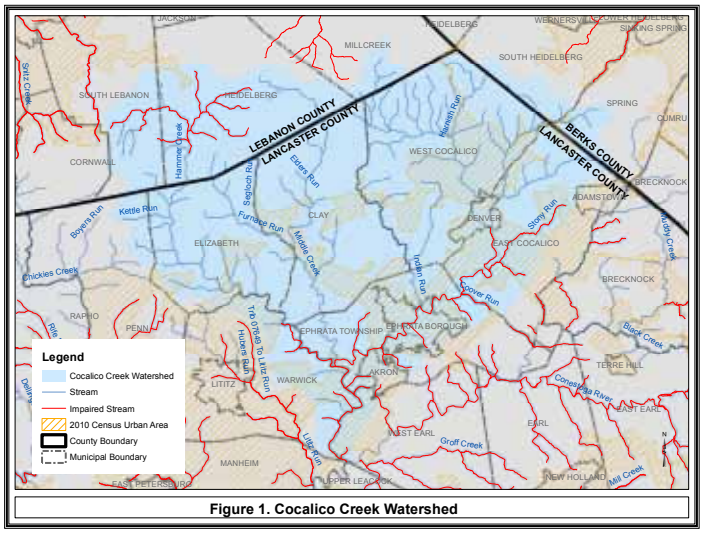
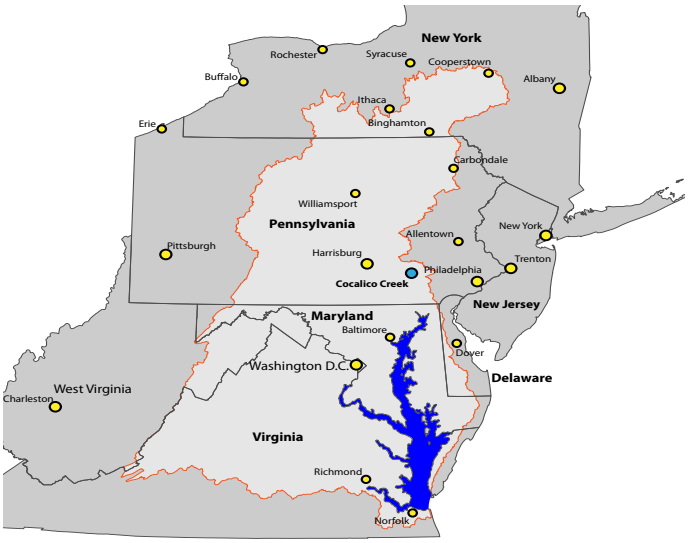


Figure 1. Cocalico Creek Watershed



Cocalico Creek Chesapeake Bay Pollutant Reduction Plan

MS4 permit compliance planning made simple

Twelve municipalities within the Cocalico Creek watershed in Lancaster County, Pennsylvania combined efforts to develop a watershed-based Chesapeake Bay Pollution Reduction Plan (CBPRP), which is required by their individual Municipal Separate Storm Sewer System (MS4) permits. The CBPRP, a new regulatory requirement, must address nutrient and sediment loadings to streams from the regulated MS4 draining to the Chesapeake Bay.

The CBPRP found the primary and most significant sources of nitrogen and sediment pollutant loads were groundwater (57%) and streambank erosion (79%) respectively in the urbanized area (UA)--not residences or parking lots, as might be expected. Therefore, a collective focus on the primary sources — specifically streambank erosion — will yield the largest reductions in the watershed to meet regulatory requirements.

THE CBPRP COMPARED EFFECTIVENSS OF POLLUTANT REDUCTION BMPs AND DETERMINED THE ESTIMATED COST TO REDUCE SEDIMENT LOADS BY 100,000 POUNDS USING FLOODPLAIN RESTORATION (FPR) IS $330,000 — AND TO ACHIEVE THE SAME REDUCTION USING RAIN GARDENS: $5.09 MILLION.

Streambank erosion accounts for 14.4 million pounds (79%) of the sediment load in the urbanized area.

By combining efforts, the municipalities each saved ~80% on the cost of producing a CBPRP.

The watershed-based CBPRP included a template for individual municipal submissions.

