Bobs Creek Stream Guardians



Coldwater Conservation Plan For Rhodes, Ciana, and Ickes Run

Bobs Creek Watershed

Prepared by Bobs Creek Stream Guardian Volunteers
July 2005

Coldwater Heritage Partnership

The Coldwater Heritage Partnership (CHP) exists to provide leadership, coordination, technical assistance, and funding support for the evaluation, conservation, conservation and protection of Pennsylvania's coldwater streams. The CHP is composed of Pennsylvania Trout (PATU), the PA Department of Conservation and Natural Resources DCNR), and the PA Fish and Boat Commission (PFBC). The CHP grant program is administered by PATU under contract with DCNR and receives funding assistance from DCNR, PFBC, and the Western PA Watershed Program (WPWP).

Coldwater Conservation Grants

The Coldwater Heritage Partnership administers a grant program to develop Coldwater Conservation Plans to conserve and protect our coldwater streams. These plans are useful in building awareness and support for the long-term stewardship of coldwater streams and their surrounding watersheds. The plans are meant to identify potential problems and opportunities for stream conservation and may lead to more detailed watershed studies or projects to improve watershed health.

Bobs Creek Stream Guardian Board of Directors

Tim Clingerman
Chairman
1561 Tulls Hill Road
Bedford, PA 15522
(814) 733-2394

Jim Clingerman
Board Member
RR 2 Box 107D
Hollidaysburg, PA 16648
(814) 696-1318

George Corle
Board Member
1850 Burnt House Road
Imler, PA 16655
(814) 276-9345

Chris Ickes
Board Member
474 Burnt House Road
Imler, PA 16655
(814) 276-3563

Jason Pittman
Treasurer
3812 Pitt Street
Schellsburg, PA 15559
(814) 733-2578

Volunteers Who Gathered Data for This Report

Marla Berkey
109 Park Rd
Imler, PA 16655
(814) 276-3720

Stan Burkett
389 Burnt House Rd
Imler, PA 16655
(814) 276-3190

Tiffany Clingerman
1561 Tulls Hill Rd
Bedford, PA 15522-
(814) 733-2394

Shane Corle
1850 Burnt House Rd
Imler, PA 16655
(814) 276-9345

Taylor Corle
1850 Burnt House Rd
Imler, PA 16655
(814) 276-9345

James Davis
109 Park Rd
Imler, PA 16655
(814) 276-3720

Ned Ellenberger
188 N Imler Valley Rd
Imler, PA 16655
(814) 276-3812

Ken & Dorothy Ickes
998 Newry Lane
Duncansville, PA 16635
(814) 695-8650

Ryan Ickes
173 N Scrubgrass Road
Claysburg, PA 16625-
(814) 239-5367

Corey McKee
RD 2 Box 1060
Claysburg, PA 16625
(814) 239-2118

Mark Rhodes
6816 Bedford Valley Rd
Bedford PA 15522
(814) 356-3530

Laverne Shane
348 Burnt House Rd
Imler, PA 16655
(814) 276-0025

Doug Stiffler
8032 King Saint Clair Rd
Osterburg PA 16667-
(814) 276-3016

Guy Stottlemyer
125 Spring Street
Bedford, PA 15522
(814) 623-8099

John Strayer
1428 N Imler Valley R
Imler, PA 16655
(814) 239-8456

Tony Willoughby
4299 Lincoln Hwy, Apt 1
Schellsburg, PA 15559
(717) 856-6329

Tom E. Wolfe
RD #2 Box 352-C
Portage, PA 15946
(814) 695-5953

Bob Webb
158 Sandstone Lane
New Paris, PA 15554
(814) 839-4538

Partners for this Conservation Plan

Mike Makufka
Juniata Clean Water Partnership
1701 Penn Street
Huntingdon, PA 16652
(814) 506-1190

Rob Criswell
PA Game Commission
PO Box 537
Huntingdon PA 16652
(814) 643-1831

Mark Dubin
PA - DEP
909 Elmerton Avenue
Harrisburg, PA 17110
(717) 705-6641

Jim Eckenrode
Blair County Conservation District
1407 Blair Street
Hollidaysburg, PA 16648
(814) 696-0877

Colleen Haney
ALLARM Dickinson College
PO Box 1773
Carlisle, PA 17013
(717) 245-1565

Lauren Imgrund
ALLARM Dickinson College
PO Box 1773
Carlisle, PA 17013
(717) 245-1565

Larry Jackson
PA Fish & Boat Commission
844 Big Spring Road
Newville, PA 17241-9473
(717) 776-3170

Ted Kane
PA Fish & Boat Commission
PO Box 465
Osterburg, PA 16667
(814) 239-2244

Dave Koppenhaver
PA Game Commission
PO Box 537
Huntingdon, PA 16652
(814) 643-1831

Paula Ledney
Bedford County Conservation District
702 West Pitt Street, Fairlawn Court Suite 3
Bedford, PA 15522
(814) 623-7900

Kristen Travers
Stroud Water Research Center
970 Spencer Road
Avondale, PA 19311
(610) 268-2153

Deb Nardone
Coldwater Heritage Partnership
450 Robinson Lane
Bellefonte, PA 16873
(814) 359-5233

Stephanie Odenwald
Juniata Clean Water Partnership
1701 Penn Street
Huntingdon, PA 16652
(814) 506-1190

Bob Schott
DEP, Water Management
909 Elmerton Avenue
Harrisburg, PA 17110
(717) 705-4764

Julie Vastine
ALLARM Dickinson College
PO Box 1773
Carlisle, PA 17013
(717) 245-1565

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Bobs Creek Stream Guardians

The Bobs Creek Stream Guardians have made it their mission to protect and rehabilitate the Bobs Creek watershed on both private and public lands so that future generations can enjoy a clean, high-quality watershed for many years to come. Several goals were identified to attain this vision: cleaning up litter and illegal dumps from the waterways and roads; identifying and resolving sedimentation issues from land use by the farmers, businesses, and residents in the region; and monitoring the water chemistry to identify quality problems. The Stream Guardians envision themselves as a catalyst to secure funding for improvements on both public and private lands and attain this by the development of communication links with township, county, state, and federal representatives. The importance of educating the public to resolve septic, solid waste, and nutrient issues as well as the blight of junk vehicles is a continuing focus.

Partnerships have developed with agencies and municipalities including Bedford County Conservation District, Bedford Chapter PA CleanWays, Blue Knob State Park, Western Pennsylvania Conservancy, PA Fish and Boat Commission, PA Game Commission, Department of Environmental Protection, U S Geological Survey, Townships, Stroud Water Research Center, PA Trout Unlimited, Susquehanna River Basin Commission, and local landowners in order to further the quality of Bobs Creek Watershed. The Bobs Creek Stream Guardians are currently implementing work plans for a Bobs Creek Watershed Education and Monitoring Project funded through a Growing Greener Grant. A study design encompassing a three-year plan for monitoring in the watershed was produced in June 2003 with the assistance of the Consortium for Scientific Assistance to Watersheds.

Ickes run flows through State Game Land #26.

Purpose of Study

The purpose of this study is so the Stream Guardians may:

- Perform habitat, chemical, and macro invertebrate assessments on Rhodes, Ciana and Ickes Runs that are major tributaries of the Bobs Creek Watershed.

- Help provide supporting data to the Pennsylvania Fish and Boat Commission's "wild trout" designation within Management Unit 2 a Class A Wild Trout section of the Bobs Creek Watershed.

- Educate at least five volunteer community leaders in watershed assessment methods of professional standards; other tributaries will then be studied in the future.

- Seek a better understanding of our watershed, foster greater awareness of watershed issues within our community, and build a foundation for future projects.

Rhodes Run Site RR1 is currently being chemically tested each month.

The Watershed

Physical Description of Bobs Creek

Bobs Creek and its watershed are located predominately in Northwestern Bedford County with sections in Blair and Cambria Counties. The watershed is approximately sixty-five (65) square miles and contains 20 miles of mainstream. Long, narrow ridges and valleys oriented northeast to southwest characterize the topography. Over 45% of the watershed is forested with most of the forested area under the Bureau of State Parks and PA Game Commission. The remainder of the watershed is agricultural and includes the small communities of Blue Knob, Pavia, Weyant, and Osterburg. Appendix A includes several maps showing the location of the study streams in the watershed and state game lands and park lands.

The headwaters of Bobs Creek lie in Portage Township, Cambria County and flow in a mostly southerly direction through corners of Juniata and Greenfield Townships in Blair County. Bobs Creek enters State Game Lands 26 north of the Blair-Bedford County Line and most of the next five miles on the game lands are newly designated (in 2002) Class A Wild Trout Waters. Within SGL 26, Ickes Run (listed as an unnamed tributary to Bobs Creek by the state) enters from the west, flowing off the slopes of the Allegheny Front. Leaving SGL 26, Bobs Creek flows for about ¾ mile through private land and here Rhodes Run adds its flow to the main stem from the east. Ciana Run is the only named tributary to Rhodes Run, entering from the north approximately 0.5 miles upstream of the Rhodes Run junction with Bobs Creek. The creek again enters state park lands of Blue Knob State Park for about three miles including the Griffith property that was recently purchased by the park. Within this stretch, Wallack's Branch, a wild trout stream, adds its flow. Below this confluence, Bobs Creek again enters Blue Knob State Park for a short stretch to the town of Pavia. Below Pavia, Bobs Creek flows through private land, primarily agricultural, with residential concentrations at Weyant and Osterburg to its confluence with Dunning Creek in Reynoldsdale. Northwest of Osterburg, Scrubgrass Run enters from the north and Osterburg Run enters just south of that town.

In 1998, the Western Pennsylvania Conservancy (WPC) prepared the Bedford County Natural Heritage Inventory for the Bedford County Planning Commission (BCPC). Several types of Natural Heritage Areas are cited in the inventory. Biological Diversity Areas (BDA) are those that have one or more occurrences of plants, animals, or natural communities recognized as a state or federal species of concern and/or have high quality examples of natural communities supporting exceptional native diversity. These areas are ranked in the categories Exceptional, High, Notable, or County according to their significance regarding biological diversity and ecological integrity. The Upper Bobs Creek Watershed Biological Diversity Area is cited as an area of county significance due to the large contiguously forested watershed, the high quality streams, and associated springs and seeps. The Herman Point Slope BDA on the eastern slope of Rhodes Run

near Forest Road (SR 4035) is of notable significance with a population of a plant of special concern ranked S2 (SP002).

Land Use and Recreation

Throughout the Bobs Creek watershed most areas remain undeveloped; about sixty-two percent of the land surface is forested. Agricultural use, primarily in the valleys along the lower sections of Bobs Creek and tributaries such as Scrubgrass and Muddy Runs, accounts for approximately twenty-six percent of the watershed area. Low-density residential use also occurs in these lower valleys. Concentrated residential use is located in the villages of Pavia, Weyant, Osterburg, and at Reynoldsdale, where Bobs Creek joins Dunning Creek. Land use maps can be found in Appendix A.

The Bobs Creek watershed encompasses 8 townships; with East St. Clair, King, Kimmel, Lincoln, and Pavia townships within Bedford County. Portage Township in Cambria County and Juniata and Greenfield Townships in Blair County contain headwater areas of Bobs Creek and Rhodes Run. Rhodes, Ickes, and Ciana Runs are located in Pavia Township with forest the dominant land type; although the headwaters of Rhodes Run begins in an agricultural zone.

The Bobs Creek watershed offers premier opportunities for diverse outdoor activities. The trout fishery provides anglers a productive resource in a lush, natural setting. The Pennsylvania Fish and Boat Commission and the Pavia Sportsmen Association Cooperative Nursery program take part in annual trout stocking of sections of the stream as well as the abundant native trout that inhabit the waters. Hunting is another popular outdoor pursuit in the Bobs Creek watershed, especially on the large areas of publicly owned and managed lands. Nature activities, such as bird and wildflower observation, hiking and biking, are also among the most popular activity. The extensive trail system in Blue Knob State Park and adjacent lands in a legacy of trails established by the Civilian Conservation Corps during the 1930's. The future state park was at that time one of five demonstration parks established in Pennsylvania by the National Park Service. After World War II, many of the trails were abandoned while others became roads. In 1976, Youth Conservation Corps crews blazed the Lost Turkey Trail using some of the old system. This popular trail transects the study area, with an eastern terminus near a radio tower atop Herman Point within Blue Knob State Park, approximately 0.75 mile northwest of Blue Knob Mountain peak. The trail descends Conrad Ridge, crossing Rhodes Run at the Lost Cox Children Monument (see Appendix H for the story of the Lost Children), and then follows Ciana Run north, in part following an old railroad grade of the Babcock Lumber Company. Climbing along the headwaters of Ciana onto the face of Stein Mountain, the trail turns west across a high gap north of Hogback Ridge and descends to cross Bobs Creek near the junction of Ickes Run. The trail loops around Ickes Run then climbs Forks Ridge, following this south out of the project area. The western trailhead is at the Babcock Picnic Area along SR 56 in Gallitzin State Forest in Somerset County, 26.28 miles from the eastern end.

Skiing at nearby Blue Knob Resort on the northeastern face of the mountain is seasonably popular for downhill and cross-country skiing. Mountain biking in the area attracts greater numbers every year.

Soils and Geology

Bedford County is primarily in the Valley and Ridge Physiographic Province with a smaller area along the western border and in the far northwestern corner being part of the Appalachian Plateau Physiographic Province. It is in the northwestern corner of the county where Bobs Creek is found. From the village of Pavia downstream, Bobs Creek flows through a moderately broad valley but the headwaters flow through a jumble of narrow valleys and steep ridges lying between the escarpment of the Allegheny Front (forming the boundary between the two provinces) to the west and the mass of Blue Knob Mountain (3136 feet) to the east.

Soils in the headwater areas of Bobs Creek have weathered from the sandstone, siltstone, conglomerate, and shale rocks that were formed during the Mississippian and Devonian ages. The lower portions of all three study streams have banks made up of Basher-Birdsboro complex soils with an additional site of Albrights silt loam on lower Ickes Run adjacent to Bobs Creek. These are deep loam soils on level to gently sloped land. The Basher soils are moderately well drained with moderate to moderately rapid permeability. Available water capacity is moderate, surface runoff is slow, and the erosion hazard is slight. Birdsboro soils are well drained with moderate permeability. Available water capacity is moderate, surface runoff is medium, and the erosion hazard is moderate. The Albright silt loam soils can be well drained or somewhat poorly drained. Permeability is moderate to moderately slow, water capacity is low, surface runoff is medium, and the erosion hazard is low. Albright and Basher soils are moderately to extremely acid in the upper stratum and slightly to strongly acid in substratum. Birdsboro soils are strongly to extremely acid throughout.

Most of Ickes Run flows through very stony Meckesville gravelly loam soils with slopes of 25 to 35%. These soils are very deep and well drained. Permeability is moderate in the upper layers above the fragipan (25 to 40 inches deep) and moderately slow within it. Available water capacity is moderate, surface runoff is rapid, and the erosion hazard is severe. These soils are extremely to strongly acidic. The slopes drained by Ickes Run are steep to very steep (15 to 45% slopes) composed of soils of the Hazelton-Clymer association, Laidig cobbly loams, and Klinesville-Calvin channery loams. The Klinesville and Calvin soils are shallow while the others are moderately to very deep. All have moderately rapid permeability, low available water capacity, rapid runoff, severe erosion hazards, and are moderately to very strongly acidic.

Ciana Run has Meckesville gravelly loam and Klinesville-Calvin channery loams along the stream banks. The slopes above Ciana Run include Klinesville channery loams, Meckesville gravelly loams, Leck Kill-Calvin complex soils, and Klinesville-Rock outcrop complex. These areas exhibit characteristics similar to the stream bank areas, or to soils described in the Ickes Run drainage but include more rocky areas and some extreme slopes.

Rhodes Run stream banks are composed of Meckesville gravelly loams with some Klinesville-Rock outcrop complex areas. The ridge slope soils are similar to those found elsewhere in the watershed with Meckesville, Klinesville-Calvin, and Leck Kill-Calvin predominant. The headwaters of Rhodes Run are in Blair County, just west of SR 4035 (Forest Road) and the junction with Monument Road (TR 652). Several springs emerge in a gently sloped upland area of Leck Kill channery loams. These soils and the 3 to 8 % slopes make this area suitable for agriculture, unlike the remainder of the study area described above, and a dairy operation is found in this area.

The shale and sandstone geology, and associated soils, of the watershed predict that buffering capacity, measured through alkalinity, would be low for the streams flowing off these lands and that acidic precipitation would have a potential for greater effect on terrestrial and aquatic communities. However, measured stream pH and alkalinities, especially during low water (base flow) periods are not as low as the Stream Guardians would expect. This poses the question of possible bedrock influences that are sustaining higher pHs at base flow and further investigation to answer this is anticipated. A generalized map of soil classification can be found in Appendix A.

Climate

Temperatures in the study area are a few degrees cooler than the averages for Bedford County due to the altitude. Blue Knob Mountain to the east of the study area receives an average of 160 inches of snow annually and even in the lower valleys along Ickes and Ciana Runs snow can cover the ground continuously from November through late April. Monument Road is frequently impassable due to snow`1 for days or weeks in some winters. Thunderstorms and occasional heavy rains can cause flash floods and damaging stream flows in the narrow valleys.

Property Owners

Ickes Run
- PA Game Commission

Ciana Run
- Altoona Water Authority
- Cox Monument Association
- PA Game Commission

Rhodes Run
- PA Game Commission
- Cox Monument Association
- Altoona Water Authority
- DCNR – Blue Knob State Park
- Elwayne Stombaugh
- Francis Ritchey
- Robert Brumbaugh
- Robert Chappell

Bobs Creek Watershed Health

Watershed health is the main reason for the Stream Guardians monitoring the Bobs Creek Watershed. Some of the most pressing issues of water quality that are facing the waters of the Bobs Creek Watershed include sedimentation, nutrients, flow, buffering capacity, shading/temperature, and wild trout populations. Other threats to the watershed include nutrient and sediment loading from agricultural operations, sedimentation caused by dirt and gravel roads, improper timber harvest practices, poorly functioning on-lot sewage systems, illegal dumping, and acid rain.

During planning sessions for the monitoring program study design, the Stream Guardians identified illegal dumping and the impacts of livestock operations on the headwaters of the main stem as priority concerns. Illegal dumping was noted as a concern of highest priority in the Juniata River Watershed Management Plan prepared by the Juniata Clean Water Partnership (JCWP). Currently, a partnership exits within the county, as in other watershed counties, between JCWP and PA Clean Ways of Bedford County, to complete an illegal dump survey for the Juniata River Watershed. A number of dumpsites were identified in the upper reaches of the Bob's Creek watershed, primarily in Pavia, Lincoln, and King Townships. These, as all illegal dumps, pose a threat to ground surface waters through leachate that can contain viral and bacterial pathogens, metals, and toxic organic compounds. Direct contact with discarded trash can pose a health threat to wildlife and livestock through injury, entanglement, or ingestion. Threats to human endeavors also include reduced property values and negative effects on tourism and community pride. The public lands portions of the watershed have benefited from annual litter clean-ups over many years. Blue Knob State Park personnel, the Pavia Sportsmen Association, Fort Bedford Trout Unlimited, church groups, scouting groups, Pennsylvania Conservation Corps, and others have conducted these annual clean-ups. Addressing the litter and dumping problems on private lands has been a more recent evolution. In 2002, the Stream Guardians partnered with PA CleanWays of Bedford County to conduct the first annual stream cleanup along the main stem downstream from Pavia and the public lands. Succeeding cleanups in 2003, 2004 and 2005 have expanded the cleanup area to the mouth of Bobs Creek at Reynoldsdale, included participation of four townships and numerous volunteer groups, and eliminated several streamside 'private dumps'. Susquehanna River Basin Commission stream cleanup grants have allowed the removal of four roadside dumps near tributary headwaters. Stream Guardian cleanup efforts have seen the removal of over 200 tons (forty-five 30 cubic yard roll-off containers) of trash from the watershed. Additionally, townships in the watershed now participate in bulky waste collection days.

The Stream Guardians initial concerns regarding livestock operations impacting the headwaters focused on a farm along SR 164 in Blair County being leased to a bison producer. Animals had uncontrolled access to the stream and would often 'wallow' within the stream. Downstream effects were apparent when the animals were most active. The Stream Guardians were the catalyst that brought together the landowner, the lessee, Western Pennsylvania Conservancy, conservation districts, and the Natural Resource Conservation Service resulting in stream bank fencing and stabilized crossings to reduce the impacts to the stream. This work was completed in 2004.

Many of the other concerns in the watershed, including: erosion and sedimentation due to paved and unpaved road run-off, a perceived decline in water quality, sustaining the fishery, decreased aesthetics, impacts of business and industry, flood plain development, scrap vehicles, a lack of watershed education, and nutrient loading by malfunctioning septic systems, are issues that the Stream Guardians will be addressing with future projects and partnerships.

Visual Stream Assessment

The Stream Guardians held a stream visual assessment training seminar on July 22, 2003 at the Mt. Zion activity building in Pavia PA. Ben Wright, Director of Watershed Field Services at the Western Pennsylvania Conservancy, conducted the training. The protocol for the training came from USDA National Water and Climate Center Technical Note 99-1, Stream Visual Assessment Protocol. This document presents an easy to use assessment tool to evaluate the condition of aquatic ecosystems associated with streams. The protocol does not require expertise in aquatic biology or extensive training.

