

Fry's Run Coldwater Heritage Plan

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Prepared For:

Fry's Run Watershed Association

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Executive Summary

Fry's Run is a tributary to the Delaware River located in the southern half of Williams Township in Northampton County, Pennsylvania. The Fry's Run watershed is a scenic, limestone valley surrounded and defined by ridges and characterized by a gently rolling landscape. The watershed basin has a drainage area of 6.1 square miles and contains 16.3 stream miles. There are no major populations centers in the watershed; it is mostly agricultural land and low-density residential development.

The current Chapter 93 designation of Fry's Run is a High Quality-Cold Water Fishery and a Migratory Fishery. This designation requires that permitted discharges to the stream meet water quality criteria designed to protect a high quality-cold water aquatic community. Fry's Run is also listed on the 2006 Class A Wild Trout Waters list issued by the PA Fish and Boat Commission from "spring 1530 m upstream of the Delaware River to the mouth."

The overall water quality of the stream is very good to excellent. However, water quality concerns include lack of forested riparian buffer along the stream, high coliform bacteria counts detected in previous water quality investigations, and damage due to flooding.

Based on the findings in this report, the Fry's Run Watershed Association will implement the following next steps to protect the watershed:

- 1) Develop and implement an environmental education and outreach program that will focus on supporting the proposed recommendations.
- 2) Perform macroinvertebrate assessment, additional coliform monitoring, and continue water quality monitoring to further determine the health of Fry's Run and assess further protective measures that may be needed.
- 3) Support land preservation efforts that protect water resources and preserve and enhance sense of place.
- 4) Pursue creative and innovative ways to encourage landowners to protect and restore/establish protective forested riparian buffers. There are federal funding sources available through the USDA's Natural Resource and Conservation Service for stream-bank fencing and restoration that may be used to compensate farmers for widening buffers. The Fry's Run Watershed Association will cooperate with the USDA's Natural Resource and Conservation Service to work with the local farming community.
- 5) Support existing municipal ordinances that are protective of water quality such as the new stormwater ordinance recently adopted by the township. Review the model floodplain and riparian buffer (currently in progress) ordinance put together by LVPC.

- 6) Pursue funding to implement the proposed recommendations. Funding sources that will be considered include the Pennsylvania Growing Greener Program through PADEP or PADCNR, private foundations, and cooperating organizations.

Introduction

The Fry's Run Coldwater Heritage Plan addresses the potential problems and resource protection and enhancement opportunities for the Fry's Run watershed, located in lower Northampton County, Pennsylvania. This plan is the first conservation plan developed for the watershed focused on water resources. Implementation of this plan's recommendations will benefit the preservation and protection of Fry's Run, which is both a High Quality-Cold Water Fishery and a Migratory Fishery. Fry's Run is also listed on the 2006 Class A Wild Trout Waters list issued by the PA Fish and Boat Commission from "spring 1530 m upstream of the Delaware River to the mouth."

Funding for this plan has been provided through a grant from the Coldwater Heritage Partnership Program to the Northampton County Conservation District (NCCD). NCCD submitted the grant application in partnership with the Fry's Run Watershed Association. The mission and goals of the watershed organization are to protect, preserve, and improve the quality of water and land resources in the Fry's Run Watershed. Completion of this plan was a partnership effort among the Fry's Run Watershed Association, the Northampton County Conservation District, Williams Township, and the local community.

This Coldwater Heritage Plan provides a description of the watershed; discusses the unique and outstanding values of the watershed; reviews historical and on-going conservation efforts and studies in the watershed; discusses the overall water quality of the watershed; describes some of the water quality concerns; and provides recommendations and next steps for enhancing the coldwater resources within the watershed. This plan is the first step toward improving the health of the Fry's Run coldwater ecosystem. The plan will be used as a basis for future funding, more detailed watershed studies, environmental education, and restoration and implementation efforts.

Description of Watershed

Fry's Run is a tributary to the Delaware River located in the southern half of Williams Township in Northampton County, Pennsylvania. The stream flows generally east through Stouts Valley to its confluence with the Delaware River (Map 1), approximately 6 miles southwest of Easton. It is a scenic, limestone valley surrounded and defined by ridges and characterized by a gently rolling landscape. The watershed basin has a drainage area of 6.1 square miles and contains 16.3 stream miles. There are no major population centers in the watershed, and it is mostly agricultural land and low-density residential development (Map 2). (Note that Map 2 shows existing land use in the watershed based on data from the Lehigh Valley Planning Commission and may not be representative of actual land use.) Map 3 shows all 643 land parcels in the watershed.

The current Chapter 93 designation of Fry's Run is a High Quality-Cold Water Fishery (HQ-CWF) and a Migratory Fishery. This designation requires that permitted discharges to the stream meet water quality criteria designed to protect a high quality-cold water aquatic community. Fry's Run is also listed on the 2006 Class A Wild Trout Waters list

issued by the PA Fish and Boat Commission from “spring 1530 m upstream of the Delaware River to the mouth.” Currently there are no permitted discharges to Fry’s Run.

The watershed is at the northern edge of the Northern Piedmont/Lower New England province, which extends from northern Virginia to southwestern Maine. The elevation high is about 1005 feet, and the low is about 121 feet (Map 4). Geologically, the Fry’s Run Watershed is essentially a valley composed of Ordovician-Cambrian dolomites and limestone, surrounded by ridges of older Precambrian metamorphosed bands of largely igneous rock (Map 5). The landscape and underlying geology have influenced much of the valley’s historical agricultural land use in the valley. Much of the steep slopes and ridges are wooded. Map 6 shows the slopes in the watershed.

Gladstone and Washington soils make up most of the soils in the watershed (Map 7). They are mostly deep, well-drained, loamy soils. Gladstone soils are found over virtually all of the watershed’s slopes and ridges. These soils are class 7 and unsuitable for agriculture. The Washington soils are found over much of the valley floor and are some of the most productive agricultural soils in the region. They are considered Class 1 and 2 agricultural soils.

The general forest type in the area can be describe as a ‘dry oak-mixed forest’ comprised of second growth hardwoods. Map 8 shows the woodlands in the watershed. About 2.7 square miles or about 44% of the watershed are woodlands. The primary tree species associated with this forest type are white, northern red, chestnut, and black oak, sweet birch, hackberry, red and sugar maple, white ash, and basswood. The under story typically consists of hornbeam, shadbush, flowering dogwood, redbud, and hopbeam.

Existing zoning for the township is shown in Map 9. In recent years, there has been an increase in development of agricultural fields and ridges in Williams Township. LVPC has estimated that in 2005, the land use in Williams Township was divided as 31.7% residential, 0.3% commercial, 0.5% industrial, 7.1% transportation and utilities, 1% public space, 5.2% parks and recreation, and 54.2% agricultural land. They have estimated the population change from 2000 to 2006 at about 34%. This is in contrast to LVPC's estimate of population change in Williams Township from 1990 to 2000, which was estimated at about 12.3%. From 2005 through 2030, LVPC estimates that the population change in the township will increase about 45%, so the current rate of development is expected to increase. It should be noted that the demographic data put together by the planning commission is for the whole township. Most of the existing development in the township is occurring to the north, outside of the watershed area. However, the Lehigh Valley Planning Commission did note in their 2007 greenways plan that a substantial amount of residential development has taken place in the eastern portion of the Fry’s Run watershed (LVPC, 2007).

Unique and Outstanding Values of the Watershed and Stream

Springs, Wetlands, and Groundwater

Fractures and solution channels in carbonate areas provide a direct connection between groundwater and surface water. Fry's Run flows over an aquifer that many residents use as their prime source of drinking water. The groundwater resources in the Fry's Run watershed are generally considered to be abundant and of good water quality. Fry's Run is a spring fed stream. Spring water is the surface expression of the groundwater table.

Wetlands are not a particularly significant feature in the Fry's Run watershed (Map 10). The National Wetlands Inventory maps indicate the presence of a small area of emergent marsh and forested swamp areas along one of the tributaries of Fry's Run. Based on these maps, wetlands constitute less than 5% of the total watershed area. Most of the natural wetlands are associated with the stream corridors or the Delaware River. It is likely that any of the wetlands that have not been mapped in the area by the National Wetland Inventory would be of a riverine nature and fairly small. One of the components of wetlands is hydric soil. If hydric soils are identified, a wetlands evaluation by a qualified person is usually required to determine the presence of wetlands. Because hydric soils are considered potentially sensitive land areas, a map of the hydric soils for the watershed is included in Map 10.

The ground water and surface water are connected in the Fry's Run watershed. Given that groundwater is a source of drinking water for many of the residents in the watershed, it is particularly important that both surface- and ground-water resources in the watershed be protected.

Historical Significance

The National Register of Historic Places (NRHP) is the official list of historical and cultural resources worthy of preservation in the United State and is administered by the National Park Service. The NRHP is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historical and archeological resources. Places listed in the NRHP include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. Four properties in the watershed that are on the list are shown on Map 11 and include the following:

- The Jacob Arndt House and Barn, listed in 2005
- Bridge in Williams Township, listed in 1988
- Coffeetown Grist Mill, listed in 1977
- Isaac Stout House, listed in 2004

In addition to the historical places listed above, the Fry's Run watershed area has historically been an agricultural community, and agriculture remains an important part of the watershed's heritage. Throughout the 19th and early 20th century, over three-fourths of the land surface in the Fry's Run watershed were active, open farm fields (Groendaal and Jones, 1996). Stone farmhouse and stone-and-frame bank barns are common in the area.

Most of the farms in the area are part of the Township's Agricultural Security Area and would be eligible for protection under the State's Agricultural Conservation Easement Program (Map 12).

Significant Natural Areas

The Pennsylvania Science Office of the Nature Conservancy put together a Natural Areas Inventory report for the Lehigh Valley in 2005. The report presents Lehigh and Northampton County's known outstanding natural features, including floral, faunal, and geologic. There are several areas in the Fry's Run watershed of statewide significance identified in the report. These include the Hexenkopf Wetlands and Mariton Uplands. Sites of statewide significance support species of special concern or exemplary natural communities. These sites may be some of the best natural areas in the state.

In addition, sites of local significance are identified in the report. These sites provide locally significant habitat and may be suitable for environmental education, parks, or preserves; however, no species of special concern or exemplary communities have been identified at these sites. Locally significant sites in the Fry's Run watershed include the Mariton Slopes and the Hexenkopf Slopes.

Each of these areas is described in more detail below.

1) Hexenkopf Wetlands

The Hexenkopf Wetlands include a series of wetlands and seepy forests along an unnamed tributary to Fry's Run. A PA Endangered animal was observed here as recently as 1995. In 1998 it was determined that the suitable habitat still exists, but is marginal.

2) Mariton Uplands

The Mariton Uplands includes forests of varying ages and several large meadows. It supports a fair to poor quality population of threatened plant species. This site is part of the Mariton Wildlife Sanctuary and Wilderness Trust and is contiguous with the locally significant area called the Mariton Slopes.

3) Mariton Slopes

The Mariton Slopes is a series of forested slopes and shaded escarpments along the Delaware River. The cool, heavily shaded outcrops at this site are good habitat for numerous fern species as well as spring wildflowers. The site is also valuable as migratory habitat for numerous bird species that use the river corridor.

4) Hexenkopf Slopes

The Hexenkopf Slopes include a broad southeast-facing forested slope. The summit of the ridge includes a large linear rock outcrop formation. Areas adjacent to the summit have large and small boulders making up the substrate. The site also includes several seeps and at least one vernal pool.

Historical and On-going Water Conservation Efforts and Studies in the Watershed

Conservation Efforts

1. Land Preservation Board

Williams Township currently has a Land Preservation Board that was established to promote the preservation of open space in the Township through outreach and communication to Township residents as well as implementing the Open Space Plan approved by the Board of Supervisors. The board is currently working with landowners interested in permanently preserving their properties in the Township. This is done through a combination of State/County/Township programs and funding mechanisms. Preservation options include the acquisition or donation of conservation easements and/or the purchase or contribution of development rights on farmland or other areas such as woodlands and identified important natural areas. Preservation of these properties is, in many cases, protective of water resources. The priority natural area lands for protection according to an analysis completed by LVPC are shown in Map 13. Land currently preserved in the watershed is shown in Maps 12 and 14.

2. Fry's Run Watershed Association

The Fry's Run Watershed Association's mission and goals are to protect, preserve, and improve the quality of the water and land in the Fry's Run Watershed. Since its inception in early 2006, the Fry's Run Watershed Association, a registered non-profit group, completed both visual and chemical assessments of Fry's Run. In addition, members have actively participated in the development of this plan and will be responsible for plan implementation.

3. Lehigh Valley Greenway Conservation Landscape Initiative

The PA Department of Conservation and Natural Resources has designated the Lehigh Valley as one of their Conservation Landscape Initiative areas. In doing so, they have pledged resources to the area to support the preservation and conservation of greenways. The Two Rivers Area Greenway Plan and the Lehigh Valley Greenways Plan (described in the next section) are major focuses of this initiative.

4. Highlands Coalition

The Highlands Coalition is an assemblage of 110 individual conservation organizations with the common goal of protecting the natural features of the Highlands Region stretching from northwestern Connecticut to Reading, Pennsylvania. All of the Fry's Run Watershed falls into this region. The coalition seeks to protect and enhance water quality, forested habitat, large open spaces, and outdoor recreation opportunities in this belt of forested hills and farms. Stouts Valley and Bougher Hill are listed as critical resources of the Highlands.

Conservation Studies

1. Stouts Valley Landscape Conservation Plan, March 2001

The Stouts Valley Landscape Conservation Plan provides a summary of the key natural features of Stouts Valley, the landscape ecology that supports local and regional biodiversity, as well as current land issues and land ownership patterns affecting the area.

The report concluded that some of the highest value habitats in the area have physical characteristics that should be self-defending and constraining on development: steep slopes, wetlands, and flood-prone areas.

The report highlights the watershed as a regional keystone link in the Highlands Province greenway and provides information on the relative importance and cost-effectiveness of strategies to implement conservation actions.

2. Agricultural Conservation and Historic Resources Study, 1996

In February 1995, the Williams Township Supervisors applied for and received a grant of \$25,000 to conduct a Special Purpose Study for the Williams Township Historic District and a Stouts Valley Agricultural Preservation Techniques Study.

The intent of the study was to engage and create consensus as to how to approach the potential conservation of the agricultural community and historic resources in the southern portion of the township.

Extensive field analysis and historic resource fieldwork were completed in preparation for a sequence of public workshops that were to focus on the consensus building. Initially, the workshops began well, however, issues related to the potential historic district became a topic of division. The issue became polarizing for the community, and the township supervisors suspended the project in July 1996.

The project was not completed because of a lack of community input and detailed development analysis of the area's agricultural resources. However, a report was issued to fulfill grant requirements. The report summarizes the historic and agricultural resources of Stouts Valley.

The report recommends that agricultural land should be prioritized for preservation.