Cocalico Creek CBPRP

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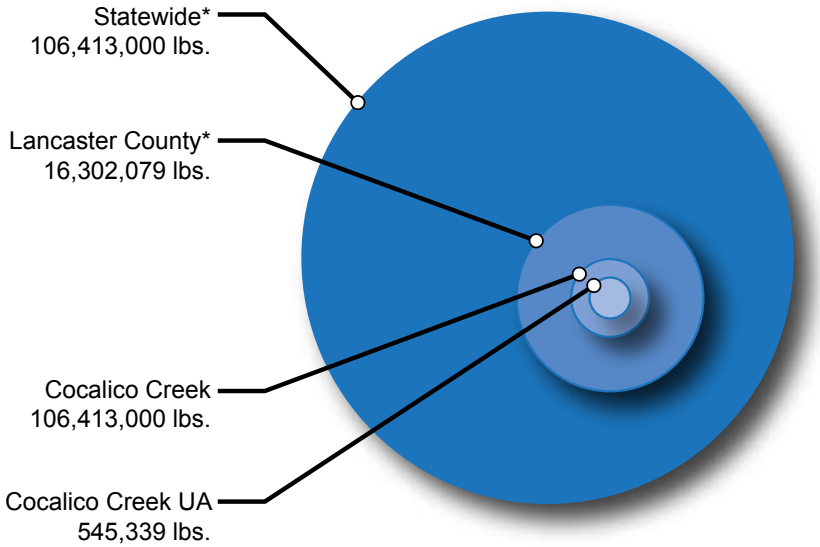
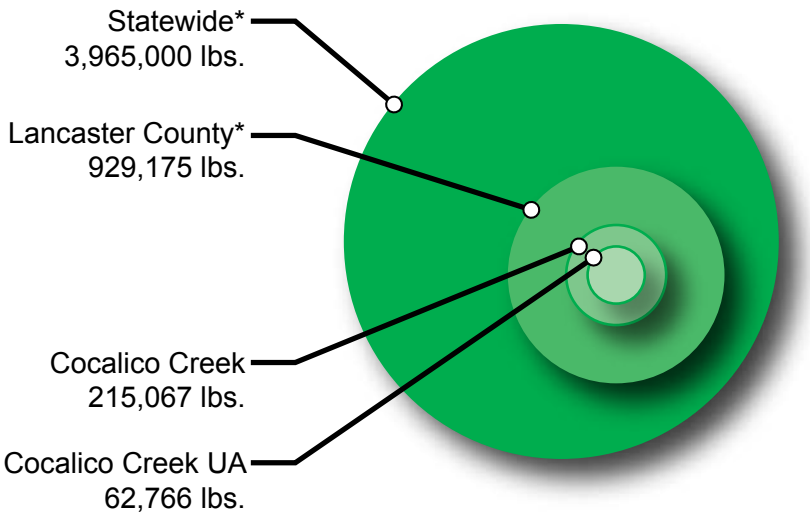
COCALICO CREEK CHESAPEAKE BAY POLLUTANT REDUCTION PLAN (CBPRP)

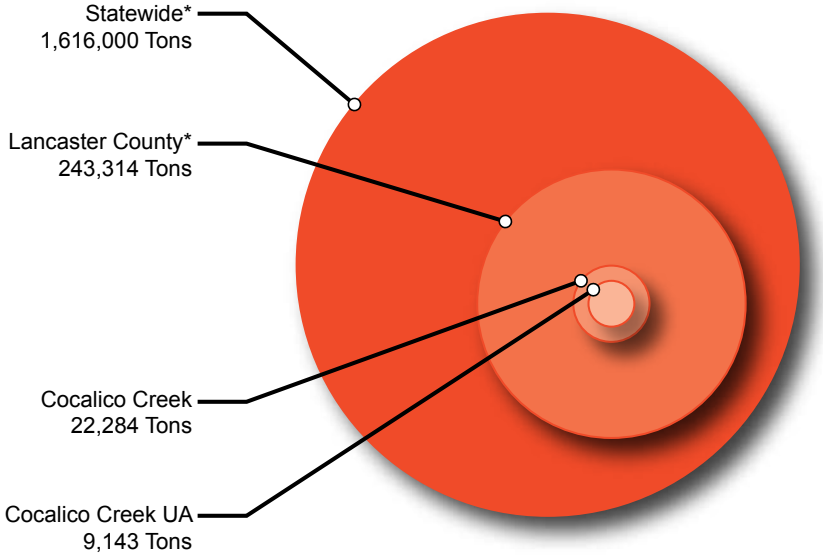
Nitrogen Loading



Phosphorus Loading



Sediment Loading



*2009 Progress Loading

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The Regulatory Environment

In accordance with the Clean Water Act, the Environmental Protection Agency (EPA) is requiring each of the six Chesapeake Bay watershed states and the District of Columbia to take action to improve the health of the Chesapeake Bay and remove it from the nation's list of impaired waters. A series of pollution reduction targets for nitrogen, phosphorus, and sediment — called total maximum daily loads (TMDLs) — are intended to move the region toward this goal. Sixty percent of reductions must be met by 2017 and 100 percent by 2025.

