

Stream & Floodplain Restoration

Lititz Run Project Example



Floodplain Restoration

What it is and why it is important



Issue: **Legacy Sediment**

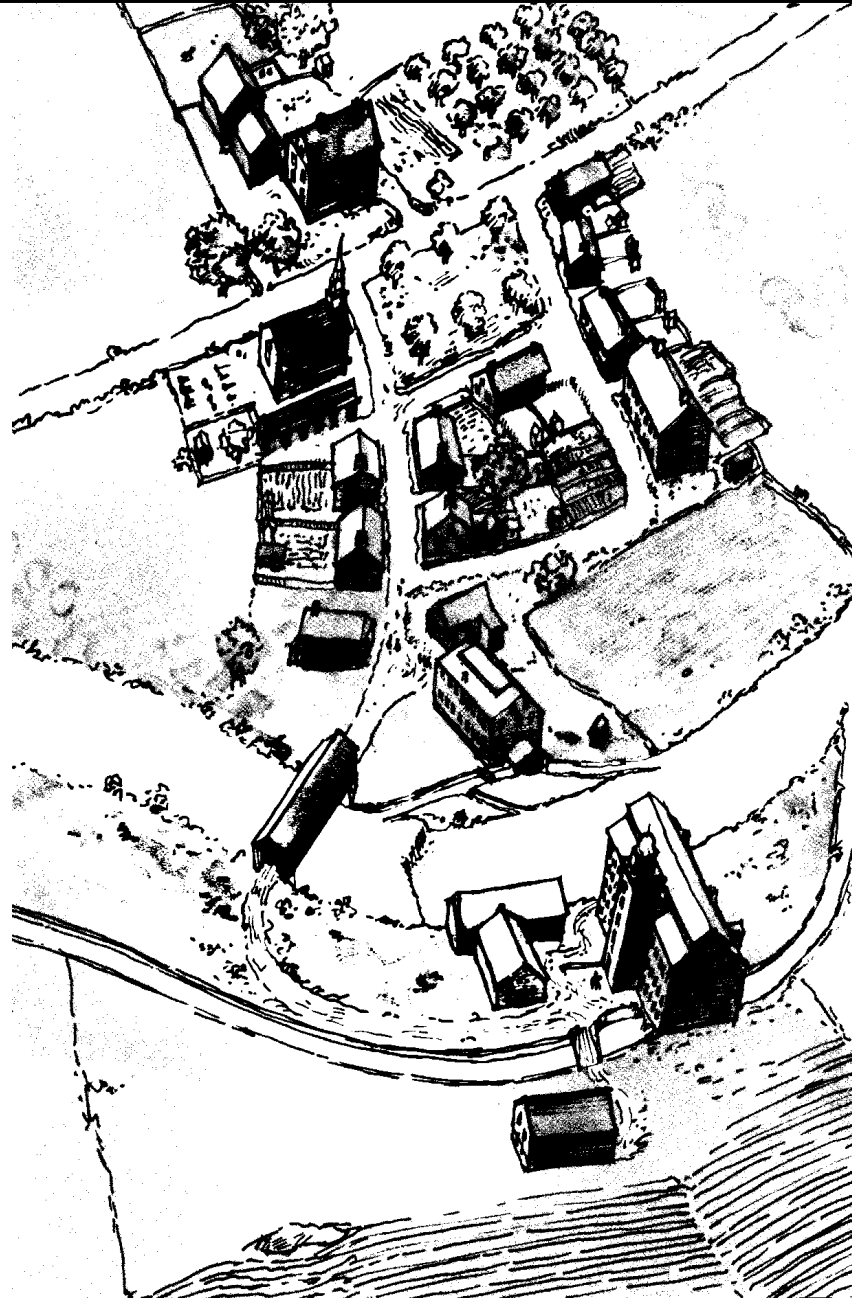
Material that eroded during the 18th through early 20th century due to large-scale forest clearing and poor farming practices dumping millions of tons of soil into streams, valleys and floodplains



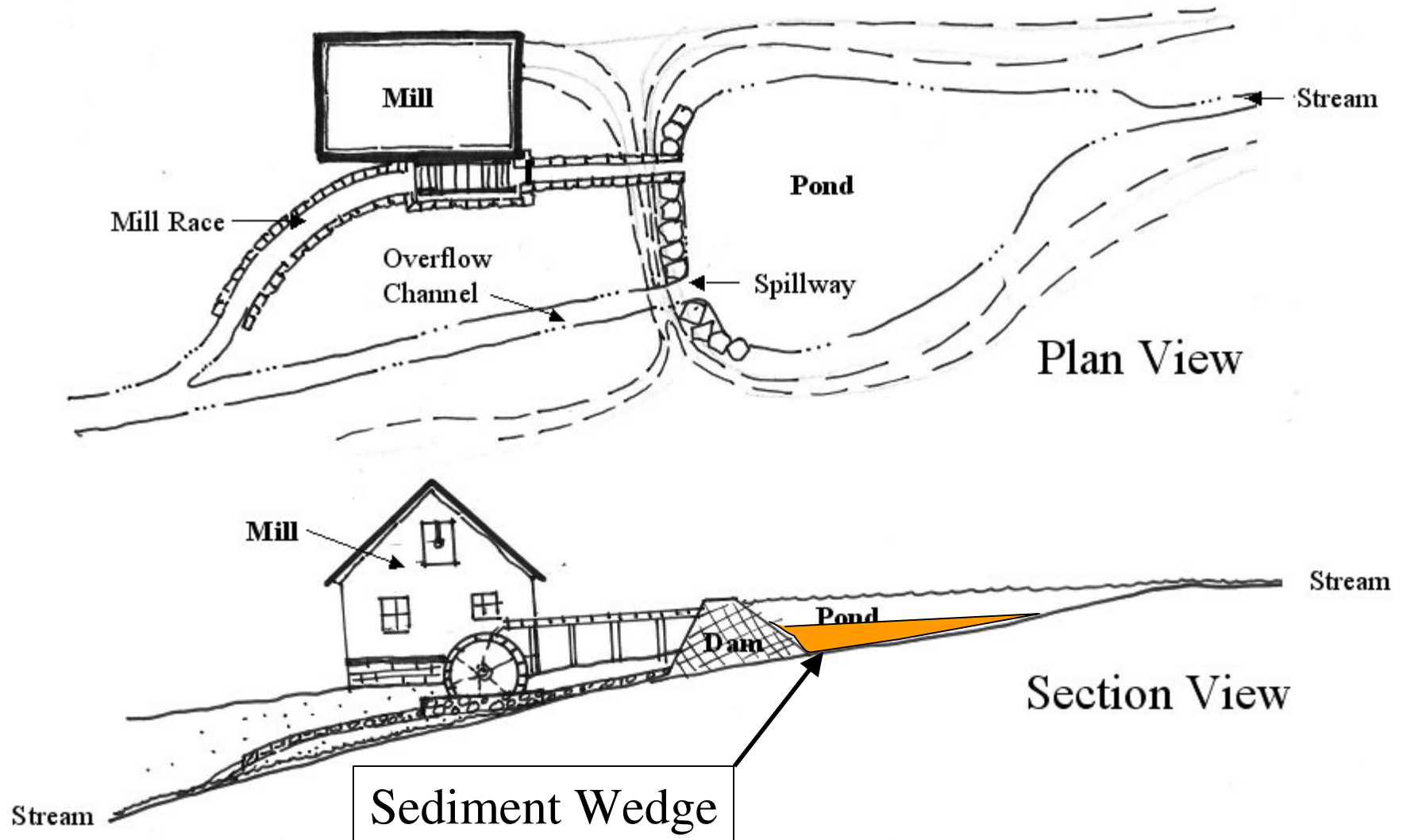
Solution: **Floodplain Restoration**

Returning floodplains to their historic elevations including the size and quantity of bed/sediment load, downstream base-level controls, and streambank materials