3. Two Rivers Area Greenway Plan, 2005

The Two Rivers Area Greenway Plan was completed in January 2005. This plan focuses on the linear areas of open space centered on important natural features such as streams and ridges, known as greenways. The Plan employs a comprehensive approach for the study area that includes the Bushkill Creek Watershed and Williams Township. The plan recognizes the complex nature of greenways and incorporates numerous key resources such as natural, cultural, historical, agricultural, and recreational components.

Recommendations in the plan that are specific to the Fry's Run watershed include the following:

- a. Protect upland forests and geologic features, such as Hexenkopf Rock, by creating a woodlands ordinance or through designation of an official map.
- b. Preserve additional agricultural land in Stout's valley with a focus on large areas of contiguous farmland while encouraging best management practices on all farms.
- c. Conserve streamside buffers along Fry's Run.
- d. Encourage riparian easements and land donations through education and outreach.
- e. Protect wooded slopes along the Delaware River.
- f. Consider a possible extension of highlands trail into Pennsylvania.

4. The Pennsylvania Highlands Conservation Atlas, 2006

The Pennsylvania Highlands Conservation Atlas completed in 2006 gives a detailed review of the special highlands features in Pennsylvania.

The Fry's Run Watershed is within the Northampton Highlands, which is the most northeasterly expression of the Pennsylvania Highlands. The limestone-rich Stouts Valley is identified as a locally important agricultural area. The waterways of this highland region are mentioned. The report also states that the majority of lands in the Northampton Highlands are privately owned and at risk of being lost to development.

5. Lehigh Valley Greenways Plan, 2007

The Lehigh Valley Planning Commission completed a greenways plan that details the natural and cultural resources worthy of discovery and preservation throughout the Lehigh Valley. The Fry's Run Greenway is included in the plan and begins where Fry's Run empties into the Delaware River and extends upstream to the southwest corner of the township (LVPC, 2007). The Fry's Run Greenway connects with the Delaware River Greenway and parts of the Pennsylvania Highlands that include Hexenkopf Hill and the Mariton Wildlife Sanctuary (LVPC, 2007).

Water Quality Studies

1. PA Fish and Boat Commission Studies

In 1979 and 1991, the PA Fish and Boat Commission conducted investigations of the fish inventory in Fry's Run.

The PA Fish and Boat Commission (PFBC) has historically managed Fry's Run for wild trout under conventional, statewide angling regulations. In 1979, the PFBC performed a survey of Fry's Run that quantified the brown trout population at one site located 225 m upstream from the mouth of Fry's Run that was 308 m long (Station 201). (See Map 15). The results of the water quality sampling conducted in 1979 are shown in Table 1. Fifteen species of fish were captured, with brown trout being the dominant gamefish present. Brown trout biomass and brown trout number/ha were 45.03 kg/ha and 351 fish/ha, respectively.

In 1991 another PFBC survey was initiated because of drought conditions that existed during the summer of 1991. Fry's Run was one of several streams selected for inclusion in a statewide study of the effects of the drought on wild trout populations. The study was also completed to assess the changes in the trout population since 1979 and these results are discussed here.

The fisheries survey was conducted on October 16 and 30, 1991. Station 101, located 40 m downstream from SR 2003 bridge, was 90 m long. Station 202 was located 225 m upstream from the mouth and was 300 m long (see Map 15).

The results of the water chemistry measured in 1991 are shown in Table 1. The results of the fish assessment are shown in Table 2. Fry's Run continues to maintain a Class A (>40kg/ha) wild brown trout population since the population was first documented in 1979. The biomass at station 201 of Fry's Run increased from 45.03 kg/ha in 1979 to 128.77 kg/ha in 1991. The 1991 estimate for Station 201 was the highest trout population biomass ever recorded by PFBC in southeastern PA as of 1991.

2. PA Department of Environmental Protection Studies

Fry's Run received its special protection status based on a 1990 PA DEP survey which investigated in-stream water quality, in-stream biological conditions and historical/geological features of the watershed (DER, 1990). The 1990 PA DEP survey found water quality that was better than applicable standards necessary for special protection status, a diverse invertebrate community, and a naturally reproducing brown trout population. Also noted was that the basin contained a scenic geologic feature (Hexenkopf Rock) and some publicly owned land.

In response to a petition submitted by a Fry's Run Resident's Group, the watershed was evaluated for redesignation to Exceptional Value Waters (EV) by PADEP. Field studies were conducted in December 1997 and March 2000 that included habitat assessments, a benthic macroinvertebrate study, a fish assessment, and water quality sampling. The sampling locations are shown on Map 15. A summary of the investigation is described below.

Both surface water chemistry and aquatic biota were sampled and evaluated. Water chemistry results are shown in Table 1, and the results of the fish survey is shown in Table 2. Station 2FR was sampled for benthic macroinvertebrate and habitat assessment in January 1997 and again in March 2000. Between those two dates, it appears that a major flood occurred in the basin. Habitat scores for aquatic biota at Station 2FR decreased. The parameters most affected were bank condition and vegetative cover. At station 1FR in-stream habitat was good, but the banks were impacted by agricultural activity, and the riparian zone was very narrow. The benthic macroinvertebrate survey results indicated that the Fry's Run did not meet the threshold required for designation as High Quality Waters. The report stated that the PFBC classified the portion of Fry's Run as a Class A Wild Trout Water based on biomass of wild brown trout. Except for this

requirement, none of the other antidegradation qualifying requirements lists in Chapter 93 applied to this watershed.

Based on applicable regulator definitions, the PADEP recommended that the Fry's Run watershed retain the HQ-CWF, MF designation. The report noted that a portion of the basin supports a "Class A" trout water and contains migratory American eels.

3. *Results of Delaware River Basin Commission Water Quality Sampling Conducted in 2000*

From May to September of 2000 through 2003, the Delaware River Basin Commission (DRBC) conducted water quality surveys of the Delaware River and selected tributaries located between the Delaware Water Gap and Trenton, NJ. As part of that investigation, Fry's Run was sampled eight times in 2000 at the location shown in Map 15. The results of the investigation along Fry's Run are shown in Table 1. The objectives of the overall investigation were to define the existing water quality for this segment of the Delaware River, and subsequently link long-term water quality monitoring to integrated water management.

4. *Results of Water Quality Sampling Conducted in October 2007*

The water quality data collected by members of the Fry's Run Watershed Association in October 2007 are shown in Table 1. Sampling locations are shown in Map 15. These data are consistent with those data collected by the PADEP and the PFBC, with the exception of the measurement collected for dissolved oxygen. These dissolved oxygen data were determined to be erroneous due to problems associated with testing technique or the sampling kits. These data are not shown in Table 1.

Discussion of Overall Water Quality of Fry's Run Watershed

The overall water quality is good to excellent and reflects the underlying geology of the watershed. The slightly alkaline nature of the water may be an influence of the mixture of the gneiss in the upland portions of the water and dolomitic limestone beneath the valley floor.

Table 1 lists the water quality results of various sampling events conducted sporadically from 1979 to 2007. The measurements collected for dissolved oxygen are excellent and support a cold water fishery. The pH measurements are all well within range for supporting a trout fishery. The stream is a cold-water stream, which helps keep the dissolved oxygen levels high. The stream is considered a limestone stream since it is partially underlain by dolomitic rock. Springs discharge cool water to the stream throughout the year. The calcium carbonate in the bedrock dissolved in the spring water provides for a stable pH. These factors make the conditions favorable for sensitive fish such as trout species. The specific conductance, an indicator of the amount of total dissolved solids in the water, is relatively low, as is the amount of total dissolved solids measured in the water. The very low amount of total suspended solids in the stream offers a high level of protection for aquatic life. Hardness and alkalinity are typical for

carbonate streams, and the high alkalinity levels provide good buffering capacity for the stream.

The turbidity levels measured are good, and the phosphorus, nitrogen, and chloride parameters are within acceptable levels. The fecal coliform samples collected by the DRBC measured above 100 col/100ml in four out of six samples collected.

In the 1992 Fish and Boat Commission report, sediment runoff from agricultural fields was listed as a potential threat to the water quality of the stream. To a lesser degree, sedimentation may also be coming from new development in the watershed. A substantial amount of residential development has taken place in the eastern portion of the Fry's Run watershed (LVPC, 2007).

The habitat assessment completed by the PADEP in January 1997 and March 2000 showed degraded bank conditions and vegetative protection on the lower portion of the stream, attributed in part to flooding during that time period. At Station 1FR (see Map 15), the in-stream habitat was considered good, but the banks were reported to be impacted by agricultural activity, and the riparian zone was very narrow.

A GIS assessment of the status of the forested riparian buffers in the watershed was conducted using aerial photographs from 2004 (Map 16). This analysis indicates that 44% of the Fry's Run has no forested buffer on either side of the stream. About 8% of the stream has only one side of forested buffer. It is clear from this analysis that many of the forested riparian buffer areas along the stream corridor are not intact, especially along the main stem of the creek. It should be noted that this GIS analysis included only forested buffers. Grassy or shrubby buffers do exist in some locations, but were not included in the forested buffer analysis. There has been significant research documenting the importance of forested riparian buffers for stream health. The lack of forested riparian buffer along the stream corridor is a threat to the overall water quality of the watershed.

Water Quality and Stream Health Concerns

Coliform Bacteria

As noted above, the fecal coliform samples collected by the DRBC in 2000 measured above 100 col/100ml in four out of six samples collected. This is a potential water quality concern and should be evaluated through additional testing.

Forested Riparian Buffers

Based on observations made by the PA Fish and Boat Commission, the PA Department of Environmental Protection, and the forested riparian buffer analysis that was completed using 2004 aerial photographs for this study, the major watershed concern is lack of forested riparian buffers. The LVPC is currently working on a model riparian buffer ordinance. The township should review the model ordinance upon its completion.

The analysis of the riparian buffers in the watershed indicates that forested buffers in the watershed could and should be increased in order to conserve and enhance the water quality in the watershed. Ideally, 50 to 100 feet of forested buffer on both sides of the stream is recommended.

In a 1998 USGS report titled “Water Quality in the Lower Susquehanna River Basin, Pennsylvania and Maryland,” it was documented that areas with limestone streams also have valuable limestone farmland that is commonly cultivated to the edge of the stream bank, leaving little or no riparian vegetation (canopy cover). This, in turn, affects water temperature. Agricultural areas with little or no riparian buffers can also have increased sedimentation.

Fish are sensitive to suspended sediment; therefore, erosional bank conditions also influenced fish communities. Steep, high banks with little vegetative cover have a greater chance of erosion during storms than lower banks with more vegetation. Banks consisting of finer sediment are more erodible than banks that consist of cobbles and boulders. These factors also influence the amount of oxygen in the stream water. Fish with high oxygen demands (trout) typically thrive in cooler waters with little to no erosion and with fairly high oxygen concentrations. Fish with lower oxygen demands can live in warmer waters where lower oxygen concentrations are common.

Flooding

Damage from recent flooding events is a major concern to the community. Map 17 shows the flood plains in the watershed. Although flooding along waterways is a natural event, damage from flooding can be minimized by good planning and preventative measures.

The Lehigh Valley Hazard Mitigation Plan put together by the Lehigh Valley Planning Commission in July 2006 summarizes the flooding issues in the Lehigh Valley and provides some recommendations for flood mitigation.

Floods are the most prevalent type of natural disaster occurring in Pennsylvania and are the most significant hazard in the Lehigh Valley. All municipalities in the valley have areas prone to flooding along streams and rivers. Given that the Fry’s Run watershed has the Fry’s Run and is adjacent to the Delaware River, it is particularly prone to flooding events.

Since 1955, there have been 14 flood events within the Lehigh Valley that have resulted in disaster declarations. According to the State Water Plan (1983), the largest amount of damage ever recorded was from the 1955 flood event.

In recent years, the remnants of Hurricane Ivan interacting with a slow moving cold front caused widespread heavy rain to fall on September 18, 2004, in the Lehigh Valley. Storm totals averaged about 5 inches and caused creek and river flooding. Runoff from the heavy rain caused the worst flooding along the Delaware since 1955. Williams

Township had over one million dollars worth of property damage, one of the worst hit municipalities in the Lehigh Valley.

In April 2005 and for the second time in seven months, a greater than 50-year flood affected the Delaware River basin and its tributaries. Many homes and businesses that were flooded by the remnants of Hurricane Ivan were flooded again. The already wet soil conditions due to heavy rain on both March 23 and 28, 2005, exacerbated the flooding. In addition to flooding, the snowmelt in the upper basin of the Delaware River added to the problem. Williams Township again had over one million dollars in property damage and was again one of the hardest hit municipalities. The Delaware River flooded for a third time in two years in June 2006, with a flood crest just below that of the 2005 flood.

The storm events that produce the greatest number of flooding losses are not necessarily related to the total amount of rainfall that falls on an area. Other factors are important such as whether the ground is frozen, whether a significant depth of snow is on the ground that may melt and contribute to the runoff, whether prior storms have left the ground saturated, among other factors.

Since the watershed has a major river and a stream within its borders, it is safe to assume that the potential for flooding will always be a concern. The structures most at risk are located within the 100-year floodplain (Map 17).

Township Ordinances Protective of Water Quality

Williams Township does have a setback requirement for streams. No new structure, impervious surface, off-street parking, or commercial or industrial storage or display area shall be located within 75 feet from the edge of the water of any stream. Streams are identified on the Official Zoning Map.

In addition, Williams Township adopted a new Stormwater Ordinance in 2007 based on recommendations made by the Lehigh Valley Planning Commission. The ordinance is written to 1) preserve desirable existing natural drainage systems, 2) encourage infiltration of stormwater to maintain groundwater recharge, to prevent degradation of surface and groundwater quality, and to otherwise protect water resources, 3) preserve and restore the flood carrying capacity of streams, 4) manage stormwater impacts close to the runoff source which requires a minimum of structures and relies on natural processes, 5) meets the legal water quality requirements under state law, including regulations at 25 Pa. Code chapter 93.4a to protect and maintain “existing uses” and maintain the level of water quality to support those uses in all streams and to protect and maintain water quality in “special protection” streams. The adoption of these ordinances will help protect the Fry’s Run watershed from negative impacts of stormwater runoff from new development. The newly adopted ordinances do not cover preexisting development and associated stormwater controls. A map of the existing impervious surface in the watershed is shown in Map 18.

The Township also adopted an ordinance in 2007 for optional conservation development for properties 10 acres or more whose purpose among other things is to:

- Conserve open space and preserve and protect natural and historic resources such as woodlands, steep slopes, streams, floodplains and wetlands, by minimizing development on such resources
- To require designation and permanent preservation of open space and agricultural land, as part of the design and development of a property; to reduce erosion and sedimentation by retaining existing vegetation and minimizing the development of steep slopes.

Finally, a floodplain ordinance does exist for the township, but could be updated according to the model floodplain ordinance put together by LVPC in 2007 that would be more protective of areas along the stream.