After the training, the stream guardians organized into six groups and were assigned sections of Rhodes Run, Ickes Run, Ciana Run or Guardians Run to perform stream visual assessments. Each group was given protocol worksheets to perform evaluations. A sample of these worksheets is located in the appendix. The visual stream assessments were conducted between the dates of 8/9/03 and 8/19/03.

The Stream Guardians during visual stream assessment training.

Results of Visual Assessment of Stream Sections

Ickes Run: (entire length)

- 100% Forested-Mature Saw timber
- Active Channel Width-Range 1ft. to 10ft.
- Dominant Substrate-100% Boulder w/ 50% Cobble at confluence of Bobs
- Overall Scores-in 5 reaches-range 5 to 9
- Elements w/ Lowest Scores
    - Fish Barriers-range 5 to 6
    - Instream Fish Cover-range 4 to 5
- Elements w/ Highest Scores
    - Channel Condition-9
    - Riparian Zone-9
    - Bank Stability-9
    - Water Appearance-9
    - Canopy Cover-9

OVERALL RATING—Good 7.8
Special note: Ickes Run is a baseline stream for the Stream Guardians monitoring program.

Rhodes Run: (From Bobs Ck Confluence to Cox Monument Parking Lot)

- 100% Forested-Area has signs of forest regenerated homestead farms.
- Active Channel Width - Range 15ft. to 20ft.
- Dominate Substrate-33% Boulder 33 % Cobble & 33% Gravel
- Overall Scores-in 2 reaches-range 8.1 to 9.6
- Elements w/ Lowest Scores
    - Bank Stability-7
    - Instream Fish Cover-7
- Elements w/ Highest Scores
    - Riparian Zone-9
    - Fish barriers-9
    - Insect/Invertebrate Habitat-9
    - Canopy Cover-9

OVERALL RATING –Good 8.8

Ciana Run: (entire length)

- 100% Forested-Mature Saw timber-Narrow gauge train trails still evident along stream banks from late 1800s logging operations.
- Active Channel Width-5ft. (at source) to 12ft.
- Dominate Substrate-Boulder & Cobble –Source Mud 85% & Boulder 15%
- Overall Scores-in 3 reaches-range 8.1 to 8.9
- Elements w/ Lowest Scores
    - Instream Fish Cover-4 at source
    - Fish Barriers-6 at source
- Elements w/ Highest Scores
    - Riparian Zone-9
    - Bank Stability-9
    - Water Appearance-10

    - Embeddedness-9
    - Insect/invertebrate Habitat-9
    - Canopy Cover-9

OVERALL RATING-Good 8.6
Special Note: Ciana Run is an intermittent stream at source with areas of subterranean flow near source. There are many spring seeps (approximately 7) along middle section.

Rhodes Run: - (Cox Monument bridge to 1st State Game Land parking lot.)

- 100% Forested-Mature Saw timber
- Active Channel Width - 4ft. to 25ft.
- Dominate Substrate-Boulder 30% Cobble 70%
- Overall Scores-in 6 reaches-range 4 to 10
- Elements w/ Lowest Scores
    - Channel Condition-6
    - Instream Fish Cover-4
    - Bank Stability-4
    - Embeddedness-7
- Elements w/ Highest Scores
    - Riparian Zone-10
    - Fish Barriers-9
    - Canopy Cover-10

OVERALL RATING-Good 8.1
Special Note: Cox Monument Road follows stream along these reaches. Dredging was noted above 1st culvert. 1st culvert has erosion due to unstable headwalls. Eroding along steep road banks causing tree uprooting.

Guardians Run: - (entire length)

- 100% Forested- Mature Saw timber w/ Rhododendron & M-Laurel
- Active Channel Width - 8ft to 9ft.
- Dominate Substrate-30% Boulder, 30% Cobble, 35% Gravel, 3% Sand, 2% Silt
- Overall Scores-1 reach-6 to 9
- Elements w/ Lowest Scores
    - Instream Fish Cover-6
    - Canopy Cover-8
- Elements w/ Highest Scores
    - Channel Condition-9
    - Riparian Zone-9
    - Bank Stabiliy-9
    - Water Appearance-9
    - In stream Fish cover-9

OVERALL RATING-Good 8.6
Special note-Guardian is an unmapped tributary that supplies approximately 50% of Rhodes Run flow. Bobs Creek Stream Guardians named this stream.

Rhodes Run: - (above Chappell's Hollow)

- 100% Forested-Mature Saw timber
- Active Channel Width-5ft to 30ft
- Dominate Substrate-3 reaches break out
    1. 10% Boulder 60% Cobble 20% Gravel 10% Sand

2. 40% Boulder 40% Cobble 20% Gravel
3. 80% Boulder 20% Cobble

- Overall Scores-in 3 reaches-range 7.9 to 8.6
- Elements w/ Lowest Scores
    - Canopy Cover-3
    - Bank Stability
    - Nutrient Enrichment-7
- Elements w/Highest Scores
    - Riparian Zone-9
    - Water Appearance-9
    - Fish Barriers-9
    - Insect/invertebrate Habitat-9

OVERALL RATING-Good 8.2
Special note-above Chappell's Hollow stream is braided (3 channels)

Rhodes Run: (area between two state game land parking lots)

- 100% Forested-logging evident in area
- Active Channel Width-Range 7 ft. to 20 ft. (braiding noted in 1 reach)
- Dominate Substrate:
    1. 20% Boulder 60% Cobble 20% Gravel (2 reaches)
    2. 40% Boulder 40% Cobble 20% Gravel (1 reach)
- Overall Scores-in 3 reaches-range 7.8 to 8.7
- Elements w/Lowest Scores:
    - Instream Fish Cover-5
    - Water Appearance-7
- Elements w/Highest Scores:
    - Riparian Zone-9
    - Fish Barriers-9
    - Insect/invertebrate Habitat-9
    - Canopy Cover-9

OVERALL RATING-Good 8.1
Special Note- Below second parking lot is a 40 foot section of bedrock.

Rhodes Run: (upper culvert of residential area)

- 90% Forested & 10% Residential
- Active Channel Width - Range 4ft to 5ft.
- Dominate Substrate (2 reaches):
    1. 75% Boulder 10% Cobble 15% Gravel
    2. 40% Cobble 60% Gravel
- Overall Scores-in 2 reaches-range 3 to 10
- Elements w/ Lowest Scores:
    - Embeddedness-3
    - Canopy Cover-6
- Elements w/ Highest Scores:
    - Riparian Zone-10
    - Channel Condition-9
    - Insect/invertebrate Habitat-9

OVERALL RATING-Good 7.6
Special Note: Increase in sediment from residential runoff and stream becomes braided with areas of heavy vegetation.

Rhodes Run: (home culverts to source)

- 3 reaches studied:
    1. 75% Forested 25% Residential
    2. 75% Grazing 25% Forested
    3. 100% Pasture
- Active Channel Width - Range 4ft to 5ft.
- Dominate Substrate-3 reaches:
    1. 20% Cobble 80% Mud
    2. 5% Boulder 20% Cobble 75% Mud
    3. 15% Boulder 40% Cobble 25% Mud
- Overall Scores-in 3 reaches-range 1 to 9
- Elements w/ Lowest Scores:
    - Bank Stability-3
    - Channel Condition-3
    - Instream Fish Cover-3
    - Embeddedness-2
    - Insect/invertebrate Habitat-4
    - Manure Presence-3
    - Riparian Zone-1

OVERALL RATING-Poor 4.9
Special Note-Streambed is mostly mud with manure present. One spring source emerges within a feedlot.

One of the many spring seeps located along Ciana Run.

Visual Assessment Summary

Ickes and Ciana Runs scored well in visual assessments undertaken by the Stream Guardian volunteers. Fish barriers and Instream fish cover were the only deficiencies cited but the barriers here are not manmade but rather a natural result of the step-pool character of these small type A streams. Instream fish cover will not be as diverse in these stream types, as well. The existence of established trails near these two streams are potential sources of sediment pollution if usage by foot traffic increases or should biking or horse riding occur. Logging operations could be a potential threat as well.

Existing conditions were found to be suboptimal on Rhodes Run throughout its length with the headwaters scoring lowest in the survey. Bank stability, channel conditions, and embeddedness on the lower reaches scored poorly with the effects seemingly associated with the close proximity of Monument Road, the road's poor condition and concentrated stormwater runoff. The upper portions of Rhodes Run are more severely impacted road runoff from Monument Road as well as private lanes as well as the areas only significant agricultural operations. Bank stability, channel conditions, fish and invertebrate habitat, and riparian zone condition all received low scores and manure presence was detectable.

Water Quality Monitoring Introduction

The Stream Guardians partnered with the Alliance for Aquatic Resource Monitoring (ALLARM) of Dickinson College and designed a Bobs Creek Watershed Monitoring program in June of 2003. With the knowledge gathered from these meetings they designed a water quality monitoring plan for the tributaries of Rhodes, Ickes, and Ciana Runs. The plan included 6 monitoring sites and these sites would be tested once a month (on the 3rd weekend) for a total of 12 months. They began monitoring in September of 2003, and concluded in August of 2004. Of the 12 months only one month of monitoring was missed; it was January when the Cox Monument Road was snowed in, but in February a snowmobile was used to collect water samples. The monitoring methods, and parameters were identical to the Bobs Creek Watershed Monitoring Plan. The parameters tested included dissolved oxygen, pH, water temperature, alkalinity, nitrate, orthophosphate, and turbidity. A sample of a water monitoring sheet that the Stream Guardians used is in Appendix E.

At a Data to Information workshop presented by ALLARM (2/21/05) the 12 months of raw data was interpreted using statistical summaries. These summaries included data summary tables and Box & Whisker Graphs. The following chemical analysis summaries represent the 12 months of water sampling at the 6 sites.

A Stream Guardian testing Rhodes Run in February of 2003.

pH

General Guidelines

pH is an expression of the negative logarithm of the concentration of hydrogen ions (H+) in water. A pH of 7 (neutral) has an equal amount of H+ and OH- ions. Since the scale is logarithmic, a drop in the pH by 1.0 unit is equivalent to a 10-fold increase in acidity; So, a water sample with a pH of 4.0 is 10 times as acidic as one with a pH of 5.0, 100 times as acidic as a solution with a pH of 6.0 and 1000 times as acidic as a solution with a pH of 7.0; Natural waters usually have a pH in the range of 4 to 9, and most are slightly basic due to the presence of alkaline bedrock.

Sources

Acid mine drainage (from iron pyrite) due to coal mining; acid rain (PA receives the most acid rain of any state) caused by the emission of nitrogen oxides and sulfur dioxides released from cars and fossil fuel burning power plants; acid or alkaline waste industrial processes.

Effect on Ecosystem

The largest variety of organisms flourish within a range of pH 6.5 to pH 8.0. A pH of 5.0 is inhibitive to juvenile forms of most organisms. The larvae of fishflies, midges, and alderflies can survive at a pH of 4 and brook trout can tolerate a pH as low as 4.5. Sowbugs, snails, clams and several fish such as brown trout and carp can tolerate a pH of 9. Most plant life enjoys a pH closer to neutral or slightly toward the alkaline (basic) side of the scale. Water having a low pH can act as a solvent and leach toxins out of the stream bottom and surrounding soils and into the water column, making these toxins available to aquatic organisms. Changes in pH can provide valuable clues. It can detect if the acid feed to a treatment system is not performing properly, it can reflect decomposition of organics in the water or photosynthetic activity in surface waters; the solubility of iron, copper, calcium, manganese, and other metals, and the proportions of carbon dioxide, bicarbonate, and carbonate are greatly changed by small numerical changes in pH (0.3 units or less change).

Data Findings

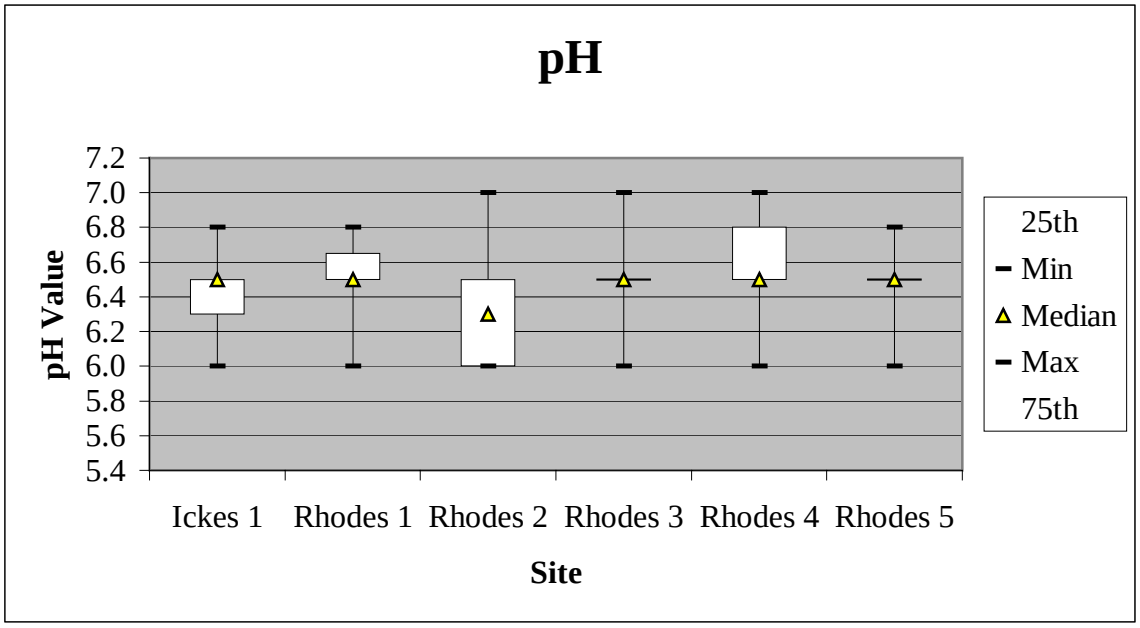
The median pH for all sites was 6.5 with a range of 6.0 to 7.0. No readings ever exceeded 7.0 (neutral). For all sites September was the most consistent pH month with readings of 6.5, and the Box & Whiskers Graph demonstrates this. Jim Davis Blue Knob State Park manager has pH history of readings showing an average of 7.2; so these tributaries are slowly becoming more acidic.

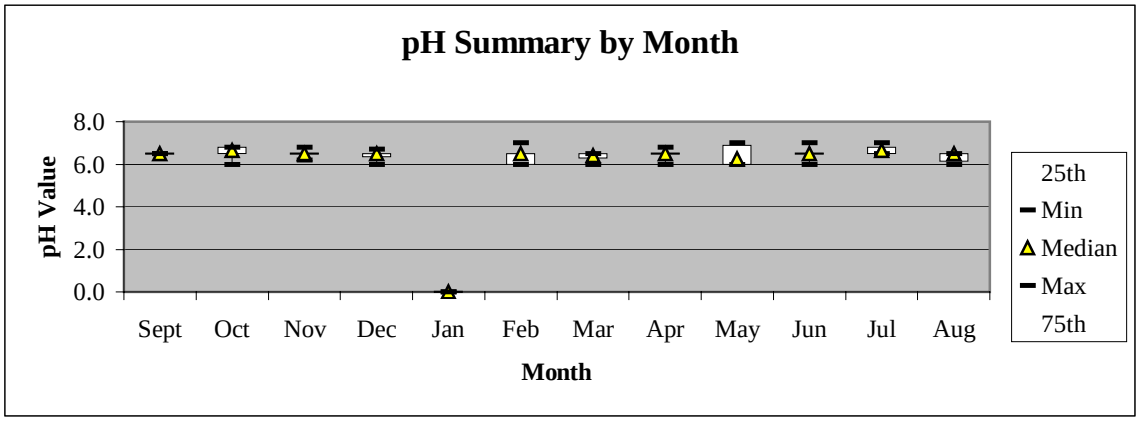
(Note: the following two pages contain raw data and graphs of one years pH monitoring)

pH	Raw Data											
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	6.5	6.8	6.2	6.5			6.3		6.5	6	6.5	6.5
Rhodes 1	6.5	6.5	6.8	6.7		6	6.5	6.5	6		6.8	6.5
Rhodes 2	6.5	6	6.5	6.3		6	6	6	7	6.5	7	6
Rhodes 3	6.5	6.5	6.5	6.5		6.5	6.3	6.5	7	7	6.5	6
Rhodes 4	6.5	6.8	6.5	6.5		7	6.5	6.8	6	6.5	6.8	6.5
Rhodes 5	6.5	6.8	6.5	6		6.5	6.5	6.5	6	6.5	6.5	6.5

pH - Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	6.4	6.0	6.3	6.5	6.5	6.8	0.8	0.2
Rhodes 1	6.5	6.0	6.5	6.5	6.7	6.8	0.8	0.2
Rhodes 2	6.3	6.0	6.0	6.3	6.5	7.0	1.0	0.5
Rhodes 3	6.5	6.0	6.5	6.5	6.5	7.0	1.0	0.0
Rhodes 4	6.6	6.0	6.5	6.5	6.8	7.0	1.0	0.3
Rhodes 5	6.4	6.0	6.5	6.5	6.5	6.8	0.8	0.0

pH - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	6.5	6.6	6.5	6.4		6.4	6.4	6.5	6.4	6.5	6.7	6.3
Min	6.5	6.0	6.2	6.0		6.0	6.0	6.0	6.0	6.0	6.5	6.0
25th	6.5	6.5	6.5	6.4		6.0	6.3	6.5	6.0	6.5	6.5	6.1
Median	6.5	6.7	6.5	6.5		6.5	6.4	6.5	6.3	6.5	6.7	6.5
75th	6.5	6.8	6.5	6.5		6.5	6.5	6.5	6.9	6.5	6.8	6.5
Max	6.5	6.8	6.8	6.7		7.0	6.5	6.8	7.0	7.0	7.0	6.5


pH
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
pH Value
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Site
25th
Min
Median
Max
75th


pH Summary by Month
8.0
6.0
4.0
2.0
0.0
pH Value
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
25th
Min
Median
Max
75th

Alkalinity

General Guidelines

Alkalinity measures water's ability to neutralize acids or act as a buffer to keep the pH constant. If a stream had no acid-neutralizing capacity, any addition of acid would cause an immediate change in pH. Measuring alkalinity can help determine the sensitivity of a stream to change with acid input. Streams with an alkalinity above 20 mg/L have some resistance to acid impacts but a more desirable range is 80-150 mg/L, with limestone streams being in the range of 200-300 mg/L. Alkalinity is one of the best measures of the sensitivity of a stream to acid inputs.

Sources

Natural sources of alkalinity originate from limestone (CaCO3)) soils and rocks. Alkalinity in water is due primarily to the presence of bicarbonate, carbonate, and hydroxide ions. Salts of weak acids, such as borates, silicates and phosphates, also may contribute to alkalinity. These ions lower the acidity of water by combining with H+ ions to make new compounds.

Effect on Ecosystem

A stream with a high alkalinity is more resistant to acid impacts (from rain or mining); however, over time, the stream's resistance and neutralizing capacity can get "used up", and the stream can become more vulnerable to acid impacts. Streams with high alkalinity often produce a lot of algae and aquatic plants. Acid mine drainage remediation projects often use limestone to treat acidic waters but the limestone needs to be replenished on a regular basis. Drinking water with low alkalinity is corrosive and may leach metals from pipes and soils, so public water departments often add alkaline compounds to protect the public. Clams and mussels prefer water with 35mg/L or more but can survive in less than half of that.

Data Findings

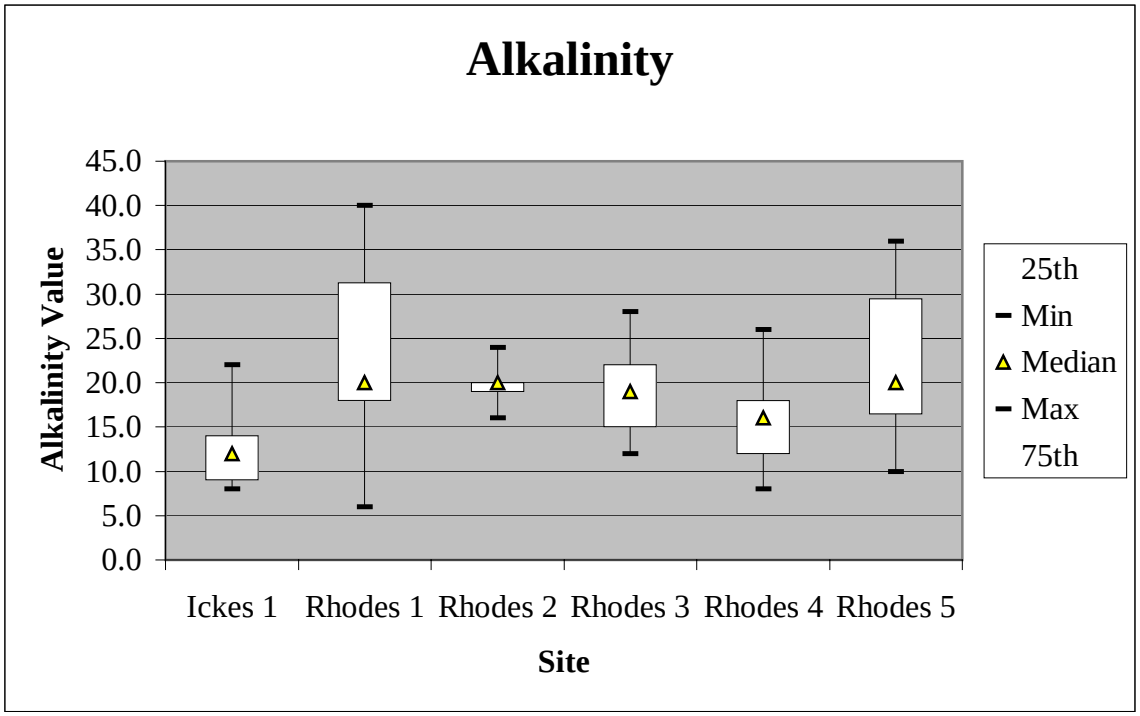
Since all sites lie within sandstone and clay soils, alkalinity remains low during all seasons. The median alkalinity was 16.0 ppm for all sites and the range during the 12-month study was 6.0 ppm to 40 ppm. The highest readings came from the most downstream site (RR 1), and this may be attributed to limestone gravel eroding from Cox Monument road into the stream. Ciana Run had the most consistent alkalinity readings as shown by the Box & Whiskers Graph, and February was the month with the highest median alkalinity readings for all sites as shown on the graph.

