

FFY2003 Project Summaries



Compilation of Results

Section 319(h) sub-grant projects funded under the FFY2003 grant cycle were successful in achieving the following:

- Planted nearly 31,000 native hardwood trees in riparian areas
- Restored natural function and flow in 15,000 linear feet of stream
- Restored 2,200 linear feet of natural stream channels
- Installed more than 2,000 linear feet of in-stream habitat structures
- Protected 230 acres of riparian lands with conservation easements
- Replaced 463 discharging and failing home sewage treatment systems
- Installed 6 steel slag leach bed Acid Mine Drainage treatment systems
- Installed 6,200 linear feet of Acid Mine Drainage treatment channels
- Reclaimed 58 acres of abandoned mine land
- Drained and reclaimed 7 acidic pit impoundments
- Conducted 33 watershed tours
- Completed chemical sampling on 755 sites
- Reduced Nonpoint Source Pollutant Loadings by:
 - Nitrogen—19,771 pounds/year
 - Phosphorus—7,488 pounds/year
 - Sediment—50 tons/year
 - Untreated Home Sewage—164,150 gallons/day



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-04
Project Completion December 31, 2006—GRANT CLOSED

SubGrantee Darke County General Health District
300 Garst Avenue
Greenville, OH 45331

Project Contact: Roberta Broerman, RS, MPH
Darke County General Health District
300 Garst Avenue
Greenville, OH 45732

Grant Amount: \$775,478
Local Match: \$516,986

Project Title: Reduction of NPS from Onsite Sewage Systems

Project Location: Darke County
Watershed: Stillwater River

Project Summary: \$775,478 in federal section 319(h) Clean Water Act grant funding was awarded to Darke County General Health District to inventory and replace failing home sewage treatment systems within the Stillwater River watershed in Darke County. An estimated 11,000 housing units within the watershed treat their home sewage with HSTS units or small package plants. 53% of these homes were constructed prior to 1949 and many of the HSTS units are failing. This project will establish a computerized inventory to identify and track 7,000 of the 10,000 HSTS units within the watershed. Additionally, they will increase inspections of HSTS units to more than 300 per year and use cost share funds to replace 72 failing systems.

The Stillwater River is a high quality waterway with extensive Exceptional Warmwater Habitat segments. A portion of the Stillwater and Greenville Creek—a major tributary, have been designated state scenic and recreation rivers under provisions of Ohio's scenic rivers law (ORC 1517).

Project Deliverables: Successful completion of this project will result in the following:

- Development of a computerized database of 10,000 home sewage treatment systems throughout the watershed.
- Repair or replacement of 72 failing home sewage treatment systems using federal cost-share funding
- Cost-share replacement of HSTS riser installation on 125 units.
- Extensive project specific public education and outreach activities.

Environmental Results: This project will reduce nutrient and bacteria loadings into the Stillwater River and tributary streams within the project area by eliminating the discharge of untreated home sewage from 72 failing systems.

Project Results to Date: The following activities were completed during the reporting period:

- Inspected 315 HSTS units using voluntary local inspection program
- Cost-shared the installation of 128 HSTS risers.
- Replaced 252 failing HSTS units using 319 cost-share funds.
- Replaced 169 failing HSTS units without using section 319 cost-share funds. Units were repaired and/or replaced following inspection by the Darke County General Health District by the respective landowners.
- Developed and distributed 12,000 refrigerator magnets and 7,000 brochures to landowner within the project area.

