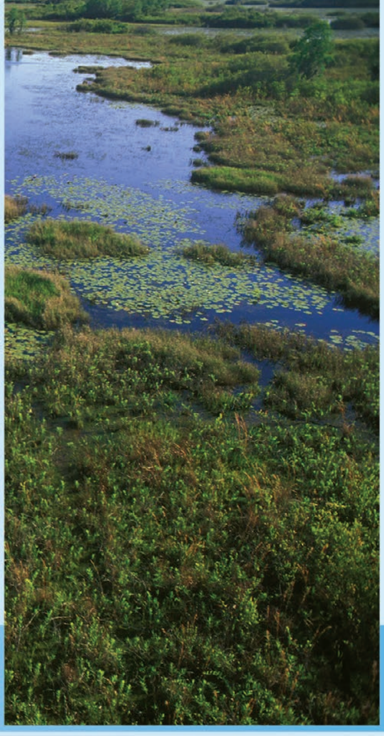
EPA 841-R-16-009

National Nonpoint Source Program

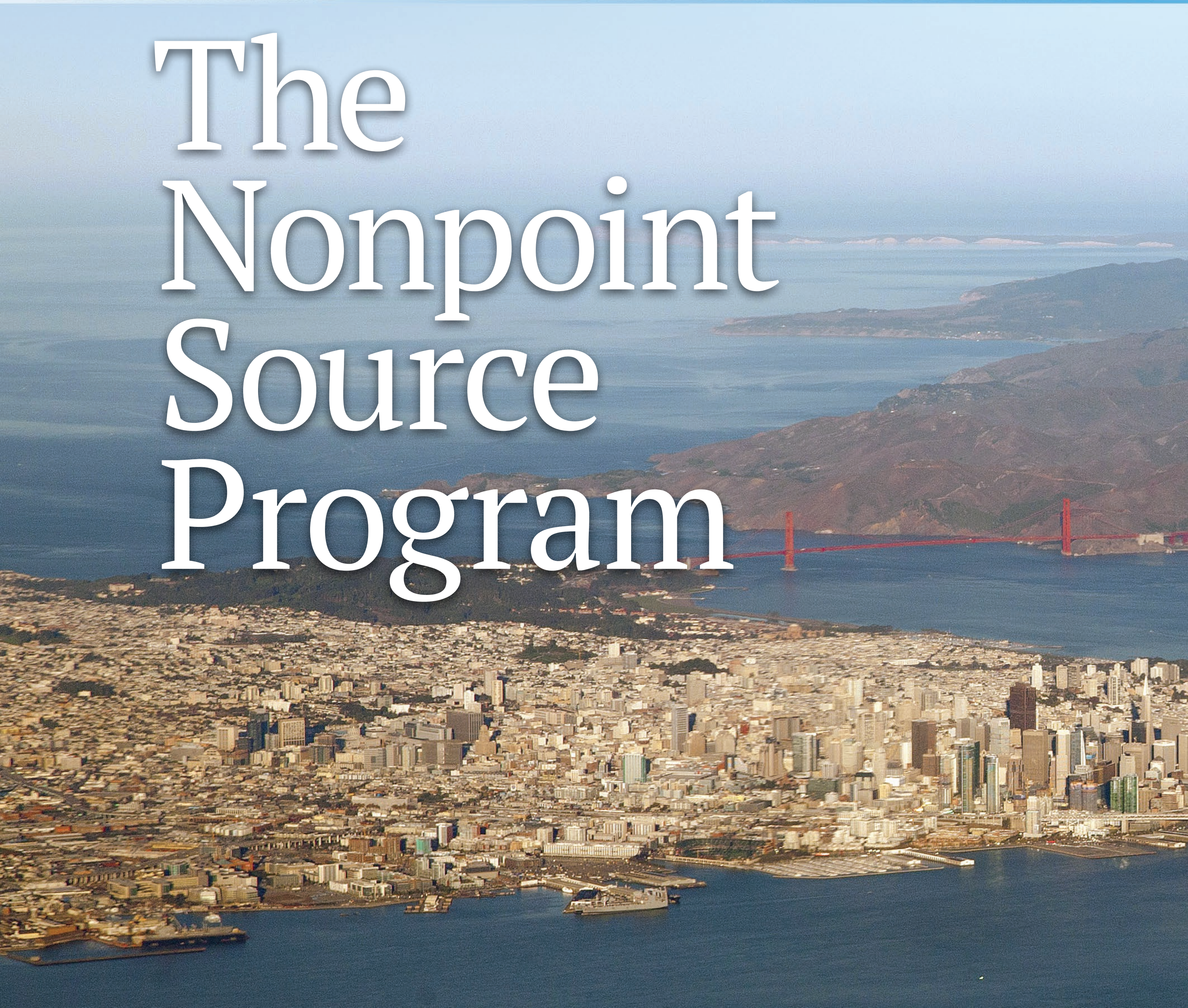
—a catalyst for water quality improvements

A REPORT ON HIGHLIGHTS OF THE §319 PROGRAM



The Nonpoint Source Program



Congress enacted Section 319(h) (§319) of the Clean Water Act in 1987, establishing a national program to control nonpoint sources of water pollution. Through §319, the U.S. Environmental Protection Agency (EPA) provides states, territories and tribes with guidance and grant funding to implement their nonpoint source (NPS) programs. This can include a wide variety of activities including regulatory or nonregulatory programs, technical assistance, financial assistance, education, training, technology transfer, watershed projects and monitoring to assess the success of specific NPS implementation projects. Collectively this work has restored over 6,000 miles of stream and over 164,000 acres of lakes since we began tracking progress in 2005. These numbers do not yet reflect the work that is currently going on in more than 2,000 projects across the country.[1]

This report offers a glimpse of NPS activities underway across the United States. It highlights the key issues and provides a snapshot of strategies that state agencies, territories and tribes are using to tackle the spectrum of water quality issues related to NPS pollution. We are excited to introduce this national snapshot of NPS work. We invite feedback at NPS-highlights@epa.gov.

NPS pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, streams, wetlands, coastal waters and ground waters.

Why Is the NPS Program Important?

Of all the waterbodies across the nation that have been assessed and a possible source of impairment identified, 85% of rivers and streams and 80% of lakes and reservoirs are polluted by nonpoint sources.[2]

The CWA's regulatory programs include enforceable provisions that are directed at point source pollution—the discharge of pollutants to surface waters from pipes, outlets and other discrete conveyances. The NPS Program, in contrast, addresses NPS pollution, or *polluted runoff*, primarily through nonregulatory means.

An overwhelming majority of Americans—215 million (>70%)—live within 2 miles of a polluted lake, river, stream or coastal area.[3] States have identified more than 600,000 miles of rivers and streams, more than 13 million acres of lakes and more than 500,000 acres of wetlands that do not meet state water quality goals. Many of these waters are considered unsafe for swimming or are unable to support healthy fish or other aquatic life. The NPS Program and EPA's §319 grants are a key resource in the effort to improve and protect our nation's waters.

Total Assessed Waters of the United States	Rivers and Streams (Miles)	Lakes, Reservoirs, and Ponds (Acres)
Good Waters	487,299	5,470,004
Threatened Waters	5,550	34,621
Impaired Waters	614,153	13,009,273

Source: USEPA July 2016[4]

The Role of §319 Funding as a Catalyst to Restore and Protect the Nation's Waters

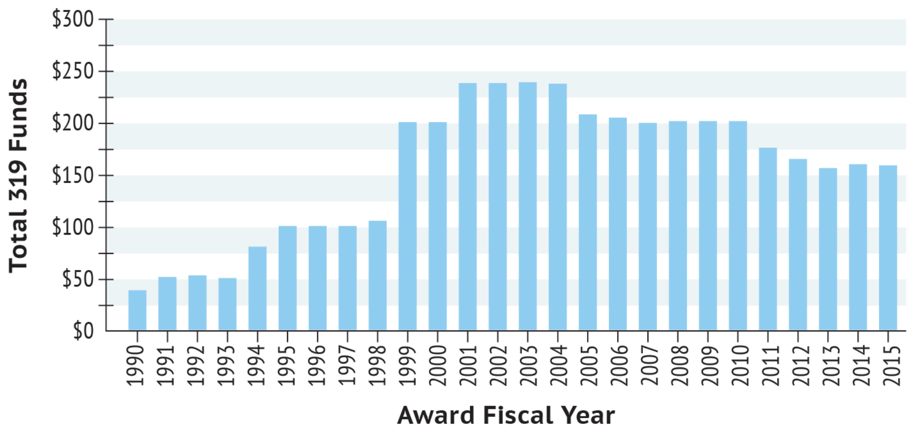
NPS pollution encompasses a wide range of sources that are not subject to federal or often state regulation. The scope of the problem expands as a result of population growth and land use changes. Even as waters are restored, others are identified as impaired as a result of development pressures and other factors such as recent assessment of existing water quality problems.