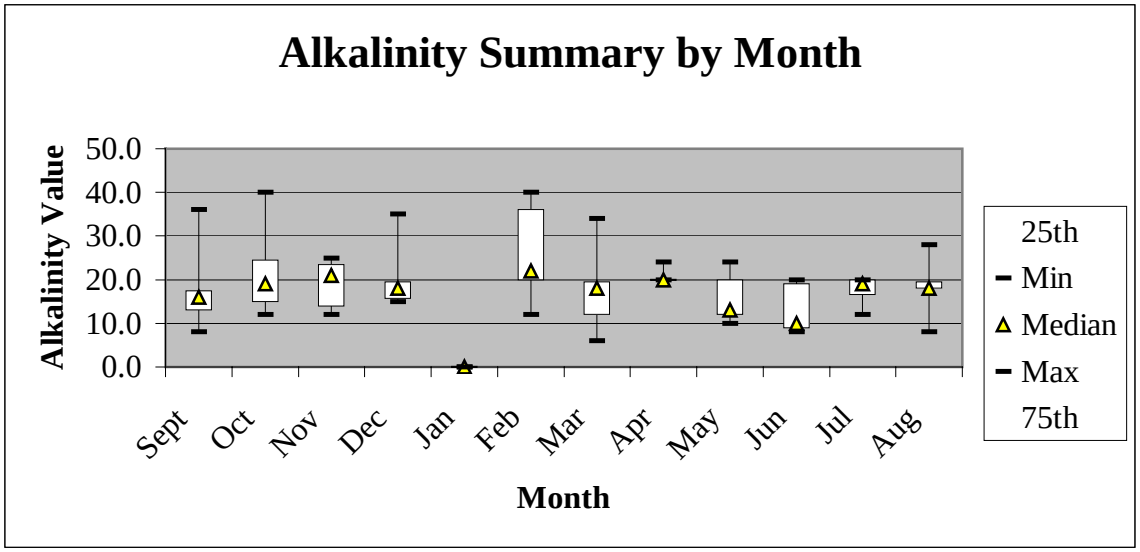
(Note: The following two pages contain raw data and graphs of alkalinity monitoring)

Alkalinity		Raw Data										
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	8	14	22	20			10		12	9	12	8
Rhodes 1	18	40	20	35		40	6	20	12		20	18
Rhodes 2	16	18	24	18		20	20	20	24	20	20	20
Rhodes 3	12	12	12	18		22	18	24	22	19	20	28
Rhodes 4	16	26	12	15		12	18	20	10	8	16	18
Rhodes 5	36	20	25	15		36	34	20	14	10	18	18

Alkalinity- Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	12.8	8.0	9.0	12.0	14.0	22.0	14.0	5.0
Rhodes 1	22.9	6.0	18.0	20.0	31.3	40.0	34.0	13.3
Rhodes 2	20.0	16.0	19.0	20.0	20.0	24.0	8.0	1.0
Rhodes 3	18.8	12.0	15.0	19.0	22.0	28.0	16.0	7.0
Rhodes 4	15.5	8.0	12.0	16.0	18.0	26.0	18.0	6.0
Rhodes 5	22.4	10.0	16.5	20.0	29.5	36.0	26.0	13.0

Alkalinity - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	17.7	21.7	19.2	20.2		26.0	17.7	20.8	15.7	13.2	17.7	18.3
Min	8.0	12.0	12.0	15.0		12.0	6.0	20.0	10.0	8.0	12.0	8.0
25th	13.0	15.0	14.0	15.8		20.0	12.0	20.0	12.0	9.0	16.5	18.0
Median	16.0	19.0	21.0	18.0		22.0	18.0	20.0	13.0	10.0	19.0	18.0
75th	17.5	24.5	23.5	19.5		36.0	19.5	20.0	20.0	19.0	20.0	19.5
Max	36.0	40.0	25.0	35.0		40.0	34.0	24.0	24.0	20.0	20.0	28.0


Alkalinity
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Alkalinity Value
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Site
25th
Min
Median
Max
75th


Alkalinity Summary by Month
50.0
40.0
30.0
20.0
10.0
0.0
Alkalinity Value
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
25th
Min
Median
Max
75th

Nitrates

General Guidelines

All organisms require nitrogen to build proteins. There are three major species of inorganic nitrogen compounds: ammonia (NH3), nitrite (NO2) and nitrate (NO3). In aquatic ecosystems, nitrogen is essential for plant growth, but excessive amounts in water present a major pollution problem. Nitrate tends to be higher during spring and times of heavy rain-peak agricultural/lawn season. States have specific criteria for nitrates. The acute water quality standard for nitrogen (nitrite plus nitrate) is 10 mg/L. The water quality standard for ammonia is not a given number but based on the temperature and pH of the water.

Sources

When organic waste, containing complex nitrogen compounds (proteins) is released into water, bacteria break down the compounds and first produce ammonia, then nitrite and finally, nitrate. Failing on-lot septic systems, runoff from fertilized lawns and cropland, runoff from animal manure storage areas, sewage treatment plants, industrial and packing house wastes; drainage from livestock feeding areas; industrial discharges that contain corrosion inhibitors. Most sewage treatment plants are not required to treat nitrogen before it inters the stream. Other sources include NOx air emissions from automobiles and coal-fired power plants.

Effect on Ecosystem

If the Nitrate level in drinking water rises above 10mg/L, it may cause “blue baby syndrome” or methemoglobinemia, a health hazard to infant animals and humans. Less than 1 mg/L has no negative effect on organisms or the ecosystem but greater than 1mg/L can cause an increase in algae, part of the process called eutrophication (a pond choked with green algae is eutrophic); when this excess algae uses up all of the nitrate in the system, the algae dies and the decay process robs oxygen from the water; this increase in plant growth can choke waterways and change plant community structure and composition.

Data Findings

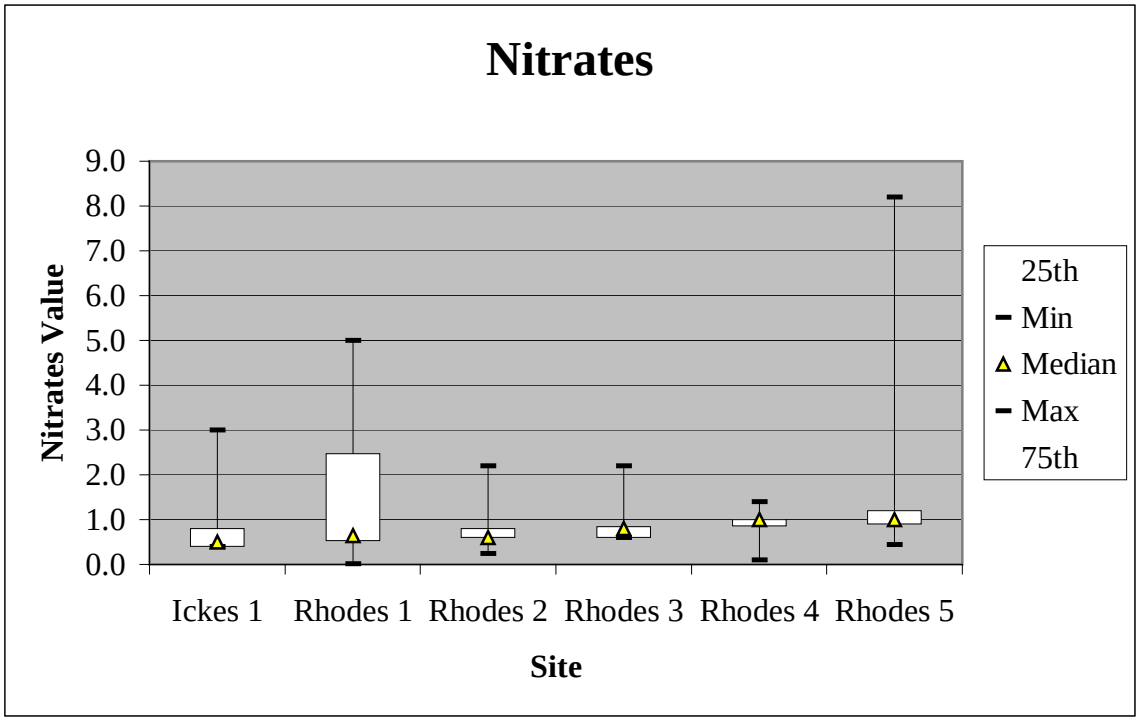
Ickes Run had the lowest nitrate readings during the study period at a median of .5 mg/L. It flows through forested lands with no influences from development or agriculture. Rhodes Run site 5 (the site closest to the source) had the highest median reading for all months with a 1.0 mg/L. The site is below a residential and agricultural area. Downstream these high nitrate readings could result in the streambed turning green with algae during springtime a sign of early stages of eutrophication.

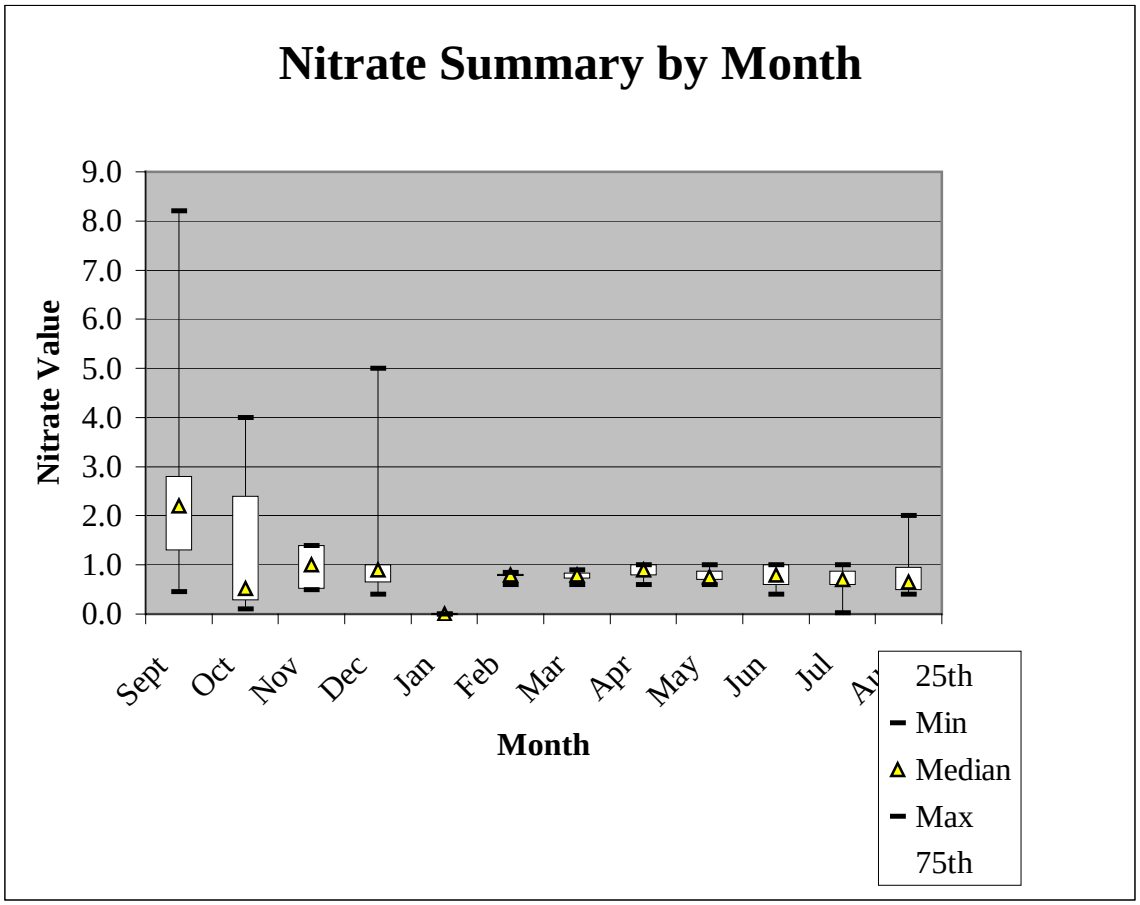
(Note: The following two pages contain raw data and graphs of nitrate monitoring)

Nitrate		Raw Data										
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	0.46	3	0.5	0.4			0.7		0.8	0.4	0.8	0.4
Rhodes 1	3	4	0.5	5		0.6	0.6	0.9	0.7		0.02	0.5
Rhodes 2	2.2	0.24	0.6	0.6		0.8	0.9	0.8	0.6	0.8	0.6	0.5
Rhodes 3	2.2	0.6	1.4	0.8		0.85	0.85	0.6	0.7	0.6	0.6	0.8
Rhodes 4	1	0.1	1.4	1		0.8	0.8	1	0.9	1	0.9	1
Rhodes 5	8.2	0.44	1.4	1		0.8	0.8	1	1	1	1	2

Nitrate- Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	0.8	0.4	0.4	0.5	0.8	3.0	2.6	0.4
Rhodes 1	1.6	0.0	0.5	0.7	2.5	5.0	5.0	2.0
Rhodes 2	0.8	0.2	0.6	0.6	0.8	2.2	2.0	0.2
Rhodes 3	0.9	0.6	0.6	0.8	0.9	2.2	1.6	0.3
Rhodes 4	0.9	0.1	0.9	1.0	1.0	1.4	1.3	0.2
Rhodes 5	1.7	0.4	0.9	1.0	1.2	8.2	7.8	0.3

Nitrate - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	2.8	1.4	1.0	1.5		0.8	0.8	0.9	0.8	0.8	0.7	0.9
Min	0.5	0.1	0.5	0.4		0.6	0.6	0.6	0.6	0.4	0.0	0.4
25th	1.3	0.3	0.5	0.7		0.8	0.7	0.8	0.7	0.6	0.6	0.5
Median	2.2	0.5	1.0	0.9		0.8	0.8	0.9	0.8	0.8	0.7	0.7
75th	2.8	2.4	1.4	1.0		0.8	0.8	1.0	0.9	1.0	0.9	1.0
Max	8.2	4.0	1.4	5.0		0.9	0.9	1.0	1.0	1.0	1.0	2.0


Nitrates
Nitrates Value
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Site
25th
Min
Median
Max
75th


Nitrate Summary by Month
Nitrate Value
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Month
25th
Min
Median
Max
75th

Orthophosphate

General Guidelines

Phosphorus (and nitrogen are essential nutrients for plants and animals. Phosphorus is normally found as phosphate but there are three kinds of phosphates: organic, orthophosphate, and condensed. Organic phosphate is present in living plants and animals, their wastes and remains. Bacteria convert this organic phosphate to inorganic phosphates (orthophosphate & condensed) which can then be used by plants that convert the inorganic phosphate back to organic phosphate as it becomes part of their tissues, starting the cycle over again. Water quality standards for P are site-specific and based on stream modeling but usually water quality standards are reported as Total P (phosphorus).

Sources

Soil and rocks; failing on-lot septic systems, runoff from fertilized lawns and cropland, runoff from animal manure storage areas, industrial and packing house wastes; drainage from livestock feeding areas; farm manure3s and legumes; sewage treatment plants, drained wetlands, water treatment and commercial cleaning preparations.

Effect on Ecosystem

Phosphorus is an essential plant nutrient needed for growth, and it also plays a role in the metabolic processes of humans and animals. Commonly, there is not a lot of phosphate present in an aquatic system and this limits plant growth. This means that only a small change in phosphorus can set off a chain of undesirable events causing extensive algal growth or blooms; most water quality scientists agree that unpolluted streams have a phosphate level of less than 0.01 mg/L and background levels in streams should not exceed about 0.1 mg/L –this is a small concentration and can be difficult to detect; most sewage treatment plants have effluent limits set a .1 or .2 mg/L of Total P (phosphorus).

Data Findings

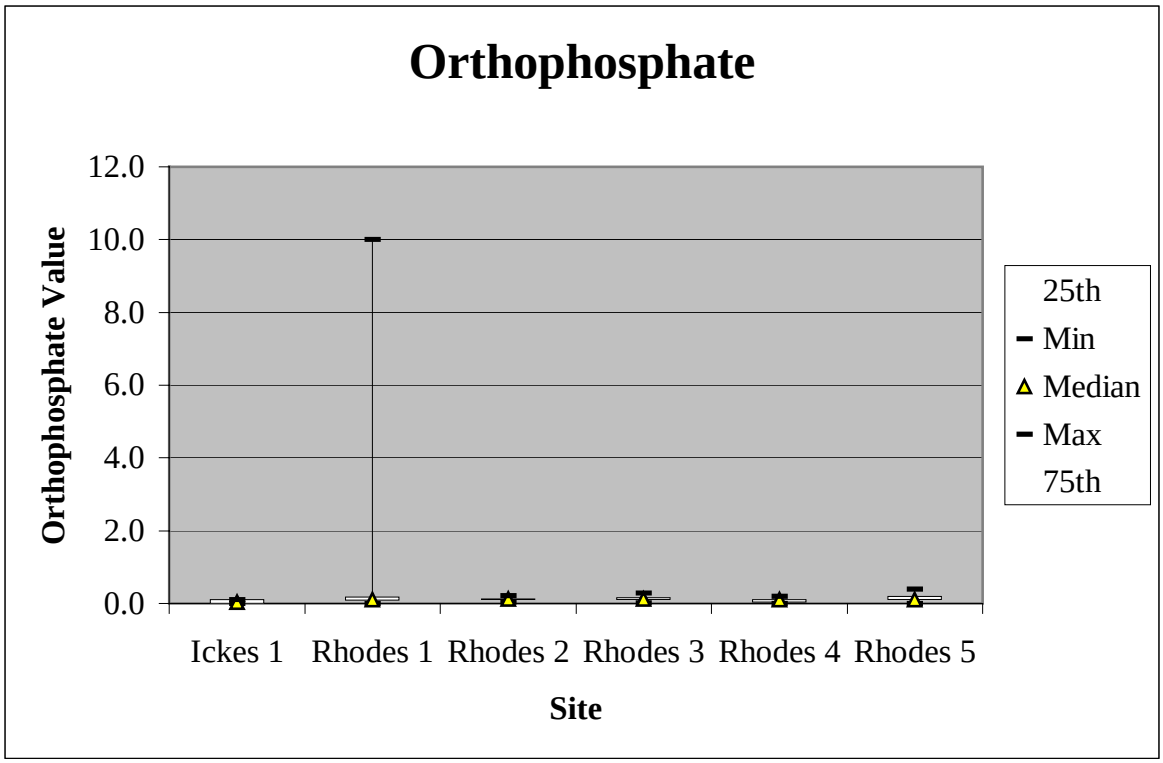
During the study period, Ickes Run had the best orthophosphate median reading at 0.0 mg/L, and a range of 0.00 to 0.1 mg/L. Rhodes Run site 5 had the highest maximum reading of 0.4 mg/L but still maintained a 12-month median of 0.1 mg/L. The months of July and August had some of the highest readings for all sites as shown on the monthly summary for all sites. These consistently high orthophosphate readings are of concern because of the effect they may have on the streams ecosystem.