NPS Load Reductions Resulting from Project

Pollutant	Total Load Reductions
Nitrogen	17,748 pounds/year
Phosphorus	6,722 pounds/year
Sediment	0 tons/year
Untreated Home Sewage	147,350 gallons/day



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-05
Project Completion GRANT CLOSED 11/15/07

SubGrantee Cuyahoga County Board of Health
5550 Venture Drive
Parma, OH 44130

Project Contact: Harry Stark
Cuyahoga County Board of Health
5550 Venture Drive
Parma, OH 44130

Federal Amount Spent: \$622,208
Local Match: \$522,178

Project Title: Rocky River Watershed Implementation Project

Project Location: Cuyahoga County
Watershed: Rocky River

Project Summary: \$624,085 in federal section 319(h) Clean Water Act grant funding was awarded to the Cuyahoga County Board of Health to address failing Home Sewage Treatment Systems (HSTS) and to acquire conservation easements within the Rocky River watershed in northeastern Ohio. It is estimated that there are more than 17,000 HSTS units within the watershed in portions of Cuyahoga, Lorain and Medina counties. A large percentage of these units are old and failing—approximately 75% of these units have off-lot discharges. This project is being implemented consisted with the TMDL study for Rocky River that has been previously approved.

Project Deliverables: Successful completion of this project will result in the following:

- Chemical and biological water quality monitoring and assessment at 36 sites within the project areas.
- Replacement of 41 failing HSTS discharging systems
- Acquisition of 6,000 linear feet of conservation easements
- Conducting 3 watershed festivals during the life of the grant
- Extensive project specific public education and outreach activities

Environmental Results: This project resulted in the elimination of 16,800 gallons per day of untreated household wastewater being discharged into the watershed. As a result, nitrogen loadings to the Rocky River watershed were reduced by 7,174 pounds per year and phosphorus by 766 pounds/year. Additionally, sediment loadings and

impairments caused by riparian encroachment were reduced as a result of acquiring conservation easements on 230 acres of riparian lands throughout the watershed.

Project Results to Date:

- Successfully replaced 42 failing HSTS units with non-discharging units
- Acquired 230 acres of non-wetland conservation easements
- Conducted 18 NPS and monitoring workshops
- Conducted 34 NPS and watershed related workshops for landowners
- Conducted 9 HSTS workshops for area landowners
- Prepared and distributed 5 project related fact sheets
- Coordinated 3 watershed festivals and river day events
- Completed volunteer stream clean-up on Plum Creek tributary
- Completed chemical and biological monitoring at 36 sites within project areas consisting of the collection and analysis of 112 water samples.
- Collected 17 coliform samples at HSTS installation locations

NPS Load Reductions Resulting from Project

Pollutant	Total Load Reductions
Nitrogen	2,023 pounds/year
Phosphorus	766 pounds/year
Sediment	0 tons/year
Untreated Home Sewage	16,800 gallons/day



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-06
Project Completion November 30, 2005—GRANT CLOSED

SubGrantee The Little Beaver Creek Land Foundation
P.O. Box 60
East Liverpool, OH 43920

Project Contact: Joshua Noble
Little Beaver Creek Land Foundation
Metropolitan Sewer District
P.O. Box 60
East Liverpool, OH 43920

Grant Amount: \$100,000
Local Match: \$100,588

Project Title: Protecting Little Beaver Creek-Phase II

Project Location: Columbiana
Watershed: Little Beaver Creek

Project Summary: \$100,000 in federal section 319(h) Clean Water Act grant funding was awarded to the Little Beaver Creek Land Foundation to develop a watershed action plan for the Little Beaver Creek. Little Beaver Creek in northeastern Ohio is a river of great diversity and remains relative untouched by the development pressure common to many Ohio rivers. Portion of the Little Beaver Creek are designed wild & scenic under Ohio's Scenic River Law and also is a nationally designated scenic river. The watershed supports 63 fish species; 49 mammal species; 140 breeding bird species and 46 species of reptiles and amphibians. Ohio's largest population of the state endangered Hellbender resides within the Little Beaver Creek.