The vast extent and continuous nature of NPS pollution is a daunting challenge that requires problems be addressed through a variety of approaches using multiple funding sources. Although not the entire remedy, §319 funding is an essential part of the solution to the costly challenges of NPS pollution—it is a critical source of support for NPS management programs and for watershed projects. State NPS programs typically leverage other programs and funding sources to achieve water quality improvements.

§319 Funding as a Path to Improvement

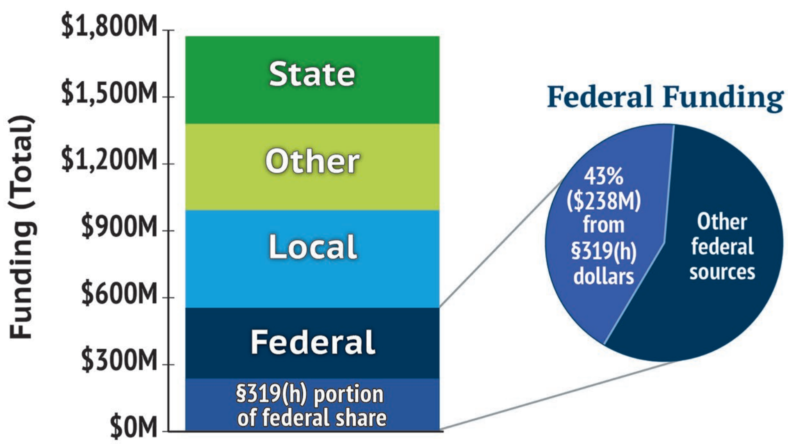
Since 1990, the NPS program at the federal, state, tribal and local levels evolved with refinement of NPS management program plans, an improved understanding of suites of best management practices (BMPs), and new monitoring and modeling approaches to increase the likelihood of water quality restoration. The program continues to improve partnerships with federal, state and local entities—sharing information with the public and measuring and reporting water quality improvements.

Total §319 Funding Per Year (in millions)



Source: USEPA[5]

§319 Catalyzes Other Project Funding



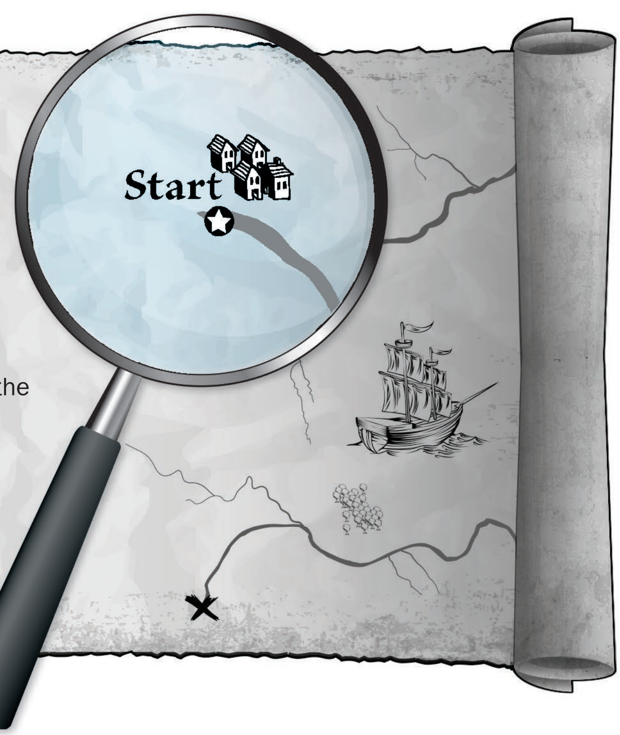
Source: USEPA Success Stories[6]

This chart shows the amount of funding from various sources that supported restoration of 538 NPS-impaired waters across the nation. Of these restored waterbodies, states reported a total of $1.78 billion in funding for restoration work. Approximately $238 million (13%) of the total was §319 funding.[6]

The Watershed Approach

The watershed approach is fundamental to implementing work at the local scale to achieve water quality results. A watershed plan is a strategy and roadmap for achieving water quality resource goals:

- Watershed plans provide the **technical** basis to guide work related to pollutant loads, sources, and BMPs strategically prioritized in critical areas that will have the greatest impact on water quality.
- Watershed plans lay out a path for **engaging** affected stakeholders and landowners in the process along the way. Basically, without local capacity and landowner engagement, projects don't happen.



Achieving Water Quality Improvement in a Dynamic Environment

Creating a Path to Success

Start

1 **Watershed plans** lay out the route for water quality improvements. These plans address the sources of the problem and identify critical areas where focused work will make the most impact on water quality. A watershed can contain dozens or hundreds of NPS pollution sources and these can fluctuate over time. Finding solutions is not a simple task! Watershed plans help local groups take a holistic approach to restoring water quality. This approach requires four key things: people, money, work and time. If one of those four is missing, success is simply out of reach.

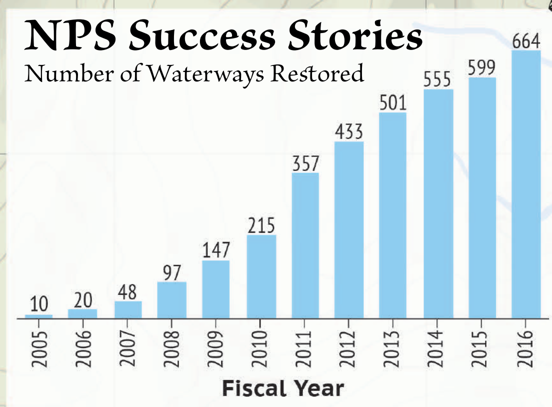
Building Partnerships

2 **Success takes people—many people.** People from local communities, state agencies, tribal governments, conservation districts and other organizations are working hard every day to reduce NPS pollution. They are the foundation that sets everything into motion.

Implement Plans

3 **Success also takes money, of course.** Many times, the §319 program serves as the catalyst to set watershed plans into motion. State, local and regional staff work with other partners to identify funding from additional sources to meet costs for the entire project. A little bit of §319 money goes a long way!

WATERSHED PLANNING GEAR

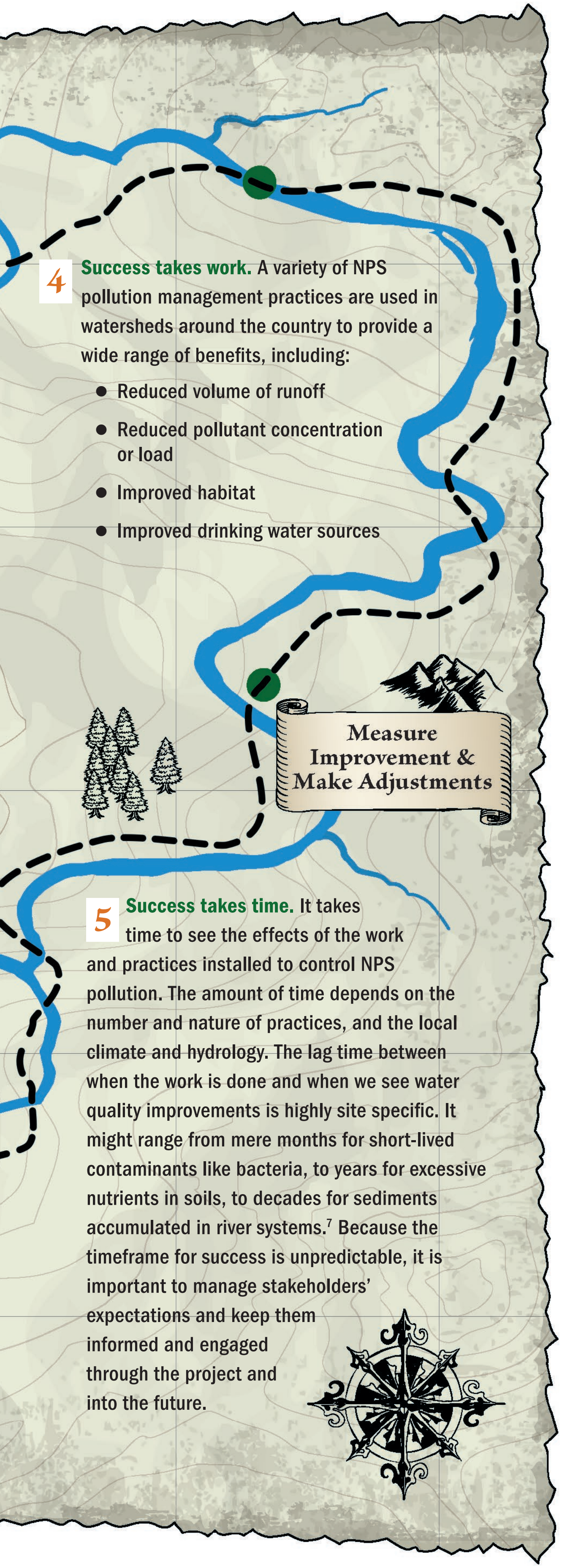


Source: NPS Success Stories web site: www.epa.gov/nps/success[6]

Success!

