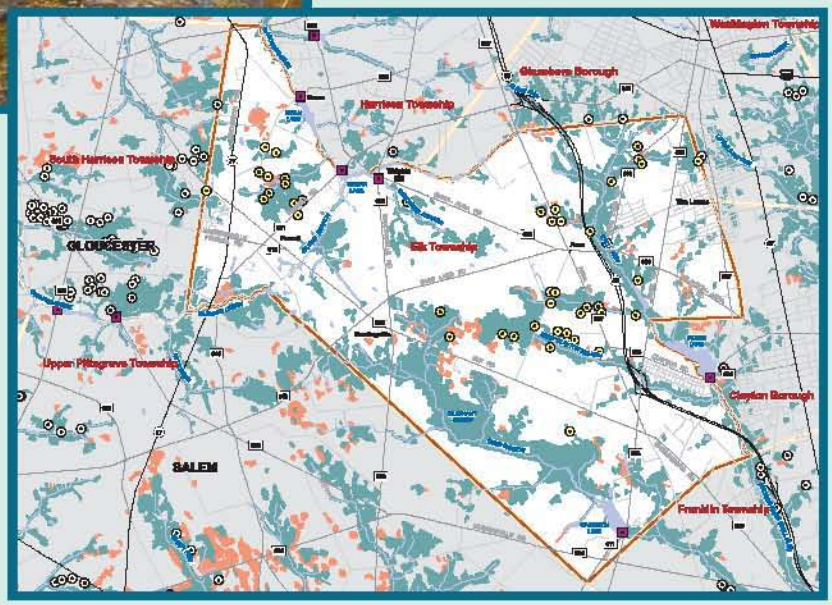
ENVIRONMENTAL RESOURCE INVENTORY

for the TOWNSHIP of

ELK

GLOUCESTER COUNTY, NEW JERSEY



prepared by:

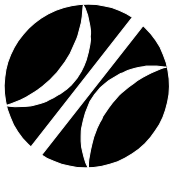
Delaware Valley
Regional Planning
Commission

with:

The Environmental
Commission of
Elk Township

2008

The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals and the public with a common vision of making a great region even greater. Shaping the way we live, work and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region – leading the way to a better future.



The DVRPC logo is adapted from the official seal of the Commission and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River flowing through it. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey. The logo combines these elements to depict the areas served by DVRPC.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) The Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for this report's findings and conclusions, which may not represent the official views of policies of the funding agencies.

DVRPC fully complies with Title VI of the Civil Rights Act of 1964 and related statutes and regulations in all programs and activities. DVRPC's website may be translated into Spanish, Russian, and Traditional Chinese online by visiting www.dvrpc.org. Publications and other public documents can be made available in alternative languages or formats, if requested. For more information, please call (215) 238-2871.

This report was funded in part by the Association of New Jersey Environmental Commissions (ANJEC) Smart Growth Assistance Grant Program, which is supported by the Geraldine R. Dodge Foundation. Matching funds were provided by the Township of Elk and by the Delaware Valley Regional Planning Commission. The authors are solely responsible for the report's findings and conclusions, which may not represent the official views or policies of the non-township funding agencies.

Cover Photo: *Pond at Stillwater Farm*. Photo by Donna Weiss

TABLE OF CONTENTS

TABLES

FIGURES

MAPS

Source: DVRPC

Apple Trees in Spring at the Haynicz Bros. Orchards

ACKNOWLEDGEMENTS

Many thanks are due to the organizations that provided funding for this *Environmental Resource Inventory for Elk Township*. They are:

- The Association of New Jersey Environmental Commissions (ANJEC) Smart Growth Assistance Grant Program, funded by the Geraldine R. Dodge Foundation.
- The Delaware Valley Regional Planning Commission
- The Township of Elk

Township Committee, Township of Elk

Mayor, Mr. Phil Barbaro
Deputy Mayor, Mr. Don Brovero
Committeeperson, Mrs. Michele Doyle
Committeeperson, Mr. Wayne Swanson
Committeeperson, Mr. Tony Creta

The impetus for the creation of this document, and its guidance and review, came from the Elk Township Environmental Commission.

The Elk Township Environmental Commission

Teal Jefferis, Chairman	Frank Goss, Member
Donna Weiss, Vice Chairman	Kevin Costello, Alternate #1
Donna Nicholson, Secretary	Larry Christy, Alternate #2
Lillian Chambers, Member	Don Brovero, Twp. Committee Liaison

Special thanks to Teal Jefferis for providing detailed information on the township, including ordinances, photos, and other resources needed for completion of this report. Christina Arlt, DVRPC intern, also made major contributions to this Resource Inventory.

Source: Donna Weiss

Winter Time, Pond, Stillwater Farm

INTRODUCTION

The purpose of an Environmental Resource Inventory is to identify and describe the natural resources of a community. A community's natural resources – its soil, water, air, forests, fields, and waterways – are fundamental to its character. They are the foundation for its economic success and its quality of life. The protection and wise use of those resources is essential to the public health, safety, and welfare of current and future residents.

The Environmental Resource Inventory provides the basis for the development of methods and steps to preserve, conserve, and utilize those resources, although it does not include specific recommendations to those ends. It is, instead, a compendium of all the existing information that can be found about a township's natural resources, presented in a form that is useful to a broad audience. The inventory reflects a particular moment in time, and it is assumed that it will be updated as new data becomes available.

Natural resources have influenced the lives of Elk's inhabitants since early times. Long before European settlement, the area's streams and upland forests provided fishing and hunting grounds for the Native Americans that lived in Gloucester County. Native American villages also made good use of the region's rich agricultural soils, farming indigenous corn, tomatoes, and fruits. European settlers took advantage of the area's high-quality agricultural soils, clearing the forest and cultivating grain, fruits, and vegetables.

Source: DVRPC

Mood's Farm raises both fruit and vegetables

Elk Township continues to have a rich diversity of resources. Its soils sustain a variety of agricultural products, including grain and vegetable crops, fruit orchards, and nurseries of ornamental plants. There are also extensive greenhouses that serve a large market in the eastern U.S. and beyond. Over 2,500 of Elk's 12,366 acres are permanently preserved through farmland easements.

The streams running through this inland community tend to be small in size because they are headwater streams. Indeed, Elk Township contains the starting waterways of three important watersheds. The South Branch of Raccoon Creek begins on the western edge of Elk Township and the upper reaches of the Raccoon Creek main channel forms the township's northern border. Oldmans Creek also starts in Elk and forms part of the township's southern border. Still Run and Reeds Branch, which rise in the eastern portion of the township, are headwaters of the Maurice River drainage system that flows to the Delaware Bay.

The condition of these headwater streams affects the quality of the aquatic habitat in and downstream from the township. Both Oldmans Creek and parts of the Maurice River are classed as waters of exceptional value, with important pristine habitat and endangered aquatic animal species. As these streams pass through Elk Township, they are also the source of the privately-owned recreational lakes within and next to the township, such as Lake Gilman, and Garrison and Silver Lakes.

Forests still abound in Elk Township, although the majority of wooded acreage is wooded wetlands, such as the approximately 313 acre Elephant Swamp that has been preserved by the township as protected habitat. A number of threatened and endangered species are documented in these woods as well as in the remaining upland forests and across the open agricultural lands of the community. These include endangered plants, such as swamp pink, and several bird species, such as red-shouldered hawk, Cooper's hawk, and bobolink.

Source: DVRPC

A Walking Trail next to Woods at the Elk Recreation Facilities

As a rural community, Elk Township relies on individual groundwater wells for residential and agricultural use. Its streams and lakes are also fed by groundwater. Elk Township sits atop the Kirkwood-Cohansey aquifer, which is a rich source of water, although it is also an aquifer without any protective confining layers above it and therefore, is easily contaminated from the surface. Fortunately, the number of contaminated sites in Elk is small. However, the surficial geology of the area does make the threat of radium contamination a potential hazard to residential wells.

Elk residents and businesses rely on septic systems for sewage management, although there is a large approved sewer service area within the township. There are also many acres of land on the northeastern and eastern side of the township, near Route 55, that have approvals for large development projects, including over 2,000 units of residential housing and 820,000 square feet of commercial development. These will bring sewer service and public water to those areas. They will also change the character of the community in many ways.

As development increases in Gloucester County and Elk Township, documentation of Elk's natural resources has become a necessity, especially if it is to support future residents. Resources such as surface and groundwater will become increasingly important to the residents of the township and neighboring communities. Elk Township's water, wetlands, forests, and grasslands provide significant habitat for a wide variety of plants and animals. The quality of these areas is important in maintaining the health and vitality of the township. With a detailed knowledge of these resources, Elk Township's citizens will be able to balance the pressures of growth with conservation, maintaining and shaping their community's identity, and the sense of place it provides.

Sources

Several documents and reports were utilized in preparing the *Environmental Resource Inventory (ERI) for Elk Township*. These reports and a number of reference works are listed at the end of this document.

The maps and data relating to natural resources are derived from the New Jersey Department of Environmental Protection's (NJDEP's) Geographic Information System mapping, *The Landscape Project* produced by the Endangered and Nongame Species Program of the New Jersey Division of Fish and Wildlife, reports by the US Geologic Service and New Jersey Geologic Service, and mapping data compiled and prepared by the Delaware Valley Regional Planning Commission (DVRPC). Information from these sources that is specific to Elk Township has been included whenever it was available. Information from other reports about specific sites has also been incorporated, along with data provided by township and county staffs. The Environmental Resource Inventory has been reviewed and corrected by members of the Environmental Commission and other township officials.

Somewhat lengthy introductions to some topics, especially surface water monitoring and groundwater, have been included in the ERI to give readers background on these complex topics. Hopefully, that will also assist the Environmental Commission and other township officials to obtain additional data from state sources in the future and to determine the types of investigations that still need to be conducted.

Source: DVRPC

Corn Field

Source: Kevin Costello

Peach Orchard

BRIEF HISTORY

Before European settlers arrived in the Delaware Valley, American Indians populated the Gloucester area. Recent archeological findings show that humans have been present in the region for approximately 10,000 years. Native American communities relied on the area's natural resources, such as Raccoon Creek, which sustained small Indian villages of the Narraticon tribe. The tribe and creek name was a version of the Lenape Indian word for "raccoon," which was an animal probably found in abundance in the area.

The first European settlers in the Delaware Valley were the Dutch, who founded a colony in New Jersey in 1624. In 1638, Swedish and Finnish settlers ventured to the Delaware Valley and a Scandinavian colony was established at the confluence of the Delaware River and Raccoon Creek in Logan Township. A few Swedish and Finnish families, accustomed to water travel, purchased land from the Indians and founded their own homesteads along the interior waterways. The largest settlement was at Swedesboro, on the Raccoon Creek downstream from Elk Township.

In 1644, the Dutch ceded control of their New World holdings to the English. The Swedish and Finnish settlers remained, tending thriving farms and establishing successful trade with the Indians, especially for furs. These settlers gave shelter to the first group of English colonists who arrived on the English ship *Kent*, docking at Raccoon Creek in 1677. Settlers from other countries also began arriving. Today, Elk Township citizens of German and Irish lineage make up the largest segment of the population.

It is believed that the earliest residents in Elk Township settled in the Ewan-Bridgeton Pike area, where the oldest homes still standing date to the 1700s. Jacob and Leonard Fisler, originally from Switzerland, purchased land in 1791 and are credited with "officially" settling Elk Township. Early settlers raised grain, fruit and vegetables, and tended livestock. Because of the rich farming soils, the area entered a long era of highly successful agricultural production.

According to town lore, the roads in Elk Township follow the paths of elks. No history can be found to authenticate this or any other source for the name "Elk."

Incorporated in 1881, the township contains several distinct regions. Until 1891 Elk Township was considered part of Franklin Township, and later some of its land area belonged to Harrison Township. Historical settlements include the communities of Aura, Ewan, Ferrell, Hardingville, and the Lawns, along with development around Silver Lake, Lake Gilman, and the Wright's Mill area. The first two lakes were summer resorts that became private associations with permanent housing in the twentieth century. There are also several new areas of development, including Still Run, Covey Estates, Hampton Hills, and Meadowbrook.

Aura was first established by John Early who arrived from Ireland in 1764. Originally known as Union, Unionville, and Union Station (due to its location at a crossroads), the name was changed to Aura in 1892 (the name was supposedly based on a town in Oregon) because so many other New Jersey communities had "Union" as their name or as part of it. Aura was the largest community in the surrounding area, with many other local towns receiving mail from the Aura

post office until they established their own. The primary light industry in early Aura was the manufacturing of hay forks and similar farming implements.

The tiny hamlet of Ewan, formerly known as Ewansville and Ewan's Mill, settled on its current name in 1894. Prior to 1861 it was notable for the grist mill located there along Raccoon Creek. Based on the age of its structures, Ewan is thought to be one of the first occupied parts of the township. Only the southwest part of Ewan, along the Ewan-Mullica Hill Road, Mood`s Road, and part of the Bridgton Road, is actually within Elk Township. The majority of the town falls within Harrison Township.

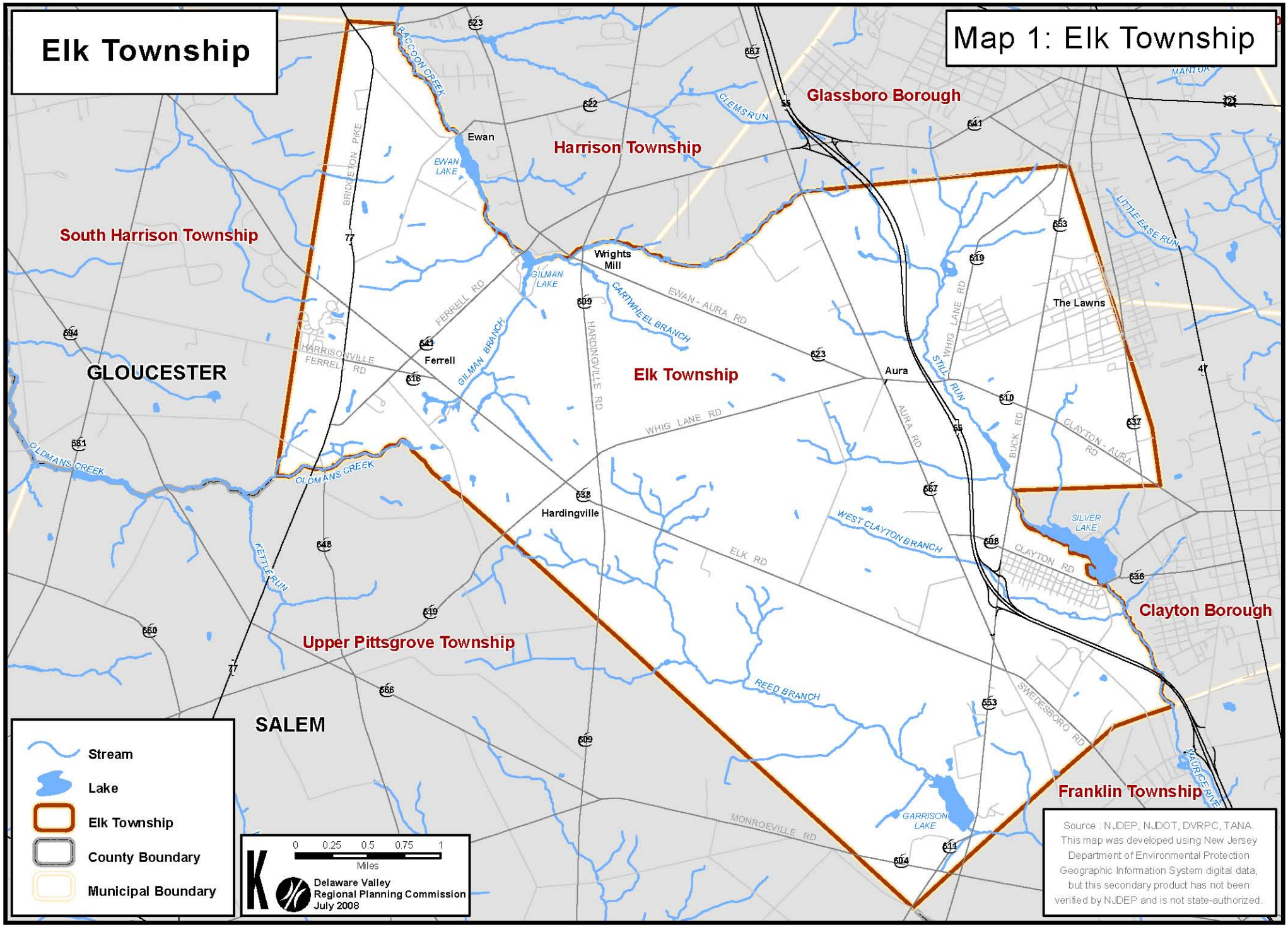
The town of Ferrell was originally known as Fairview. Because another town with the same name pre-dated it, the town changed its name in honor of Thomas M. Ferrel, a well-liked politician from Glassboro. Notable early settler families included the Fryes, Morgans, Laffertys, Nelsons, and Moods. Historically, farming and basket making were the chief occupations. Later, a large pickle processing plant employed a significant part of the town.

Hardingville is the settlement in the area where the Swedesboro-Franklinville Road, the Glassboro-Hardingville Road, and the Barnsboro-Elmer Road all meet. The community was founded by John Harding in 1796. Notable past structures included a basket-manufacturing plant, the Red Lion Inn, and the Red Lion Tavern. It is asserted that the inn and tavern gave the area the name "Red Lion," at least unofficially for a time in the first half of the 1800's. Much of the area was originally part of Franklin Township and later became part of Elk Township. Along with asparagus and tomatoes, white potatoes were the main crop of Hardingville.

The Lawns section of Elk Township was established in 1835. The Great Eastern Corporation of New York brought large tracts of land in this area, as did many private individuals. Although small by most standards, the community had its own school from 1929-1960, and by the 1970's included two stores, one gas station, four churches, and one volunteer fire company. Its most well-documented historical feature was the Pine Tavern which existed from 1752 to 1840.

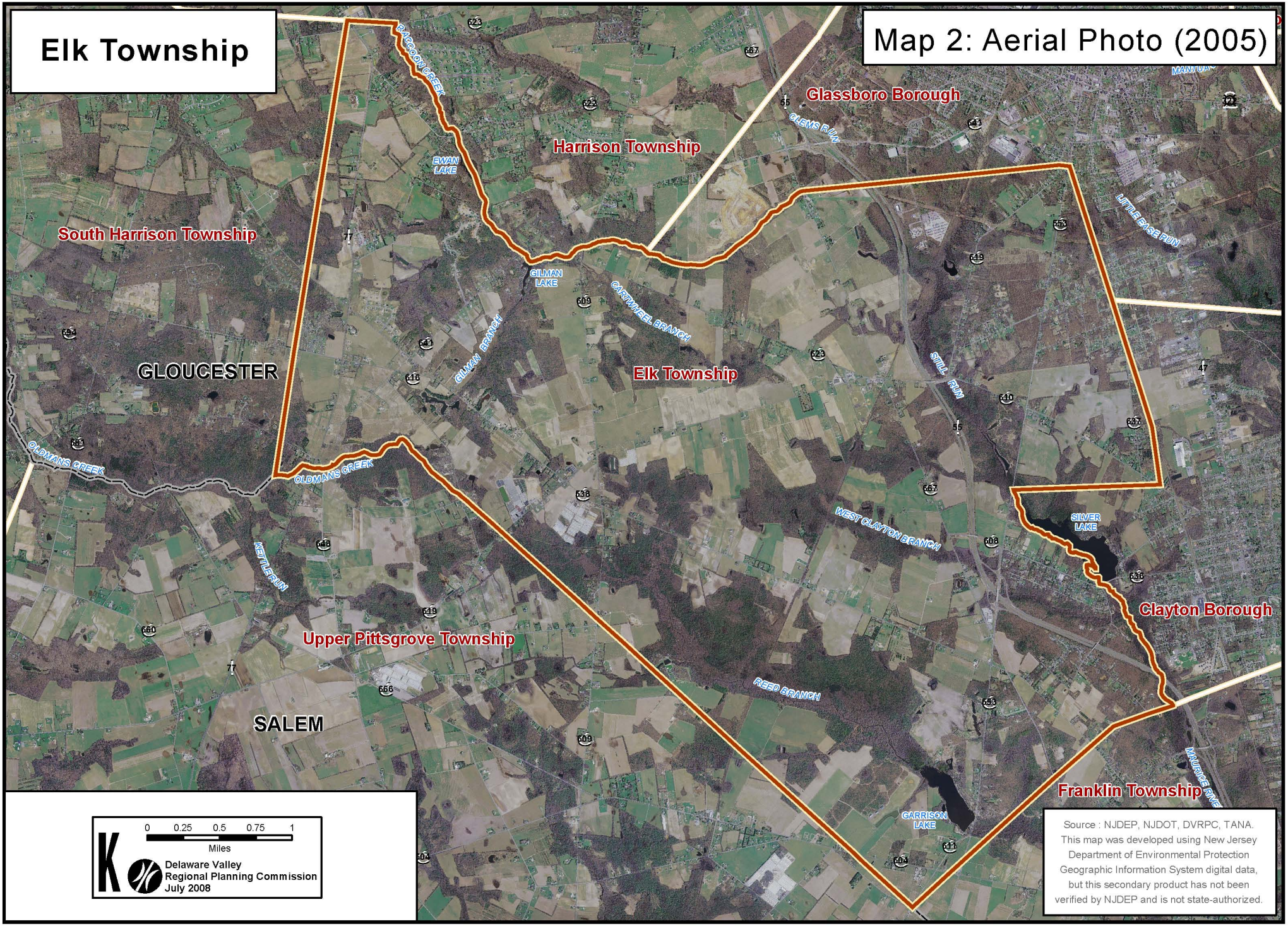
The economy of Elk Township as a whole was historically noted for its lumbering, farming, basket making, and milling. It was particularly well known for its apple orchards. Indeed, the Lewis Mood Farm near Ferrell is credited with creating its own recognized variety of apple, the Mood apple, in 1922. This variation on the "Red Delicious" apple, later called the "Starking Delicious," was sold and released on the market in 1975.

To this day Elk Township maintains it agrarian character and businesses. Its rich farmland and thriving horticultural industry are predominant in the township. Over 2,585 acres have been permanently preserved through state and county programs. However, the easy access to the township provided by State Highway 55, a major north-south corridor in southern New Jersey, began attracting development interest in the 1990s. There are currently plans for considerable residential and commercial growth in the northeast section of the township through the Silvergate Planned Unit Development and other similar projects. As a consequence, Elk Township will probably undergo many changes in the next few years. Township initiatives to preserve open space and large blocks of farmland have been ongoing for several years. In recent years, these efforts have accelerated.


Elk Township
Map 1: Elk Township
Glassboro Borough
Harrison Township
South Harrison Township
GLOUCESTER
Elk Township
Upper Pittsgrove Township
SALEM
Clayton Borough
Franklin Township
Ewan
Wrights Mill
Ferrell
Aura
Hardingville
The Lawns
RACCOON CREEK
CLEMS RUN
EWAN LAKE
BRIDGETON PIKE
FERRELL RD
GILMAN LAKE
GILMAN BRANCH
CARTWHEEL BRANCH
HARDINGVILLE RD
EWAN - AURA RD
WHIG LANE RD
HARRISONVILLE FERRELL RD
OLDMANS CREEK
KETTLE RUN
ELK RD
WEST CLAYTON BRANCH
REED BRANCH
MONROEVILLE RD
SWEDESBORO RD
CLAYTON RD
CLAYTON - AURA RD
BUCK RD
AURA RD
STILL RUN
LITTLE EASE RUN
SILVER LAKE
GARRISON LAKE
MAURICE RIVER
Stream
Lake
Elk Township
County Boundary
Municipal Boundary
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : NJDEP, NJDOT, DVRPC, TANA
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Elk Township

Map 2: Aerial Photo (2005)



0 0.25 0.5 0.75 1

Miles

Delaware Valley Regional Planning Commission
July 2008

Source : NJDEP, NJDOT, DVRPC, TANA.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

ELK TOWNSHIP: LOCATION, SIZE & LAND USE

Elk, an incorporated township, is located in central Gloucester County, New Jersey. The township is bounded by six municipalities: Harrison Township and Glassboro Borough to the north, Clayton Borough to the east, Franklin and Upper Pittsgrove townships to the south, and South Harrison Township to the west.

Elk Township occupies 12,366 acres, or 19 square miles, on the coastal plain of New Jersey, and had a population of 3,810 in 2005. Elk's land use reflects its natural setting and its long agricultural past. Thanks to high quality soils, over 40 percent of the township's land remains dedicated to agricultural uses (as of 2002). Water and wetlands constitute just over 20 percent of the township land.

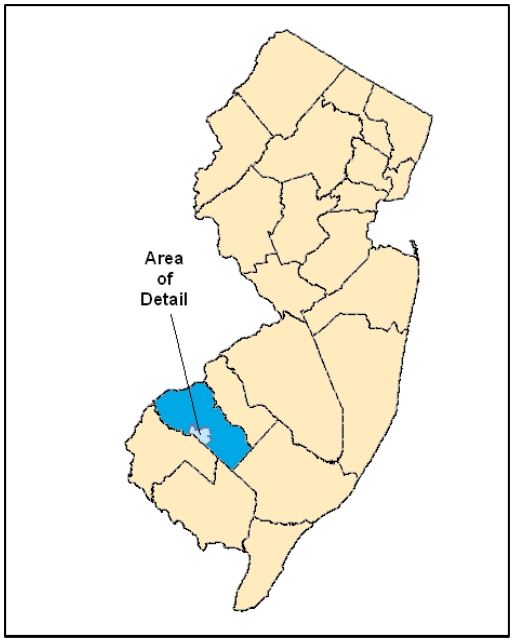


Figure 1: Location of Elk Township

Residential development is dispersed along many of the roads in Elk, with a concentration of housing on the eastern end of the Township, adjacent to the Boroughs of Glassboro and Clayton. County roads crisscross Elk in all directions, with some connecting in the east to State Highway 55, a major transportation corridor in the township.

