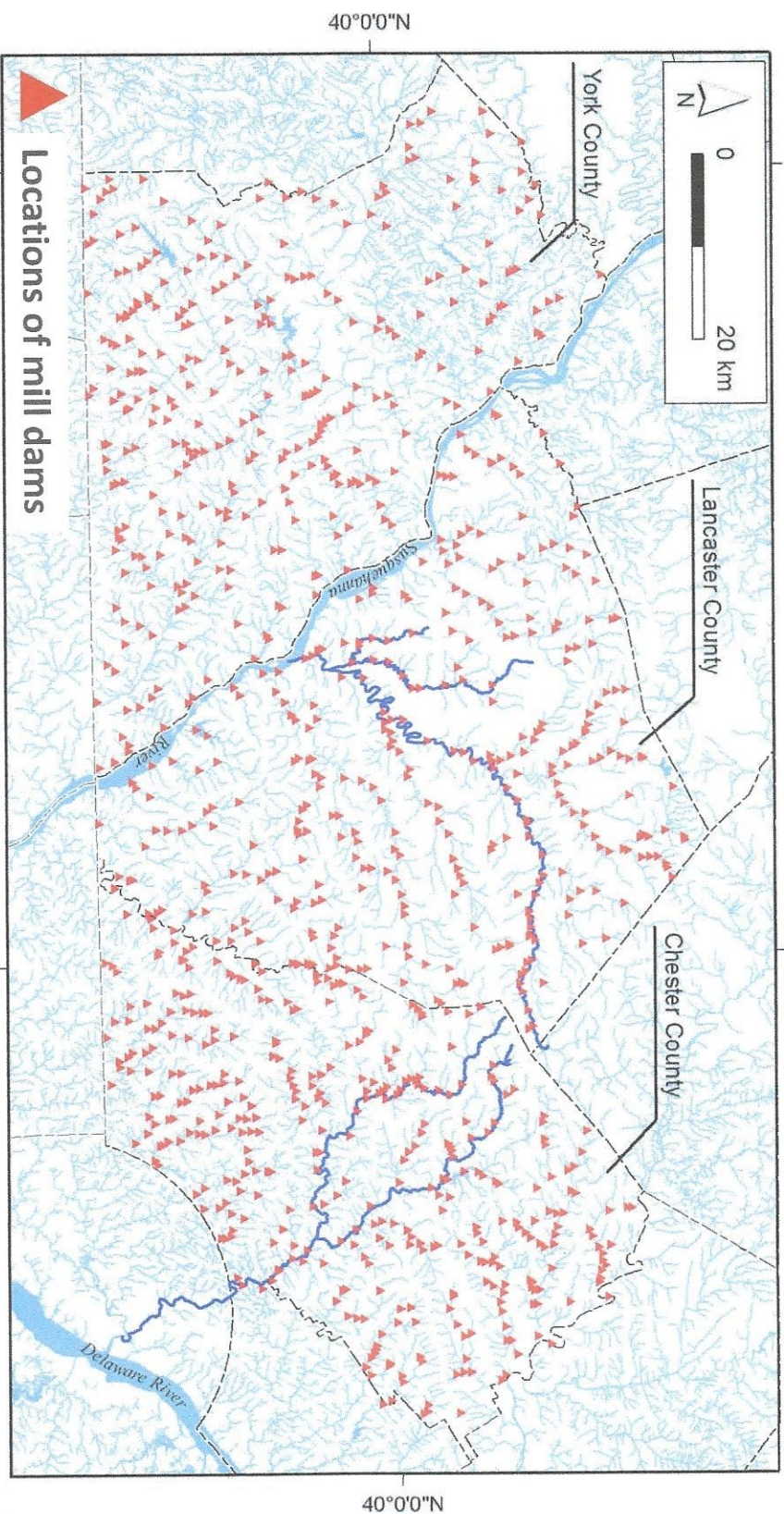**WATER SCIENCE INSTITUTE**

The Water Science Institute promotes the sustainable, science-based benefits of projects that provide available, clean water through conservation, restoration and exploration.

