



*An Environmental Assessment  
of Northern Delaware*



**Delaware Department of Natural Resources and Environmental Control**

# Introduction



This report is the Department of Natural Resources and Environmental Control's effort to present a comprehensive assessment of northern Delaware's environment. It provides a synopsis of environmental information and key issues of concern for northern New Castle County. This information will aid the Department and other local, state, and federal agencies in identifying the environmental issues requiring the greatest attention in this region.



Delaware's most urbanized landscape drains into the Brandywine, White Clay, and Red Clay creeks, the Christina River, and other tributaries.

Understanding and respecting the relationships that exist in nature among the air, land, water, and living resources as they constantly interact in a dynamic, ever-changing system has prompted the Department to focus on looking at the environment from multiple perspectives in an integrated fashion. This effort, which we refer to as "Whole Basin Management," involves monitoring, assessing, and managing all of Delaware's biological, chemical, and physical environments on the basis of drainage patterns.

Five major drainage basins encompass Delaware: the Piedmont, Chesapeake Bay, Delaware Bay, Delaware Estuary, and Inland Bays/Atlantic Ocean basins. Each basin consists of smaller management units, or watersheds, which represent the area drained by a river, stream, or creek. Delaware has 45 sub-basins, or watersheds.

For each major basin, a team of scientists, planners, engineers, and managers representing the six different environmental units within the Department is being assembled to carry out a five-year, eight-phase plan. The phases begin with planning and range through preliminary assessment, monitoring, analysis of problems and issues, development of management and resource protection strategies, and, finally, implementation of the plan. Throughout the

process, we will be asking you and your neighbors to express your ideas, concerns, and opinions about the region in which you reside.

This publication is a summary of the Preliminary Assessment report that has been completed for the six watersheds that make up the Piedmont Basin. The pages that follow include information on these topics:

- ◆ Land Use & Comprehensive Planning
- ◆ Watershed Hydrology
- ◆ Air Quality
- ◆ Water Quality & Quantity
- ◆ Recreation & Living Resources
- ◆ Contaminant Sources

As you read the *Piedmont Environmental Profile*, we encourage you to think about the problems or issues of concern that may exist in your region and the actions we all can take to protect and improve Delaware's environment.

Let's all join together and become responsible stewards of our environment, and leave our future generations the pristine natural resources that we and our ancestors have had the privilege to experience and enjoy!

For more information about the Department of Natural Resources and Environmental Control's Whole Basin Management approach, please contact:

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**Delaware's Good Nature  
 Depends on You!**

Throughout our lives, in whatever we do, we must always remember that . . .

**"we are borrowing this land from our children."**

The basis for developing this report comes from our realization that virtually every activity that takes place within the environment impacts more than one resource or land use. For example, improper disposal of hazardous substances on land can contaminate more than just surface soils. Contaminants can leach into the groundwater or be transported to streams during storms. Contaminants in streams then may impact public drinking-water supplies, aquatic life, and sport fishing.

Additionally, abandoned contaminated sites challenge state and local governmental agencies to find ways to make these sites safe and attractive to potential buyers such as industry.

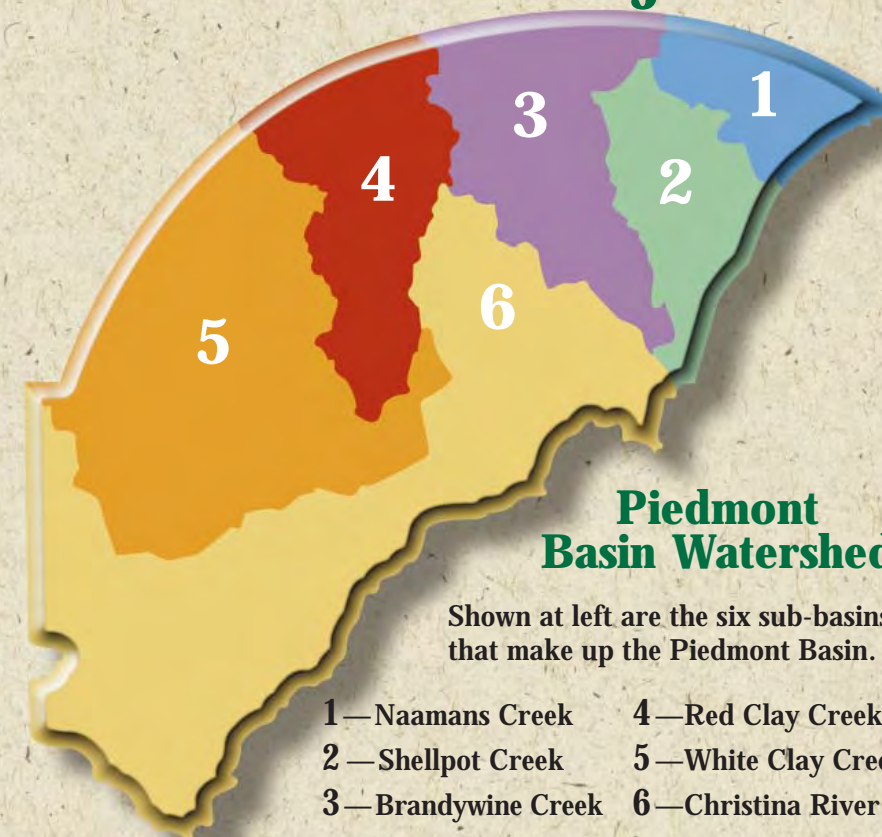


The streams and waterways of northern New Castle County make up the Piedmont drainage basin.