Recommendations and Next Steps

Recommendations

1. *Protect and enhance the existing stream corridor*
 - a) *Restore or establish forested riparian buffers as needed along stream; and*
 - b) *Limit new development in riparian corridors and floodplains.*
2. *Promote a sustainable approach to managing development that protects stream habitats*
 - a) *Continue implementation of land conservation programs;*
 - b) *Support new stormwater ordinance and promote infiltration in new development; and*
 - c) *Support new conservation development ordinance.*
3. *Preserve groundwater resources through good watershed stewardship by focusing on environmental education and outreach.*
4. *Support land preservation efforts that will be protective of water resources and will help preserve a sense of place for the community.*
5. *Conduct a macroinvertebrate study of Fry's Run to further assess stream health.*
6. *Continue with water quality monitoring 2-4 times per year to establish baseline conditions.*
7. *Perform additional coliform monitoring of the Fry's Run.*
8. *Review the Lehigh Valley Planning Commission's existing model floodplain ordinance and the model riparian buffer ordinance, which is currently in progress.*

Next Steps

The Fry's Run Watershed Association will implement the following next steps to address the recommendations listed above:

- 1) Develop and implement an environmental education and outreach program that will focus on supporting the proposed recommendations.
- 2) Perform macroinvertebrate assessment, additional coliform monitoring, and continue water quality monitoring to further determine the health of Fry's Run and assess further protective measures that may be needed.
- 3) Support land preservation efforts that protect water resources and preserve and enhance sense of place.
- 4) Pursue creative and innovative ways to encourage landowners to protect and restore/establish protective forested riparian buffers. There are federal funding sources available through the USDA's Natural Resource and Conservation Service for stream-bank fencing and restoration that may be used to compensate farmers for widening buffers. The Fry's Run Watershed Association will cooperate with the USDA's Natural Resource and Conservation Service to work with the local farming community.
- 5) Support existing municipal ordinances that are protective of water quality such as the new stormwater ordinance recently adopted by the township. Review the model floodplain and riparian buffer (currently in progress) ordinance put together by LVPC.
- 6) Pursue funding to implement the proposed recommendations. Funding sources that will be considered include the Pennsylvania Growing Greener Program through PADEP or PADCNR, private foundations, and cooperating organizations.

References

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Lindsey, B.D., Breen, K.J., Bilger, M.D., and Brightbill, R.A., 1998, Water Quality in the Lower Susquehanna River Basin, Pennsylvania and Maryland, 1992-95: U.S. Geological Survey Circular 1168, on line at <URL: <http://water.usgs.gov/pubs/circ1168>>, updated June 22, 1998.

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PA Department of Environmental Resource, Division of Water Quality, Frya Run Special Protection Evaluation Report, 1990.

PA Department of Environmental Protection Stream Redesignation Evaluation Report, Water Quality Standards Review, January 2001, Revised February 2002.

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Pennsylvania Highlands Conservation Atlas, November 2006.

URCD, Two Rivers Area Greenway Plan, January 2005.

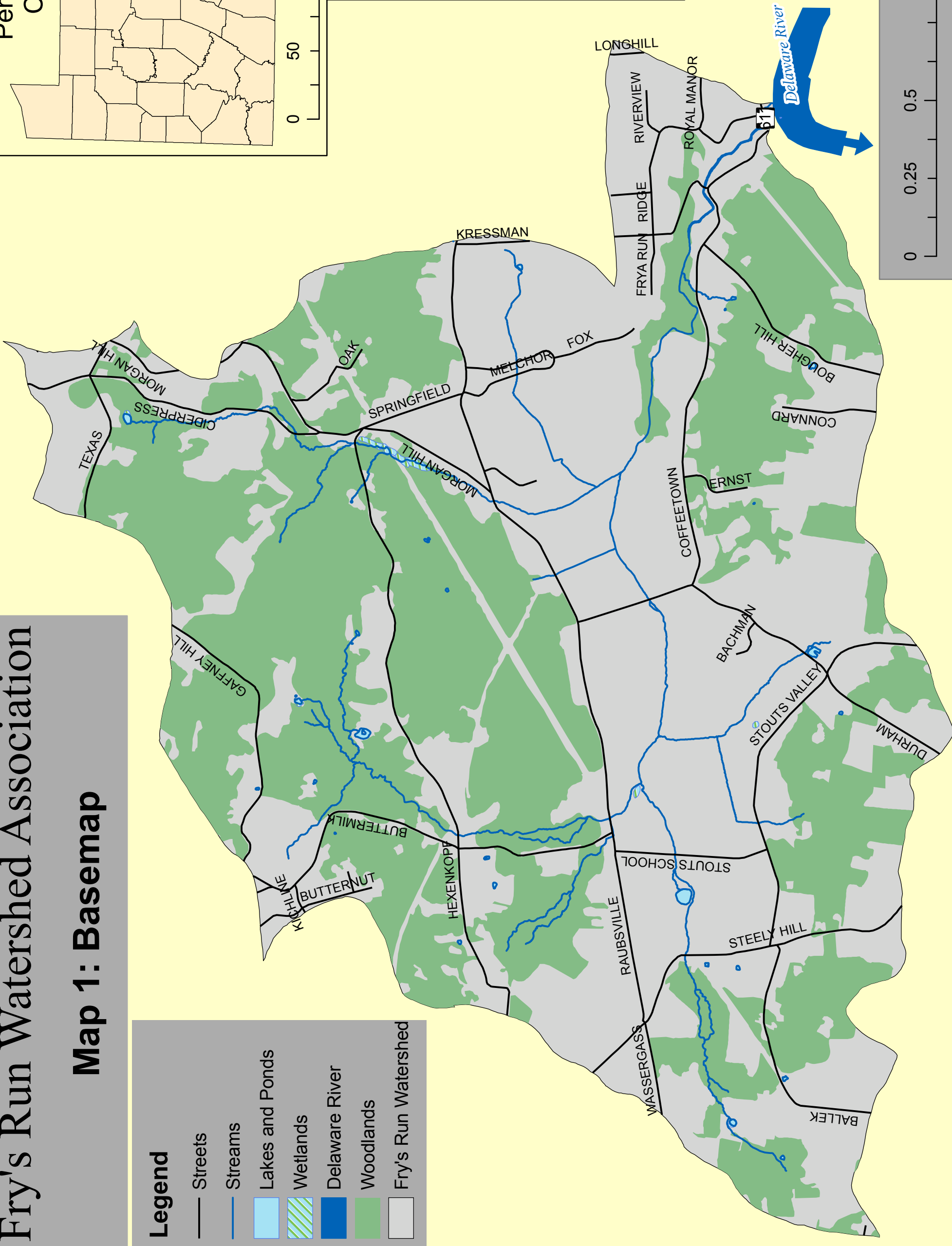
Maps

Fry's Run Watershed Association

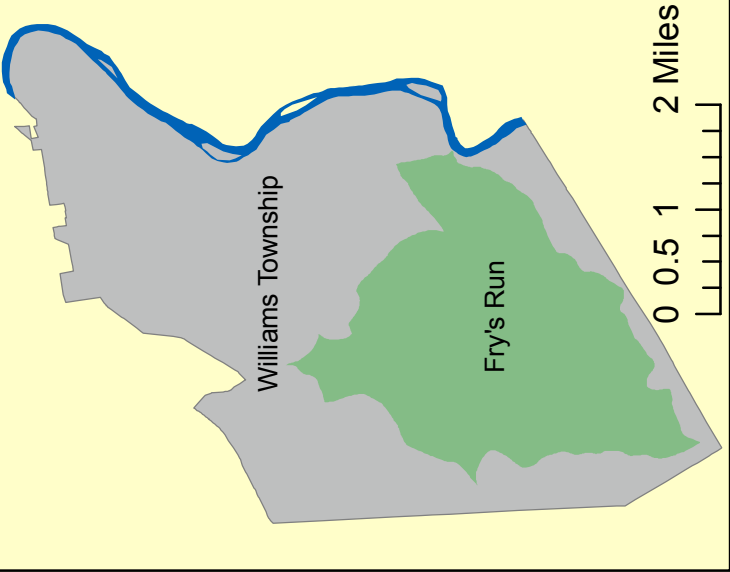
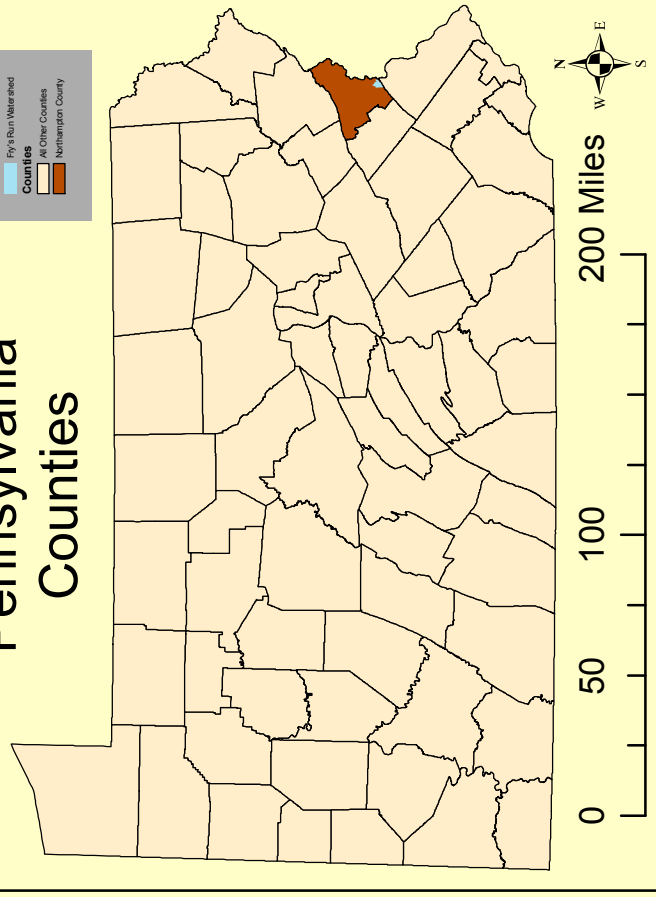
Map 1: Basemap

Legend

- Streets
- Streams
- Lakes and Ponds
- Wetlands
- Delaware River
- Woodlands
- Fry's Run Watershed

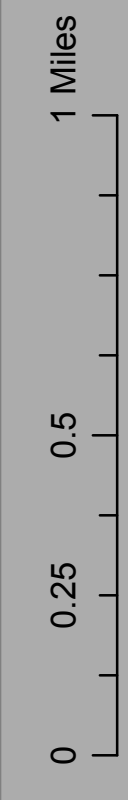


Pennsylvania Counties



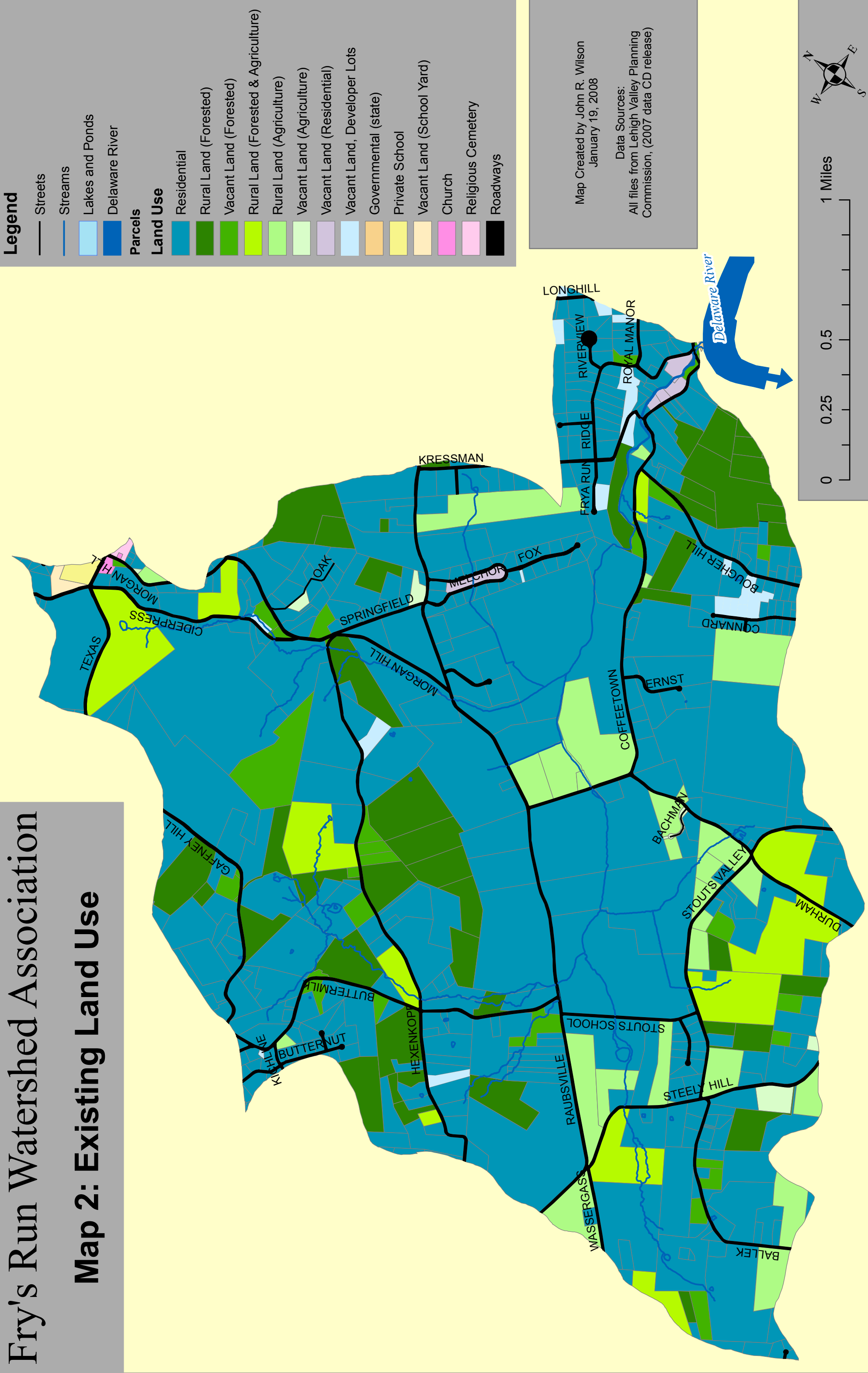
Map Created by John R. Wilson
January 19, 2008

Data Sources:
Counties data from PASDA
All other files from Lehigh Valley Planning Commission, (2007 data CD release)