Table 1: Elk General Land Use/Land Cover (2002) shows Elk's land use/land cover grouped into general categories. ***Table 2: Elk Township Detailed Land Use/Land Cover (2002)*** breaks down the data into more detailed land cover categories based on 2002 data from the New Jersey Department of Environmental Protection. See **Map 3: Elk Land Use/Land Cover (NJDEP 2002).**

Table 1: Elk General Land Use/Land Cover Classes (2002)

General Land Use/ Land Cover Class	Acres	Percent
AGRICULTURE	5,103.98	41.27%
BARREN LAND	58.85	0.48%
FOREST	2,503.24	20.24%
URBAN	1,869.54	15.12%
WATER	148.89	1.20%
WETLANDS	2,681.69	21.69%
TOTAL	**12,366.17**	**100%**

Source: NJDEP, Bureau of Geographic Information Systems

Table 2: Elk Township Detailed Land Use/Land Cover (2002)

Land Use Categories	Acres	Percent (%) of Total Land Area
AGRICULTURAL WETLANDS (MODIFIED)	186.23	1.51%
ALTERED LANDS	18.32	0.15%
ARTIFICIAL LAKES	146.64	1.19%
ATHLETIC FIELDS (SCHOOLS)	2.36	0.02%
ATLANTIC WHITE CEDAR WETLANDS	17.65	0.14%
CEMETERY	13.21	0.11%
COMMERCIAL/SERVICES	78.21	0.63%
CONIFEROUS BRUSH/SHRUBLAND	9.68	0.08%
CONIFEROUS FOREST (>50% CROWN CLOSURE)	52.24	0.42%
CONIFEROUS FOREST (10-50% CROWN CLOSURE)	4.94	0.04%
CONIFEROUS WOODED WETLANDS	130.95	1.06%
CROPLAND AND PASTURELAND	3,631.16	29.36%
DECIDUOUS BRUSH/SHRUBLAND	44.62	0.36%
DECIDUOUS FOREST (>50% CROWN CLOSURE)	1,213.09	9.81%
DECIDUOUS FOREST (10-50% CROWN CLOSURE)	264.29	2.14%
DECIDUOUS SCRUB/SHRUB WETLANDS	42.92	0.35%
DECIDUOUS WOODED WETLANDS	1,458.54	11.79%
DISTURBED WETLANDS (MODIFIED)	27.94	0.23%
EXTRACTIVE MINING	4.70	0.04%
FORMER AGRICULTURAL WETLAND (BECOMING SHRUBBY, NOT BUILT-UP)	15.52	0.13%
HERBACEOUS WETLANDS	22.44	0.18%
INDUSTRIAL	35.68	0.29%
MAJOR ROADWAY	45.97	0.37%
MANAGED WETLAND IN BUILT-UP MAINTAINED REC AREA	0.35	0.00%
MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE	4.84	0.04%
MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND	161.17	1.30%
MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)	91.67	0.74%
MIXED FOREST (>50% CONIFEROUS WITH 10-50% CROWN CLOSURE)	75.16	0.61%
MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)	207.86	1.68%
MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)	254.60	2.06%
MIXED SCRUB/SHRUB WETLANDS (DECIDUOUS DOM.)	14.76	0.12%
MIXED WOODED WETLANDS (CONIFEROUS DOM.)	170.66	1.38%
MIXED WOODED WETLANDS (DECIDUOUS DOM.)	577.84	4.67%
NATURAL LAKES	0.23	0.00%
OLD FIELD (< 25% BRUSH COVERED)	123.91	1.00%
ORCHARDS/VINEYARDS/NURSERIES/HORTICULTURAL AREAS	1,391.62	11.25%
OTHER AGRICULTURE	81.19	0.66%
OTHER URBAN OR BUILT-UP LAND	156.78	1.27%

Land Use Categories	Acres	Percent (%) of Total Land Area
RECREATIONAL LAND	81.77	0.66%
RESIDENTIAL, HIGH DENSITY, OR MULTIPLE DWELLING	68.34	0.55%
RESIDENTIAL, RURAL, SINGLE UNIT	979.29	7.92%
RESIDENTIAL, SINGLE UNIT, LOW DENSITY	339.97	2.75%
RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY	36.73	0.30%
STORMWATER BASIN	2.49	0.02%
STREAMS AND CANALS	2.02	0.02%
TRANSITIONAL AREAS	35.82	0.29%
TRANSPORTATION/COMMUNICATION/UTILITIES	17.93	0.15%
UPLAND RIGHTS-OF-WAY DEVELOPED	0.09	0.00%
UPLAND RIGHTS-OF-WAY UNDEVELOPED	10.71	0.09%
WETLAND RIGHTS-OF-WAY	11.04	0.09%
TOTAL	**12,366.17**	**100%**

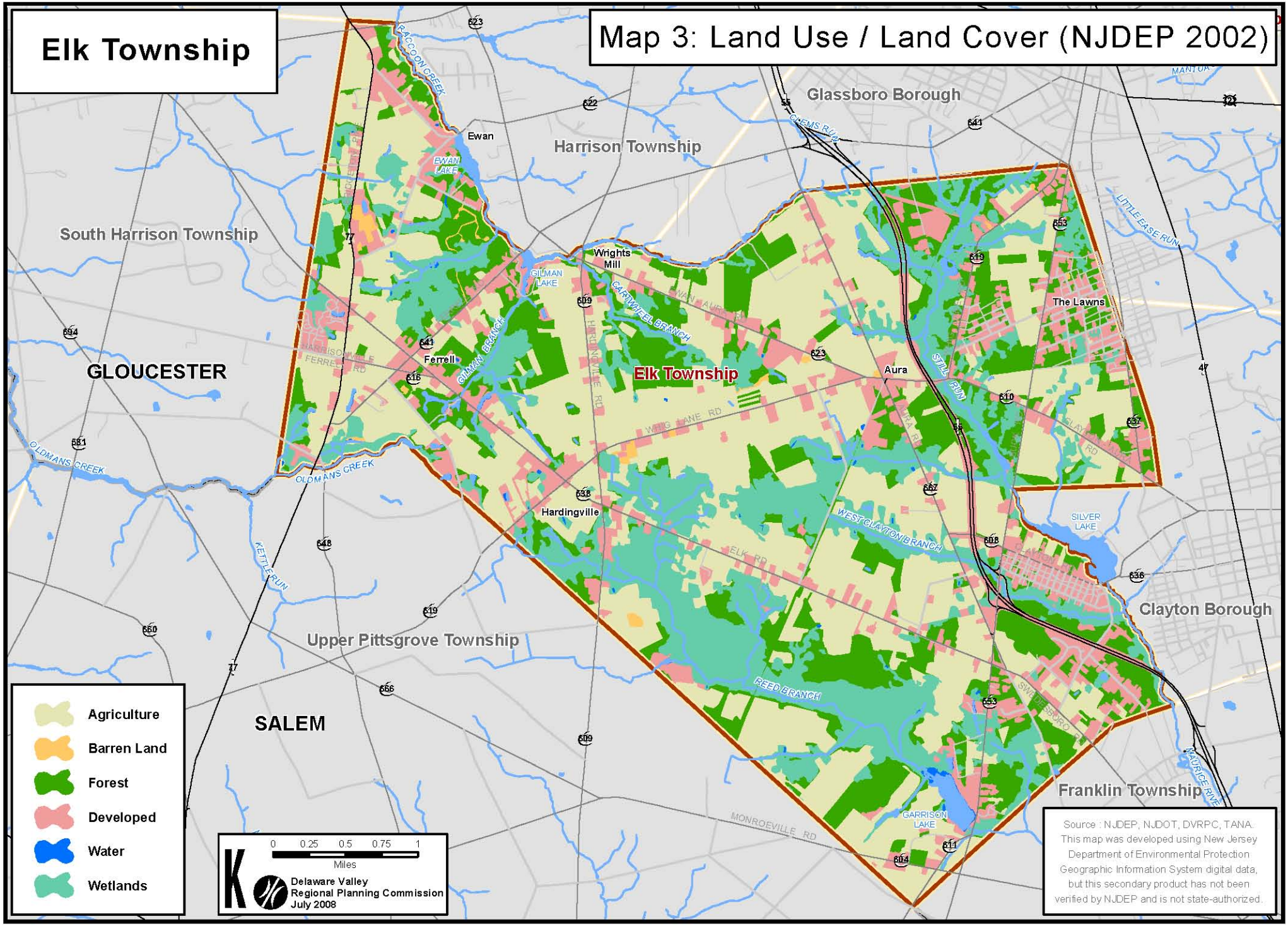
Source: NJDEP, Bureau of Geographic Information System

Source: Donna Weiss

New Vineyard, Chardonnay, Stillwater Farm

Elk Township

Map 3: Land Use / Land Cover (NJDEP 2002)



NATURAL RESOURCES

PHYSIOGRAPHY

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by four physiographic provinces. The rocky terrain of the Appalachian Province is at one extreme and the sands of the coast are at the other. Elk is located in the Coastal Plain, the southernmost of these four provinces in New Jersey.

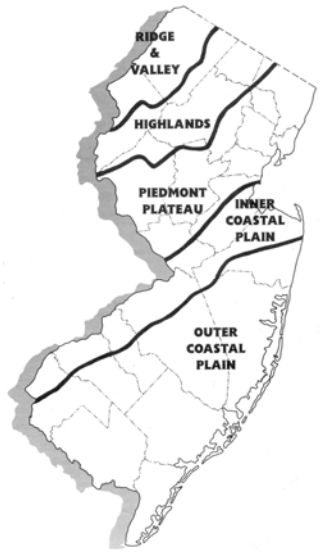


Figure 2: The Physiographic Regions of New Jersey

The Atlantic Coastal Plain landscape extends from Massachusetts to Texas and is divided into Inner and Outer sections. In New Jersey, the Inner Coastal Plain is made up of interbedded sand and clay. Deposits originating in the breakdown of Appalachian and Catskill sedimentary, metamorphic, and igneous rocks are interbedded with layers formed by oceanic (marine) deposition, which occurred as the ocean shoreline advanced and receded over geologic time. The Inner Plain layers date from the Cretaceous Period, 135 to 65 million years ago. Generally, soils of the Inner Coastal Plain are quite fertile.

The Outer Coastal Plain was formed more recently than the Inner Coastal Plain. It was laid down by the ocean and developed during the mid-to-late part of the Cenozoic Era, 65 million years ago to the present. Outer Coastal Plain soils are sandier and less fertile than those of the Inner Plain and do not hold water as well.

In the general vicinity of the dividing line between the two segments of the Coastal Plain is a belt of low hills, which runs northeast and southwest through the southern half of New Jersey. These hills are the youngest of the Cretaceous formations and are largely made up of sand and marl formations. The hills taper to fairly low elevations in Gloucester County but are visible in the Mullica Hill area. They are less visible in Salem County but do contribute to the slightly rolling landscape. The Inner Coastal Plain lies to the west of this band of hilly formations and the Outer Coastal Plain lies to the east.

Elk straddles the divide of the Inner and Outer coastal plains. Although portions of Elk are in the Outer Coastal Plain, most of the township's soils are generally regarded as highly productive, agriculturally. This is because the drop in soil fertility between the Inner and Outer coastal plains is not immediate, but changes gradually moving from west to east across the Outer Coastal Plain.

TOPOGRAPHY AND SURFACE LANDSCAPES

Elk Township is dominated by high quality agricultural soils and natural environments (wetlands and forests). Most wetlands occur adjacent to the rivers and streams that flow across the township, most notably along Still Run and the Reed Branch. Deciduous wooded wetlands flank streams throughout Elk. These wetlands give way to forests as they move away from streams, and move outward towards farmland and developed areas.

Steep slopes are found in the north of Elk, along Raccoon Creek and its tributaries. These areas are generally forested and near developed land. Northwestern Elk is also the area with the lowest elevation in the township, with the lowest point being Ewan Lake, through which Raccoon Creek runs on the northeast border. From the lake, at 75 feet above sea level, the township rises in this area to average about 100 feet, with high points being around 130 feet above sea level. Elevation increases slightly towards the western side of Elk, with most areas being between 130 and 140 feet high. The highest point in the township is 147 feet near Aura. This generally flat landscape is ideal for farming.

SOILS

Soil is the foundation for all land uses. A region's soil defines what vegetation is possible, influencing agricultural uses. It also determines how land can be developed for other purposes. Soil is also a natural resource that cannot be replenished on the human time scale.

Elk Township soils consist of 17 series types and 41 variations within those series as identified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). These are listed in ***Table 4: Elk Township Soils*** and shown on **Map 4: Elk Township Soils**.

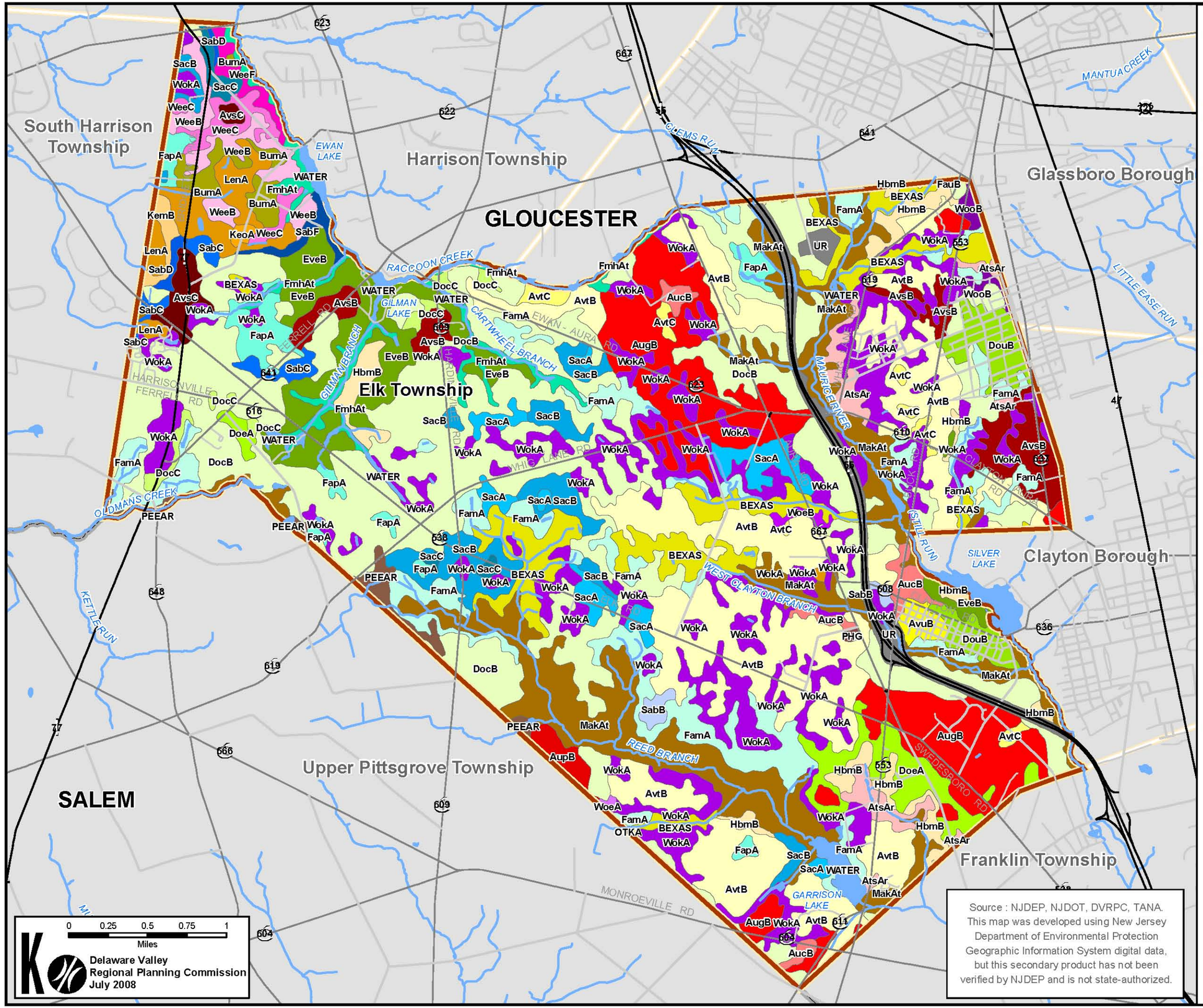
Soil Quality Classification

State and national agricultural agencies classify farmland soils into several categories. Elk contains Prime Farmland soils, Soils of Statewide Importance, and Soils of Unique Importance. About three-quarters of Elk's land is rich, arable, and valuable soil. Each category of farmland is explained on the following pages. See ***Table 3: Agricultural Value for Elk Soils*** for the acreage in each category and **Map 5**: **Agricultural Quality of Soils.**

Prime Farmland Soils
The most abundant soils in Elk are those classified as Prime Farmland soils. About 41 percent (5,095 acres) of Elk's soils are considered Prime Farmland (P-1) soils. Prime Farmlands are lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They can sustain high yields of crops when managed with correct farming methods. Prime Farmlands are not excessively erodible or saturated with water for long periods of time, and do not flood frequently.

Elk Township

Map 4:
Elk Township Soils



Source : NJDEP, NJDOT, DVRPC, TANA. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Soil Type
MUSYM, MUNAME

- AtsAr, Atsion sand, 0 to 2 percent slopes, rarely flooded
- AucB, Aura loamy sand, 0 to 5 percent slopes
- AugB, Aura sandy loam, 2 to 5 percent slopes
- AupB, Aura loam, 2 to 5 percent slopes
- AvsB, Aura-Sassafras loamy sands, 0 to 5 percent slopes
- AvsC, Aura-Sassafras loamy sands, 5 to 10 percent slopes
- AvtB, Aura-Sassafras sandy loams, 2 to 5 percent slopes
- AvtC, Aura-Sassafras sandy loams, 5 to 10 percent slopes
- AvuB, Aura-Urban land complex, 0 to 5 percent slopes
- BEXAS, Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded
- BumA, Buddtown-Deptford complex, 0 to 2 percent slopes
- DocB, Downer loamy sand, 0 to 5 percent slopes
- DocC, Downer loamy sand, 5 to 10 percent slopes
- DoeA, Downer sandy loam, 0 to 2 percent slopes
- DouB, Downer-Urban land complex, 0 to 5 percent slopes
- EveB, Evesboro sand, 0 to 5 percent slopes
- FamA, Fallsington sandy loam, 0 to 2 percent slopes
- FapA, Fallsington loam, 0 to 2 percent slopes
- FauB, Fallsington-Urban land complex, 0 to 5 percent slopes
- FmhAt, Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded
- HbmB, Hammonton loamy sand, 0 to 5 percent slopes
- KemB, Keyport sandy loam, 2 to 5 percent slopes
- KeoA, Keyport loam, 0 to 2 percent slopes
- LenA, Lenni loam, 0 to 2 percent slopes
- MakAt, Manahawkin muck, 0 to 2 percent slopes, frequently flooded
- OTKA, Othello and Fallsington soils, 0 to 2 percent slopes
- PEEAR, Pedricktown, Askecksy, and Mullica soils, 0 to 2 percent slopes, rarely floode
- PHG, Pits, sand and gravel
- SabB, Sassafras loamy sand, 0 to 5 percent slopes
- SabC, Sassafras loamy sand, 5 to 10 percent slopes
- SabD, Sassafras loamy sand, 10 to 15 percent slopes
- SabF, Sassafras loamy sand, 15 to 40 percent slopes
- SacA, Sassafras sandy loam, 0 to 2 percent slopes
- SacB, Sassafras sandy loam, 2 to 5 percent slopes
- SacC, Sassafras sandy loam, 5 to 10 percent slopes
- UR, Urban land
- WATER, Water
- WeeB, Westphalia fine sandy loam, 2 to 5 percent slopes
- WeeC, Westphalia fine sandy loam, 5 to 10 percent slopes
- WeeF, Westphalia fine sandy loam, 15 to 40 percent slopes
- WoeA, Woodstown sandy loam, 0 to 2 percent slopes
- WoeB, Woodstown sandy loam, 2 to 5 percent slopes
- WokA, Woodstown-Glassboro complex, 0 to 2 percent slopes
- WooB, Woodstown-Urban land complex, 0 to 5 percent slopes

Elk Township

Map 5: Agricultural Quality of Soils

- P-1 -Prime Farmland
- S-1 -Farmland of Statewide Importance
- U-1 -Farmland of Unique Importance
- NA -Not Rated for Agricultural Use

South Harrison Township
Harrison Township
Glassboro Borough
GLOUCESTER
Elk Township
Clayton Borough
Franklin Township
Upper Pittsgrove Township
SALEM
EWAN LAKE
GILMAN LAKE
SILVER LAKE
GARRISON LAKE
RACCOON CREEK
GILMAN BRANCH
GARTHWHEEL BRANCH
MAURICE RIVER
WEST CLAYTON BRANCH
REED BRANCH
OLDMANS CREEK
KETTLE RUN
STILL RUN
GLEMS RUN
MANTUA CREEK
LITTLE EASE RUN
MONROEVILLE RD

0 0.25 0.5 0.75 1 Miles

Delaware Valley Regional Planning Commission
July 2008

Source : NJDEP, NJDOT, DVRPC, TANA.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

The USDA-NRCS outlines specific criteria for Prime Farmland classification. For example, according to Prime and Unique Farmlands federal regulation, soil horizons (layers) within a depth of 40 inches (or within the root zone if the root zone is less than 40 inches) must have a pH between 4.5 and 8.4 (mildly acidic to mildly basic). The soils must have an average temperature above 32 degrees Fahrenheit at a depth of 20 inches. The USDA outlines additional Prime Farmland requirements for mean summer soil-temperature, erodibility factor, water table depth, permeability rate, and more. When identifying qualifying prime soil mapping units within a state, state conservationists are allowed to deviate from the permeability standard or to adopt more stringent criteria for the other requirements.

Land classified as Prime Farmland does not have to be farmed but does have to be available for such use. Thus, water or urban or built-up land does not qualify as Prime Farmland.

Soils of Statewide Importance

About 35 percent (4,250 acres) of Elk's soils are classified as Soils of Statewide Importance (S-1). These soils are close in quality to Prime Farmland and can sustain high yields of crops when correctly managed under favorable conditions. Under such conditions, these yields may be as high as Prime Farmland yields.

Criteria for establishing Soils of Statewide Importance are determined by state agencies. In New Jersey, soils with a land capacity class of II or III that do not meet prime farmland criteria are rated as Soils of Statewide Importance. Soils in these capacity classes have moderate to severe limitations that reduce the choice of plants or require special conservation practices.

Unique Farmland Soils

Thirteen percent (1,655 acres) of Elk's soils are ranked as Unique Farmland (U-1) soils. Certain soil qualities, locations, growing seasons, and moisture supplies allow Unique Farmland to support specialized crops when properly managed. The USDA outlines specific Unique Farmland criteria, including temperature, humidity, air drainage, elevation, aspect, or proximity to market, that support a particular food or fiber crop. In order for lands to be classified as Unique Farmland, the land must also be used for a specific high-value food or fiber and have an adequate moisture supply for that crop.

Land Not Appropriate for Farming

Several of the soils that are present in Elk have not been rated for agricultural use by the Natural Resource Conservation Service (NRCS) and are labeled "NA." These soils and land masses are not appropriate for agricultural use, and may be best suited for other uses or they may not yet have been assessed for quality by NRCS. NRCS created all the Soil Quality Classifications in 1990, but in 2005, the agency created several new subtypes of soils, which are not yet rated. Soils that are not rated for agricultural use are not necessarily limited. Each soil's land capability class and subclass describe how the soil is limited with respect to different uses, and why the soil is limited.

Table 3: Agricultural Values for Elk Soils

Designation	Type	Acres	Percent
P-1	Prime Farmland	5,094.61	41.20%
S-1	Statewide Importance	4,251.14	34.38%
U-1	Unique Farmland	1,655.76	13.39%
NA	Water; Soils not classified for farmland use: wet soils, pits, steep slopes, made land, etc.	1,364.57	11.03%
Totals		**12,366.17**	**100.0%**

Source: NJ Important Farmlands Inventory, NJ Natural Resources Conservation Service

Hydric Soils

More than 50 percent of Elk's soils are considered hydric soils. Hydric soils, as defined by the NRCS, are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic (oxygen-free) conditions in their subsurface. They support the development of hydrophytic (water loving) vegetation only. Hydric soils have unique soil properties, and they are an important element to wetland areas. If a soil is classified as "hydric," land use may be restricted due to the relationship of hydric soils to the definition of wetlands and to laws regarding wetland preservation. Soils that have limitations, such as high water table or flooding, can qualify as prime and statewide when the limitations are overcome by measures such as drainage or flood control. In other words, hydric soils can be productive for agriculture when drained by measures such as field tiles or field drains.

Soil Series

Several soil series appear more frequently in Elk than others, and are briefly described as follows according to the Gloucester County Soil Survey and NCRS soil database.

Aura Series

A quarter of Elk's soils (nearly 3,000 acres) are part of the Aura series. Aura soils are well drained and usually occupy the highest elevations in Gloucester County. In Elk they are more prominent in the central and eastern portions of the township than in the western areas. Aura soils occur in association with Sassafras, Downer, and Woodstown soils, all of which are found in Elk. Aura soils are moderately permeable in the subsurface layer, but runoff is rapid and erosion can be a problem. Plants with deep roots do not flourish on these soils because their roots cannot penetrate the firm lower layers and the pebbly topsoil impedes the growth of seedlings. Although these soils are low in fertility, they are well suited to growing fruit, flowers, and most types of vegetables. Special care and maintenance is necessary to maintain organic matter and soil structure so that water can be absorbed. On level land and gentle slopes, Aura soils are considered Prime Farmland (Capability Unit II, III, IV depending on slope).