Historical Impacts

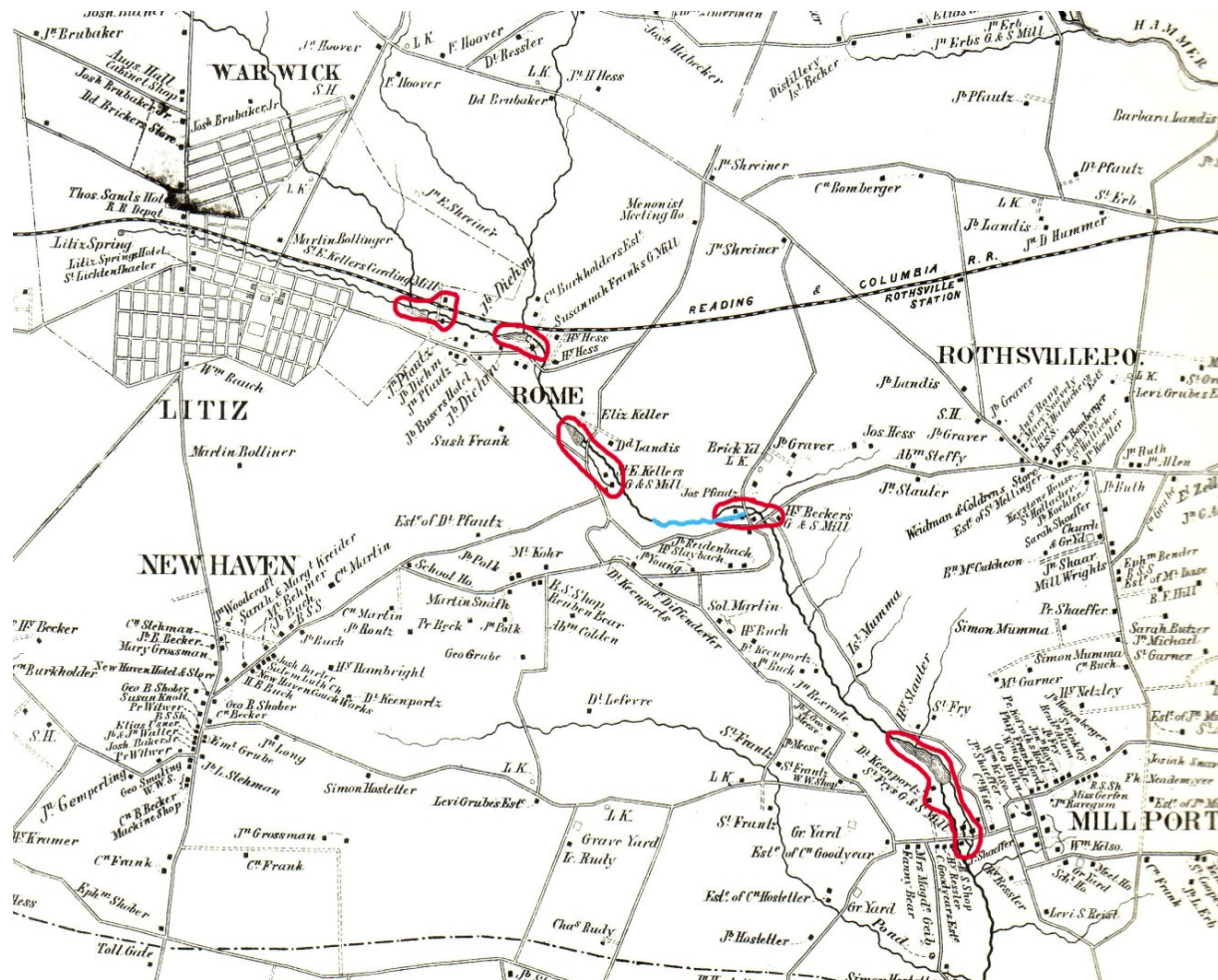


Sediment trapped behind mill dams



Bridgen's 1864 Atlas

Lancaster County, Warwick Township



Mill Dams