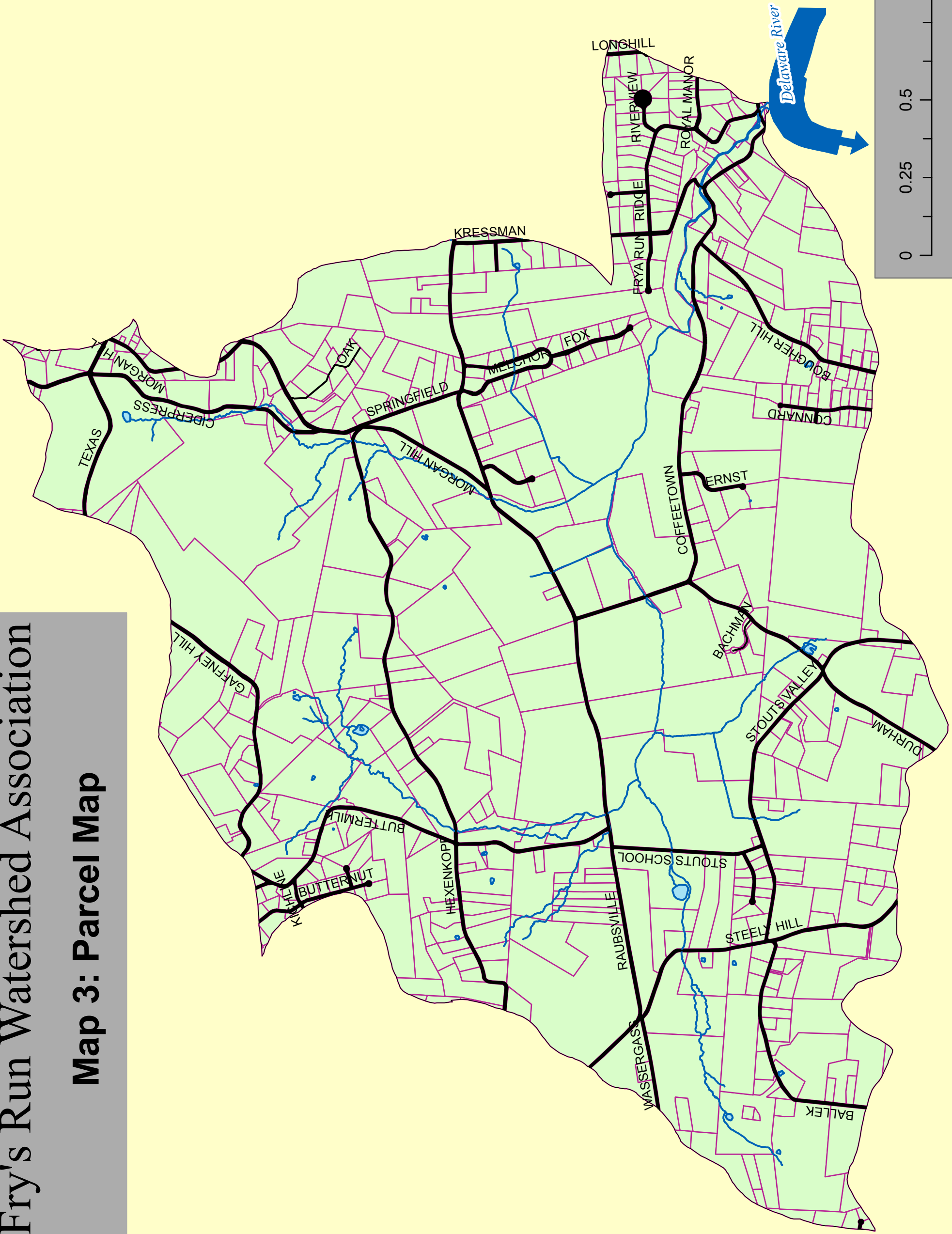
Fry's Run Watershed Association

Map 2: Existing Land Use



Fry's Run Watershed Association

Map 3: Parcel Map



Legend


- Streams
- Lakes and Ponds
- Delaware River
- Parcels
- Roadways
- Parcels

Map Created by John R. Wilson
January 19, 2008

Data Sources:
All files from Lehigh Valley Planning
Commission, (2007 data CD release)

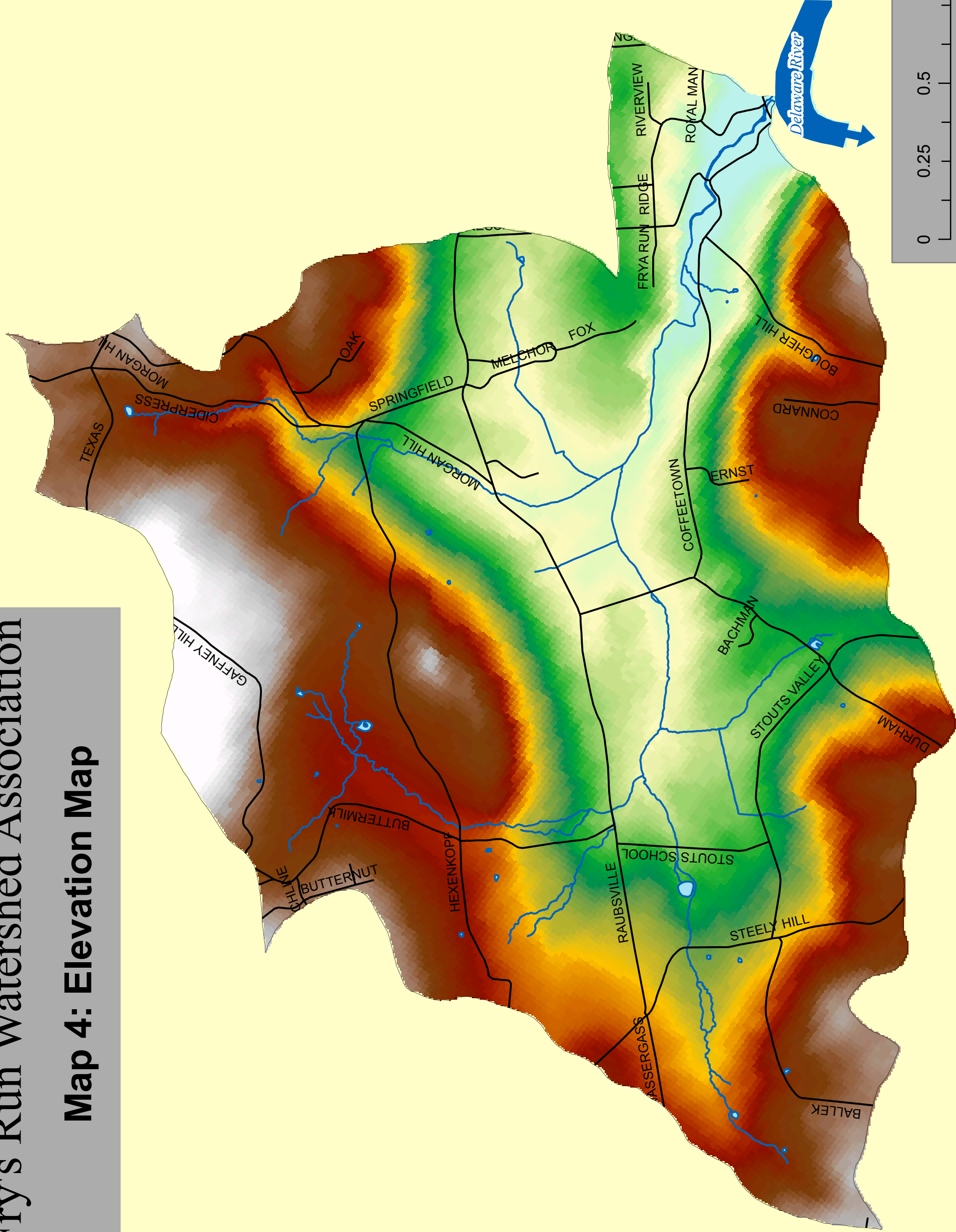
There are 643 parcels in
the Fry's Run Watershed

0 0.25 0.5 1 Miles



Fry's Run Watershed Association

Map 4: Elevation Map

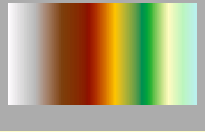


Legend

- Streets
- Streams
- Lakes and Ponds
- Delaware River

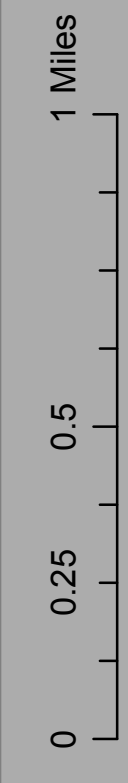
Digital Elevation Model

Elevation in Feet



Map Created by John R. Wilson
January 19, 2008

Data Sources:
DEM from USGS (90m cell resolution)
All other files from Lehigh Valley Planning
Commission, (2007 data CD release)



Fry's Run Watershed Association

Map 5: Geology

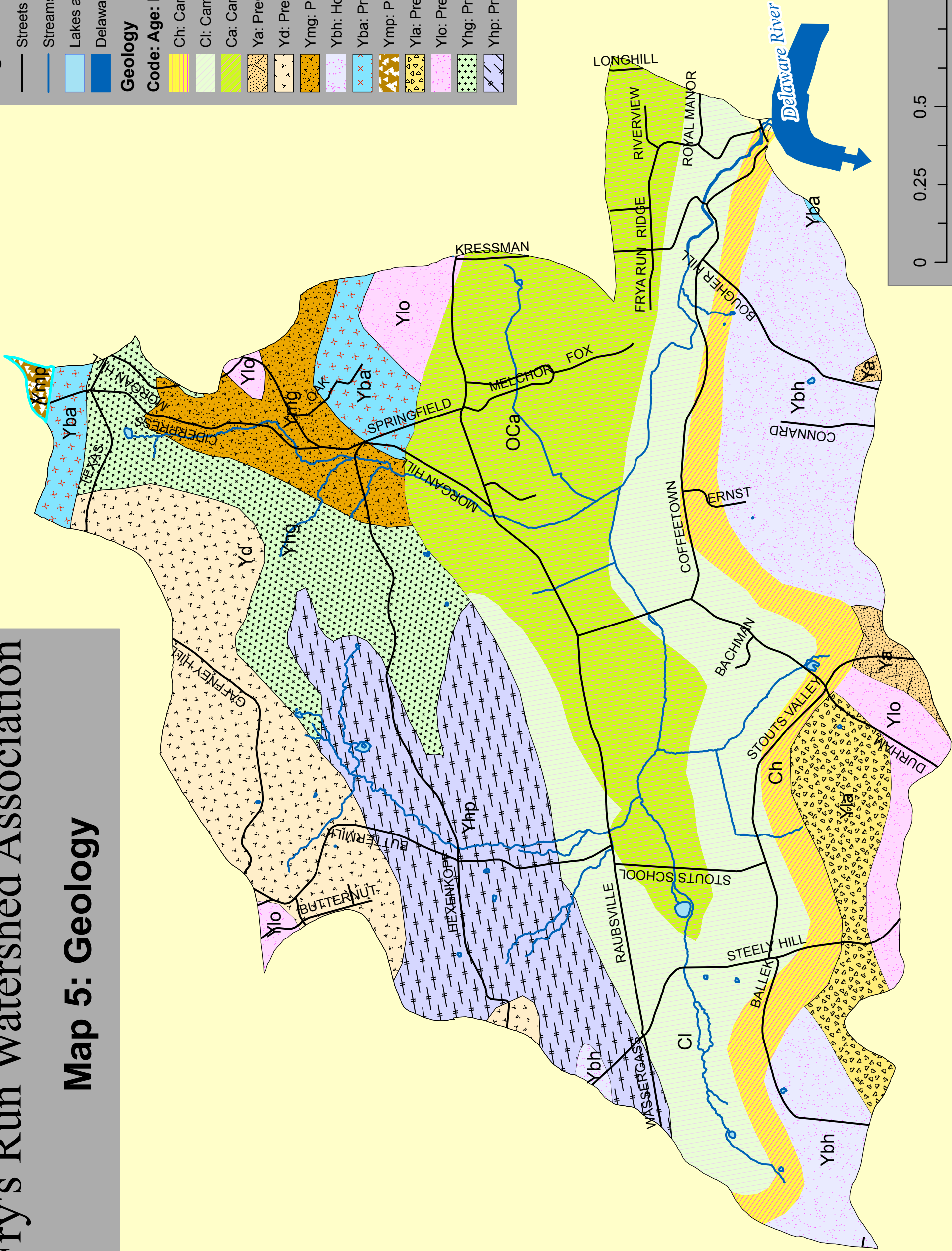
Legend

- Streets
- Streams
- Lakes and Ponds
- Delaware River

Geology

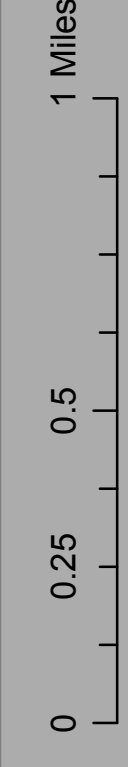
Code: Age: Name/Type

- Ch: Cambrian: Hardyston Quartzite
- Cl: Cambrian: Leithsville Formation
- Ca: Cambrian: Allentown Dolomite
- Ya: PreCambrian: Amphibolite
- Yd: PreCambrian: Quartz Diorite
- Ymg: PreCambrian: Migmatites
- Ybh: Hornblende Granite
- Yba: PreCambrian: Alaskite
- Ymp: PreCambrian: Mafic Gneiss
- Yla: PreCambrian: Granite
- Ylo: PreCambrian: Oligoclase Gneiss
- Yhg: PreCambrian: Quartz-garnet-augite Granofels
- Yhp: PreCambrian: Epidote Gneiss



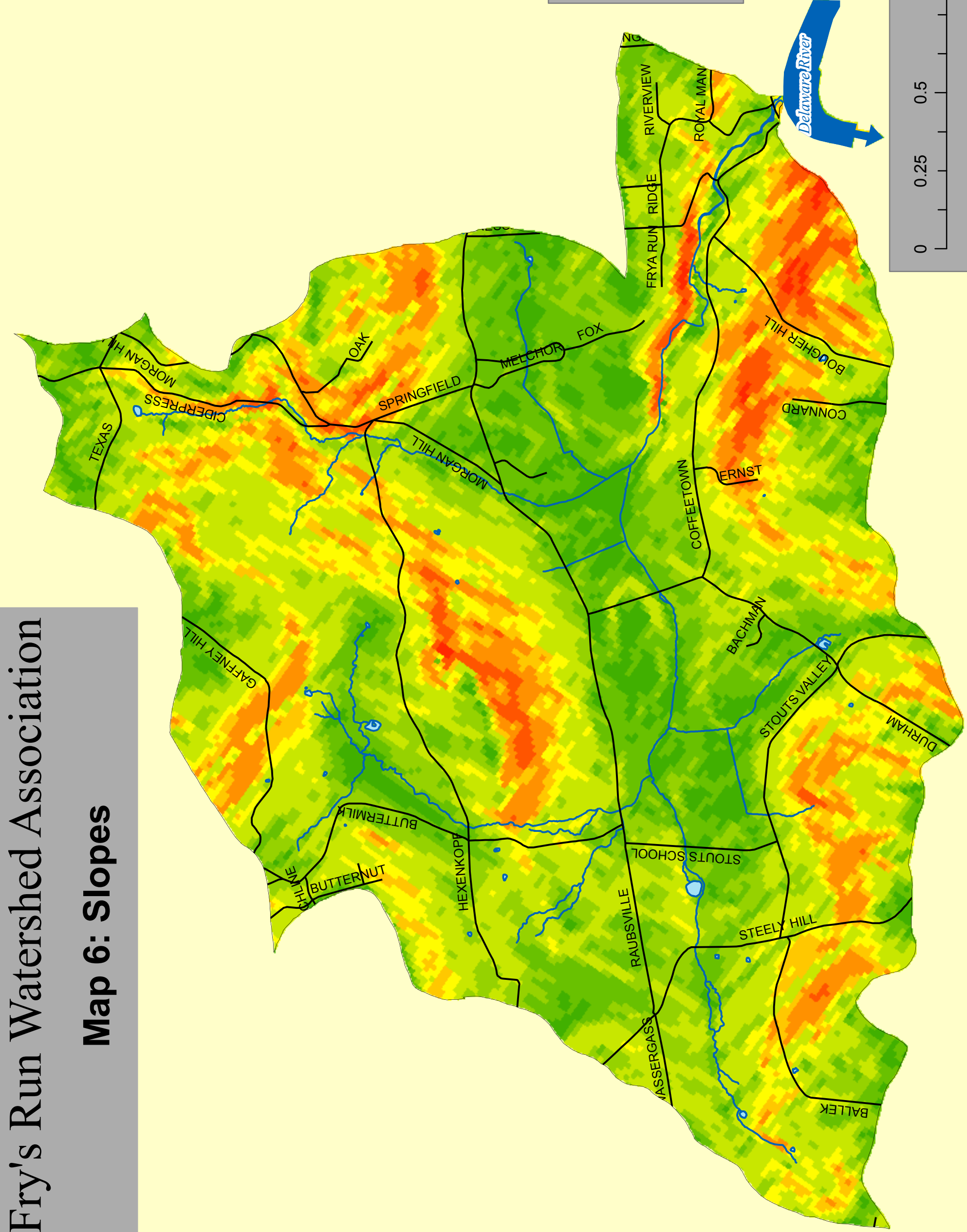
Map Created by John R. Wilson
January 19, 2008

