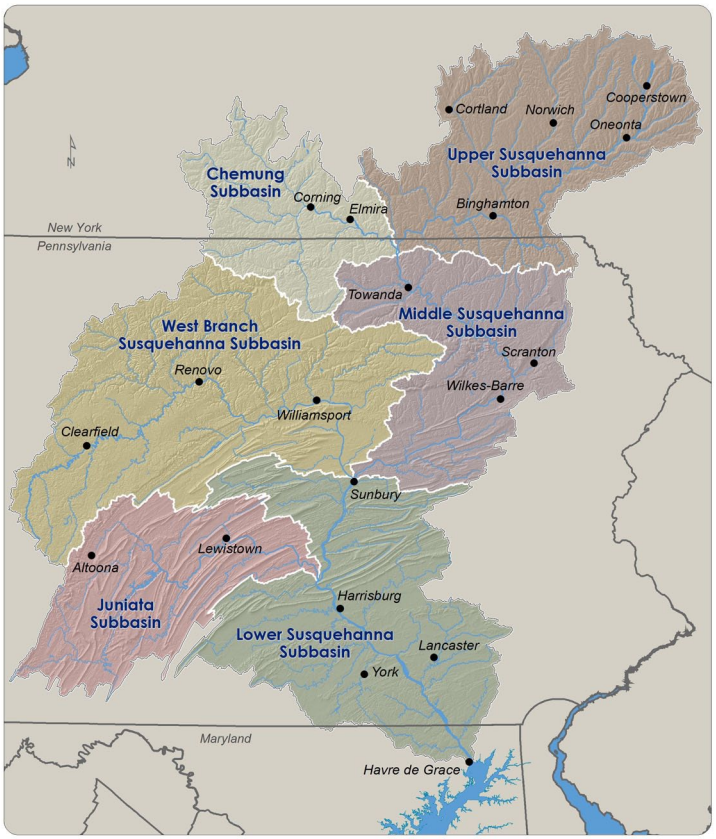
SUSQUEHANNA RIVER BASIN



The Susquehanna River Basin...

- is a 27,510-square-mile watershed.
- has more than 49,000 miles of waterways – rivers, streams, creeks, brooks and runs.
- is one of the most flood-prone areas in the entire nation, experiencing a major devastating flood on average every 14 years.
- flows 444 miles from its headwaters at Otsego Lake in Cooperstown, N.Y., to Havre de Grace, Md., where the river meets the Chesapeake Bay.
- is the largest river lying entirely within the United States that drains into the Atlantic Ocean.
- flows about 20 miles per day on an average summer day.
- has a normal flow of about 18 million gallons per minute at Havre de Grace, Md.
- has a population of 4.1 million people.

Cover Photo: Northbranch Susquehanna River, southwest view from Wyalusing Rocks, Bradford County, along US Route 6. Courtesy of Nicholas A. Tonelli.

Executive Director's Message

The Susquehanna River Basin Commission (SRBC) is pleased to release the ***2013 State of the Susquehanna*** report, which provides a snapshot look at data and trends for seven overarching water resource indicators. The indicators are: (1) Water Use and Development, (2) Floods and Droughts, (3) Stormwater, (4) Mine Drainage, (5) Sediment and Nutrients, (6) Human Health and Drinking Water Protection, and (7) Habitat and Aquatic Resources.

SRBC's goal is to provide data and let the data speak for themselves, not to rate or rank conditions.

This report would not be possible without monitoring data, collected by both SRBC and the agencies of its member jurisdictions. Monitoring is a core expertise of SRBC and provides data that are invaluable not only to SRBC's management decisions but to others as well.

This expertise includes all aspects of monitoring – from using approved methods, to collecting data that follow protocols for quality assurance and quality control, to carefully recording and analyzing the data. It also extends to providing monitoring results to agencies and policy makers in the interest of science-based decision-making as well as to watershed organizations and the general public.

We hope you will find the data and information included in this report useful. As you will see, some of the indicators show improving or virtually unchanged trends while others show declining trends for the assessment periods covered.

Good Progress to Date, Much More Is Needed

Based on analyses of SRBC's nutrient and sediment monitoring data, the health of the Susquehanna River Basin overall is improving. The mainstem Susquehanna River meets or exceeds its designated uses along most of its 444 miles. The basin includes many pristine watersheds with unimpaired water quality – of the more than 49,000 miles of stream miles in the basin, less than 14 percent are impaired for aquatic life uses. More and more communities are applying best management practices to reduce stormwater runoff and several agencies, SRBC included, are encouraging the reuse of mine drainage and other lesser quality waters.

But we know that is by no means the full story. There is much more progress to be made as we face increasing demands on the basin's water resources. More than 2,000 miles of streams are still impacted by mine drainage. The prevalence of disease in the smallmouth bass population has continued to increase since 2005. The percentage of the basin's assessed stream miles impaired for microbial pollutants doubled between the 2010 and 2012 assessment periods.

Greatest Threat to Water Resources Management

Today, I believe the greatest threat to water resources management in the Susquehanna basin is the ongoing uncertainty over funding for the network of stream gages throughout the Susquehanna River Basin. This is not a new concern. However, with the loss of line-item funding in the federal budget starting in fiscal year 2011 for the Susquehanna Flood Forecast and Warning System, it has been a growing concern.

A more viable, sustainable way of funding the stream gages needs to be secured. The gages, which are operated by the U.S. Geological Survey (USGS), generate real-time data that are vital for SRBC and numerous other water resource management agencies.

The tracking of virtually all seven indicators described in this State of the Susquehanna report and others not mentioned is directly or indirectly tied to USGS stream gages. Without these data, we would literally be "flying blind."

For example, SRBC would not be able to determine when major water users need to cease water withdrawals to safeguard other water users and the aquatic environment during times of low flow. The National Weather Service would not be able to provide timely and accurate predictions of when flooding is expected to impact communities throughout the basin. SRBC would not be able to assess whether pollutant loads in the basin are increasing or decreasing.

Those are just three of the many examples of how water resource management functions would be severely impeded should stream gages be lost.

We are familiar with physical infrastructure such as roads and bridges, water and wastewater systems and railway lines, and we know the consequences of not maintaining this infrastructure for public health, safety and welfare. Stream gages are no different. They are the "hidden infrastructure" that water resource managers rely upon extensively. If they are no longer operated and maintained, the result is that public health, safety and welfare is likewise jeopardized.

SRBC has been at the forefront for some years urging the federal government to adequately fund the stream gages. I cannot stress enough just how incredibly vital the stream gaging network is for the communities and citizens of the Susquehanna basin. I sincerely hope the importance of gages can be fully appreciated BEFORE this hidden infrastructure is lost to us.

Long Term Sustainable Water Resources Management

SRBC will continue to advocate for reliable stream-gage funding as part of its overall goal of sustainable water resources management for the Susquehanna basin. Through pro-active planning, management and cooperation among governmental and non-governmental affiliates, I truly believe we can set our sights to achieving that goal.

Paul O. Swartz
Executive Director
Susquehanna River Basin Commission

Indicator 1

Water Use & Development

Overarching Issue

The Susquehanna River Basin provides water to support a variety of industries, including public water supply, with increased activity in the energy sector. Heightened demand requires a focus toward sustainable planning and management of the water resources within the 27,510-square-mile drainage basin. Low flow protection and consumptive use mitigation are two ongoing concerns. SRBC continues to work on policies aimed at instream flow protection and to take actions related to the Commission's Consumptive Use Mitigation Plan.

Overview

Water from the Susquehanna River Basin is needed for public water supply, electrical generation, manufacturing, agricultural, environmental, recreational and many other purposes. The basin is rich in energy resources. Increased activity in the energy sector is driving new water use, including drilling for natural gas and new or upgraded coal-fired and nuclear power plants. SRBC continues to employ scientific criteria to balance sustainable development of water resources in the basin and protect the aquatic ecosystem from potential impacts associated with water use.

Balancing Water Use and Instream Flow Protection

Although the Susquehanna River Basin is abundant in water resources, unconstrained development of the resources has the potential to impact other water users and aquatic ecosystems. SRBC has protective regulations, policies and guidance in place to afford adequate protection of instream flows while still allowing for necessary water use. Examples of instream flow protection measures implemented by SRBC include conservation releases, passby flows and consumptive use mitigation. Consumptive use is water that is withdrawn and not returned to the basin undiminished in quantity.

Conservation releases are prescribed flow quantities that must be maintained downstream of an impoundment. Passby flows are prescribed streamflow levels at which a withdrawal must cease. Consumptive use mitigation is the elimination or replacement of consumptive water use during critical low flow periods.

Indicator Criteria

Criteria	Assessment Period	
	Jan 1 - Dec 31, 2009	Jan 1 - Dec 31, 2011
Amount of reported consumptive water use (MGD - million gallons per day)	110	127
Amount of reported surface water withdrawal (MGD)	2,404	2,841
Amount of reported groundwater withdrawal (MGD)	111	131
Amount of freshwater delivered to natural gas well pads (MGD)	1	6

Data Sources: SRBC water use data

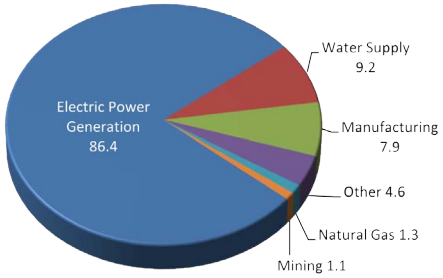
SRBC owns water storage at two U.S. Army Corps of Engineer (USACE) reservoirs - Cowanesque and Curwensville - for release during times of low flow to mitigate for regulated consumptive uses. SRBC also has arrangements with the USACE for water at its Whitney Point Restoration Project to be released for downstream environmental restoration purposes during times of low flow. In addition, SRBC partnered with the Pennsylvania Department of Environmental Protection at its Lancashire 15 mine drainage treatment plant to mitigate consumptive uses by agricultural operations in the Pennsylvania portion of the basin.