Downer Series
The Downer series also constitutes about a quarter of Elk's soils. They are found throughout Elk, but are less prominent in the southern end of the township. Downer soils are considered to be typical of New Jersey agriculture and are listed as prime farmland or farmland of statewide importance. These soils are moderately permeable, have a low available water capacity, warm early in the calendar year, and are easily worked. While natural fertility is low and added fertilizers leach out easily, Downer soils can support high value crops with proper management and irrigation. The series supports native vegetation including various oaks, Virginia pine, pitch pine, hickory, sassafras, dogwood, greenbriar, American holly, low bush blueberry, and mountain laurel (Capability Units II and III depending on variation).

Sassafras Series
The Sassafras series makes up about five percent of the township's soils. Sassafras soils are usually found on sandy flats along waterways, but may also be associated with steep slopes. These soils are found in the northwest corner of Elk, near the headwaters of the Reed Branch, and in various small patches in the center and southern portions of the township. Sassafras soils can support vegetation consisting of mixed oaks and scattered pines. They are often considered farmland of statewide importance, depending on slope. They are easy to work, have a low natural fertility, and respond to fertilization (Capability Units I, II, and III, depending on variation).

Woodstown Series
Woodstown soils occupy about 11 percent of Elk's land. Historically, these soils have supported oak, beech, poplar, and pitch pine forests. This series is closely associated with Aura, Downer, Freehold, and other soils. These soils usually occur on terraces along large streams and in beds of gravel, and are found throughout Elk. Woodstown soils are considered prime soils or soils of statewide importance but, as these soils are not well-drained, cultivation can be hampered by wetness (Capability Unit II).

Manahawkin Series
Manahawkin muck covers just over 8 percent of Elk. This very poorly drained hydric soil consists of black, finely decomposed, saturated organic matter, generally over sand and gravel. It is found in level areas along streams where the water table is right below the surface throughout the year. The Manahawkin series can support wetland species such as Atlantic white cedar. Muck is moderately fertile but lacks minerals. Its organic layer is very unstable and cannot support building foundations (Capability Unit VII).

Fallsington Series
Fallsington soils are scattered throughout Gloucester County and found in circular depressions adjacent to streams. They cover about 7 percent of Elk Township, mostly adjacent to wetlands. These soils are very deep, poorly drained hydric soils that formed from loamy marine and old alluvial sediments. The depth of the seasonal high water table is shallow (less than one foot), and the permeability of the soils ranges from moderate to moderately slow. When used for agricultural land, open ditches must be employed to drain these soils. Fallsington soils are mainly used for cultivation of crops such as corn, soybeans, or small grains, as well as for pasture. White oak, water oak, willow oak, swamp or red maple, sweet gum, holly, greenbriar,

and pond pine dominate in wooded areas, and loblolly pine does grow in areas no longer in cultivation.

Table 4: Elk Township Soils

Soil Code	Soil Description	Acres	Percentage of all Acres	Designation *	Hydric Soil**
AtsAr	Atsion sand, 0 to 2 percent slopes, rarely flooded	126.32	1.02%	L-1	Y
AucB	Aura loamy sand, 0 to 5 percent slopes	86.62	0.70%	P-1	N
AugB	Aura sandy loam, 2 to 5 percent slopes	862.63	6.98%	P-1	N
AupB	Aura loam, 2 to 5 percent slopes	46.47	0.38%	P-1	N
AvsB	Aura-Sassafras loamy sands, 0 to 5 percent slopes	238.67	1.93%	P-1	N
AvsC	Aura-Sassafras loamy sands, 5 to 10 percent slopes	71.48	0.58%	S-1	N
AvtB	Aura-Sassafras sandy loams, 2 to 5 percent slopes	1587.51	12.84%	P-1	N
AvtC	Aura-Sassafras sandy loams, 5 to 10 percent slopes	60.26	0.49%	S-1	N
AvuB	Aura-Urban land complex, 0 to 5 percent slopes	37.90	0.31%	NA	N
BEXAS	Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded	479.43	3.88%	L-1	Y
BumA	Buddtown-Deptford complex, 0 to 2 percent slopes	81.91	0.66%	P-1	Y
DocB	Downer loamy sand, 0 to 5 percent slopes	2,554.81	20.66%	S-1	Y
DocC	Downer loamy sand, 5 to 10 percent slopes	58.65	0.47%	S-1	N
DoeA	Downer sandy loam, 0 to 2 percent slopes	196.38	1.59%	P-1	Y
DouB	Downer-Urban land complex, 0 to 5 percent slopes	177.87	1.44%	NA	N
EveB	Evesboro sand, 0 to 5 percent slopes	433.96	3.51%	NA	Y
FamA	Fallsington sandy loam, 0 to 2 percent slopes	738.32	5.97%	S-1	Y
FapA	Fallsington loam, 0 to 2 percent slopes	170.05	1.38%	S-1	Y
FauB	Fallsington-Urban land complex, 0 to 5 percent slopes	1.77	0.01%	NA	Y
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	205.57	1.66%	NA	Y
HbmB	Hammonton loamy sand, 0 to 5 percent slopes	207.37	1.68%	S-1	Y
KemB	Keyport sandy loam, 2 to 5 percent slopes	29.98	0.24%	P-1	Y
KeoA	Keyport loam, 0 to 2 percent slopes	10.32	0.08%	P-1	Y
LenA	Lenni loam, 0 to 2 percent slopes	178.63	1.44%	S-1	Y
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	1,050.01	8.49%	L-1	Y
OTKA	Othello and Fallsington soils, 0 to 2 percent slopes	1.01	0.01%	S-1	Y
PEEAR	Pedricktown, Askecksy, and Mullica soils, 0 to 2 percent slopes, rarely flooded	76.90	0.62%	NA	Y
PHG	Pits, sand, and gravel	4.70	0.04%	NA	N
SabB	Sassafras loamy sand, 0 to 5 percent slopes	28.48	0.23%	S-1	N
SabC	Sassafras loamy sand, 5 to 10 percent slopes	59.97	0.48%	S-1	N
SabD	Sassafras loamy sand, 10 to 15 percent slopes	20.01	0.16%	NA	N
SabF	Sassafras loamy sand, 15 to 40 percent slopes	36.10	0.29%	NA	N
SacA	Sassafras sandy loam, 0 to 2 percent slopes	185.80	1.50%	P-1	Y
SacB	Sassafras sandy loam, 2 to 5 percent slopes	281.43	2.28%	P-1	Y
SacC	Sassafras sandy loam, 5 to 10 percent slopes	43.77	0.35%	S-1	N
UR	Urban land	216.51	1.75%	NA	N
WATER	Water	81.13	0.66%	NA	N
WeeB	Westphalia fine sandy loam, 2 to 5 percent slopes	132.07	1.07%	P-1	Y
WeeC	Westphalia fine sandy loam, 5 to 10 percent slopes	78.35	0.63%	S-1	N

Soil Code	Soil Description	Acres	Percentage of all Acres	Designation *	Hydric Soil**
WeeF	Westphalia fine sandy loam, 15 to 40 percent slopes	38.44	0.31%	NA	N
WoeA	Woodstown sandy loam, 0 to 2 percent slopes	7.10	0.06%	P-1	Y
WoeB	Woodstown sandy loam, 2 to 5 percent slopes	15.72	0.13%	P-1	Y
WokA	Woodstown-Glassboro complex, 0 to 2 percent slopes	1,332.01	10.77%	P-1	Y
WooB	Woodstown-Urban land complex, 0 to 5 percent slopes	33.70	0.27%	NA	N
Total		**12,366.17**	**100.0%**		
Total Farmland Acreage		**11,001.52**	**88.97%**		
Total Non-Farmland Acreage		**1,364.57**	**11.03%**		

Source: USDA-Natural Resources Conservation Service (2002)

Explanation of Designations

P–1	Prime Farmland
S–1	Statewide Importance
U–1	Unique Farmland
NR	Soils not classified for farmland use: wet soils, pits, steep slopes, made land, etc.

** Typically hydric soils are not considered to be Prime Farmland (P-1) because of their excessive water saturation. However, several soils in Elk Township are classified by the Natural Resource Conservation Service (NRCS) as both Prime Farmland (P-1) and Hydric soils. This indicates that the soil meets the Prime Farmland (P-1) standards but is also a very wet soil. Thus, the only way that this soil can perform at its full potential is if the site is drained, reducing the effect of its hydric characteristics.

Soil characteristics can severely restrict the use of sites for construction and development. ***Table 5: Soil Limitations for Development*** records the soils and their possible limitations for building foundations. This table is a summary of a report on building suitability available from the NRCS 2006 database for Gloucester County soils. It is included here as a general guide and is not intended to eliminate the need for site analysis.

Another primary concern associated with development is a soil's ability to maintain a septic system disposal field. These fields require soils that have a low water table (over five feet below the surface) and high permeability to allow for proper drainage of wastewater. Soils with high water tables (five feet or less from the surface) create a potential for erosion, wet basements, and low permeability, often allowing wastewater to collect near the surface. Elk Township's soils generally rate low for septic drainage field suitability. Because the suitability of a soil for a septic disposal field is very site-specific and relies on many factors, including but not limited to the soil type, there is not an accurate source of soil information on this subject. The best way to determine soil suitability for a septic system is to request a site survey by a professional.

Table 5: Soil Limitations for Development

Soil Description	Soil Code	Acres	Building without Basement	Building with Basement
Atsion sand, 0 to 2 percent slopes, rarely flooded	AtsAr	126.32	C	C
Aura loamy sand, 0 to 5 percent slopes	AucB	86.62	A	A
Aura sandy loam, 2 to 5 percent slopes	AugB	862.63	A	A
Aura loam, 2 to 5 percent slopes	AupB	46.47	A	A
Aura-Sassafras loamy sands, 0 to 5 percent slopes	AvsB	238.67	A	A
Aura-Sassafras loamy sands, 5 to 10 percent slopes	AvsC	71.48	A	A
Aura-Sassafras sandy loams, 2 to 5 percent slopes	AvtB	1,587.51	A	A
Aura-Sassafras sandy loams, 5 to 10 percent slopes	AvtC	60.26	A	A
Aura-Urban land complex, 0 to 5 percent slopes	AvuB	37.90	N/R	N/R
Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded	BEXAS	479.43	C	C
Buddtown-Deptford complex, 0 to 2 percent slopes	BumA	81.91	C	C
Downer loamy sand, 0 to 5 percent slopes	DocB	2,554.81	A	A
Downer loamy sand, 5 to 10 percent slopes	DocC	58.65	A	A
Downer sandy loam, 0 to 2 percent slopes	DoeA	196.38	A	A
Downer-Urban land complex, 0 to 5 percent slopes	DouB	177.87	N/R	N/R
Evesboro sand, 0 to 5 percent slopes	EveB	433.96	A	A
Fallsington sandy loam, 0 to 2 percent slopes	FamA	738.32	C	C
Fallsington loam, 0 to 2 percent slopes	FapA	170.05	C	C
Fallsington-Urban land complex, 0 to 5 percent slopes	FauB	1.77	C	C
Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	FmhAt	205.57	C	C
Hammonton loamy sand, 0 to 5 percent slopes	HbmB	207.37	B	C
Keyport sandy loam, 2 to 5 percent slopes	KemB	29.98	B	C
Keyport loam, 0 to 2 percent slopes	KeoA	10.32	B	C
Lenni loam, 0 to 2 percent slopes	LenA	178.63	C	C
Manahawkin muck, 0 to 2 percent slopes, frequently flooded	MakAt	1,050.01	C	C
Othello and Fallsington soils, 0 to 2 percent slopes	OTKA	1.01	C	C
Pedricktown, Askecksy, and Mullica soils, 0 to 2 percent slopes, rarely flooded	PEEAR	76.90	C	C
Pits, sand, and gravel	PHG	4.70	A	A
Sassafras loamy sand, 0 to 5 percent slopes	SabB	28.48	A	A
Sassafras loamy sand, 5 to 10 percent slopes	SabC	59.97	A	A
Sassafras loamy sand, 10 to 15 percent slopes	SabD	20.01	B	B
Sassafras loamy sand, 15 to 40 percent slopes	SabF	36.10	C	C
Sassafras sandy loam, 0 to 2 percent slopes	SacA	185.80	A	A
Sassafras sandy loam, 2 to 5 percent slopes	SacB	281.43	A	A
Sassafras sandy loam, 5 to 10 percent slopes	SacC	43.77	A	A
Urban land	UR		N/R	N/R
Water	WATER		N/R	N/R
Westphalia fine sandy loam, 2 to 5 percent slopes	WeeB	216.51	A	A
Westphalia fine sandy loam, 5 to 10 percent slopes	WeeC	81.13	A	A
Westphalia fine sandy loam, 15 to 40 percent slopes	WeeF	132.07	C	C
Woodstown sandy loam, 0 to 2 percent slopes	WoeA	78.35	B	C

Soil Description	Soil Code	Acres	Building without Basement	Building with Basement
Woodstown sandy loam, 2 to 5 percent slopes	WoeB	38.44	B	C
Woodstown-Glassboro complex, 0 to 2 percent slopes	WokA	7.10	C	C
Woodstown-Urban land complex, 0 to 5 percent slopes	WooB	15.72	B	C
Total Acres		**12,366.17**		

Source: US Department of Agriculture, Natural Resource Conservation Service

Key to Table 5

A = Not Limited	Little or no limitation(s) or easily corrected by use of normal equipment and design techniques.
B = Somewhat Limited	Presence of some limitation, which normally can be overcome by careful design and management at somewhat greater cost.
C = Very Limited	Limitations that, normally, cannot be overcome without exceptional, complex, or costly measures.
N/R = Not Rated	Limitations are not rated.

Source: US Department of Agriculture, Natural Resource Conservation Service

STEEP SLOPES

Slope is measured as the percent of vertical rise to horizontal distance. Most of Elk Township has slopes of 10% or less. Slopes between 15% and 20% are generally considered to be steep slopes, and there are some areas of Elk with slopes of 20% or more. The areas with steep slopes in Elk are concentrated in the northwestern portion of the Township, near Raccoon Creek, Ewan Lake, Gilman Lake, and the Cartwheel Branch. Elk Township's steep slopes are depicted on **Map 8: Flood Hazard Areas (1996) and Steep Slopes**.

In general, development is inadvisable in steep slope areas because of soil instability, erosion, sedimentation of streams, increased stormwater runoff, and flooding. This causes habitat destruction, water pollution, and potential damage to property. Erosion on steep slopes is especially prevalent where excessive tree removal has taken place. On steep slopes, structures and septic systems should generally be limited or prohibited.

On steep slopes bordering creeks and streams, it is not unusual to see trees that have fallen into the gullies or into the streams themselves. In some places, the rate of tree loss is accelerated beyond natural rates by erosion from flash flooding, which in turn is often caused by increases in impervious surface upstream. However, trees on steep slopes fall for other reasons as well, including age, severe storms (especially if their roots have been exposed from erosion), and heat and water loss, which dries the soil.

CLIMATE

Located along the 39th Parallel (about midway between the North Pole and Equator), New Jersey is influenced by hot, cold, dry, and humid airstreams that create highly variable local weather conditions. From May through September, New Jersey is dominated by moist, tropical air,

originating in the Gulf of Mexico and carried by prevailing winds from the southwest. In winter, winds generally prevail from the west and northwest bringing cold, polar air masses from subarctic Canada.

The climate in New Jersey varies within five regions: North, Central, Southwest, Pine Barrens, and Coastal. Elk straddles the Southwest and Pine Barrens zones. The Southwest region is generally warmer than the Pine Barrens, due to differences in soil composition and proximity to the Delaware Bay, which gives the Southwest region a maritime influence. The soils of the Southwest retain moisture better than those of the Pine Barrens, contributing to the warmer temperatures. The soils of the Pine Barrens are sandy and allow precipitation to rapidly infiltrate the ground and leave the surface dry. This, along with the swift rate at which solar radiation absorbed during the day is radiated back into space, allow for a wider range between the daily maximum and minimum temperatures than in the southwest. The Southwest experiences the longest growing season in the state thanks to the moderating effects of the Delaware Bay and the relatively early spring frosts and late fall frosts, compared to the other regions.

Detailed weather data from nearby Glassboro is available from the National Oceanic and Atmospheric Administration, which operated a station there from 1948 to 2004. The Elk area experiences a normal high temperature of 85.7°F in July and a normal low temperature in January of 23.7°F. The extreme temperatures recorded in Glassboro are a low of -8°F on January 22, 1984 and a high of 104°F on July 4, 1966.

The region's annual mean temperature is 54.2°F. This compares with a statewide mean temperature of 52.3°F. The mean temperature in the Elk area for July is 76.1°F; the monthly mean temperature for January is 31.2°F.

Precipitation and Storm Events

The Southwest climate zone, where Elk is located, receives less precipitation than the North, Central, and Coastal regions of New Jersey. The normal average annual precipitation for the area from 1971 through 2000 was 45.54 inches compared to a statewide normal annual precipitation of 47.87 inches. The region's lack of orographic (mountainous) features and greater distance from the Great Lakes-St. Lawrence storm track may explain lower precipitation. Elk's location, approximately 50 miles inland, is also less susceptible to heavy rains associated with coastal storms. The Elk area receives the most precipitation in August, normally 4.42 inches, and the least precipitation in February, normally 2.83 inches.

Snowfall typically occurs in New Jersey when moist air from the south converges with cold air from the north. In Elk, snowfall may occur from mid-October to mid-April, but is most likely to occur from December to March. At least one inch of snow is on the ground an average of 11 days each year.

Severe storm events, including thunderstorms, tropical storms, blizzards, ice storms, hail storms, and tornadoes, occur in Gloucester County. Tornadoes are infrequent; about five, generally

weak, occur in New Jersey each year. Thunderstorms occur in Elk about 30 days each year, mainly between May and August. In modern history, only hurricanes passing offshore of New Jersey or the remnants of hurricanes have impacted the state. Nevertheless, some of these have been severe. For example, on September 16, 1999, Hurricane Floyd caused torrential rains, high winds, and flooding across New Jersey.

Growing Seasons

Elk is within U.S. Department of Agriculture (USDA) Plant Hardiness Zone 7, where annual minimum temperatures are typically between 0°F and 5°F. Hardiness Zones are based on average annual minimum temperatures, and are helpful in indicating which plant species are able to survive the winter in each area. Nearly all of Gloucester County, along with Salem County, portions of Cumberland and Camden counties, and areas along the Atlantic coastline are designated as Zone 7, the warmest USDA Plant Hardiness Zone in New Jersey.

Elk's agricultural growing season is approximately six months, or 180 days, from mid-April to mid-October. This is the period between the last spring frost and first autumn frost. However, harvesting of grain crops typically continues throughout November, and winter crops such as broccoli, cauliflower, and cabbage are grown until the first hard freeze, usually in early January. The frost-free growing season in Elk is about 60 days longer than in northern New Jersey, where frosts generally end in May and begin in October.

CRITERIA POLLUTANTS

Ground level ozone is formed when volatile organic compounds (VOC) and **nitrogen oxides** react with sunlight and heat. It is produced more in the summer months, and is the primary constituent of smog. Ground level ozone is a pulmonary irritant which, even in low levels, can be dangerous to sensitive populations such as people with asthma or emphysema, and the elderly. It can also affect plant growth and is responsible for hundreds of millions of dollars in lost crop production.

Particulate matter (PM), or particle pollution, is made up of dust, ash, smoke, and other small particles formed from the burning or crushing of materials such as wood, rocks, or oil. When ingested, particulate matter can lodge deep in the lungs and can contribute to serious respiratory illnesses such as asthma or lung disease. Particulate matter also creates haze, reduces visibility, and covers buildings in dirty soot.

Carbon monoxide (CO_2) is a colorless, odorless gas that is formed when carbon fuel is not burned completely. It is a component of motor vehicle exhaust; therefore higher levels of CO_2 generally occur in areas with heavy traffic congestion. The highest levels of CO_2 typically occur during the colder months when air pollution becomes trapped near the ground beneath a layer of rising warm air.

Nitrogen oxides are a group of highly reactive gases which contain nitrogen and oxygen in varying amounts. Motor vehicles, electric utilities, and homes and businesses that burn fuels emit nitrogen oxides; they can also be found naturally. Nitrogen oxides are primary components in ground-level ozone (smog), acid precipitation, and other toxic chemicals. Acid precipitation can cause lung ailments in humans, property damage, harm to aquatic life, and other environmental and human health problems.

Sulfur dioxide (SO_2) is released into the atmosphere when fuel containing sulfur, such as coal and oil, is burned, and when gasoline is refined from oil. SO_2 dissolves in water vapor to form acid precipitation.

Lead is a pollutant that was historically released by cars and trucks burning leaded fuel, but metals processing plants and trash incinerators are the major source of emissions today. Lead tends to be a localized air pollutant, found in urban or high traffic areas, and is deposited in soil and water, harming fish and wildlife.

AIR QUALITY

Air quality is one of the most difficult environmental resources to measure because its sources are diffuse and regional in nature. Sources of air pollution include industry, cars, trucks, buses, fires, and dust. Air pollutants can travel extremely far from their source. For example, the burning of coal in Ohio, Michigan, and Western Pennsylvania to generate electricity sends pollutants like sulfur, nitrogen, and particulate matter all the way to the East Coast. Local sources of air pollution include traffic and industrial complexes in the Delaware Valley.

In 1970, the Environmental Protection Agency (EPA) was formed to enforce the Clean Air Act (CAA). The CAA identified six *criteria* pollutants – ozone, particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and lead – that are destructive to human health, and the built and natural environment. The EPA sets National Ambient Air Quality Standards (NAAQS) for these pollutants based on human health effects, as well as environmental and property damage.

In New Jersey, NJDEP does the air quality monitoring for the EPA (see NJAC 7:27). NJDEP's Bureau of Air Monitoring maintains a network of monitoring stations across the state. These stations continually monitor some or all of seven parameters – carbon monoxide, nitrogen oxides, ozone, sulfur dioxide, smoke shade, particulate matter, and meteorological data. The monitoring station closest to Elk Township is located approximately 19 kilometers away in Clarksboro, New Jersey. The Clarksboro monitoring station tracks ozone and sulfur dioxide concentrations. It is an urban scale station, which means that the location is ideal for monitoring pollutants over an area of 10-100 kilometers.

Under the CAA, the EPA limits the amount of other air pollutants and toxins that are emitted by point sources, such as chemical plants, industrial factories, power plants, and steel mills. The NJDEP Air Quality Permitting Program issues permits for stationary sources of air pollution, such as power plants, oil refineries, dry cleaners, food processing centers, and manufacturing plants, and regulates and monitors their emissions. There are two active air quality permits in Elk Township (one for Cifron Environmental Service Inc. and the other for the Elk Fuel Stop Service Station).

Air Quality Index

EPA created the Air Quality Index (AQI) to indicate a metropolitan region's air quality by measuring levels of five of the six criteria pollutants (excluding lead). The AQI is focused on the potential human health hazards experienced by breathing unhealthy air. Scores for the AQI range from 0 to 500 and are divided into six color-coded categories, as shown in ***Table 6***.

Table 6: Air Quality Index

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	...air quality conditions are:	...as symbolized by this color:
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Source: AIRNow

The daily score is based on whatever the highest individual pollutant score is reported. For example, if ozone scored 150 and particulate matter scored 100, the daily AQI would be 150 – Unhealthy for Sensitive Groups. The index is used to measure overall air quality by counting the number of days per year when the AQI of each metropolitan region exceeds 100. Across all metropolitan regions (with populations over 500,000), the number of days per year with an AQI of over 100 steadily decreased between 1988 and 2001. In 2005, the closest metropolitan region to Elk Township, Philadelphia, had 28 days when the AQI exceeded 100.

New Jersey is subdivided into nine regions that each report the AQI. Gloucester County is in Region 8: Southern Delaware Valley. In 2005, this area reported 219 good (green) and 130 moderate (yellow) days, 16 days which were unhealthy for sensitive groups (orange), and 0 unhealthy (red) days.

SURFACE WATER RESOURCES

All of the land in Elk Township drains to the Delaware River and Bay. The Township is located within three watersheds. The south half of Elk is part of the Maurice River watershed, which drains into the Delaware Bay. The majority of the north half of Elk is part of the Raccoon Creek watershed, while a small portion of western Elk is part of Oldmans Creek watershed. Both of these watersheds drain into the Delaware River. Elk Township is a starting point for all three watersheds, and its land is traversed by their headwaters.

Watersheds

A watershed is all the land that drains to a particular waterway such as a river, stream, lake, or wetland. A watershed's boundaries are defined by the high points in the terrain, such as hills and ridges. Large watersheds are made up of smaller ones, down to the catchment level of a local

site. So, for example, the Delaware River watershed is made up of many smaller watersheds, such as the Maurice River watershed. This watershed, in turn, is formed by several **subwatersheds**, consisting of the land that drains to a major tributary or branch of the river, such as the Still Run subwatershed. These subwatersheds can be further subdivided into smaller ones, each surrounding the smaller tributaries that flow to the larger channel, and so on down to the catchment level. Watersheds are natural ecological units, where soil, water, air, plants, and animals interact in a complex relationship. Elk contains three HUC-11[1] watersheds – the Still Run watershed, which is part of the Maurice River drainage, as well as Raccoon Creek, and Oldmans Creek.