To that end, EPA has required each of the six Chesapeake Bay watershed states and the District of Columbia to develop Watershed Implementation Plans (WIPs), outlining the steps each state will take to improve the health of the Chesapeake Bay by 2025. The WIPs emphasize load reductions in three primary sectors: agriculture, urban/suburban, and wastewater. The plans need to quantitatively explain how the states will achieve reductions in nitrogen, phosphorus, and sediment pollutant loads.

In Pennsylvania, the Department of Environmental Protection (PADEP) now requires municipalities subject to an issued Municipal Separate Storm Sewer System (MS4) permit to develop a CBPRP to outline the steps and measures the municipality will implement to reduce the pollutants of concern. This is PADEP's primary approach for the urban/suburban sector.

Municipalities within the Cocalico Creek watershed have responded with the CBPRP. The CBPRP addresses the new regulatory requirement and determines a baseline of nutrient and sediment loading conditions within the Cocalico Creek watershed. Additionally, the municipalities needed to determine pollutant loadings from urbanized areas (UAs) within the watershed in order to develop approaches for reducing pollutants as required by their MS4 permits. Due to tight budgets and limited resources, the regulated municipalities of the Cocalico Creek watershed chose to combine efforts and address their regulatory requirements as a group.

Sediment plume effects from Susquehanna River Tributaries

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The Cocalico Creek Watershed

The Cocalico Creek watershed is located in south-central Pennsylvania, mostly within Lancaster County. The primary waterway through the watershed is the Cocalico Creek, which is a tributary to the Conestoga River. Dominated by an agricultural landscape, over 40% of the land in the 140-square-foot watershed is used for hay and row crops. There are also pockets of urban and suburban areas.

Cultural map of Ephrata, Pennsylvania

Chesapeake Bay Pollutant Reduction Plans (CBPRP)

The PADEP provided guidance to municipalities in August 2013 for the creation and implementation of CBPRPs. Each municipality with an MS4 draining to the Chesapeake Bay is required to outline its plans to implement best management practices (BMPs) resulting in reductions of nitrogen, phosphorus, and sediment. Each municipal plan must:

1. Provide a narrative describing the MS4 and corresponding pervious and impervious coverage in the UA;
2. Identify areas where municipal upgrades are planned, and provide an evaluation for the use of green infrastructure (GI) could be included;
3. Estimate current loadings of nitrogen, phosphorus, and sediment discharged annually to waterways draining to the Chesapeake Bay (optional); and
4. Indicate the BMPs and corresponding timeline for implementation and the reduction in nutrients and sediment that it will be achieved.

Development and implementation of a CBPRP is a mandatory MS4 Permit requirement for municipalities in the Chesapeake Bay watershed.

Ultimately, municipalities are required — with indifference towards fiscal abilities — to implement BMPs that will achieve reductions in nitrogen, phosphorus, and sediment. CBPRP development can be a costly endeavor for cash-strapped municipalities. To meet this requirement in a cost-effective manner, the regulated municipalities within the Cocalico Creek watershed pooled their resources and developed a single CBPRP for the entire watershed via the local watershed association (Cocalico Creek Watershed Association).

Each municipality, therefore, saved almost 80% of the costs that can be expected with CBPRP development. This approach also satisfied MS4 Permit requirements associated with public participation and involvement.