This is accomplished through funding and administration of education, advocacy and implementation of research projects in the study of the interrelationship of water and its surroundings.

WATER
SCIENCE
INSTITUTE

Over 1,000 mill dams in 19th C. Atlases of York, Lancaster & Chester Counties

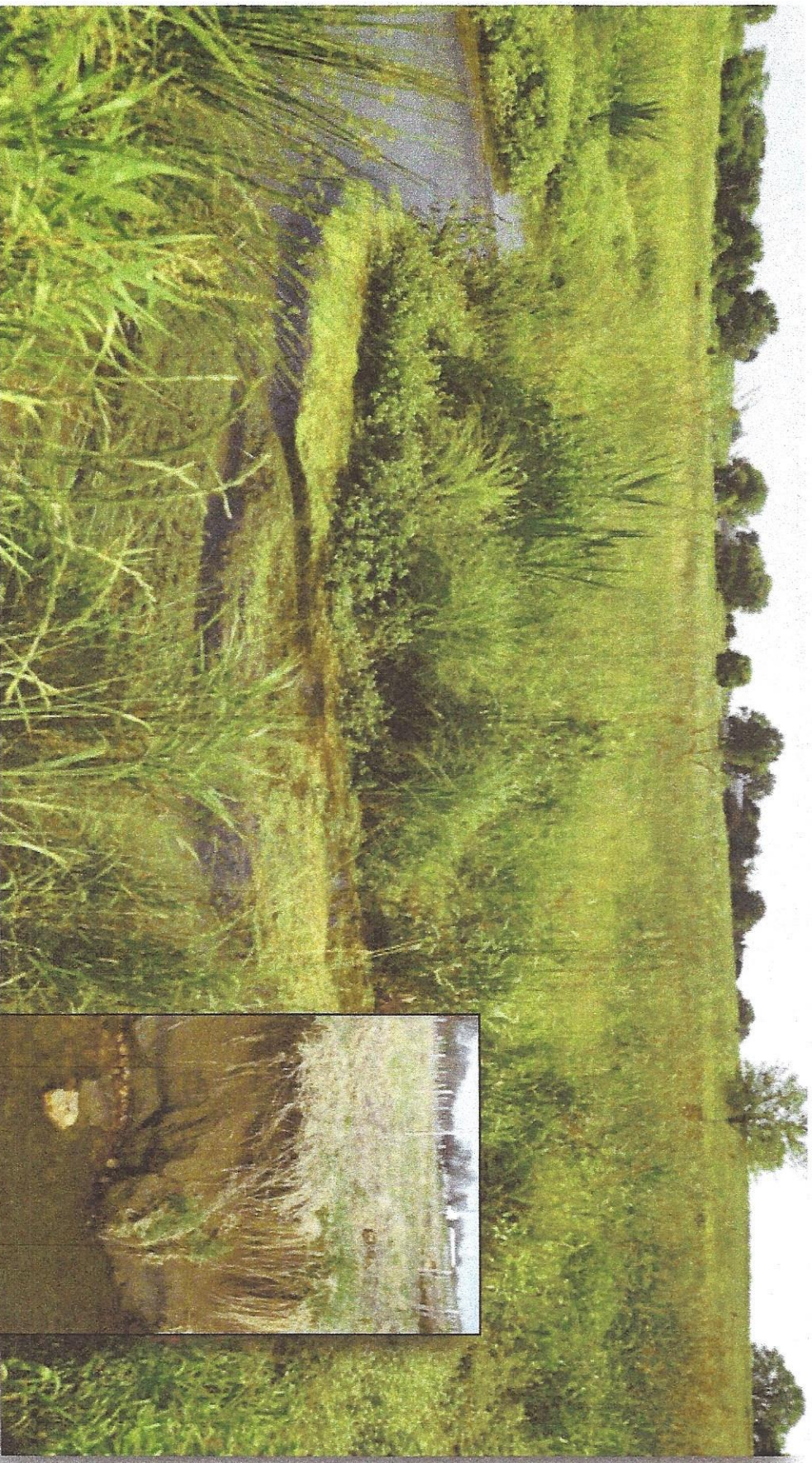[Note: These dams are not in the NID database.]