Data Sources:
All files from Lehigh Valley Planning
Commission, (2007 data CD release)



Fry's Run Watershed Association

Map 6: Slopes



Legend

- Streets
- Streams
- Lakes and Ponds
- Delaware River
- Slope (Degrees)

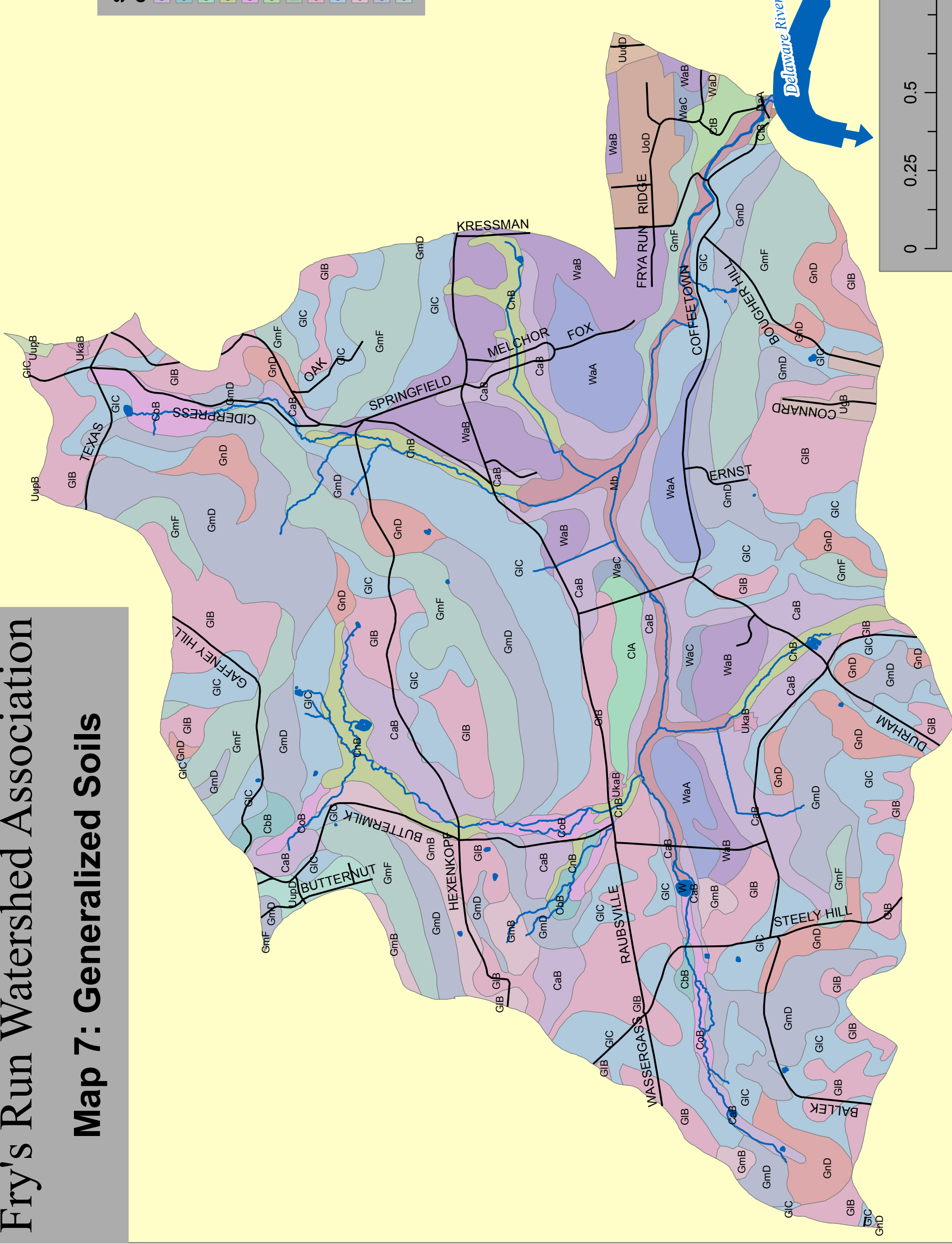
Map Created by John R. Wilson
January 19, 2008

Data Sources:
Slope map created from 90m resolution
DEM from USGS
All other files from Lehigh Valley Planning
Commission, (2007 data CD release)

0 0.25 0.5 1 Miles

Fry's Run Watershed Association

Map 7: Generalized Soils



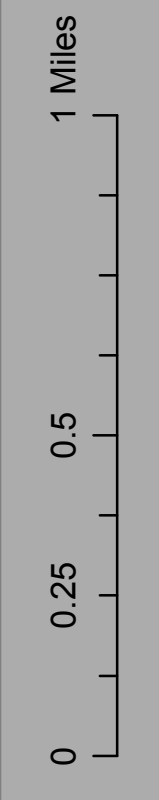
Legend
— Streets
— Streams
Lakes and Ponds
Delaware River

Soils	Group Name
GnD	Gladstone-Parker
Mb	Middlebury
UgB	Udorthents
UkaB	Urban Land
JoD	Urban-Gladstone
UudD	Urban-Udorthents
UupB	Urban-Udorthents
UupD	Urban-Udorthents
W	Water
Waa	Washington
Wab	Washington
Wac	Washington
Wad	Washington

CaB	Califon
CbB	Califon
CjA	Clarksburg
CnB	Cokesbury
CoB	Cokesbury-Califon
CtB	Conotton
DaA	Delaware
GIB	Gladstone
GIC	Gladstone
GmB	Gladstone
GmD	Gladstone
GmF	Gladstone

Map Created by John R. Wilson
January 19, 2008

Data Sources:
Soils data from Soil Mapping Program
of the NRCS (2007)
(<http://websoilsurvey.nrcs.usda.gov/app/>)
All other files from Lehigh Valley Planning
Commission, (2007 data CD release)



Fry's Run Watershed Association

Map 8: Woodlands

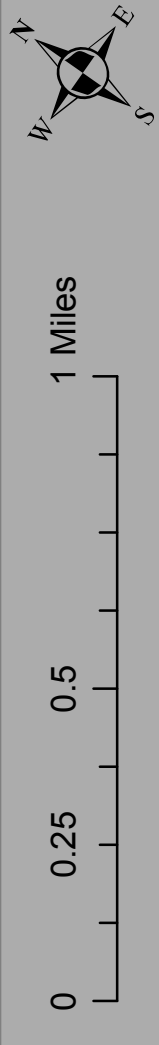
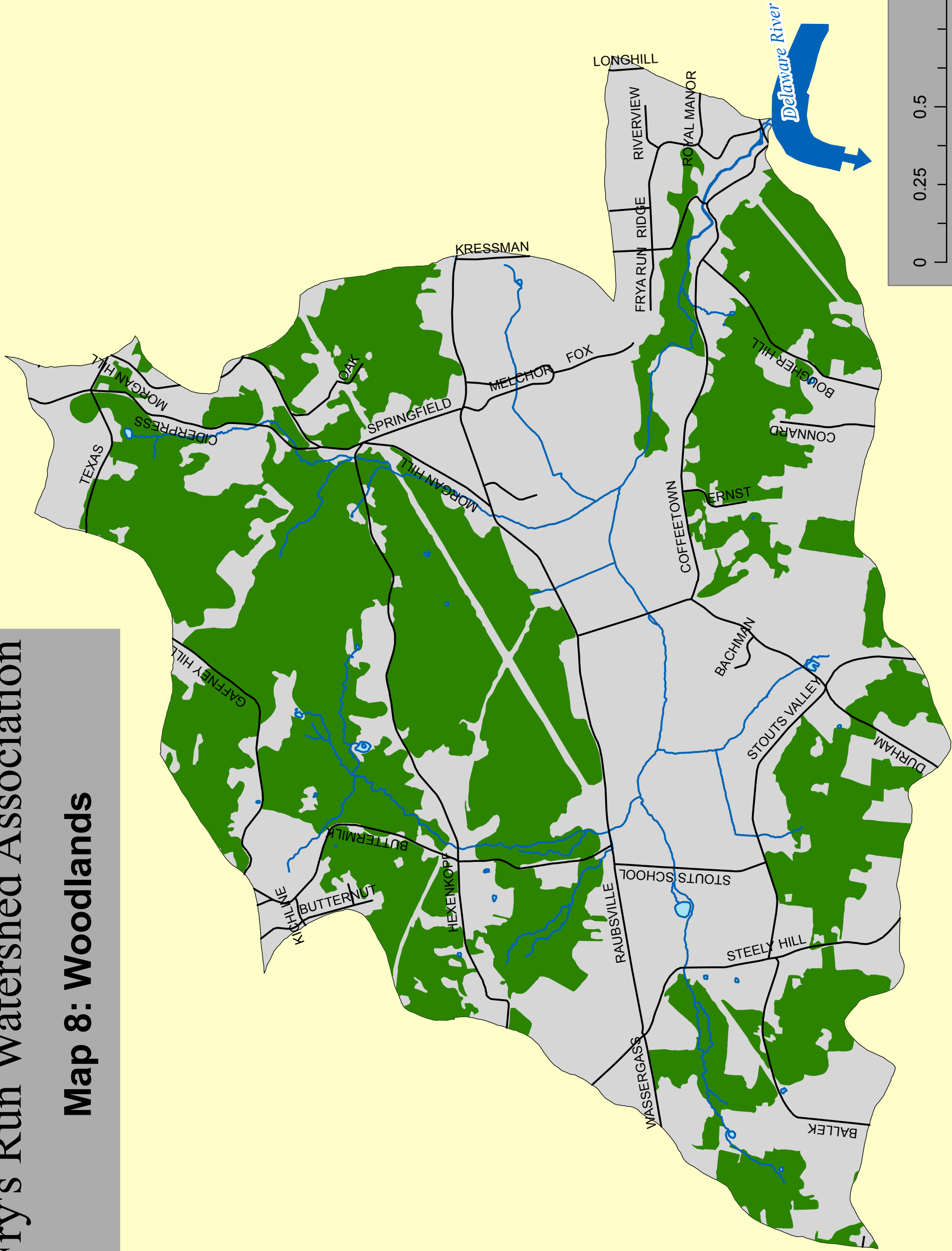
Legend

- Streets
- Streams
- Lakes and Ponds
- Delaware River
- Woodlands
- Fry's Run Watershed

Map Created by John R. Wilson
January 19, 2008

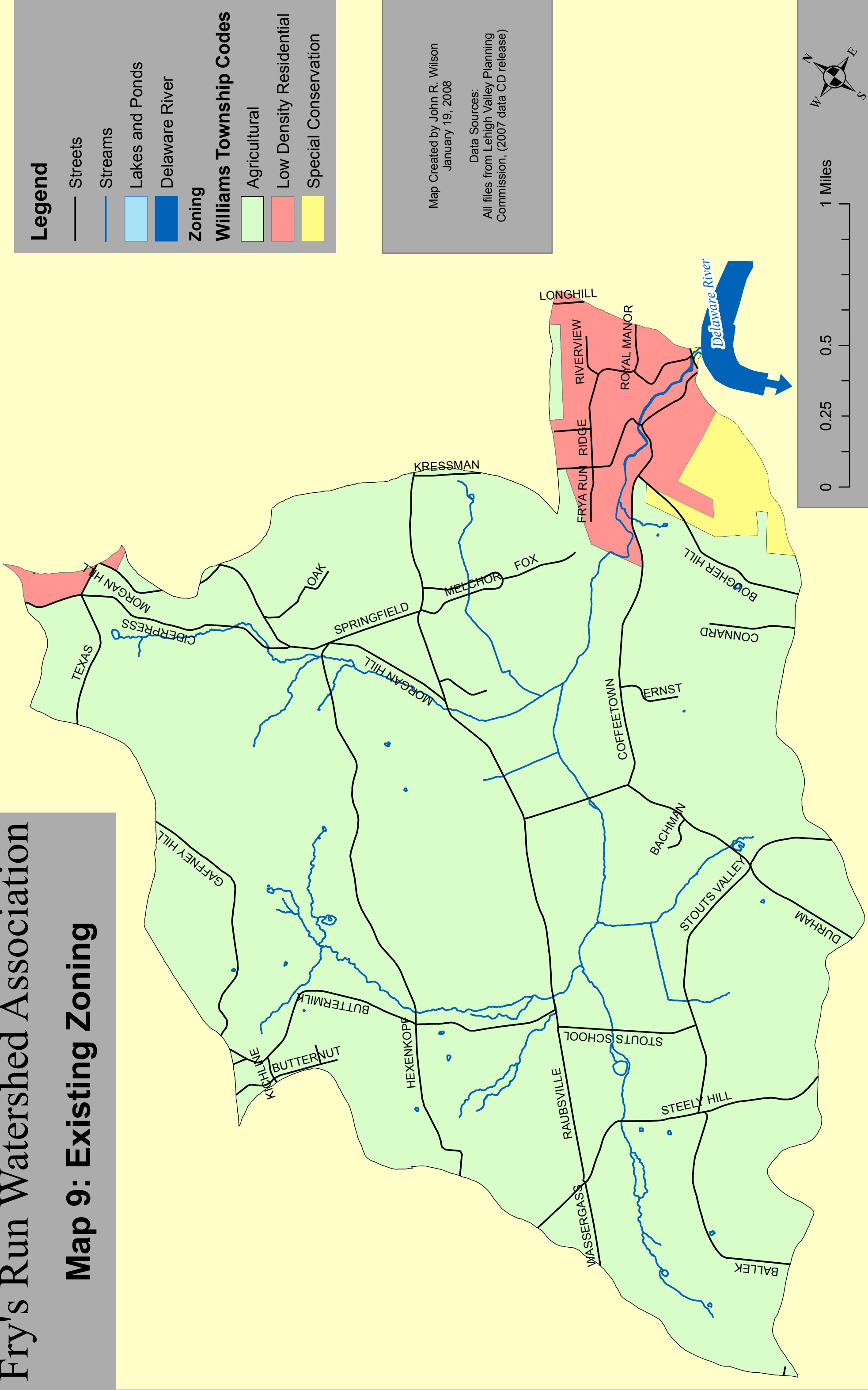
Data Sources:
All files from Lehigh Valley Planning
Commission, (2007 data CD release)