SRBC continues to evaluate and refine its implementation of instream flow protection measures. The recent development of a new Low Flow Protection Policy is one such example.

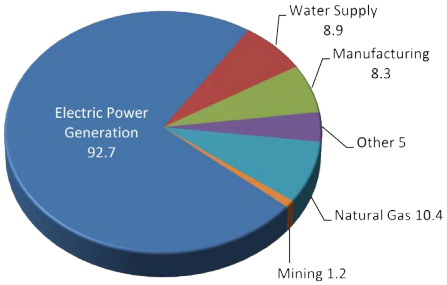
Natural Gas Post-Hydrofracture Report Summary		
Parameter Assessed	Assessment Period	
	Jan 1 – Dec 31, 2009	Jan 1 – Dec 31, 2011
Water supplied by Public Water Supply (%)	52	29
Water supplied by SRBC-approved sources (%)	48	71
Average volume of water used per well (mgal)	3.73	4.54
Average flowback fluid recovered (%)	10	7
Wells reusing flowback fluid (%)	58	87

Data Sources: SRBC water use data

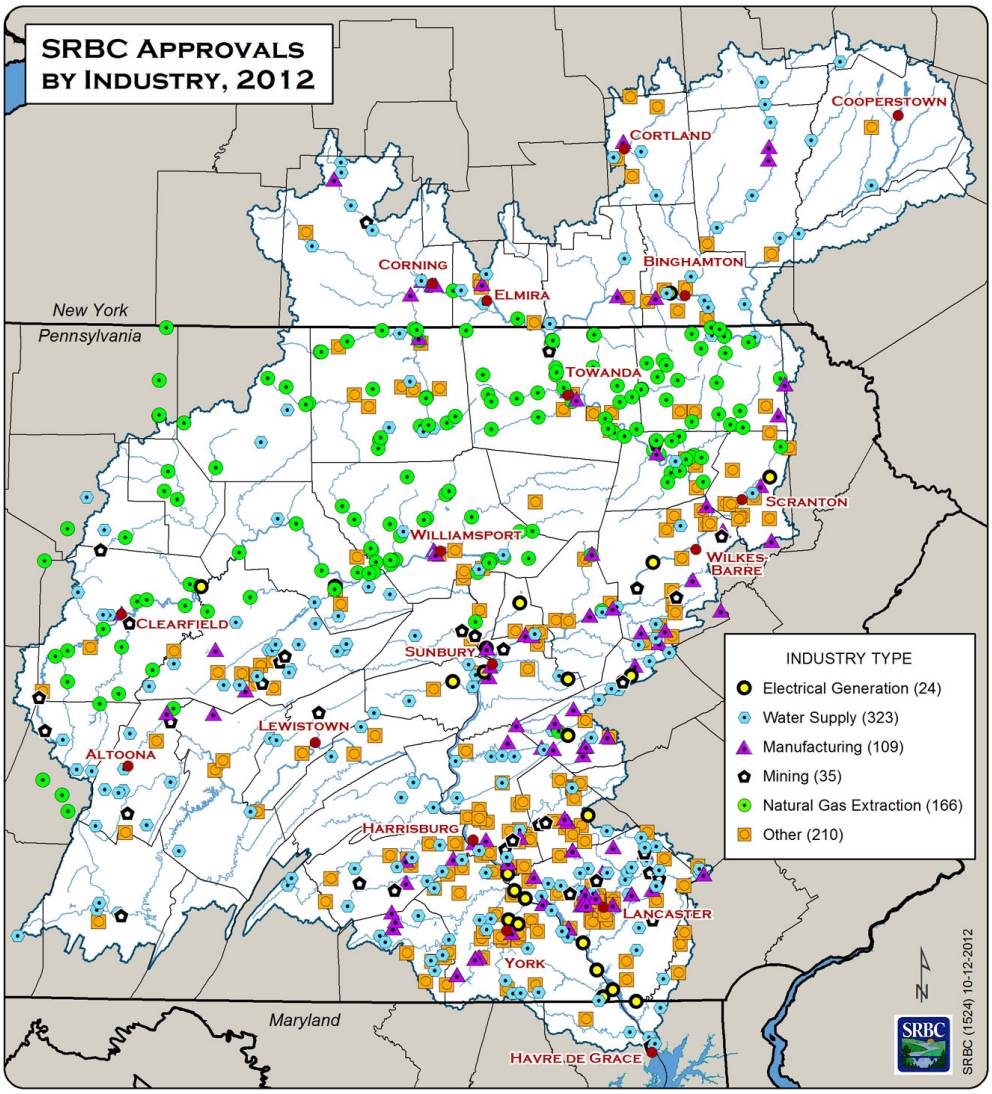
Reported Consumptive Water Use By Industry (MGD) 2010 Status*



Reported Consumptive Water Use By Industry (MGD) 2012 Status*



**2012 status based on 2011 SRBC water use data; 2010 status based on 2009 SRBC water use data*
MGD — million gallons per day



Water Use Industry	Reported Groundwater Withdrawals (MGD)		Reported Surface Water Withdrawals (MGD)	
	Jan 1 - Dec 31, 2009	Jan 1 - Dec 31, 2011	Jan 1 - Dec 31, 2009	Jan 1 - Dec 31, 2011
Electric Generation	4.8	5.6	2,352	2,749
Water Supply	51	51	23	57
Manufacturing	17	17	26	25
Mining	27	46	0.7	1.5
Other	11	10	2.0	1.4
Natural Gas Extraction	0.0	0.9	0.8	8.3

Data Sources: SRBC water use data

Focus Story

Developing the Low Flow Protection Policy

The USACE, SRBC, and The Nature Conservancy (TNC), in cooperation with other project stakeholders, conducted an Ecosystem Flow Study culminating in a November 2010 report entitled "Ecosystem Flow Recommendations for the Susquehanna River Basin."

In the report, TNC presented a set of recommended flows to protect the species, natural communities, and key ecological processes within the various stream and river types in the Susquehanna River Basin. One of the most critical findings of the study is that seasonal flow recommendations are preferred to year-round flow recommendations as ecosystem flow needs are naturally seasonal.

These ecosystem flow recommendations are one of the original motivations that triggered SRBC to develop a new Low Flow Protection Policy, which was adopted as final in December 2012. The policy provides seasonally variable criteria for determining passby flows and conservation releases associated with approved withdrawal projects.

Indicator 2

Floods & Droughts

Overarching Issue

The Susquehanna River Basin is one of the most flood-prone watersheds in the nation, experiencing on average tens of millions of dollars in damages each year. On the other side of the hydrologic spectrum, the basin experiences severe droughts about once every decade. The network of rain, stream and groundwater gages throughout the basin, maintained and operated by the U.S. Geological Survey (USGS), are critical for monitoring hydrologic conditions and informing management decisions. Unfortunately, funding for this critical water infrastructure continues to be a perennial challenge.

Overview

The Susquehanna River Basin experiences major flooding on the mainstem rivers on average once every 14 years and flash flooding throughout the basin annually. The mainstem Susquehanna is also subject to ice jams and flooding – to a greater extent than any river east of the Rocky Mountains.

Since the beginning of the 1900s, the basin has experienced severe droughts, with the recent decades being particularly problematic. From 1990 to 2011, emergency drought status was declared 17 times for counties within the basin; in addition, drought warning status was declared in counties 11 out of the 21 years.

Indicator Criteria

Criteria	Assessment Period	
	Jan 1 - Dec 31, 2009	Jan 1 - Dec 31, 2011
Number of river forecast points (RFPs) with flood inundation mapping	17 (23% of RFPs)	18 (24% of RFPs)
Occurrences of major flood exceedence at RFPs	no major floods	25 (32% of RFPs)
Number of county drought declarations (% of year)	Warning: 4 (7% of year)	Warning: 4 (8% of year) Watch: 28 (19% of year)
Approved surface water (SW) & groundwater (GW) withdrawals & % with passby flow requirements	GW: 54 approvals, 13% w/ passby SW: 54 approvals, 69% w/ passby	GW: 27 approvals, 28% w/ passby SW: 67 approvals, 69% w/ passby

Data Sources: SRBC water use data, State Drought Coordination Committees, National Weather Service