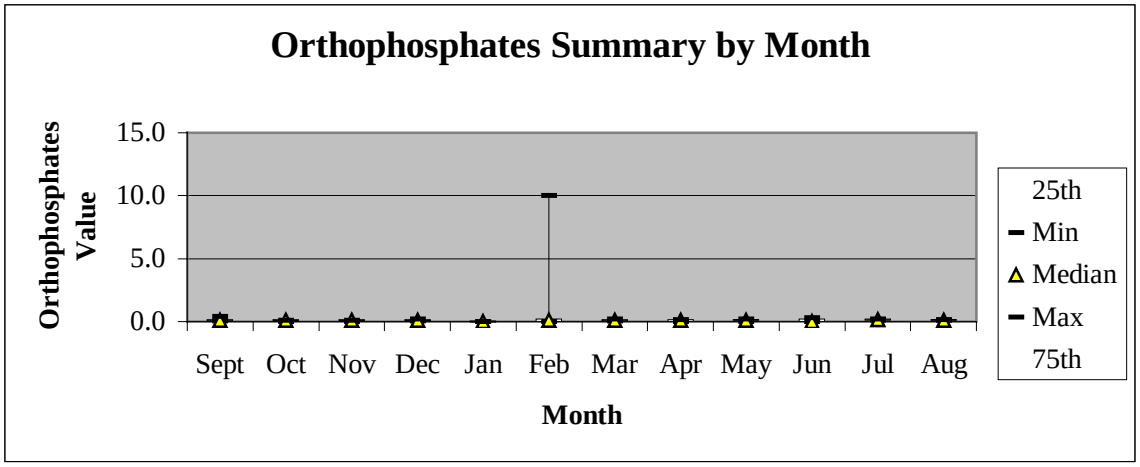
(Note: the following two pages contain raw data and graphs of orthophosphate monitoring)

Orthophosphate	Raw Data											
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	0.1	0.1	0	0.04			0.04		0	0	0.1	0.1
Rhodes 1	0.2	0.1	0.1	0.08		10	0.04	0	0.22		0.1	0.14
Rhodes 2	0.04	0.1	0.1	0.12		0.12	0.06	0.14	0.1	0.22	0.14	0.12
Rhodes 3	0.04	0.12	0.1	0.18		0.02	0.1	0.16	0.12	0.28	0.2	0.12
Rhodes 4	0.08	0.1	0.1	0.1		0	0.2	0	0.1	0	0.12	0.16
Rhodes 5	0.4	0.02	0.1	0.1		0.2	0.2	0.1	0.14	0	0.2	0.1

Orthophosphate- Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Rhodes 1	1.1	0.0	0.1	0.1	0.2	10.0	10.0	0.1
Rhodes 2	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.0
Rhodes 3	0.1	0.0	0.1	0.1	0.2	0.3	0.3	0.1
Rhodes 4	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.1
Rhodes 5	0.1	0.0	0.1	0.1	0.2	0.4	0.4	0.1

Orthophosphate - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	0.1	0.1	0.1	0.1		2.1	0.1	0.1	0.1	0.1	0.1	0.1
Min	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.1	0.1
25th	0.1	0.1	0.1	0.1		0.0	0.0	0.0	0.1	0.0	0.1	0.1
Median	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.0	0.1	0.1
75th	0.2	0.1	0.1	0.1		0.2	0.2	0.1	0.1	0.2	0.2	0.1
Max	0.4	0.1	0.1	0.2		10.0	0.2	0.2	0.2	0.3	0.2	0.2


Orthophosphate
Orthophosphate Value
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Site
25th
Min
Median
Max
75th


Orthophosphates Summary by Month
Orthophosphates Value
15.0
10.0
5.0
0.0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
25th
Min
Median
Max
75th

Turbidity

General Guidelines

Turbidity is a measure of water clarity and is the milky or muddy look that comes with light scattering from very small suspended particles, such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms. Polluted waters are commonly turbid but many clean rivers are never clear because they contain fine suspended minerals that never settle out of the water column. Some monitors look at turbidity upstream and downstream of a new development site to detect changes due to sediment pollution.

Sources

Sediment from earth-moving activities and construction sites; dye manufacturers; plankton, organic and inorganic matter, treatment plants may effect water clarity and turbidity. Urban runoff and soil erosion from agricultural fields are another source of sediment.

Effect on Ecosystem

Ecosystem effects are dependent on what elements are causing the turbidity; finely suspended particles in the water column can clog fish gills and impede proper respiration; Turbidity prevents sunlight from penetration the water column which decreases submerged aquatic vegetation growth on the stream bottom. Water suppliers are very concerned with turbidity since they must remove turbidity to acceptable levels in the treatment process. Total dissolved solids and total suspended solids are other parameters that can measure particles in the water column.

Data Findings

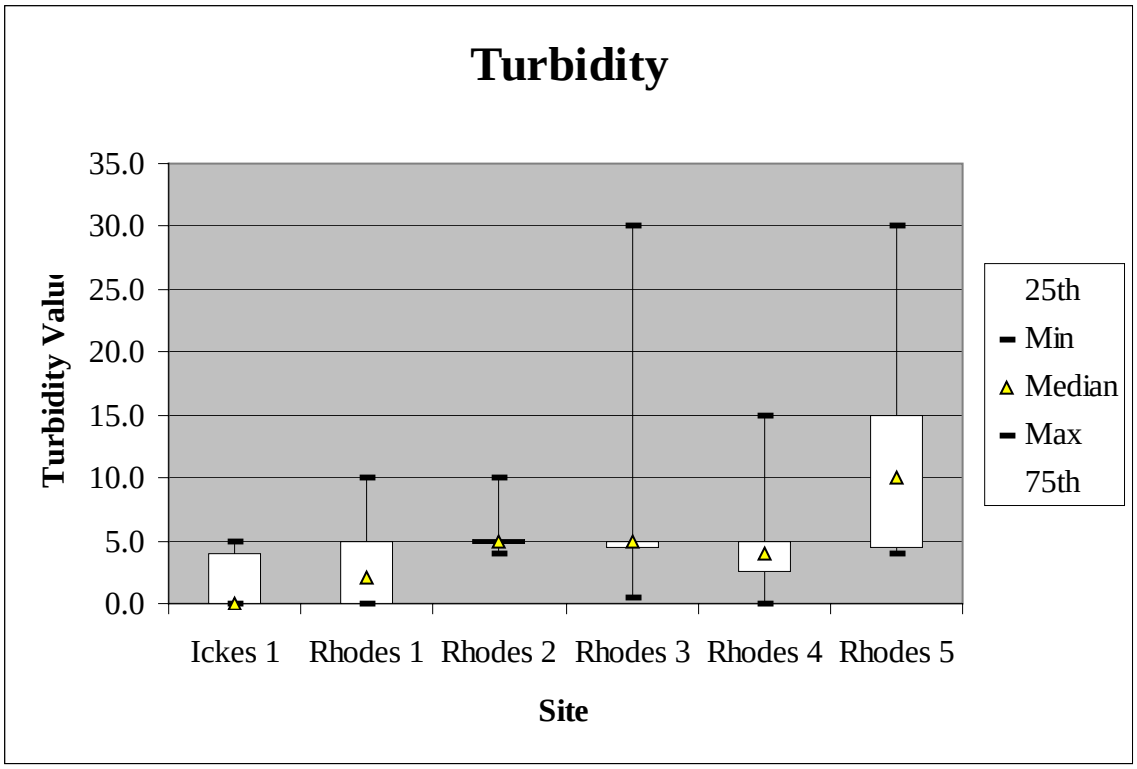
Overall turbidity for all sites was good; 5 JTU's or less except for site RR 5 which is below a residential and agricultural land use area. This site had turbidity 10 JTU's and higher seven out of twelve months. During the study period, Ickes Run had the lowest readings with a median turbidity reading of 0.00 JTU's.

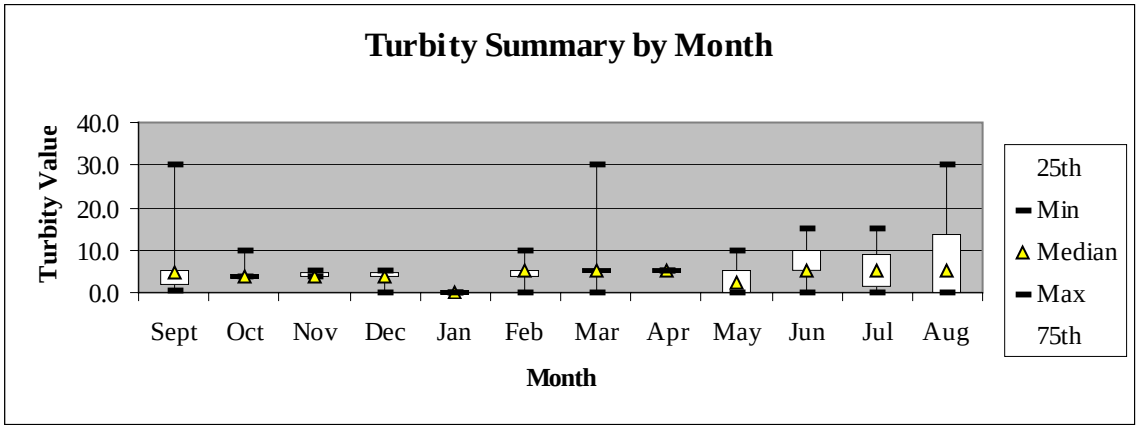
(Note: the following two pages contain raw data and graphs of turbidity monitoring)

Turbidity	Raw Data											
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	5	4	5	4			0		0	0	0	0
Rhodes 1	5	10	4	0		0	5	5	0		0	0
Rhodes 2	4	4	5	5		5	5	5	5	5	5	10
Rhodes 3	0.5	4	4	5		5	5	5	5	5	5	30
Rhodes 4	1	4	4	4		4	5	5	0	10	15	0
Rhodes 5	30	4	4	4		10	30	5	10	15	10	15

Turbidity- Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	2.0	0.0	0.0	0.0	4.0	5.0	5.0	4.0
Rhodes 1	2.9	0.0	0.0	2.0	5.0	10.0	10.0	5.0
Rhodes 2	5.3	4.0	5.0	5.0	5.0	10.0	6.0	0.0
Rhodes 3	6.7	0.5	4.5	5.0	5.0	30.0	29.5	0.5
Rhodes 4	4.7	0.0	2.5	4.0	5.0	15.0	15.0	2.5
Rhodes 5	12.5	4.0	4.5	10.0	15.0	30.0	26.0	10.5

Turbidity - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	7.6	5.0	4.3	3.7		4.8	8.3	5.0	3.3	7.0	5.8	9.2
Min	0.5	4.0	4.0	0.0		0.0	0.0	5.0	0.0	0.0	0.0	0.0
25th	1.8	4.0	4.0	4.0		4.0	5.0	5.0	0.0	5.0	1.3	0.0
Median	4.5	4.0	4.0	4.0		5.0	5.0	5.0	2.5	5.0	5.0	5.0
75th	5.0	4.0	4.8	4.8		5.0	5.0	5.0	5.0	10.0	8.8	13.8
Max	30.0	10.0	5.0	5.0		10.0	30.0	5.0	10.0	15.0	15.0	30.0


Turbidity
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Turbidity Valu
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Site
25th
Min
Median
Max
75th


Turbity Summary by Month
40.0
30.0
20.0
10.0
0.0
Turbity Value
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
25th
Min
Median
Max
75th

Water Temperature

General Guidelines

Water temperature controls how much oxygen water is able to hold. Colder water holds more oxygen than warmer water. Warmer water increases the rate of aquatic plant growth, photosynthesis and respiration. The hottest water temperatures occur naturally during low flows in the summer. If temperature is a concern, a key time to record hot temperatures is in the summer months in late afternoon. Temperature will vary in deeper bodies of water, warmer water being nearer the surface.

Sources

Stormwater runoff of heated urban surfaces (streets, sidewalks); electric-generating power plants with insufficient cooling water process, exposure to sunlight—lack of a riparian buffer and shade to the water column; ponds behind dams act as a heat sink; soil erosion—more turbid water can absorb more of the sun's rays, causing water temps to rise.

Effect on Ecosystem

Practically all forms of aquatic life prefer a relatively narrow temperature range. Fish such as trout and salmon prefer cooler temperatures. Warm-water fish such as catfish, carp, bass, and bluegills, can tolerate higher temperatures. Most aquatic plants grow better in warmer waters above 20 C in order to complete their reproductive cycle. An increase in temperature can be controlled by keeping as much of the riparian area vegetated as possible. Trees help to cool down the runoff into the streams, as well as shading the stream from radiant energy. Warmer temperatures increase bacterial growth and disease.

Data Findings

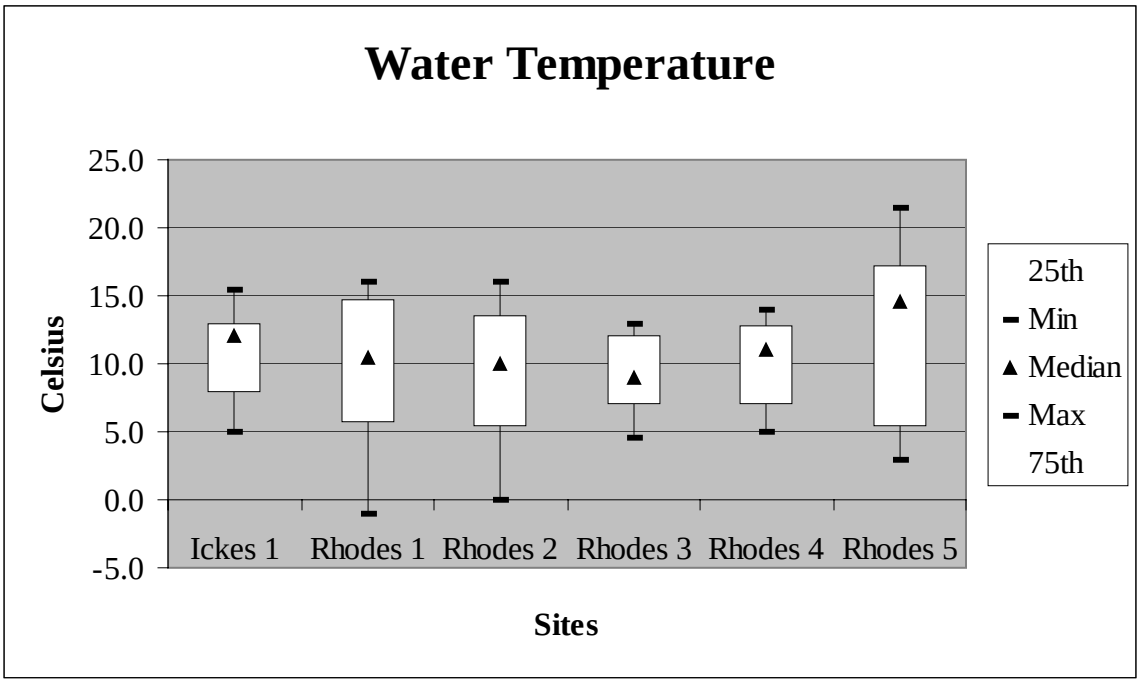
The twelve-month median temperature for all sites was 13 C (55 F) with a seasonal range of -1 C (30 F) to 21.5 C (71 F). Rhodes Run site 5 had the highest water temperatures during the months of April, May, June, July, (21.5 C), August and September. This may be attributed to the streams source flowing through an open pasture and residential area before entering forested land. Ciana Run site RR 2 had the most consistent water temperatures as shown on the Box and Whisker graph. Also this graph shows the seasonal fluctuation at all sites.

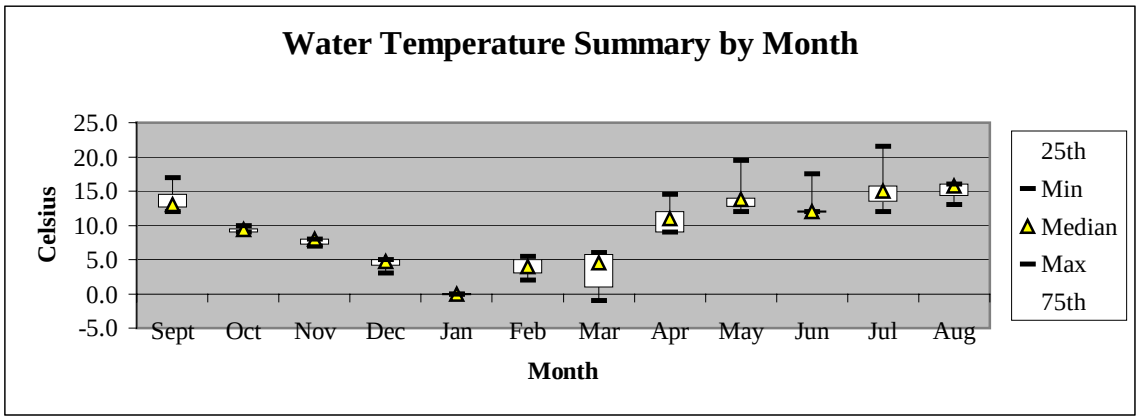
(Note: The following two pages contain raw data and graphs of water temperature monitoring.)

Water Temperature (Celsius)	Raw Data											
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	13	9.5	7.9	5			5		12.5	12	15	15.5
Rhodes 1	15	9	8	5		2	-1	12	14		16	16
Rhodes 2	13	10	7	4		4	0	9	14	12	15	16
Rhodes 3	12	9	8	4.5		5	6	9	12	12	12	13
Rhodes 4	12.5	9.2	8	5		5.5	6	11	13.5	12	13	14
Rhodes 5	17	9.5	7	3		3	4	14.5	19.5	17.5	21.5	16

WATER TEMPERATURE - Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	10.6	5.0	7.9	12.0	13.0	15.5	10.5	5.1
Rhodes 1	9.6	-1.0	5.8	10.5	14.8	16.0	17.0	9.0
Rhodes 2	9.5	0.0	5.5	10.0	13.5	16.0	16.0	8.0
Rhodes 3	9.3	4.5	7.0	9.0	12.0	13.0	8.5	5.0
Rhodes 4	10.0	5.0	7.0	11.0	12.8	14.0	9.0	5.8
Rhodes 5	12.0	3.0	5.5	14.5	17.3	21.5	18.5	11.8

WATER TEMPERATURE - Monthly Summary for All Sites												
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	13.8	9.4	7.7	4.4		3.9	3.3	11.1	14.3	13.1	15.4	15.1
Min	12.0	9.0	7.0	3.0		2.0	-1.0	9.0	12.0	12.0	12.0	13.0
25th	12.6	9.1	7.2	4.1		3.0	1.0	9.0	12.8	12.0	13.5	14.4
Median	13.0	9.4	8.0	4.8		4.0	4.5	11.0	13.8	12.0	15.0	15.8
75th	14.5	9.5	8.0	5.0		5.0	5.8	12.0	14.0	12.0	15.8	16.0
Max	17.0	10.0	8.0	5.0		5.5	6.0	14.5	19.5	17.5	21.5	16.0


Water Temperature
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
Celsius
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Sites
25th
Min
Median
Max
75th


Water Temperature Summary by Month
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
Celsius
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
25th
Min
Median
Max
75th

Dissolved Oxygen (DO) & Percent Saturation

General Guidelines

The amount of oxygen dissolved in the water column is measured in mg/L. The warmer the water, the less oxygen the water can hold. The amount of oxygen found in a water sample compared to the amount of oxygen that the sample could hold is called percent saturation. When water has all the dissolved oxygen it can hold at a given temperature, it is said to be 100% saturated. You can determine the percent saturation using a thermometer, DO test kit, and a percent saturation chart. DO is lowest in summer due to water temperatures and just before dawn due to respiration of aquatic plants and algae during darkness, a process that utilizes oxygen in contrast to daytime photosynthesis. DO can be measured by using the Winkler-titration method or an electronic meter.

Sources

Mixing with the atmosphere, algae and rooted aquatic plants add DO via photosynthesis but when these aquatic plants and algae die, the decomposition process robs oxygen from the water, often causing a crash in DO. Organic substances from sewage, animal waste, food processing plants, paper mills, and slaughter houses are major forms of oxygen demanding wastes (substances broken down by bacteria who consume dissolved oxygen); thermal pollution causes an increase in temperature and a decrease in DO; deforestation along stream banks also cause an increase in temperature and corresponding decrease in DO.

Effect on Ecosystem

Dissolved oxygen (DO) is essential for maintaining healthy aquatic ecosystems and is one to the most important analyses in determining stream health. DO is used by respiring fish and aquatic insects, and is also used in the decomposition (rotting) process of dead plant and animal matter. Fish require the highest levels of DO, invertebrates lower levels, and bacteria the least. For a diverse warm-water fishery, the DO should not fall below 5 mg/L and in cold-water fisheries it should not fall below 6 mg/L. Sometimes water can be supersaturated- that is, water can hold more oxygen than it is supposed to be able to hold at a given temperature. Supersaturation may result when water is tumbled over rapids and falls and is a common problem along rivers controlled by dams. Supersaturation, even for short periods of time, can be very harmful to fish. Rivers that have a DO saturation percent value of 80-120% are considered to be excellent, 60-79% is okay, and if a DO percent saturation value is over 125% or below 60% the water quality is poor.