US Census in Eastern US – ~60,000 mills in 1840

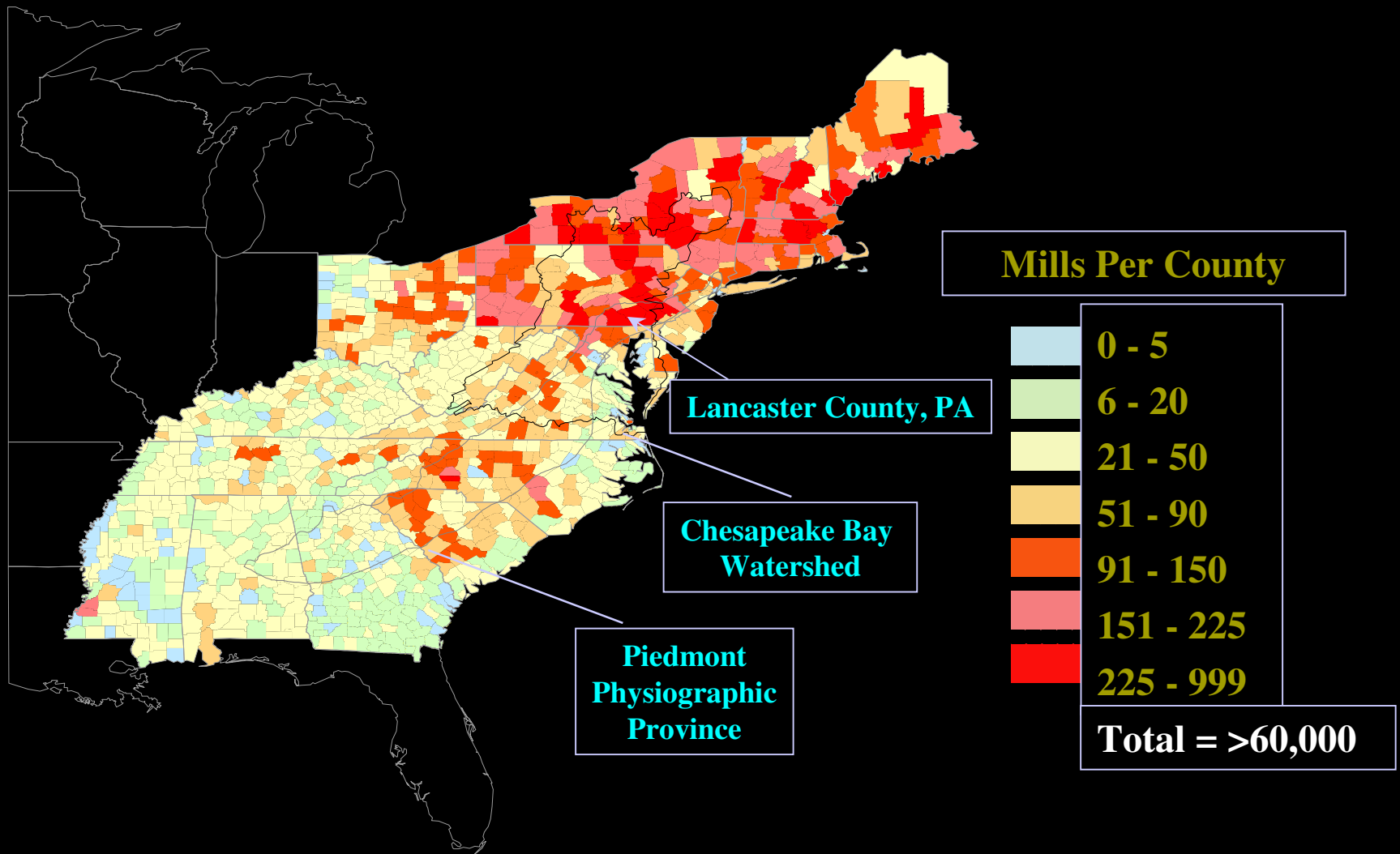
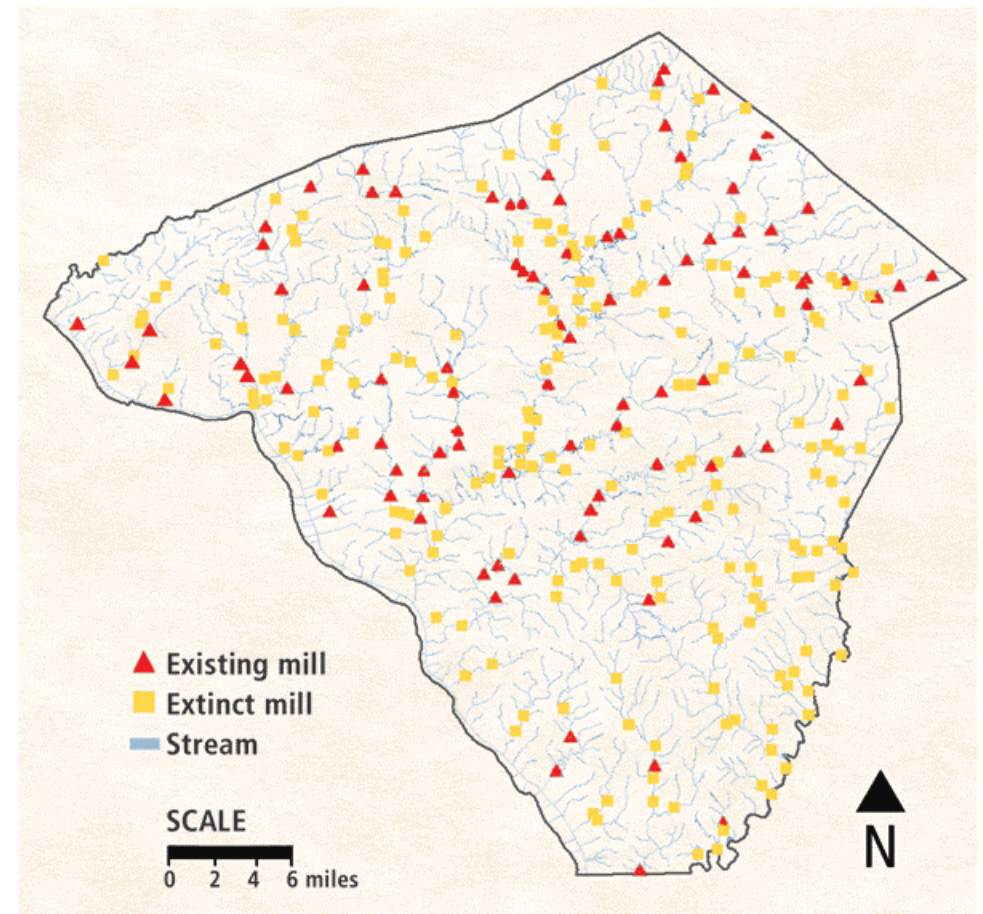
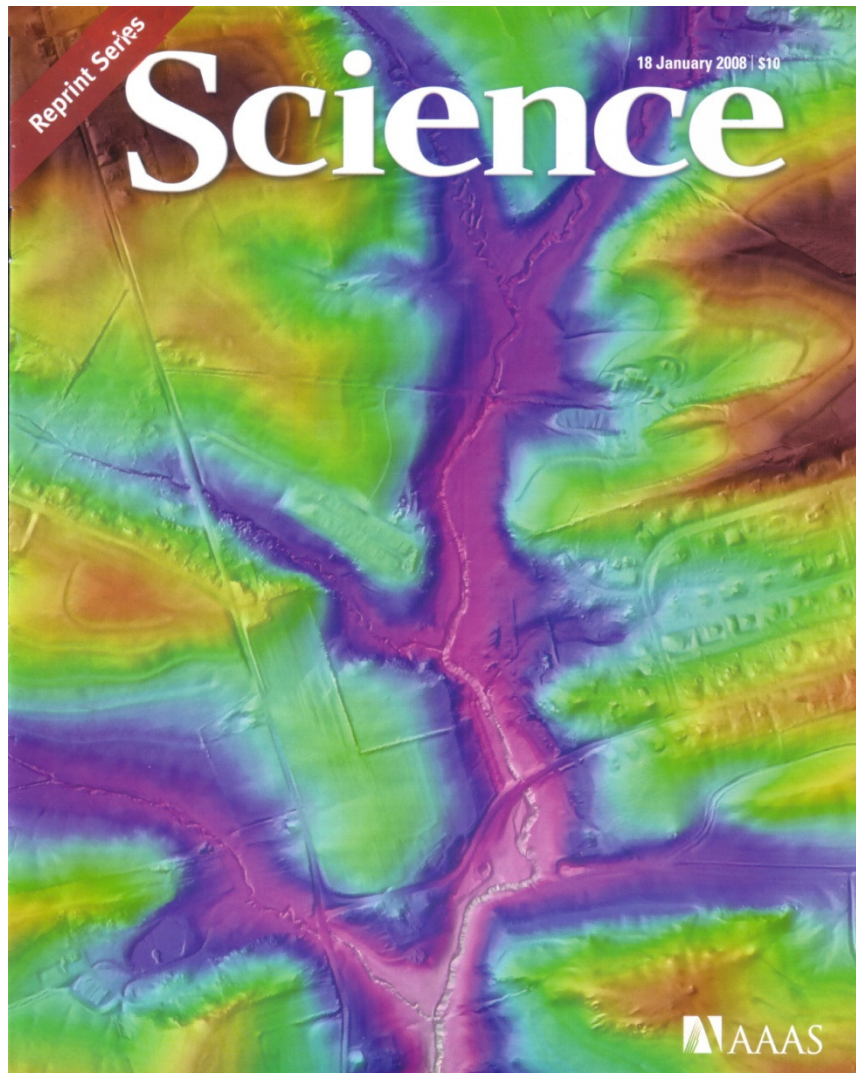