6 EPA's Success Stories website communicates the results of partners' efforts that achieved water quality goals. Each story documents the specific water quality problems, the water quality restoration activities that took place, data showing improvement, funding sources used, and the valuable partnerships that were pivotal to the success. Although it can take years to see water quality improvements, success stories provide a glimpse into what we can expect in time from the many projects going on in watersheds across the country.[6]

Over 6,000 miles of stream and over 164,000 acres of lakes have been removed from the impaired waters list since we began tracking NPS work in 2005.[6]



4 **Success takes work.** A variety of NPS pollution management practices are used in watersheds around the country to provide a wide range of benefits, including:

- Reduced volume of runoff
- Reduced pollutant concentration or load
- Improved habitat
- Improved drinking water sources

5 **Success takes time.** It takes time to see the effects of the work and practices installed to control NPS pollution. The amount of time depends on the number and nature of practices, and the local climate and hydrology. The lag time between when the work is done and when we see water quality improvements is highly site specific. It might range from mere months for short-lived contaminants like bacteria, to years for excessive nutrients in soils, to decades for sediments accumulated in river systems.[7] Because the timeframe for success is unpredictable, it is important to manage stakeholders' expectations and keep them informed and engaged through the project and into the future.

The Faces of Success

People are the foundation that sets everything into motion to restore our waters. States, territories, tribes, conservation districts, local governments, watershed groups, landowners and others—all working toward the common goal of improved water quality, habitat and public health. Here, and in the following pages, we introduce you to just a few of the people that are making these changes around the country.

Kari Hedin, Fond du Lac Band of Lake Superior Chippewa, Minnesota

Excess nutrient runoff from poor farming practices resulted in high phosphorus levels, fish kills and algal blooms in Third Lake on the Fond du Lac tribal reservation. Kari Hedin, a watershed specialist for the tribe, explains, "Grant funding paid for an alum treatment in the lake to bind the phosphorus to bottom sediments preventing algae growth, resulting in a huge reduction in phosphorus." A local horse farm owner also chipped in by turning several large piles of manure into garden compost for a school. "The farmer was an enthusiastic key partner who worked hard to improve his farm management techniques," noted Hedin.

Jennifer Zygmunt, Department of Environmental Quality, Wyoming

"To me, the NPS program means helping to leave things better than when you found them and finding solutions that benefit multiple problems."

As Wyoming's NPS coordinator, Jennifer Zygmunt has worked on more than 60 NPS projects. One project sticks out in her mind as particularly gratifying. By the early 1990s, historic grazing practices had caused sedimentation in a mountain creek in northeastern Wyoming. Twenty years after §319 funds were used to help improve grazing practices, monitoring data demonstrated that the project was a success. "The project shows that you often need many years for problems to be corrected," she said. "I think it's important to recognize that nonpoint source problems weren't created overnight and they won't be fixed overnight. Sometimes you have to nudge things in the right direction and then allow time for natural processes to work and heal things."

Dave Thomas, Broad Top Township, Pennsylvania

In southern Pennsylvania, Broad Top Township has put the cleaning of its streams on par with maintaining roads—using its own plans, employees and equipment to restore and protect waters impacted by abandoned mine drainage and bacteria. "Funding through §319 grants has allowed our small rural township to have a great impact on the restoration of our watershed that will be enjoyed for generations to come."

§319 Projects by NPS Type

This graph shows the source categories NPS projects have focused on from 2008–2013.

Agriculture
1,968

- Livestock and crop production activities and facilities
- Forestry (silviculture) operations

Urban
1,507

- Stormwater runoff (e.g., motor oil and road salts) from roads and parking lots
- Stormwater runoff from lawns and gardens
- Stormwater runoff from pet waste and failing septic systems

Hydrologic/ Habitat Modification
609

- Stream channelization and channel modification
- Impacts from dams
- Impacts from streambank and shoreline erosion

Other
578

- Some state work might not be easily captured by one defined category. Examples of recent projects in this category include technical analysis, emerging contaminant studies, and rehabilitation work after wildfires.

Waste Disposal
197

- Inappropriate waste disposal practices
- Malfunctioning or poorly placed septic systems
- Leaking storage tanks

Resource Extraction
177

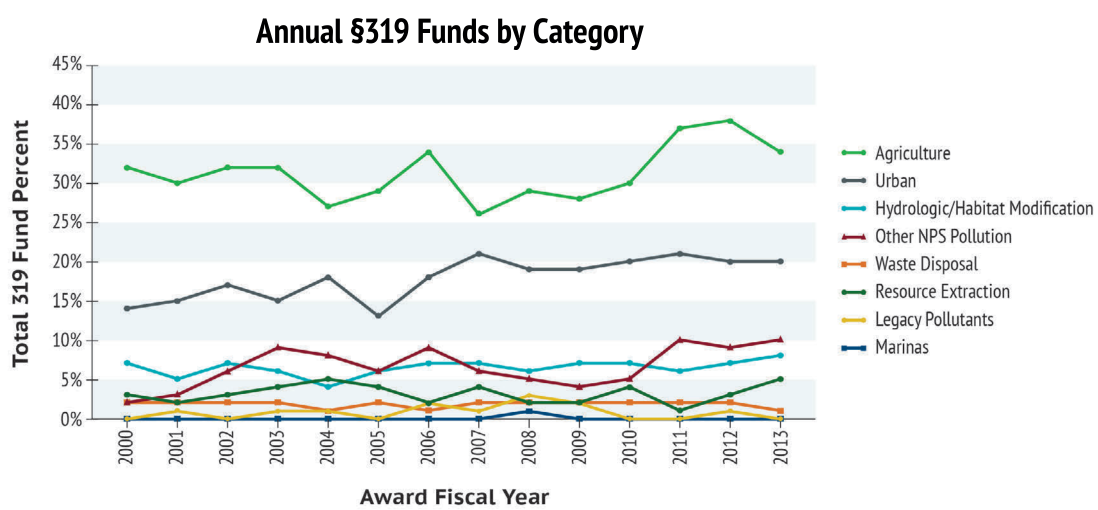
- Abandoned mine drainage or former fuel extraction sites and activities

Legacy Pollutants
117

- Chemicals used historically in agricultural, manufacturing and mining activities—some of which are now banned.
- Usually these pollutants are associated with contaminated sediment.

Marinas
54

- Boat cleaning, boat fueling or marine head (toilet) discharge
- Stormwater runoff from parking lots and hull maintenance/ repair areas