There are 2.7 square miles of woodlands
in the Fry's Run Watershed



Fry's Run Watershed Association

Map 9: Existing Zoning



Fry's Run Watershed Association

Map 10: Hydric Soils and Wetlands

Legend

- Streets
- Streams
- ▨ Wetlands
- Delaware River

Soils

Hydric Criteria

2b3	Soils that are poorly drained and have a depth to water table of 1 foot or less
2b3, 4	Soils that are poorly drained and have a depth to water table of 1 foot or less and are frequently flooded during the growing season
2b3, 3	Soils that are poorly drained and have a depth to water table of 1 foot or less and are frequently ponded during the growing season
N/A	Unknown hydric

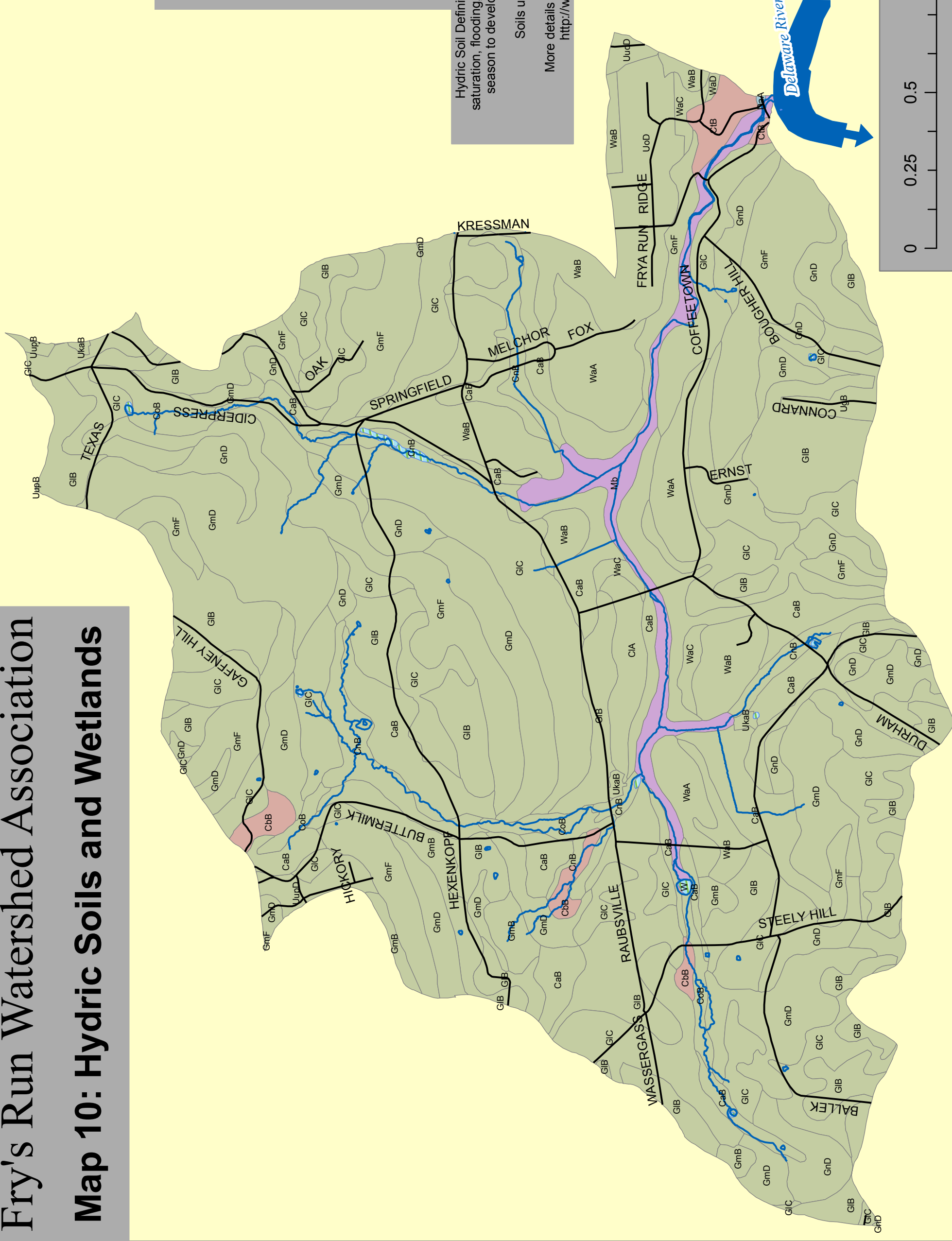
Hydric Soil Definition: A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Soils unit codes can be seen on Map 7

More details can be found at the following website:
<http://websoilsurvey.nrcs.usda.gov/app/>

Map Created by John R. Wilson
 January 19, 2008

Data Sources:
 Soils data from soil mapping program of the NRCS (2007)
 All other files from Lehigh Valley Planning Commission, (2007 data CD release)



Fry's Run Watershed Association

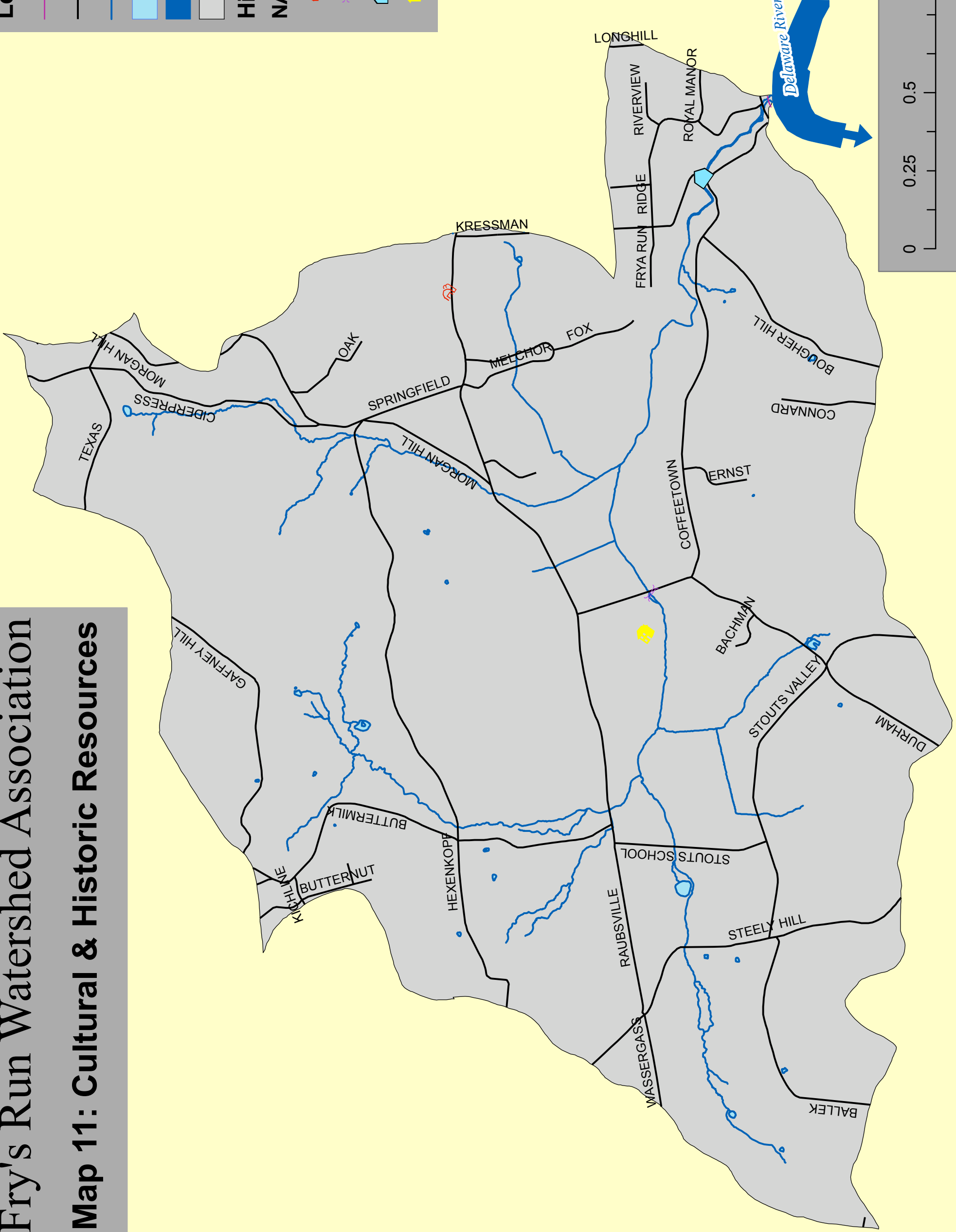
Map 11: Cultural & Historic Resources

Legend

- Historic Canals
- Streets
- Streams
- Lakes and Ponds
- Delaware River
- Fry's Run Watershed

Historic Structures

NAME	Symbol
Jacob Arndt House and Barn	
Bridge in Williams Township	
Coffeetown Grist Mill	
Isaac Stout House	



Map Created by John R. Wilson
January 19, 2008

Data Sources:
Historic Structures data from National Register of Historic Places
All other files from Lehigh Valley Planning Commission, (2007 data CD release)

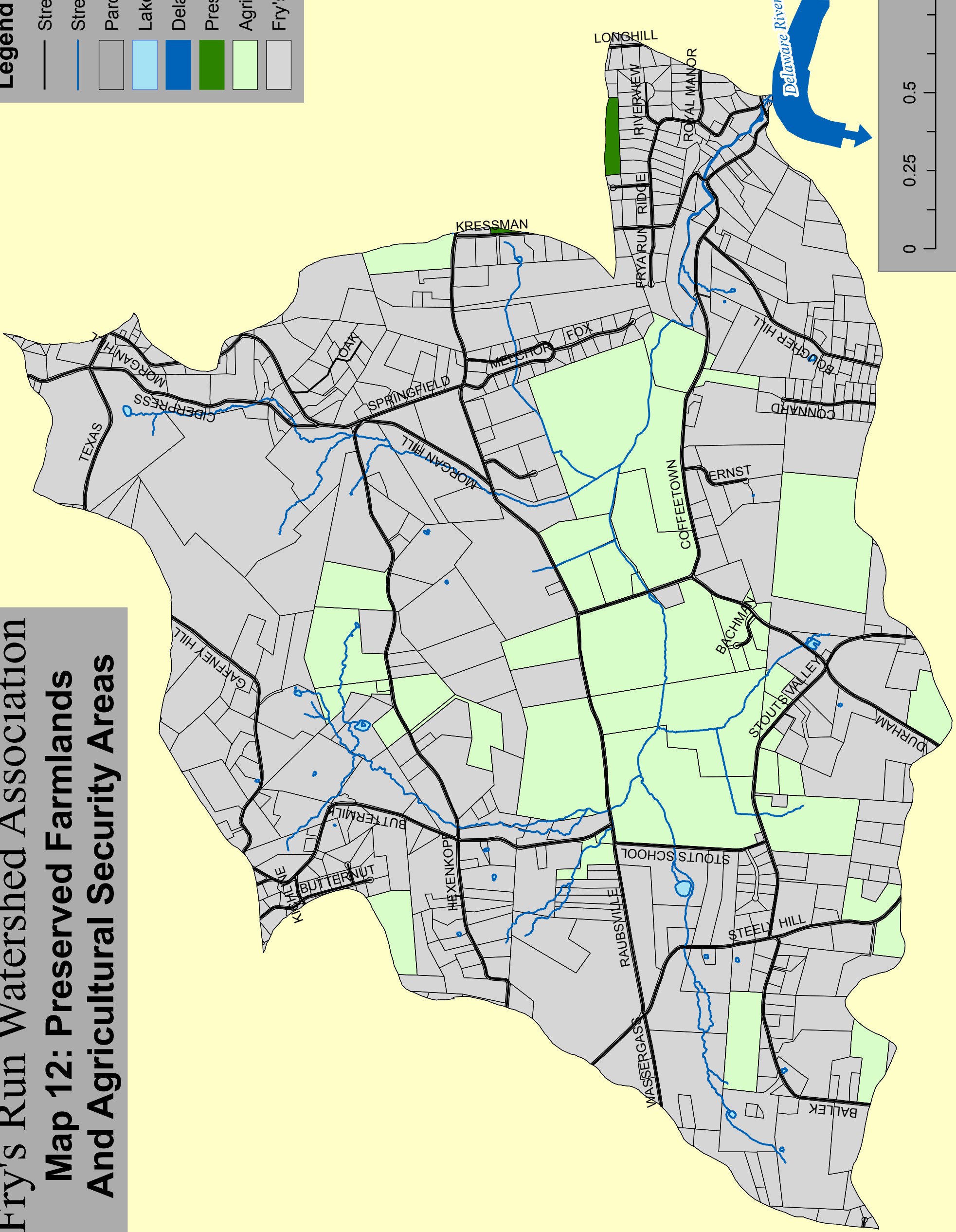
0 0.25 0.5 1 Miles

Fry's Run Watershed Association

Map 12: Preserved Farmlands And Agricultural Security Areas

Legend

- Streets
- Streams
- ▭ Parcels (2007)
- ▭ Lakes and Ponds
- ▭ Delaware River
- ▭ Preserved Farmlands (PA Act 149)
- ▭ Agricultural Security Areas (PA Act 43)
- ▭ Fry's Run Watershed



Map Created by John R. Wilson
January 19, 2008

Data Sources:
Act 149 data from Northampton County
Conservation District
Act 43 data from Williams Township
All other files from Lehigh Valley Planning
Commission, (2007 data CD release)

There are 1207 acres (1.88 square miles)
of Farmland within PA Act 43 and 96
acres (.15 square miles) within PA Act 149