Final Project Results: The Little Beaver Creek Watershed Action Plan was submitted and reviewed for endorsement in March 2006. Following revisions, the plan was conditionally endorsed. Following is a listing of grant achievements in addition to the preparation of a watershed plan:

- Completed inventory report of failing home sewage treatment systems within the watershed
- Produced and distributed 2 Little Beaver Creek watershed newsletters
- Produced and published 6 watershed related news articles
- Identified priority areas to target conservation easements
- Conducted 2 VIP canoe floats and 1 volunteer stream clean up

- Completed all water sampling as required by the grant
- Created map of all zoned areas within the watershed
- Mapped all known agricultural NPS problem areas within the watershed
- Conducted HSTS workshop with septic installers and WWTP operators



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-07
Project Completion June 30, 2005—GRANT CLOSED

SubGrantee City of Kent
930 Overholt Road
Kent, OH 44240

Project Contact: Robert Brown
City of Kent
930 Overhold Road
Kent, OH 44240

Grant Amount: \$500,000
Match Amount: \$869,000

Project Title: Cuyahoga River Restoration Project

Project Location: Portage County
Watershed: Cuyahoga River

Project Summary: \$500,000 in federal section 319(h) Clean Water Act grant funding was awarded to the city of Kent for the restoration of 2,000 linear feet of stream habitat following modification of the Kent Dam. The modification of the Kent Dam was completed consistent with specific recommendations within the Middle Cuyahoga TMDL completed and approved in 1999. This project was completed using a combination of section 319(h) grant funding and funds from the Water Resources Restoration Sponsorship Program (WRRSP). See the following for more detailed information about this project.

Project Deliverables: Successful completion of this project will result in the following:

- Successful modification of the Kent Dam, thereby restoring more than 2 miles of the Cuyahoga River to free-flowing conditions.
- Restoration of more than 2,000 linear feet of riparian habitat
- Establishment of 600 linear feet of in-stream habitat and fish passage structures rock weirs
- Production and installation of 11 interpretive signs within the Kent Heritage Park
- Extensive project specific public education and outreach activities, including a comprehensive project web-site.

Environmental Results: Completion of this project resulted in restoration of full attainment of warmwater habitat for this segment of the Cuyahoga River.

Final Project Results:

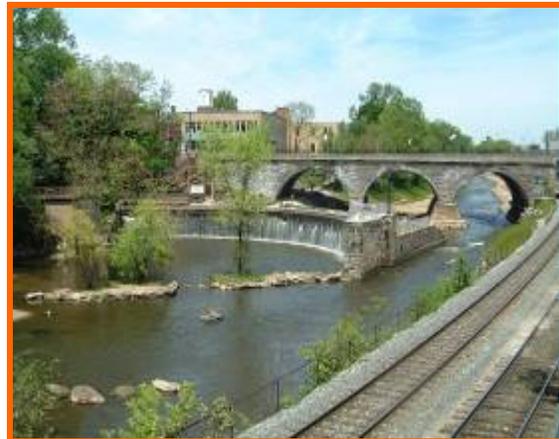
- Successfully modified Kent Dam and restored free-flowing conditions to more than 2 miles of previously impounded stream.
- Restored more than 2,000 linear feet of riparian habitat
- Established 600 linear feet of in-stream habitat and fish passage structures using rock weirs
- Designed and installed 11 interpretive signs within the newly created Kent Heritage Park
- Successfully developed and continue to maintain a Kent Dam Project website that may be found on the city of Kent's home page.

Ohio EPA Kent Dam Pool Bio-Survey Results

Bio-Measure	Pre-Construction	Post-Construction
Index of Biological Integrity (IBI)	28.0	44.0
Modified Index of Well Being (MiWb)	8.2	8.9
Habitat Conditions (QHEI)	51.0	79.5