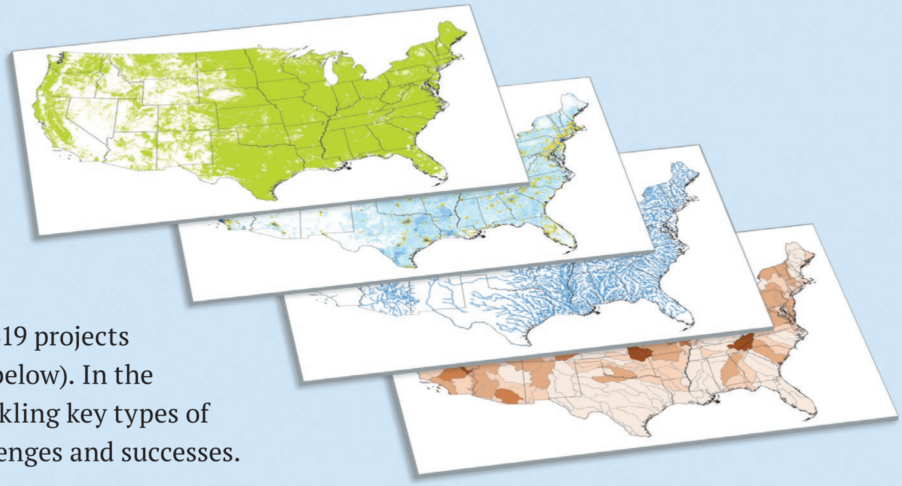


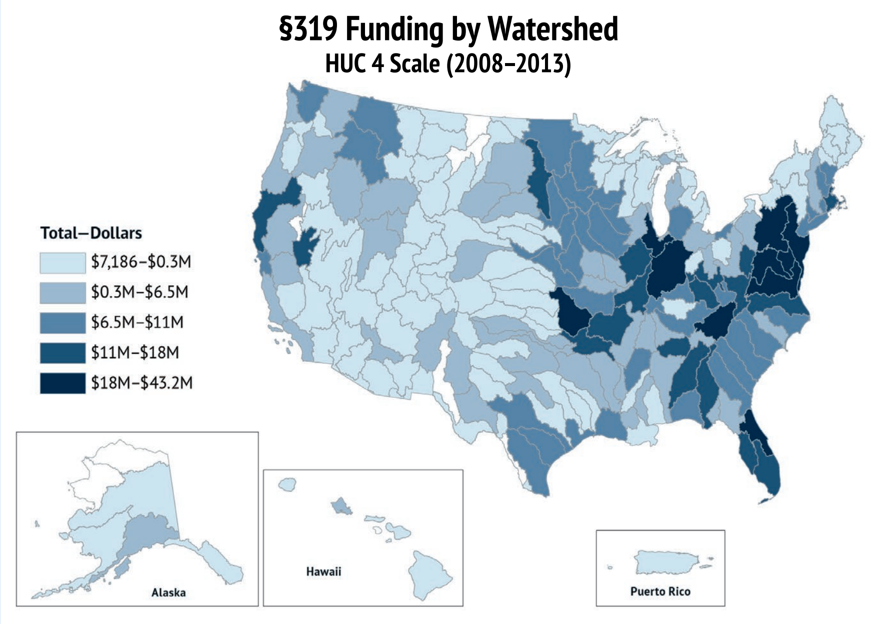
Source: USEPA Grants Reporting and Tracking System[8]

This graph shows the source categories NPS funding has addressed over the longer term (2000–2013).

Land Use Drives NPS Work

A snapshot of completed projects provides insight into the focus of NPS efforts. The type of NPS pollution affecting local waters is driven primarily by an area's land use. Other influencing factors include population, climate, soil and topography. As a result, the number, funding level and focus of §319 projects vary across the country (see images, below). In the following pages, we profile people tackling key types of NPS pollution and explore their challenges and successes.

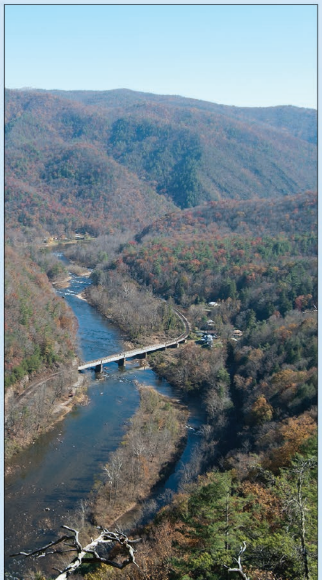


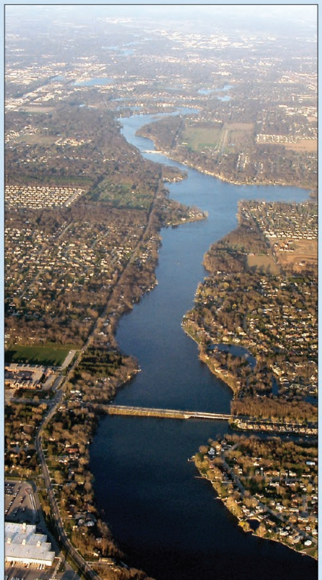


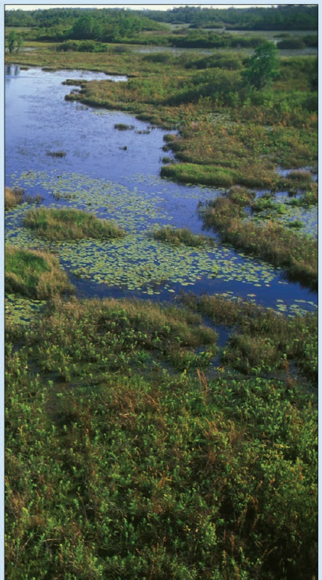
Source: USEPA Grants Reporting and Tracking System[9]

Note: HUC 4 = four-digit hydrological unit code representing large river basins across the nation.

This map includes the overall distribution of NPS efforts as dollars from 2008–2013. Projects can vary from thousands to hundreds of thousands of dollars.







Agriculture

States reported that agricultural NPS pollution was the leading source of water quality impacts on surveyed rivers and lakes, the second largest source of impairments to wetlands, and a major contributor to contamination of surveyed estuaries and groundwater. Of §319 funds that go to watershed projects, 30% to 40% annually go towards addressing agricultural sources. Tribal §319 dollars also have a strong focus on projects that address agricultural impacts on waterbodies.[10] Partnerships with U.S. Department of Agriculture (USDA) agencies such as the Natural Resources Conservation Service, Farm Service Agency and Forest Service are able to identify the most effective approach along with the resources necessary to protect and restore rivers, streams, lakes and estuaries.

NPS funds often work in concert with USDA program funding to demonstrate innovative BMPs, coordinate implementation efforts, or provide technical assistance and landowner outreach to accelerate practice adoption.

Top Pollutants

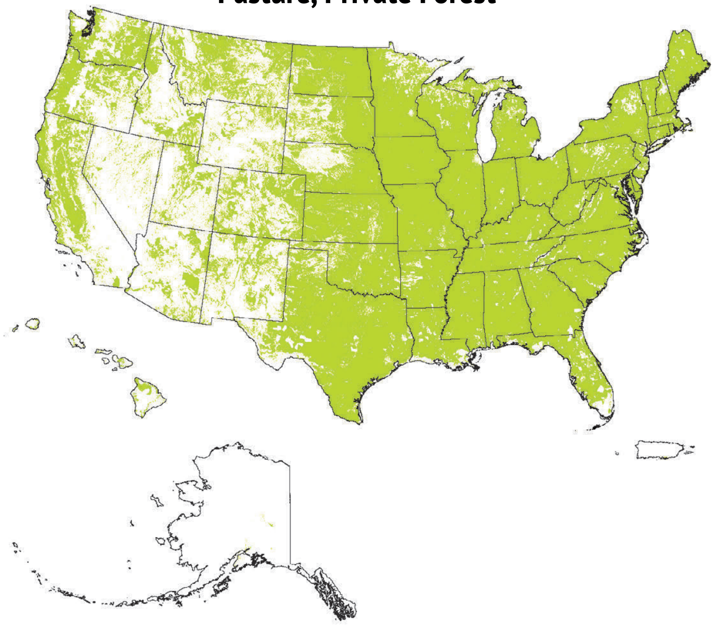
- Nutrients
- Suspended solids/sediments
- Pathogens

Others include pesticides, temperature and selenium.

Frequent BMPs

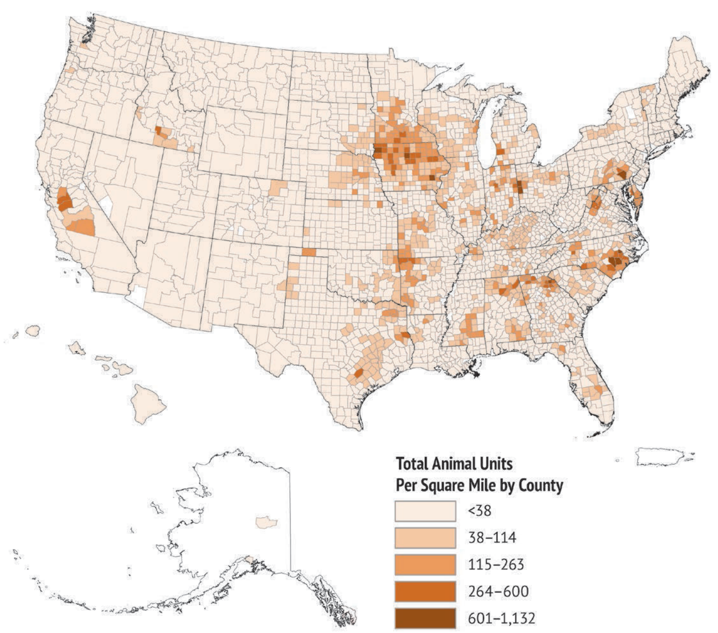
- Nutrient management planning
- Livestock exclusion
- Conservation cropping (including cover crops)
- Riparian buffers and grassed waterways

Agricultural Land Use Including Crops, Pasture, Private Forest



Sources: National Land Cover Dataset, 2011 and NOAA's Land Cover Atlas[11]

USDA Ag Census for Total Animal Units by County

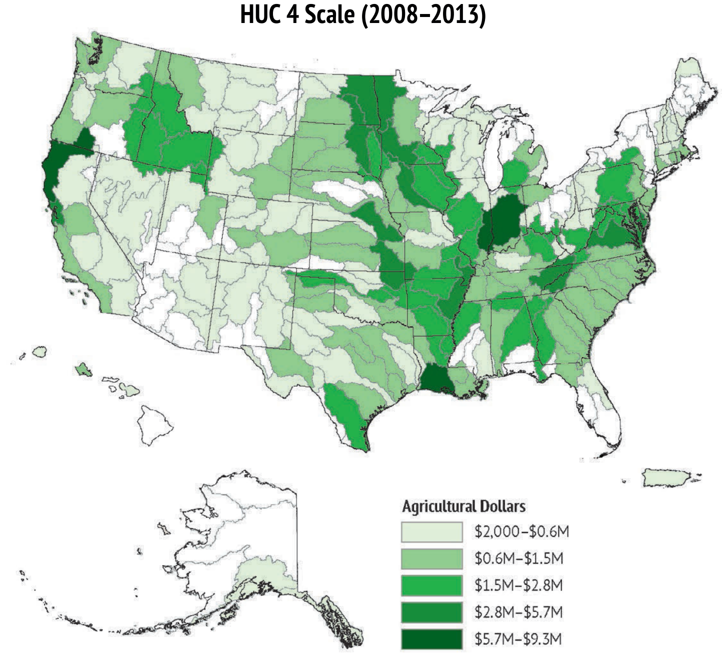


Source: USDA National Agricultural Statistics Service Quick Stats[12]



Systems of conservation practices that avoid, control and trap nutrient losses can be the most effective strategy to treat agricultural NPS pollution.