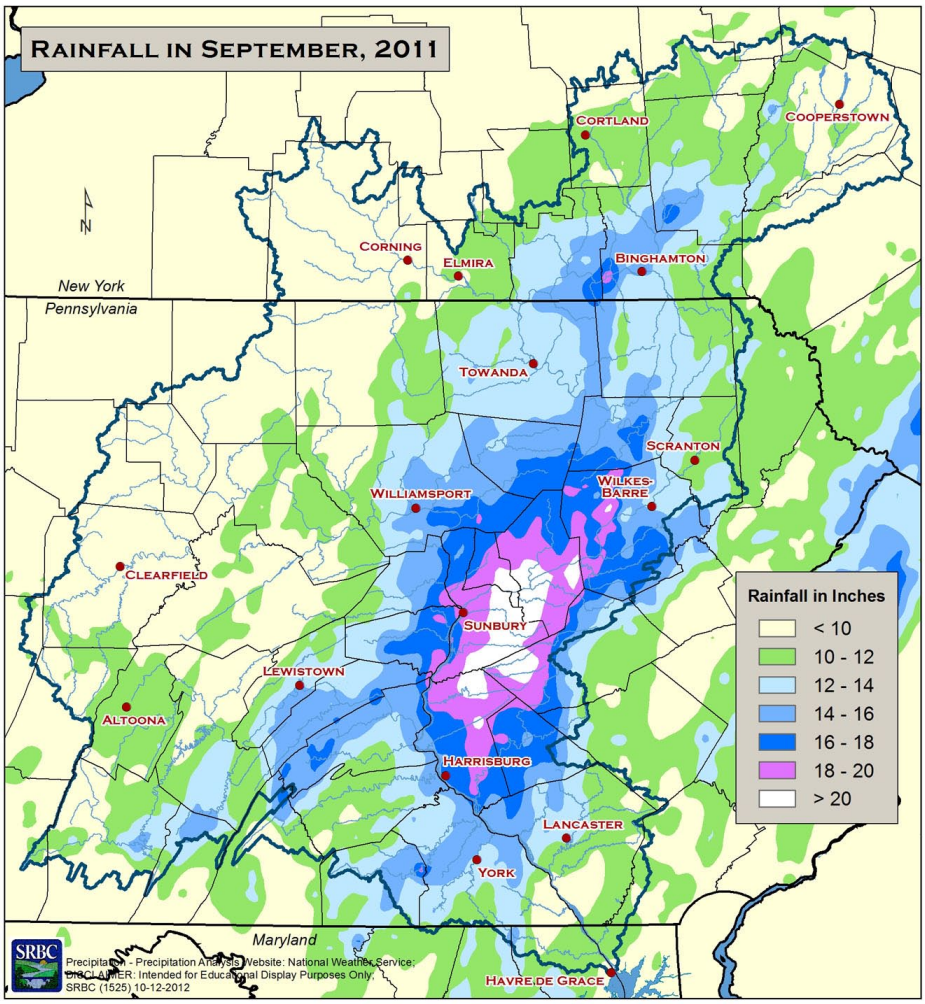
Effects of Tropical Storm Lee

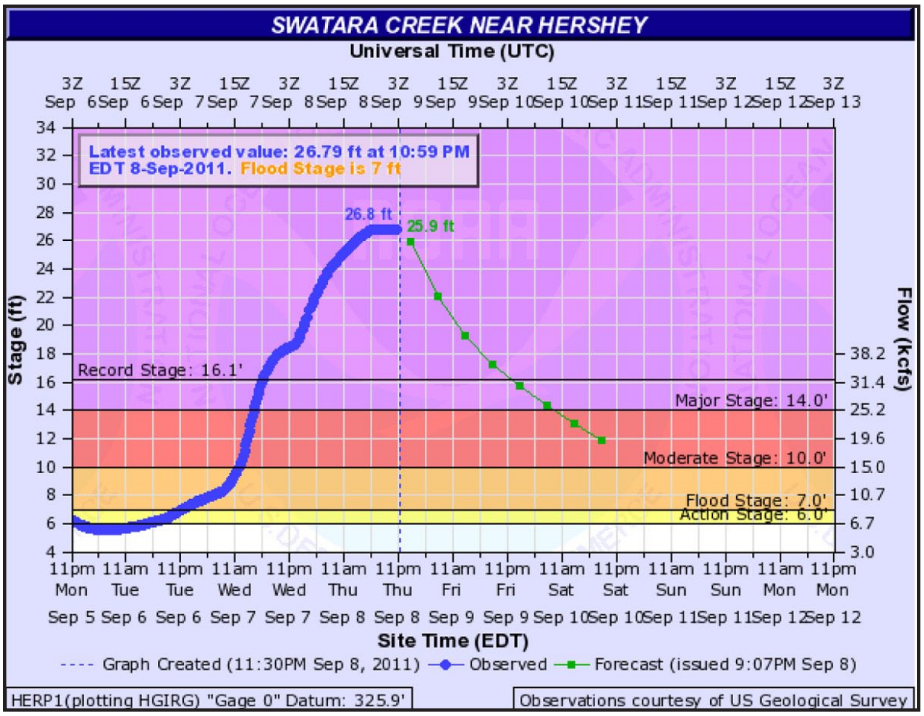
In September 2011, the remnants of Tropical Storm Lee dumped more than 15 inches of rain (see rainfall graphic, page 7) throughout the basin displacing nearly 100,000 people and causing an estimated $1 billion in damages in Pennsylvania.

On September 8, the President declared an emergency for 32 Pennsylvania counties within the basin (17 of which were declared as Major Disasters); seven New York counties and two Maryland counties in the basin were also federally declared disasters. The Susquehanna River reached a record high of 32.75 feet at Bloomsburg, Pa.; Swatara Creek in Hershey, Pa., crested at a record high of 26.8 feet, nearly double its 14-foot major flood stage (see hydrograph).

Due to the major widespread impacts of Tropical Storm Lee, SRBC's Susquehanna Inundation Map Viewer (SIMV) received 14,703 hits from September 6 to September 12, 2011. The availability of SIMV during Tropical Storm Lee provided emergency management personnel and at-risk communities with a valuable tool for assessing flood risk and making informed decisions during the extreme hydrologic event.

Susquehanna River flooding in Athens, Pa., September 2011.





Hydrograph for Swatara Creek near Hershey, Pa., during September 2011 flooding from Tropical Storm Lee. Note the observed crest of 26.8 feet, which is 12.8 feet above major flood stage and 10.7 feet above the record flood stage for this location. Also note that streamflows remained above major flood stage for a period of approximately 2 days from September 7 - 9, 2011.

Focus Story

PA Silver Jackets Partnership to Develop Harrisburg Flood Inundation Mapping

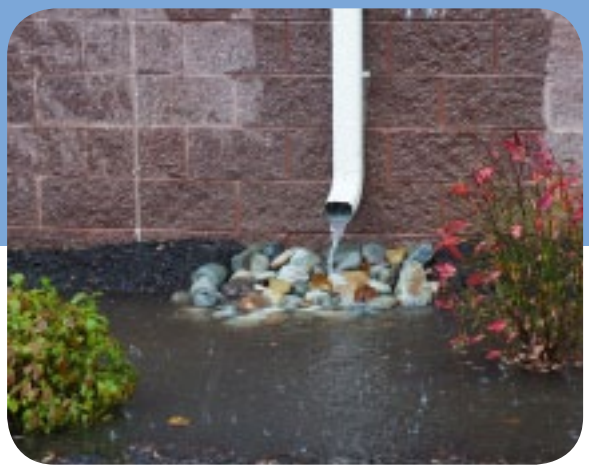
'The Silver Jackets' is an innovative federal program that brings together multiple state, federal and local agencies to learn from one another and apply their knowledge to identify, prioritize and address risk management issues and implement solutions. The PA Silver Jackets, an interagency flood risk management team, is comprised of many agencies, including SRBC, U.S. Army Corps of Engineers, National Weather Service, USGS, City of Harrisburg, Pennsylvania Emergency Management Agency and Federal Emergency Management Agency.

Given the area's risk to flooding, in 2011, the PA Silver Jackets team selected the City of Harrisburg and surrounding areas for the Harrisburg Flood Inundation Mapping project. The team, along with the Harrisburg Authority, performed the technical work in 2011 and 2012 and is expected to complete the flood inundation maps and make them available on the Internet by spring 2013. This mapping project covers a 20-mile stretch of the Susquehanna River including the city and those communities to the north and south.

Silver Jackets workshop, May 2012.

Indicator 3

Stormwater



Overarching Issue

When rain or snow falls on land, the water returns to the hydrologic system in one of three ways: seeping into the ground to recharge the soil or groundwater; evaporating or being used by plants; or running off land and into lakes or rivers. As development occurs within a watershed, the land is less able to absorb water as impervious surfaces, like parking lots and roofs, intercept water that would typically infiltrate into the ground and funnel that water directly into streams and rivers. The intercepted water is commonly referred to as stormwater.

Overview

Stormwater typically can carry very high pollutant loads from the developed areas of the Susquehanna basin. Regardless of the activity, human alteration of the landscape affects the natural hydrology. Several studies indicate that the presence of as little as 8-10 percent of developed lands within a watershed will negatively affect the quality of water (Arnold and Gibbons, 1996; Schueler, 1994).

Within the Susquehanna basin, more than 1,000 stream miles are classified as polluted from developed/stormwater runoff. Some of the pollution issues associated with stormwater runoff include: contaminants washed from the land surface; streambank erosion and sedimentation; overflow of raw sewage from sewer systems; increased water temperature; and increased flooding.

Impervious surfaces in developed areas prevent the natural infiltration of rainfall into the soil. This decreases the removal of pollutants by the soil and increases the volume and flow rate of surface runoff.