Locations of mill dams

York County

Lancaster County

Chester County

Susquehanna River

Delaware River

40°0'0"N

77°0'0"W

76°0'0"W

N

0   20 km

Big Spring Run Floodplain/Wetland Restoration

August 23, 2017

Robert Walter, Dorothy Merritts, Mike Rahnis, Evan Lewis and Joseph Sweeney, Water Science Institute

After (June 2013)

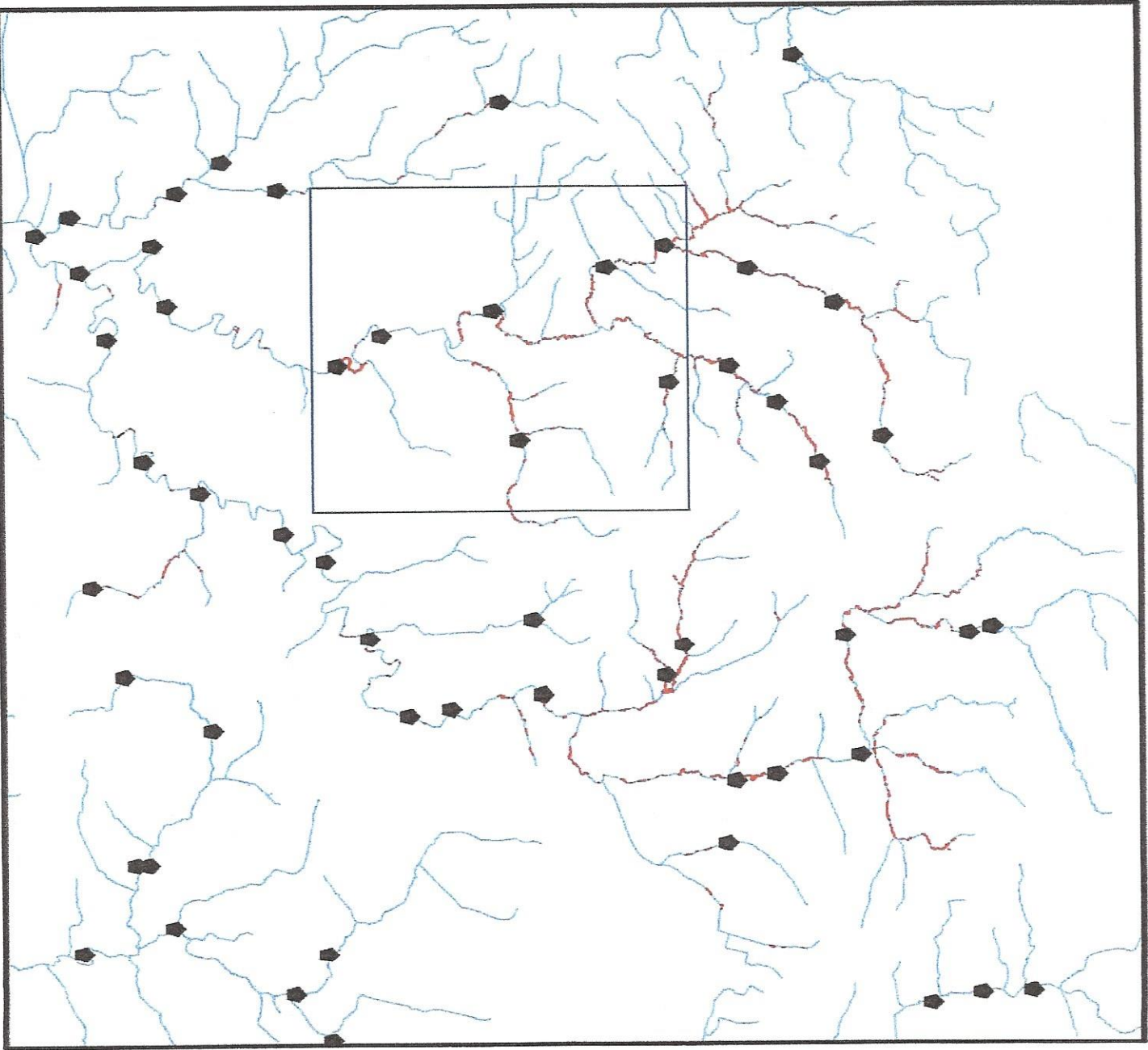Before (April 2004)