§319 Agricultural Grant Funds by Watershed
HUC 4 Scale (2008–2013)



Source: USEPA Grants Reporting and Tracking System[9]

As shown on the maps on pages 10 and 11, the §319 funds awarded for agriculture and silviculture broadly align with two of the country's major land uses—farms and forests.

Richland Soil Conservation District

Installing a vegetated diversion dike reduces soil erosion, holds the soil in place, and reduces flooding in crop fields.

The Faces of Success

Donny Latiolias, Capital Resource Conservation & Development Council, Louisiana

"Little Silver Creek would not have been removed from the list of impaired waters without Section 319 funding which covered 34 percent of the cost of grain drills, pasture renovators, and aerator equipment for producers to lease from a local co-op," says Donny Latiolias, watershed coordinator with the Capital Resource Conservation & Development Council. Landowners saw the benefits of this equipment immediately. One even noted that when it rained after his first time using the pasture renovator, he could see the water infiltrating the soil instead of standing on the surface and making its way downhill to local waterbodies as it had done in the past.

Jennifer Klostreich, Richland Soil Conservation District, North Dakota

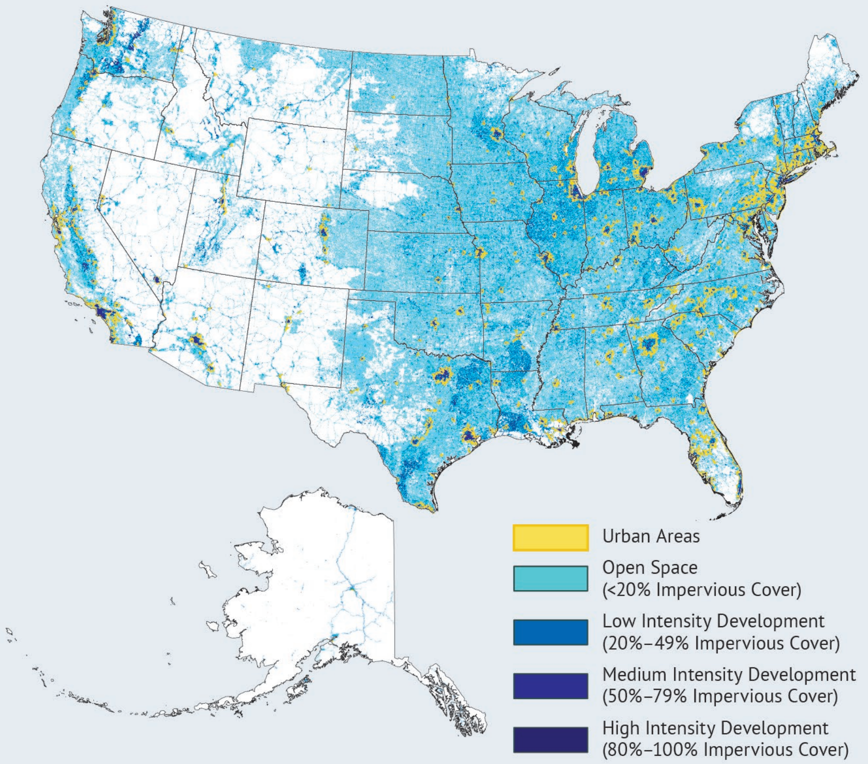
Jennifer Klostreich has used funding from three §319 grants to upgrade many older septic systems in addition to improving agricultural practices that were causing high bacteria levels in the Wild Rice River. "Whether it's a new farming practice or a septic system upgrade, the Nonpoint Source Program gives landowners the little bit of a push they need to try something new," says Klostreich.

"The 319 program helps us guide people through the process of making a change and ultimately, making that change become the new status quo."

Urban

Urban and suburban areas pose unique challenges to the water resource manager because of mixed land ownership, heterogeneous land uses and large areas of impervious surfaces. NPS funds have been used to demonstrate and evaluate BMP designs and operation and maintenance practices, as well as to identify the most effective practices for a state or locality. States also use §319 funds to support the development of urban runoff policies and programs at the local level. The use of these funds often stimulates long-term partnerships between universities, nongovernment organizations and state and local governments to promote innovative runoff management designs and treatment approaches.[13]

Developed Land Use and Urbanized Centers



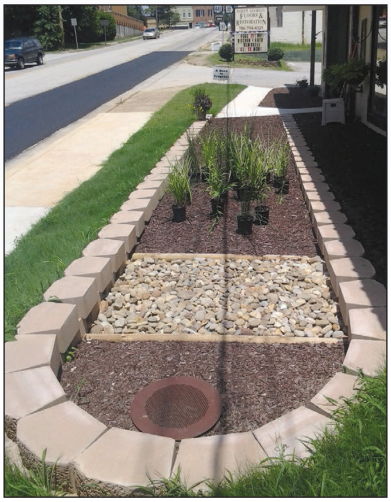
Sources: National Land Cover Dataset, 2011 and 2010 U.S. Census[14]

Top Pollutants

- Suspended solids
- Nutrient-related pollutants: phosphorous, nitrogen, oxygen demand
- Metals and pathogens

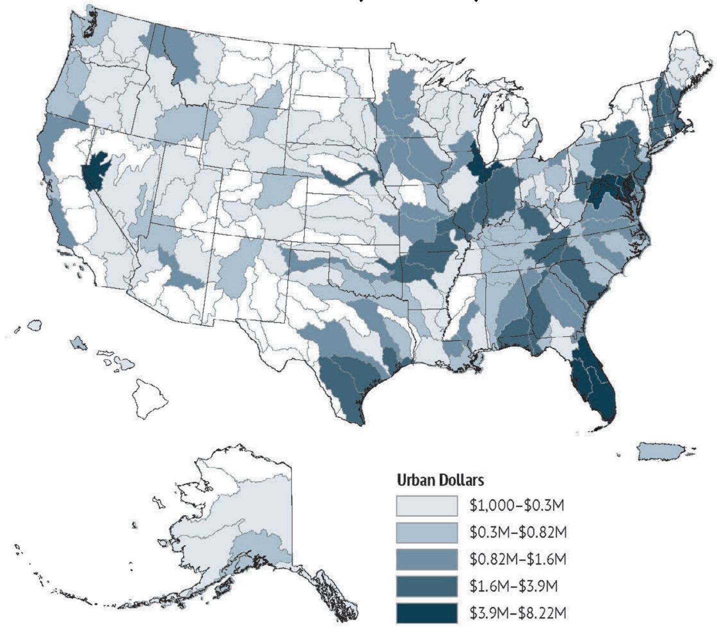
Frequent BMPs

- Rain garden/bioretention
- Porous pavement
- Vegetated swales
- Education and outreach



Bioretention in Clarkesville, Georgia, and rain garden education just to the west in Waleska.

§319 Urban Grant Funds by Watershed
HUC 4 Scale (2008–2013)



Source: USEPA Grants Reporting and Tracking System[9]

Bioretention rain garden at Villanova, Pennsylvania. Since 1999, the Villanova Urban Stormwater Partnership has constructed and monitored multiple innovative BMP devices, including a stormwater wetland, bioinfiltration and bioretention rain gardens, pervious concrete/porous asphalt installations, an infiltration trench, a treatment train and a green roof.

The Faces of Success

Steve Saari, Planning and Restoration Branch Chief, Department of Energy and Environment, District of Columbia

"Section 319 funding allowed the District to hire and retain staff for many years who could dedicate the time needed for developing and implementing watershed plans," says Steve Saari with the District of Columbia's Department of Energy and Environment. Steve's work is helping communities see urban streams as assets rather than eyesores.