Kent Dam Pool – **BEFORE** Modification



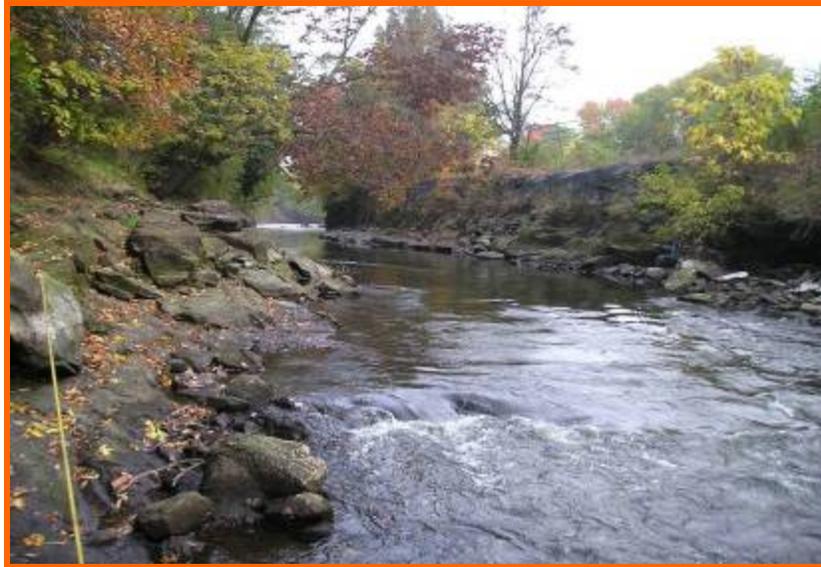
Kent Dam– **AFTER** Restoration

Middle Cuyahoga River Restoration Project Summary

Ohio EPA completed a TMDL study on the Middle Cuyahoga River during 1999, determining that the river was only partially attaining objectives for Warmwater Habitat (WWH) designation. The TMDL identified that regulating only point source discharges within the Middle Cuyahoga would not be sufficient to bring the river into full attainment of WWH designation due to the influence of nonpoint source pollution (NPS). Specific recommendations within the TMDL included modifying or removing dams within the Middle Cuyahoga located in the cities of Kent and Munroe Falls.

Ohio EPA determined that the dam within the city of Kent was contributing to water quality problems in three specific ways:

- Stagnant flows and eutrophication within the dam pool caused dissolved oxygen levels to fall below water quality criteria during periods of low flow.
- The dam pool altered aquatic habitat, impairing both the health and diversity of indigenous fish species.
- The dam was a barrier to fish migration.



Previously impounded areas upstream from Kent Dam

Modifying the Kent Dam was a vital component of the Middle Cuyahoga River Restoration Project. Successfully implementing this project required a complex consideration of science, engineering, cultural & archaeological sensitivity, regulatory finesse and public involvement. The Kent Dam project initially met with fierce public resistance due to its historic nature and location within a designated historic district. The dam itself was also listed on the National Register of Historic Places since it was one of the first recorded arched dams constructed in the United States. After forming an independent committee comprised of the general public and various local, state and federal representatives, it was determined that the dam could be successfully modified and still retain its historic character. Final plans included the removal of an old canal lock east of the dam to provide for a free flowing river channel while at the same time preserving and restoring the arched dam structure for future generations. The former dam pool area was converted into a Heritage Park with extensive interpretative signage chronicling the history of the area as well as the environmental benefits of the Middle Cuyahoga River Restoration Project.

The city of Kent, working in partnership with the cities of Ravenna and Massillon, Summit County and agencies such as USEPA, Ohio EPA, and ODNR, was able to secure nearly \$3 million to fund the project. Funding was provided through the Section 319 Implementation grant program and the Water Resources Restoration Sponsorship Program (WRRSP) by Ohio EPA, as well as funding from The Clean Ohio Fund and ODNR.

This project consisted of a variety of important management actions, including extensive natural stream channel and stream bank restoration above the dam. Preliminary biological and water quality improvements resulting from this project are impressive. Prior to the project, the preponderance of pollution tolerant fish species within the Middle Cuyahoga resulted in very poor scores using the Index of Biological Integrity¹ (IBI), indicating that fish life within the river was failing to meet WWH standards. Physical habitat conditions within and along the river were measured using the Qualitative Habit Evaluation Index² (QHEI) and also failed to meet WWH standards.