## Delaware's Major Drainage Basins

The five major drainage basins are highlighted below. Each basin consists of smaller management units or sub-basins.

- Piedmont
- Delaware Bay Drainage
- Chesapeake Bay Drainage
- Inland Bays/Atlantic Ocean
- Delaware Estuary



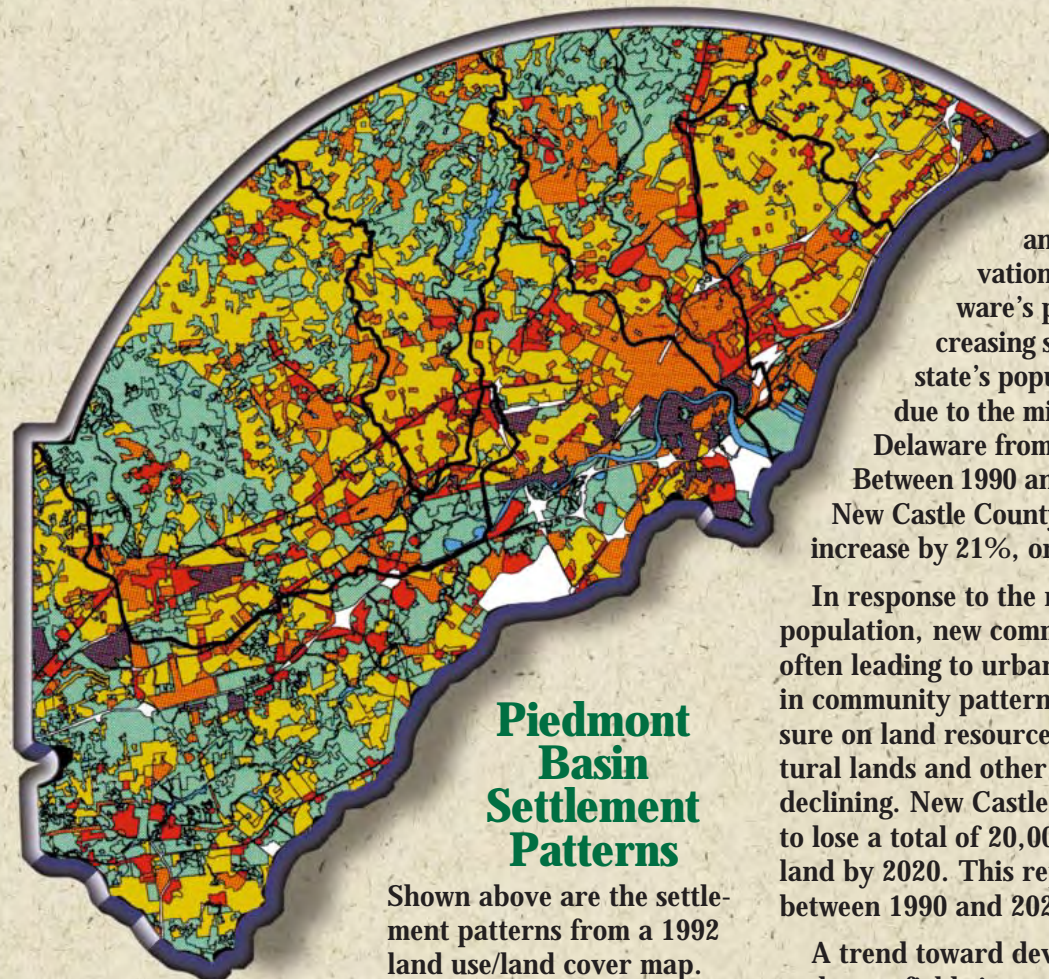
### Piedmont Basin Watershed

Shown at left are the six sub-basins that make up the Piedmont Basin.

- |                    |                    |
|--------------------|--------------------|
| 1—Naamans Creek    | 4—Red Clay Creek   |
| 2—Shellpot Creek   | 5—White Clay Creek |
| 3—Brandywine Creek | 6—Christina River  |

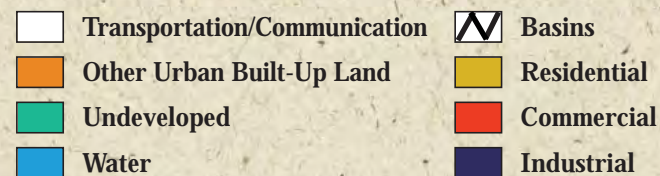


# Land Use & Comprehensive Planning



## Piedmont Basin Settlement Patterns

Shown above are the settlement patterns from a 1992 land use/land cover map.



Indicators	1990	2020
Population	443,580	538,426
Agricultural Land	87,134 acres	67,134 acres
Automobile Trips	91% of total trips	95% of total trips
Public Transit Trips	3% of total trips	1% of total trips

New Castle County is at a crossroads in maintaining a balance between development and environmental preservation. Since the 1960s, Delaware's population has been increasing steadily. In the 1980s, the state's population grew substantially due to the migration of people to Delaware from neighboring states.

Between 1990 and 2020, the population of New Castle County alone is expected to increase by 21%, or nearly 100,000 people.

In response to the needs of an ever-growing population, new communities were developed, often leading to urban sprawl. Such changes in community patterns have put added pressure on land resources in Delaware. Agricultural lands and other open spaces are fast declining. New Castle County is expected to lose a total of 20,000 acres in agricultural land by 2020. This represents a 23% decrease between 1990 and 2020.

A trend toward developing open spaces and greenfields instead of directing growth to abandoned, vacant, or underutilized properties (commonly referred to as *brownfields*) also exists. The City of Wilmington alone contains 10.8 square miles of brownfields.