Data Findings

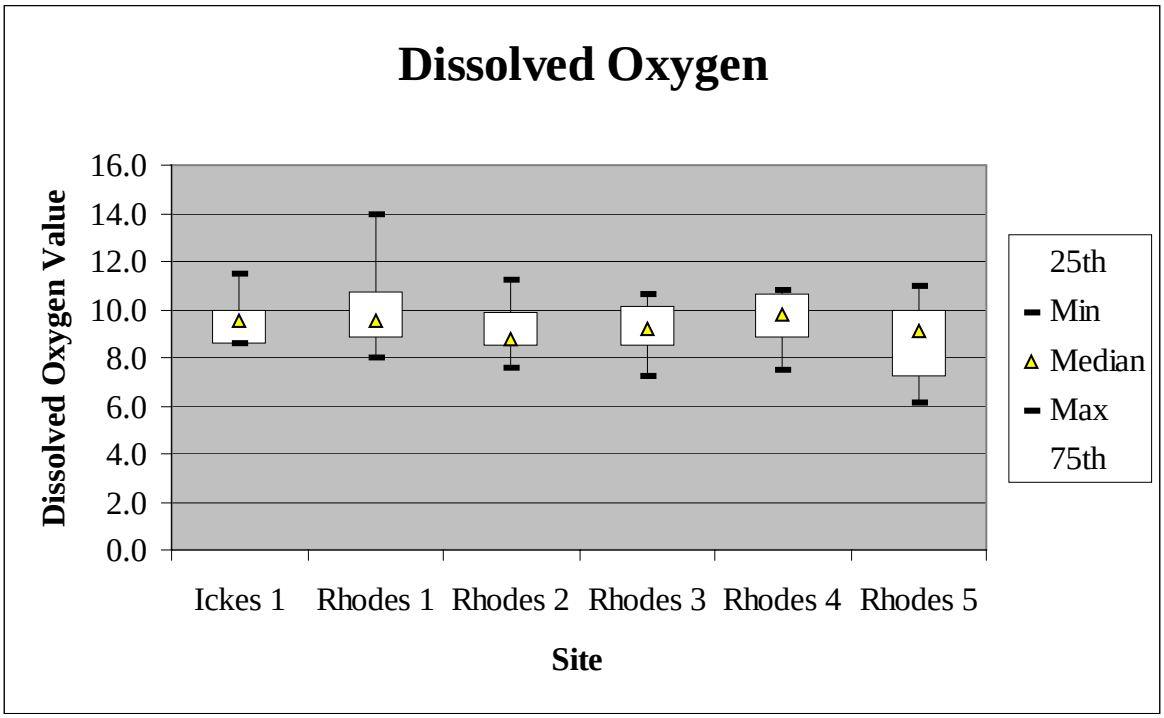
The median DO for all sites during the study period was 9.3 with a range from 6.1 (RR 5 Aug) to 14 (RR 1 Feb). On the Box & Whiskers Graph the monthly summary demonstrates the rise in DO during colder months and the fall in DO during warmer months. The % of saturation median for all sites is 89.45 during the study period that is considered excellent for streams. Rhodes Run site RR #5 had the lowest % of saturation at 65.88, August 2004, and its water temperature was highest during this month.

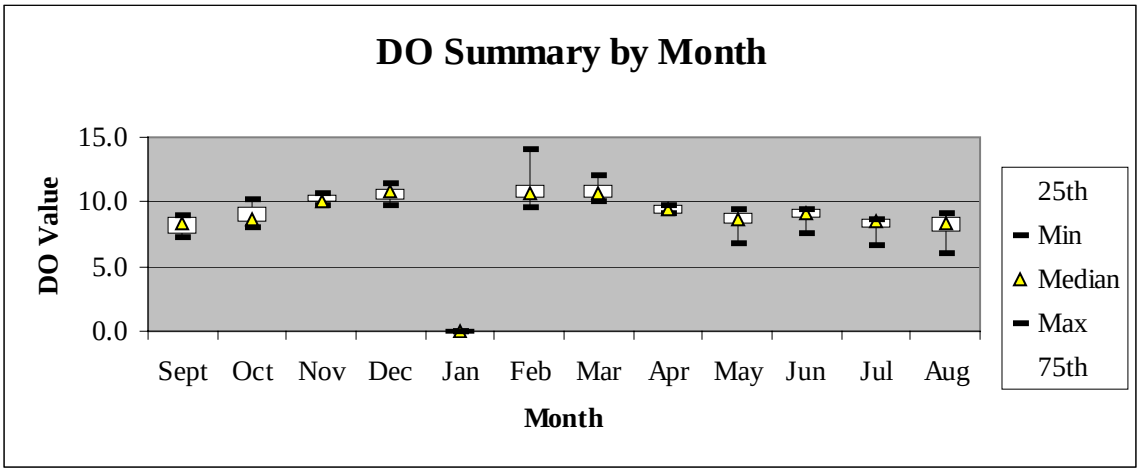
(Note: The following pages contain raw data and graphs of DO and % of saturation)

DO - Raw Data												
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	8.6	8.65	10	11.5			11.5		9.5	9.5	8.6	8.6
Rhodes 1	9	8	9.8	11		14	12	9.8	9.2		8.5	8.8
Rhodes 2	8.8	8.6	10	9.8		11.25	10.6	9.5	8.4	8.8	7.8	7.6
Rhodes 3	7.2	8.4	10.6	10		10.3	10.2	9.2	8.85	9.2	8.6	8
Rhodes 4	7.5	10.2	10.6	10.8		10.6	10.7	9.8	8.5	9.5	8.6	9.1
Rhodes 5	8	10	10	11		9.6	10	9.1	6.8	7.6	6.6	6.1

DO - Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	9.6	8.6	8.6	9.5	10.0	11.5	2.9	1.4
Rhodes 1	10.0	8.0	8.9	9.5	10.7	14.0	6.0	1.9
Rhodes 2	9.2	7.6	8.5	8.8	9.9	11.3	3.7	1.4
Rhodes 3	9.1	7.2	8.5	9.2	10.1	10.6	3.4	1.6
Rhodes 4	9.6	7.5	8.9	9.8	10.6	10.8	3.3	1.8
Rhodes 5	8.6	6.1	7.2	9.1	10.0	11.0	4.9	2.8

DO - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	8.2	9.0	10.2	10.7		11.2	10.8	9.5	8.5	8.9	8.1	8.0
Min	7.2	8.0	9.8	9.8		9.6	10.0	9.1	6.8	7.6	6.6	6.1
25th	7.6	8.5	10.0	10.2		10.3	10.3	9.2	8.4	8.8	8.0	7.7
Median	8.3	8.6	10.0	10.9		10.6	10.7	9.5	8.7	9.2	8.6	8.3
75th	8.8	9.7	10.5	11.0		11.3	11.3	9.8	9.1	9.5	8.6	8.8
Max	9.0	10.2	10.6	11.5		14.0	12.0	9.8	9.5	9.5	8.6	9.1


Dissolved Oxygen
Dissolved Oxygen Value
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Ickes 1
Rhodes 1
Rhodes 2
Rhodes 3
Rhodes 4
Rhodes 5
Site
25th
Min
Median
Max
75th


DO Summary by Month
DO Value
15.0
10.0
5.0
0.0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Month
25th
Min
Median
Max
75th

Percent Saturation Dissolved Oxygen												
Site	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Ickes 1	93.36	79.67	87.77	95.95			95.95		93.93	93.93	90.85	90.85
Rhodes 1	95.08	73.69	88.13	91.78		107.85	87.44	96.89	95.11		91.80	95.04
Rhodes 2	95.53	81.18	87.77	79.65		91.43	77.24	87.50	86.84	87.00	82.40	82.08
Rhodes 3	71.19	77.37	95.32	81.27		85.94	87.30	84.74	87.50	90.96	85.03	86.84
Rhodes 4	74.15	93.95	95.32	90.11		88.44	91.58	94.69	92.27	93.93	93.36	94.08
Rhodes 5	88.19	92.11	87.77	87.07		75.99	81.27	94.08	78.12	83.78	78.89	65.88

Percent Saturation Dissolved Oxygen - Annual Summary for Each Site								
SITE	Average	Min	25th	Median	75th	Max	Range	IQ Range
Ickes 1	91.36	79.67	90.85	93.36	93.93	95.95	16.28	3.08
Rhodes 1	92.28	73.69	89.04	93.42	95.10	107.85	34.16	6.06
Rhodes 2	85.33	77.24	81.63	86.84	87.64	95.53	18.29	6.01
Rhodes 3	84.86	71.19	83.01	85.94	87.40	95.32	24.13	4.40
Rhodes 4	91.08	74.15	90.85	93.36	94.02	95.32	21.17	3.17
Rhodes 5	83.01	65.88	78.51	83.78	87.98	94.08	28.20	9.47

Percent Saturation Dissolved Oxygen - Monthly Summary for All Sites												
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average	86.25	83.00	90.35	87.64		89.93	86.80	91.58	88.96	89.92	87.06	85.80
Min	71.19	73.69	87.77	79.65		75.99	77.24	84.74	78.12	83.78	78.89	65.88
25th	77.66	77.95	87.77	82.72		85.94	82.78	87.50	87.01	87.01	83.06	83.27
Median	90.78	80.43	87.95	88.59		88.44	87.37	94.08	89.89	90.96	87.94	88.85
75th	94.65	89.38	93.52	91.36		91.43	90.55	94.69	93.52	93.93	91.56	93.27
Max	95.53	93.95	95.32	95.95		107.85	95.95	96.89	95.11	93.93	93.36	95.04

Water Quality Monitoring Summary

Overall, the yearlong chemistry monitoring produced few surprises. Nutrient loading as indicated by nitrate and orthophosphate sampling was greatest in the upper reaches of Rhodes Run nearest the dairy farming area, though there was significant seasonal variation. Dissolved oxygen levels were also somewhat lower at the upper Rhodes sites. Alkalinity and pH are predictably low throughout the study area due to the soil and bedrock but the lower base flow periods resulted in higher ratings that indicate better buffering capacity than some similar streams might exhibit in other regions.

During July 2003, DEP personnel conducted water quality sampling at several locations throughout the Bobs Creek watershed including some sites in the study area. The results of this monitoring indicate conditions similar to the volunteer monitoring results.

The Stream Guardians anticipate continuing their water quality monitoring at least some of the sites used during this study. Data from collections taken during precipitation events would be useful to gain a better understanding of impacts from land use particularly related to upper Rhodes Run.

Macroinvertebrate Survey of Rhodes Run and Ickes Run

With assistance from Stroud Water Research Center (SWRC), on May 4, 2004, the Stream Guardians undertook a macroinvertebrate survey by sampling two sites on Rhodes Run, and a single site on Ickes Run .The three sites selected were also water quality monitoring sites; they included Rhodes Run log footbridge (RR1), Ickes Run footbridge (IR1), and second State Game Land parking lot (RR3). At each site, three 1 square meter kick-net samples were collected. The samples were than taken to the Pavia Activity building, and SWRC conducted a macroinvertebrate identifications workshop. Using protocol adapted from DCNR Bureau of State Parks Watershed Education Teacher Manual (Biological Parameters-see appendix) to develop "stream quality ratings", the Stream Guardians analyzed the samples. The methods in the teacher manual required macroinvertebrate identifications to order level that is simpler for training volunteers. SWRC provided an Identification Guide to Freshwater Macroinvertebrates for the volunteers to identify the macroinvertebrates to order. (See Appendix G).

Biological Data Findings

The following chart lists each stream and its Stream Quality Rating based upon the macroinvertebrate data. Taxa are assigned to one of three groups determined by pollution tolerance levels. Within each group, observed taxa are recorded as being dominant, common, or rare dependent upon the relative abundance of the taxa. The tolerance and abundance characterizations are used to obtain a 'Weighting Factor". The number of taxa in each group is multiplied by the weighting factor, subtotals obtained for each pollution tolerance level, and a grand total indicates the Stream Quality Rating. Scores below 20 are poor, from 20 to 40 are fair, and above 40 the quality is rated good.

Site	Score	Rating
Ickes Run (IR1)	39.5	Fair
Rhodes Run (RR1)	35.5	Fair
Rhodes Run (RR3)	40.1	Good

At the time of the identification workshop, it was evident that there was great diversity in the samples within ephemeroptera (mayfly) and plecoptera (stonefly) taxa. Among the plecoptera, peltoperlids and pteronarcyids were noted, and the ephemerellids were significant among the ephemeroptera. And, although the trichoptera (caddis) were dominated by net-spinning hydropsychids, there were several other families evident as well, including rhyacophilids. The presence of these highly sensitive taxa suggests an alternative scoring method, using identification to family level, could have yielded different ratings (better?) of stream health.

During July 2003, the PA Department of Environmental Protection conducted biological and chemical sampling at several locations in the Bobs Creek watershed, including sites on Ickes Run and Rhodes Run. The data provided by DEP to the Stream Guardians indicates the presence or absence of taxa (family and genus) in the samples without

frequency data. Therefore, using this data to calculate stream quality ratings is not possible but the reports do indicate greater diversity than was inferred from the Stream Guardians data alone. These reports would seem to confirm the diversity suspected in the workshop samples noted above. The DEP data is found in Appendix F.

The Stream Guardians recommend that follow-up sampling at the three sites be undertaken using the protocol outlined by the EPA in the Volunteer Stream Monitoring Manual. This sampling should be scheduled for as early in the year as possible, preferably late February or March, to avoid missing early emergences.

Watershed Education – Biosurvey

Group: Bobs Creek Stream Guardians
Contact Persons: Guy Stottlemyer & Tim Clingerman
Basin: Susquehanna **Watershed**: Bobs Creek **Stream**: Rhodes Run
Location: Water Quality Monitoring Site-(RR 1) Log Footbridge
Date: May 4, 2004 Time: 1:00 P.M. **# of Participants**: 8 to 10
Weather: Partly Cloudy , Temperature 73F

Macroinvertebrate Count for Biosurvey

Relative Abundance (RA) Weighting Factor R=(1-9) C=(10-99) D=(100 or more)

Group 1 Taxa (PTV<=4)	RA	Group 2 Taxa (Ptv>4 and <=6)	RA	Group 3 Taxa (PTV>6)	RA
Dobsonfly Larva (0.0)		Beetle Larva (4.7)		Primitive Minnow Mayflies (7.0)	
Fishfly Larva (0.0)		Damselfy Nymph (5.2)		Small Squaregills (Mayfly) (7.0)	
Net winged Midges (0.0)		True Flies (5.6)		Snails (7.0)	
Clubtails (Dragonfly) (1.0)		Blackfly Lava (6.0)		True Midges (7.0)	8 R
Stonefly Nymph (1.1)	277 D	Crayfish (6.0)	12 C	Aquatic Sowbugs (8.0)	
Watersnipe Flies (2.0)	2 R	Scuds (6.0)		Aquatic Worms (8.0)	
Caddisfly Larva (2.8)	535 D			Leech (10.0)	
Cranefly Larva (3.0)	9 R			Moth Flies (10)	
Mayfly Nymph (3.5)	427 D			Rat-tailed Maggot (10.0)	
Alderfly Larva (4.0)					
Water Penny Larva (4.0)	1 R				
Other: (*)		Other: (*)		Other: (*)	

* See Pollution Tolerance Values in WE manual appendix for “other” macroinvertebrates

Calculating Stream Quality Rating

Abundance	Weighting Factor		
	Group 1 (Sensitive)	Group 2 (Somewhat Sensitive)	Group 3 (Tolerant)
R (Rare)	5.0	3.2	1.2
C (Common)	5.6	3.4	1.1
D (Dominant)	5.3	3.0	1.0

Group 1 (Sensitive)			Group 2 (Somewhat Sensitive)			Group 3 (Tolerant)		
3	(# of R's) x 5.0 =	15	0	(# of R's)x3.2=	0	1	(# of R's) x 1.2 =	1.2
0	(# of C's) x 5.6 =	0	1	(# of C's)x3.4=	3.4	0	(# of C's) x 1.1 =	0
3	(# of D's) x 5.3 =	15.9	0	(# of D's)x3.0 =	0	0	(# of D's) x 1.0 =	0
	Total:	30.9		Total:	3.4		Total:	1.2

Sum of Rating Value for Group 1		Sum of Rating Value for Group 2		Sum of Rating Value for Group 3		Rating Value for Site
30.9	+	3.4	+	1.2	=	35.5

Stream Quality Rating

Site	Score	Rating
	> 40	Good
RR 1 35.5	20-40	Fair
	< 20	Poor

Watershed Education – Biosurvey

Group: Bobs Creek Stream Guardians
Contact Persons: Guy Stottlemyer & Tim Clingerman
Basin: Susquehanna **Watershed**: Bobs Creek **Stream**: Rhodes Run
Location: Water Quality Monitoring Site-(RR 3) 2nd Game Land Parking Lot
Date: May 4, 2004 Time: 1:00 P.M. **# of Participants**: 8 to 10
Weather: Partly Cloudy, Temperature 73F

Macroinvertebrate Count for Biosurvey

Relative Abundance (RA) Weighting Factor R=(1-9) C=(10-99) D=(100 or more)

Group 1 Taxa (PTV<=4)	RA	Group 2 Taxa (Ptv>4 and <=6)	RA	Group 3 Taxa (PTV>6)	RA
Dobsonfly Larva (0.0)	1 R	Beetle Larva (4.7)	1 R	Primitive Minnow Mayflies (7.0)	
Fishfly Larva (0.0)		Damselfy Nymph (5.2)		Small Squaregills (Mayfly) (7.0)	
Netwinged Midges (0.0)		True Flies (5.6)		Snails (7.0)	
Clubtails(Dragonfly) (1.0)		Blackfly Lava (6.0)		True Midges (7.0)	32 C
Stonefly Nymph (1.1)	230 D	Crayfish (6.0)	3 R	Aquatic Sowbugs (8.0)	
Watersnipe Flies (2.0)	1 R	Scuds (6.0)		Aquatic Worms (8.0)	38 C
Caddisfly Larva (2.8)	219 D			Leech (10.0)	
Cranefly Larva (3.0)	12 C			Moth Flies (10)	
Mayfly Nymph (3.5)	498 D			Rattailed Maggot (10.0)	
Alderfly Larva (4.0)					
Water Penny Larva (4.0)					
Other: (*)		Other: (*)		Other: (*)	

* See Pollution Tolerance Values in WE manual appendix for “other” macroinvertebrates

Calculating Stream Quality Rating

Abundance	Weighting Factor		
	Group 1 (Sensitive)	Group 2 (Somewhat Sensitive)	Group 3 (Tolerant)
R (Rare)	5.0	3.2	1.2
C (Common)	5.6	3.4	1.1
D (Dominant)	5.3	3.0	1.0

Group 1 (Sensitive)			Group 2 (Somewhat Sensitive)			Group 3 (Tolerant)		
2	(# of R's) x 5.0=	10	2	(# of R's)x3.2=	6.4	0	(# of R's) x 1.2 =	0
1	(# of C's) x 5.6 =	5.6	0	(# of C's)x3.4=	0	2	(# of C's) x 1.1 =	2.2
3	(# of D's) x 5.3=	15.9	0	(# of D's)x3.0=	0	0	(# of D's) x 1.0=	0
	Total:	31.5		Total:	6.4		Total:	2.2

Sum of Rating Value for Group 1		Sum of Rating Value for Group 2		Sum of Rating Value for Group 3		Rating Value for Site
31.5	+	6.4	+	2.2	=	40.1

Stream Quality Rating

Site	Score	Rating
RR 3 40.1	> 40	Good
	20-40	Fair
	< 20	Poor

Watershed Education – Biosurvey

Group: Bobs Creek Stream Guardians
Contact Persons: Guy Stottlemyer & Tim Clingerman
Basin: Susquehanna **Watershed**: Bobs Creek **Stream**: Ickes Run
Location: Water Quality Monitoring Site-(IR 1) Trail Footbridge
Date: May 4, 2004 Time: 1:00 P.M. **# of Participants**: 8 to 10
Weather: Partly Cloudy, Temperature 73F

Macroinvertebrate Count for Biosurvey

Relative Abundance (RA) Weighting Factor R=(1-9) C=(10-99) D=(100 or more)

Group 1 Taxa (PTV<=4)	RA	Group 2 Taxa (Ptv>4 and <=6)	RA	Group 3 Taxa (PTV>6)	RA
Dobsonfly Larva (0.0)		Beetle Larva (4.7)		Primitive Minnow Mayflies (7.0)	
Fishfly Larva (0.0)		Damselfy Nymph (5.2)		Small Squaregills (Mayfly) (7.0)	
Netwinged Midges (0.0)		True Flies (5.6)	27 C	Snails (7.0)	
Clubtails(Dragonfly) (1.0)		Blackfly Lava (6.0)	2 R	True Midges (7.0)	107 D
Stonefly Nymph (1.1)	85 C	Crayfish (6.0)	11 C	Aquatic Sowbugs (8.0)	
Watersnipe Flies (2.0)		Scuds (6.0)		Aquatic Worms (8.0)	8 R
Caddisfly Larva (2.8)	25 C	Salamander	1 R	Leech (10.0)	
Cranefly Larva (3.0)		Sculpin	2 R	Moth Flies (10)	1 R
Mayfly Nymph (3.5)	137 D	Brown Trout	1 R	Rattailed Maggot (10.0)	
Alderfly Larva (4.0)					
Water Penny Larva (4.0)					
Other: (*)		Other: (*)		Other: (*)	

* See Pollution Tolerance Values in WE manual appendix for “other” macroinvertebrates

Calculating Stream Quality Rating

Abundance	Weighting Factor		
	Group 1 (Sensitive)	Group 2 (Somewhat Sensitive)	Group 3 (Tolerant)
R (Rare)	5.0	3.2	1.2
C (Common)	5.6	3.4	1.1
D (Dominant)	5.3	3.0	1.0

Group 1 (Sensitive)			Group 2 (Somewhat Sensitive)			Group 3 (Tolerant)		
0	(# of R's) x 5.0=	0	4	(# of R's)x3.2=	12.8	2	(# of R's) x 1.2 =	2.4
2	(# of C's) x 5.6 =	11.2	2	(# of C's)x3.4=	6.8	0	(# of C's) x 1.1=	0
1	(# of D's) x5.3=	5.3	1	(# of D's)x3.0=	3.0	1	(# of D's) x 1.0=	1.0
	Total:	16.5		Total:	19.6		Total:	3.4

Sum of Rating Value for Group 1		Sum of Rating Value for Group 2		Sum of Rating Value for Group 3		Rating Value for Site
16.5	+	19.6	+	3.4	=	39.5

Stream Quality Rating

Site	Score	Rating
	> 40	Good
IR 1 39.5	20-40	Fair
	< 20	Poor

Conclusions and Recommendations

The Rhodes, Ciana and Ickes Run watersheds are in generally good condition; the naturally reproducing brook and brown trout population is testament to this. But the stream and riparian zone are not pristine; and current, as well as historic land uses have had detrimental effects. The Bobs Creek Stream Guardians consider preserving and enhancing the wild brook trout fishery as the primary conservation management goal. The multiple strategies recommended to pursue this goal will also result in positive effects that can help to fulfill other needs in the Bobs Creek watershed, the Juniata River sub-basin, and, ultimately, the Chesapeake Bay.