Nearly two-thirds of Elk Townhip's land—mostly in the east and in the south—drains to Still Run, the West Clayton Branch, and the Reed Branch, which all eventually flow into the Maurice River and the Delaware Bay. Just under one-third of the township's land—mostly in the northwestern section—drains into Raccoon Creak. Only 4% of the municipality's land drains to Oldmans Creek. See also **Table 7: Watersheds and Subwatersheds in Elk**, **Map 6: Watersheds** and **Map 7: Surface Water, Wetlands, and Vernal Pools**.

Table 7: Watersheds and Subwatersheds in Elk

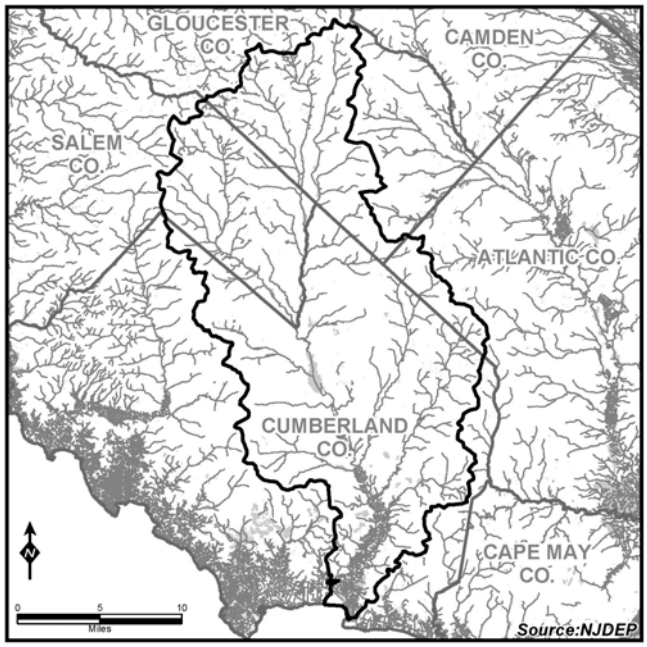
Source: NJDEP, Bureau of Geographic Information Systems

Watershed	USGS Watershed Code (HUC-11 Number)	Acreage within Municipality	% of Municipal Land	Subwatersheds (HUC-14 Numbers) within Elk
Still Run (Maurice River)	02040206120	8,217.22	66.45%	02040206120010 02040206120030 02040206120040 02040206120050
Oldmans Creek	02040202160	495.25	4.00%	02040202160010
Raccoon Creek	02040202150	3,653.69	29.55%	02040202150010 02040202150020 02040202150030

Maurice River Watershed

The Maurice River watershed is one of New Jersey's largest watersheds, covering 385 square miles. Within Gloucester County the watershed (referred to as the Upper Maurice River watershed) encompasses 74 square miles, and covers approximately 66% of Elk Township. The Maurice River originates in Gloucester and Salem counties and flows southward, forming part of the border between Salem and Cumberland counties, and empties into the Delaware Bay at Bivalve in Cumberland County. The length of the Maurice River from its headwaters to its mouth is 58 miles. The river is tidal below Union Lake in Millville, Cumberland County.

[1] "HUC" stands for Hydrological Unit Code, which is a numerical identification number given to every drainage system in the United States by the US Geological Survey. HUC-11 codes are the 11-digit numbers applied to a part of a drainage area that is approximately 40 square miles in size. HUC-11 areas are further subdivided into HUC-14 subwatersheds, with the identification number for each one having 14 digits.



Source: NJDEP

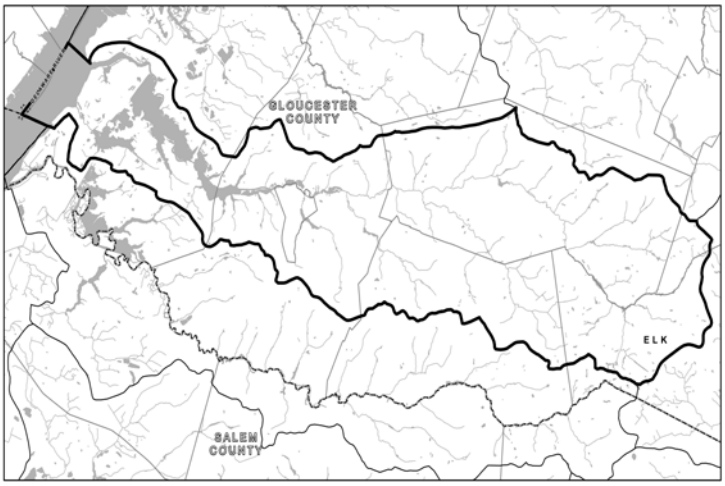
Figure 3: The Maurice River Watershed

The three main branches of the river located within Gloucester County are Still Run, Little Ease Run, and Scotland Run. The three stream systems run parallel to each other and come together in Willow Grove Lake, located just below the Gloucester border in Salem County. Most of the headwaters of Little Ease Run are within the Glassboro Wildlife Management Area in Glassboro. The West Clayton Branch, Reed Branch, and Elwell Branch are tributaries to Still Run, all of which cross Elk Township. The Kinard Branch, Hell Branch, Jericho Branch, Indian and Hays Branches, and Malaga Branch are tributaries to Scotland Run. Major lakes within Gloucester County include Silver Lake, Wilson Lake, Garrison Lake, Franklinville Lake, Iona Lake, and Malaga Lake. Silver and Garrison Lakes are within Elk Township.

Originally called "Wauhatquenack" by the Lenape Indians, the current name is thought to have come from the name of a Dutch ship, the Prince Maurice, which burned and sank in 1657 below present day Mauricetown, Cumberland County (pronounced like "Morris," with the accent on the first syllable). In the early 1700s, white settlers moved into the area and built mills on many of the river's tributaries. These mills gave way to glass factories in the 19th Century. In the early 20th Century, several lakes in the area were developed for recreational use. Cottage colonies grew up around these lakes, and today most of these houses are in year-round use. The Maurice River watershed is home to more than half of the species of plants and animals listed on the New Jersey Threatened and Endangered Species List.

The Raccoon Creek Watershed

The Raccoon Creek watershed covers approximately 40 square miles, of which 5.75 square miles are in Elk Township. The main channel of the creek is 19 miles in total length and starts in Elk Township, forming the border between Elk and Glassboro and then Elk and Harrison Township. Tributaries to the main or North Branch of the Raccoon Creek in Elk are Cartwheel Branch and Gilman Branch. Other major tributaries include Clems Run, starting in Glassboro, and Little Clems Run, starting in Harrison. There are also many small, unnamed tributaries. From Elk Township, the creek flows across Harrison and on through Woolwich and Logan townships to the Delaware River.



Source: NJDEP

Figure 4: The Raccoon Creek Watershed

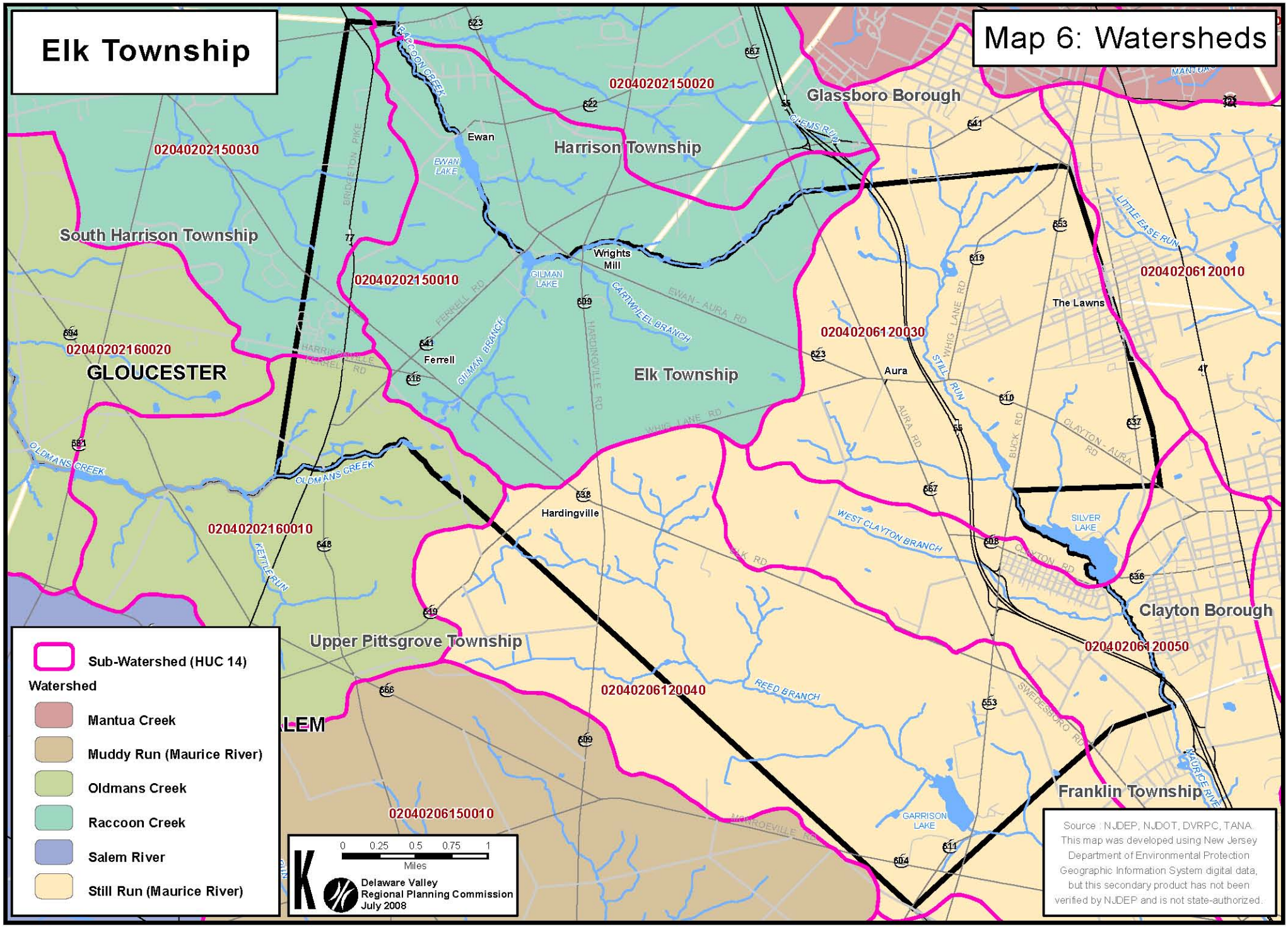
While there are several tributaries to the creek, the main one is the South Branch of Raccoon Creek, which starts in Elk Township close to the western edge of the border between Elk and South Harrison townships. The South Branch is shorter than the main branch. A main tributary is Poplar Branch. From Elk, the South Branch flows northwestward into Harrison Township where it joins the North Branch just before crossing under Tomlin Station Road in Harrison. Less than a mile beyond the juncture of the two branches, the creek leaves Harrison and travels across Woolwich and Logan townships, where it widens into extensive tidal wetland areas.

The Raccoon Creek was home to the Narraticons, a sub-tribe of Lenape Indians, who called the creek the "Narraticon-sippus," meaning "raccoon-river." The earliest settlement by Europeans in Gloucester County was at the mouth of the Raccoon Creek, near the town of Bridgeport. The creek is navigable by large ships from the Delaware River up to Kings Highway in Woolwich. During the 18th and 19th centuries the creek was a transportation corridor between Mullica Hill and the larger downstream community of Swedesboro, which had wharves and piers from which bigger vessels carried cargo to Philadelphia and other ports.

Oldmans Creek Watershed

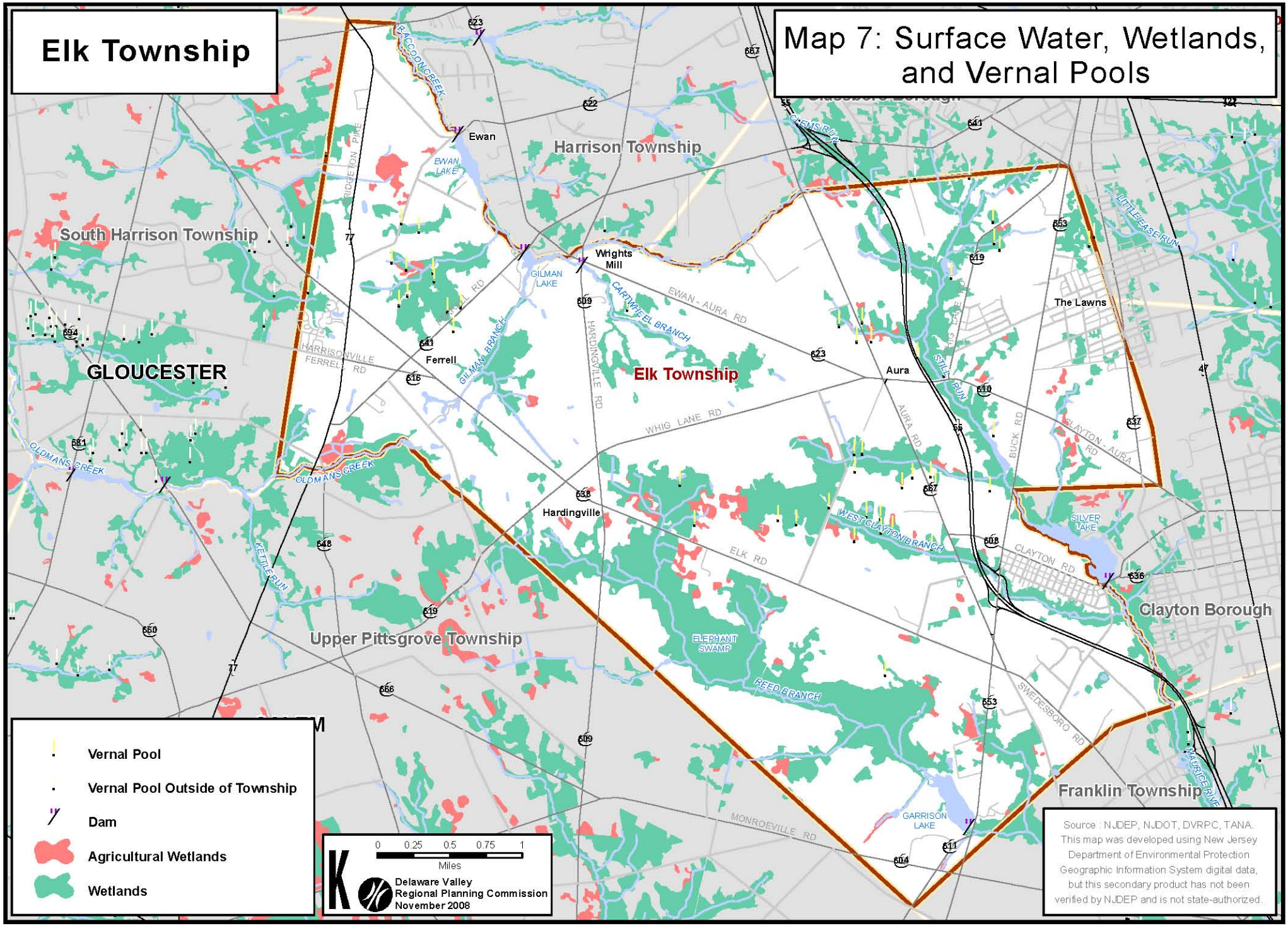
Oldmans Creek watershed covers an area of 44 square miles in Gloucester and Salem counties and the creek itself forms the border between these counties. The watershed covers a small portion of Elk Township's western corner, occupying five percent of the township. The creek serves as part of the border between Elk and Pilesgrove Township in Salem County.

Oldmans Creek has one main 20-mile channel with many small tributaries, none of which run through Elk. Major tributaries in Gloucester County are Tide Branch**,** Beaver Creek**,** and Indian Branch. Ebenezers Branch, Rainey Run, Porches Creek, Indian Run, Marl Run, and Lincoln Stream run through Salem County. Two major lakes**,** Algonquin Lake and Harrisonville Lake, are located in the watershed in South Harrison Township.


Elk Township
Map 6: Watersheds
02040202150020
02040202150030
02040202150010
02040202160020
02040202160010
02040206120010
02040206120030
02040206120040
02040206120050
02040206150010
Glassboro Borough
Harrison Township
South Harrison Township
GLOUCESTER
Elk Township
Upper Pittsgrove Township
Clayton Borough
Franklin Township
Ewan
Wrights Mill
Ferrell
Hardingville
Aura
The Lawns
RACCOON CREEK
EWAN LAKE
GILMAN LAKE
GILMAN BRANCH
CARTWHEEL BRANCH
FERRELL RD
HARDINGVILLE RD
EWAN - AURA RD
OLDMANS CREEK
KETTLE RUN
WHIG LANE RD
STILL RUN
AURA RD
BUCK RD
CLAYTON - AURA RD
LITTLE EASE RUN
CHEMS RUN
WEST CLAYTON BRANCH
SILVER LAKE
CLAYTON RD
ELK RD
REED BRANCH
SWEDESBORO RD
GARRISON LAKE
MONROEVILLE RD
MAURICE RIVER
Sub-Watershed (HUC 14)
Watershed
Mantua Creek
Muddy Run (Maurice River)
Oldmans Creek
Raccoon Creek
Salem River
Still Run (Maurice River)
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : NJDEP, NJDOT, DVRPC, TANA
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

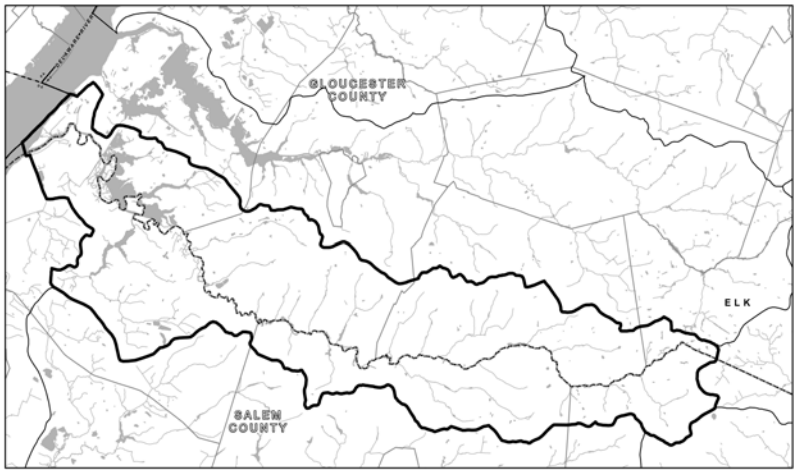
Elk Township

Map 7: Surface Water, Wetlands, and Vernal Pools



Source : NJDEP, NJDOT, DVRPC, TANA. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

The original inhabitants of the Oldmans Creek area were the Kagkakaini Sakins, a sub-tribe of the Lenape Indians. They called the creek the "Mosackas," the meaning of which is unknown. "Oldmans Creek" is a variation on the name "Aldermans Creek," given to the waterway by the Dutch. In the early 17th Century, Europeans settled the area, using the creek for industrial activities and transportation.



Source: NJDEP

Figure 5: The Oldmans Creek Watershed

Oldmans Creek watershed, along with Raccoon Creek watershed, is home to some of the Delaware Bayshore region's most fertile farmland. It also provides a critical habitat for many threatened and endangered species, and is part of the Atlantic Flyway, making it an important stopover site for migrating birds. The stretch of creek close to and including Harrisonville Lake is classed as a Category 1 water, meaning that it is of exceptional ecological, recreational, water supply, and/or fisheries significance. An additional stretch of the stream from Harrisonville Lake down to head-of-tide in Woolwich Township also has this same classification, based on the presence of an endangered species of freshwater mussel and of the endangered bog turtle. The presence of the mussel in the stream segments upstream from Harrisonville Lake, including the stretch in Elk Township, has not been investigated.

Streams

Elk Township is the source for three stream systems. About 33 stream miles cross Elk Township altogether. Of these, 26 miles are first order or second order (headwater) streams. That is, they are the initial sections of stream channels with no contributing tributaries (first order streams), or they are stream channels formed from only one branching section of tributaries above them (second order streams). The headwaters are where a stream is "born," and actually begins to flow. See **Map 7: Surface Water, Wetlands, and Vernal Pools**.

Table 8: Elk Township Streams

Stream Order	Miles
First Order Streams (smallest)	21.36
Second Order Streams	4.99
Third Order Streams	6.88
Total Stream Miles	**33.23**

Source: NJDEP

Headwaters are of particular importance because their condition affects downstream water quality and because they tend to contain a greater diversity of aquatic species. Because of their small size, they are highly susceptible to impairment by human activities on the land. First and second order streams are narrow and often shallow, and are characterized by relatively small base flows. This makes them subject to greater temperature fluctuations, especially when forested buffers on their banks are removed. They are also easily over-silted by sediment-laden runoff and their water quality can be rapidly degraded. In addition, first order streams are greatly affected by changes in the local water table because they are fed by groundwater sources. Headwaters are important sites for the aquatic life that is at the base of the food chain, and often serve as spawning or nursery areas for fish.

Due to the patchwork of agriculture, wetlands, forests, and developed areas in Elk Township, it is very difficult to characterize the land uses through which the streams flow. The Still Run watershed includes developed areas such as Aura and the Lawns. The upper portion of the West Clayton Branch watershed is not heavily developed, though the lower portion, which is west of Aura Road and north of Swedesboro Road, is more extensively developed. Development in the Reed Branch watershed is mostly found adjacent to roads, such as Elk Road and Routes 619, 609, and 553. A great deal of the Reed Branch watershed is covered by wetlands, such as Elephant Swamp. The headwaters of Raccoon Creek are predominantly agricultural and forested, though there are also pockets of development, especially near Ewan Lake and Gilman Lake.

Lakes and Ponds

There are 147 acres of artificial ponds and small lakes in Elk, which are all classified as artificial waterbodies by NJDEP. Artificial lakes and ponds are man-made impoundments of water that are formed by damming. They are often used for irrigation and flood control. Artificial ponds and lakes may also be the result of extractive mining operations. Naturally occurring lakes and ponds do not exist in southern New Jersey.

Principal lakes include Garrison and Gilman, both of which are privately owned. Garrison is a recreation site with swimming, boating, and camping available to the public for a fee. It is located along Reed Branch, which meets Still Run in neighboring Franklin Township. Another lake in the Still Run (Maurice River) drainage is Silver Lake, also privately owned, that sits along the boundary of Elk Township in Clayton but which is fed by the headwaters of Still Run and its tributary, West Clayton Branch, which are both in Elk. Lake Gilman is on the Raccoon Creek North Branch. It is situated at the juncture of

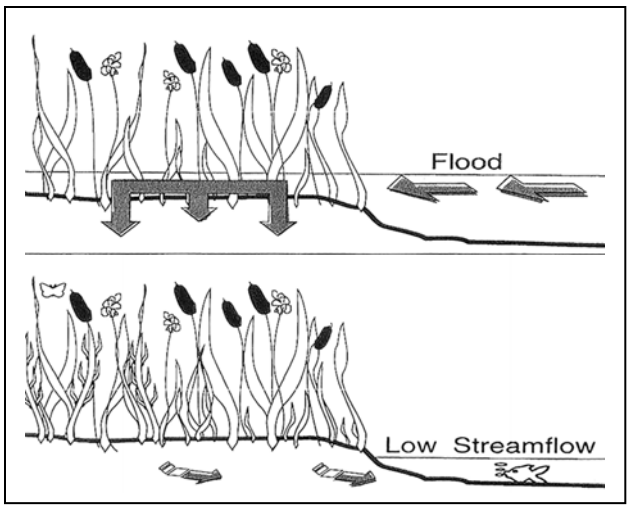
Source: DVRPC

Lake Gilman

the main channel with two tributaries, Cartwheel Branch and Gilman Branch, which both flow across Elk Township. Wrights Mill Pond, also known as Winarski Lake, is upstream of Lake Gilman along the Cartwheel Branch. It was drained in 2004 and has reverted to attractive wetlands. Rich Crow Lake is on Gilman Branch upstream from Lake Gilman. Omary Lake is on another unnamed tributary of the main channel. These lakes are privately owned and managed. Downstream from Lake Gilman on the main channel is Ewan Lake. See **Map 7: Surface Water, Wetlands, and Vernal Pools**.

Wetlands

Wetlands support unique communities that serve as natural water filters and as incubators for many beneficial species. The term "wetland" is applied to areas where water meets the soil surface and supports a particular biological community. The source of water for a wetland can be an estuary, river, stream, lake, or groundwater that rises close to the land surface. Under normal circumstances, wetlands are those areas that support a prevalence of defined wetland plants on a wetland soil. The US Fish & Wildlife Service designates all large vascular plants as wetland (hydric), non-wetland (non-hydric) or in-between (facultative). Wetland soils, also known as hydric soils, are areas where the land is saturated for at least seven consecutive days during the growing season.



Source: The Streams of Washington Township, with permission.

Figure 6: Wetlands.
Wetlands vegetation traps and holds flood waters, allowing it to percolate into the ground.

New Jersey protects freshwater (interior) wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C. A 7:7A. The law also protects transition areas or "buffers" around freshwater wetlands. The New Jersey freshwater wetlands maps provide guidance on where wetlands are found in New Jersey, but they are not the final word. Only an official determination from DEP, called a "letter of interpretation (LOI)," can determine if there are freshwater wetlands on a property. An LOI verifies the presence, absence, or boundaries of freshwater wetlands and transition areas on a site. Activities permitted to occur within wetlands are very limited and permits are required for most of them.

All of Elk's wetlands are freshwater. Natural wetlands of all types total 2,435 acres (or slightly less than 20% of the township's total area), the vast majority of which are forested. Herbaceous and low-growing scrub/shrub wetlands constitute the remainder of Elk's natural wetlands. See **Map 7: Surface Water, Wetlands, and Vernal Pools**.