"That §319 funding provides the backbone of our work and has allowed us to develop the technical know-how we needed for stream restoration projects."

Dr. Robert Traver, Professor of Civil and Environmental Engineering, Villanova University

Monitoring the effectiveness of urban NPS BMPs is critically important when it comes to ensuring that BMPs installed under §319 projects are working effectively. Villanova University, in collaboration with the Pennsylvania Department of Environmental Protection, created a Stormwater Best Management Practice Research and Demonstration Park on its campus near Philadelphia to gauge and understand the effectiveness of various BMP designs. The partnership's work leveraging campus infrastructure to improve BMP design is helping to increase our understanding of NPS issues and advance sustainable stormwater management. Since 2002 the collaboration has resulted in many journal publications that are cited worldwide in technical guidance, and have supported the training of doctoral, masters, and many undergraduate students. Tours of the site have been provided for various groups, including attendees of stormwater conferences, delegations from China and Panama, and others.

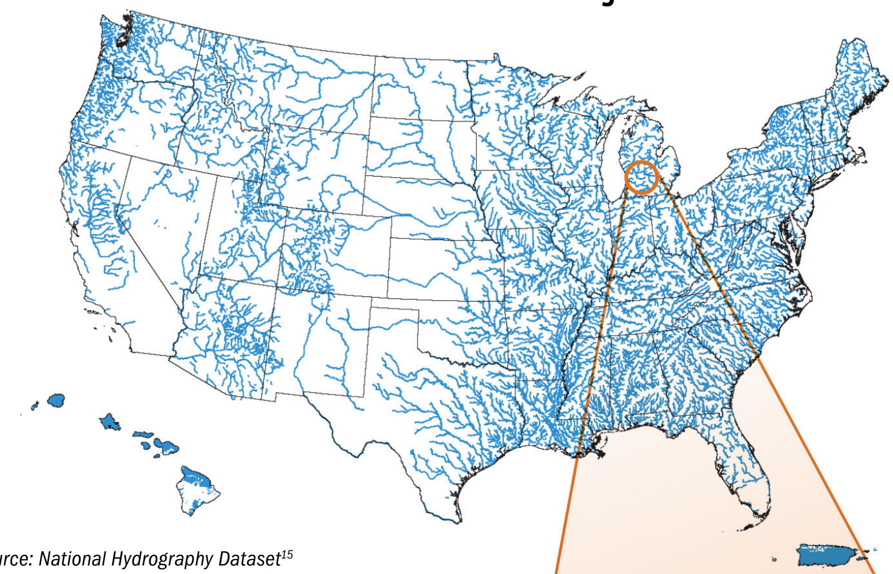
Hydromodification

Hydromodification includes the physical modification or degradation of stream channels or banks, wetlands, or lake or coastal shorelines. Streambank and shoreline erosion and channel incision can mobilize and transport sediment, nutrients and other pollutants (e.g., heavy metals and organic pollutants found in urban soils) that can impact downstream water quality.

Constructing levees, dams and bulkheads and channelizing streams or rivers are examples of direct hydromodification activities. Upstream land uses that create impervious surface areas and consequently increase runoff volumes and velocities indirectly cause hydromodification.

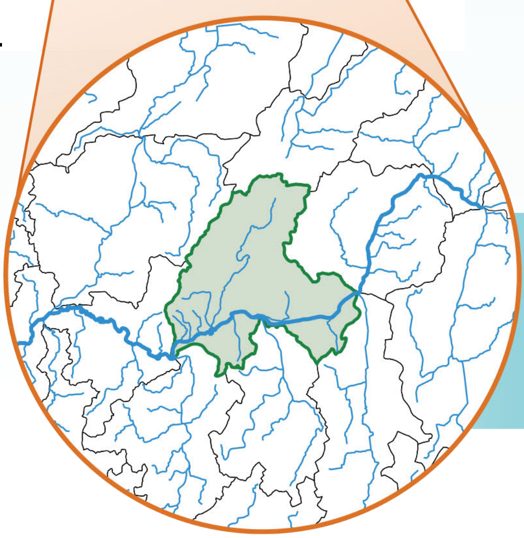
§319 funds can be used to help restore floodplains, daylight streams that have been piped underground, restore natural shorelines, reestablish stream channel sinuosity and depths, reduce pollutant discharges and increase the resiliency of shoreline areas to climate change related flooding.

U.S. Rivers and Streams with the Highest Flows



Source: National Hydrography Dataset[15]

To show density of streams across the U.S., this map shows only the highest flowing streams. Hydromodification can occur in a stream of any size.



Subwatershed Project Area Along the Thornapple River[16]

Top Pollutants

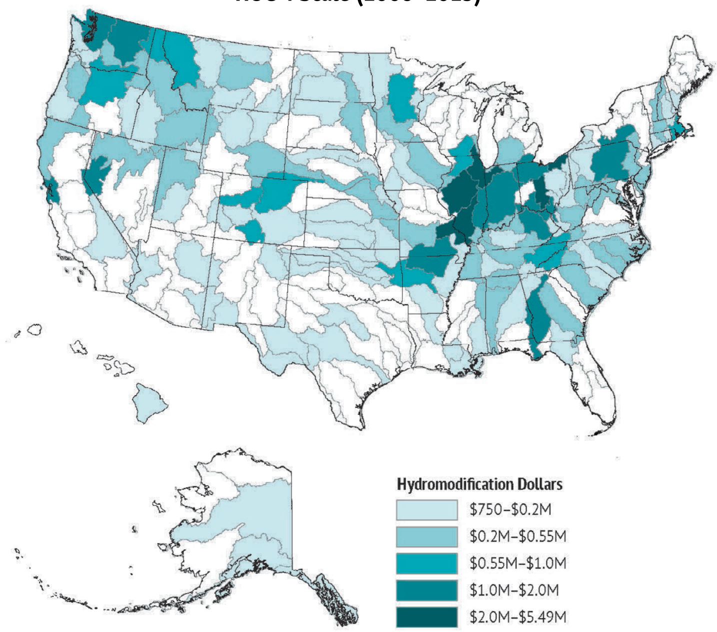
- Sediment
- Nitrogen
- Phosphorous
- Low dissolved oxygen

Frequent BMPs

- Stream bank and channel restoration/protection
- Riparian buffers/trees and shrubs
- Wetland restoration

§319 Hydromodification Grant Funds by Watershed

HUC 4 Scale (2008–2013)



Puerto Rico is not included because no §319 projects related to hydromodification were reported from 2008–2013.

Source: USEPA Grants Reporting and Tracking System[9]

Michigan Department of Environmental Quality

After the dam was removed from the Thornapple River in Nashville, Michigan, a four-tiered rock ramp was installed to improve stream conditions.

The Faces of Success

Shawn Chato, Santa Clara Pueblo, New Mexico

The Santa Clara Pueblo Office of Environmental Affairs (OEA) hired a firm to construct 347 sediment retention structures in the Santa Clara Creek watershed in New Mexico. "Without Section 319 funding, it would have taken us a long time to do this work ourselves," says Shawn Chato, the water quality coordinator for OEA (pictured far left in the photo below). Some of the project locations were very steep and rocky, allowing access by foot only. According to Chato, "The crew even had to camp out during the winter months in freezing temperatures to get the job done."

Dana Strouse, Michigan Department of Environmental Quality, Grand Rapids, Michigan

"Funding from the NPS Program not only supported pre- and post-monitoring for a dam removal project on the Thornapple River, it also helped cover staff time to work with area partners to apply for funding from other sources to complete the project," says Dana Strouse with the Michigan Department of Environmental Quality. Removing the dam improved water quality and habitat for nearly 30 species of fish.

Resource Extraction

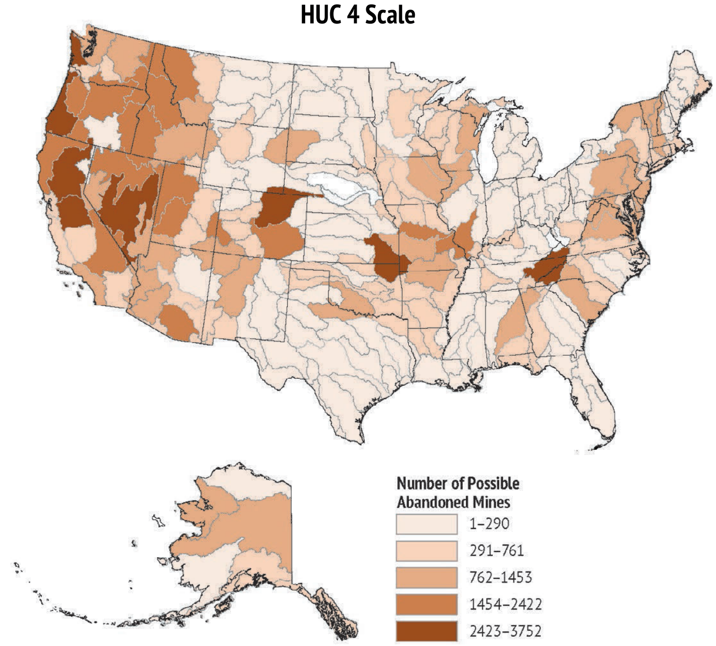
Acid mine drainage (AMD) is water that has become polluted after exposure to metals, minerals or mining wastes. It is the most common form of NPS pollution associated with resource extraction. While AMD is usually associated with coal mining, it can also occur as a result of metal, rock, gravel and sand mining. AMD impacts ecosystems and people by altering pH and transporting metals into the environment and water supplies. Metals can include zinc, iron, mercury, copper, aluminum, manganese and arsenic. AMD also introduces elevated sulfate levels and carries large amounts of suspended sediment into streams and water supplies.