Erosion and sedimentation problems result from road design and maintenance shortcomings, poor site planning with ongoing residential development, and inadequate storm water management methods. Increased runoff from roads and impacted areas in the upstream sections seem to have resulted in some channel instability Nutrient loading is probably less worrisome than many other watersheds in the region since there is relatively little agricultural land, but what exists (on Rhodes Run only) is in the headwaters and so its effects are evident through most of the stream length.

A tract of land containing the Lost Children of the Alleghenies Monument (Cox Monument) has unclear ownership at this time. Inadequate trail and site maintenance on this 2.5-acre plot contribute toward sedimentation problems in both Ciana and Rhodes Run. Guardian Run, a tributary to Rhodes Run, has anecdotally been attributed a major source of surface flow for Rhodes Run in low water years. The source of this run has not yet been mapped.

The following three pages list in order the goals that the Bobs Creek Stream Guardians believe need to be accomplished for a successful Coldwater Conservation Plan of Rhodes, Ciana and Ickes Runs.

Goal 1: Minimize Sediment Loading of Rhodes Run.

Objective 1: Improve design & maintenance of unpaved roads in Rhodes Run watershed.

- Action Step 1: Assist Pavia Township in identifying problem areas along Monument Road (TR 652) that route sediment-laden runoff into Rhodes Run.
- Action Step 2: Investigate, with assistance of Dirt and Gravel Road Center, best management practices to correct problems at identified sites.
- Action Step 3: Insure that current culverts are properly sized and sited to Prevent damage to roads during high flows.
- Action Step 4: Enact a maintenance program to preserve function of stormwater devices along Monument Road.
- Action Step 5: Investigate usage of detention/retention devices to manage flow to stream during weather events.

Objective 2: Reduce runoff from private roads, driveways, development sites and impervious surfaces.

- Action Step 1: Encourage Pavia Township to adopt recommendations of Bobs Creek and Dunning Creek Stormwater Management Plan and enact ordinance to manage runoff from land development, timber harvesting, etc.
- Action Step 2: Educate landowners in watershed problems resulting from Site runoff and stormwater management options (low-impact development).
- Action Step 3: Identify residential site to develop demonstration "pilot" Project for stormwater "Best Management Practices" BMPs (rain gutter diversion, rain garden, rain barrels pervious paving, etc.).
- Action Step 4: Partner with conservation district to provide erosion and sedimentation education (workshops) for timber harvesters and land developers.
- Action Step 5: Establish monitoring program for timber harvest operations
- Action Step 6: Stress conservation tillage practices in the watershed.

Objective 3: Reduce stream bank erosion caused by agricultural, and human impacts to the riparian zone.

- Action Step 1: Partner with producers, conservation district, Western Pennsylvania Conservancy, and other agencies to provide controlled livestock access to the stream through fencing stabilized crossings, watering systems, etc.
- Action Step 2: Partner with conservation district to provide workshop and/ or brochure for small property owners concerning stream-friendly landscaping practices.

Goal 2: Reduce Nutrient Loading of Rhodes Run.

Objective 1: Assist producers in watershed with best-management practice implementations.

- Action Step 1: Encourage all producers in watershed to develop nutrient management plans and to follow plan guidelines.
- Action Step 2: Stream bank fencing, etc. (see Goal 1, Objective 3, Action Step 1).
- Action Step 3: Encourage producers to use buffer zones during manure or fertilizer applications.

Objective 2: Eliminate Residential Nutrient Loading Sources.

- Action Step 1: Identify "gray water" sources of nutrients and raw sewage infiltrations.
- Action Step 2: Encourage elimination of above residential nutrient inputs through landowner and township official education, ordinance enactment, and enforcement.
- Action Step 3: Educate landowners on household and backyard practices that can reduce nutrient-laden runoff (see Goal 1, Objective 2, Action Step 3).

The Cox Monument with its story of "The Lost Children of The Alleghenies" is a popular tourist attraction along Ciana Run.

Goal 3: Improve Land Management Practices, Identify Critical Resource Areas, And Enhance Riparian Habitat.

Objective 1: Investigate management options to protect wild brook trout fishery of Rhodes, Ciana, and Ickes Runs (and other headwaters area).

- Action Step 1: Establish a population dynamics study to research areas times different habitats are utilized by adult and juvenile brook trout, prime spawning sites, etc. Determine critical habitat areas.
- Action Step 2: Initiate discussions with PA Fish and Boat Commission to determine if changes to regulatory status of fishery is a viable option for ensuring wild brook trout conservation.
- Action Step 3: Develop a public education campaign to educate anglers, and others that spend time in critical habitat areas about the importance of these habitats and how to avoid detrimental impacts to habitat, spawning trout, etc.

Objective 2: Stabilize trails and usage areas at Cox Monument site and enhance informational features.

- Action Step 1: Resolve ownership issue of the Cox Monument tract.
- Action Step 2: Identify local group to maintain trails and Cox site.
- Action Step 3: Work with trail groups, DCNR, etc, to identify "Best Management Practices" BMPs for Cox site.
- Action Step 4: Stabilize trails and use area including parking lot.
- Action Step 5: Develop and install signage to present story of the "Lost Children" as well as information on Rhodes, Ciana, and Ickes Runs. Have signage on stream improvement projects, narrow gauge railroad logging, homesteading, etc.

Objective 3: Investigate spring sources for Rhodes and Ickes Runs and tributaries, in particular springs supplying "Guardians Run".

- Action Step 1: Locate and map spring sources.
- Action Step 2:Encourage the landowner of Guardians Run springs to protect this area with a conservation easement.
- Action Step 3: Continue to monitor flow on Guardians Run.

Objective 4: Enhance riparian habitat at problem sites as identified during Stream Visual Assessment Protocols.

- Action Step 1: Consult with PA Fish and Boat Commission habitat section to assess in-stream habitat for adult and juvenile trout.
- Action Step 2: Develop a trout habitat enhancement plan as needed.
- Action Step 3: Plant appropriate native plants at sites identified to stabilize banks, provide shade and habitat, etc.

References

Alliance for Aquatic Resource Monitoring, Dickinson College. January 2004. Bobs Creek Stream Guardians Water Quality Monitoring Methods Manual.

Environmental Protection Agency, Office of Water. 1997. Volunteer Stream Monitoring: A Methods Manual.

Frear, Ned. 2002. The Lost Children. Frear Publishing, Inc. Bedford, PA

Juniata Clean Water Partnership. September 2000. Juniata Watershed Management Plan. Pennsylvania Rivers Conservation Program

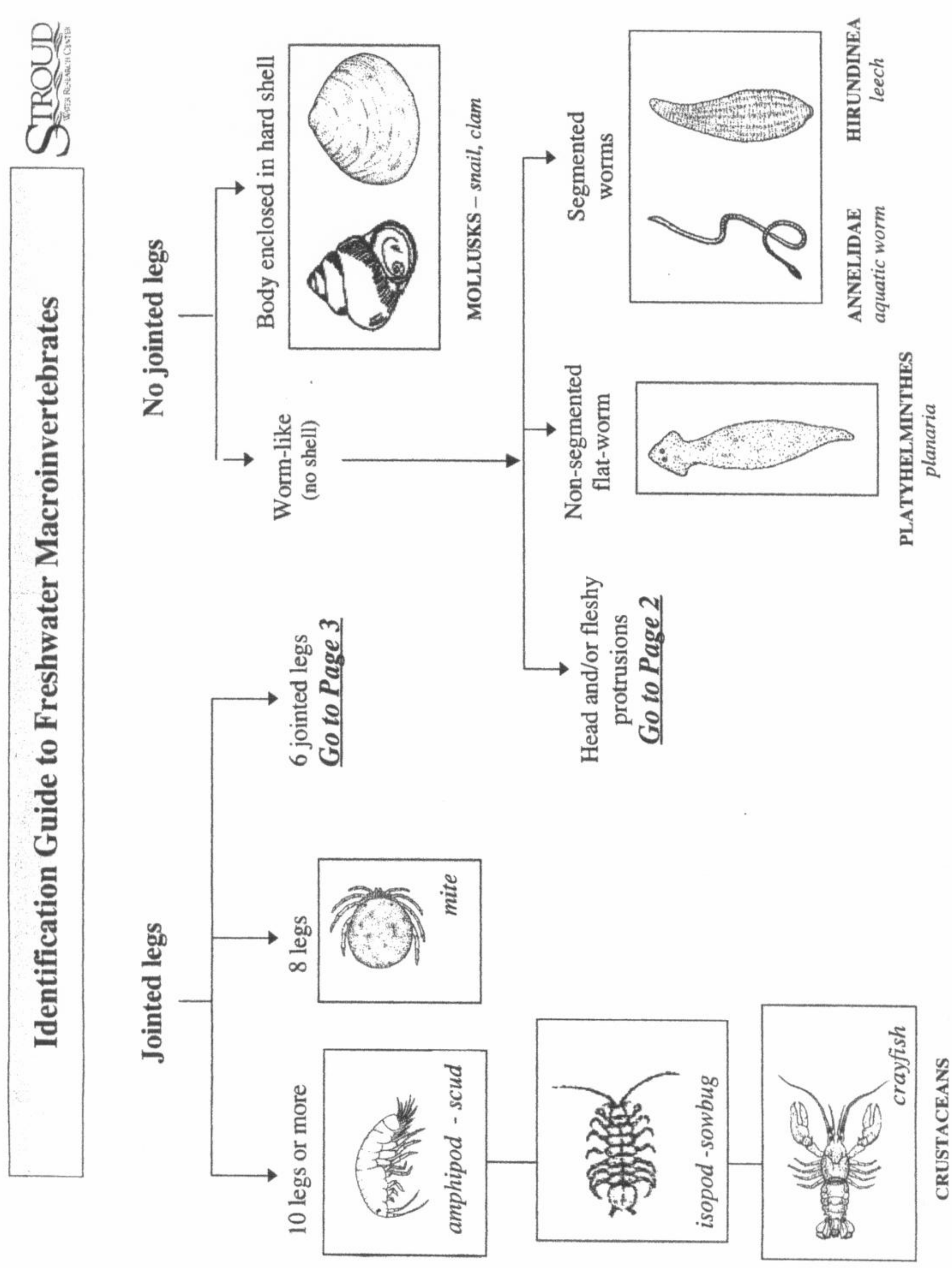
United States Department of Agriculture, Natural Resources Conservation Service. 1998. Soil Survey of Bedford County.

United States Department of Agriculture, Natural Resources Conservation Service. December, 1998. Stream Visual Assessment Protocol. National Water and Climate Center Technical Note 99-1.

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks, Environmental Education and Information Division. 2002. Watershed Education Teacher Manual.

Western Pennsylvania Conservancy. 1998. Bedford County Natural Heritage Inventory.

Appendix G



Identification Guide to Freshwater Macroinvertebrates
Jointed legs
No jointed legs
10 legs or more
8 legs
6 jointed legs
Go to Page 3
Body enclosed in hard shell
Worm-like
(no shell)
amphipod - scud
mite
MOLLUSKS – snail, clam
isopod -sowbug
Head and/or fleshy
protrusions
Go to Page 2
Non-segmented
flat-worm
Segmented
worms
crayfish
CRUSTACEANS
PLATYHELMINTHES
planaria
ANNELIDAE
aquatic worm
HIRUNDINEA
leech

Page 2

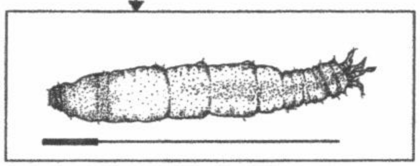
STROUD WATER RESEARCH CENTER

Worm-like with distinct head or fleshy protrusion

DIPTERA – *true flies*

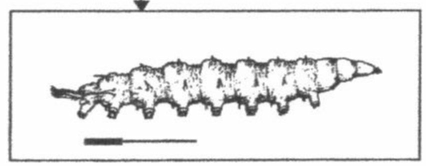
Head small, often hidden from view

- Fleshy protrusions at posterior end



TIPULIDAE
crane flies

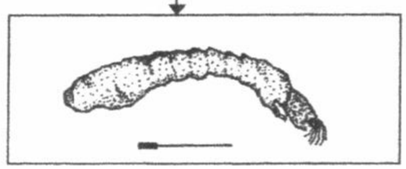
- 8 pairs of prolegs; posterior with 2 pointed protrusions longer than prolegs



ATHERICIDAE
water snipe flies

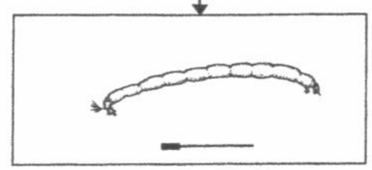
Distinct head

- One end wider than the other



SIMULIIDAE
black flies

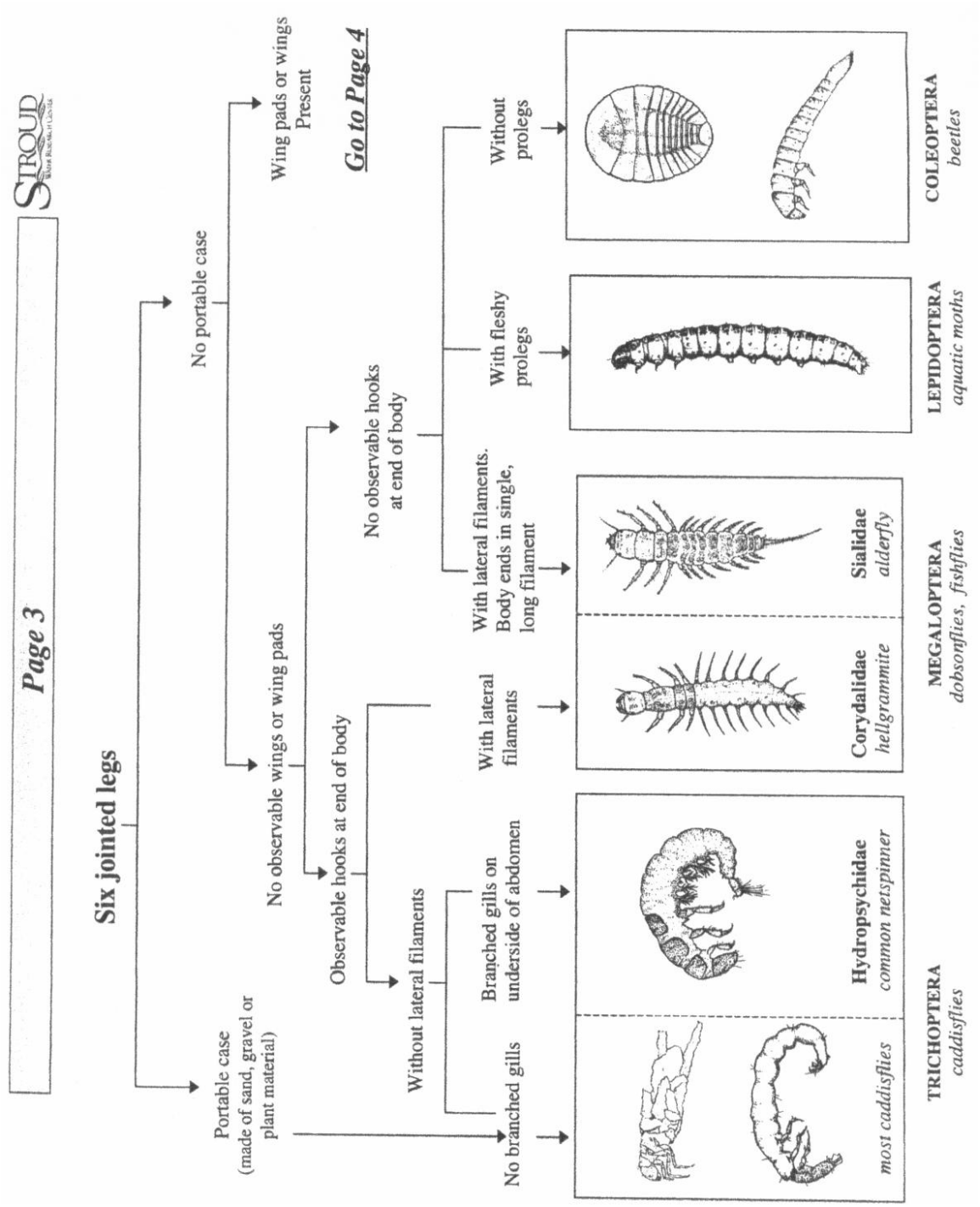
- Both ends similar width



CHIRONOMIDAE
midges

Approximate size range
Minimum — maximum

Appendix G

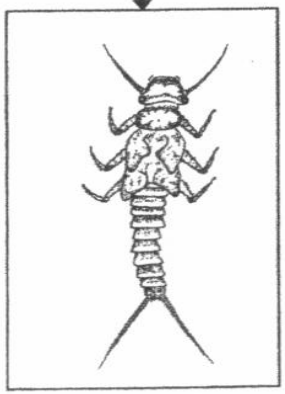

Page 3
STROUD
Six jointed legs
Portable case
(made of sand, gravel or plant material)
No branched gills
Without lateral filaments
Observable hooks at end of body
No observable wings or wing pads
No portable case
Wing pads or wings
Present
Go to Page 4
Branched gills on underside of abdomen
With lateral filaments
No observable hooks at end of body
With lateral filaments. Body ends in single, long filament
With fleshy prolegs
Without prolegs
Hydropsychidae
common netspinner
most caddisflies
TRICHOPTERA
caddisflies
Corydalidae
hellgrammite
Sialidae
alderfly
MEGALOPTERA
dobsonflies, fishflies
LEPIDOPTERA
aquatic moths
COLEOPTERA
beetles