Elk also includes 246 acres of wetlands—covering approximately 2% of the township's area—that have been altered by human activities and no longer support typical wetland vegetation or are not vegetated at all. These modified wetland areas do, however, show obvious signs of soil saturation and exist in areas shown to have hydric soils on US Soil Conservation Service soil surveys. Modified wetlands fall into categories defined by the *Anderson Land Use Classification* system, as follows: there are 16 acres of former agricultural wetlands, 28 acres of disturbed wetlands, 11 acres of wetland right-of-ways, and 5 acres of wetlands found in maintained greenspace, lawns, or recreation areas.

Agricultural Wetlands

Agricultural wetlands occupy 186 acres (1.5 percent) of Elk Township. These "quasi-wetlands" are found scattered as small sites throughout the township. These wetlands tend to border natural wetlands or streams. Agricultural wetlands are modified former wetland areas that are under cultivation. They still exhibit evidence of soil saturation in aerial infrared photo surveys, but do not support natural wetland vegetation. See **Map 7: Surface Water, Wetlands, and Vernal Pools**.

As long as agricultural wetland areas remain in agricultural use, they are exempt from New Jersey's Freshwater Wetlands Rules *N.J.A.C. 7:7A.* However, if an agricultural area is removed from agricultural production for more than five years, any wetlands located within that area lose their exempt status. Also, according to *N.J.A.C. 7:7A-2.8(b)2*, "the exemptions apply only as long as the area is used for the exempted activity." Therefore, if the area is used for anything other than farming, the exemption no longer applies.

In addition, if hydric soils are present, certain activities on drained farmland may be regulated by the state of New Jersey. While the Freshwater Wetlands Protection Rules set forth several specific farming, ranching, and silviculture exemptions, those exemptions are subject to another limitation:

> If an area with hydric soils has been drained for farming purposes through the use of drainage structures such as tiles or ditches, the Department shall presume that the area has wetlands hydrology for the purpose of identifying a freshwater wetland under N.J.A.C. 7:7A-2.3. To rebut this presumption of wetlands hydrology, all drainage structures shall be removed or completely disabled and the area shall be left undisturbed for at least one normal rainfall year, after which the presence or absence of wetlands hydrology shall be determined through use of technical criteria, field indicators, and other information, in accordance with the 1989 Federal manual. [7:7A-2.8(b)5]

The Natural Resources Conservation Service sponsors the Wetlands Reserve Program (www.nrcs.usda.gov/programs/wrp), a voluntary program that offers landowners incentives for restoring and protecting wetlands on their property, including agricultural wetlands. Restoring agricultural wetlands requires removing them from agricultural use and restoring them to their natural state. This program provides technical and financial assistance to landowners who can enroll eligible lands through permanent easements, 30-year easements, or restoration cost-share agreements.

Vernal Pools

Vernal pools are bodies of water that appear following snowmelt and during spring rains, but that disappear or are dry during the rest of the year. They are highly important sites for certain rare species of frogs and salamanders, called obligate breeders. Obligate breeders will only breed in vernal pools, because the pool's impermanence prevents residence by predators who would consume the eggs and young. Vernal pools also provide habitat for amphibians and reptiles that do not exclusively breed in them, but may use the pools at some point in their life cycles for breeding or other purposes (facultative breeders).

Vernal pools are so intermittent that their existence as wetlands has frequently not been recognized. Consequently, many of them have disappeared from the landscape, or have been substantially damaged. This, in turn, is a principal cause of the decline of their obligate amphibian species.

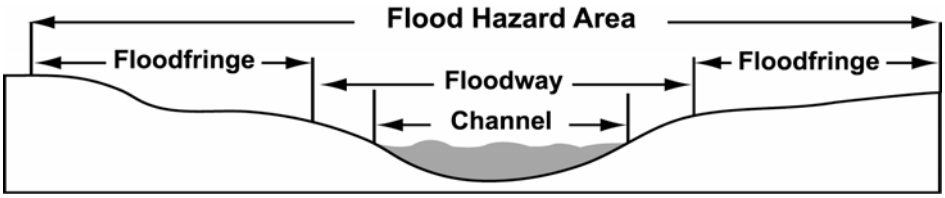
The New Jersey Division of Fish and Wildlife has been conducting a Vernal Pool Survey project since 2001 to identify, map, and certify vernal ponds throughout the state. Unless they have been certified, vernal pools less than 1 acre in size can be filled. Once a vernal pond is certified, regulations require that a 75-foot buffer be maintained around the pond. NJDEP's Division of Land Use Regulation oversees this designation and restricts development around vernal ponds by denying construction permits. Local municipalities can provide additional protection by instituting restrictive zoning or negotiating conservation easements on the land surrounding the pond. The South Jersey Land and Water Trust provides training sessions every March to teach volunteers how to identify, survey, and certify vernal pools. Information is available at their website: www.sjwatersheds.org/ongoing/vernalpools.htm.

The state has identified 45 possible vernal pools within Elk, which are listed in **Appendix E: Vernal Pools in Elk Township** and depicted on **Map 7: Surface Water, Wetlands, and Vernal Pools**. These pools are found throughout Elk, with concentrations along Raccoon Creek and Still Run and Reed Branch and their tributaries. Volunteers can survey each pool to determine what species are present and if the pool is still in existence as a natural habitat. Once surveyed, the New Jersey Division of Fish and Wildlife will review the data and those pools that meet the criteria will be certified. A certified vernal pool is defined as one that occurs in a confined basin without a permanently flowing outlet, has habitat documented for one obligate or two facultative herptile (reptile and amphibian) species, maintains ponded water for at least two continuous months between March and September, and is free of fish populations throughout the year.

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving water, and the adjacent flood fringe, which helps to hold and carry excess water during overflow of the normal stream channel. The 100-year floodplain is defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood that has a 1 percent chance of occurring in any given year).

Although the terms "flood hazard area" and "100-year floodplain" denote similar concepts, NJDEP defines them in slightly different ways. New Jersey's regulations define the flood hazard area as the area inundated by a flood resulting from the 100-year discharge increased by 25 percent. This type of flood is called the "flood hazard area design flood" and it is the flood regulated by NJDEP.



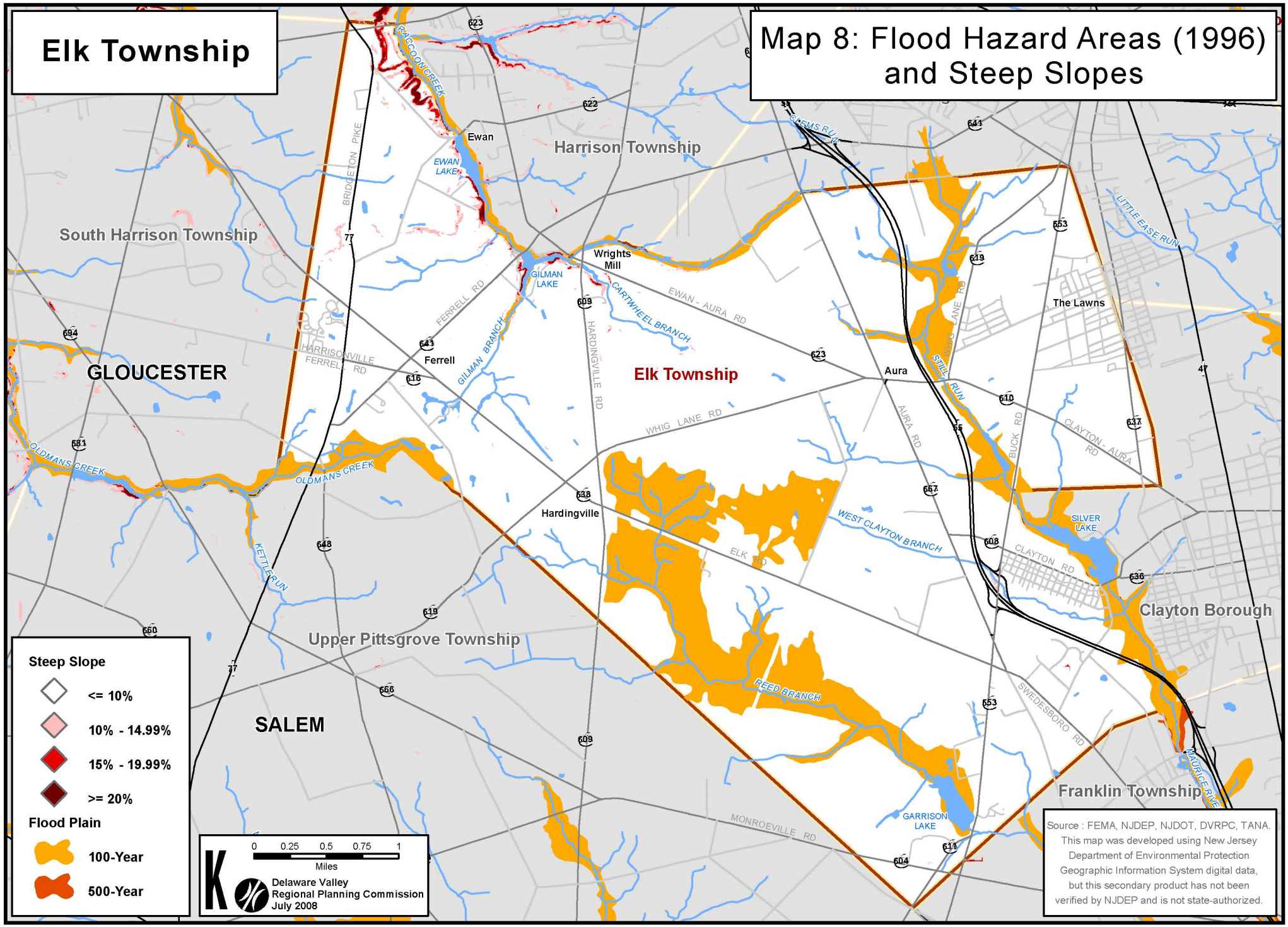
Source: The Streams of Washington Township

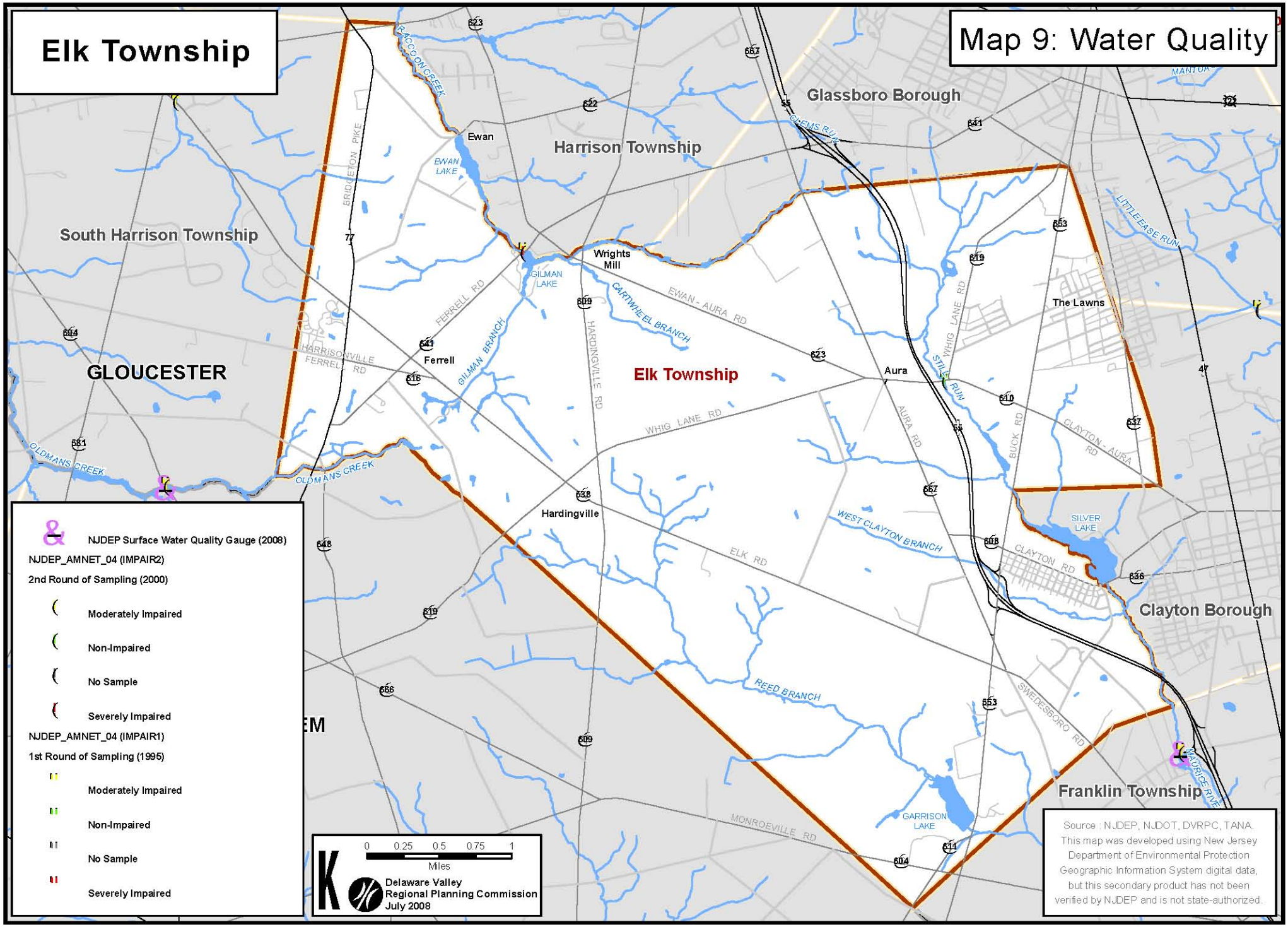
Figure 7: Parts of a Flood Hazard Area

Floodplains require protection in order to prevent loss to residents, especially within the boundaries of the floodway. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in floodplains. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplains remove and mitigate various pollutants because their vegetation removes excess chemical loads from the water and filters sediments. All efforts to keep development out of floodplains will help to preserve the flood-carrying capacity of streams and their water quality.

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment. New Jersey regulates construction in the flood hazard area under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and its implementing rules at N.J.A.C. 7:13. Activities that are proposed to occur in a flood hazard area require a stream encroachment permit or a letter of non-applicability from the NJDEP. Additional information on floodplain activities is available from NJDEP and from its website under "Land Use."

New Jersey's flood hazard area maps are not available in digital form. Consequently, it is only possible to approximate the spatial extent of the flood hazard area in Elk by using the Federal Emergency Management Agency's (FEMA's) 100-year floodplain maps. FEMA's maps show that 1,630 acres (13 percent) of the township's land area fall within the 100-year floodplain.


Elk Township
Map 8: Flood Hazard Areas (1996) and Steep Slopes
Harrison Township
South Harrison Township
GLOUCESTER
Elk Township
Upper Pittsgrove Township
SALEM
Clayton Borough
Franklin Township
Ewan
Wrights Mill
Ferrell
Aura
Hardingville
The Lawns
RACCOON CREEK
EWAN LAKE
GILMAN LAKE
GILMAN BRANCH
CARTWHEEL BRANCH
HARDINGVILLE RD
FERRELL RD
HARRISONVILLE FERRELL RD
EWAN - AURA RD
WHIG LANE RD
AURA RD
BUCK RD
CLAYTON - AURA RD
STILL RUN
OLDMANS CREEK
KETTLER RUN
WEST CLAYTON BRANCH
ELK RD
CLAYTON RD
SILVER LAKE
REED BRANCH
SWEDESBORO RD
GARRISONI LAKE
MONROEVILLE RD
LITTLE EASE RUN
MAURICE RIVER
BRIDGETON PIKE
Steep Slope
<= 10%
10% - 14.99%
15% - 19.99%
>= 20%
Flood Plain
100-Year
500-Year
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : FEMA, NJDEP, NJDOT, DVRPC, TANA. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.


Elk Township
Map 9: Water Quality
Glassboro Borough
Harrison Township
South Harrison Township
GLOUCESTER
Elk Township
Clayton Borough
Franklin Township
Ewan
Wrights Mill
Ferrell
Aura
Hardingville
The Lawns
RACCOON CREEK
BRIDGETON PIKE
EWAN LAKE
GILMAN LAKE
GILMAN BRANCH
FERRELL RD
HARRISONVILLE FERRELL RD
CARTWHEEL BRANCH
EWAN - AURA RD
HARDINGVILLE RD
WHIG LANE RD
STILL RUN
AURA RD
BUCK RD
CLAYTON - AURA RD
OLDMANS CREEK
WEST CLAYTON BRANCH
ELK RD
SILVER LAKE
CLAYTON RD
REED BRANCH
SWEDESBORO RD
GARRISON LAKE
MONROEVILLE RD
LITTLE EASE RUN
CHEMS RUN
MAURICE RIVER
NJDEP Surface Water Quality Gauge (2008)
NJDEP_AMNET_04 (IMPAIR2)
2nd Round of Sampling (2000)
Moderately Impaired
Non-Impaired
No Sample
Severely Impaired
NJDEP_AMNET_04 (IMPAIR1)
1st Round of Sampling (1995)
Moderately Impaired
Non-Impaired
No Sample
Severely Impaired
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : NJDEP, NJDOT, DVRPC, TANA
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Presumably, the flood hazard area would be slightly larger.[2] Elk's floodplain areas are located along most water bodies, with the largest floodplains surrounding the Reed Branch and the Maurice River. Smaller streams may periodically flood, but the Federal Emergency Management Agency and NJDEP have not delineated these floodplains because the risk to property and human health is usually minor. See **Map 8: Flood Hazard Areas and Steep Slopes.**

Table 9: Flood Hazard Area Acreage

Category	Acres
100-year floodplain	1,630

Source: Federal Emergency Management Agency (FEMA)

Surface Water Quality

Water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The federal Clean Water Act (P.L. 95-217) requires that wherever possible water-quality standards provide water suitable for fish, shellfish, and wildlife to thrive and reproduce and for people to swim and boat.

All waterbodies in New Jersey are classified by NJDEP as either freshwater (FW), pinelands water (PL), saline estuarine water (SE), or saline coastal water (SC). Freshwater is further broken down into freshwater that originates and is wholly within federal or state parks, forests, or fish and wildlife lands (FW1), and all other freshwater (FW2). The water quality for each of these groups must be able to support designated uses that are assigned to each waterbody classification (see *Surface Water Quality Standards N.J.A.C. 7:9B-1.12*). In addition to being classified as FW1 and FW2, fresh waterbodies are classified as trout-producing (TP), trout maintaining (TM), or non-trout waters (NT). Each of these classifications may also be subject to different water quality standards.

The streams that are part of the Maurice River drainage in Elk (Still Run, Reeds Branch) are classified as FW2–NT, meaning that they are freshwater streams that are not trout producing or trout maintaining. Oldmans Creek and Raccoon Creek are both classified as of FW2-NT/SE. This means that these waters are classed as saline (SE) from head-of-tide to their discharge at the Delaware River and as freshwater and non-trout above head-of-tide. Elk is located above head-of-tide and, therefore, the portions of these rivers in the township are all FW2-NT. Tributary streams that are not explicitly classified by the NJDEP take the classification of the river into which they flow. Therefore, tributary streams in Elk are also classified as FW2-NT.

[2] Site plan and subdivision applications require detailed engineering studies that depict the boundaries of the flood hazard area at a large scale.

Table 10: Water Quality Classifications of Streams in Elk

Streams	Classification
Maurice River	FW2-NT
Oldmans Creek	FW2-NT/SE1
Raccoon Creek	FW2-NT/SE2

Source: NJDEP, 2006 Integrated Water Report

According to NJDEP rules, FW2 (both trout maintaining and not) waters must provide for (1) the maintenance, migration and propagation of the natural and established biota; (2) primary and secondary contact recreation (i.e., swimming and fishing); (3) industrial and agricultural water supply; (4) public potable water supply after conventional filtration and disinfection; and (5) any other reasonable uses.

The determination of whether or not water quality is sufficient to meet a waterbody's designated use(s) is based on whether the waterbody is within established limits for certain surface water quality parameters. Some examples of surface water quality parameters include fecal coliform, dissolved oxygen, pH, phosphorous, and toxic substances. NJDEP also evaluates water quality by examining the health of aquatic life in a stream.

New Jersey's Integrated Water Quality Monitoring and Assessment Report

The Federal Clean Water Act (Act) mandates that states submit biennial reports to the U.S. Environmental Protection Agency (USEPA) describing the quality of their waters. States must submit two reports: the *Water Quality Inventory Report* or "305(b) Report," documenting the status of principal waters in terms of overall water quality and support of designated uses, and a list of waterbodies that are not attaining water quality standards – the "303(d) List."

In 2002, 2004, and again in 2006, NJDEP integrated the 303(d) List and the 305(b) Report into a single report according to USEPA's guidance. The 2006 *Integrated Water Quality Monitoring and Assessment Report* (www.state.nj.us/dep/wmm/sgwqt), released in early 2007, places the state's waters on one of five "sublists." Sublists 1 and 2 contain waters that are attaining standards. Sublist 3 contains waters for which there is insufficient data to determine their status. Sublist 4 contains waters that do not attain water quality standards, but meet other conditions. Sublist 5 contains waters that do not attain their designated use and for which a TMDL is required (See page 48 for a definition of a TMDL). Sublist 5 is equivalent to the 303(d) List.

In the 2002 and 2004 Integrated Reports, NJDEP placed each of the state's water quality monitoring stations on a sublist. Stations that tested for more than one water quality parameter, i.e., pH, phosphorous, fecal coliform, dissolved oxygen, temperature, etc., could be placed on different sublists for different parameters. For example, a station could be on Sublist 5 (non-attaining) for phosphorous and Sublist 1 (attaining) for temperature. Individual stream segments (also referred to as waterbodies) were then associated with water quality sampling stations using a methodology established by NJDEP. However, the ability of a waterbody to meet its designated uses was not explicitly stated in the 2002 and 2004 Integrated Reports.

Map 9: Water Quality shows the monitoring stations and impairment status of these stream segments in Elk Township.

In 2006, NJDEP revised its methodology so as to report the attainment of water quality standards required for achieving designated uses on a subwatershed basis. See page 28 for a definition of a a subwatershed. **Map 6: Watersheds** shows the subwatersheds with their 14-digit Hydrologic Unit Code numbers (HUC-14). Rather than placing water quality monitoring stations and their associated stream segments on a sublist for an individual parameter, NJDEP identified the designated uses applicable to each HUC-14 subwatershed (assessment unit) and assessed the status of use attainment for each applicable designated use. Designated uses include:

- Aquatic life (general)
- Aquatic life (trout)
- Primary contact recreation
- Secondary contact recreation
- Drinking water supply
- Industrial water supply
- Agricultural water supply
- Shellfish harvesting
- Fish consumption

The assessment unit was then placed on the appropriate sublist for each use. (Note: not all designated uses are applicable for all HUC-14 subwatersheds).

NJDEP based the assessment of entire HUC-14 watersheds on the results of one or more monitoring site(s) within the subwatershed. The results from monitoring site(s) located within the HUC-14 subwatershed were extrapolated to represent all the waters within the entire HUC boundary. In practice, the HUC-14 approach provides a more conservative assessment since any impairment of any waterbody (stream, river, etc.) in a given HUC-14 subwatershed will result in that entire subwatershed being listed as impaired for that use/parameter.

See ***Table 11: 2006 Integrated Water Quality Monitoring and Assessment Report, Elk Township***, for the status of each of Elk's HUC-14 watersheds.

Table 11: 2006 Integrated List of Waterbodies by Subwatershed, Elk Township

Assessment Unit ID (Subwatershed)	Assessment Unit Name	Aquatic Life (general)	Primary Contact Recreation	Secondary Contact Recreation	Drinking Water Supply	Agricul Water Supply	Industr Water Supply	Fish Consumption
2040206 120030-01	Still Run (above Silver Lake Road)	Sublist 1	Sublist 1	Sublist 1	Sublist 1	Sublist 1	Sublist 1	Sublist 3
2040206 120040-01	Reed Branch (Still Run)	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3
20402060 120050-01	Still Run (Willow Grove Lake - Silver Lake Road)	Sublist 5	Sublist 2	Sublist 2	Sublist 2	Sublist 2	Sublist 2	Sublist 3
2040202 150010-01	Raccoon Creek (above Clems Run)	Sublist 5	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3	Sublist 3
2040202 60010-01	Oldmans Creek (above Commissioners Road)	Sublist 5	Sublist 4A	Sublist 4A	Sublist 2	Sublist 2	Sublist 2	Sublist 5

Source: NJDEP, Bureau of Freshwater and Biological Monitoring

Key to Table 11 Integrated Report Sublists

Sublist 1	There is sufficient data to assess all applicable designated uses for the waterbody and the assessment indicates **full attainment** for all designated uses.
Sublist 2	Waterbodies are placed on this Sublist when an assessment for an individual designated use is complete and results for that assessment indicate **full attainment but other designated uses are unassessed**, **assessed as non-attaining or have an approved TMDL**. (See p. 48 for a definition of a TMDL.) When all designated uses are assessed as fully attaining, these waterbodies will be moved to Sublist 1.
Sublist 3	Waterbodies are placed on this Sublist when the designated use assessment indicated **insufficient or no data** to assess the designated use.
Sublist 4A	A **TMDL has been completed** for the pollutant causing non-attainment.
Sublist 5	Designated use assessment is complete and results for the assessment indicate **non-attainment**.

As shown in Table 11 above, an assessment unit may be listed on one or more sublists depending on the results of the assessment (i.e., on Sublist 2 for drinking water, Sublist 3 for aquatic life, etc.). In order to determine whether or not an assessment unit supports a designated use, NJDEP identified a suite of parameters that serve as the minimum data set associated with each designated use. An assessment unit can only be placed on Sublist 1 if all uses for an individual HUC-14 are assessed and attained.