Indicator Criteria

Criteria	Assessment Period	
	2010	2012
Number of stream miles impaired by stormwater	1,120	1,150
Percent impervious cover or developed lands	7.9%	8.1%
Approximate area managed by state permits covering "urbanized areas" (Municipal Separate Storm Sewer System (MS4) Permits)	1300 sq mi	2700 sq mi
Number of precipitation-driven high flow events for the Susquehanna River above the 100,000 cubic-feet-per-second threshold over the previous two years	33	100

Data Sources: SRBC SNAP data, NY/PA/MD MS4 community data, NY/PA/MD stream impairment data, USGS land use data

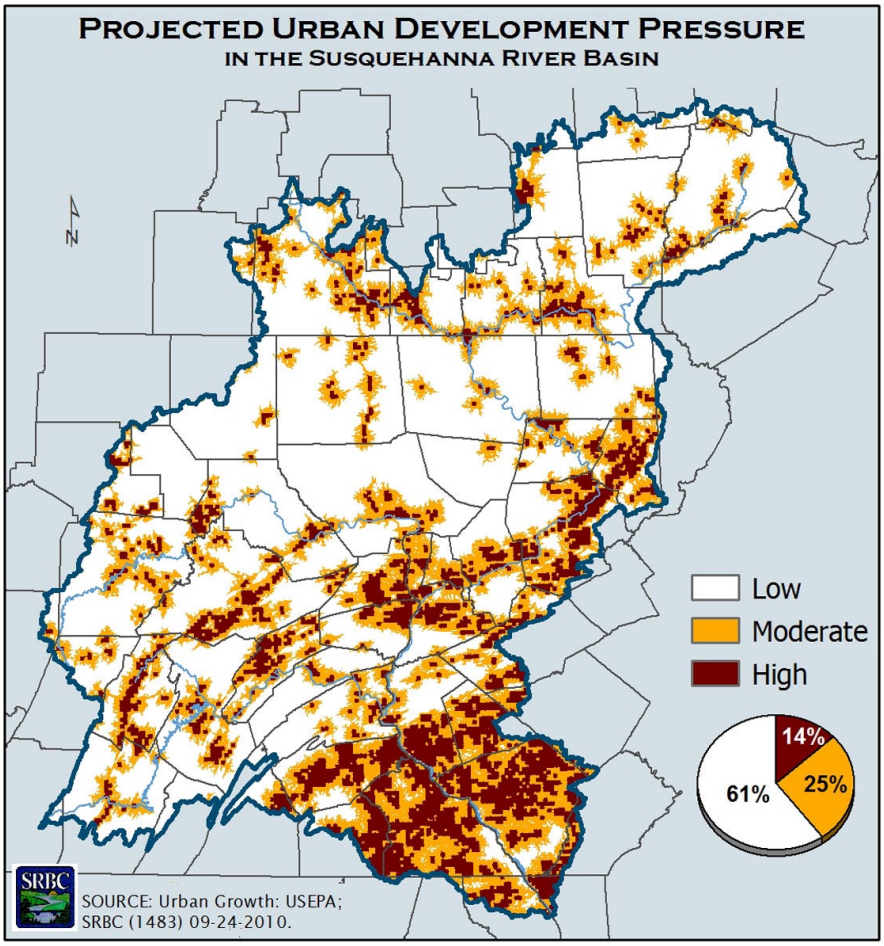
Partnerships

Through partnerships with Lancaster County, the Center for Watershed Protection, the Alliance for the Chesapeake Bay, and several local Pennsylvania municipalities, SRBC has supported stormwater retrofit assessments and implementation of local projects in the Lower Susquehanna Region for installing improved stormwater management practices using bioretention and other "green" infrastructure measures. These demonstration projects, which have served as examples for other groups to follow to reduce the negative effects of stormwater in local communities, reduced impervious surfaces and increased beneficial filtration/infiltration of stormwater through the use of natural vegetation.

Stormwater Tips

Every property owner can help minimize the negative impacts of stormwater runoff. Use landscaping practices that infiltrate stormwater, and reduce or refrain from using products that can contaminate stormwater runoff.

- Plant a rain garden (above photo), which is a specially designed and strategically located garden to intercept and treat stormwater using carefully selected plants and soil medium.
- Leave a buffer strip of native vegetation (trees, bushes and other plants) along lake shorelines or streambanks.
- Prevent grass clippings and leaves from washing into the storm sewer.
- Make certain, if you use a lawn care service, that the company is not applying "blanket" applications of fertilizer and pesticides. Ask if the company has conducted soil tests and a pest analysis to determine appropriate applications.



Focus Story

Urban Monitoring — Cedar Run and Paxton Creek

Since 2006, SRBC has been conducting both chemical and biological sampling in two small urban watersheds to better understand the conditions that affect water quality within these land use intensive settings. Water quality in urban watersheds is typically affected not only by polluted runoff from impervious areas, but also by an increased concentration of industrial/commercial facilities and discharges, concrete stream channelization, runoff from heavily treated lawns, and other issues. The Paxton Creek and Cedar Run Watersheds in the greater Harrisburg area have monitoring programs in place to track water quality conditions, and in some areas, the conditions are monitored continuously in "real-time" as well as outfitted with auto-samplers to collect water for full lab analyses during storms or when the real-time data may "trigger" an alarm. These data are critical to understanding urban watershed processes.

Urbanized channel of Paxton Creek, Harrisburg ,Pa., during base flow and stormflow conditions.

Continuous water quality monitoring and water auto-sampler station in the Cedar Run Watershed.

The Drinking Water Connection

The tap water we all take for granted did not necessarily start out so clean. It may have passed through farm fields and construction sites, over ice-covered roads laden with salt, through over-fertilized lawns and broken septic fields, or past a leaking underground storage tank before it was pumped into the local water treatment plant.

These and other man-made influences increase the cost for public water suppliers to monitor and treat raw water for human consumption. If point- and non-point source dischargers, public water suppliers, water resource agencies, landowners and others can help keep the influences in check, those costs can be significantly reduced.

How can we help keep water cleaner before it reaches the treatment plant? Some of the answers lie in Source Water Protection (SWP) Plans.

Source Water Protection plans accomplish three key objectives:

- they delineate recharge areas of wells (for supplies relying on groundwater sources) or the watershed (for supplies that use surface water sources);
- they provide detailed inventories of potential sources of contamination; and
- they involve community stakeholders in developing strategies for reducing the likelihood of water contamination.

Although source water assessments were mandated by the federal Safe Drinking Water Act, the voluntary development of Source Water Protection plans lags seriously behind. About 16 percent of the public water systems in the basin have Source Water Protection plans in place. Since 2003, SRBC has been helping 23 community water systems develop SWP plans that are tailored to the watershed areas contributing water to their public drinking systems.

WATER SUPPLY & DEVELOPMENT

The Susquehanna River Basin provides drinking water for about 4.1 million basin residents in New York, Pennsylvania and Maryland. In addition, more than 15 million gallons per day are diverted out of the basin to supply public drinking water to another 2 million people outside of the basin, including substantial diversions to support the City of Baltimore, Md., and Chester County, Pa.

FLOODS & DROUGHTS

Floods and droughts both have impacts on the basin's drinking water supply. Droughts can lead to voluntary and mandatory water use restrictions and, depending on severity, reliance on contingency sources. Floods not only affect transportation and building infrastructure, they can also impact drinking water quality and sewer conveyance, particularly in areas with combined sewer overflow systems. Floods can necessitate boil-water advisories and water conservation measures.

Since many systems do not own the lands around their water supply wells and intakes, there is strong evidence that the plans that produce the most tangible results usually rely heavily on collaboration and public education.

For more information on SWP plans that reflect strong partnerships and on-the-ground results, see www.srbc.net/programs/partnership.htm.

MINE DRAINAGE

Mine drainage pollution affects the availability of clean, affordable drinking water. In addition, new industries and large water users may avoid areas in which clean water supplies are not available.

STORMWATER

Urban runoff that may contain heavy metals, organic compounds such as pesticides and herbicides, pathogens, and nutrients or sediments, is commonly collected in storm sewers and discharged to waterways untreated. Thus, surface waterbodies that are used for drinking water routinely receive contaminants carried in runoff.

SEDIMENT & NUTRIENTS

Sediment and nutrient pollution affects the treatment of clean, affordable drinking water. In addition, excessive nutrients can increase the production of harmful disinfection byproducts during the drinking water treatment process.

HABITAT & AQUATIC RESOURCES

Healthy aquatic communities and habitats indicate the presence of reasonably good water quality, which is integral to sustaining sound ecosystems and numerous human activities, including using water sources as drinking water.

The Susquehanna River Basin provides drinking water to more than 6 million people.

Focus Story

Major Public Water Supplies Relying on the Susquehanna River			
Water Supply	**Population Served**	**Type of Operation**	**Source**
New York			
Binghamton	> 40,000	City	Susquehanna
Elmira	> 60,000	City	Chemung River in combination with groundwater wells
Pennsylvania			
Danville	> 15,000	Municipal	Susquehanna
Milton/ Lewisburg Area	> 40,000	PA American Water Co.	West Branch Susquehanna
Shamokin Dam	> 1,500	Municipal	Susquehanna
Sunbury	>10,000	Municipal	Susquehanna serves as a backup source
Harrisburg Area	> 90,000	United Water Co.	Susquehanna in conjunction with Swatara Creek
Harrisburg Area	> 65,000	Municipal	DeHart Reservoir (Susquehanna serves as a backup source)
Steelton	> 5,000	Municipal	Susquehanna
Columbia	> 25,000	Columbia Water Co.	Susquehanna
City of Lancaster	> 100,000	Municipal	Susquehanna in conjunction with Conestoga River
Wrightsville	> 4,000	Municipal	Susquehanna
City of York Area	> 180,000	York Water Co.	Susquehanna (blending with reservoir water as a backup)
Red Lion	> 10,000	Municipal	Susquehanna serves as backup source for blending with other primary sources
Southwestern Delaware and Southern Chester counties	> 200,000	Chester Water Authority	Susquehanna serves as a source for blending with reservoir water
Maryland			
Baltimore	> 1,800,000	City	Susquehanna serves as a source for blending with reservoir water
Other Maryland Communities	> 100,000	Harford County, Havre de Grace, Perryville, Port Deposit	Susquehanna serves as primary for Havre de Grace, Port Deposit, and Perryville - Harford County blends with other sources

This list does not include small suppliers (those serving only several hundred customers — fewer than six suppliers fit this criteria for the Susquehanna mainstem -- Peach Bottom, etc.)