STROUD WATER RESEARCH CENTER

Wing pads or Wings present

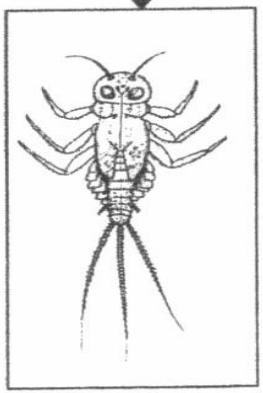
With tail filaments

Two tail filaments, without abdominal gills



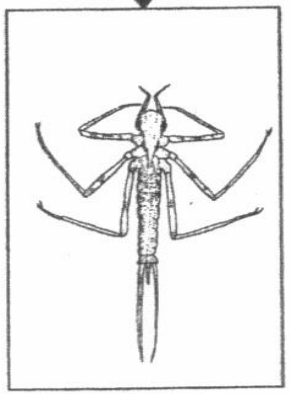
PLECOPTERA
stoneflies

Two or three tail filaments, with abdominal gills



EPHEMEROPTERA
mayflies

Three flat tail filaments, without abdominal gills

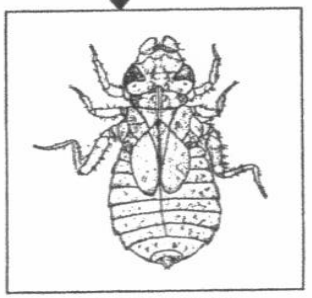


ODONATA
damselflies

Without tail filaments

Wing pads

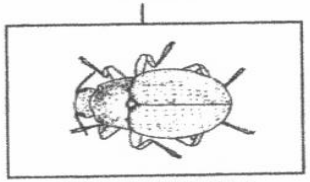
Large mouth, hinged



ODONATA
dragonflies

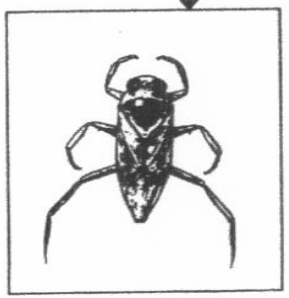
Wings

Hard wing coverings with centerline



COLEOPTERA
adult beetles

Wings leathery, tips overlapping



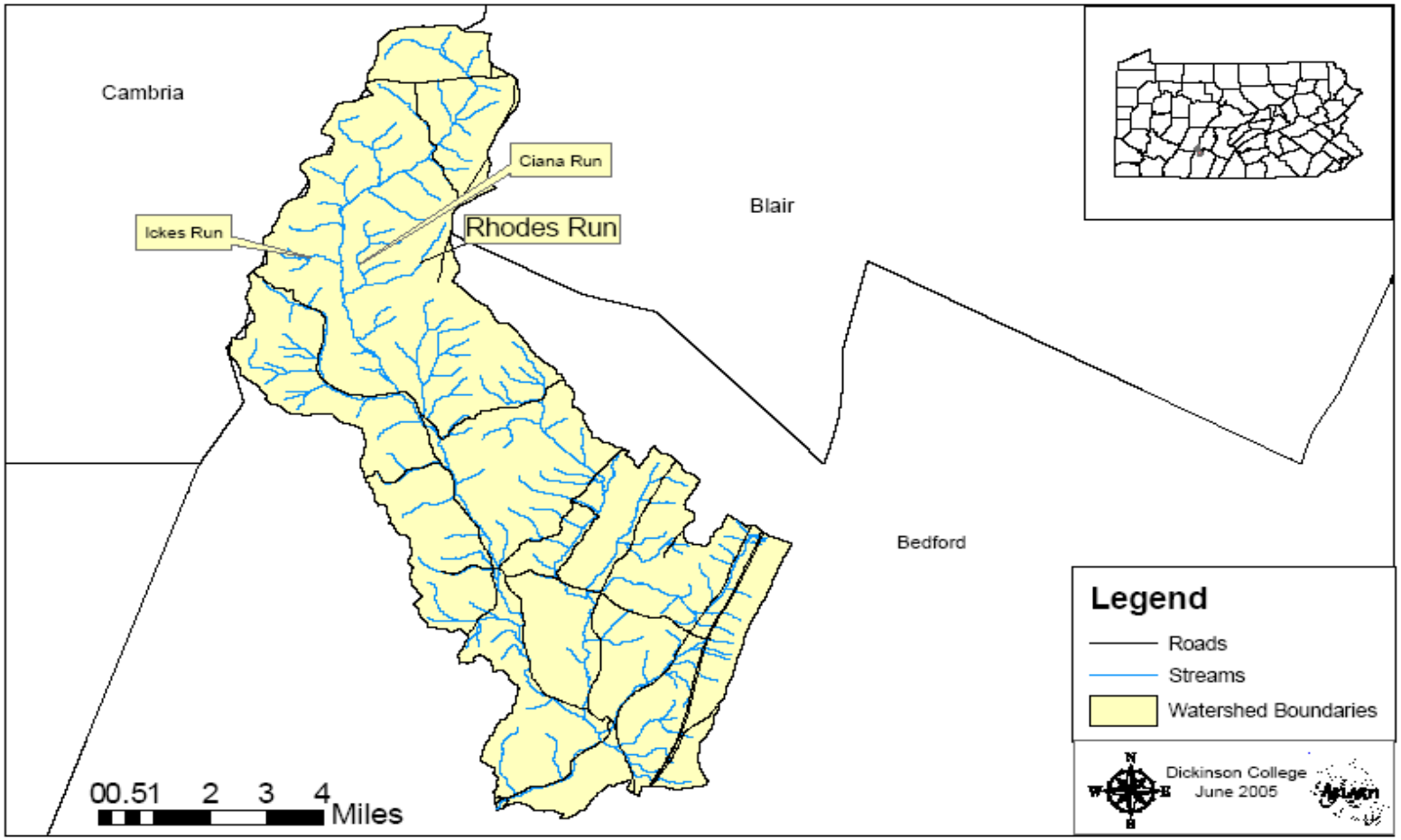
HEMIPTERA
true bugs

Appendices

Appendix A

Appendix A

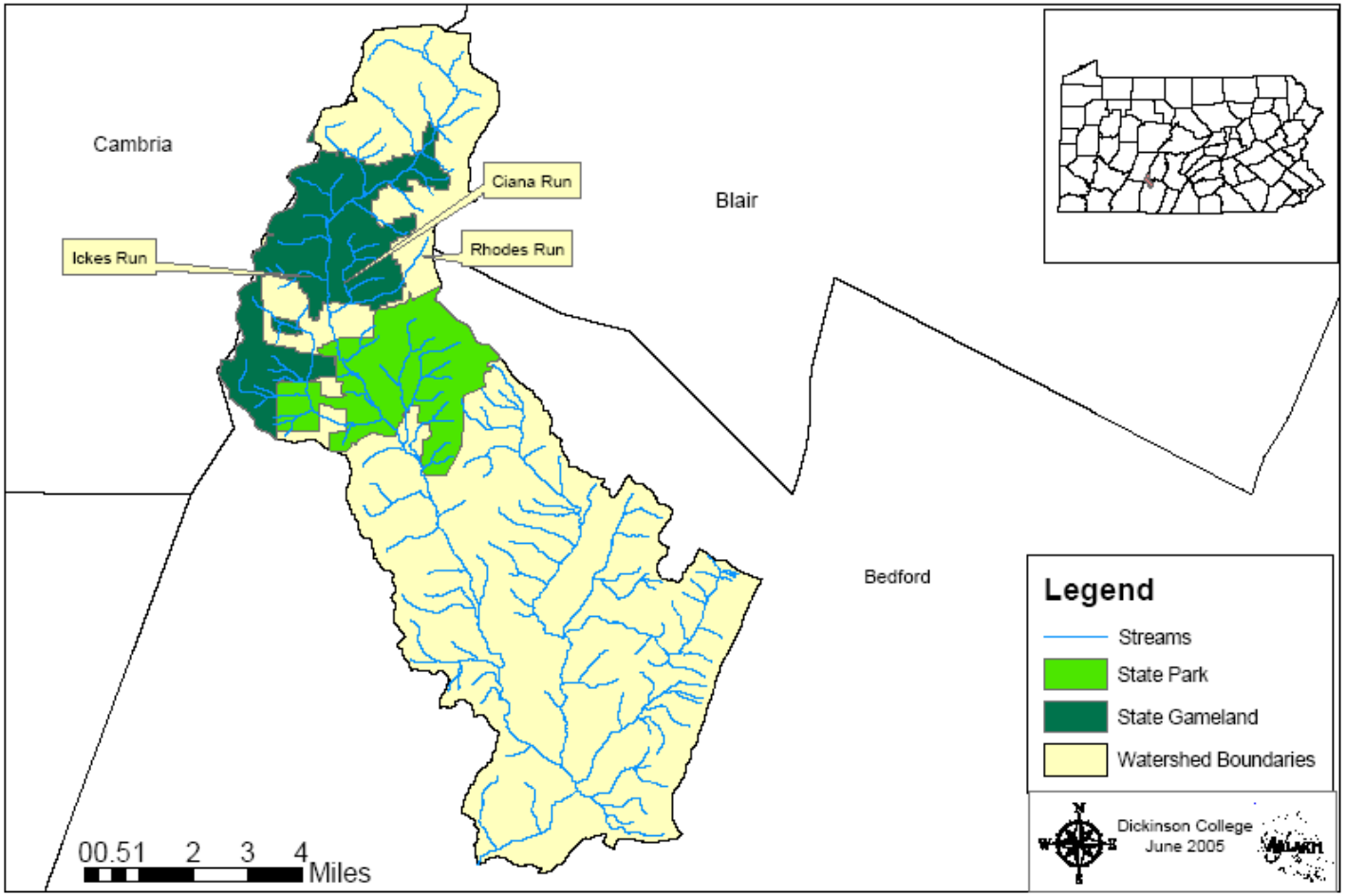
Bob's Creek Watershed



Appendix A

Appendix A

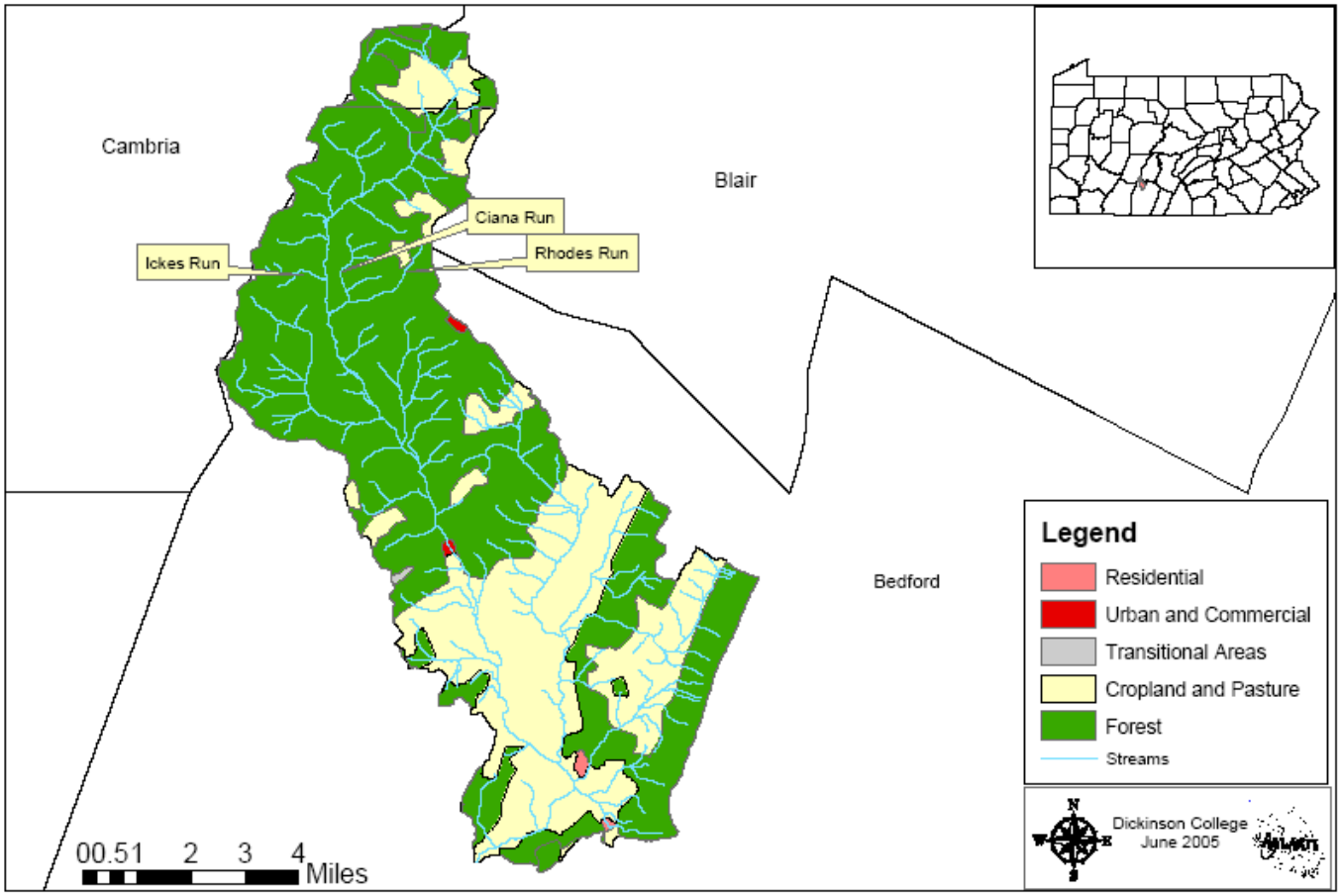
Bob's Creek Watershed: Areas of Conservation



Appendix A

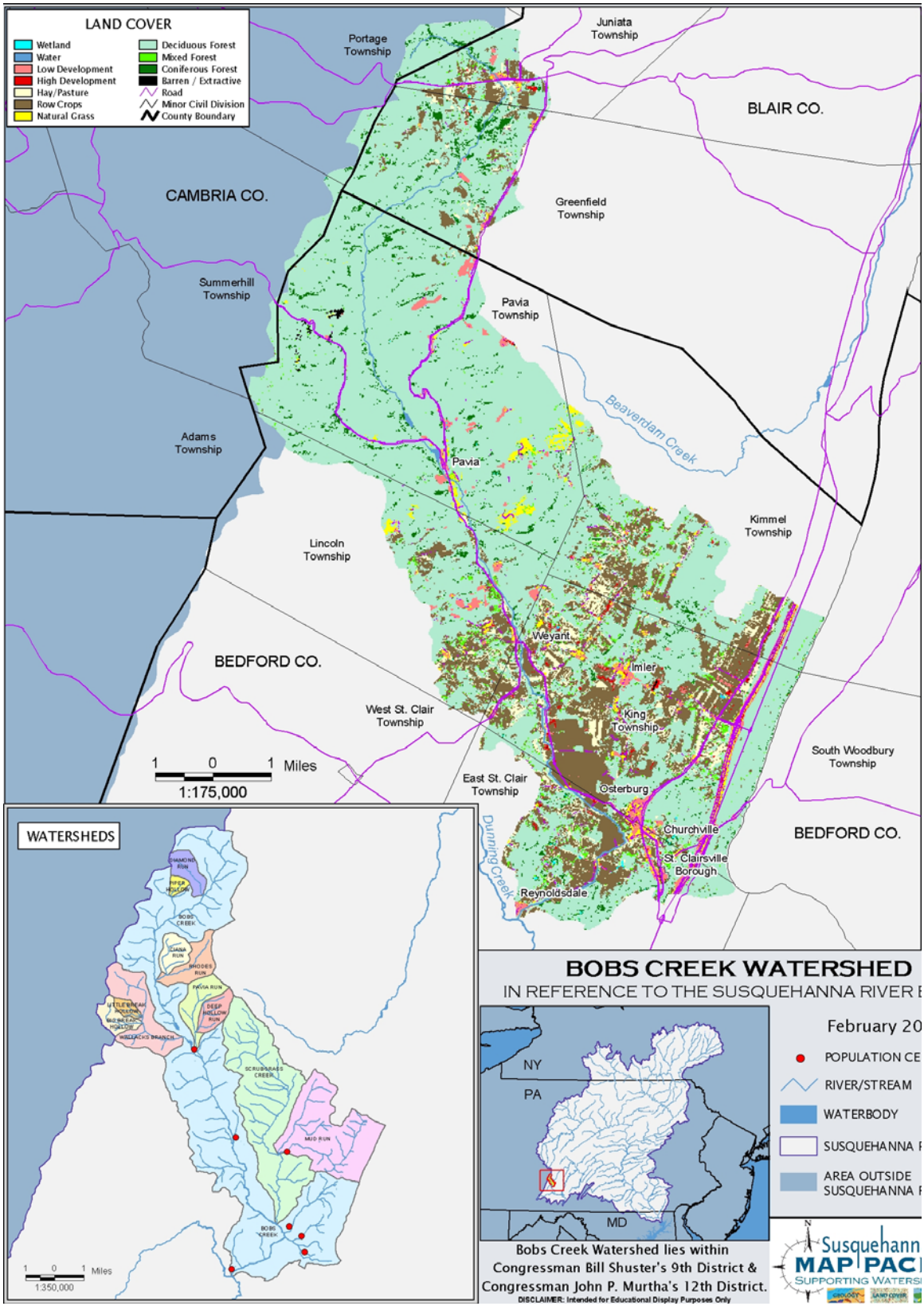
Appendix A

Bob's Creek Watershed: Landuse



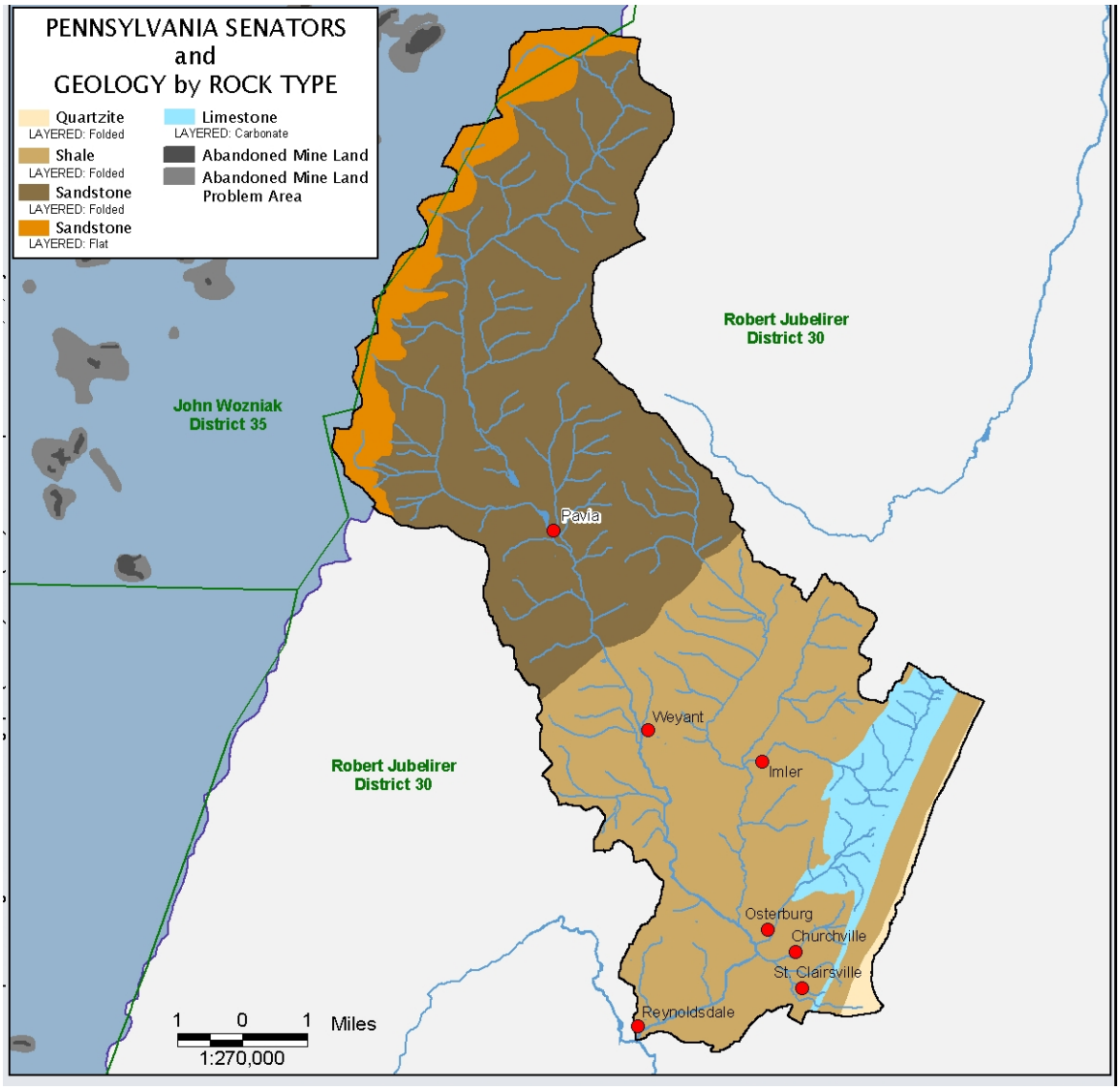
Appendix A

Appendix A


LAND COVER
Wetland
Water
Low Development
High Development
Hay/Pasture
Row Crops
Natural Grass
Deciduous Forest
Mixed Forest
Coniferous Forest
Barren / Extractive
Road
Minor Civil Division
County Boundary
Portage Township
Juniata Township
BLAIR CO.
CAMBRIA CO.
Greenfield Township
Summerhill Township
Pavia Township
Beaverdam Creek
Adams Township
Pavia
Kimmel Township
Lincoln Township
Weyant
BEDFORD CO.
Imler
West St. Clair Township
King Township
South Woodbury Township
1 0 1 Miles
1:175,000
East St. Clair Township
Osterburg
Churchville
BEDFORD CO.
St. Clairsville Borough
Dunning Creek
Reynoldsdale
WATERSHEDS
BOBS CREEK WATERSHED
IN REFERENCE TO THE SUSQUEHANNA RIVER
February 20
POPULATION CE
RIVER/STREAM
WATERBODY
SUSQUEHANNA
AREA OUTSIDE SUSQUEHANNA
NY
PA
MD
Bobs Creek Watershed lies within Congressman Bill Shuster's 9th District & Congressman John P. Murtha's 12th District.
DISCLAIMER: Intended for Educational Display Purposes Only
Susquehann
MAP PAC
SUPPORTING WATERS