If one or more designated uses are assessed as "non-attainment" (Sublist 5) the pollutant(s) causing the non-attainment status is identified on the "303(d) List of Impaired Waters with Priority Ranking." When the pollutant causing non-attainment is not known, the pollutant is listed as "pollutant unknown" or "toxic unknown." ***Table 12: 303(d) List of Impaired Waters***

with Priority Ranking, lists the non-attaining assessment units and their pollutants in Elk Township. The ranking (low, medium, high) refers to the priority given a specific assessment unit when determining the schedule for a TMDL. High priority assessment units are those for which the State intends to establish a TMDL in the next two years. (See p. 48 for a definition of a TMDL.)

Table 12: 303(d) List of Impaired Waters with Priority Ranking, December 2006

Assessment Unit ID (subwatershed)	Assessment Unit Name	Parameter	Ranking
02040206120030-01	Still Run (above Silver Lake Road)	Pollutant Unknown	Low
02040206120050-01	Still Run (Willow Grove Lake - Silver Lake Road)	pH	Medium
02040202150010-01	Raccoon Creek (above Clems Run)	Pollutant Unknown	Low
02040202160010-01	Oldmans Creek (above Commissioners Road)	pH	Medium

Source: NJDEP Bureau of Freshwater and Biological Monitoring

Water Quality Monitoring Networks

The determination of whether or not water quality is sufficient to meet an assessment unit's designated use(s) is based on testing results from various water quality monitoring networks. Across the state, NJDEP primarily relies on two water quality monitoring networks: the ***Ambient Stream Monitoring Network (ASMN)*** and the ***Ambient Biomonitoring Network (AMNET).*** NJDEP runs the ASMN network in cooperation with the U.S. Geological Survey (USGS). This network contains 115 stations that monitor for nutrients (i.e., phosphorous and nitrogen), bacteria, dissolved oxygen, metals, sediments, chemical, and other parameters. AMNET, which is administered solely by NJDEP, evaluates the health of aquatic life as a biological indicator of water quality. This network includes 820 monitoring stations located throughout the state. Each station is sampled once every five years. The first round of sampling for all stations took place between 1992 and 1996 and a second round occurred between 1997 and 2001. A third round of sampling took place between 2002 and 2006.

Ambient Stream Monitoring Network (ASMN)

The USGS/NJDEP Ambient Surface Water Monitoring (ASWM) network operates one site near Elk Township, on Still Run at Little Mill Road in Franklin Township. This site is tested for a range of elements, including dissolved oxygen, pH, ammonia, nitrogen, and phosphorous. Waters that meet the standard set for each parameter are given the status of "attaining." See table below.

Table 13: New Jersey ASWM Sampling Locations for Elk Area Waterways

Site ID	Station Name/Waterbody	Municipality	Parameters Tested	Data Source	2004 Impairment Status	2006 Impairment Status
01411452	Still Run at Little Mill Rd near Clayton	Franklin Township	Phosphorus, Fecal Coliform, Temperature, Dissolved Oxygen, pH, Nitrate, Dissolved Solids, Total Suspended Solids, Unionized Ammonia	NJDEP/USGS Data	attaining	attaining

Source: NJDEP, Bureau of Freshwater and Biological Monitoring Ambient Biomonitoring Network (AMNET)

There are two AMNET sites that assess aquatic life within Elk and an additional three sites located in neighboring townships. These five AMNET sites are listed in ***Table 14: New Jersey AMNET Sampling Locations for Elk Waterways*** and are also depicted on **Map 9: Water Quality**.

NJDEP first sampled the Raccoon Creek AMNET sites in March of 1995 and the Little Ease Run and Still Run at Aura sites in November of that year. The second Still Run site, in Franklin Township, was sampled in February of 1996. Five years later the five sites were sampled again. Each AMNET site was tested for the diversity of the aquatic communities at that site—specifically, the benthic macroinvertebrates (bottom-dwelling insects, worms, mollusks, and crustaceans that are large enough to be seen by the naked eye). The numbers and types of species present are directly related to water quality. As the pollution level increases, more sensitive species disappear first, followed by others. As these species "drop out," the diversity of the community drops as well. Benthic macroinvertebrate sampling is simple and inexpensive, and offers a holistic indication of overall water quality.

Table 14: New Jersey AMNET Sampling Locations for Elk Waterways

Site ID	Station Name/Waterbody	Municipality	Parameters Tested	1995 NJ Impairment Score	2000 NJ Impairment Score
AN0679	Raccoon Ck Ellis Mill Rd (below Gilman Lake)	Elk	Benthic Macroinvertebrates	9	6
AN0681	S Br Raccoon Ck Swedesboro-Franklinville Rd (Rt538)	South Harrison Twp	Benthic Macroinvertebrates	21	18
AN0726	Unknown Tributary to Little Ease Run Carpenter Rd	Glassboro Borough	Benthic Macroinvertebrates	9	9
AN0729	Still Run Aura Rd	Elk	Benthic Macroinvertebrates	24	30
AN0730	Still Run Little Mill Rd	Franklin Twp	Benthic Macroinvertebrates	18	18

Source: NJDEP, Bureau of Freshwater and Biological Monitoring **See Key below**

Table 14: KEY

NJ Impairment Score	Biological Assessment
0-6	Severely Impaired
9-21	Moderately Impaired
24-30	Non-impaired

Map 9: Water Quality uses color coding to denote the impairment level at each site from 1995 to 2000.

In the 1995 (first round) sampling four of the five sites in the vicinity of Elk were found to be "moderately impaired." The Still Run site at Aura Road in Elk was not impaired.
In the 2000 (second round) sampling all sites maintained the same impairment rating in 2000 except the Raccoon Creek site in Elk Township (AN0679). This site's rating declined, going from "moderately impaired" to "severely impaired."

Other Monitoring

Certain fish may contain toxic chemicals, such as PCBs, dioxins, or mercury, which accumulate in water and aquatic life. Chemical contaminants such as dioxin and PCBs are classified by the U.S. Environmental Protection Agency as probably cancer-causing substances in humans.

While the DEP has not sampled any waterbodies in Elk, it has issued advisories for fish in four Gloucester County lakes. In addition to these warnings, the DEP urges residents to follow the general and statewide fish consumption advisories as outlined by the NJDEP Division of Science, Research, and Technology.

Knowing the actual condition of streams and stream banks, and planning for their improvement, requires fuller surveys and more frequent monitoring than the state can provide. The state primarily monitors main channels in nontidal areas and only does biological assessments on a five-year cycle. Even that schedule is difficult for the State to achieve. The 2005 AMNET monitoring has not yet been reported, for example. Stream surveys

N.J. DEPARTMENT OF ENVIRONMENTAL PROTECTION FRESHWATER FISH ADVISORIES

Certain fish may contain toxic chemicals, such as polychlorinated biphenyls (PCBs), dioxins, and mercury, which accumulate in water and aquatic life. Chemical contaminants such as dioxin and PCBs are classified by the U.S. Environmental Protection Agency as probably cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public. Since 1982, NJDEP catches fish at numerous sampling stations throughout the state and tests for contaminant levels, adopting advisories to guide residents on safe consumption practices.

In 2007, NJDEP issued specific freshwater fish advisories for waterbodies in Gloucester County for: black crappie, channel catfish, largemouth bass, white catfish, brown bullhead, bluegill sunfish, common carp, yellow perch, chain pickerel, and pumpkinseed sunfish. Statewide advisories for the following fish were also issued in 2007: striped bass, bluefish, American eel, and American lobster. Recreational fishermen and women should regularly check for local fish advisories on NJDEP's Division of Science, Research and Technology web site: http://www.state.nj.us/dep/dsr/njmainfish.htm.50

by local organizations are needed, along with regular monitoring of water quality on all of a community's waterways.

Total Maximum Daily Loads

For each impaired waterway (waters on Sublist 5), the state is required by the USEPA to establish a Total Maximum Daily Load (TMDL). A TMDL quantifies the amount of a pollutant a waterbody can assimilate (its loading capacity) without violating water quality standards. A TMDL's purpose is to initiate a management approach or restoration plan based on identifying the sources of a pollutant and determining the percent reductions of the pollutant that must be achieved by each source. These sources can be point sources, such as sewage treatment plants or non-point sources, such as runoff from various types of residential, commercial, or agricultural lands. A TMDL goes through four stages; it is "proposed" in a report by NJDEP, "established" when NJDEP finalizes their report, "approved" by EPA Region 2, and "adopted" when NJDEP adopts it as an amendment to a water quality management plan.

A TMDL determines the percentage of reduction needed in order for a stream segment to meet the water quality standard. Because of the extent of extrapolation required for this approach, NJDEP must perform more detailed testing to determine the actual cause, source, and extent of impairment in the HUC-14 subwatershed before developing a TMDL or before taking other regulatory action to address the impairment. The largest contributors to poor water quality are nonpoint and stormwater point sources. For example, during rain events, runoff from various land uses transports pollutants (such as fecal coliform from geese, farm animals, and domestic pets) into waterbodies. Nonpoint sources also include inputs from "illicit" sources such as failing sewage conveyance systems, sanitary sewer overflows, and failing or inappropriately located septic systems.

The State is in charge of prioritizing the 303(d)-listed waterbodies for Total Maximum Daily Load (TMDL) analyses and identifying those high priority waterbodies for which they anticipate establishing TMDLs in the next two years. The state prioritizes fecal coliform and phosphorus contamination above benthic macroinvertebrate impairments. Elk's waterbodies have "medium" and "low" priority rankings, and therefore TMDLs will not be developed as quickly for Elk's impaired streams as for other waterbodies having fecal coliform or phosphorus impairments.

There have been some TMDLs created for parts of Oldmans Creek already (in 2003), although no specific remedial actions were ever developed from them. These are:

- A TMDL for fecal coliform based on assessment of Oldmans Creek at Jessups Mill (Monroeville Rd.) in South Harrison Township, which is just downstream from the Elk Township border.
- A TMDL for phosphorus based on assessment of Harrisonville Lake in South Harrison Township. This is also downstream from Elk Township, but considerably farther away.

Causes of Water Quality Impairments

Stormwater Runoff

Stormwater runoff and other nonpoint source pollution (pollution coming from a wide variety of

sources rather than from a single point such as a discharge pipe) have the largest effect on the water quality and channel health of streams in Elk. These sources are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative in their effect. Known causes of non-point source pollution include septic system effluent, agricultural runoff, construction activities, and stormwater drainage. Most non-point source pollution in Elk Township derives from stormwater drainage off paved surfaces such as streets, commercial/industrial areas, and residential sites (with and without detention basins), and from agricultural fields that lack adequate vegetative buffers.

In March 2003, the NJDEP issued a new Stormwater Management Rule, as required by the US Environmental Protection Agency's Phase II Stormwater Management Program for Municipal Separate Stormwater Sewer Systems (MS4). The rule lays out guidance and requirements for management of and education about stormwater at the local level. It applies to all towns in New Jersey, all county road departments, and all public institutional facilities on large sites (such as hospitals and colleges). Beginning in 2004, every municipality was required to obtain a New Jersey Pollution Discharge Elimination System (NJPDES) general permit for the stormwater system and its discharges within municipal borders, which are considered to be owned and "operated" by the municipality.

Stormwater Management Statewide Basic Requirements
Tier B* Towns (Elk)

1. Control post-construction stormwater management in new development and redevelopment through:
    - Adoption of a stormwater management plan in accordance with N.J.A.C. 7:8.
    - Adoption and implementation of a stormwater control ordinance in accordance with N.J.A.C. 7:8. This ordinance requires retention on site of 100% of preconstruction recharge, and use of low-impact design in stormwater facilities, among other features.
    - Ensuring compliance with Residential Site Improvement Standards for stormwater management. The RSIS has been revised to incorporate the low-impact design and other requirements of the stormwater control ordinance.
    - Ensuring long-term operation and maintenance of Best Management Practices on municipal property.
    - Requiring that new storm drain inlets meet new design standards.

2. Conduct local public education:
    - Distribute educational information (about stormwater requirements, nonpoint source pollution, and stewardship) annually to residents and businesses and conduct a yearly "event" (such as a booth with these messages at a community day).
    - Have all municipal storm drain inlets labeled with some type of "don't dump" message.
    - Distribute information annually regarding fertilizer/pesticide application, storage, disposal, and landscaping alternatives and regarding proper identification, handling, and disposal of wastes including pet waste and litter
    - Adopt specific ordinances to control waste disposal and other nonpoint sources.

* Tier B municipalities are communities with lower population levels and densities. They have fewer stormwater requirements imposed on them. See the NJDEP Stormwater website www.njstormwater.org for more information.

Under the 2004 NJPDES permit, a town must meet certain specific requirements in planning, ordinance adoption, education, management of township facilities, and investigation of parts of

the stormwater system. Fulfillment of these Statewide Basic Requirements is scheduled to occur over the course of five years. All of the requirements are intended to reduce water pollution from stormwater runoff.

In Gloucester County, all municipalities have been aided in complying with the new Rule by a program sponsored by the County Freeholders and managed through the Gloucester County Improvement Authority. This has included development of a stormwater management plan and ordinance for each town. Until recently, the County also sponsored the South Jersey Land & Water Trust, a nonprofit organization, to conduct the annual education event and to assist with labeling storm drain inlets in Elk Township. The Environmental Commission could be the appropriate group to carry out such a program locally, in the future.

Impervious Coverage

The volume of runoff that is carried to a stream also impacts stream channel condition. Increased volume usually results from increased impervious surface within a subwatershed. As an area becomes developed, more stormwater is directed to the streams from neighborhood storm drains, residential and commercial stormwater facilities, and road drainage. An increase in impervious coverage can decrease groundwater recharge potential, which can lead to a decrease in stream base flow during the dry summer months. In general, scientists have found that levels of impervious cover of 10 percent or more within a subwatershed are directly linked to increased stormwater runoff, enlargement of stream channels, increased stream bank erosion, lower dry weather flows, higher stream temperatures, lower water quality, and declines in aquatic wildlife diversity. When impervious cover reaches 25% to 30%, streams can become severely degraded. Although impervious surface coverage in Elk is currently minimal, township development will increase the level of coverage.

The effects of impervious cover can be minimized by reducing the requirements for road widths and parking, encouraging the use of impervious building materials, discouraging the destruction of stream buffers, and encouraging the use of better designs for stormwater management. Some New Jersey municipalities, such as Freehold and Wall in Monmouth County, have specific ordinances limiting the percentages of allowable impervious coverage per zoning category. Elk Township currently does not have such guidelines.

Inadequate Stream Buffers

The stream buffer is the region immediately adjacent to the banks of a stream that serves to limit the entrance of sediment, pollutants, and nutrients into the stream itself. Vegetated stream buffers are quite effective at filtering substances washing off the land. The vegetation of the buffer traps sediment and can actually utilize (uptake) a percentage of the nutrients flowing from lawns and farm fields. When forested, a stream buffer promotes bank stability and serves as a major control of water temperature. The buffer region also serves as a green corridor for wildlife to move between larger forested habitat areas. Residents can use these greenways for recreation with the addition of trails, bikeways, and access points to water for fishing and canoe/kayak launching.

The importance of a healthy, intact buffer zone (also referred to as a "riparian corridor") has been well documented scientifically over the past 20 years, especially for headwater streams. There is little agreement and much continuing research about the appropriate minimum width of a buffer. In literature on this issue, a recommended minimum buffer width of 100 feet is most common, with differing activities permitted in each of three zones within the buffer. Buffers of up to 300 feet are recommended for wildlife corridors and potential passive recreational use, such as walking trails.

The New Jersey Freshwater Wetlands Protection Act incorporates buffer requirements into its wetland protection regulations. The width of the "transition zone" extending beyond a wetland is determined by the value of the wetland, based on its current use and on the documented presence/absence of threatened or endangered species. Municipalities may not establish buffers on wetlands that exceed those required by the state statute. However, the municipality can make certain that those limits are accurate through its review of the wetlands delineation process, and can also monitor use of the land within the transition area and take action against encroachments.

The U.S. Department of Agriculture and the New Jersey Department of Agriculture support various programs dedicated to stream buffer restoration, including the Conservation Reserve Program (CRP), administered by the USDA's Farm Service Agency (FSA), and the New Jersey version of this program which is labeled as CREP (Conservation Reserve Enhancement Program). This program is designed to help farmers reduce impairments from agricultural water runoff sources in an effort to improve water quality. The program compensates farmland owners for the loss of land being converted to a buffer or other habitat. It also funds or directly creates new buffers where they are absent. Programs such as the Environmental Quality Incentive Program (EQIP), administered by the Natural Resources Conservation Service (NRCS) of the USDA, encourage the environmentally conscious management of agricultural lands. The NRCS funds practices that address issues such as surface water quality, erosion, and fertilizer and pesticide runoff. These are all programs in which individual landowners volunteer to take part. See **Appendix C: Federal and State Conservation Programs for Farmers** for a listing of these programs.

It is particularly beneficial for farmers and property owners in Elk to take advantage of the numerous state and federal programs that encourage agricultural best management practices (BMPs) and stream buffers because Elk contains the headwaters of three streams. If the water quality in Elk Township decreases due to excessive nutrients, siltation, or pollution, the damage will have greater consequences because stream headwaters are more fragile ecosystems and their condition affects the health of the entire stream (See subsection about **Streams** in the **Surface Water Resources** section).

Point Sources of Pollution

Point sources of pollution, which come from a single source or "point" such as an industrial discharge pipe, are regulated by NJDEP through the New Jersey Pollution Discharge Elimination System (NJPDES). New Jersey created NJPDES in response to the Federal Clean Water Act of 1972, which mandated that each state develop water quality standards and regulate the amount of pollution entering water bodies. The Act classified all water pollution into one of two categories:

"point source" pollution and "nonpoint source" pollution (coming from many diffuse sources, such as through stormwater), but did not require states to regulate nonpoint sources until recently.

NJDEP, through the Division of Water Quality and the Bureau of Point Source Permitting, administers the NJPDES program (*N.J.A.C. 7:14A*). Under NJPDES, any facility discharging domestic or industrial wastewater directly into surface water or groundwater (usually through a septic system) must apply for and obtain a permit for discharging. Rather than creating individually tailored permits for every facility, the Division of Water Quality uses scientific standards to create and issue general permits for different categories of dischargers. NJDEP enforces the terms of NJPDES permits by visiting discharging facilities and requiring facilities to conduct water quality, biological, and toxicological analyses, and thermal impact and cooling water assessments periodically.

Under the Open Public Records Act (OPRA) of 2002, a list of active NJPDES permits is available through the New Jersey Environmental Management System. As of February 2006, ten NJPDES permits were in Elk. These are shown in ***Table 15*** below.

Since the adoption of the federal Clean Water Act in 1972 and the implementation of NJPDES in subsequent years, water pollution from point sources has decreased drastically. However, as development has continued to spread through New Jersey, nonpoint source pollution has increased substantially in recent decades. NJDEP's new Stormwater Management Rules, described previously, focus on reducing and controlling nonpoint sources of water pollution.

Table 15: Elk NJPDES Permits

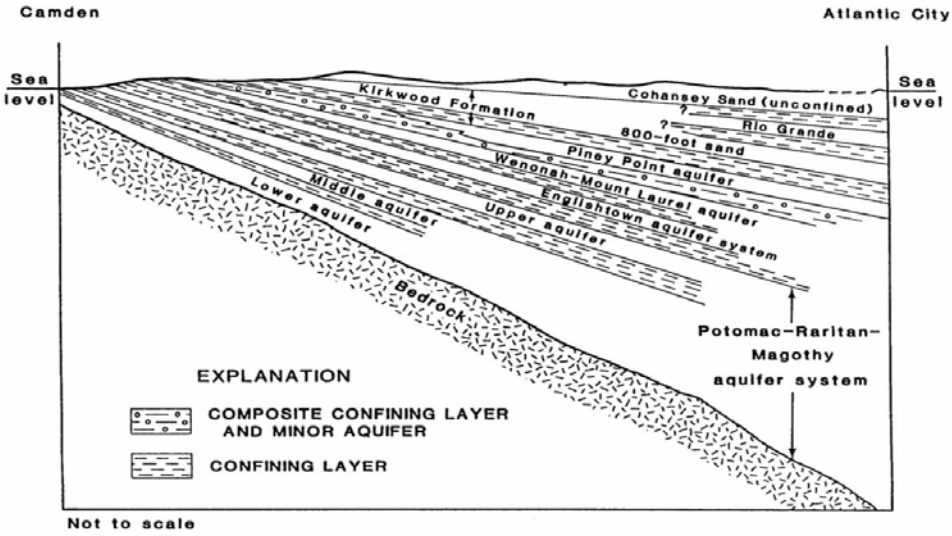
NJPDES Permit #	Facility Name	Effective Start Date	Expiration Date	Discharge Category Description	Street Address
NJG0054151	LAUX LAKEVIEW TRAILER PARK	6/1/2003	5/31/2013	Sanitary Subsurface Disposal	734 Bridgeton Pike, # 170 (Route 77)
NJG0075990	AURA ELEMENTARY SCHOOL	6/1/2003	5/31/2013	Sanitary Subsurface Disposal	100 Unionville Road
NJG0085316	OLD CEDAR CAMP INC	6/1/2003	5/31/2013	Sanitary Subsurface Disposal	274 Richwood Road
NJG0088838	OLDMAN'S CREEK CAMPGROUND	6/1/2003	5/31/2013	Sanitary Subsurface Disposal	323 Laux Road
NJG0105201	ELEANOR CORBETT HOUSE	6/1/2003	5/31/2013	Sanitary Subsurface Disposal	948 Whig Lane Road
NJG0144037	INDUSTRIAL DRUM CO INC	6/1/2007	5/31/2012	Basic Industrial Stormwater Permit	New Jersey Avenue
NJG0146790	CLEAR LAND INC	6/1/2007	5/31/2012	Basic Industrial Stormwater Permit	541 Bridgeton Pike
NJ0157074	ELK TOWNSHIP	5/1/2005	4/30/2010	Discharge to Groundwater	667 Whig Lane Road
NJG0148997	ELK TOWNSHIP	9/1/2005	2/28/2009	Tier B Municipal Stormwater GP	667 Whig Lane Road

Source: NJDEP, NJ OPRA, Active Permit List January 2008

GROUNDWATER

The geology of the New Jersey Coastal Plain can be visualized as a tilted layer cake, with its "layers" or strata formed of gravels, sands, silts, and clays. The saturated gravel and sand layers, with their large pore spaces, are the aquifers from which water is drawn. The silt and clay layers, which impede the movement of water, are called confining beds.

A cross-section across southern New Jersey from west to east would show that the layers are not horizontal but tilt downward toward the southeast, getting deeper as they cross the state toward the Atlantic Ocean. Because of this tilting, each layer formation emerges on the land surface in a sequential manner. The deepest formations emerge on the surface near the Delaware River. Where a formation emerges is its "outcrop" area. The Potomac-Raritan-Magothy (PRM) formation, the deepest and most abundant aquifer, is a major water source for Inner Coastal Plain communities. Other aquifers on top of the PRM are the Englishtown, the Wenonah-Mount Laurel, and the Kirkwood-Cohansey. The Kirkwood-Cohansey is a formation composed of two thick layers, the Kirkwood (lower) and the Cohansey (upper) that overlie the older formations. It begins east of the inner/outer coastal plain divide.



Source: US Geological Survey

Figure 8: Aquifers of Southern New Jersey along a line from Camden to Atlantic City

Aquifers

Elk Township lies entirely within the Kirkwood-Cohansey aquifer outcrop. Three major aquifers – the Kirkwood-Cohansey, the Wenonah-Mount Laurel, and the Vincentown – provide public and private drinking water for Elk residents, and some wells may draw water from the Upper Potomac-Raritan-Magothy Aquifer System. All Elk residents rely on private well water.

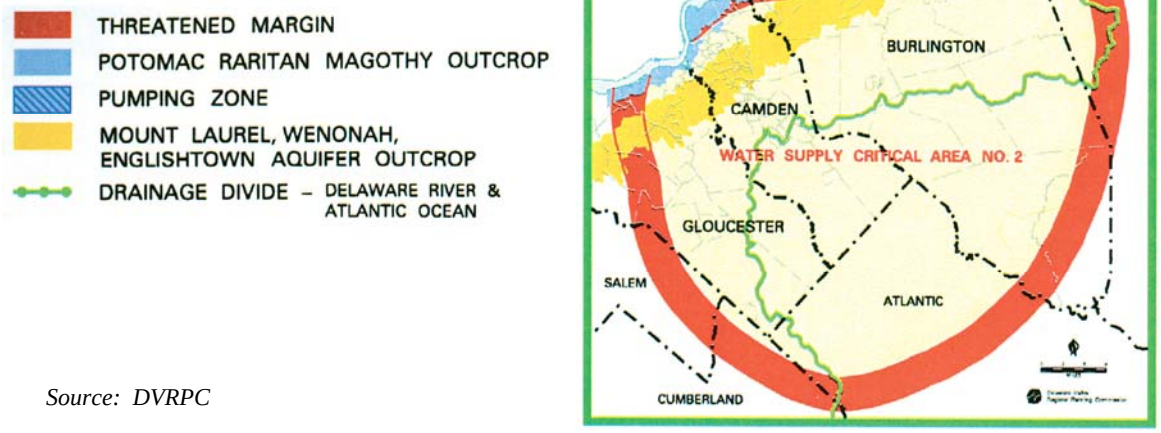
Potomac-Raritan-Magothy Aquifer System (PRM)

The PRM is a major source of drinking water to New Jersey residents from Burlington to Salem

counties, as well as to communities in Delaware. This multiple aquifer system is a large series of formations that have been combined and described as a single unit because the individual formations – the Potomac group and the Raritan and Magothy formations – are lithologically indistinguishable from one another over large areas of the Coastal Plain. That is, they are composed of materials of like kind and size laid down by both an advancing and retreating sea across southern New Jersey and by deposits of material that came from the breakdown and erosion of the Appalachian and Catskill Mountains beginning in the Cretaceous Period (60 to 150 million years ago).