Chiques Creek
Watershed, PA

Lidar DEM differencing
2008-2014

Red: Erosion hot spots
along stream banks at sites
of millpond reservoir
sedimentation.

Analysis: M. Rahnis

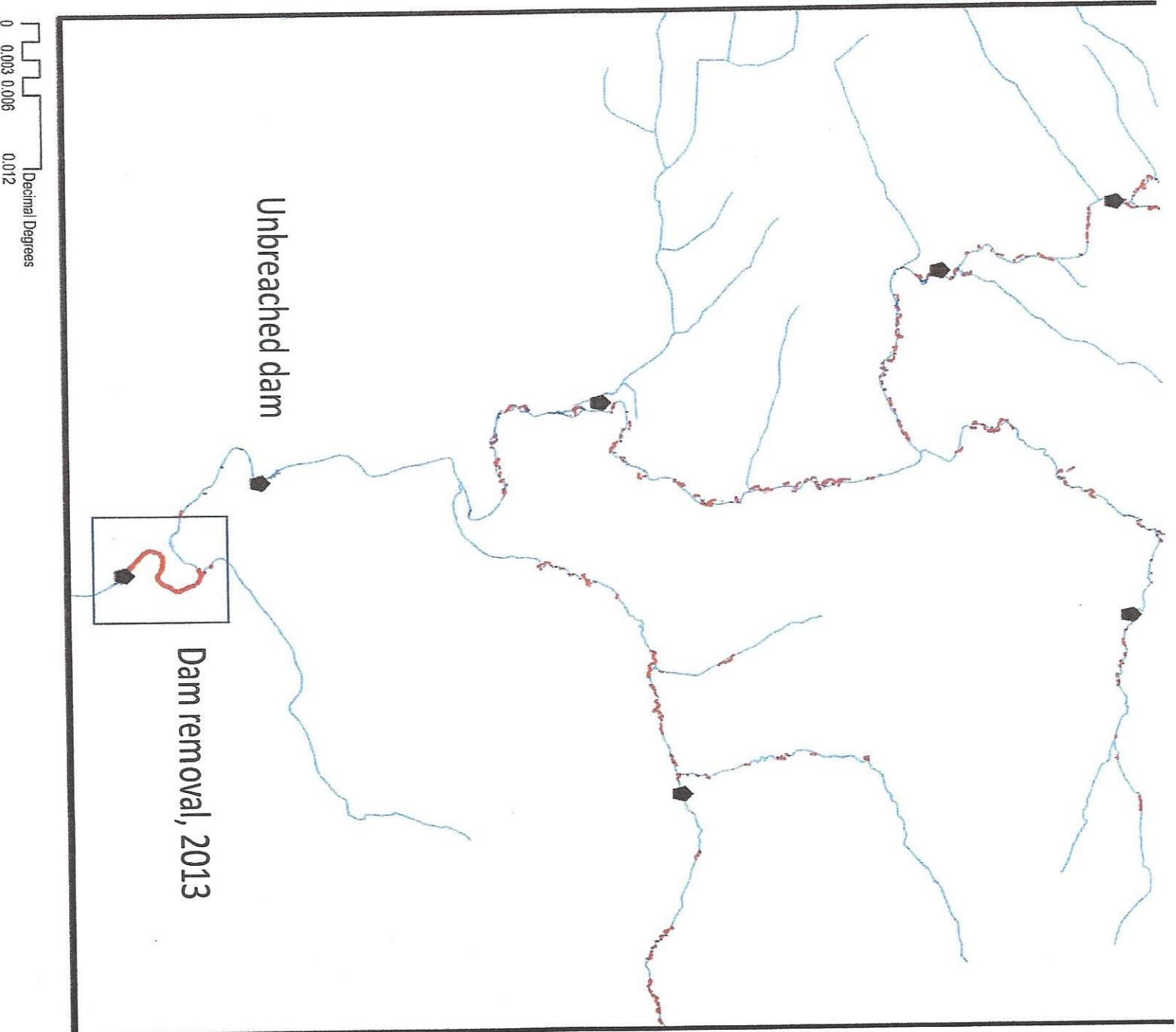0 0.0075 0.015   0.03   Decimal Degrees

Chiques Creek
Watershed, PA

Lidar DEM
differencing
2008-2014

Red is bank
erosion in 6.7 yrs

Erosion hot spots
in hot moments
after dam breaching
or removal.

Analysis:
M. Rahnis

Unbreached dam

Dam removal, 2013

0 0.003 0.006   0.012   Decimal Degrees

Land use watershed model loads vs Lidar DEM differencing

AVGWLF--ArcView Generalized Watershed Loading Function

~26,000,000 lbs/yr for Chiques watershed

(316 km of stream)

Our calculations from lidar DEM differencing:

EROSION, m^3	TONS PER YEAR	TONS/MILE/YR	POUNDS PER YEAR
~81,000	~20,600	~105	~41,271,600

Based on modern land use. Nothing about historic dams, reservoir sediment, lag times, legacy effects.