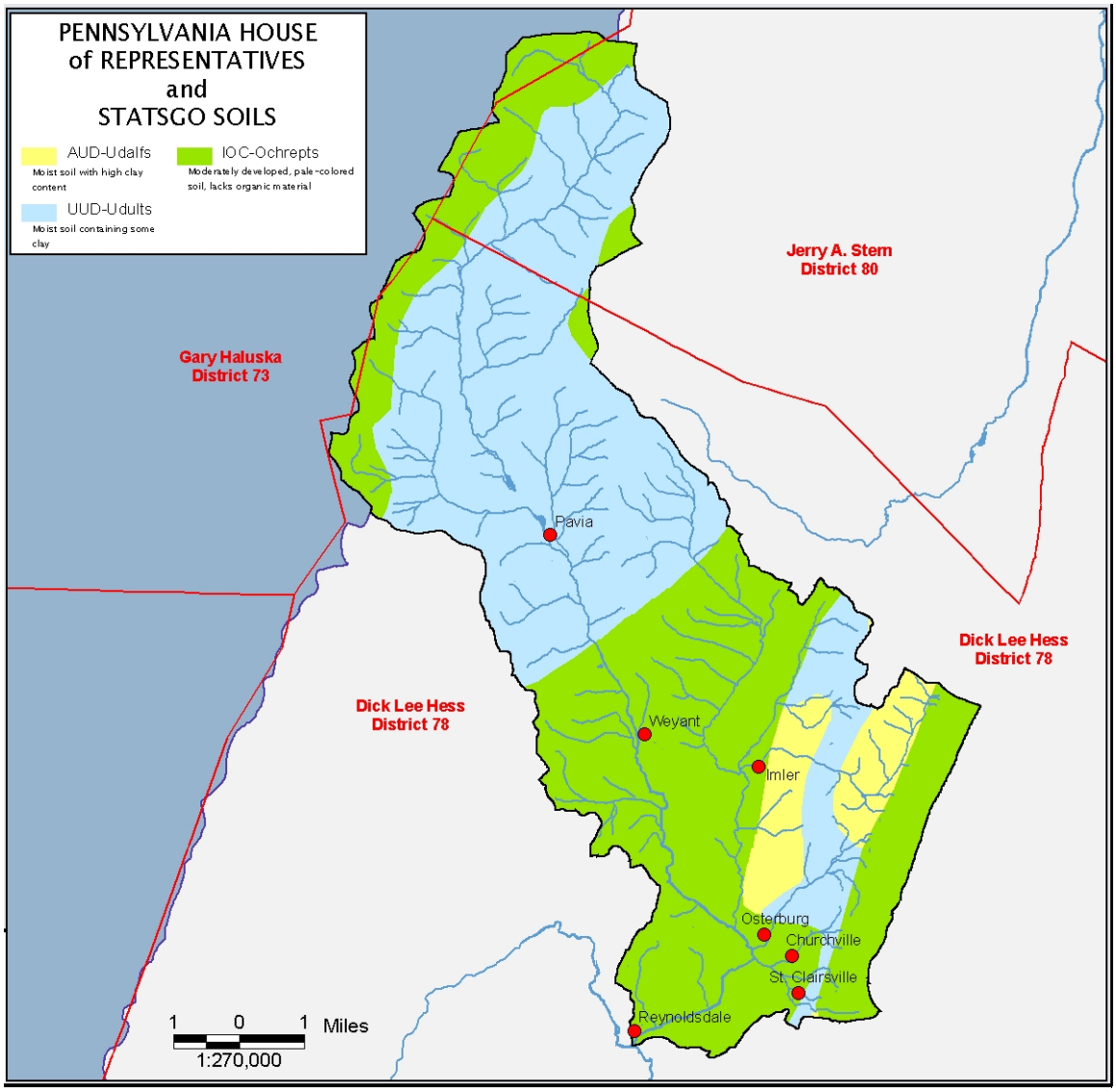
Appendix A

Appendix A


PENNSYLVANIA SENATORS
and
GEOLOGY by ROCK TYPE
Quartzite
LAYERED: Folded
Shale
LAYERED: Folded
Sandstone
LAYERED: Folded
Sandstone
LAYERED: Flat
Limestone
LAYERED: Carbonate
Abandoned Mine Land
Abandoned Mine Land
Problem Area
John Wozniak
District 35
Robert Jubelirer
District 30
Robert Jubelirer
District 30
Pavia
Weyant
Imler
Osterburg
Churchville
St. Clairsville
Reynoldsdale
1 0 1 Miles
1:270,000

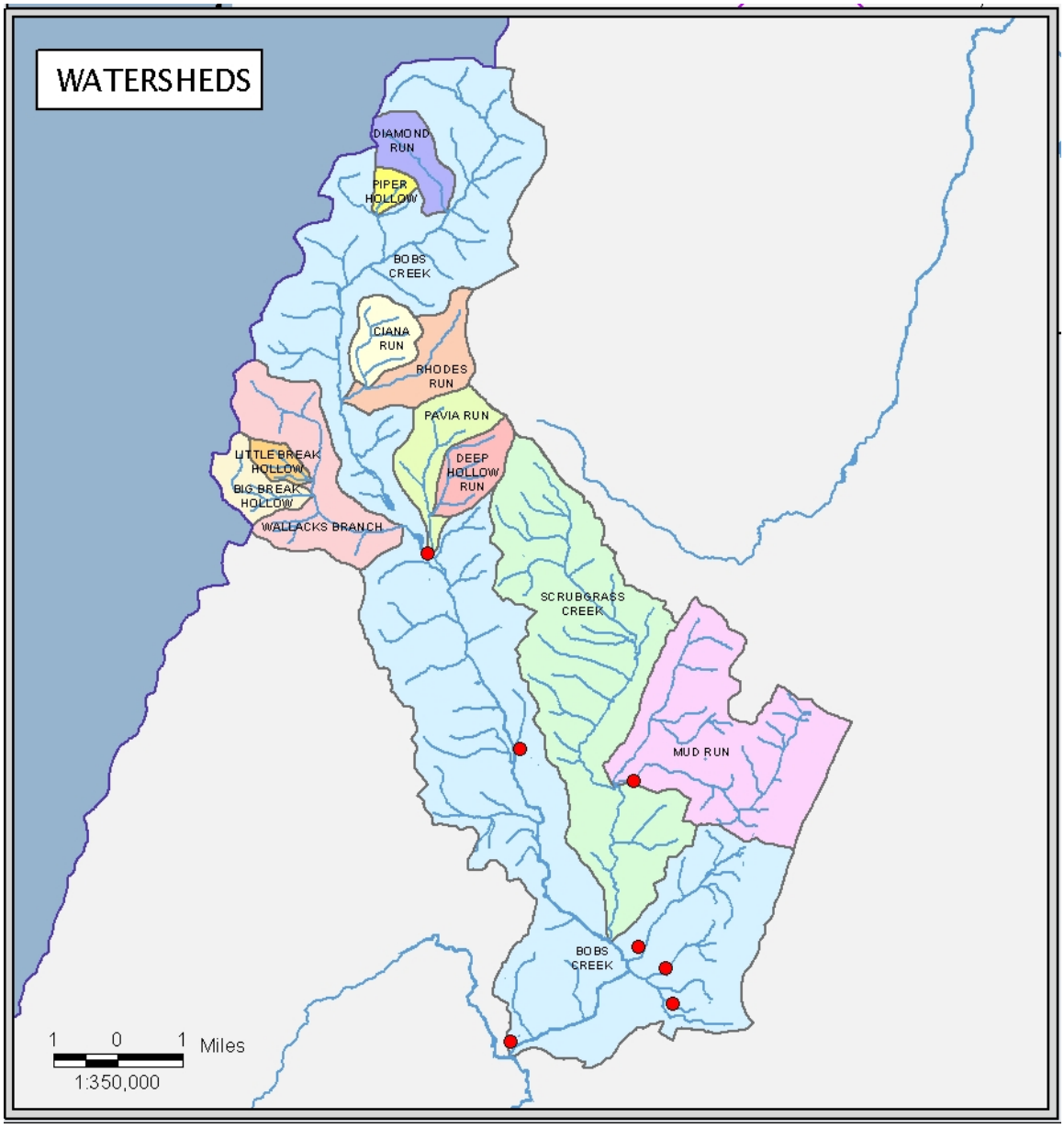
Appendix A

Appendix A


PENNSYLVANIA HOUSE
of REPRESENTATIVES
and
STATSGO SOILS
AUD-Udalfs
Moist soil with high clay content
IOC-Ochrepts
Moderately developed, pale-colored soil, lacks organic material
UUD-Udults
Moist soil containing some clay
Jerry A. Stern
District 80
Gary Haluska
District 73
Dick Lee Hess
District 78
Dick Lee Hess
District 78
Pavia
Weyant
Imler
Osterburg
Churchville
St. Clairsville
Reynoldsdale
1 0 1 Miles
1:270,000

Appendix A

Appendix A


WATERSHEDS
DIAMOND RUN
PIPER HOLLOW
BOBS CREEK
CIANA RUN
RHODES RUN
PAVIA RUN
DEEP HOLLOW RUN
LITTLE BREAK HOLLOW
BIG BREAK HOLLOW
WALLACKS BRANCH
SCRUBGRASS CREEK
MUD RUN
BOBS CREEK
1 0 1 Miles
1:350,000

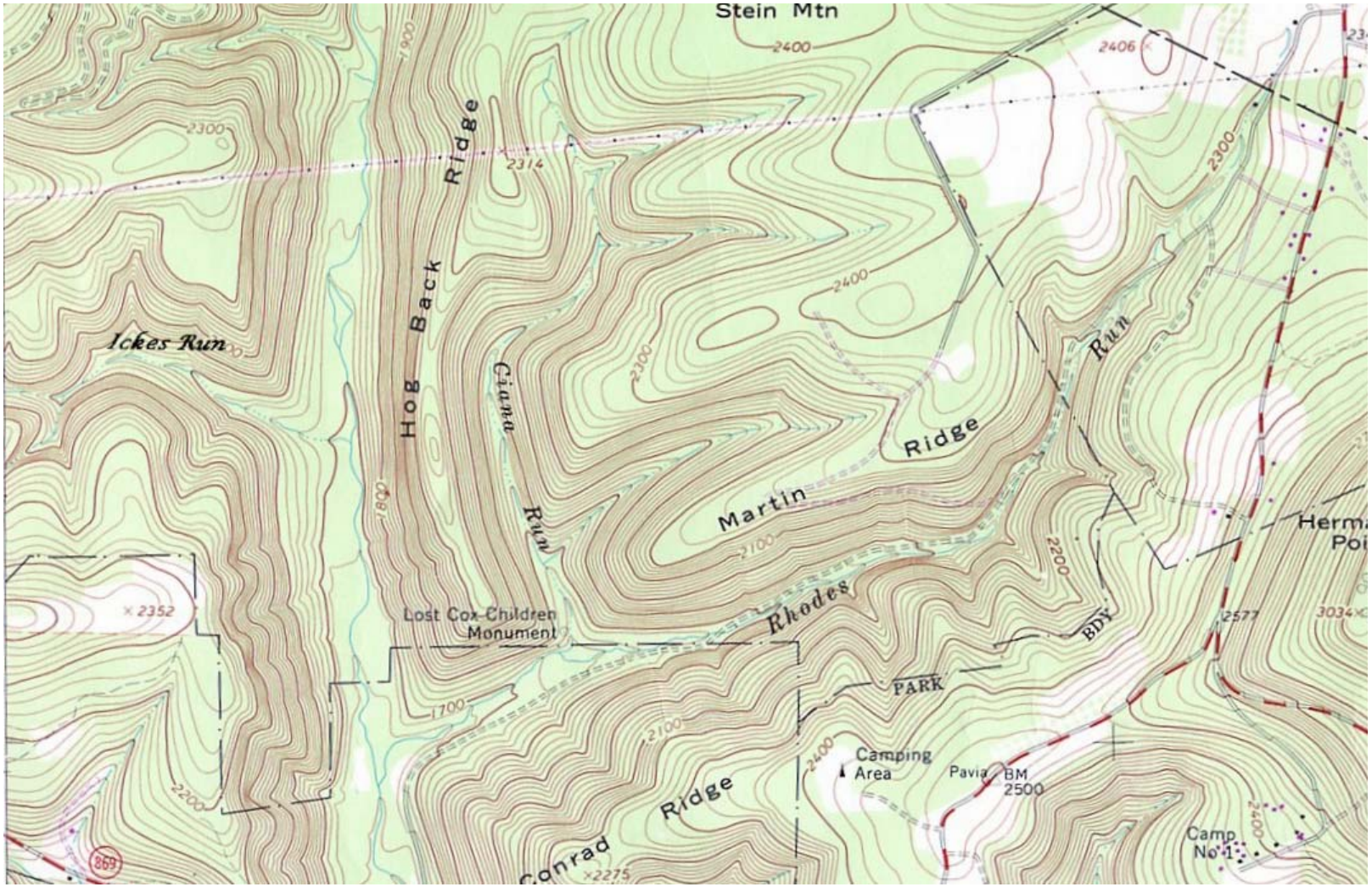
Appendix A

Appendix A

Location of Bobs Creek Watershed in Susquehanna River Basin

Appendix A

Appendix A



Topographic detail of Study Area from Blue Knob 7.5” Quadrangle

Appendix A

Bobs Creek Trout Fishery Today

1) Stream and Zones of Interest (from Drainage List)	**2)** Water Uses Protected (from Drainage List)
Pennsylvania Fish and Boat Commission	
Source to Township Road	Management Unit 1, Class B Trout Waters
Township Road to junction Rhodes Run	Management Unit 2, Class A Wild Trout
Rhodes Run to lower park boundary at Pavia	Management Unit 3, Class B Trout Waters
Park boundary to junction with Dunnings	Management Unit 4, Class B Trout Waters
Department of Environmental Protection Chapter 93	
Source to Pavia Run/Deep Hollow	High Quality Cold Water Fishery
Pavia Run to junction with Dunnings	Cold Water Fishery

Appendix C

Water Body	**Dominating Land Use**	**Township**
Bob's Creek	Forest	Pavia, East St. Clair, Kimmel, Lincoln, King, Greenfield, Juniata, Portage
Osterburg Run	Agricultural	East St. Clair
Scrubgrass	Meadow	King, Kimmel
Mud Run	Agricultural	King, Kimmel
Garmen Run	Agricultural	King
McDonald Run	Meadow	King
Burkett Run	Agricultural	Pavia
Pavia Run	Forest	Pavia
Deep Hollow Run	Forest	Pavia
Big Break Hollow	Forest	Pavia
Little Break Hollow	Forest	Pavia
Wallack's Branch	Forest	Pavia
Rhodes Run	Forest	Pavia
Ickes Run	Forest	Pavia
Mock Run	Forest	Pavia
Little Cedar	Forest	Pavia
Big Cedar	Forest	Pavia
Piper Hollow	Forest	Greenfield
Diamond Run	Forest	Greenfield
Ciana Run	Forest	Pavia
Stombaugh Run	Forest/Agricultural	Greenfield
Walter Hollow	Agricultural	Lincoln

Appendix D

Watershed Studies

Watershed studies that have been accomplished on Bobs Creek include the following:

- Donnley (1941) conducted a biological survey in Bedford/Blair counties on portions of Bobs Creek. Alkalinity and total hardness reflect the relatively infertile low carbonate geology of the stream.

- PA Fish and Boat Commission investigated water quality and fishery (1981) for classification on Bobs Creek. All management section will be Class B trout waters. Report by Jackson and Roscinski 1982.

- An (1991) aquatic biological investigation of tributaries of Bobs Creek was accomplished by Robert Schott, Water Pollution Biologist, Bureau of Water Quality. Report is dated February 1992.

- Bobs Creek, basin source to Deep Hollow has water use protection as "High Quality Cold Water Fishery." Deep Hollow Run, basin has water use protection as "High Quality Cold Water Fishery. "Deep Hollow Run to mouth has water use protection as "Cold Water Fishery." All on page 93-117, Title 25, dated August 14, 1999.

- PA Fish and Boat Commission, conducts July survey and report dated February 2002 on Bobs Creek 711C Section 2. Management report by L. L. Jackson, T. A. Wilson and J. E. Daum. Section 2 should be managed as a mixed fishery wild trout with no stocking of hatchery trout.

- PA Fish and Boat Commission conducts July survey which finalizes a wild trout fishery from the mouth of Rhoades Run to LR 07002 cross Bobs Creek from the Mt. Hope Church.

USGS Assessments 1998

Appendix E

Water Monitoring Sheet
Bob's Creek Watershed

Monitor's Name: _____ **Phone:** _____

Site Number: _____

Date: _____

Air Temperature: _____ °C

Weather Conditions: Clear Partly Cloudy Cloudy Rain Snow

Water Color: Clear Milky Muddy

Stream Bed Coating: Orange/Red Yellowish Green Black

Brown None Other: _____

Stream Flow: Low Moderate High

Parameter	**Units**	**Test# 1**	**Test #2**	**Test #3(if necessary)**
Water Temperature	°C			
Lamotte Dissolved Oxygen Kit #5860	mg/l			
Hach Nitrate Kit #NI-14	mg/l			
Lamotte pH				
Lamotte Turbidity Kit #7519	JTU's			
Hach Orthosphosphate Kit #PO-19	mg/l			
Lamotte Alkalinity	ppm			

Appendix E

"Ickes" Run
July 15, 2003
Macroinvertebrates

TAXA	Station 1
Decapoda (Crayfish)	
Cambaridae	X
Ephemeroptera (Mayflies)	
Baetis	X
Drunella	X
Epeorus	X
Paraleptophlebia	X
Stenacron	X
Stenonema	X
Odonata (Damselflies and Dragonflies)	
Lanthus	X
Plecoptera (Stoneflies)	
Acroneuria	X
Amphinemura	X
Haploperla	X
Leuctra	X
Pteronarcys	X
Suwallia	X
Trichoptera (Caddisflies)	
Diplectrona	X
Dolophilodes	X
Polycentropus	X
Rhyacophila	X
Diptera (Flies and Midges)	
Chironomidae	X
Hexatoma	X
TOTAL TAXA	20
EPT TAXA	16

Rhodes Run
July 15, 2003
Macroinvertebrates

TAXA	Station 1	Station 2
Turbellaria (Flatworms)	X	X
)ligochaeta (Worms)		X
Decapoda (Crayfish)		
Cambaridae	X	X
Ephemeroptera (Mayflies)		
Baetis	X	X
Drunella	X	X
Epeorus	X	X
Ephemera		
Ephemerella		X
Heptagenia		
Leucrocuta	X	
Paraleptophlebia	X	X
Stenonema	X	
Odonata (Damselflies and Dragonflies)		
Lanthus	X	
Plecoptera (Stoneflies)		
Acroneuria		
Amphinemura	X	
Haploperla	X	
Isoperla		X
Leuctra	X	X
Peltoperla	X	X
Pteronarcys		X
Remenus		X
Yugus	X	
Megaloptera (Dobsonflies, Fishflies, and Alderflies)		
Nigronia		X
Trichoptera (Caddisflies)		
Diplectrona	X	X
Dolophilodes	X	X

Glossosoma		X
Hydropsyche		
Neophylax	X	X
Polycentropus		
Pycnopsyche	X	X
Rhyacophila	X	X
Diptera (Flies and Midges)		
Atherix		X
Chelifera		
Chironomidae	X	X
Dicranota		
Dixa	X	
Hexatoma	X	
Simulium		
Tipula		X
TOTAL TAXA	22	23
EPT TAXA	16	16

Appendix H

The Lost Children of the Alleghenies

Near the junction of Ciana Run and Rhodes Run stands a monument marking the site where the lost Cox children were found in 1856. Erected by public subscription, the monument commemorates an event that had never been fully explained.

On the morning of April 24, 1856, Samuel Cox took his gun toward the sound of the family dog's barking while his wife Susannah busied herself about the homestead. During these brief moments while both parents were occupied with their tasks, the two young sons of Samuel and Susannah vanished. The boys, George (seven) and Joseph (five), had wandered off into the woods and didn't respond to their parents' repeated calls. Samuel made his way to the house of his nearest neighbors to enlist their aid. One neighbor set out on horseback to enlist more help from all the farmers scattered for miles around. By nightfall, more than a hundred people were searching the woods for the boys, with no success.

At daybreak when the search began again, searchers were hopeful of finding the boys in good condition since it had been a warm night for the season. But even with additional volunteers, the search party again came to the end of the day without finding George and Joseph. For the next ten days, even though the number of searchers swelled to over a thousand, the boys could not be located. The parents became so desperate that they asked a local dowser and a reputed witch to help; neither could.

Soon, suspicions turned on Samuel and Susannah Cox themselves as several people accused them of doing away with their own children. The floor of the family's shack was torn up and the yard around the home was dug up, in an attempt to prove the theory, but nothing was found. Rumors and accusations pointed at other supposed 'kidnappers'; Masons, Catholics, various foreigners all were lamed. This was the era of the Know-Nothing Party and other xenophobic groups. These attitudes and beliefs held sway among many in the isolated villages and homesteads of the region. Church congregations in the area were known to participate in 'pow wows' and witchcraft was often an explanation for the strange or unusual.

It was at this time that a farmer named Jacob Dibert, who lived about 12 miles distant from the Cox's, had an odd dream. In it, he was searching alone for the children in a section of the woods that he had never seen before. As he walked forward he discovered a dead deer just past it. He stepped over the body and followed a deer trail until he found a child's shoe; beyond that was a fallen beech tree which allowed him to cross a stream. Next he came to a stony ridge that led into a ravine with a small brook; and there, in the shelter of a semi-circle formed by the roots of a birch tree, he found the boys... dead.

Dibert told his wife about the dream, and they decided to keep it to themselves; but when the dream repeated itself on the following two nights, they decided to tell Mrs. Dibert's brother, Harrison Whysong, about it. Whysong was familiar with the area the boys had disappeared in, and there were similarities between this area and Jacob's dream. So the two men went to the area and began to search; five minutes later, they found a dead

deer... exactly as in the dream. Then the child's shoe... the beech tree over a creek... the stony ridge... and the birch tree. At the roots of the birch tree they found the boys, George and Joseph Cox, dead of exposure. The boys were buried in Mt. Union Cemetery in Lovely on May 8, 1856. In 1906, on the fiftieth anniversary of the tragedy, the stone monument was erected near the site the bodies were found so that the strange event would never be forgotten.