In southern New Jersey, three aquifers have been distinguished within the PRM system – designated as lower, middle, and upper, divided by two confining units or layers between the three water-bearing strata. The aquifers themselves are largely made up of sands and gravels, locally interbedded with silt and clay. The lower aquifer sits on the bedrock surface. Confining beds between the aquifers are composed primarily of very fine-grained silt and clay sediments that are less permeable and thus reduce the movement of water between the aquifers. They also help to slow the entry of any contaminants on the surface down into the groundwater.

Figure 9: Critical Area Number 2



Source: DVRPC

Because of such high usage, PRM aquifer water levels have declined. The water level drop became so serious that the New Jersey Department of Environmental Protection established Water Supply Critical Area #2 in 1986. All water supply companies within Critical Area #2 were given annual limits on water withdrawals in the PRM. Usage from the PRM was cut back by over 20 percent and no increases in pumping were allowed. Piping of treated Delaware River water filled the gap in much of the region. As shown in Figure 9, the eastern half of Elk Township falls within the Water Supply Critical Area #2, and the western side of Elk Township falls in the "Threatened Margin."

There is increased concern that additional pumping from the aquifer in the borderline areas will necessitate the expansion of the Critical Area boundaries. Thus, water supply companies in Gloucester and Salem counties have and will continue to have difficulty getting approvals from the New Jersey Department of Environmental Protection for any additional water allocations from the PRM.

In Gloucester and Salem counties, use of the lower PRM aquifer for drinking water is limited due to high chloride concentrations (salt water intrusion). This is thought to be very ancient seawater within the lower aquifer, resulting from movement from the southeastern side, which is in contact with ocean water. Whatever the cause, most of the lower aquifer is not usable as a drinking supply. There are also problems with salinity levels in the upper and middle PRM aquifers, especially for wells closest to the Delaware River where pumping has increased the amount of slightly saline water from the river to be drawn into the aquifers.

The PRM does not outcrop in Elk Township; rather it outcrops under and immediately beside the Delaware River in New Jersey and Pennsylvania. River water enters and recharges the upper and middle PRM aquifers. Because an outcrop is the area where the aquifer emerges on the land surface, preventing contamination of the land in outcrop areas is extremely important in order to maintain a safe drinking water supply.

Wenonah-Mount Laurel Aquifer System

The Wenonah-Mount Laurel aquifer is composed of the Wenonah Formation and the Mount Laurel Sand Formation, both of late Cretaceous period. It is thickest in Burlington, Camden, Gloucester, and Salem counties, reaching 100 to 120 feet in width.

The Wenonah-Mount Laurel aquifer is affected by withdrawals from the Englishtown aquifer, which lies below it. As a result of Englishtown withdrawals, more Wenonah-Mount Laurel water leaks through the confining layer to the Englishtown aquifer. Reductions in the Potomac-Raritan-Magothy Aquifer System also negatively affect water levels in the Wenonah-Mount Laurel aquifer.

PRIVATE DRINKING WELLS

Private wells, supplying potable water, are not routinely monitored like public community water systems (public water) and public non-community wells. Beginning in 2002, the State of New Jersey, under the Private Well Testing Act, required that well water be tested for contaminants when properties are sold or leased. Prior to 2002, each county health department mandated what parameters were to be tested for real estate transactions.

See **Appendix C: Private Well Testing Act** for more information about private wells and drinking water in Gloucester County.

Composite Confining Unit

A composite confining unit overlies the Wenonah-Mount Laurel aquifer. The Navesink Formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, the Vincentown Formation, the Manasquan Formation, Shark River Marl, the Piney Point Formation and the basal clay of the Kirkwood Formation form this unit. These geologic formations, ranging in age from late Cretaceous to Miocene, are dominated by silty and clayey glauconitic quartz sands. Red Bank

sand and the Vincentown and Piney Point formations are somewhat permeable and function as aquifers in some locales.

The Vincentown Formation

Outcroppings of this formation are irregular as contrasted to the bands that are characteristic of the other formations described. Generally, the Vincentown is found approximately one hundred feet below the surface. Although it is primarily a confining bed, it is tapped in many places by domestic, industrial, and public wells. It is most productive as an aquifer at it thickest areas, which exceed 140 feet. In other areas the Vincentown formation ranges from 20 to 80 feet in thickness. Recharge is inter-formational from the Kirkwood.

Kirkwood-Cohansey Aquifer System

The Kirkwood-Cohansey aquifer system is one of the largest sources of groundwater in New Jersey. The Kirkwood Formation, along coastal areas, appears as thick clay beds, with interbedded zones of sand and gravel. The Cohansey Sand, also of Miocene age, is coarser grained than the underlying Kirkwood Formation. It contains minor amounts of pebbly sand and interbedded clay. Some local clay beds within the Cohansey Sand are relatively thick.

The surficial nature of the Kirkwood-Cohansey makes it vulnerable to contamination from various land uses. Water from this aquifer has a low pH and contains elevated levels of iron and manganese. Radium and mercury have also been found in this water. Industrial chemicals, pesticides, and agricultural chemicals used for crop production and residential landscaping, and products of septic tank effluent have all been found in water from the aquifer in various areas in southern New Jersey. Residents and township officials must take great care to prevent contamination on the land surface because toxins can easily enter the groundwater of this unconfined aquifer (lacking protective clay layers above it).

In Elk Township, it is particularly important to protect groundwater within the township because Elk residents draw their drinking water from wells. Once groundwater becomes contaminated, it is not only very difficult but also very costly to remediate. Therefore, the best alternative is to prevent contamination in the first place by limiting the potential for pesticides, fertilizers, road salt, motor oil, septic waste, and toxic chemicals to reach the groundwater. This can be done by regulating point and non-point pollution sources. See **Surface Water Quality** and **Causes of Water Quality Impairments.**

Groundwater Recharge

Recharge of groundwater is an important issue in southern New Jersey because of the dependence on aquifers for drinking water and agricultural use. Not all of the precipitation that falls to the earth replenishes the underlying aquifers. The amount of rainwater that actually enters an aquifer and reaches the saturated zone to become groundwater is a function of many factors, including the nature and structure of the aquifer itself, climatic conditions, the soil type, and the vegetation of an area.

The New Jersey Geological Survey has developed a methodology for evaluating land areas for their ability to transmit water to the subsurface, using precipitation records, soil surveys, and land use/land cover data. NJDEP has used this methodology to map and rank the groundwater recharge potential of land areas throughout the state. Recharge is measured as the amount of precipitation that will reach the water table in one year.

Well over half the land in Elk has groundwater recharge rates of over 8 inches per acre per year. Areas with recharge rates greater than 11 inches are found mostly in the western half of the township, and constitute about 17 percent of Elk's land. Areas with a recharge of 8 to 10 inches are spread more evenly through the area, making up 48 percent of the township. The rest of Elk's land has very low recharge rates, which are associated with the township's wetlands. See **Map 11: Groundwater Recharge**.

In general, on high recharge lands, large amounts of paving and impervious cover will have the most detrimental impact, although they are also usually the places that are most suitable for building because they are on well-drained soils. Conversely, these are also regions where the dilution of substances from septic systems, such as nitrates, may require a larger land area because the soils are usually more porous. For example, minimum average lot sizes of two to four acres are often needed for proper nitrate dilution from septic systems in areas having ten or more inches per year of groundwater recharge. Some townships that depend entirely on well water and septic tanks require nitrate dilution analysis for every subdivision, no matter how small, to make sure that septic systems do not contaminate groundwater. Nitrate dilution analysis determines the minimum lot size needed for proper dilution of the nitrates generated by a typical septic system. The dilution is by rainfall through the soil and its effectiveness varies by soil type.

Water Supply Wells

There are eight active public water supply wells in Elk. Public water supply wells are listed in ***Table 16: Public Water Supply Wells***. The wells pump water from the Kirkwood-Cohansey, Vincentown, and Mount Laurel-Wenonah aquifers. There are also several public wells in neighboring Glassboro and Clayton Boroughs. All public wells in the area are shown on **Map 10: Public Water Supply Wells.**

Table 16: Public Community Wells

Well ID #	Original Owner	Aquifer	Depth of Well (feet)
3152649	Elk Township MUA	Kirkwood-Cohansey	100
3152650	Elk Township MUA	Kirkwood-Cohansey	77
3154616	Elk Township MUA	Kirkwood-Cohansey	100
5010705	Laux Lakeview Mobile Home Park Inc	Vincentown	160
5010706	Laux Lakeview Mobile Home Park Inc	Vincentown	160

5010707	Laux Lakeview Mobile Home Park Inc	Vincentown	160
5010708	Laux Lakeview Mobile Home Park Inc	Mount Laurel-Wenonah	250
0804308	Oldman's Creek Campground	(not available)	310

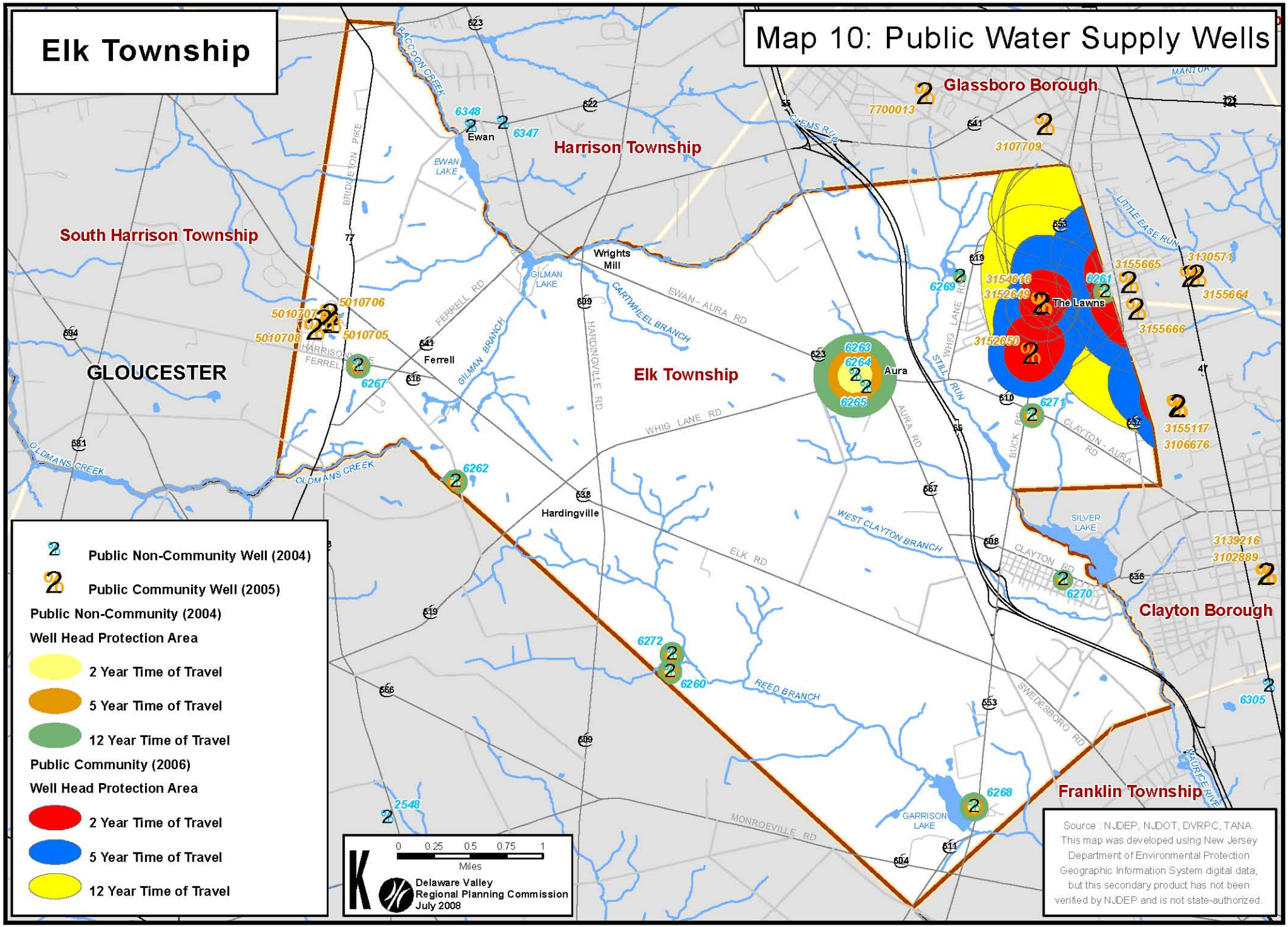
Source: NJDEP

Public non-community wells are another part of a public water system. There are two types of non-community water systems, transient and non-transient, which indicate the types of populations who utilize them. A non-transient water system serves at least 25 of the same people daily at a minimum of six months per year, at places like schools, factories, and office parks. A transient non-community water system serves at least 25 people each day, but the population changes each day. These systems are at such places as rest stops, gas stations, and restaurants.

Table 17: Public Non-Community Wells

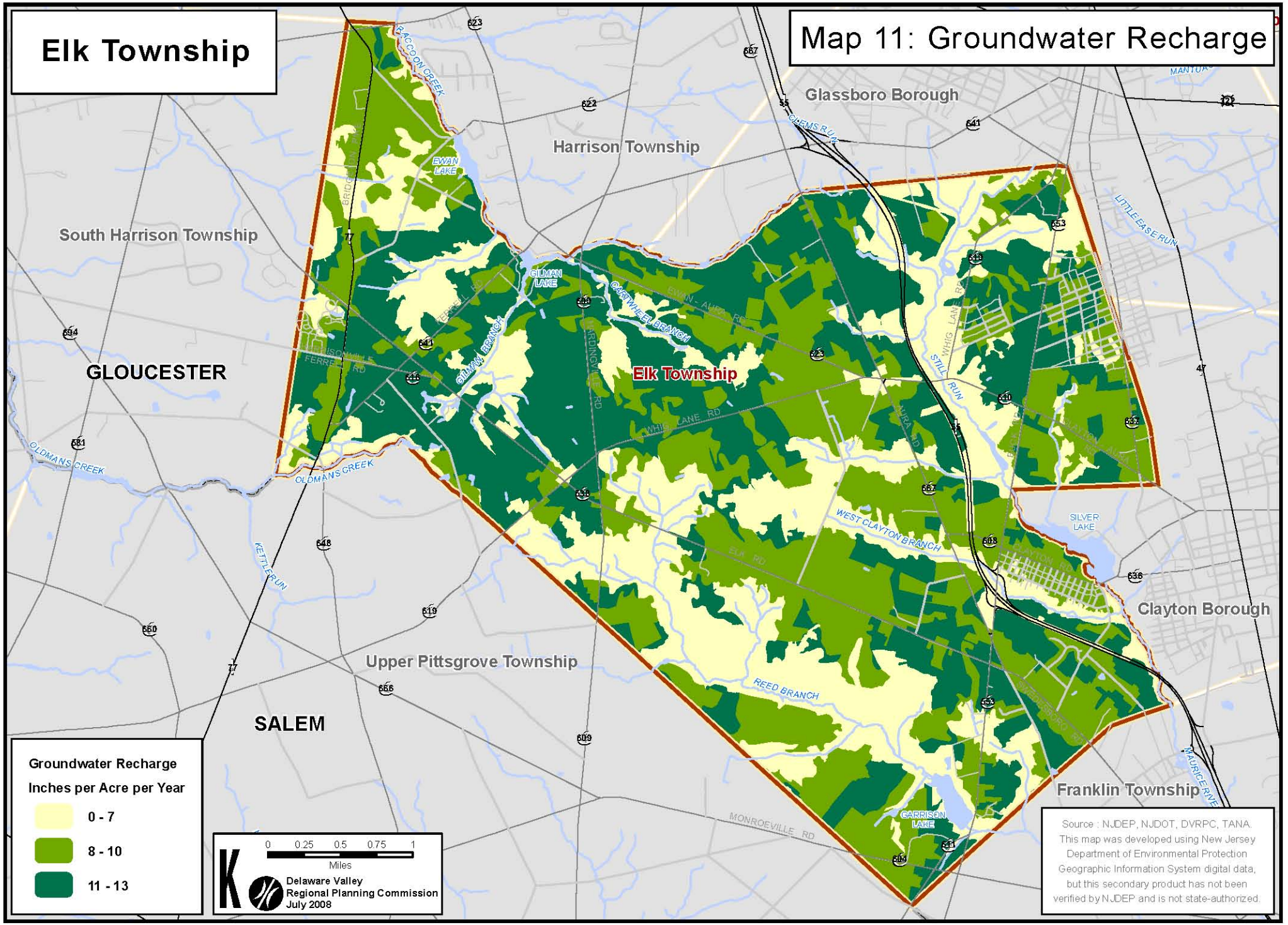
Well ID #	Original Owner	Well Depth	Well Type
0804302	OLD CEDAR CAMPGROUND	110.00	Transient
0804303	BRYANT TEMPLE CHURCH	75.00	Non-Transient
0804309	AURA SCHOOL	75.00	Non-Transient
0804309	AURA SCHOOL	70.00	Non-Transient
0804310	ELK TWP MUNICIPAL BUILDING	63.00	Transient
0804313	BAMBI CHILD CARE CENTER	110.00	Non-Transient
0804317	LAKE GARRISON INC.	60.00	Transient
0804320	VOLUNTEERS OF AMERICA	200.00	Transient
0804321	AURA BADGE CO	80.00	Non-Transient
0804322	WAWA STORE #435	60.00	Transient
0804324	OLD CEDAR CAMPGROUND	110.00	Transient

Source: NJDEP


Elk Township
Map 10: Public Water Supply Wells
Glassboro Borough
Harrison Township
South Harrison Township
GLOUCESTER
Elk Township
Franklin Township
Clayton Borough
Ewan
Wrights Mill
Ferrell
Aura
Hardingville
The Lawns
RACCOON CREEK
EWAN LAKE
GILMAN LAKE
GILMAN BRANCH
CARTWHEEL BRANCH
HARDINGVILLE RD
FERRELL RD
EWAN - AURA RD
WHIG LANE RD
AURA RD
OLDMANS CREEK
WEST CLAYTON BRANCH
REED BRANCH
ELK RD
CLAYTON RD
SILVER LAKE
GARRISON LAKE
SWEDESBORO RD
MONROEVILLE RD
LITTLE EASE RUN
STILL RUN
BUCK RD
CLAYTON - AURA RD
7700013
3107709
3130571
3155665
3155664
3155666
3154616
3152649
3152650
3155117
3106676
3139216
3102889
5010706
5010707
5010708
5010705
6348
6347
6269
6261
6263
6264
6265
6267
6271
6262
6272
6260
6270
6268
6305
2548
Public Non-Community Well (2004)
Public Community Well (2005)
Public Non-Community (2004)
Well Head Protection Area
2 Year Time of Travel
5 Year Time of Travel
12 Year Time of Travel
Public Community (2006)
Well Head Protection Area
2 Year Time of Travel
5 Year Time of Travel
12 Year Time of Travel
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : NJDEP, NJDOT, DVRPC, TANA
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Elk Township

Map 11: Groundwater Recharge



Groundwater Recharge
Inches per Acre per Year

- 0 - 7
- 8 - 10
- 11 - 13

0 0.25 0.5 0.75 1
Miles

Delaware Valley
Regional Planning Commission
July 2008

Source : NJDEP, NJDOT, DVRPC, TANA.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Wellhead Protection Areas

As part of its Wellhead Protection Program Plan, issued in 1991, the New Jersey Department of Environmental Protection has delineated Well Head Protection Areas (WHPAs) around all community wells. A WHPA is the area from which a well draws its water within a specified time frame. Once delineated, these areas become a priority for efforts to prevent and clean up groundwater contamination. Other components of the Well Head Protection Plan include implementing best management practices to protect groundwater, land use planning, and education to promote public awareness of groundwater resources.

Delineating a Well Head Protection Area (WHPA)

A WHPA consists of three tiers, each based on the time of travel to the well:

Tier 1 = two years
Tier 2 = five years
Tier 3 = twelve years

Calculation of the tier boundaries is based on findings of how long specific contaminants can survive in groundwater, how much time would be required for specific remedies to be undertaken, and on the likelihood of natural dilution over distance.

Once WHPAs are delineated, potential pollution sources may be managed by owners or municipalities in relation to the tier locations. Protection of land and restrictions on activities within wellhead zones, relating to uses that generate contaminants, and to the storage, disposal, and handling of hazardous materials are important for maintaining the quality of water in wellhead areas.

Source: DVRPC

Pond at the headwaters of Gilman Branch

Source: DVRPC

Start of Elephant Swamp trail

BIOLOGICAL RESOURCES

When a community protects wildlife and habitat, it also protects biodiversity, which enables many species, including humans, to thrive and live healthy lives. Biodiversity refers to the variety of genetic material within a species population, the variety of species (plants, animals, microorganisms) within a habitat, and the variety of ecosystems within a given region. Biodiversity facilitates adaptation and evolution, improving a species' chance of survival as the environment changes. A diversity of plant and animal species is also necessary to maintain healthy human environments, working landscapes, and productive ecosystems. Lower organisms, many not well known, contribute to nutrient cycling, decomposition of organic matter, soil rehabilitation, pest and disease regulation, pollination, and water filtering. Once biodiversity declines, it is extremely hard for an ecosystem to recover or replace species.

Elk contains numerous types of natural habitats, all of which are important for maintaining biodiversity. Wetlands, which support plants that require constantly saturated soils, are the most abundant type of natural habitat in Elk. Upland forests make up most of the remainder of major habitats present in Elk, and brushlands and scrublands are also present. The following sections will identify and describe in more detail the plant and animal communities that inhabit these ecosystems within Elk.

NATURAL VEGETATION

An area's vegetation is dependent on many factors, the most important of which are climate and soils. The region has a cool, temperate climate with rainfall averaging 45 inches per year. See the *Climate* section on page 24 for a detailed description of Elk's variable climate. Elk's varieties of hydric and non-hydric soils support diverse populations of trees, crops, and wetland vegetation. See the *Soils* section on pages 14-21 for a detailed description of Elk's soils.

Elk's natural vegetation types, along with human-influenced types of land cover, have been tabulated and mapped by NJDEP's 2002 land cover analysis. This data, based on infrared aerial photography, is the most recent available. The designation of a particular land cover as a vegetation type is based on definitions provided by the Anderson Land Use Classification System, created by the U.S. Geologic Survey. See ***Table 18: Elk Township Natural Vegetation*** and **Map 12: Natural Vegetation (NJDEP 2002**).

Table 18: Elk Township Natural Vegetation

Type of Vegetation	Acres	% of Total Land Area of Township
Brush/Shrubland	215.47	1.74%
Brush/Shrubland - Oldfield	123.91	1.00%
Upland Forest - Coniferous	57.18	0.46%
Upland Forest - Deciduous	1477.38	11.95%
Upland Forest - Mixed (Coniferous Dominated)	166.84	1.35%
Upland Forest - Mixed (Deciduous Dominated)	462.46	3.74%
Water	148.89	1.20%
Wetlands - Herbaceous	22.44	0.18%
Wetlands - Modified	230.4	1.86%
Wetlands - Scrub/Shrub	73.2	0.59%
Wetlands - Wooded - Atlantic White Cedar	17.65	0.14%
Wetlands - Wooded - Coniferous	13.95	1.06%
Wetlands - Wooded - Deciduous	1458.54	11.79%
Wetlands - Wooded Mixed (Coniferous Dominated)	170.66	1.38%
Wetlands - Wooded Mixed (Deciduous Dominated)	577.84	4.67%
Total Natural Vegetation Land Cover	5333.81	43.13%

Source: NJDEP (2002 Land Cover)

Wetlands

Wetlands are a critical ecological resource, supporting both terrestrial and aquatic animals and boasting biological productivities far greater than those found on dry land. Wetlands play a vital role in maintaining water quality by cleaning surface water and groundwater. The ecological importance of wetlands, however, has not always been appreciated. For over three centuries people drained, dredged, filled, and leveled wetlands to make room for development and agriculture. Although the pace of wetland destruction has slowed markedly in the past three decades, human activities have destroyed approximately 115 million of the original 221 million acres of wetlands in the United States since the beginning of European settlement.