## Table 6. Existing Loading Values for Chickies Creek Watershed

Land Use Category	Area (acres)	Total P (lbs/yr)	Unit Area P Load (lbs/acre/yr)	Total N (lbs/yr)	Unit Area N Load (lbs/acre/yr)	Sed Load (lbs/year)	Unit Area Sed Load (lbs/acre/yr)
Hay/Past	9,027	4,408	0.49	64,821	7.18	1,278,781	141.66
Cropland	20,598	49,143	2.39	322,832	15.67	24,356,865	1,182.52
Coniferous For	341	5	0.01	55	0.16	1,733	5.08
Mixed For	585	9	0.02	83	0.14	3,915	6.69
Deciduous For	8,363	591	0.07	1,415	0.17	357,347	42.75
Transition	2	0	0.00	0	0	0	0
Lo Int Dev	1,195	107	0.09	801	0.67	13,962	11.69
Hi Int Dev	661	723	1.09	6,523	9.87	10,080	15.25
Groundwater		4,396		627,990			
Point Source		1,447		7,092			
Septic Systems		201		34,374			
Total	40,772	61,030	1.50	1,065,987	26.15	26,093,711	640.00

AVGWLF--ArcView Generalized Watershed Loading Function

The AVGWLF model was run for both the Chickies Creek Watershed and Conococheague watershed to establish existing loading conditions under existing land cover use conditions in each watershed.