Transportation trends also foretell increasing land-use pressures. Current trends denote less reliance on public transportation and greater reliance on private automobile trips. It is expected that by the year 2020, trips made by automobiles will rise to 95% of total trips (a 4.4% increase compared to 1990). Also, public transit trips will decrease by 66% in 2020. As a consequence, traffic congestion will triple.

## KEY ISSUES/GOALS FOR DELAWARE

In response to the growing concern about the viability of comprehensive planning to direct and manage new development and make land-use decisions, the Delaware General Assembly enacted Senate Bill 116 in June 1995. Through this act, known as "Shaping Delaware's Future," the state began to exert a direct role in the land-use planning process. "Shaping Delaware's Future" established the following 10 goals to improve the effectiveness of land-use decisions made by state and local governments:

1. Direct state investment and future development to existing communities, urban concentrations, and designated growth areas.
2. Protect important farmlands from ill-advised development.
3. Protect critical natural resource areas from ill-advised development.
4. Develop methods for assessing the fiscal impact and cost-benefit of development that can be used by both state and local governments when considering land-use policies and infrastructure.
5. Streamline regulatory processes and provide flexible incentives and disincentives to encourage growth in desired areas.
6. Encourage redevelopment and improve livability of existing communities and urban areas, and guide new employment into underused commercial and industrial sites.
7. Provide high-quality employment opportunities for citizens, and attract and retain a diverse economic base.
8. Protect the state's water supplies, open spaces, farmlands, and communities by encouraging revitalization of existing water and wastewater systems and the construction of new systems.
9. Promote mobility for people and goods through a balanced, multi-modal transportation system.
10. Provide access to educational opportunities and health care for all Delawareans.



New Castle County is expected to lose 20,000 acres in agricultural lands by the year 2020.

## Challenges for the Future

The following land-use goals have been identified for Delaware's Piedmont Basin:

- ◆ Connect land use with environmental quality, and support ecologically oriented planning.
- ◆ Link transportation to land use, and improve mobility.
- ◆ Support revitalization of brownfields.
- ◆ Protect vital farmland, open spaces, and natural resources.
- ◆ Enhance land-use planning and decision making through the use of new tools such as the Geographic Information System (GIS), with its layers of maps and data.
- ◆ Continue cooperation and coordination between state and local planning authorities in making land-use decisions.

# Watershed Hydrology



**L**iterally translated from its ancient Greek origin, *hydrology* means the “study of water.”

As practiced today, hydrology is the study of water as it interacts with the land, the sea, and the sky.

About 70% of the Earth’s surface is covered by water, and almost all of that water has been around since the Earth was formed billions and billions of years ago. Thus, the glass of water you drink today could be the water that a dinosaur once sipped. Water is constantly recycled on Earth as rain, snow, oceans, lakes, streams, hail, and glaciers. Scientists refer to this as the *water cycle*.

There are several parts to the water cycle. Evaporation occurs when lakes, oceans, rivers, and streams are heated by the sun. The liquid water evaporates into a gas called water vapor. Trees and plants also release water vapor through their leaves through a process called transpiration. Condensation is when the water vapor comes together to form clouds.

Precipitation occurs when water from the clouds falls to Earth as rain, sleet, hail, or snow. Some of the precipitation that reaches the Earth filters through the soil and ends up as groundwater. If more precipitation falls than the soil can absorb, it ends up as runoff. Both runoff and groundwater eventually reach a

stream or other water body, and the cycle starts all over again, around and around, all the time, all over the world.

But human activities can have significant impacts on the water cycle. When vegetation is removed and impervious surfaces, such as parking lots, buildings, and highways, are added to the landscape, less precipitation can infiltrate the soil. Thus, runoff increases, which results in an increase in flooding. It can also cause streambanks to erode.

Flooding is not the only negative impact associated with urban runoff. Water has often been called the “universal solvent,” which means that most substances will mix at least somewhat with it. As water runs over land during heavy storms, it can pick up fertilizers, pet waste, and other chemicals and materials and carry these pollutants into our streams, rivers, and lakes.

Stormwater management practices can offset some of the adverse impacts caused by urbanization. However, they can not be viewed as a cure-all. While the technology is improving, stormwater management practices can provide only partial control.