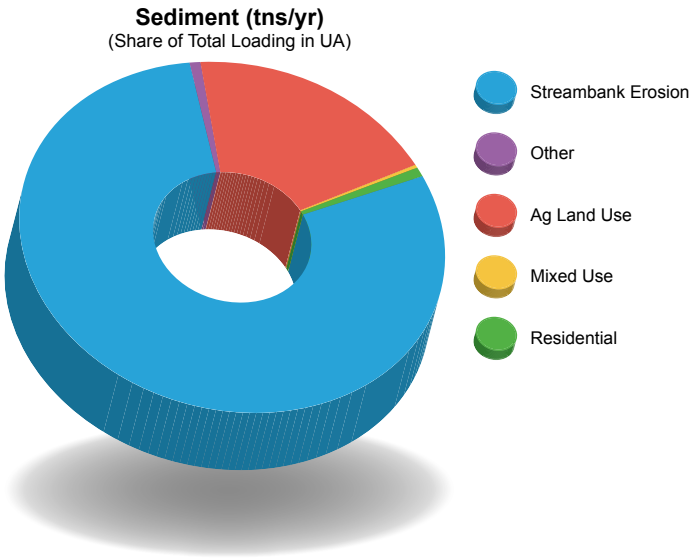
Watershed Modeling Results

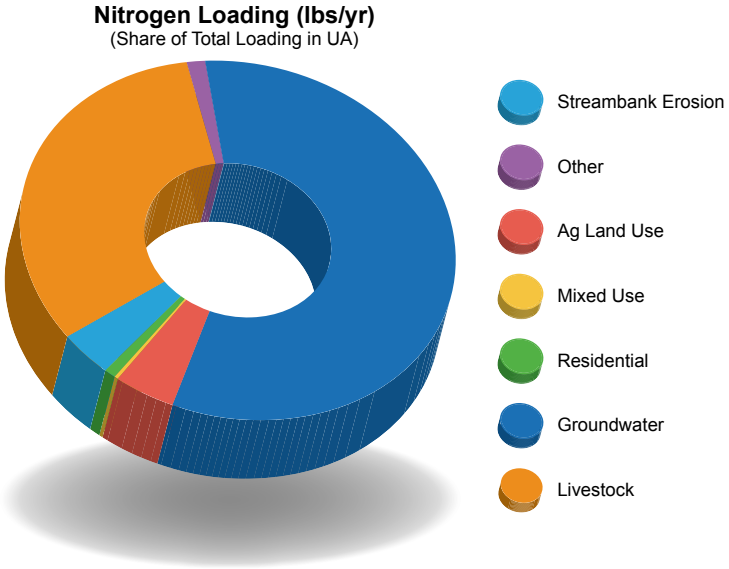
The watershed modeling program MapShed was used to model the Cocalico Creek watershed. MapShed is a GIS-based watershed modeling tool developed by the Penn State Institute of Energy and the Environment (PSIEE). MapShed is a customized interface that automatically creates input data for the watershed model. MapShed uses historical rain data, climate data, land use data (agricultural and urban), groundwater well withdrawals, septic systems, and more to model the pollutant loading conditions across the watershed. Each municipality received specific data for individual CBPRP submissions created through the watershed CBPRP.

The highest annual pollutant loading rates within the watershed are as follows:

- Sediment: streambank erosion at 14,219 tons,
- Nitrogen: groundwater (stream baseflow) at 1,148,660 lbs; and
- Phosphorus: livestock at 639,368 lbs.

The data was delineated to reflect loading conditions within the UA and to provide useful information to the municipalities in Lancaster County.





Groundwater (stream baseflow interface) contributes 57% of the total nitrogen loading in the UA of the Cocalico Creek watershed. Residential land uses only account for .5% of the total nitrogen.

The Cocalico Creek CBPRP painted a clear picture of pollutant loading sources. The primary culprits were groundwater for nitrogen and streambank erosion for sediment — not residential or commercial land uses.

Streambank erosion contributes 79% of the total sediment loading in the UA of the Cocalico Creek watershed. Residential and commercial land uses account for less than 1% of the total sediment.