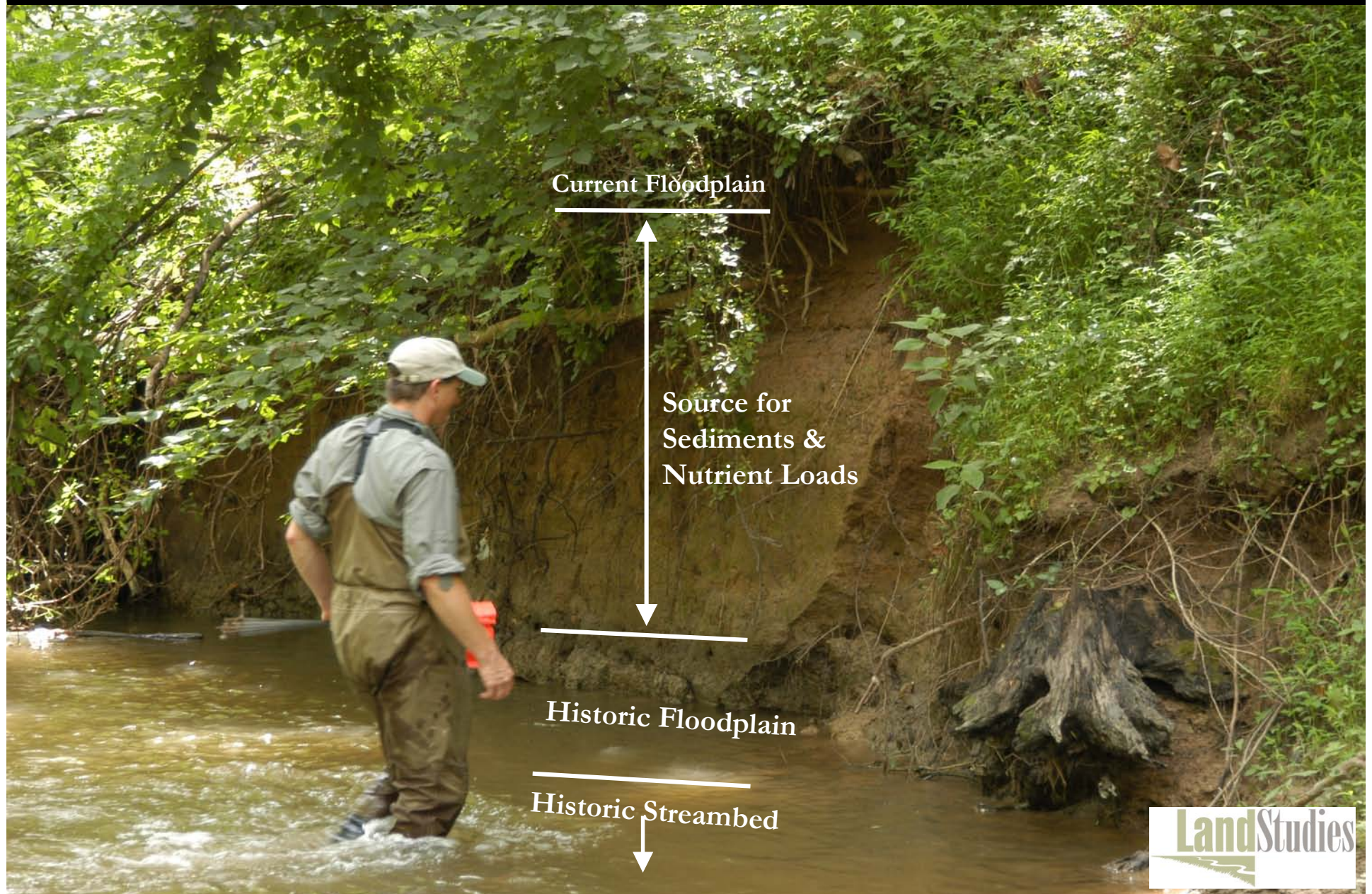
Figure credit: Franklin & Marshall College, Lancaster, PA.

Natural Streams and the Legacy of Water-Powered Mills

Robert C. Walter and Dorothy J. Merritts

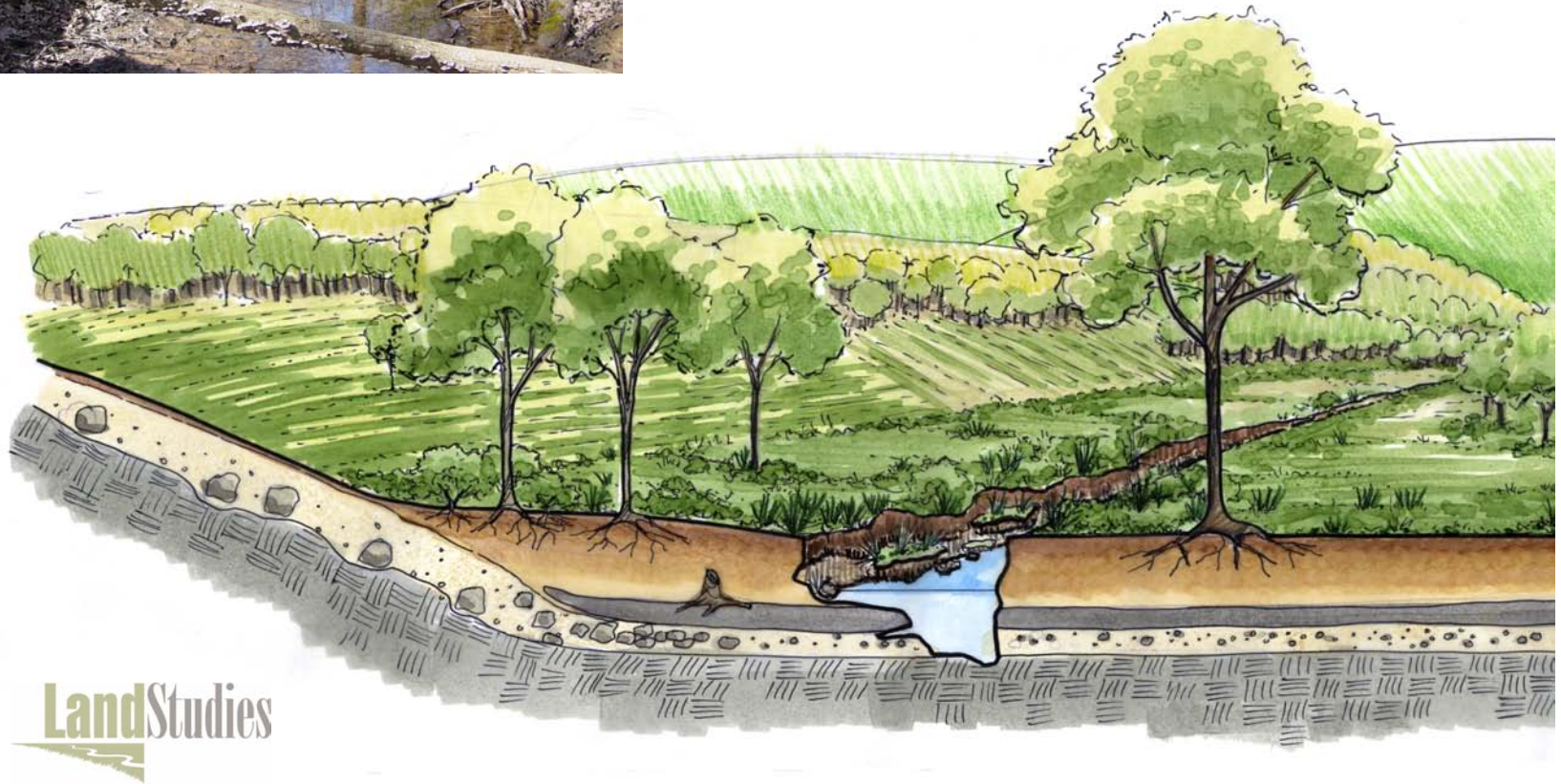


Post-Settlement Sedimentation









LandStudies



The Multiple Benefits of Floodplain Restoration

Chesapeake Bay Tributary Strategy

- *reduces the flow of sediments and nutrients in waterways*
- *contributes to the goals of the Chesapeake Bay Tributary Strategy*