Planning alone does nothing to reduce the risk to water supplies; the key is to implement Source Water Protection (SWP) Plan strategies.

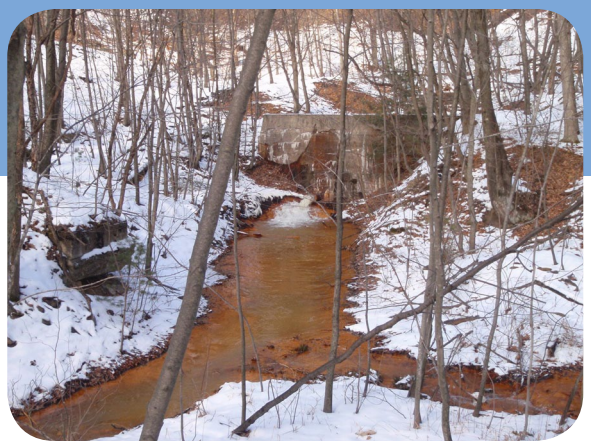
That is one reason SRBC convened a workshop in February 2012 to consider a regional approach to facilitating SWP implementation in the lower Susquehanna River basin. Nearly 80 representatives from the region's water authorities, water companies, municipalities, private firms and state water agencies attended the workshop and weighed in on whether to pursue a regional path.

Local SWP partnerships and regional organizations from outside the focus area shared success stories and lessons learned in SWP implementation. Size, structure, degree of collaboration, and shared goals were among the discussion items. Overall, the participants agreed that a regional framework would be valuable. How such an umbrella organization will be structured and operated will be determined through future dialogue.

For more information on SRBC's Source Water Protection efforts, see www.srbc.net/programs/partnership.htm.

Indicator 4

Mine Drainage



Overarching Issue

Mine drainage is the second largest source of stream impairment in the basin and encompasses a variety of aquatic impacts, including depressed pH and elevated acidity, sulfate, and metals such as iron, manganese, and aluminum, as well as sedimentation. These impacts, taken together, can have devastating impacts on aquatic life, such as mayflies, stoneflies, plants and native brook trout. Mine drainage also can preclude use of water for agriculture, commercial and industrial purposes and human consumption.

Overview

Mine drainage impacts approximately 2,000 miles of streams/rivers in the basin, and represents the second largest source of pollution in the Susquehanna River Basin. These impacts can be devastating to aquatic life and prevent the use of the resource for recreation and other human use. However, plans and strategies for addressing the problem have been developed for watersheds throughout the basin, and progress is being made towards realizing recovery of the resource within many settings.

Indicator Criteria

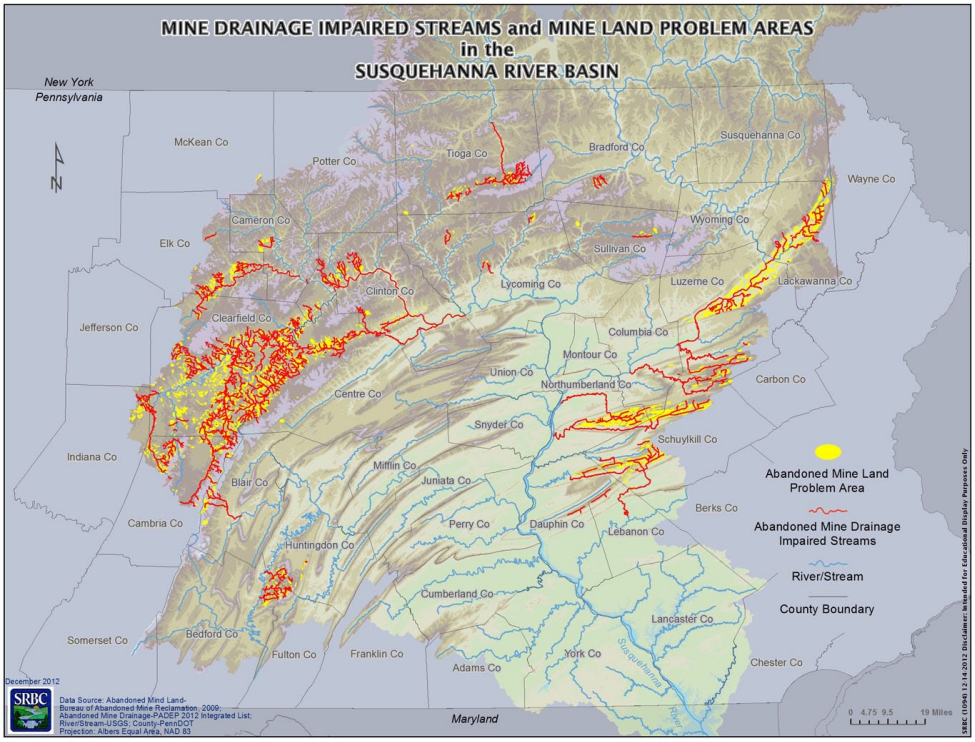
Criteria	Assessment Period	
	2010	2012
Number of mine drainage impaired stream miles	1,980	2,010 *
Number of remediation projects implemented	123	133
Number of acres of abandoned mine lands restored	15,752	16,554
Amount of mine drainage water allocated for beneficial use/ reuse (MGD)	142	155

** Increases in stream miles data from 2010 to 2012 largely reflect refinements to states' impaired-waters categorization process.*

Data Sources: SRBC water use data, EPCAMR RAMLIS data, PADEP BAMR data, PA stream impairment data

Partnerships

In the Anthracite Region, SRBC is coordinating its efforts with the Pennsylvania Department of Environmental Protection, Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR) and other private/public partners. In particular, the sharing of data between EPCAMR and SRBC for EPCAMR's Anthracite Region Mine Pooling Initiative and SRBC's remediation strategy has proven invaluable for moving both initiatives forward. Both agencies will continue to work together to implement the restoration strategy and continue the mine pool mapping effort in additional Anthracite Coal Fields.



Restoration Efforts

Although mine drainage can have devastating effects on water quality and overall health of the aquatic ecosystem, there is the potential to see short term improvements after successful restoration efforts. The pictures at right show the changes that have occurred in the Bear Run Watershed after treating iron-laden discharges. Trout populations and other aquatic species can move into such areas quickly under such improved conditions.

Bear Run before (left) and after restoration efforts to reduce mine drainage into the watershed.

Focus Story

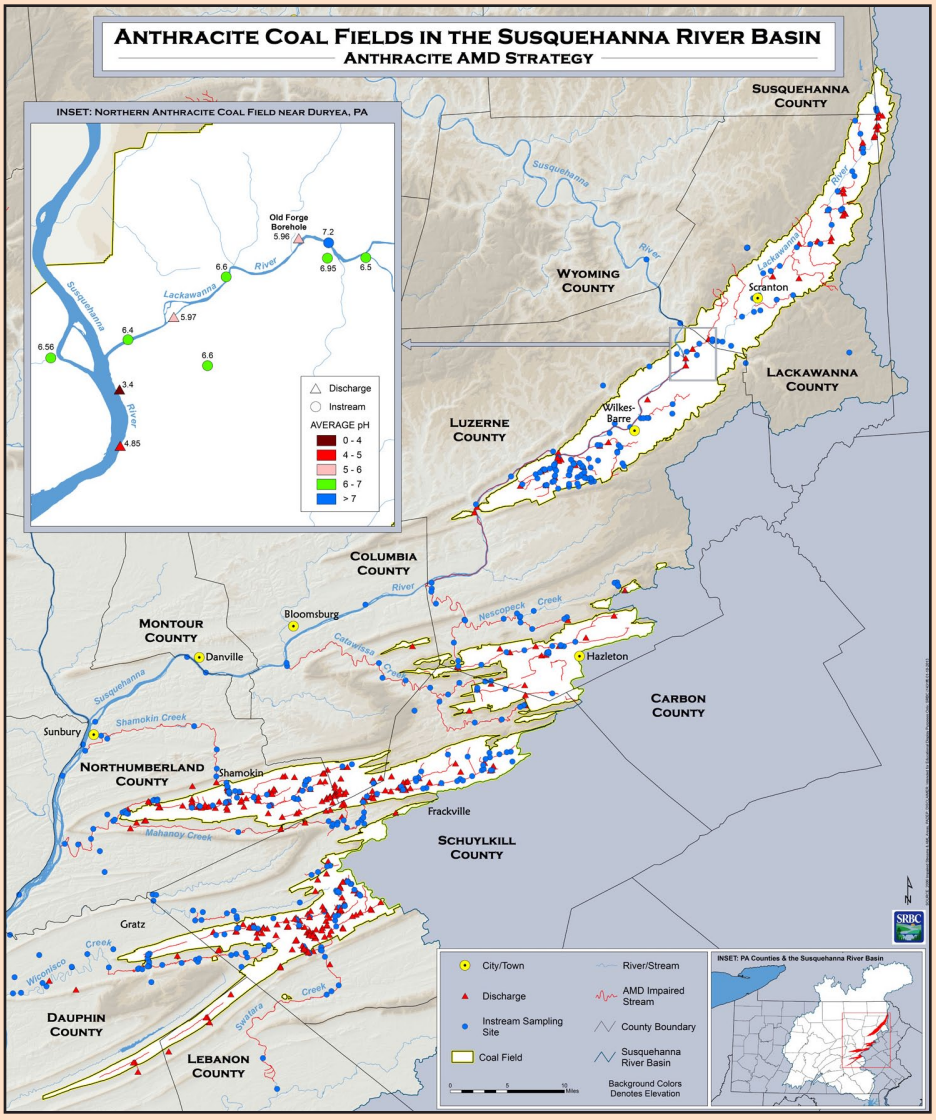
Anthracite Region Mine Drainage Remediation Strategy

In 2011, SRBC completed the Susquehanna River Basin Anthracite Region Strategy, which encompasses a comprehensive inventory and analyses of water quality data for streams and mine drainage discharges within the basin's eastern anthracite region.