BMP Implementation

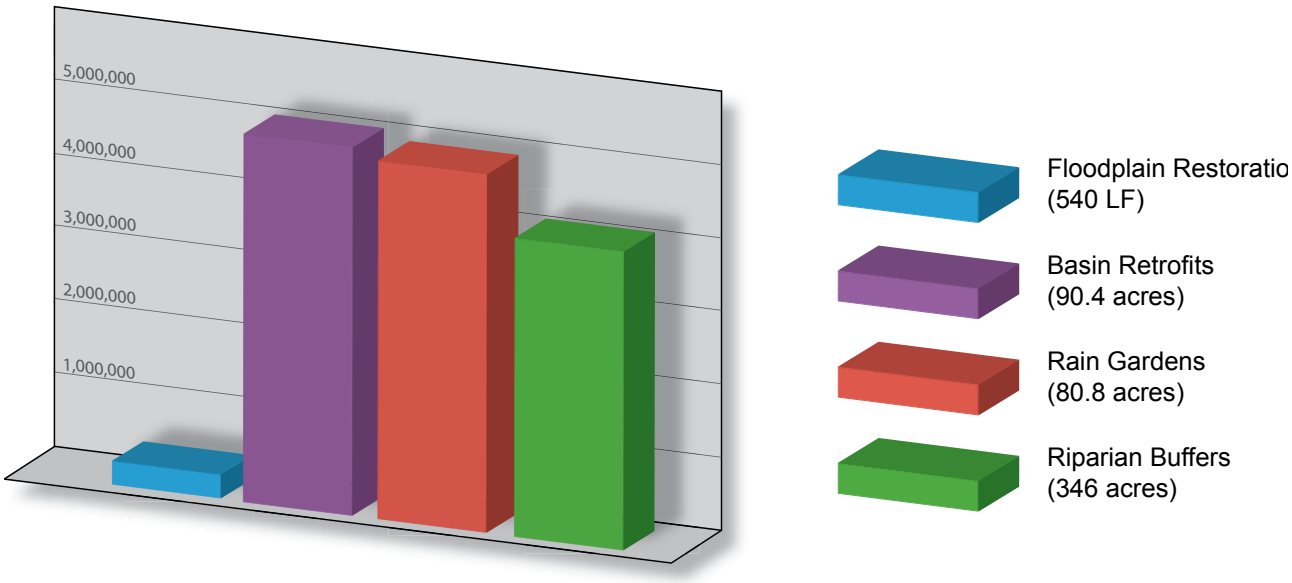
MapShed provided a clear picture of pollutant loading sources in the UA (including a delineation of individual municipalities). This data enables the municipalities to focus on the primary sources and allocate resources more appropriately to achieve mandated reductions. However, the municipalities desired to know what BMPs would give them the "biggest bang for the buck." The Lancaster County Clean Water Consortium (LCCWC) has published cost-effectiveness data, revealing that the municipalities would achieve the greatest reductions, and get the biggest bang for the buck, by joining forces and concentrating their efforts on the primary pollutant contributors.

As the cost-effectiveness data show, not all BMPs are created equal. For example, to reduce sediment loads by 100,000 pounds in the Cocalico Creek watershed, it would cost about $329,000 using floodplain restoration. To achieve the same result using basin retrofits, rain gardens, or riparian buffers, the cost rises sharply: $5.25 million, $5.09 million, and $4.24 million respectively.

How to Get the Biggest Bang for the Buck

1. **Pool resources to save money and to tackle watershed issues regionally instead of locally.**
2. **Focus on the primary sources of pollutants.**
3. **Implement cost-effective BMPs, such as floodplain restoration, that achieve the greatest return on investment.**

New Street Park floodplain restoration (during construction, 2005)



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Stormwater Offsets

Stormwater is the second leading cause of impaired streams and rivers. To address this issue, and to encourage the use of green infrastructure, the EPA has issued a series of policy memos supporting the integration of floodplain restoration into National Pollutant Discharge Elimination System (NPDES) permits and combined sewer overflow (CSO) remedies. But implementing green infrastructure means thinking and acting regionally for the improved function of an entire watershed. When municipalities such as those in the Cocalico Creek watershed work together, a regional approach is well within reach. A regional approach often includes floodplain restoration and provides greater opportunity for stormwater offsets.

Floodplain restoration can not only remedy stormwater issues but also reduce streambank erosion, both of which contribute to pollutant loads in streams and rivers. Because floodplain restoration provides multiple benefits, such as reduced streambank erosion and stormwater offsets, it's more cost-effective than other single-benefit BMPs. Furthermore, because the root problem, a buried floodplain, is remedied, investment resources are put to better use than if allocated to standard approaches that do not get to the root problem and therefore offer only temporary benefits.

Grant Funding

Another benefit of a regional approach is that grant funders are looking for projects that will provide the biggest bang for the buck while benefiting the most people and the largest geographic region. A regional approach comes out ahead, then, against other more locally focused ones. It's also wise for grant applicants to be prepared to implement a plan submitted for grants. Funders will prioritize projects that are packaged and ready for installation. Local governments can improve their chances of receiving grants by working with the private sector to provide funders with engineering plans for its design and implementation. When design and build are packaged together, other benefits include consulting services from experienced professionals who can ensure the plans are implemented well and that the process of obtaining permits and cutting through other red tape is made as seamless as possible.

Summary

Grant applicants can increase their chances of project funding with a regional approach, since funders prioritize regional projects; regional projects benefit more people and a larger geographic region. Funders also prioritize projects that are ready for installation. And when design and build are packaged together, other benefits include consulting services from experienced professionals who can ensure plans are implemented well and that the process of obtaining permits and cutting through red tape is seamless.

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