0 0.25 0.5 1 Miles

Fry's Run Watershed Association

Map 13: Natural Areas Recommended for Protection

LVPC 2007 Ranking

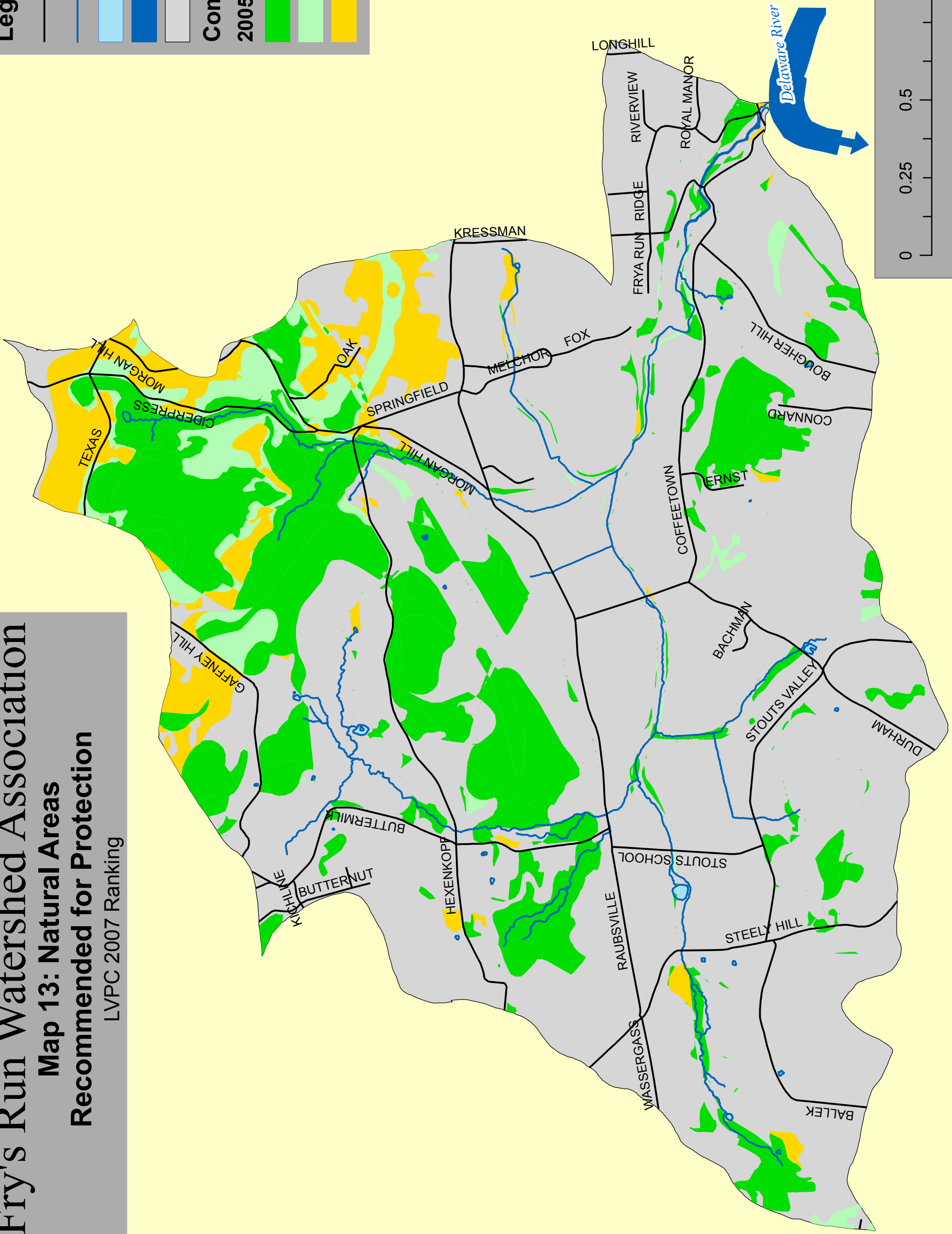
Legend

- Streets
- Streams
- Lakes and Ponds
- Delaware River
- Fry's Run Watershed

Comprehensive Plan

2005 Natural Resources

- Very High Conservation Priority
- High Conservation Priority
- Medium Conservation Priority



Map Created by John R. Wilson
January 19, 2008

Data Sources:
All files from Lehigh Valley Planning Commission, (2007 data CD release)

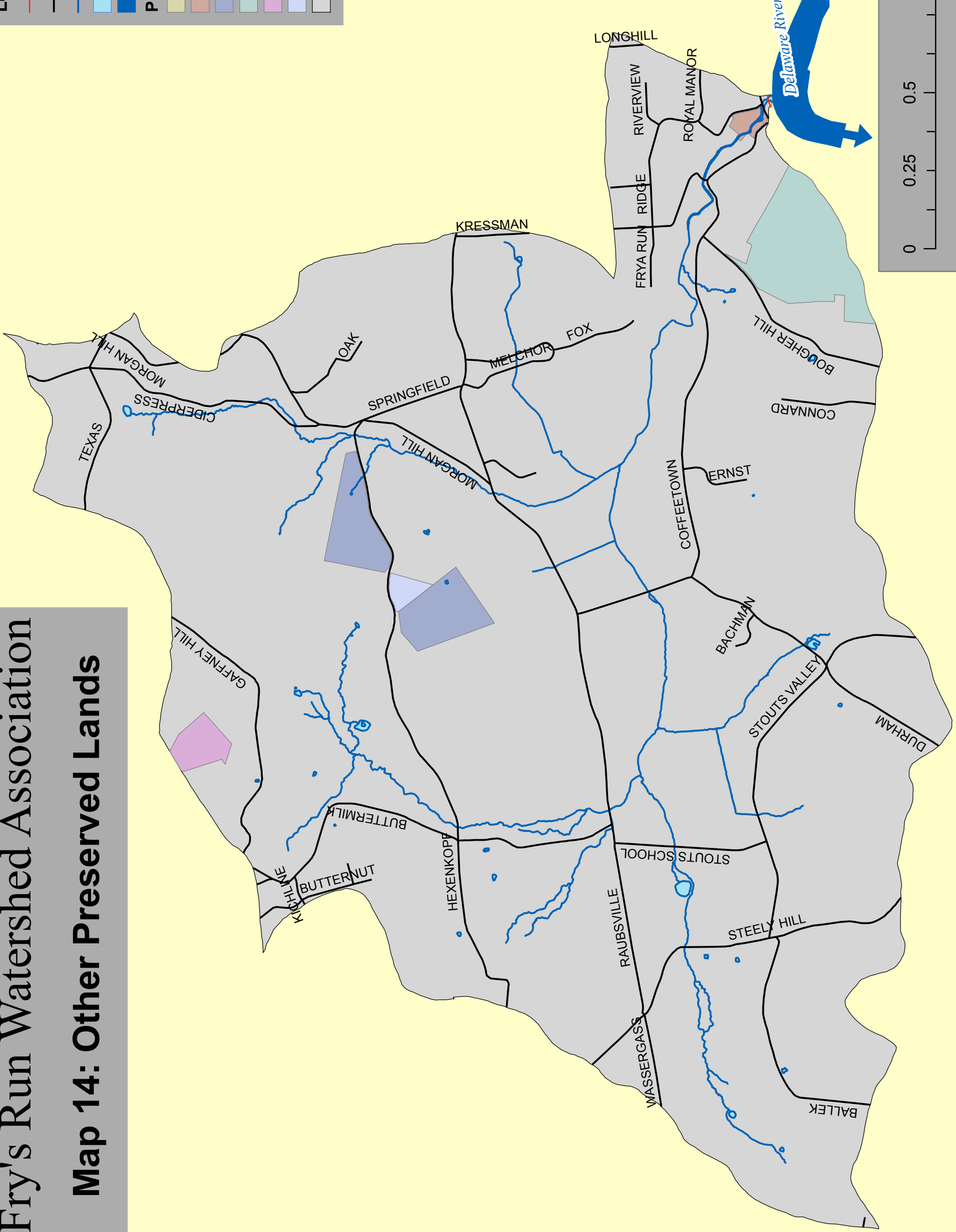
0 0.25 0.5 1 Miles

Fry's Run Watershed Association

Map 14: Other Preserved Lands

Legend

- Historic Canals
- Streets
- Streams
- Lakes and Ponds
- Delaware River
- Preserved Lands**
 - Delaware Canal State Park
 - Fry's Run Park
 - Hexenkopf Rock Easements
 - Mariton Wildlife Sanctuary
 - Williams Township Sportman's Association
 - Hexenkopf Rock (Wildlands Conservancy)
 - Fry's Run Watershed



Map Created by John R. Wilson
January 19, 2008

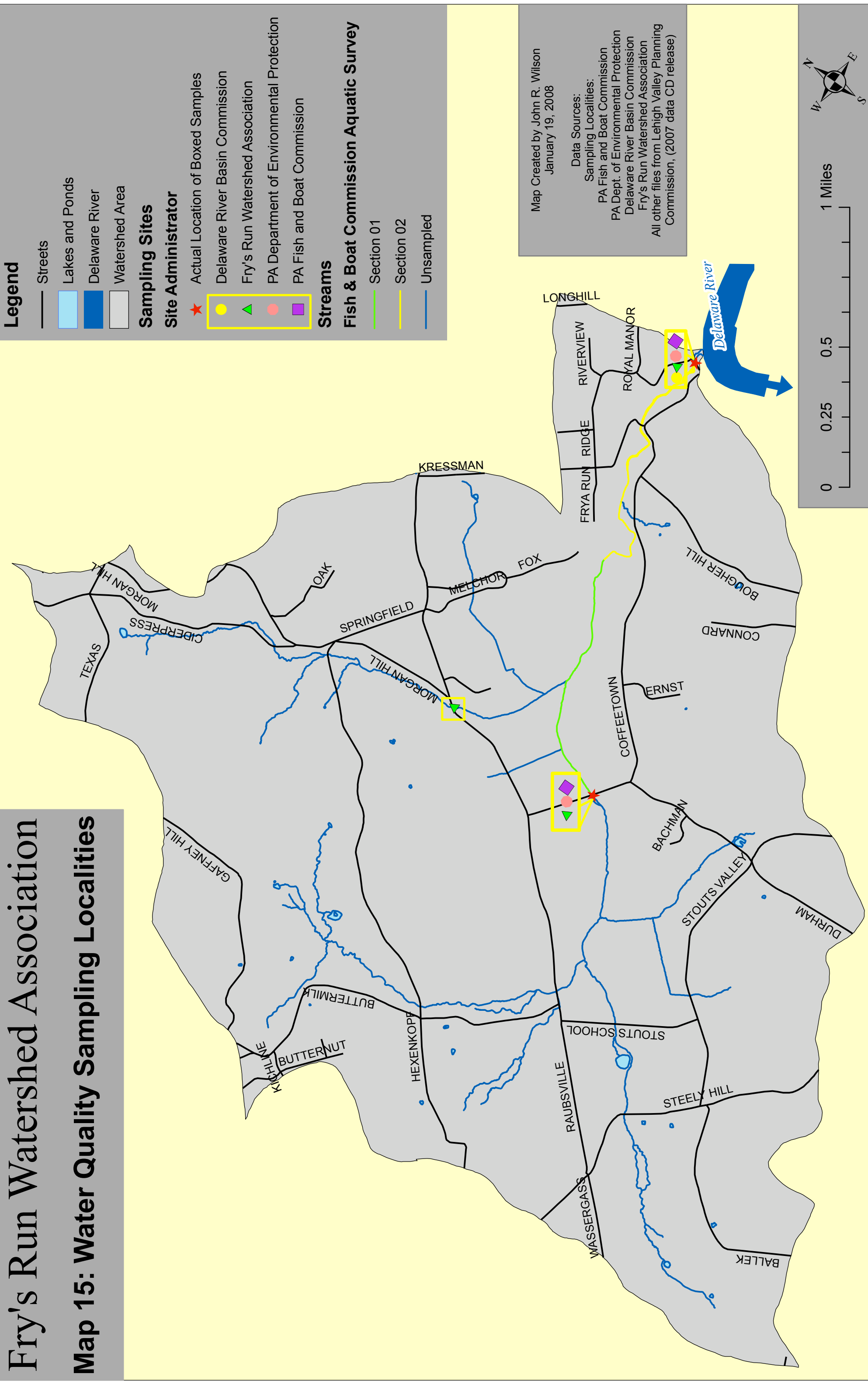
Data Sources:
All files from Lehigh Valley Planning
Commission, (2007 data CD release)

0 0.25 0.5 1 Miles

A scale bar showing distances from 0 to 1 mile, with increments of 0.25 miles. A north arrow is located to the right of the scale bar.

Fry's Run Watershed Association




Map 15: Water Quality Sampling Localities






Fry's Run Watershed Association

Map 16: Forested Riparian Buffer

Legend

-  Lakes and Ponds
-  Delaware River
-  Fry's Run Watershed

Riparian Buffer Status

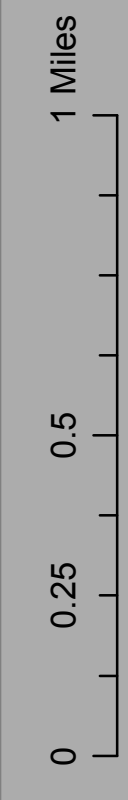
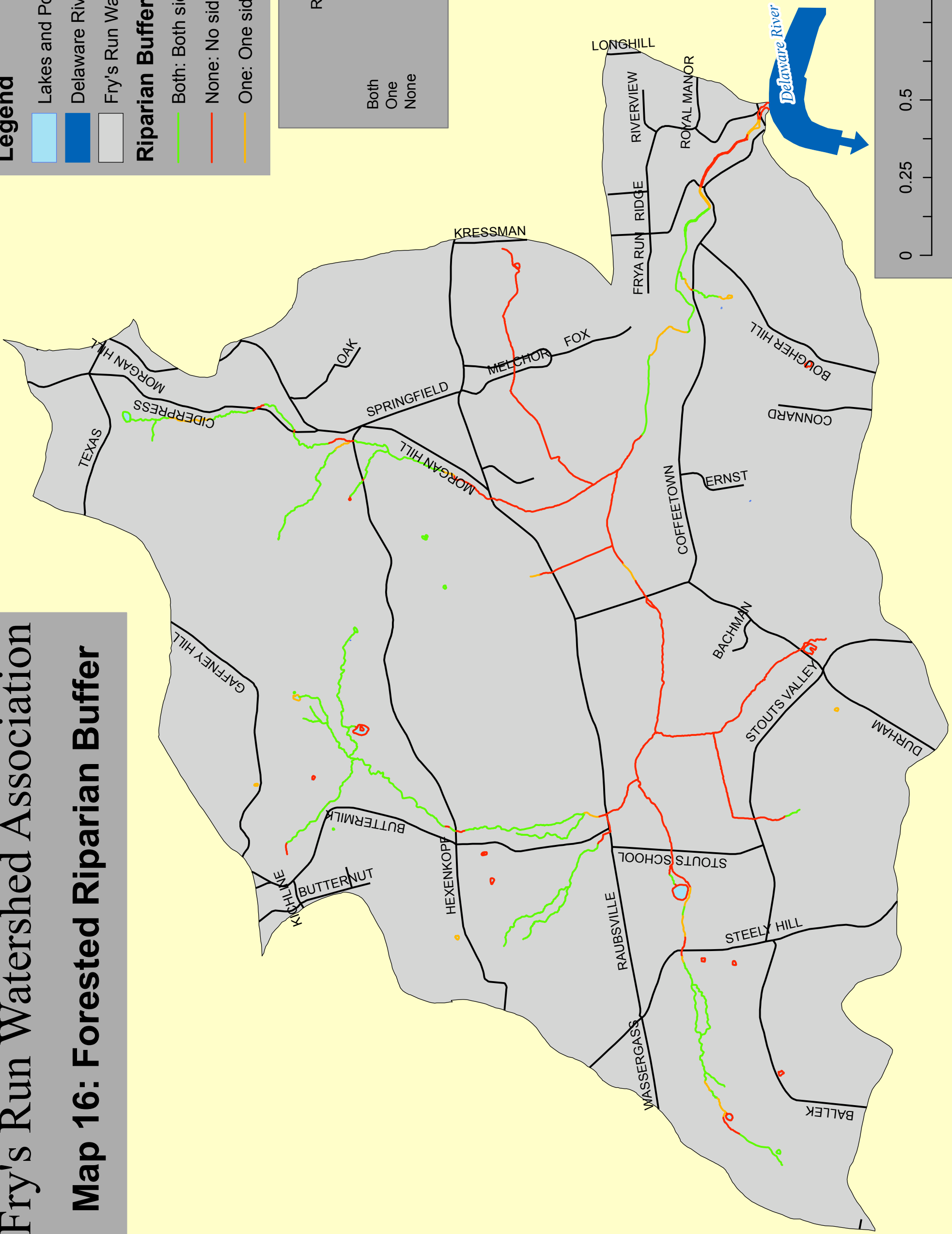
-  Both: Both sides have greater than 50 ft Buffer
-  None: No sides have Riparian Buffer
-  One: One side has greater than 50 ft Buffer