Big Spring Run Floodplain/Wetland Restoration Outcomes (2008-2017)
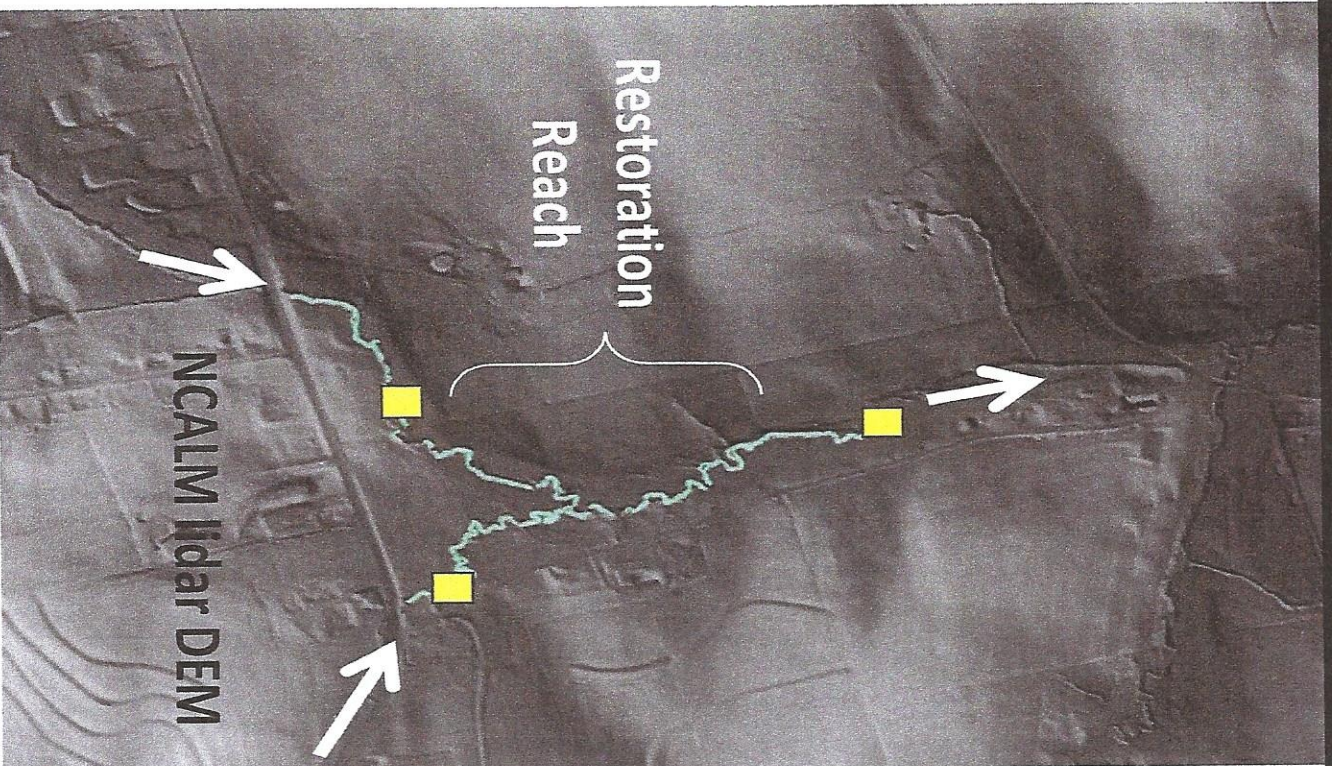
- **Sediment Removed:** ~21,955 tons

- **Sediment Source:** 85-100% from Banks (~100% from within restoration reach)

- **Sediment Load Reduction:** ~150 tons/yr

- **Total P Removed:** ~50,500 lbs

- **Total Sorbed P Removed*:** ~35,128 lbs

- **Total N Removed:** ~63,600 lbs

- **Nitrate Reduction:** 15% in base flow

- **Total P Reduction:** 26% in storm flow

- **Carbon Storage:** 7,300 lbs/yr

- **Water Storage:** 2.7 million gallons inc. (50%)

- **Groundwater:** 10% more output

- **Up/Down Peak Delay:** 17 min inc.

- **Surface Water T:** ~10-15° C drop

- **Biological Indicators:** Shift from upland dominated to aquatic ecosystem dominated floodplain area based on biological indicators - vascular plants, diatoms, amphibians,

For more information see: http://www.bsr-project.org/