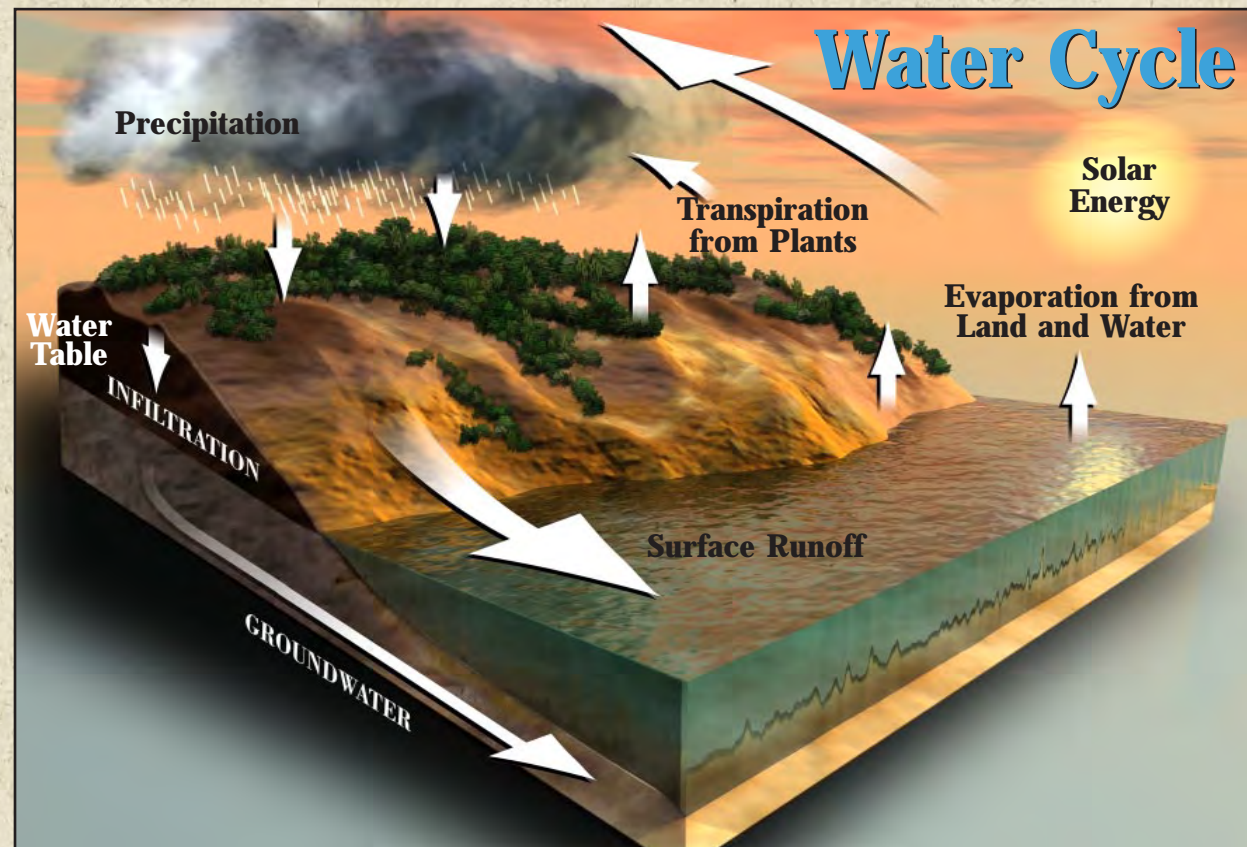
How is urbanization affecting stream quality? In fall 1993, the Department conducted biological and habitat assessments in 39 nontidal streams in the Piedmont Basin. The larval stages of aquatic insects served as the principal indicators of biological quality. Besides being generally long-lived, these insects are known to be sensitive to pollution and are the primary food source for fish.

Three-fourths (74%) of the nontidal streams in the basin were found to have degraded biological conditions; an equal number of sites were deemed moderately and severely degraded. The degraded sites were dominated by pollution-tolerant species such as fly larvae, snails, and worms, while “good” sites were dominated by pollution-sensitive species such as mayfly, stone fly, and caddis fly larvae.



*The Brandywine River does not meet standards for fishing, drinking, or swimming.*

Almost all (90%) of the nontidal streams had undergone some degree of habitat degradation as exhibited by eroded banks, newly deposited sediment in the channel, and lack of a shade canopy. Many of these conditions are indicative of urban streams, where roads, parking lots, and other impervious surfaces have increased the frequency and magnitude of peak flows during storms.



*Human activities can have a significant impact on the water cycle. When forests and other vegetation are removed and roads and buildings constructed, less precipitation can infiltrate the soil and runoff increases.*

## Challenges for the Future

**T**he Department’s challenge will be to do a better job of mimicking Delaware’s natural hydrology in the face of an increasingly urbanized landscape.

- ◆ Watershed management will be the preferred method to control flooding, maintain stability of streams and rivers, and prevent further environmental degradation due to urban runoff.
- ◆ Sophisticated computer modeling and Geographic Information Systems (GIS) are becoming accessible to virtually anyone with a desktop computer. These will become increasingly important tools as urbanization, and the complex issues associated with it, continues in the future.

# Air Quality

The air around us is constantly mixing and moving and cannot be confined to a locality or geographic area. Even so, air quality plays a major part in the Department's Whole Basin Planning process, and it is a very important factor in the Piedmont Basin's ecology. Although much of Delaware's air pollution is carried into the state on the prevailing winds, a significant amount of pollutants are added right here in the Piedmont Basin. These man-made particles and gases create environmental damage wherever the wind carries them.

## CURRENT STATUS

Delaware has been measuring air quality for over 20 years and is required by federal statute to monitor levels of specific gases known as *criteria pollutants* on an hourly basis. Of all the air pollutants that are monitored and have clean air standards, only ozone occurs at levels that are above the federal standard and are classified as "unhealthy." Ozone is a colorless gas that is the main ingredient of smog. Ground-



Water quality is also affected by air pollution. As much as 30% of the nitrogen in some of Delaware's waters is believed to come from atmospheric deposition.

level ozone is a severe public health concern. It damages lung tissue, aggravates respiratory conditions, and makes people more susceptible to respiratory infections. Children are especially vulnerable to ozone's harmful effects. Ozone also causes damage to sensitive species of plants and agricultural crops.

Ozone is formed when a chemical reaction occurs between pollutants in the lower atmosphere on hot, sunny days. The air pollutants contributing most to ozone formation are *volatile organic compounds* and *nitrogen oxides*. There are many sources of both of these pollutants in the Piedmont Basin, including large and small industrial facilities, motor vehicles, chemical solvents, and natural sources. These chemical compounds can be carried far from their sources before reacting to form ozone. Ozone, or the compounds that form it, can be blown in to the Piedmont Basin from upwind areas such as Baltimore and Washington, DC. Ozone levels regularly reach unhealthy concentrations in the summer in the Piedmont Basin, as well as in many areas throughout the mid-Atlantic and northeastern United States.