Following completion of the Middle Cuyahoga Restoration Project, IBI scores within the Kent Dam area increased 57%, QHEI scores increased 56% and the Cuyahoga River is now performing in FULL attainment with its Warmwater Habitat aquatic life-use designation. Combined with additional projects such as modification of the dam downstream at the city of Munroe Falls, water quality improvements to this important river will continue to be realized as nonpoint source causes of impairment within the watershed are addressed with projects using Section 319 grant funding, WRRSP funds and funding from other important Ohio water quality partners, such as ODNR and others.

Benefits resulting from the Middle Cuyahoga River Restoration Project are extensive, including far more than the biological improvements and water quality that we

¹ The Index of Biological Integrity (IBI) is an objective measurement of fish community health used by Ohio EPA in determining Ohio's water quality standards.

² Qualitative Habitat Evaluation Index (QHEI) is an objective measurement of physical habitat conditions within and near the stream channel.

are already measuring. They include very important social and cultural benefits as well, such as the preservation of an important link to Ohio's history, as well as the development of the city of Kent's Heritage Park in the former dam pool. Benefits also include considerable economic benefits. The city of Kent realized a potential savings of several million dollars in wastewater treatment upgrades that would have otherwise been required to address impairments caused by the dam. The project is also an excellent example of the importance of effective collaboration between local, state and federal water quality partners. Ohio EPA will continue to monitor the improvements to the Middle Cuyahoga River resulting from this important project.



The return of pollution intolerant fish species such as this Northern Pike and Smallmouth Bass collected within the Kent Dam project area are indicative of water quality improvements resulting from this project.



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-08
Project Completion July 31, 2007—GRANT CLOSED

SubGrantee Crossroads RC&D
277 Canal Avenue, SW
New Philadelphia, OH 44663

Project Contact: Sandra Chenal
Crossroads RC&D
277 Canal Avenue, SW
New Philadelphia, OH 44663

Grant Amount: \$1,000,000
Match Amount: \$ 728,979

Project Title: Huff Run Restoration Project

Project Location: Tuscarawas County
Watershed: Huff Run

Project Summary: \$1,000,000 in federal section 319 grant funding is awarded to the Crossroads Resource Conservation and Development Council to complete reclamation and acid mine drainage abatement projects on four sites within the Huff Run watershed. Huff Run is a watershed that has been seriously impacted by the effects of surface and underground coal mining and associated acid mine drainage from abandoned and unreclaimed mine lands. Projects selected for funding under this grant included the Lindentree, Harsha North and Lyons reclamation sites. A detailed summary of the three project sites is provided on following pages.

Project Deliverables: Successful completion of this project will result in the following:

- Complete the design, construction and reclamation of the 21 acre Harsha North abandoned mine land project site.
- Complete the design, construction and reclamation of the Lindentree abandoned mine land project site
- Complete the design, construction and reclamation of the Lyons abandoned mine land project site.
- Conduct extensive project specific public education and outreach activities.

Environmental Results: These three projects resulted in the reclamation of 41 acres of previously unreclaimed mine land, removal of 4 acidic impoundments and neutralization of a 15-acre coal gob pile. Ongoing water quality monitoring is

demonstrating that pH and net acidity have improved downstream from the project site for a length of 1.5 miles. Post-construction data shows pH in the range of 6.1 to 6.7 at the discharge from the site and downstream. Pre-construction pH levels were in the 3.0 range.

Final Project Results:

- Successfully reclaimed the Lindentree project site resulting in the following:
 - Reclamation of 16 acres of abandoned mine lands
 - Removal and reclamation of 4 acidic impoundments
 - Installation of 700 linear feet of open limestone channels
- Successfully reclaimed the Lyons site resulting in:
 - Reclaiming a 15-acre coal gob pile
 - Installing 3,000 linear feet of limestone channel
 - Installing 1,500 linear feet of steel slag leaching channel
 - Reclaiming and regrading 5 acres of abandoned mine land
 - Planted 30,750 tree seedling on the Lyons site
 - Planted 5 acres of native forbs and warm season grasses
- Successfully reclaimed the Harsha North Site resulting in:
 - Reclamation of 22 acres of abandoned mine lands
 - Installing 3,000 linear feet of open limestone channels