Sediment and Nutrient Reduction

- *provides significant and quantifiable sediment and nutrient reductions*
- *traps incoming sediments and vegetative strips filter incoming nutrients*

Groundwater Recharge

- *reconnects the floodplain and stream to the water table*
- *provides sustainable water supply*
- *provides groundwater recharge in Karst geology without sinkhole formation*

Wetland Creation

- *provides locations for wetland banking*
- *provides functional wetland creation*
- *provides wildlife habitat and native plant habitat*

The Multiple Benefits of Floodplain Restoration

Riparian Buffers

- *provides stable location for planting riparian buffers*
- *reconnected floodplain improves water quality benefits of tree planting*

Wildlife Habitat Improvement

- *provides corridors and habitat for flora and fauna*
- *re-establishes historic plant communities*

Stormwater Management

- *approved BMP in accordance with the PA Stormwater BMP Manual, 6.7.4*
- *provides regional locations for stormwater management*
- *addresses infiltration and water quality associated with NPDES II*

Flood Reduction

- *expanded, accessible floodplain help alleviate nuisance flooding*
- * *reduces 100 year flood elevation*
- *reduces pressure on waterway*

The Multiple Benefits of Floodplain Restoration

Invasive Plant Species Removal

- *native plant community establishment*
- *reduced competition from non-native species*

Aesthetic Enhancement

- *low maintenance natural landscape*
- *reduced erosion produces lush green vegetation*
- *diversity of seasonal interest native plants.*

Topsoil Generation

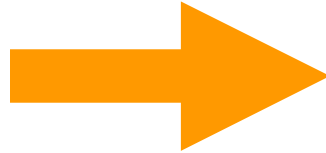
- *high-quality, nutrient-rich topsoil removed from the floodplain*
- *development and landfill reclamation*

Environmental Education

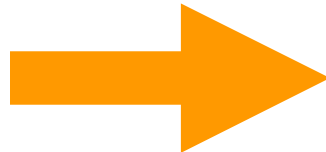
- *outdoor classrooms for all levels of education*



Single Function



Multiple Function



Lititz Run Watershed
EXAMPLES



Lititz Run Watershed

*“A Community
Improving its Water
Quality”*

Began work in early '90's

* First in PA

Numerous projects implemented through the Lititz Run Watershed Alliance and local Trout Unlimited groups include:

Riparian buffers

Stream restoration

In-stream habitat devices

Wetland creation / restoration

Agricultural BMP's

Dam removal

Regional Water Quality Facility * (7 acre)

Nutrient Trading Pilot Project *

Floodplain restoration

**Critical Aquifer Recharge Area (CARA)
Restoration ***

Joint Wellhead Protection Program *



Lititz Run Watershed

Today, 19 years later, the community
HAS improved its water quality!!

In 2008, PA re-designated all of Lititz Run a cold-water fishery, a major step up from its former warm-water fishery listing.

Over 6 miles of stream and riparian corridor restoration to date

Over 10 acres of created wetlands

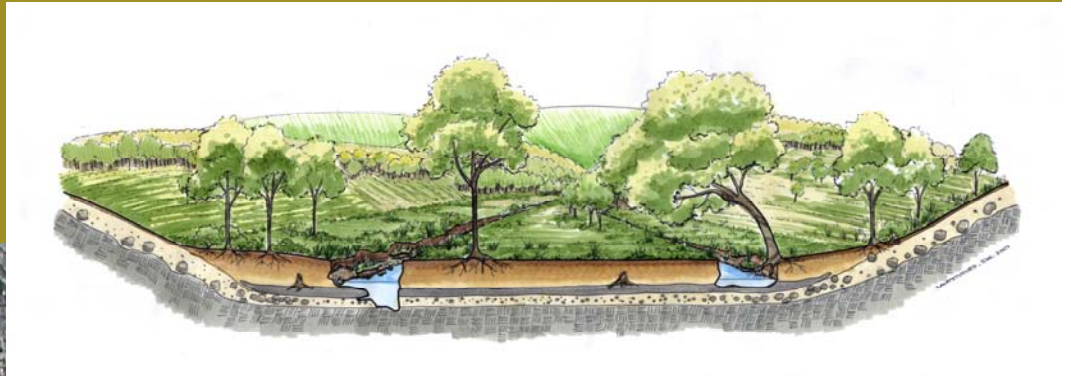
Over \$1 million in funding

Integrated education curriculum through the local school district

Young wild trout have been found in sections of Lititz Run for several years, proving they are reproducing