Of the 320 discharges inventoried, SRBC determined that as few as 20 mine drainage discharges are contributing nearly 72 percent of the mine drainage loading to rivers and streams in the region.

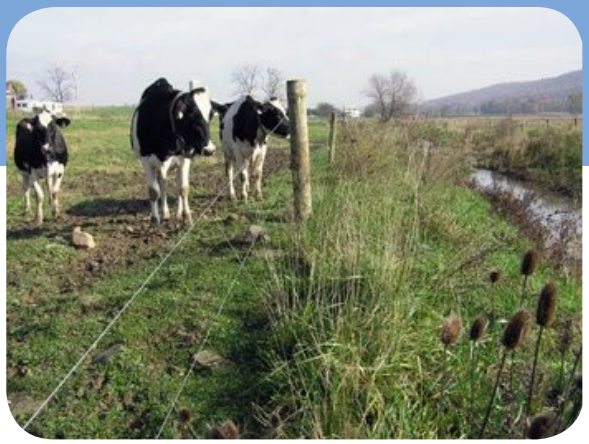
The primary recommendation of the plan is to construct 10 active treatment plants. These plants would treat only 11 percent of the 320 mine drainage discharges in the Susquehanna River Basin Anthracite Region; however, treatment of these significant discharges could potentially remove about 60 percent of the acidity loading, 68 percent of the iron loading, and 79 percent of the aluminum loading currently entering the Susquehanna River.

SRBC, along with EPCAMR and the Lackawanna River Corridor Association, is taking the steps needed to develop the first active treatment plant for the Old Forge Borehole and Duryea Breach Discharges near the mouth of the Lackawanna River. The collection of data to refine the restoration plan is complete, and the group is currently working on securing property rights for a future plant.



Indicator 5

Sediment and Nutrients



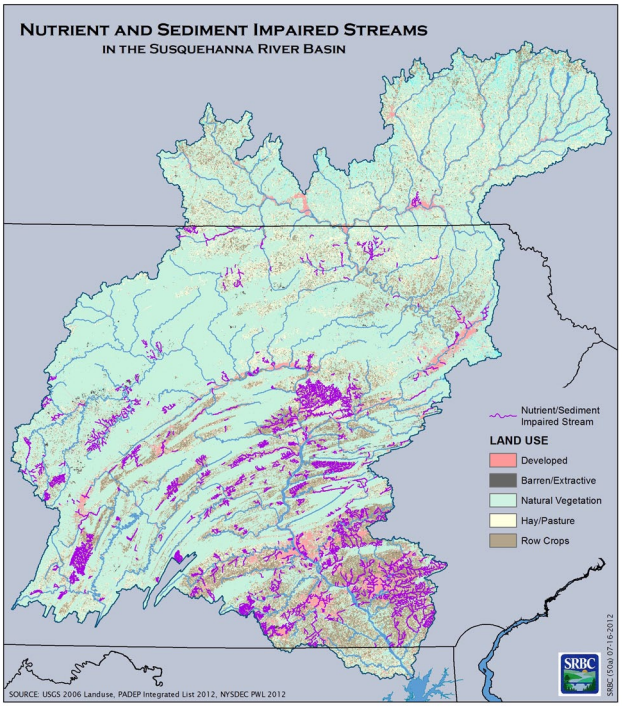
Overarching Issue

Nutrients and sediment are two of the largest contributors to stream impairment in the Susquehanna River Basin and are extremely widespread. Sediment and nutrients negatively impact aquatic life uses and can preclude water use for human consumption. Excess nutrients in the Chesapeake Bay can lead to algal blooms and eventually oxygen depletion when the algae die and decompose – affecting aquatic life. Sediment also is a problem in the Bay, as it reduces water clarity for plant life and transports nutrients that may be bound to the sediment.

Overview

About 4,200 stream miles in the Susquehanna River Basin are impacted by nutrients and/or sediment, with a large number of impacts occurring in the Lower Susquehanna region. Sediment and nutrient impairment encompasses a variety of aquatic impacts, including decreased habitat availability, increased aquatic vegetation production, and depressed dissolved oxygen levels. High nitrate levels also can preclude use of water for human consumption and can lead to poor reproduction in farm animals.

The sources of sediment and nutrients in the basin are as varied as they are widespread, ranging from atmospheric deposition, to fertilizer treatments on suburban lawns, to impacts related to animal grazing. Many best management plans exist to reduce the amount of nutrients and sediment entering stream systems, including planting healthy riparian areas, fencing farm animals from streams, installing stormwater wetlands or bioretention features and applying proper construction techniques.



Indicator Criteria

Criteria		Assessment Period	
		2009 - 2010	2011 - 2012
Number of stream miles impaired by sediment and/or nutrients		4,135	4,211 *
Number of local watershed plans (TMDLs) completed to address sediment and nutrients		106	136
State Watershed Implementation Plan (WIP) progress - % reduction needed to meet overall pollution targets		25%	21%
Percent reductions shown to date in long-term flow-adjusted concentrations, as monitored by SRBC	Nitrogen Phosphorus Sediment	30% 33% 41%	33% 41% 46%

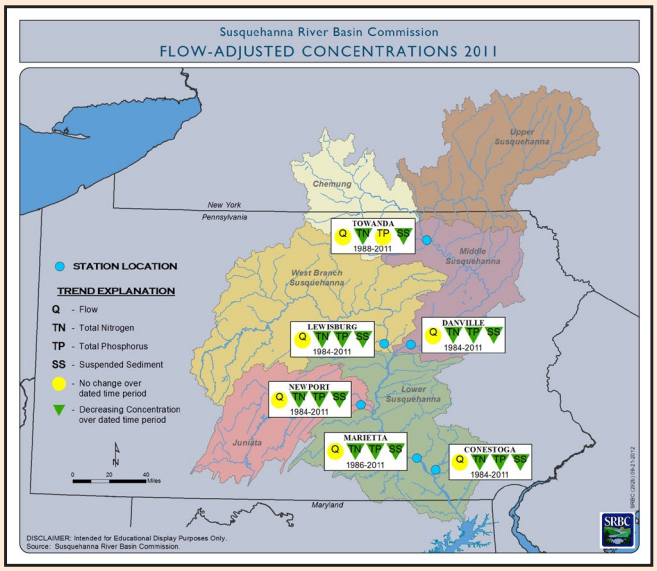
** Increases in stream miles data from 2010 to 2012 largely reflect refinements to states' impaired-waters categorization process.*

Data Sources: SRBC SNAP data, NY/PA/MD WIP and TMDL tracking data, NY/PA/MD stream impairment data

Monitoring and Addressing the Problem

Monitoring — Sediment and Nutrients in the Basin

In 1985, SRBC along with the U.S. Geological Survey, the Pennsylvania Department of Environmental Protection (PADEP) and the U.S. Environmental Protection Agency (USEPA) began an intensive study of nutrient and sediment transport in the Susquehanna River Basin. Funding for the program was provided by grants from the PADEP and the USEPA Chesapeake Bay Program Office. The long-term focus of the project was to quantify the amount of nutrients and suspended sediment transported in the basin and determine changes in flow-adjusted concentration trends at twelve sites. Several modifications were made to the network including reducing the original twelve sites to six long-term sites, then adding 13 sites in 2004, four sites in 2005 and four sites in 2012. The current network consists of 27 sites throughout the Susquehanna River Basin varying in watershed size and land use.



Collecting data at stations on the mainstem Susquehanna River and major tributaries is necessary to characterize nutrient and suspended sediment loads and trends, shown above, and to confirm the Chesapeake Bay Program watershed model load allocations. These analyses provide the basis for refining the model for tracking the necessary reductions needed to restore local waters and the Chesapeake Bay.

Addressing — Total Maximum Daily Loads

A total maximum daily load (TMDL) is the amount of a specific pollutant that a waterbody can receive and still maintain water quality standards, and meet the goals of the Clean Water Act. The allocation, or allowable amount, of a specific pollutant takes into account both point and nonpoint sources of that pollutant in a watershed.

Point sources include discharges from sewage treatment plants and industrial wastewater facilities. Nonpoint sources are the pollutants that run off from the land.

Resulting effects on streams from sediment and nutrient pollution – "choking" of aquatic life.

The USEPA established a TMDL for the Chesapeake Bay in 2010, with pollution reduction targets for sediment and nutrients established for 2025. Outside of the TMDL established for the Chesapeake Bay, New York, Pennsylvania and Maryland have developed TMDLs for more than 130 smaller watersheds addressing problems associated with sediment and nutrients and identified the reductions needed in local waters. TMDLs define the existing pollution problem and the needed reductions, laying the framework for the restoration actions needed on the landscape.

Municipal wastewater discharge point.

Indicator 6

Human Health & Drinking Water Protection

Overarching Issue

There are thousands of potential contaminants that exist in the environment, and yet only about 90 are regulated through federal or state drinking water standards. With about 4.1 million people in the basin and more than 2 million outside the basin depending on drinking water from the Susquehanna basin, maintaining and protecting clean water to support human health is critically important.