## AIR POLLUTION AND WATER QUALITY

Pollution deposition is another problem affecting the Piedmont Basin. This occurs when chemicals in the air are washed out by rain or settle out as dry particles. Acid rain and nitrogen compounds are the chief pollutants deposited in this manner in the Piedmont Basin. Acid rain can harm aquatic life in lakes and streams, damage vegetation, and erode masonry

structures and statues. Nitrogen compounds can also affect rainwater acidity and add to the nitrate load (excess nutrients) of water bodies. Although the pH of rainwater in the Piedmont Basin is acidic, ranging between 4.2 and 4.3 (clean rain is 5.6), no acidic bodies of water currently are present. While few measurements have been made of nitrogen deposition in the Piedmont Basin, research in nearby states indicates that a significant amount of nitrogen is entering the ecosystem from atmospheric pollution.

Many other chemicals known or suspected to be capable of causing harm to people can be detected in air in very low concentrations. These chemicals are often referred to as *air toxics* and can come from many sources including industrial facilities,



Pollution which contributes to ozone comes from large industrial sources, car exhaust, and some small businesses.

transportation sources, and chemical processes. There are no acceptable official standards for outdoor air concentrations of these chemicals; instead they are controlled through permit limits placed on industry. The emissions are quantified on an annual basis and published in the Toxics Release Inventory (TRI). The Piedmont Basin contains over 20 sources included in the TRI. However, TRI data show a significant decrease, from 1989 to 1994, in the amount of toxic chemicals released annually.

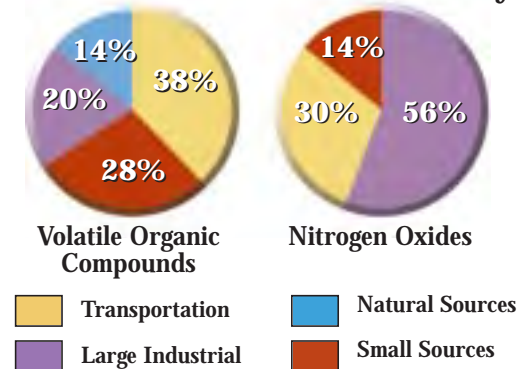


## Challenges for the Future

While ozone levels continue to be a problem in the Piedmont Basin, the number of days with unhealthy concentrations has been declining over the last ten years. This is a result of the many pollution control and prevention programs that have been implemented, including tougher emission controls on large industries, reformulated gasoline, and cleaner operating cars. These controls, as well as some additional measures, will continue to be needed as population increases in the Piedmont Basin.

- ◆ The National Acidic Deposition Program, as part of the Clean Air Act of 1990, sets goals for decreasing emissions of pollutants that contribute to acid rain. A specific goal is to reduce annual emissions of sulfur dioxide by 10 million tons between the years 1980 and 2010. While this program reported an improvement in rainwater acidity at a number of sites in 1995, Delaware's monitoring site nearest to the Piedmont Basin has yet to show any significant change.
- ◆ While the Toxics Release Inventory has shown reductions in releases of toxic chemicals since 1989, Delaware's goal is to further reduce emissions another 30% over 1995 levels by the year 2000.
- ◆ Monitoring for ozone, acid rain, and other pollutants will continue as the best means of tracking progress toward cleaner air. Delaware will also continue to gather information and cooperate with neighboring states regarding the effects of pollution deposition on land and water. We will also work closely with the EPA to develop the large-scale pollution prevention and control programs needed to meet all clean air quality standards.

### 1993 Ozone Inventory Emissions in New Castle County





# Water Quality & Quantity

The Piedmont Basin's many streams, wetlands, and tidal rivers support uniquely diverse fish and wildlife populations, provide abundant recreational opportunities, and supply approximately 70% of the drinking water for New Castle County.

As recently as 1975, Delaware routinely experienced serious water pollution and public health problems as a result of the discharge of untreated sewage. Since then, as a result of voluntary efforts, regulatory actions, and significant private and public investments in wastewater treatment facilities, localized improvements in water quality have been achieved.

However, the need for additional cleanup and pollution prevention continues. The focus of water-quality management has shifted from point source discharges (end-of-pipe) to decreased stream flows and nonpoint source problems, such as urban and agricultural runoff, erosion, and sedimentation. Unaddressed, these problems lead to poor habitat conditions for fish and other aquatic life, decreased enjoyment of



Meeting the needs of aquatic life that depend on adequate stream flows as well as the needs of people who depend on the water for drinking and industrial uses is a difficult management challenge.

our surface waters for recreation, and unhealthy conditions for those surface waters upon which New Castle County relies for the majority of its water for drinking and other domestic uses. Delaware is working to enhance its interstate cooperation with Pennsylvania since many of the streams that drain the Piedmont Basin flow from Pennsylvania.

## WATER RESOURCE ISSUES

A host of water resource issues have arisen in the Piedmont Basin over the past several years, from addressing increased demands for drinking water to restoring wetlands.

A preliminary assessment of water-quality data, completed in 1996 for the Piedmont Basin, indicates a decline in water quality. The study characterized water quality and identified existing and potential problems in streams. In some cases, water-quality criteria were frequently violated, or trends indicated potential future problems, or both.

## FISH CONSUMPTION ADVISORIES

In April 1996, a public health advisory on the consumption of fish taken from several

streams in the Piedmont Basin was issued due to elevated levels of *polychlorinated biphenyls* (PCBs) in the fish.