Huff Run Restoration Project Summary

The Huff Run Watershed encompasses approximately 14.7 square miles in the northeast hills region of Ohio in Carroll and Tuscarawas counties. Huff Run originates in northwest Carroll County and flows southwesterly into Tuscarawas County to its confluence with Conotton Creek, which then flows to the Tuscarawas River. The stream is approximately 10 miles long and is generally plagued by poor water quality.

An Acid Mine Drainage Abatement and Treatment Plan (AMDAT) was completed in 2000 for the Huff Run Watershed through the Ohio Department of Natural Resources, Division of Mineral Resources Management. The AMDAT study consisted of an intensive investigation of the watershed, identifying the sources and causes of the impairments in many areas of the watershed. One such problem area was the Lindentree abandoned mine line site. As a result of previous coal mining in the area, four highly acidic water impoundments were identified to be contributing nearly 21 pounds of acid and 1.23 pounds of iron and aluminum per day into the waters of Huff Run.



These impoundments were filled with highly acidic water resulting from previous coal-mining that occurred within the Huff Run watershed. Loadings of acid and metals such as iron and aluminum were dramatically reduced as a result of completion of this project.

Lindentree Project Site

The Lindentree project is the first of these four projects to be successfully completed.

Reclamation at the Lindentree site was completed during winter 2004 and required multiple practices. Following is a summary of practices completed at the Lindentree site:

- 16 acres of abandoned mine lands were successfully reclaimed
- 4 acidic impoundments were removed and reclaimed.
- 700 linear feet of open limestone channels were installed.



Acid water impoundments were treated, pumped and backfilled to eliminate AMD discharges into Huff Run and reduce metals and acid loadings into the stream.

Water quality improvements identified through on-going monitoring of discharges into Huff Run are impressive and encouraging. Effluent in August 2005 showed a pH of 6.8 (improved from 4.5); acid loadings of have been reduced from 21 lbs/day to 0.4 lbs/day; and alkalinity has been boosted from 0 lbs/day to 82 lbs/day.



Lyons Reclamation Site

The Lyons Reclamation Site was completed in December, 2005, funded in part by \$340,000 in 319 grant funds. This project successfully accomplished the following:

- Reclaimed 20 acres of abandoned mine lands
- 3 acidic impoundments were removed and reclaimed
- 2,500 linear feet of open limestone channels were installed

Working in partnership with Ohio EPA, the ODNR, U.S. Office of Surface Mining, Pheasants Forever and the National Fish and Wildlife Foundation, the project also planted more than 30,000 tree seedlings on the project site and 5 acres of forbs and prairie grasses.



Multiple issues were required to be addressed at the Lyons site including large open highwalls, acidic pit impoundments, unvegetated coal refuse and gob piles generating large volumes of acid mine drainage. The Lyons site was determined to be one of the largest acid producing contributors to the lower reaches of Huff Run watershed.



Water quality improvements that have been measured through ongoing water quality monitoring indicate that acidic loadings have been reduced from 201 lbs/day to 78 lbs/day.

Harsha North Reclamation Site

The Harsha Road site is the third and final site that was successfully reclaimed as a result of this section 319 sub-grant to Crossroads RC&D. Harsha North has been identified as the second highest contributor of Acid Mine Drainage (AMD) within the Huff Run Watershed. Drainage from the site is also very high in iron and aluminum as a result of flowing through toxic coal refuse piles and from highwalls left from pre-law surface mining, as well as areas affected by deep mine entries and drainage. The Harsha North site is located in the middle segments of Huff Run.

Successful reclamation of the Harsha North site resulted in the following:

- 22 acres of abandoned mine lands have been successfully reclaimed
- 3,000 linear feet of open limestone channels were installed.