Before

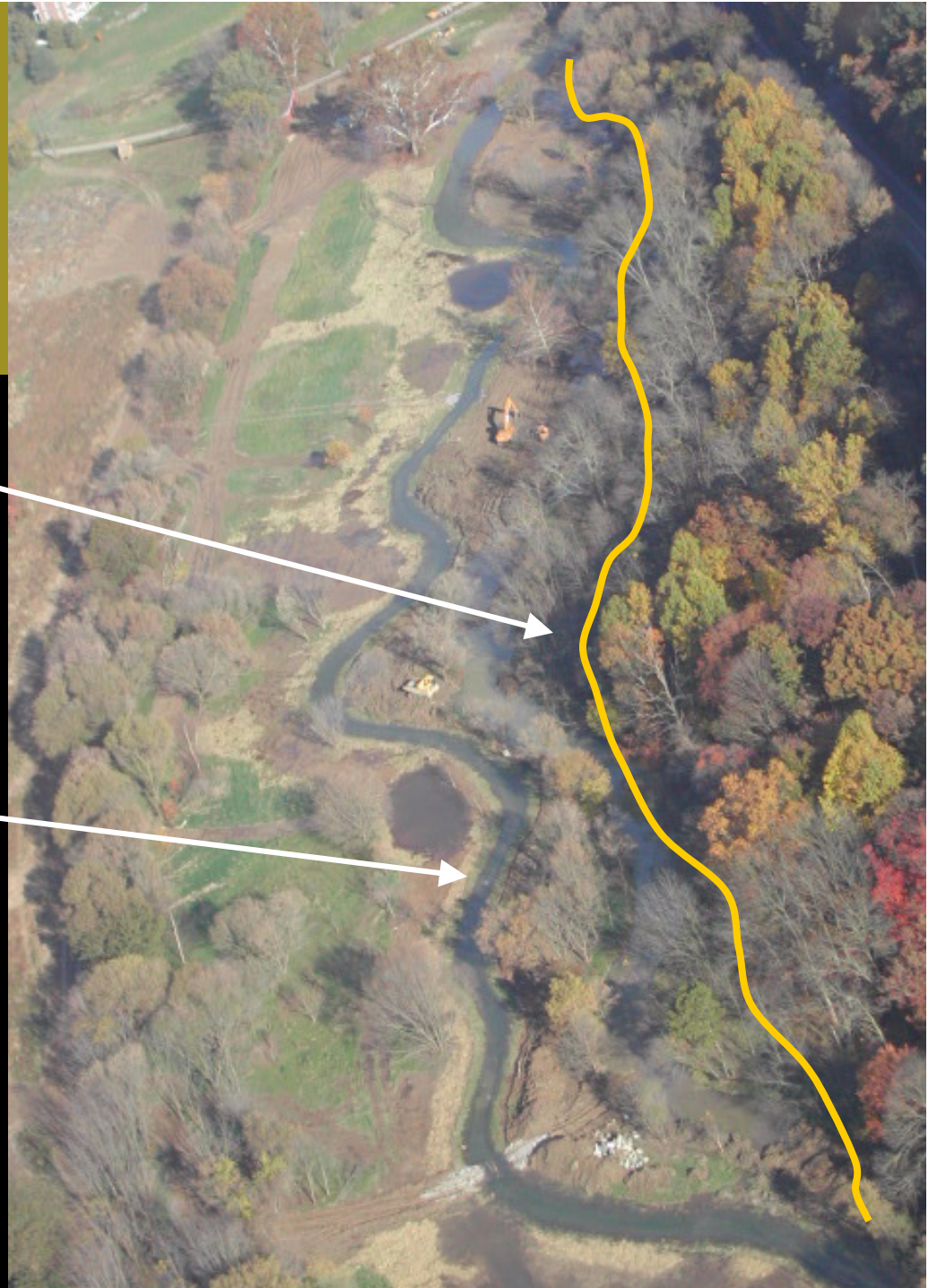
Lititz Run Banta Site



During Construction

unstable
channel was on
right

restored
channel on left



After

Lititz Run Banta Site



During Rain Event -
February 13, 2008



After -
March 19, 2009



Before

Nutrient Credit Trading Pilot Project
Lititz Run New Street Park







2004 8 27

After

Nutrient Credit Trading Pilot Project
Lititz Run New Street Park



Storm Event

Nutrient Credit Trading Pilot Project
Lititz Run New Street Park



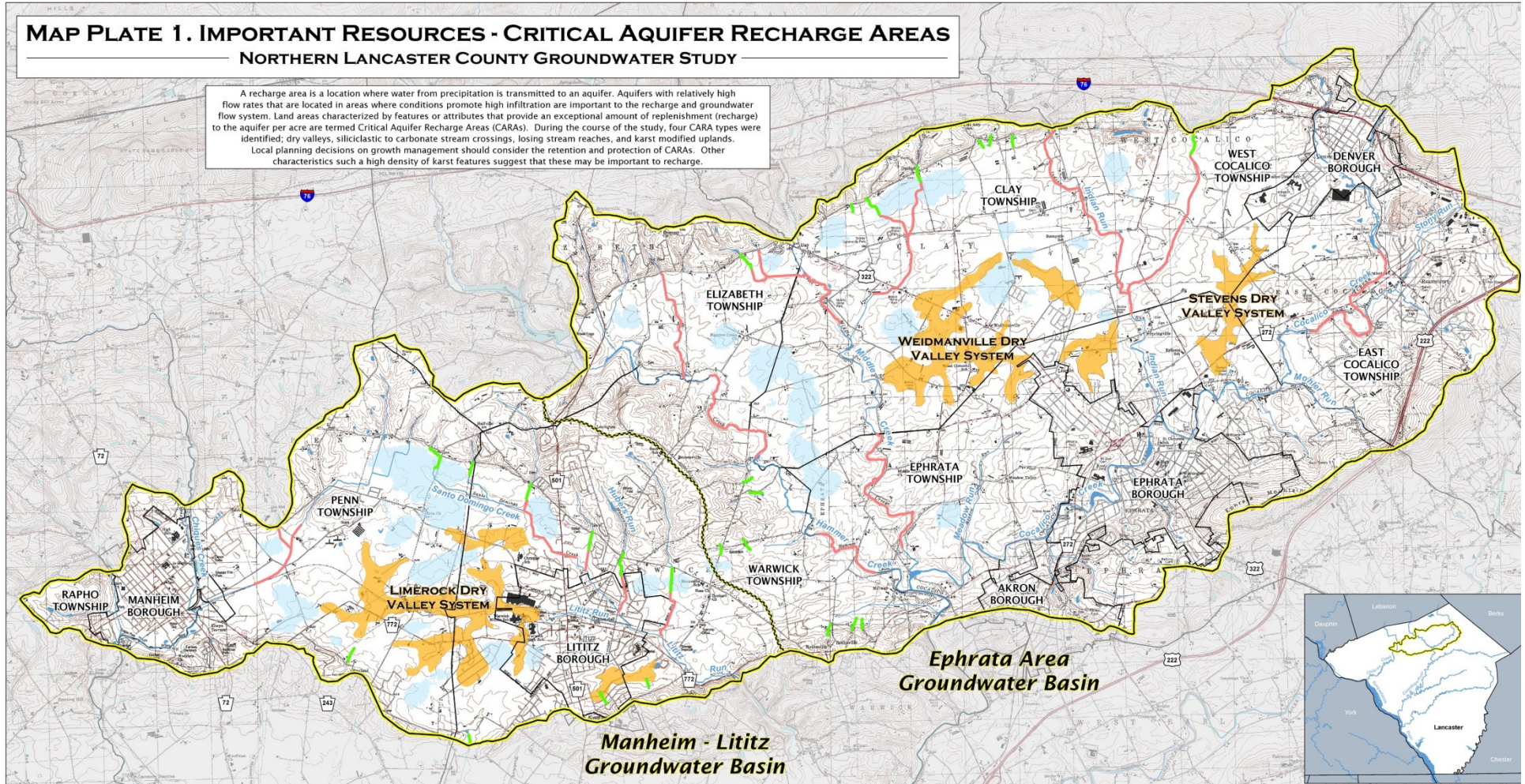
Northern Lancaster County

Critical Aquifer Recharge Areas (CARA's)