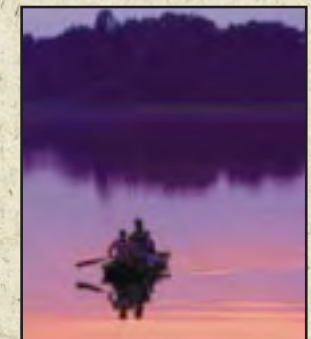
Specifically, the advisory recommends *no consumption* of any finfish caught in the tidal portion of the Christina River (from the mouth to Smalley's Dam), the tidal portion of Brandywine Creek (from the mouth to Baynard Boulevard), the tidal portion of White Clay Creek (from the mouth to Route 4), and Little Mill Creek (from the mouth to Kirkwood Highway).

The advisory recommends only *limited consumption* of fish caught in the nontidal areas of the Christina River (from Smalley's Dam to Interstate 95), White Clay Creek (from Route 4 to Paper Mill Road), and the nontidal portion of Brandywine Creek (from Baynard Boulevard to the Pennsylvania state line). Fishermen and their families eating fish caught in the areas where a limited consumption advisory has been issued are advised to limit their meals of fish from these waters to no more than one 8-ounce meal per month. The advisory also reaffirms the existing advisory on Red Clay Creek, which recommends *no consumption* of fish caught in that waterway.

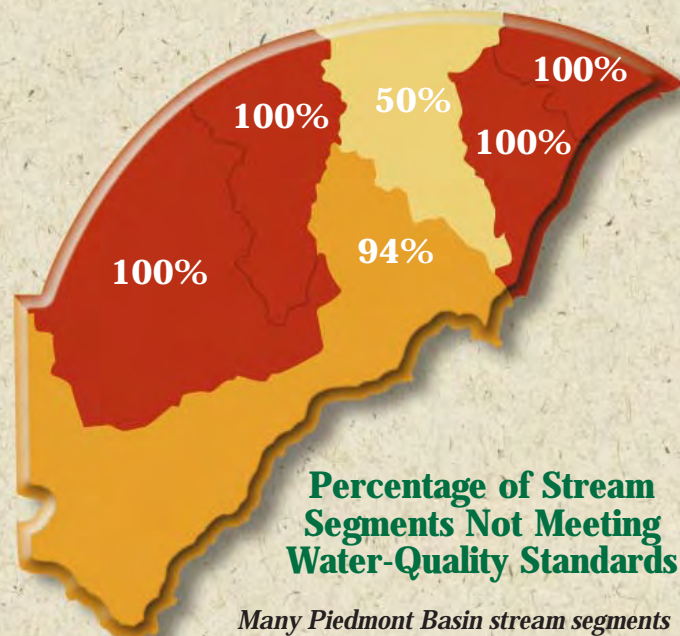
## WATER SUPPLY

Delaware has a long-established water-supply management program that involves allocation, conservation, and planning. Water utilities, both municipal and investor-owned, supply almost all water used in the Piedmont Basin. There are three major sources of supply: streams, groundwater, and transfers from Pennsylvania, which altogether yield in excess of 100 million gallons per day.

Water supplies are usually plentiful, but Delaware can have shortage problems during droughts when there simply is not enough available water especially for systems dependent on stream flow. Shallow wells also are susceptible to declining water tables during droughts. Since Delawareans rely on groundwater for drinking purposes, the protection of groundwater resources is critical.



Delaware's waterways are a valuable recreational resource. A recent survey showed that 1996 fresh-water angler expenditures in Delaware had an overall impact of \$81 million.



Percentage of Stream Segments Not Meeting Water-Quality Standards

Many Piedmont Basin stream segments do not meet water-quality standards for fishing, swimming, or drinking.

## Challenges for the Future

Delaware will continue to focus on point source and nonpoint source pollution problems such as urban and agricultural runoff, erosion and sedimentation, and groundwater contamination.

- ◆ The Department will emphasize pollution prevention, education, and both voluntary and regulatory efforts to improve the quality of surface and groundwater resources.
- ◆ Additional research and assessment efforts will be necessary to better understand how aquatic systems respond to certain pollutants. The relationship between stream flow and ecological health will require the development of a surface-water withdrawal/minimum stream-flow policy.
- ◆ Plans will continue to address water-supply problems during drought conditions. Improved assessment and management of biological health and physical habitat quality are also priorities.

# Recreation & Living Resources

Today, despite nearly 400 years of natural resource consumption and the conversion of habitats for agriculture and industry, the Piedmont Basin's remaining woodlands, rivers, and marshes still provide viable habitats and a biological history of Delaware. Yet these few remaining natural areas are under continually increasing pressure from humans. This so-called "open space" is an important part of the social fabric of the community and is a significant resource that enhances both the health of the Piedmont Basin and the health of its citizens.



Freshwater wetlands in the Piedmont Basin were, at one time, among the most productive in the state for waterfowl.

Recreation is any type of conscious enjoyment that occurs during leisure time.

## RECREATION

Recreation is any type of conscious enjoyment that occurs during leisure time.

From golfing to fishing, our recreational options are linked to the quality of our environment, the health and diversity of our natural resources, and the amount of available open space.

More than 9,000 acres of land are dedicated to public recreational use in state, county, and municipal parks in the Piedmont Basin.

Although the current acreage meets the minimum national standard for recreational space per person, the demand for recreational facilities already has exceeded the capacity of a significant portion of the basin's recreational resources.



Improved access to fishing, boating, and canoeing facilities has been identified as a priority need by the public.