Measurable water quality improvements resulting from this project demonstrate that pH of water leaving the site has been improved from 3.0 to 6.9; metals loadings are reduced from 43.6 lbs/day for iron to 4.4 lbs/day and acid loadings have been reduced from more than 540 lbs/day prior to completion to 7.7lbs/day following project completion.



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-09
Project Completion February 2008—Grant Closed

SubGrantee Vinton County SWCD
31935 State Route 93
McArthur, OH 45171

Project Contact: Brent Laverty
Vinton County SWCD
31935 State Route 93
McArthur, OH 45171

Grant Amount: \$764,521
Match Amount: \$484,675

Project Title: Raccoon Creek Headwaters Restoration Project

Project Location: Vinton County
Watershed: Raccoon Creek

Project Summary: \$764,521 in federal section 319(h) funding was awarded to the Vinton County Soil & Water Conservation District to complete reclamation and acid mine drainage abatement within the headwaters of Raccoon Creek. Specific acid mine drainage abatement activities will be focused in 8 headwater tributaries of East Branch and 3 tributaries of the Brushy Creek subwatershed. In addition, 10 acres of mine spoil in the East Branch will be successfully reclaimed and neutralized. All activities associated with this project are being implemented consistent with recommendation in the December 2002 Raccoon Creek Acid Mine Drainage Abatement & Treatment Plan.

Environmental Results: Completion of this project will successfully eliminate 98% of the acid mine discharge into the Brushy Creek subwatershed and 95% of acid discharge within the East Branch subwatershed.

Final Project Results:

- Installed 6 steel slag leach bed AMD treatment systems
- Reclaimed 10 acres of previous abandoned mine lands
- Completed and submitted Quality Assurance Project Plan

- Collected and analyzed 797 water quality samples in Raccoon Creek headwaters, Brushy Creek, East Branch, Hewett Fork, Middleton Run and Little Raccoon Creek
- Completed and distributed 6 editions of watershed Newsletter
- Completed engineering designs for East Branch-Phase 2
- Completed 31 public presentations
- Conducted 12 watershed tours
- Hosted 13 watershed canoe tours
- Completed 7 stream clean-ups

NPS Load Reductions Resulting from Project

Pollutant	Total Load Reductions
Acid	161 Tons/year



Raccoon Creek has long been seriously impaired by the impacts of acid mine drainage. Reclamation projects throughout the watershed are making significant improvements to aquatic conditions—evidenced by this spotted bas captured last spring while the Raccoon Creek project partners were performing water quality monitoring in association with this 319(h) sub-grant project.



FFY03 Section 319(h) Nonpoint Source Project Summary

Project Number #03(h) EPA-10
Project Completion December 31, 2005—GRANT CLOSED

SubGrantee Friends of Big Walnut Creek
4991 Johnstown Road
New Albany, OH 43054

Project Contact: Robert Bostard
Friends of Big Walnut Creek
4991 Johnstown Road
New Albany, OH 43054

Grant Amount: \$100,000
Match Amount: \$67,200

Project Title: Big Walnut Creek Watershed Action Plan

Project Location: Franklin County
Watershed: Big Walnut Creek

Project Summary: \$100,000 in federal section 319 funding was awarded to the Friends of Big Walnut Creek to develop a watershed action plan for Big Walnut Creek in central Ohio. Friends of Big Walnut Creek were organized in August 2001 as a grassroots effort to protect, preserve and restore Big Walnut Creek in central Ohio. This project resulted in the development of a watershed action plan to supplement the approved Big Walnut Creek TMDL. The project also conducted extensive public education and outreach activities within the watershed.

Final Project Results: The Big Walnut Creek watershed action plan was completed and submitted for endorsement in 2006. Following review and revision the plan was fully endorsed by Ohio EPA and ODNR. The project also resulted in extensive public education and outreach efforts including the following:

- Prepared and maintained a watershed website
- Conducted 1 Three Creeks River Festival
- Conducted 1 stream clean up