SRBC, DEP and LandStudies, Inc Sept 2005

MAP PLATE 1. IMPORTANT RESOURCES - CRITICAL AQUIFER RECHARGE AREAS
NORTHERN LANCASTER COUNTY GROUNDWATER STUDY

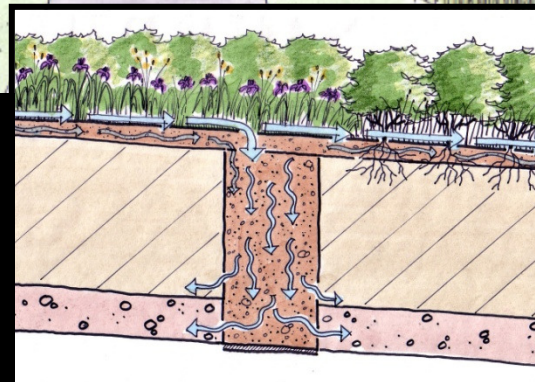
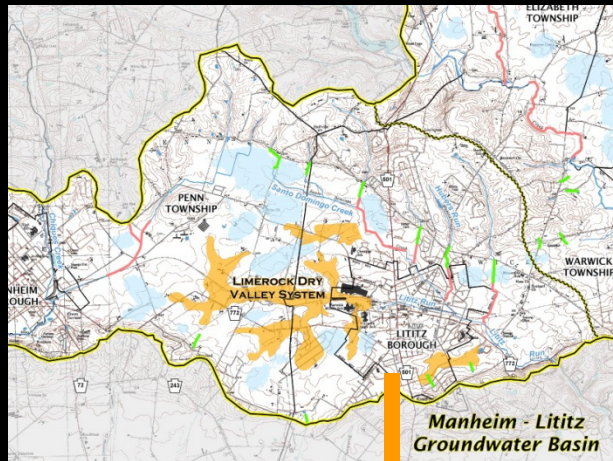
A recharge area is a location where water from precipitation is transmitted to an aquifer. Aquifers with relatively high flow rates that are located in areas where conditions promote high infiltration are important to the recharge and groundwater flow system. Land areas characterized by features or attributes that provide an exceptional amount of replenishment (recharge) to the aquifer per acre are termed Critical Aquifer Recharge Areas (CARAs). During the course of the study, four CARA types were identified: dry valleys, siliclastic to carbonate stream crossings, losing stream reaches, and karst modified uplands. Local planning decisions on growth management should consider the retention and protection of CARAs. Other characteristics such as a high density of karst features suggest that these may be important to recharge.



CARA Restoration

Partners:
Johnson and Johnson, Borough of Lititz,
SRBC, DEP and LandStudies, Inc

Phase I Constructed Fall 2007



CARA Restoration - After



Transferable EXAMPLES



LandStudies uses an integrated approach to meet stormwater management requirements and improve water resources.

Rain Gardens

Tree Planting

Pervious Pavement

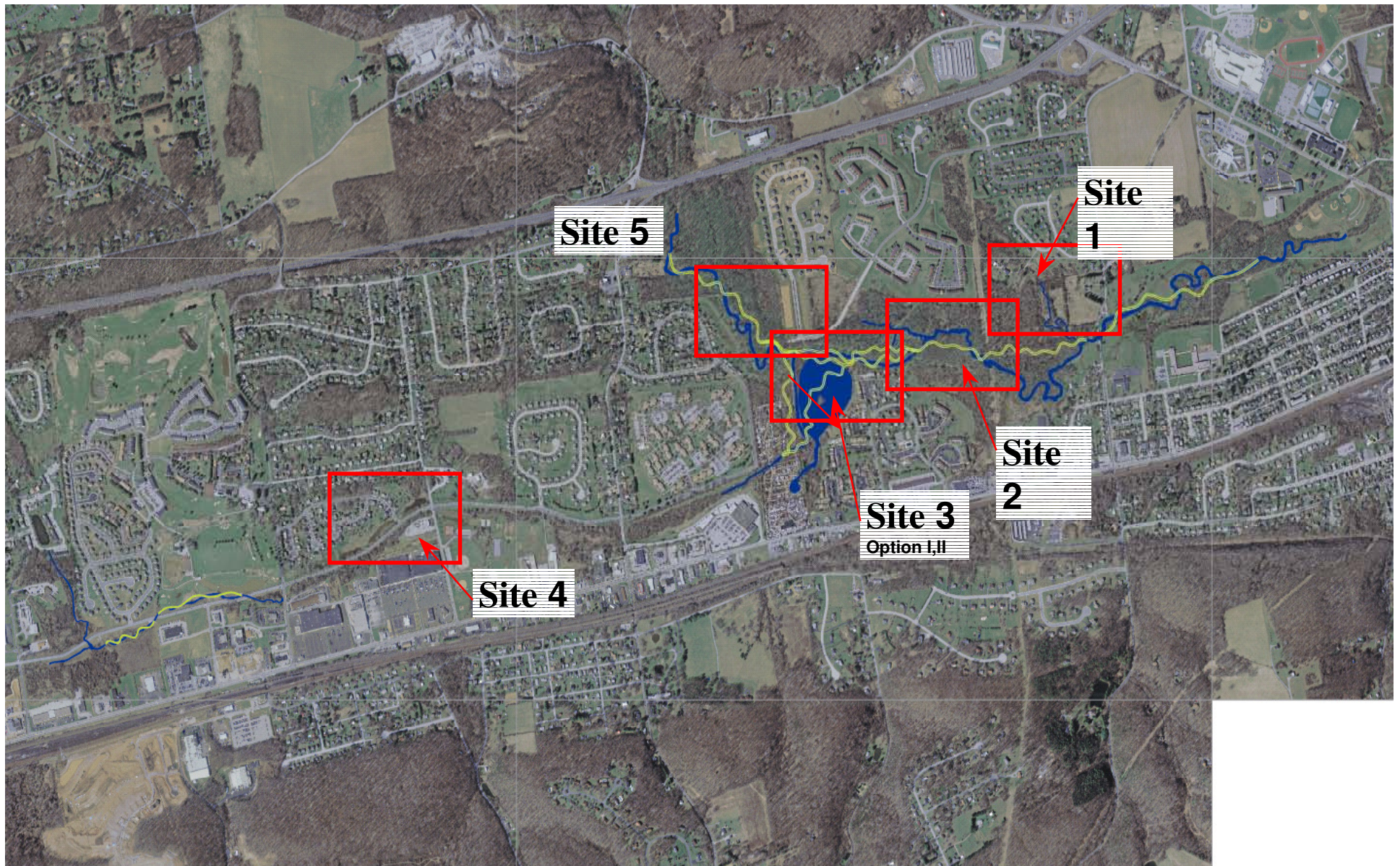
Infiltration Beds

Constructed Wetlands

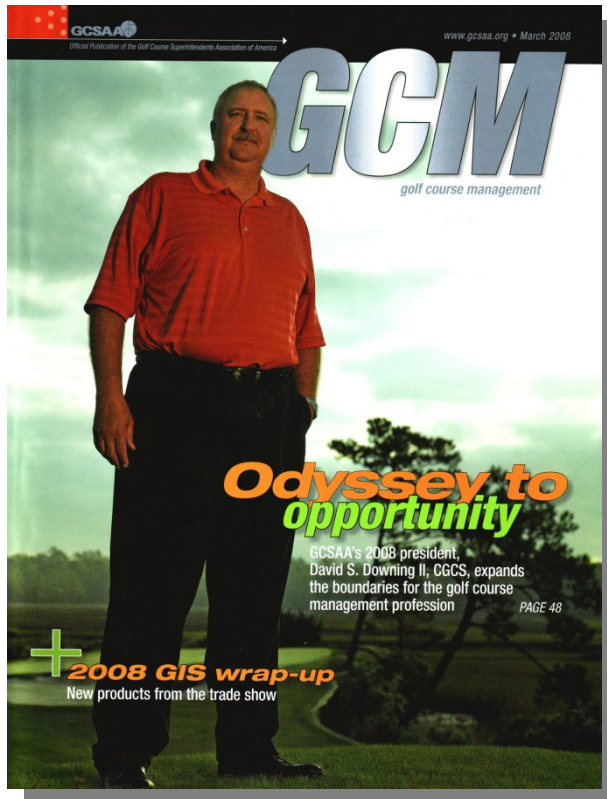
Floodplain Restoration (PA Stormwater Manual BMP 6.7.4)

Regional Stormwater Management

Caln Township,
Chester County, PA



Golf Course Industry Recognition



New tool for water management

Golf courses could become a lot “greener” with a new Green Toolbox developed by the Pennsylvania Environmental Council and LandStudies Inc., based in Lititz, Pa.