Overview

More than 50 percent of the Susquehanna River Basin population obtains drinking water from watersheds that are susceptible to a wide range of pollutant sources. Typically, those responsible for treating water to public drinking water standards have no control over the land management activities that occur upstream of public drinking water intakes that may affect the quality of the water.

Approximately 17 percent of the Susquehanna River Basin's waters are listed as impaired, and fish consumption advisories are in place throughout the basin. The major sources of pollution to these waterways include agriculture, mine drainage, urban/suburban runoff and atmospheric deposition. In addition, there are emerging concerns about pollutants, such as personal care products, antibiotics, pharmaceuticals, pesticides and hormones, which have mostly been attributed to treated wastewater flows.

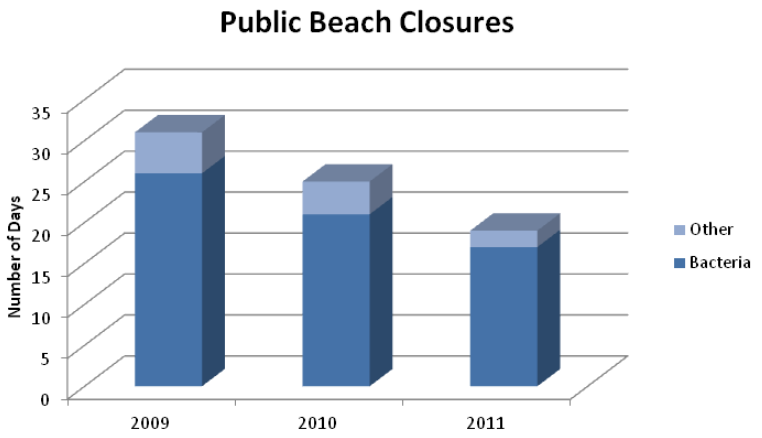
It's a Fact

- ***Groundwater plays a critical role in supplying drinking water in the Susquehanna River Basin. Total groundwater use in the basin is about 391 million gallons per day (mgd). The largest users are public water suppliers (115 mgd), mining (90 mgd), domestic withdrawals (80 mgd), industrial (48 mgd), agriculture (42 mgd), and commercial (12 mgd). (Source: Groundwater Management Plan for the Susquehanna River Basin, 2005)***

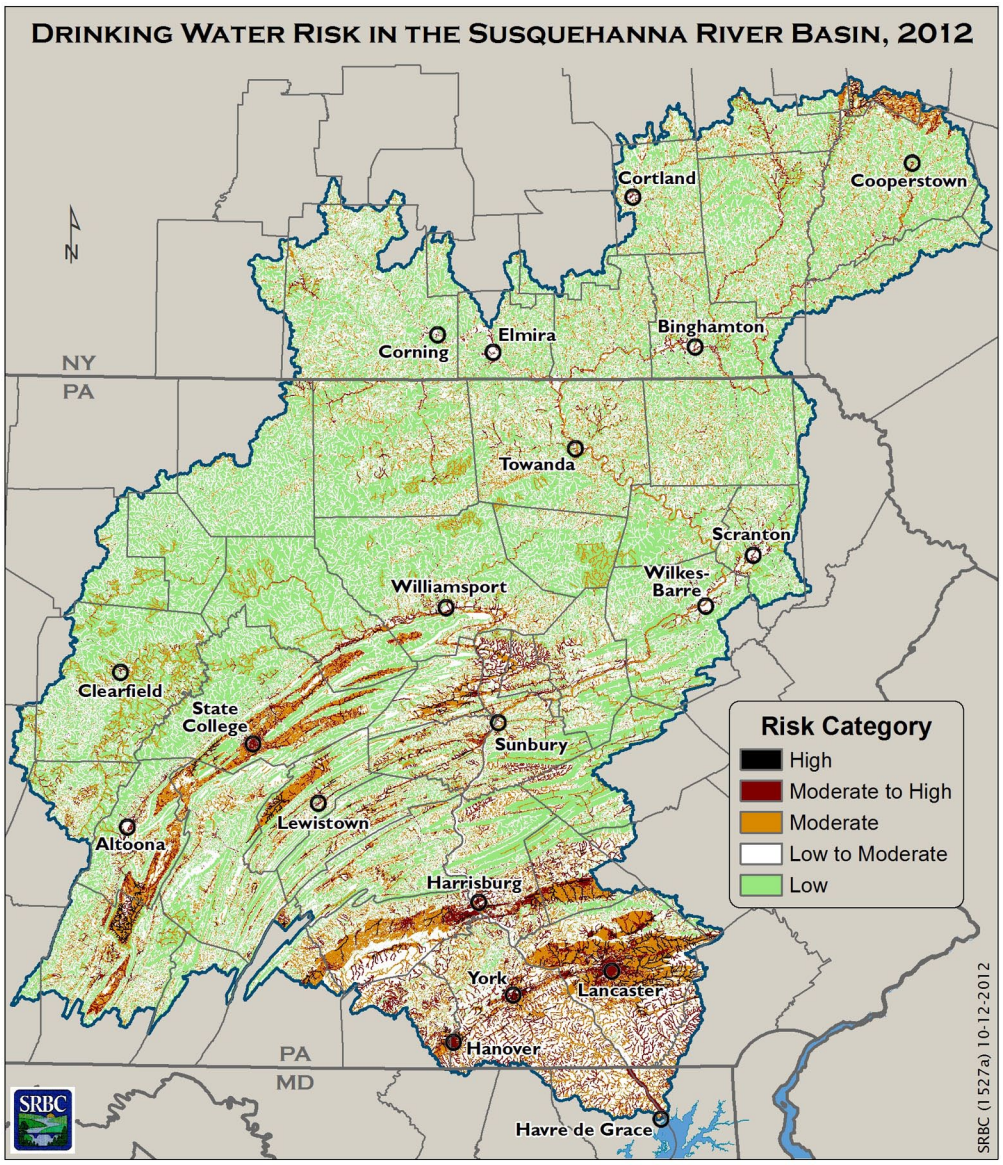
Indicator Criteria

Criteria	Assessment Period	
	2010	2012
Percent of assessed stream miles designated as recreational/potable water use that are impaired for microbial pollutants	8%	17%
Percent of assessed stream miles designated as potable water use that are impaired	3.3%	3.0%
Number of days that public beaches/swimming areas were closed	31	19
The basin's overall risk level for potential drinking water contamination in streams		
High	0.5%	0.7%
Moderate to High	5.9%	5.1%
Moderate	11.0%	13.5%
Low to Moderate	40.2%	40.3%
Low	42.4%	40.4%

Data Sources: SRBC SWP data, NY/PA/MD Dept of Health data, NY State Parks and Recreation, NY/PA/MD stream impairment data



Number of days that public beaches/swimming areas were closed.



Source Water Protection: GIS data layers for land use, geology, waterways, impaired waterways, National Pollutant Discharge Elimination System (NPDES) permit locations, and Resource Conservation and Recovery Act (RCRA) locations are all incorporated to determine risk areas that are susceptible to pollution events as shown on the above map.

In the event of a spill or contamination, real-time monitoring devices provide water quality information instantaneously to water suppliers, giving them time to put an emergency response plan into action or implement a change at a water treatment plant.

FOCUS STORY

Early Warning System:

More Time to Respond to Contaminant Events

In 2003, SRBC established the Early Warning System (EWS) for public water suppliers in Pennsylvania with intakes in the Susquehanna River, and expanded the system into the New York portion of the basin in 2006. The EWS provides a communication and data sharing tool among water suppliers, state and local agency personnel and the emergency response community to enhance drinking water protection efforts.

Currently, the EWS increases protection for about 700,000 people, providing a monitoring network to inform treatment plant operators and allow for a continuous, safe drinking water supply.

An updated web site will be released to the water suppliers with new features including new map interfaces, a directory of industrial and municipal dischargers, a directory of emergency response numbers and a time-of-travel tool developed using real-time data to estimate travel times of future spills to water intakes on the mainstem.

Eleven major water suppliers on the Susquehanna River in Pennsylvania and New York participate in the Early Warning System.

Indicator 7

Habitat and Aquatic Resources

Overarching Issue

The Susquehanna River Basin contains a large number of healthy surface waters, with a subset classified as higher quality waters. However, several different chemical and physical stressors degrade the habitat and aquatic resources along many of the basin's surface waters. These stressors in turn affect the ability of surface waters to provide healthy drinking water and support recreational activities such as hunting, fishing, nature study, wildlife, photography, bird watching and eco-tourism.

Overview

About 36.5 percent of the stream miles in the basin are currently classified by SRBC as higher quality waters based on various state regulations. About 13.5 percent of stream miles are currently impaired for aquatic life use. In Pennsylvania, siltation, metals, and nutrients are the top three impairment causes. In New York, water level and flow as well as nutrients lead the causes. Habitat alterations in both Pennsylvania and New York are documented as a major cause of habitat degradation.

Capitalizing on vulnerabilities along the basin's streams, opportunistic invasive species threaten aquatic resources by altering the food web, competing with native species for resources, and reducing available habitat for native species. There are numerous aquatic, semi-aquatic, and terrestrial invasive species within the basin that are of interest to many agencies and organizations, but zebra and quagga mussels are the two most publicized and tracked invasive species within the basin. In 2012, SRBC began incorporating brief visual screening for presence of invasive species at monitoring sites during habitat evaluation.