Riparian Buffer Analysis

	Percent	Feet	Miles
Both	47.77%	38379.91	7.55
One	8.38%	6732.75	1.32
None	43.85%	35232.44	6.93

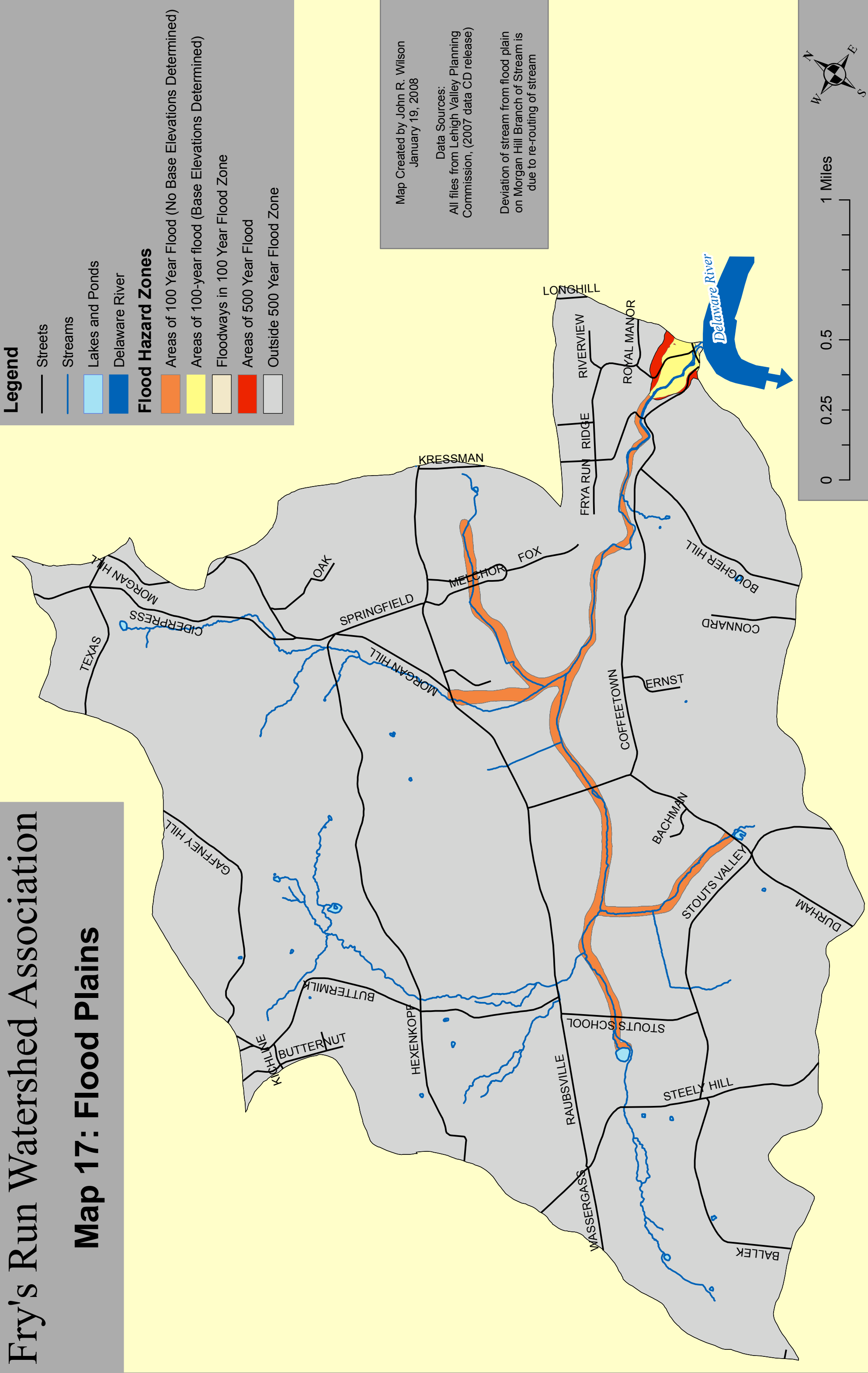
Map Created by John R. Wilson
January 19, 2008

Data Sources:
Riparian Buffer created by John R. Wilson
using LVPC file nhydroarcs
All other files from Lehigh Valley Planning
Commission, (2007 data CD release)



Fry's Run Watershed Association

Map 17: Flood Plains

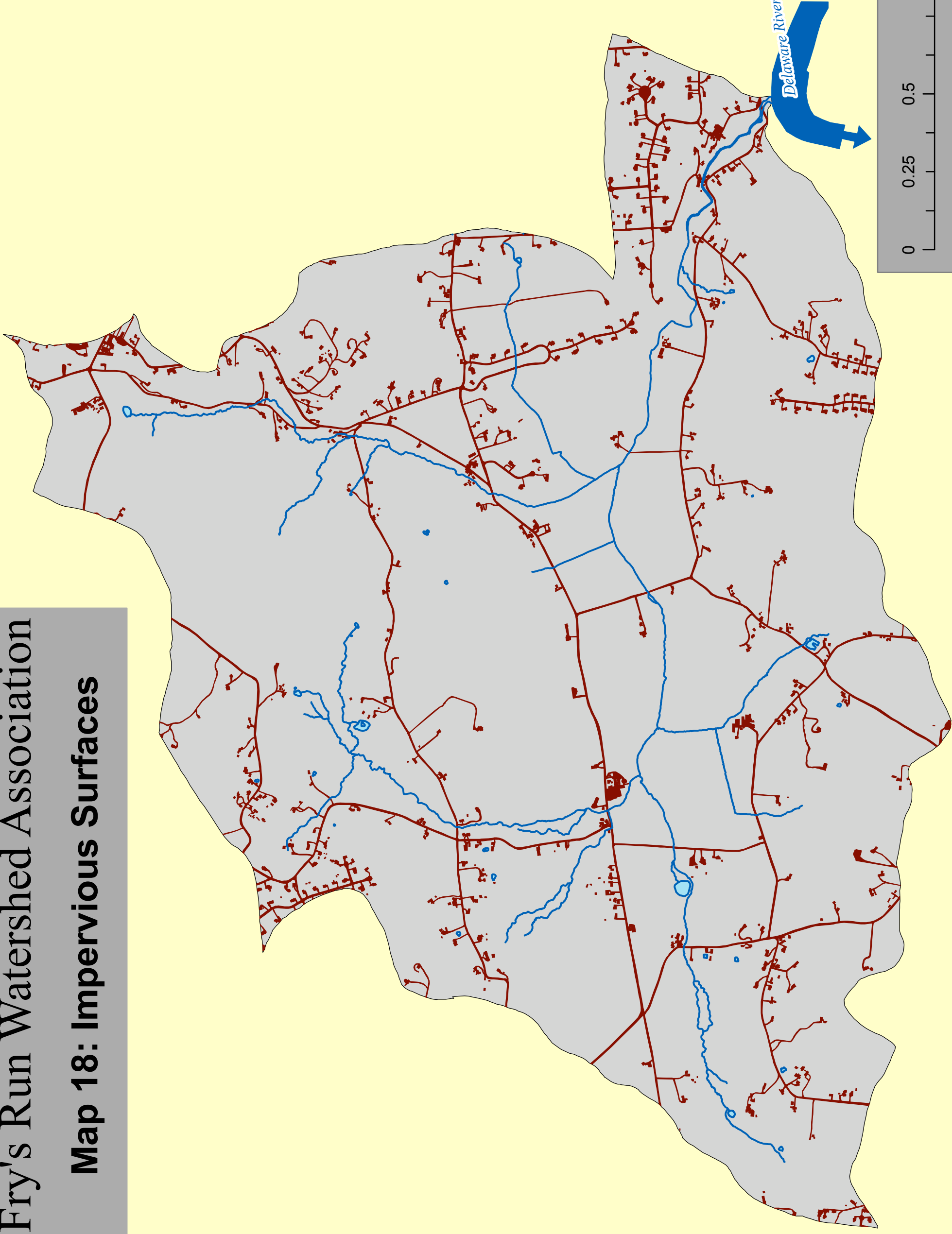


Fry's Run Watershed Association

Map 18: Impervious Surfaces

Legend

- Streams
- Lakes and Ponds
- Delaware River
- Impervious Surfaces
- Fry's Run Watershed



Map Created by John R. Wilson
January 19, 2008

Data Sources:
Impervious Surfaces created by
John R. Wilson, December 2007
All files from Lehigh Valley Planning
Commission, (2007 data CD release)

Of the 6 square miles within
the Fry's Run Watershed,
.26 square miles, or 4.3%
are completely impervious

0 0.25 0.5 1 Miles



Tables

Table 1. Water Quality Measurements in Fry's Run

Site Name	Date	Time	DO mg/l	DO Sat Value	DO % Sat	SpC umhos/cm	pH	Water Temp C	Water Temp F	TDS (mg/l)	TSS (mg/l)	CaCO3 Hardness (mg/l)	CaCO3 Alkalinity (mg/l)	Turbidity NTU	Total Phosphorus (mg/l)	Chlorides (mg/l)	Nitrate NO3-N (mg/l)	Nitrite NO2-N (mg/l)	Ammonia NH3-N (mg/l)	FC col/100ml	
Station 201	10/17/9					180	7.3	16	60.8			124	84								
Station 201	10/16/91						7.8	12.2	54.0			132.0	98.0								
Station 101	10/30/91					129	7.4	10.1	50.2			94.0	57.0								
Royal Manor Rd Station 1FR	12/16/97		9.7	12.5	77.5%	216	6.6	5.8	42.4	170	<2	72	46	0.03	0.03		1.65	0.01	0.05		
Durham Rd. Station 2FR	12/16/97		10.9	12.1	90.2%	291	8.0	7.2	45.0	178	<2	114	100	0.02	0.02		2.46	<0.01	0.02	60	
Fry's Run @ Old Bridge off Rt 611	6/6/00	12:30	10.0	10.5	95.1%	233	6.9	13.1	55.6			75.0	80.0	10.0		1.3	1.61				
Fry's Run @ Old Bridge off Rt 611	6/20/00	12:00	10.1	9.7	104.5%	234	8.0	17.0	62.6	246	3.00	123.0	100.0	2.0		1.5				1,040	
Fry's Run @ Old Bridge off Rt 611	7/11/00	10:20	10.0	9.7	102.6%	317	8.7	16.6	61.9	212	3.00	115.0	110.0	0.1		1.7	2.93			250	
Fry's Run @ Old Bridge off Rt 611	7/25/00	11:20	10.4	10.0	103.6%	310	8.2	15.2	59.4	222	3.00	150.0	115.0	2.0		2.3	2.86			160	
Fry's Run @ Old Bridge off Rt 611	8/8/00	10:30	9.9	9.4	104.8%	307	7.8	18.1	64.6	226	5.00	140.0	105.0	10.0		2.8	4.50				
Fry's Run @ Old Bridge off Rt 611	8/22/00	10:15	10.7	10.4	102.7%	318	7.8	13.5	56.3	214	1.00	120.0	110.0	6.0		1.5				250	
Fry's Run @ Old Bridge off Rt 611	9/12/00	12:00	10.4	10.0	103.8%	326	8.1	15.3	59.5	222	1.00	135.0	115.0	10.0		1.8	1.30			30	
Fry's Run @ Old Bridge off Rt 611	9/28/00	9:55	9.4	10.9	86.4%	288	8.0	11.6	52.9	310	1.00	115.0	110.0	10.0		2.0	0.81				
Royal Manor Rd (station 1FR)	9/4/07	17:00					7.5	16	60.8			173	55					0.03	0.0024		
Royal Manor Rd (station 1FR)	10/28/07	13:40					7.5	13.5	56.3			160	55					0.03	0.0024		
Durham Rd. (station 2FR)	10/26/07	13:00					7.5	14.4	57.9			114	60					0	0.0024		
Morgan Hill Rd.	10/28/07	13:00					7.5	13.5	56.3			110	55					0	0.0024		
Water Quality Standards																					
PADEP025 Pa. Code 93.7 Specific water quality criteria																					
PADEP Human Health Criteria																					
PADEP Aquatic Life Criteria																					
PADEP Maximum Contaminant Levels for Drinking Water																					
EPA Current Recommended Water Quality Criteria for Fresh Water (chronic)																					
EPA Fecal Coliform Recommendation																					
The current USEPA recommendations for body-contact recreation is fewer than 100 colonies/100 mL; for fishing and boating, fewer than 1000 colonies/100 mL; and for domestic water supply, for treatment, fewer than 2000 colonies/100 mL. The drinking water standard is less than 1 colony/ 100 mL.																					
Optimal Fish Condition according to the PA Fish and Boat Commission																					
6 and above for cold water fish																					
80-124 % excellent																					
5 to 9.5 for brown trout																					

DRBC Data
PADEP Data
PFBC Data
Fry's Run Watershed Association Data

Table 2. Fish Identified in Fry's Run

	Date				
	Oct-91	Oct-91	Oct-97	Oct-91	Oct-91
Species Name	Station 1FR	Station 2FR	Station 2FR	Station 101	Station 201
American Eel		X	X		X
Brown Trout		X	X		X
Golden Shiner		X			X
Spottail shiner			X		
Blacknose Dace	X	X	X	X	X
Longnose Dace			X		
Creek chub	X	X		X	
Fallfish		X			X
White Sucker	X	X	X	X	X
Green sunfish		X			X
Pumpkinseed		X			X
Smallmouth bass		X	X		X
Tessellated darter			X		

PADEP Data

PFBC Data