## FISH & WILDLIFE RECREATION

Hunting, fishing, and boating in the Piedmont Basin traditionally have been limited by suburban sprawl and high human population. However, the sporting activities available in the basin provide some of the most unique opportunities in the state. For example, freshwater trout fishing is available at six designated trout streams in the basin. Over 30,000 legal-sized trout are stocked annually along 19 miles of these streams — the only streams in Delaware that receive trout. Sales of the state trout stamp annually exceed 5,500, with 49% (2,718) of these anglers residing in the Piedmont Basin.

Hunting occurs primarily on private properties, as no State Wildlife Areas exist in the Piedmont Basin. However, White Clay Creek and Brandywine Creek state parks periodically allow recreational hunting to control excessive deer populations. Although opportunities are limited, hunting is an important recreational activity among Piedmont Basin residents, as approximately 30% (5,992) of all state resident hunting licenses are sold here.

## LIVING RESOURCES

The Piedmont Basin once supported a rich diversity of plants and animals. Today, nearly 75% of the basin's forests are gone, having been cleared long ago for pasture and settlements or more recently for homes and businesses. Most of the remaining forests are young, second-growth woods that have lost many of their former species, especially spring wildflowers, which have been replaced by non-native or exotic species.

The Department conducts ongoing inventories of natural communities as well as rare and declining species, including plants, birds, insects, mussels, reptiles, and amphibians. These data indicate that an alarming number of species once common in the Piedmont Basin are now found in only one or two locations, or have become extinct. Delaware has lost a higher percentage of its native plant species than any other state in the U.S.

Our native species, which have evolved to depend upon, as well as to play their role in, the intricate web of life are generally the first indicators of change or disruption. Freshwater mussels, notoriously sensitive to the effects of erosion and

## Challenges for the Future

- ◆ Identify upland forests in the Piedmont Basin, evaluate them by such factors as biodiversity, size, age, and exotic species infestation, and prioritize them for protection.
- ◆ Protect and restore floodplains, wetlands, and upland buffers along all streams in the basin. Reforest cleared uplands and restore degraded wetlands to improve water quality. Gradually eliminate sewer lines from the floodplain.
- ◆ Develop management strategies to protect natural habitats from being overrun by exotic species. The threat of exotic species, combined with habitat destruction and overpopulation by species such as white-tailed deer, has placed the basin's remaining natural habitat under severe pressure.
- ◆ Identify and protect remaining rare habitat. The loss of habitat, as well as the loss of connectivity between habitats, has resulted in significant loss of species diversity in the basin.
- ◆ Continue providing recreational opportunities to a continually increasing population without causing negative environmental impacts.
- ◆ Decrease conflicts between wildlife and humans. Some species (deer and non-migratory geese) benefit from increased human presence and eventually become nuisances. We need to stabilize nuisance populations and increase species negatively affected by human pressure.

pollutants, are an indicator of poor water quality and loss of habitat for many other aquatic animals. Steep population declines in insect-eating forest birds, such as the Kentucky warbler, may indicate the loss and fragmentation of mature forests in our area. The elusive bog turtle, found in Piedmont streamside wetlands, is becoming increasingly difficult to locate as its habitat disappears and may be facing extinction in Delaware.

Group	No. Imperiled Statewide	No. Imperiled in Piedmont	No. Gone from State	No. Secure Statewide
Reptiles & Amphibians	20	9	2	48
Birds	61	16	9	313
Fish	14	4	0	57
Mammals	2	0	1	53
Insects	57	10	13	n/a
Mussels	6	0	4	3
Plants	403	173	210	1325

CHRISTINA RIVER



BOATING ACCESS AREA

# Contaminant Sources

The Piedmont Basin contains a variety of known and potential contaminant sources such as gas stations, factories, landfills, septic systems, and abandoned industrial sites. A contaminant source is a site that has released or has the potential to release hazardous substances to air, soil, groundwater, surface water, or sediment. The potential to contaminate does not mean that the facility has released or will release pollutants to the environment. It only means that the facility uses or generates substances that could negatively impact human health and the environment if the substances were released.

## SOLID WASTE

Piedmont residents and businesses together throw away over 800 million pounds of trash each year. Nearly all of this waste is disposed of in landfills. Improperly designed or operated landfills can cause groundwater, surface water, and air pollution and are a potential breeding ground for disease-carrying insects and rodents.



Landfills do not pose the threat to public health they once did thanks to more stringent regulation.

Since the mid-1960s landfills have been regulated by the state to reduce these risks.

Modern landfills regularly cover the waste to control insects and rodents and include a bottom liner to prevent leachate ("garbage juice") from contaminating ground or surface water. Modern landfills also provide gas collection systems to control odors and collect methane. These protective measures can be done most efficiently at large landfills. As a result, where once nearly every community had its own town dump, today there are only two large, modern landfills operating in the Piedmont Basin.



Many of today's contaminant problems are a result of past practices.

## HAZARDOUS WASTE

The Piedmont Basin contains approximately 650 small and large businesses that produce and manage hazardous waste. Hazardous waste comes from the processes that supply goods and services we use routinely, from fuels and chemicals to dry cleaners and auto repair shops.

Hazardous waste that is not stored, handled, and disposed of in a safe manner can pollute the land, air, and water, harming people, animals, and plants. The Delaware Department of Natural Resources and Environmental Control helps businesses manage their hazardous waste in ways that prevent the waste from causing harm.

The Department is also helping businesses find ways to produce less hazardous waste, resulting in a cleaner and safer environment for Delaware.

## UNDERGROUND STORAGE TANKS

In New Castle County, there are 1,752 underground storage tanks in use at 707 facilities. Most of these tanks are located at gasoline stations. Underground tanks that leak can pollute the groundwater and soil. In fact, 138 leaking underground storage tank sites in the Piedmont Basin are known to have impacted groundwater. The largest concentration of leaking underground storage tanks is in the Christina watershed.