Addressing AMD is a long-term investment. An AMD treatment system usually raises the pH level in the drainage water, which neutralizes the acidity and causes the dissolved metals to drop out of suspension. Treatment systems require substantial investments in operation and maintenance. Many local communities invest for long-term operation and maintenance of these treatment systems.

Partnerships with state abandoned mine land (AML) programs help watershed experts identify the most effective approach to address AMD at each site and find the resources necessary to protect and restore rivers, streams and lakes. State AML funding is often complemented by NPS funds, which can be used to focus on the water quality element of mine reclamation.

Possible Abandoned Mines by Watershed

HUC 4 Scale



Source: U.S. Geological Survey, Mineral Resources Data System[17]

The United States is estimated to have more than 118,000 possible abandoned mines.

Top Pollutants

- Metals
- Acidity
- Sediment

Frequent BMPs

- Lime dosing
- Land and stream reconstruction
- Wetland treatment system

Colorado Division of Mining, Reclamation & Safety

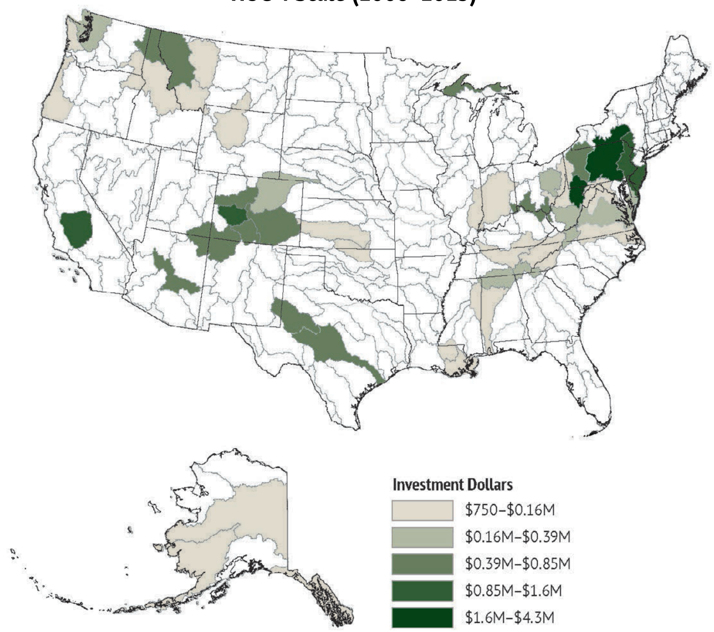
Removal of tailing piles around a historic mill structure in Summit County, Colorado.

Cyd Curtis, USEPA

Wetland treatment system for acid mine drainage in Lamberts Run watershed, West Virginia.

§319 Resource Extraction Grant Funds by Watershed

HUC 4 Scale (2008–2013)



Puerto Rico and Hawaii are not included because no §319 projects related to resource extraction were reported from 2008–2013.

Source: USEPA Grants Reporting and Tracking System[8]

Tennessee Department of Agriculture

A variety of treatments installed in the Crab Orchard Creek watershed in Morgan County, Tennessee, helped reclaim the abandoned coal mine land and restore water quality.

The Faces of Success

Amanda Pitzer, Friends of the Cheat, West Virginia

“Working on projects that clean up waterways impacted by AMD is a real labor of love,” says Amanda Pitzer, executive director of the Friends of the Cheat (FOC), who has been tackling the AMD problem in tributaries of the Cheat River in West Virginia for 6 years. Seeing area streams change from an orange slurry to healthy waterways that now support fish and aquatic plants has spurred many long-time landowners to become active partners in environmental cleanup efforts led by FOC.

“Consistent, reliable funding from the NPS Program has helped to empower people in our community to solve what was once seen as an insurmountable problem.”

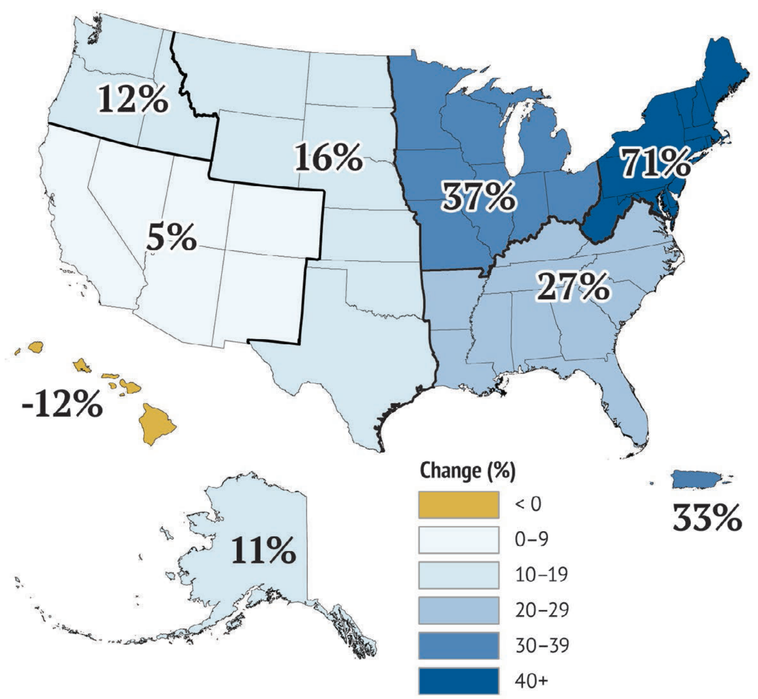
Sam Marshall, Tennessee Department of Agriculture

In Tennessee, §319 funding fills a niche by addressing polluted runoff from abandoned mines since very little money gets spent on this kind of work in Tennessee.

“It is very rewarding to see streams like Crab Orchard Creek, once plagued by acid mine drainage from former coal mining operations, come off our state list of impaired waters as a direct result of section 319 funding and matching sources.”

Looking to the Future

CWA §319 plays a unique role in addressing NPS pollution. It serves as a funding source to allow each state to implement its own, distinctive NPS management plan—using a combination of technical support, water quality assessment, innovative demonstration practices, education and outreach, and implementation of watershed-based plans. The flexible approaches used by states, territories and tribes will continue to open doors to a wide array of resources that can be used to help prevent and manage NPS pollution.



Source: National Climate Assessment, http://nca2014.globalchange.gov[18]

The map shows percent increases in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events) from 1958 to 2012 for each region of the continental United States.

The various pollutant sources contributing to nutrient pollution will continue to be a focus in the coming years. In addition, NPS managers across the country must consider new factors driven by climate variability, such as longer dry spells and more intense storms. For example, as shown in the top figure, scientists have observed a 71 percent increase in very heavy precipitation in New England since 1958. This will, undoubtedly, influence the strategies and approaches used at the local, regional and national levels.

Colorado Department of Public Health and Environment

Erosion control mats were installed after a wildfire in Waldo Canyon in central Colorado.

Minnesota Pollution Control Agency

Scientists conduct field-scale research in Minnesota to assess the resilience of stream banks to increased storm intensity.

The Final Word

This report highlights some of the many accomplishments of the NPS Program and describes how the program has evolved and is addressing a variety of water quality problems around the country. In the years to come, NPS practitioners at the federal, state, tribal and local levels will continue to work hard together to ensure clean, safe water is available for people, plants and animals—not an easy task by any means. It will take hard work and time to accomplish all that needs to be done.

Cyd Curtis, USEPA

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it is the only thing that ever has."

—**Margaret Mead** (1901–1978) quoted in John M. Richardson, ed. *Making it Happen*, 1982

Acknowledgments

The U.S. Environmental Protection Agency's Office of Water would like to thank the many people who supported this report through direct contribution and their ongoing work in nonpoint source programs around the country.