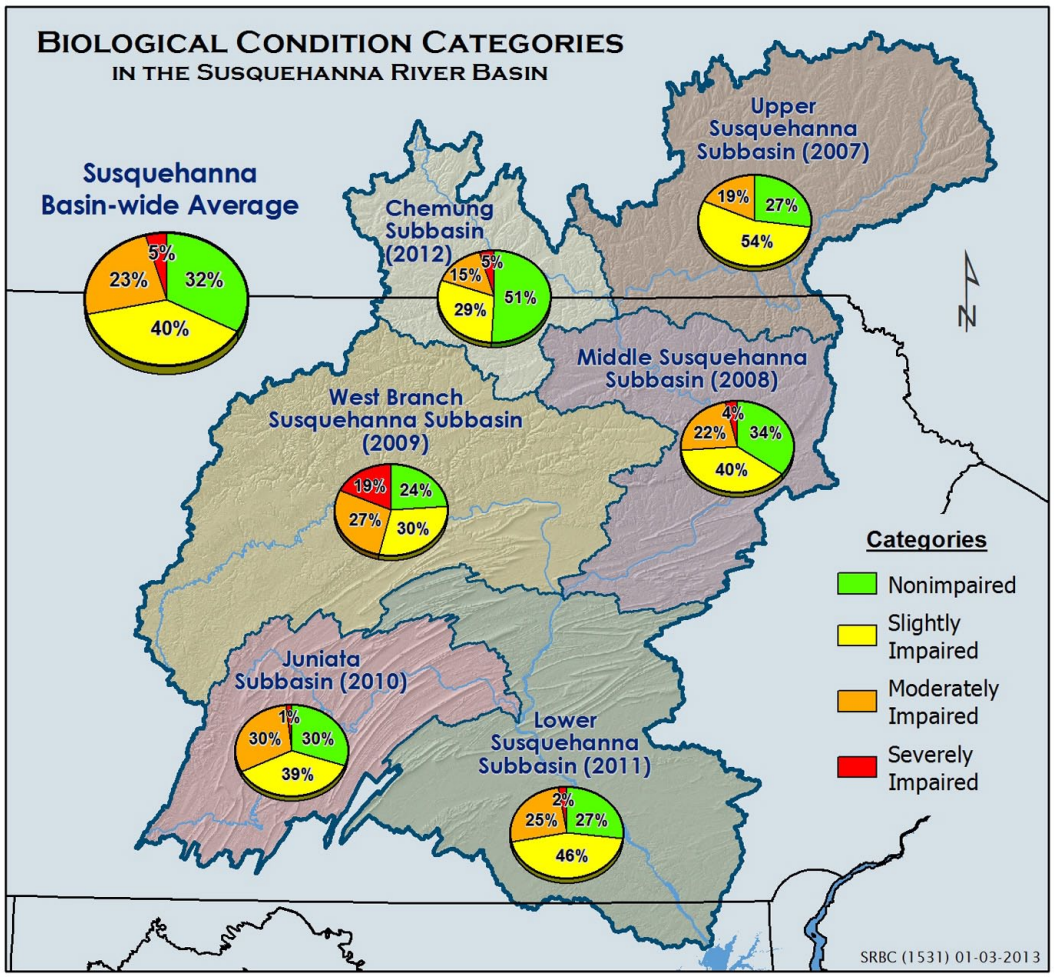
SRBC has conducted site assessments on streams through subbasin surveys since 1995 in each of the six major subbasins on a rotating schedule. Biological condition categories are based on macroinvertebrate samples. Level of impairment is determined by SRBC using a different method than what the states use for listing streams in Integrated Reports. Based on the most recent round of sampling, about 72 percent are either nonimpaired or slightly impaired. Overall, the Chemung subbasin tends to have the greatest percentage of healthiest assessed sites.

Moderately or severely impaired conditions were located mostly throughout the West Branch subbasin, in the Tioga River headwaters, in some areas of the Frankstown Branch Juniata River, in tributaries to the Raystown Branch Juniata River, in Shamokin Creek, and around Wilkes-Barre, Scranton, and Harrisburg, Pa. Moderately or severely impaired biological conditions can result from compromised water quality or habitat degradation. Threats to the basin's aquatic resources and habitat include stormwater runoff, mine drainage discharges, habitat encroachment, invasive species and changes to land use.

Indicator Criteria

Criteria		Assessment Period	
		2007 - 2010	2010 - 2012
Number (%) of stream miles	Habitat impairment (PA & NY)	346.0 (0.71%)	321.5 (0.66%)
	Impaired for aquatic life use (PA & NY)	6,347.0 (13.0%)	6,626.7 (13.5%)
	Classified as higher quality waters	17,844.3 (36.1%) (PA & NY)	18,068.9 (36.5%) (PA, NY, & MD)
General aquatic health of major subbasins		See Biological Conditions Categories bar graph on pg. 19	
Number of occurrences	PA Sea Grant monitoring sites with zebra/quagga mussels	29	36

Sources: NY/PA/MD stream impairment data, PFBC trout natural reproduction lists, NY/PA/MD stream classifications, MDE Tier II waters



Sources: SRBC Year-1 Subbasin Reports 2007 - 2013

What Is Impairment?

SRBC staff follows USEPA's Rapid Bioassessment Protocols to determine levels of impairment by comparing biological conditions for any particular study site to the biological conditions at a corresponding reference site. The specific level of impairment is assigned based on percent comparison of a site's biological score to the reference site's biological score.

Each member state (NY, PA, MD) has a different method for determining impairment and regulatory use. While SRBC methods are designed to assess conditions at a site and provide some qualitative comparison across the entire watershed, the final impairment rating is not designed to meet regulatory standards.

Focus Story

Low Flow Monitoring Project

During periods of low flow, many streams in the Susquehanna River Basin experience partial or complete drying. Resulting compromised water quality and habitat availability can be detrimental to the health of biological communities. After the completion of a two-year pilot study, SRBC established the Low Flow Monitoring Project in 2012 involving a network of 19 forested sites across Pennsylvania and New York portions of the basin. The purpose of the project is to characterize the effects of low flows on biological communities.

Under this project, SRBC is collecting data for both field and laboratory water quality analysis, water depth, streamflow, fish and macroinvertebrate communities and physical habitat during both base flow and low flow conditions. Findings from the data analyses will be used to advise management strategies, as well as to monitor water quality conditions and the general health of aquatic life during periods of low flows.

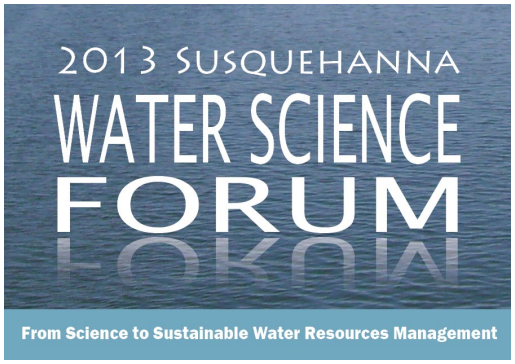
Great Trough Creek, Huntingdon County, Pa., in base flow conditions (June 2010, above) and low flow conditions (September 2010, below).

State of the SUSQUEHANNA 2013 REPORT

RESEARCH

Forum Aims to Enhance River Research
October 7 - 8, 2013

The Susquehanna River Basin Commission's first-ever Susquehanna Water Science Forum will be held **October 7-8, 2013** at the Radisson Hotel Harrisburg in Camp Hill, Pa. The Forum will bring together water resource professionals and researchers to share information on current water resource research, prioritize research needs and better coordinate research activities in the Susquehanna basin to support sustainable water resource management.



RESEARCH

Smallmouth Bass Studies Continue

Since 2005, the Pennsylvania Fish and Boat Commission (PFBC) has been tracking disease prevalence within the smallmouth bass fishery in the Susquehanna River Basin. The issue is potentially related to a host of possible stressors to the fish community that includes a rise in water temperatures, bacterial/viral infections, and pollutant loadings. To identify the cause for the disease outbreaks, the PFBC, the Pennsylvania Department of Environmental Protection, and the U.S. Geological Survey, along with several other partners including SRBC, have been collecting data in the Susquehanna River and several tributaries to characterize water quality conditions and fish health during critical life stages for the smallmouth bass population. Data results to date have been inconclusive; however, the study partners continue to refine monitoring plans each year based on the most recent findings.

RESEARCH

SRBC Partners in Study of Sediment Movement to Bay

In the aftermath of the Tropical Storm Lee flooding in 2011, a large plume of sediment headed down to the Chesapeake Bay. Of the estimated two million tons of sediment sent down the river by the storm, about 1 million tons escaped into the Bay from the Conowingo Pond. Prior to the storm, about 100 million tons of sediment were stored behind Conowingo Dam. It is likely that some of that sediment was scoured from the Pond and has been pushed into the Chesapeake Bay. During 2011, a cooperative study between the U.S. Army Corps of Engineers and Maryland was initiated to study the movement of sediment from the lower Susquehanna watershed, through the series of dams below Harrisburg, including Conowingo Dam, and into the Upper Chesapeake Bay.

Reference Gages Evaluated for Accuracy in Passby Flow Determinations

SRBC-approved withdrawals are often located on ungaged streams. In these cases, SRBC must rely on U.S. Geological Survey reference gages and other analyses to estimate flow statistics that can be used to prescribe passby flow, which is a defined quantity of flow that must be allowed to pass a specified point downstream of a withdrawal. SRBC uses passby flows to help protect aquatic resources, competing users, and instream flow uses downstream from a point of withdrawal. Research is currently underway to evaluate the predictive accuracy associated with using reference gages as trigger gages to estimate passby flow conditions at ungaged project sites.

protecting your watershed for today and tomorrow

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The 20-page *2013 State of the Susquehanna* report is available on SRBC's web site at www.srbc.net/stateofsusq2013/ and also in printed format by contacting SRBC by E-mail srbc@srbc.net or telephone (717) 238-0423.