In order to prevent future releases, the Department assures regulatory compliance at operating tank facilities. And when a tank does leak, the Department provides the necessary guidance to clean up those releases.



The state's Brownfields Program is designed to clean up sites suitable for reuse rather than converting open space for development.

## SITE INVESTIGATION AND RESTORATION (FORMERLY SUPERFUND)

Historically, the Piedmont Basin has been the most industrialized region in the state. As a result, the majority of the hazardous substance release sites in Delaware are located in this basin. These releases occurred when industries spilled, mishandled, or disposed of the hazardous substances used or generated in their processes. With the growth of New Castle County, many of the sites where hazardous substances have been released are now located in and around urban areas. Due to the liability associated with former industrial sites, or *brownfields*, many businesses have avoided old, abandoned sites, preferring to set up shop in cleaner, previously undeveloped areas called *greenfields*. Rather than continuing to develop



Illegal dumping still remains a problem in certain parts of the state.

new sites, an effort is under way to revitalize the brownfields and prevent the possible contamination of greenfields. Thus, the Department of Natural Resources and Environmental Control established a Voluntary Cleanup Program.

## Challenges for the Future

- ◆ Help all Delawareans reduce the amount of solid waste they generate by increasing consumer awareness and encouraging recycling.
- ◆ Encourage all Delawareans to reduce their use of unnecessary hazardous substances and properly use the hazardous substances they must use.
- ◆ Address the cumulative environmental impact of small contaminant sources such as septic systems and underground storage tanks.
- ◆ Clean up contaminated sites and revitalize former industrial sites called *brownfields*.
- ◆ Identify non-reporting sources of contamination.





The Delaware Department of Natural Resources and Environmental Control's *Whole Basin Management* strategy focuses on protecting Delaware's environment by managing it in a new and natural way: by drainage basin. Using the state's five major drainage basins as our chief management units, we can bring together the expertise from all our divisions — Air and Waste Management, Fish and Wildlife, Parks and Recreation, Soil and Water Conservation, and Water Resources — to better assess, monitor, and protect the health of Delaware's environment.

The basis for developing this strategy comes from our realization that virtually every activity that takes place in the environment impacts multiple resources or land-use activities. Thus, managing the complex natural world we call "the environment" requires us to examine the many resources that comprise it from multiple perspectives in an integrated fashion.

*Whole Basin Management* involves eight phases to effectively assess the health of a targeted basin and develop an implementation plan to address its environmental problems. The first basin DNREC is assessing under *Whole Basin Management* is the Piedmont Basin in northern New Castle County. Named after the geological province in which it resides, this basin encompasses the White Clay Creek, Red Clay Creek, Brandywine Creek, Shellpot Creek, Naamans Creek, and Christina River watersheds.

We encourage you to learn more about the Piedmont Basin and share with us your ideas and concerns about the region's environmental quality. We look forward to your input and cooperation as we work to improve and protect the health of Delaware's environment.



If you have any comments that you would like to share regarding this report, please contact DNREC's Office of Information and Education at (302) 739-4506. This publication is available on the Internet. Visit DNREC's Web page at [www.dnrec.state.de.us](http://www.dnrec.state.de.us).

## Easy Reference Phone Numbers



### Environment Hotlines

Citizen Complaints (In State) ...1-800-622-8802  
 Illegal Hunting/  
 Fishing Activities . . . . . 1-800-292-3030

### Office of the Secretary

Secretary's Office . . . . . 739-4403  
 Development Advisory Service . . . . 739-6400  
 Land Use Planning. . . . . 739-3091  
 Business & Permitting Assistance. . . 739-6400  
 Information & Education. . . . . 739-4506  
 Human Resources . . . . . 739-5823  
 Whole Basin Management . . . . . 739-4403

### Division of Air & Waste Management

Director's Office . . . . . 739-4764  
 Air Quality Management Section . . . 739-4791  
     New Castle . . . 323-4542  
 Hazardous Waste Mgmt. Branch . . . 739-3689  
 Underground Storage Tank Branch . . 395-2500  
 Solid Waste Management Branch . . . 739-3820  
 Site Investigation & Restoration Branch 395-2600  
 Environmental Response Branch . . . 739-3694  
 Environmental Protection Officers . . 739-5072

### Division of Fish & Wildlife

Director's Office . . . . . 739-5295  
 Fisheries Section . . . . . 739-3441  
 Wildlife Section. . . . . 739-5297  
 Enforcement Section. . . . . 739-3440  
 Mosquito Control Section. . . . . 739-3493

### Division of Parks & Recreation

Director's Office . . . . . 739-4401  
 Planning, Preservation & Development 739-5285  
 Operation and Maintenance . . . . . 739-4406  
 Cultural and Recreational Services. . 739-4413

### Division of Soil & Water Conservation

Director's Office . . . . . 739-4411  
 Shoreline & Waterway  
     Management Section. . . . . 739-4411  
 Drainage Section . . . . . 856-5488  
 Delaware Coastal Management Program 739-3451  
 Conservation District Operations . . . 739-4411

### Division of Water Resources

Director's Office . . . . . 739-4860  
 Customer Services . . . . . 739-6330  
 Environmental Services Section. . . . 739-4771  
 Surface Water Discharges Section . . 739-5731  
 Groundwater Discharges Section . . . 739-4761  
 Water Supply Section . . . . . 739-4793  
 Watershed Assessment Section. . . . 739-4590  
 Wetlands & Subaqueous Lands Section 739-4691