Gwen Berthelot, Louisiana Department of Environmental Quality

Shawn Chato, Santa Clara Pueblo

Ari Engelberg, Oak Ridge Institute for Science and Education (ORISE) Fellow

Kari Hedin, Fond du Lac Band of Lake Superior Chippewa

Jennifer Klostriech, Richland Soil Conservation District

Donny Latiolias, Capital Resource Conservation & Development Area Council

Sam Marshall, Tennessee Department of Agriculture

Amanda Pitzer, Friends of the Cheat

Steve Saari, District Department of Energy and Environment

Dana Strouse, Michigan Department of Environmental Quality

Dave Thomas, Broad Top Township

Dr. Robert Traver, Villanova University

Karen Vidrine, Louisiana Department of Environmental Quality

Jennifer Zygmunt, Wyoming Department of Environmental Quality

Tetra Tech provided graphics and layout support for the report.
Innovate!, Inc. provided support for mapping/analysis.

Endnotes

1. USEPA Grants Reporting and Tracking System data reflecting the total sum of projects in all active grants across the country.

2. USEPA, July 2016, data are from Ask WATERS Expert Query: "Assessed 305(b) Water Sources of Impairment." Data were evaluated so that each unique waterbody was counted once. This data set is a subset of the list of impaired waters. Of the total list of impaired waters, 64% of impaired lakes and 66% of impaired streams indicate one or more probable sources for the impairment. The waterbody was considered impaired for NPS if it included one or more of the following probable sources contributing to impairment: agriculture, atmospheric deposition, construction, habitat alteration, hydromodification, land application/waste sites, legacy/historical pollution, natural wildlife, recreation and tourism (boating and nonboating and marina), resource extraction, silviculture, spills/dumping, unspecified NPS, urban-related runoff/stormwater.

   Source: https://iaspub.epa.gov/apex/waters/f?p=ASKWATERS:EXPERTreference table.

	Rivers/streams	Lakes/reservoirs/ponds
Total list of impaired waters	614,153	13,009,273
Subset of impaired waters with one or more probable cause identified	404,313.6	8,307,883
Subset of impaired waters with probable cause identified as NPS	339,136	6,741,505

3. An analysis of the conterminous United States conducted in July 2015. A 2-mile buffer defined around each impaired water geometry for state level Zonal Stats for each state feature class based on the dasymetric population raster. The method finds the cells from the dasymetric populations dataset that have their centroids inside the buffer zones, and sums up the values (population counts) for those cells. Data Sources: EnviroAtlas 2010 dasymetric population (30m) https://catalog.data.gov/dataset/enviroatlas-dasymetric-population-for-the-conterminous-united-states and the Listed Impaired Waters NHDPlus Indexed dataset https://www.epa.gov/waterdata/waters-geospatial-data-downloads.

4. USEPA, July 2016, data were downloaded from USEPA ASK Waters Expert Query from query option: "assessed 305(b) waters. These data only represent waterbodies that have been assessed, which includes 31.3% of the nation's rivers and streams and 44.4% of the nation's lakes, reservoirs and ponds.
   Source: https://iaspub.epa.gov/apex/waters/f?p=ASKWATERS:EXPERT.

5. USEPA, https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/319-grant-program-states-and-territories.

6. This estimate is based on reported information for waterbodies that were removed from a state's list of impaired waters due in part to implementation of a §319 project since 2005 and reported to USEPA as a "success story." These projects are highlighted on EPA's Success Stories website at www.epa.gov/nps/success. Data from the stories are tracked in USEPA's Grants Reporting and Tracking System (GRTS) Success Story Database.

7. Lag Time in Water Quality Response to Best Management Practices: A Review. *Journal of Environmental Quality* 39:85-96(2010).

8. USEPA Grants Reporting and Tracking System. Data includes grants and related projects for states and territories. Agriculture category also includes animal feeding operations and silviculture categories. Urban sources also includes construction and turf management categories.

9. USEPA Grants Reporting and Tracking System. Map aggregates dollars for projects reported as having environmental benefits that were attributed to a specific watershed for grants awarded from 2008–2013. Watershed data (HUC 12 scale) was consolidated to a HUC 4 level for national perspective.

   Agriculture 319 dollars: includes dollars that were associated with projects that reported as agriculture, animal feeding or silviculture.

   Urban 319 dollars: include dollars associated with projects that were reported as urban, construction or turf management.

   Hydromodification, and resource extraction were not combined with any other categories as reported in GRTS.

10. Review of tribal competitive projects from 2013 and 2014; 44% and 81% of competitive projects awarded had agriculture and/or silviculture related components, respectively.

11. Agriculture land use map includes NLCD 2011 data layers 81 (pasture/hay) and 82 (cultivated crops) joined with private forest data from USDA's public and private forest ownership data in the conterminous United States as a rough indicator of potential silviculture. Reference: www.mrlc.gov/nlcd11_leg.php; http://www.fs.usda.gov/rds/archive/Product/RDS-2014-0002. The data source for land use maps for Hawaii and Puerto Rico was National Oceanic and Atmospheric Administration's (NOAA's) Land Cover Atlas (data layers 6 [cultivated crops] and 7 [pasture/hay]). Reference: https://coast.noaa.gov/digitalcoast/tools/lca.

12. Data for animal units by county was obtained from USDA's National Agricultural Statistics Service (NASS) Quick Stats. Ag Census is from 2012. Animal populations of beef cows, dairy cows, hogs, turkeys, layer chickens and broiler chickens were summed after converting for Animal Unit conversion factor. Turkey and chicken population were divided by number of flocks per year before applying the Animal Unit conversion factor. Large facilities were not excluded from this analysis. NASS withholds some data for confidential business purposes. Therefore, the number of animals in some counties is under represented. Reference: http://quickstats.nass.usda.gov/.

13. Funds from the §319 program may be used to fund any urban stormwater activities that do not directly implement a final NPDES permit.

14. Developed land use map includes several NLCD 2011 data layers: 21 developed open space (<20% impervious); 22 developed low intensity (21%-49% impervious); 23 developed medium intensity (50%-79%); and 24 developed high intensity (80%-100% impervious). The map also includes urbanized centers from the 2010 US Census. References: www.mrlc.gov/nlcd11_leg.php; www.census.gov/geo/reference/urban-rural.html. The data source for land use maps for Hawaii and Puerto Rico was NOAA's Land Cover Atlas (data layers 5-developed open space(<20% impervious), 4-developed low intensity (21%-49% impervious), 3-developed medium intensity (50%-79%), and 2-developed high intensity (80%-100% impervious). Reference: https://coast.noaa.gov/digitalcoast/tools/lca.

    Areas of the map that are white/blank are included in other NLCD land cover types not included in this map (e.g., 81 pasture/hay and 82 cultivated crops).

15. National Hydrography Dataset (NHD) uses flow volume data and joins it to NHD flow lines. Hydroregions 10, 11, 13, 16, and 18 show only the flow lines in the highest 5%. The remaining hydroregions show flowlines in the highest 10%. Reference: www.horizon-systems.com/NHDPlus/index.php.

16. National Hydrography Dataset (NHD) uses the flow volume data and joins it to NHD flow lines. Zoomed into the Thornapple River (Waterbody ID AUID 040500070206-02). Reference: http://www.horizon-systems.com/NHDPlus/index.php.

17. Data on possible abandoned mines is a subset of the U.S. Geological Survey's Mineral Resources Data System (MRDS). Note: This dataset is quite old. MRDS is a collection of previous reports of mineral occurrence, rearranged as a relational database. Most of those reports came from a variety of types of information and were incorporated into MRDS during the 1980s, lesser numbers before and after that decade. Reference: http://mrdata.usgs.gov/mrds/.

    MRDS site locations came from a time before GIS, so point locations are often approximate. For this analysis, EPA filtered the database selecting those identified as "past producers" in the DEV_STAT field. DEV_STAT is supposed to indicate the operating status of a site as of the date of the source information; however, because the source information is mostly prior to 1990, a lot of sites that MRDS says are producers are probably really past producers now but were not included in this map.

    For additional details provided by USGS to EPA for consideration in this analysis please contact Cynthia Curtis at curtis.cynthia@epa.gov.

18. National Climate Assessment, http://nca2014.globalchange.gov. Used with permission.

Watershed partners restored this section of Pennsylvania's Pierceville Run by grading streambanks, planting a riparian forest buffer and installing fences to prevent cattle access.

Source: Pennsylvania Department of Environmental Protection

Brasstown Creek, North Carolina

Rebuilt channel was designed with a more stable pattern, modeled after a similar, relatively undisturbed stream.

NPS Success Stories

Bens Branch, Maryland

Riparian area is recovering after installation of livestock exclusion fencing.

North Fork of the South Branch of the Potomac River, West Virginia

Installation of a new animal feedlot that is covered and has a concrete pad and adequate buffer prevents runoff of contaminants into the nearby stream.

Kearsarge Creek, Michigan

Removal of upstream stamp sand source allows revegetation of streambanks and riparian area.