PEC previously developed an interactive, online trading tool for Pennsylvania’s Nutrient Trading Program with funding from the Pennsylvania Department of Environmental Protection’s Growing Greener program. The golf course toolbox will add to that original project and will identify multiple environmental benefits connected with new and existing BMPs that help reduce nutrient and sediment pollution in streams and ground water.

Implementing the toolbox’s BMPs could reap multiple benefits for golf courses. Practices such as riparian buffer installation, floodplain wetland restoration and manure compost usage will be examined for their benefits beyond nutrient and sediment reduction — benefits such as improved stormwater management, improved aquifer recharge and filtration, improved water-use management, reduced maintenance, expanded native plant communities and improved wildlife habitat. BMPs directly related to improved surface and groundwater management

tendents are true stewards of the environment,” says Chassard, a 25-year member of GCSAA. “Once completed, the Green Toolbox will be a resource no manager or superintendent will want to be without.”

The toolbox will provide a range of information on specific BMPs and benefits, implementation guidelines and cost ranges. A framework to quantify environmental credits for the BMPs will be included. The end product will be published in a handbook, available in both hard copy and Web-based formats, that can be used as a component of workshops and conferences that promote golf course BMPs and environmental trading credits.

The final publication, “Integrated Water Resources Management for Golf Courses,” will include a synopsis of the developed BMPs and their associated benefits, regulatory requirements that can be addressed, how the BMPs are integrated into course management and the environmental stewardship principles they advance.

Golf Course BMP and Credit Analysis Handbook

Pennsylvania Environmental Council (PEC) and DEP

What:

A BMP guide to generate market based credits to help golf courses and municipalities meet water-related regulatory requirements.

Benefits:

- water quality improvements
- groundwater recharge
- infrastructure protection
- environmental restoration
- habitat improvement
- stormwater management

Economic Return:

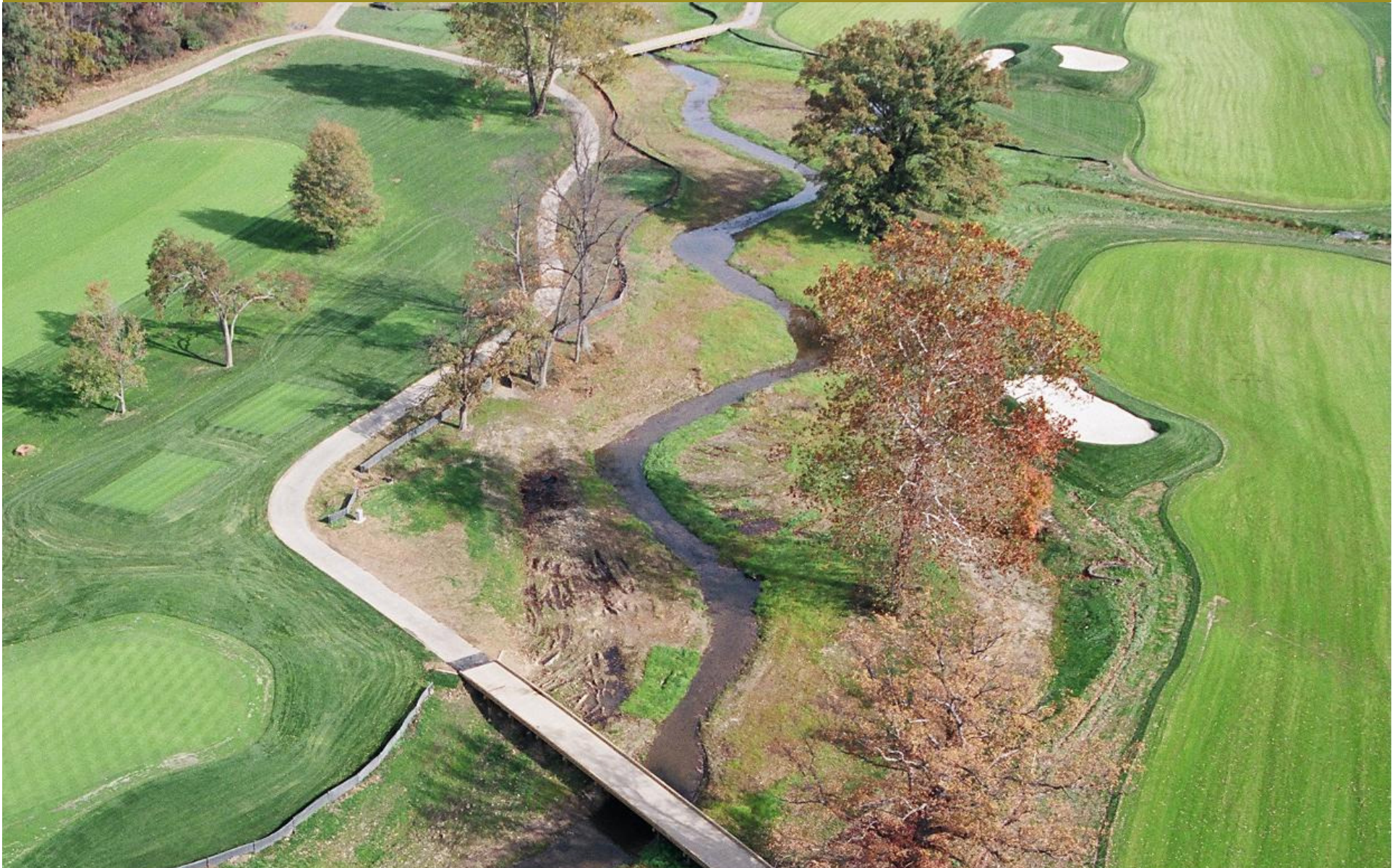
- generates nutrient and carbon credits
- wetlands credits
- stormwater management offsets
- reduced maintenance

Before

**Bedford Springs
Resort**
Bedford, Pennsylvania



After



After

***Golf Inc. Magazine
“2007 Restoration of the Year”***



After



Studies, Inc.



Real life Cost Comparison BMP's to Traditional Methods

- Previous solutions proposed costs in excess of \$1.5 million for hard (rock and concrete protection) solutions
- Bioswale and infiltration alternatives were completed for less than \$200,000
- Future Floodplain restoration to address SWM estimated at \$195,000
- Cost savings of over \$1 Million with greener solution



LandStudies

The Nature Conservancy's
2009 Investing in Nature Award Winner
for
“Innovative New Technologies”

Lititz Run Watershed
Floodplain Restoration
Warwick Township, Lancaster County
LandStudies, Inc.