Most wetlands in Elk are found in association with major streams and their tributaries, including Still Run, Reed Branch, and Raccoon Creek. Wetlands are dominant in the south, where Elephant Swamp is located, along the Reed Branch. (The area is known as Elephant Swamp because an elephant supposedly escaped from a circus that was traveling through the area in the 1800s and disappeared into the swamp.) Wetlands provide high-quality animal and plant habitats, purify surface and groundwater, and create picturesque landscapes that add immeasurably to the quality of life for area residents. Elk's most abundant wetlands are wooded deciduous and wooded mixed deciduous-dominated wetlands. Coniferous and mixed coniferous-dominated wetlands also cover a portion of the township. Other types of unmodified wetlands in

Elk Township

Map 12: Natural Vegetation (NJDEP 2002)

South Harrison Township
Harrison Township
Glassboro Borough
GLOUCESTER
Elk Township
Clayton Borough
Upper Pittsgrove Township
Franklin Township
SALEM

EWAN LAKE
RACCOON CREEK
GILMAN LAKE
GILMAN BRANCH
CARTWHEEL BRANCH
CLEMS RUN
MANTUA CREEK
LITTLE EASE RUN
MAURICE RIVER
OLDMANS CREEK
KETTLE RUN
WEST CLAYTON BRANCH
REED BRANCH
SILVER LAKE
GARRISON LAKE
HARRISONVILLE FERRELL RD
HARDINGVILLE RD
WHITE LANE RD
ELK RD
MONROEVILLE RD
SWEDESBORO RD

Natural Vegetation

- Brush/Shrubland
- Brush/Shrubland - Oldfield
- Upland Forest - Coniferous
- Upland Forest - Mixed (Con. Dom.)
- Upland Forest - Deciduous
- Upland Forest - Mixed (Decid. Dom.)
- Water
- Wetlands - Modified
- Wetlands - Cemetery
- Wetlands - Scrub/Shrub
- Wetlands - Herbaceous
- Wetlands - Wooded - Deciduous
- Wetlands - Wooded Mixed (Decid. Dom.)
- Wetlands - Wooded - Coniferous
- Wetlands - Wooded - Atlantic White Cedar
- Wetlands - Wooded Mixed (Con. Dom.)
- All other land cover

0 0.25 0.5 0.75 1
Miles

Delaware Valley Regional Planning Commission
July 2008

Source : NJDEP, NJDOT, DVRPC, TANA.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Elk Township

Map 13:
Landscape Project

South Harrison Township

Harrison Township

GLOUCESTER

Glassboro Borough

Aura

Elk Township

Clayton Borough

Upper Pittsgrove Township

SALEM

Franklin Township

EWAN LAKE

GILMAN LAKE

RACCOON CREEK

GILMAN BRANCH

CARTWHEEL BRANCH

EWAN - AURA RD

FERRELL RD

HARRISONVILLE FERRELL RD

OLDMANS CREEK

KETTLE RUN

MAURICE RIVER

AURA RD

GLASSBORO - AURA RD

CLEMS RUN

MANTUA CREEK

LITTLE EASE RUN

SILVER LAKE

WEST CLAYTON BRANCH

CLAYTON RD

REED BRANCH

SWEDESBORO RD

GARRISON LAKE

MONROEVILLE RD

0 0.25 0.5 0.75 1
Miles

Delaware Valley
Regional Planning Commission
July 2008

Source : NJDEP [Landscape Project v. 2.1 (2007)], NJDOT, DVRPC, TANA.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Natural Heritage Site

Emergent Wetland
- Suitable Habitat

Forested Wetland
- Suitable Habitat
- Critical Habitat

Upland Forest
- Suitable Habitat
- Critical Habitat

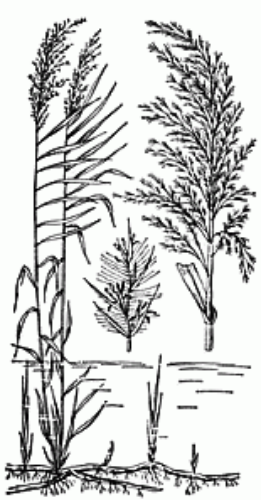
Grassland
- Suitable Habitat
- Critical Habitat

Elk include herbaceous (low-growing plants), shrub, and Atlantic white cedar wetlands. All are listed in ***Table 18***: ***Elk Township Natural Vegetation***.

Deciduous wooded wetlands (sometimes referred to as forested wetlands) occupy 1,458 acres of Elk Township and support mixed hardwoods that flourish at low elevations. Some common trees in the area's deciduous wooded wetlands are red maple, black tupelo, ash, black willow, American beech, swamp white oak, willow oak, southern red oak, and sweetgum. Similar to deciduous wooded wetlands are deciduous-dominated mixed wooded wetlands, occupying 578 acres of Elk. Vegetation in such wetlands is composed of greater than 50 percent but less than 75 percent deciduous species. Deciduous and mixed deciduous wooded wetlands are found along nearly all stream corridors in Elk.

Coniferous and coniferous-dominated wetlands are the second most common type of wetland found in Elk, occupying about 300 acres combined. These closed-canopy wetlands support species such as the loblolly pine, pond pine, black gum, and red maple.

Other types of wetlands found in Elk include scrub/shrub, Atlantic white cedar, and herbaceous. Scrub/shrub wetlands consist of woody species less than 20 feet tall. These wetlands may be in early successional stages and will later become wooded wetlands or those dominated by canopy species. Atlantic white cedar wetlands are found primarily in southern New Jersey and consist of Atlantic white cedars and other trees such as red maple, and shrubs such as blueberry.



Source: www.agroportal.ru/ manuals/plant/spisok/image9

Figure 10: Phragmites
The invasive species Phragmites crowds out native vegetation.

Like scrub/shrub and Atlantic white cedar wetlands, herbaceous wetlands cover less than one percent of Elk Township. Herbaceous wetlands may include plants such as Jack-in-the-pulpit, jewelweed, ferns, rice cutgrass, reed canary grass, pond lily, tearthumb, arrow-leafed tearthumb, and broadleaf cattail. Herbaceous wetlands may be dominated by *Phragmites*, a reed that colonizes easily and pushes into wetland areas from adjoining dryer land, growing through underground shoots that make it difficult to eradicate. As it spreads, it tends to trap silt and gradually raise the land level, converting the habitat to one that is dryer. This conversion, plus its manner of growth, enables *Phragmites* to push out other wetland species of plants.

Modified wetlands are areas that have been altered by human activities and do not support natural wetland vegetation, but which do show signs of soil saturation on aerial infrared surveys. Agricultural wetlands, described in some detail in the Surface Water section, occupy 186 acres of land that is now under cultivation. This figure may be larger because not all modified agricultural wetlands show well on aerial infrared photos. Other modified wetlands encompass former agricultural wetlands, disturbed wetlands, and wetlands that occur in maintained greenspaces such as open lawns, golf courses, and storm water swales. In total, modified wetlands occupy 230 acres or 1.92 percent of Elk's land area.

The wetlands in Elk Township are home to unique species. One federally-listed endangered plant species known to exist in Elk Township is the swamp pink (*Helonias bullata*). This fragrant flower is found in shady, forested wetland areas, where there is year-round saturation but only slight fluctuations in the water level. Swamp pink is very vulnerable to the effects of development, including pollution, sedimentation, and changes in both groundwater and surface water hydrology. In order to prevent the destruction of swamp pink, the U.S. Department of the Interior Fish & Wildlife Service recommends that all development in the upper reaches of HUC 14 subwatershed #02040206120030 – the Still Run watershed (see **Map 6: Watersheds**) – use Low Impact Development Techniques as described in Chapter 2 of the New Jersey Stormwater Best Management Practices (www.njstormwater.org).

Source: Michael A. Hogan

Swamp pink, an endangered wetland plant found in Elk Township

Upland Forests

Upland areas are those locations without water at or near the soil surface. About 17 percent of Elk is composed of upland forests. Much of the area's original upland forests have been cleared and converted to farms. The remaining upland forests are primarily located near stream corridors.

Upland forests are the third most abundant land cover type in Elk after agriculture and wetlands. Approximately 2,160 acres of Elk is upland forest, the vast majority of which is deciduous forest. The composition of Elk's upland deciduous forests is largely one of mixed oaks – black, red, chestnut, and willow oaks – joined by other hardwoods such as American beech, hickory and sweetgum. The understory is dominated by flowering dogwood, American holly, greenbriar, and sassafras. Vines, such as Virginia creeper, wild grapes, Japanese honeysuckle, and poison ivy, are common. Spicebush, arrowwood, and black haw are common shrubs in moister locations.

Coniferous trees occur on about 210 acres of Elk. These forests are mostly made up of successional, or pioneer, plants – like Virginia pine, scrub pine, and pitch pine – which will eventually be overgrown by dominant deciduous trees, such as ash, birch, oak, and hickory.

Grasslands and Agricultural Lands

NJDEP defines grassland habitat as brushland, shrubland, or old fields that were cleared or disturbed at one time and then abandoned. Following abandonment, old fields are overgrown by perennial herbs and grasses. These pioneer plants remain the dominant species for 3 to 20 years time. Later, woody plants take over. This habitat is visible especially along wood edges,

roadsides, and in landscapes where mowing is infrequent and where woody plants are not yet the dominant vegetation.

According to 2002 NJDEP land cover data, about 2.75 percent of Elk's land cover consists of brushland, shrubland or old fields. Old fields are sections of farmland that have become idle and have transitioned to land suitable for grassland and brushland species habitat. Patches of these lands are scattered throughout Elk, and are often found adjacent to agricultural lands and upland forests.

In addition to brushland and old fields, active agricultural cropland and pastureland is considered suitable "grassland" habitat for wildlife. Agricultural cropland and pastureland is the single most abundant type of vegetative land cover in Elk Township, covering about 42 percent, or 5,104 acres, of the township's land area in 2002.

Source: DVRPC

Cornfields can be good habitat for some grassland-dependent bird species

LANDSCAPE PROJECT PRIORITY HABITATS

The Landscape Project, developed by the Endangered and Nongame Species Program of the NJDEP Division of Fish & Wildlife, documents the value of various types of habitats within New Jersey. It categorizes these habitats into one of five groups according to their importance (five being the highest). Categories three through five are considered "critical" habitats that possess two exceptional conditions: (1) a documented occurrence of one or more species included on either the federal or the state threatened and endangered species lists, and (2) a sufficient amount of habitat type to sustain these species. These habitats are collectively known as "critical habitat." Category two habitats have one or more occurrences of at least one "state priority species," and category one area habitat is deemed suitable for species that are included on the state or federal threatened and endangered species lists but for which there are no documented occurrences or sightings. These habitats are labeled "suitable habitats."

The Landscape Project identifies both "critical" and "suitable" habitat in Elk. It is important to preserve both levels of habitat in order to maintain the diversity of species that still exists in the area. The rankings in Elk are primarily the result of habitat being either "critical" or "suitable" for rare bird species such as the Cooper's hawk, bobolink, and vesper sparrow or for endangered reptiles and amphibians such as the spotted turtle. See ***Table 19: Landscape Project Habitat Rankings – Acreage in Elk*** and **Map 13: Landscape Project.**

Table 19: Landscape Project Habitat Rankings – Acreage in Elk

Category	Rank	Area (Acres)	% of Elk Twp Land
Emergent Wetlands	Suitable Habitat (2)	199.25	1.61%
	Suitable Habitat (1)	38.24	0.31%
		237.49	1.92%
Forested Wetlands	Critical Habitat (4)	81.25	0.66%
	Critical Habitat (3)	53.74	0.43%
	Suitable Habitat (2)	2,093.67	16.93%
	Suitable Habitat (1)	183.14	1.48%
		2,411.80	19.50%
Upland Forest	Critical Habitat (4)	159.37	1.29%
	Critical Habitat (3)	224.35	1.81%
	Suitable Habitat (2)	4,412.48	35.68%
	Suitable Habitat (1)	62.69	0.51%
		4,858.89	39.29%
Grasslands	Critical Habitat (4)	1,643.94	13.29%
	Critical Habitat (3)	0.24	0.00%
	Suitable Habitat (2)	1,680.14	13.59%
	Suitable Habitat (1)	1,441.61	11.66%
		4,765.93	38.54%
Total Habitat		**12,274.11**	99.26%
Total Elk Area		**12,366.17**	100.00%

Source: NJDEP

Table 19: KEY

1-2	Suitable habitat
3-5	Critical habitat

Landscape Project Data on Wetland Habitat

The Landscape Project divides wetland habitats into two types – emergent and forested wetlands. Emergent wetlands are marshy areas characterized by low-growing shrubs and herbaceous (non-woody) plants in standing water. About 237 acres in Elk are identified as priority emergent wetlands habitat and are ranked at the "suitable" level. No emergent wetlands in the township are classified as "critical." Small patches of emergent wetland habitat are found throughout the township, mainly along waterways and adjacent to forested wetlands. Animal species that can be found in these wetland habitats include endangered turtles, rare fish, mollusks, crustaceans, and insects. Emergent wetlands are also important habitats for migratory waterfowl and passerines (smaller perching birds, such as migrating flycatchers and thrushes). In Elk Township in particular, this habitat is critical for the spotted turtle.

Elk's forested wetlands occupy 2,411.8 acres, of which 134.99 acres are ranked as critical. "Critical" forested wetlands in Elk are located primarily in the western portion of the township near the border with South Harrison Township, along Raccoon Creek and Oldmans Creek. There are also small portions in the northeastern part of the township, near Route 553. "Suitable" forested wetland habitat supports wildlife along the other waterways in the township. Forested wetlands support species such as migratory and nesting warblers, many of which are species of special concern. They can also be home to various rare amphibians (frogs and salamanders). In Elk Township, forested wetlands are critical for the eastern kingsnake, gray catbird, and spotted turtle.

Landscape Project Data on Upland Forest Habitat

The Landscape Project ranks nearly 4,500 acres in Elk as "suitable" upland forest habitat, and about 385 acres as "critical" upland forest habitat. Upland forest habitat can be found in scattered patches, often between forested wetlands and grasslands. As with "critical" wetlands, "critical" upland forest habitats are also located in the western and northeastern sections of Elk. Upland forests are home to eastern box turtles, eastern kingsnakes, eastern wood-pewees, and gray catbirds.

Landscape Project Data on Grassland Habitat

The Landscape Project designates nearly all of Elk's remaining land (38.54 percent) as "suitable" or "critical" grassland-species habitat. Approximately 1,640 acres are ranked as "critical" grassland-species habitat. "Critical" grassland habitat is primarily located in the central part of Elk. "Suitable" habitat, which accounts for 3,122 acres, covers much of the rest of the township. Grassland-dependent species (mostly birds) are the most threatened group of species in New Jersey, primarily because the most common form of habitat used by these species, agricultural fields, is the most threatened habitat in the state due to development pressure as well as to changed agricultural practices.

Nearly all of Elk's agricultural land is designated as "critical" or "suitable" grassland-species habitat, whether under cultivation or not, for some of the following reasons: (1) migrating birds cannot visually distinguish cropland from grassland; (2) cropland turns into grassland when it is fallow for one year or more; (3) some crops like alfalfa and soybeans provide suitable nesting habitat for some birds, especially for sparrows; and (4) all or most of the birds on the endangered and threatened lists are area-sensitive, requiring large ranges that include agricultural lands. The Landscape Project includes this land in its assessment because agricultural lands provide important disturbance buffers between rare/endangered wildlife species and both humans and widespread predatory animals like dogs and cats.

Examples of grassland-dependent species that use grassland habitat for nesting or feeding include the vesper sparrow and some species of butterflies and moths. Elk's designated grasslands provide critical habitat for eastern box turtles and field sparrows.

ANIMAL COMMUNITIES

Although no comprehensive inventory of the different animal species within New Jersey, Gloucester County, or Elk exists, there are records of sightings, biological studies of range, environmental impact assessments, and evaluations of endangered and threatened status. Using federal, state, scientific, and nonprofit sources, it is possible to identify and describe known and possible animals of Elk.

Invertebrates

Invertebrates are the basis of a healthy environment and are part of every food chain – either as food for amphibians and fish, or as a part of nutrient cycling systems that create and maintain fertile soils. Invertebrates consist of insects (beetles, butterflies, moths, dragonflies, ants, termites, bees, wasps, flies, and others), arachnids (spiders, ticks, and mites), crustaceans (crayfish, microscopic copepods), mollusks (mussels, clams, snails, and slugs), and worms.

Macroinvertebrates are invertebrates that are visible to the naked eye but smaller than 50 millimeters. Benthic (bottom dwelling) macroinvertebrate communities provide a basis for ecological monitoring and are relatively simple to collect from shallow stream bottoms. These communities consist largely of the juvenile stages of many insects, such as dragonflies and mayflies, as well as mollusks, crustaceans, and worms. Monitoring for diverse assemblages of macroinvertebrates reveals the effect of pollutants over a long period of time. The Ambient Biomonitoring Network (AMNET) surveys streams for macroinvertebrate communities, which indicate certain levels of water quality, as was discussed in the **Surface Water Quality** section of this document.

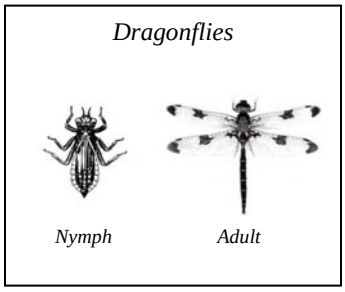


Figure 11: Dragonfly Nymph and Adult. The dragonfly nymph is a common macroinvertebrate found in Southern New Jersey's waterways.

There are nine endangered invertebrate species (two beetle species, four butterfly species, and three mussel species) and eight threatened invertebrate species (three butterfly species and five mussel species) in the State of New Jersey. Of particular interest are freshwater mussels. At one time freshwater mussels were abundant in the streams of the area and were a major food source for native peoples. Parts of Raccoon Creek provided suitable mussel habitat. Unfortunately, due to destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined, although they are still present in the creek. Of those species on the New Jersey Endangered and Threatened list, one, the dwarf wedgemussel, is listed as endangered under the federal Endangered Species Act.

Vertebrates

Vertebrates are less numerous than invertebrates but their larger size makes them much more visible, and thus better studied and recorded. Fish species are fairly well documented, as are

mammals. Birds that nest in Elk are known, and some migrants that depend on the township's wetlands as stopover sites in which to rest and feed have been inventoried.

Mammals

Mammals appear to be abundant because they tend to be larger and live in habitats also ideal for human development. There are over 80 mammal species in New Jersey, of which nine are listed by the state as endangered or threatened. Some common mammals found in Elk include cottontail rabbits, eastern gray squirrels, skunks, raccoons, opossums, and white-tailed deer.

Management of white-tailed deer is an issue in New Jersey. While many residents prize the presence of mammalian life, deer often come into conflict with humans in suburban and farm areas. According to the U.S. Department of Agriculture, deer cause more damage to agricultural crops than any other vertebrate wildlife species. Farmers in densely human-populated areas appear to be the most affected. Additionally, deer can devastate the understory of forests through overgrazing, destroying the growth of seedlings and young trees. Finally, as most motorists are aware, collisions between deer and automobiles frequently result in serious damage.

Controlling deer numbers has become increasingly difficult in New Jersey, primarily because suburban landscaping provides year-round food, which supports population growth; and because the principal method of culling the population – hunting – is not feasible in suburban environments.

To minimize human-deer conflicts, the New Jersey Agricultural Experiment Station recommends both lethal and non-lethal deer management options for community-based deer management programs. For example, municipalities can extend the hunting season, issue depredation permits to private landowners, engage in sharp shooting, and employ traps and euthanasia to reduce deer numbers. Alternatively, communities and private landowners can choose to apply non-lethal, although more costly, deer management strategies such as installing reflectors and reducing speed limits on rural roads to decrease deer-vehicle collisions, modifying habitat by planting unappealing plants on commercial and residential properties, using taste-based and odor-based repellents, and employing traps and translocation techniques.

Birds

There are between 350 and 500 bird species in New Jersey, which is an exceptional number given the state's small size. New Jersey is an important location for migratory birds flying south for the winter. Not only is the state an important "rest stop" for birds migrating to warmer climates in Central and South America, but the New Jersey Atlantic Coast and the Delaware Bay are major parts of the Eastern Flyway (established migratory air route) in North America.

Common birds in Gloucester include geese, ducks, vultures, woodpeckers, doves, swallows, crows, grackles, jays, robins, starlings, wrens, cardinals, finches, sparrows, and some hawks. Wild Turkeys are becoming increasingly common in South Jersey, and wild turkey hunting is popular. The red-shouldered hawk, an endangered bird species; the Cooper's hawk, a threatened bird species; and other rare and endangered species have been sighted in Elk. According to the

Landscape Project, Elk contains suitable habitat for a variety of predatory birds including hawks, falcons, and eagles. Bald eagles have recovered very well in southern New Jersey, and there have been numerous sightings in Elk Township.

Fishes

When European settlers arrived in present-day Gloucester County, they encountered American Indians who regularly fished along the inland streams and gathered shellfish in the Delaware River. Due to the unintended consequences of urban development, industrial advancement, and mechanized agriculture, the amount and diversity of aquatic life has decreased dramatically throughout most of New Jersey.

The New Jersey Division of Fish and Wildlife, under the Bureau of Freshwater Fisheries, monitors and actively aids the propagation, protection, and management of the state's freshwater fisheries. The bureau raises several million fish for stocking in suitable waterbodies, and conducts research and management surveys. Elk Township's freshwater streams may contain sunfish, blue gill, shiner, pumpkinseed, eastern mudminnow, common carp, largemouth bass, perch, darter, catfish, and the American eel. Other fish species are documented for Elk in the "Annotated Checklist and Distribution of New Jersey Freshwater Fishes" by Rudolf G. Arndt. See ***Sources of Information***.

Endangered Vertebrates

According to the Natural Heritage Database and the Landscape Project, a number of rare wildlife species have been sighted in Elk. Brief descriptions, provided by the New Jersey Fish and Wildlife Service, of the township's endangered and threatened species and their preferred habitat follow.

Source: U.S. Fish & Wildlife Service

A bobolink

The bobolink (*Dolichonyx oryzivorus*) is a threatened species in New Jersey. The birds live in idle farmland and low-intensity agricultural fields as well as grass, forb, and wildflower meadows. During migration, bobolinks also reside in coastal and freshwater marshes. In the 1960s and 1970s, bobolink habitat declined as forests replaced some fields, development expanded into farmland, and agricultural practices evolved. The bobolink population decrease between 1966 and 1999 is attributed to habitat reduction. As farmers rotated hay crops more frequently, mowed hay earlier, grew more cool-season rather than warm-season grasses, and decreased plant diversity, bobolink habitat diminished. Due to declining populations, the bobolink was listed as a threatened species in New Jersey in 1979.

The vesper sparrow (*Pooecetes gramineus*) is an endangered species in New Jersey. The vesper sparrow prefers open habitats, such as cultivated fields, grasslands, old fields, and pastures. This species will, ideally, nest in an old field or a fence-row adjacent to a cultivated area. Nests are

found in herbaceous land cover that provides protection from predators and humans. The vesper sparrow was once a common summer bird in New Jersey. Due to their dependence on habitats created by farming, vesper sparrow populations started to decline in the 1950s as farm fields were replaced by residential development and farming methods changed. In 1979, the bird was listed as threatened on the state list, and upgraded to endangered in 1984. It is also listed as endangered in Connecticut and Rhode Island, threatened in Massachusetts, and of special concern in New York.

The red-shouldered hawk (*Bueto lineatus*) is a soaring hawk about as big as a crow. The hawk requires mature wet woods such as riparian forests for breeding and mixed woodlands near old growth forests containing standing water for nesting. Red-shouldered hawks prefer a closed canopy of tall trees with an open sub-canopy and variable amounts of understory shrubs and seedlings. In southern New Jersey, these hawks are found in vast and contiguous freshwater wetlands, especially hardwood or mixed wood/cedar swamps containing maple, black gum, Sassafras, magnolia, and Atlantic white cedar. In Elk, agricultural fields or low-density residential tracts usually surround these areas. The red-shouldered hawk avoids nesting near residences, roads, and development. Habitat loss and declines in population in the Northeast have resulted in the listing of this species as endangered in New Jersey, threatened in New York, and of special concern in Connecticut.

FEDERAL ENDANGERED SPECIES ACT*

An "Endangered" species is in danger of extinction throughout all or a significant portion of its range.

A "Threatened" species is one that is likely to become endangered in the near future.

NEW JERSEY ENDANGERED SPECIES ACT**

An "Endangered" species is in danger of immediate extinction within the state due to one of several factors: loss or degradation of habitat, over-exploitation, predation, competition, disease, or environmental pollution.

A "Threatened" species is one that may become endangered if environment conditions continue to deteriorate. It is vulnerable due to one of several factors: small population size, restricted range, narrow habitat affinities, or significant population decline.

A species of "Special Concern" is one that warrants special attention because of the evidence of population decline, environmental deterioration, or habitat modification that would result in becoming Threatened. Special Concern status also extends to species whose population size is unknown or unstudied.

* Definitions adapted from U.S. Fish and Wildlife Service, "Listing a Species and Threatened or Endangered: Section 4 of the Endangered Species Act." Washington, DC: February 2001.
** Definitions adapted from N.J. Division of Fish, Game, and Wildlife, Endangered and Nongame Species Program, "Status Definition." Trenton, NJ: April 2002.

The Cooper's hawk (*Accipiter cooperii*) is a member of the Accipiter family – woodland hawks that prey on smaller birds – and is especially adapted to fly through dense cover chasing prey. In southern New Jersey, Cooper's hawks breed in remote wooded wetlands dominated by red maple or black gum. Adjacent upland pine or mixed oak/pine forests usually provide a buffer for nesting hawks. These hawks generally nest in sub-climax forests composed of trees 30 years or older creating a closed canopy. On average, a hawk will place the nest more than a third of a mile away from the nearest human inhabitant. While other raptor species were threatened due to hunting practices, Cooper's Hawk populations were not threatened until widespread suburbanization. Additionally, the pesticide DDT impaired many bird species' reproduction and contributed to declining populations from the 1950s to 1970s. Populations began to recover due to the nationwide ban of DDT in 1972, coupled with the reforestation of old fields throughout New Jersey. The hawk was listed as endangered in 1974 and downgraded to threatened in 1999

on the state list. The loss of large, contiguous forests remains a threat to this species and warrants the continued protection of Cooper's hawk nesting habitats.

See **Appendix A** for a list of **Vertebrate Fauna of Elk Township** and **Appendix B: Threatened and Endangered Species in Elk Township**, and **Appendix F: New Jersey Endangered and Threatened Species**.

NATURAL HERITAGE DATABASE AND NATURAL HERITAGE PRIORITY SITES

Natural Heritage Priority (NHP) sites are areas designated by the New Jersey Division of Parks and Forestry's Office of Natural Lands Management as exemplary natural communities within the state that are critically important habitat for rare species. Preserving these areas is a top priority for efforts to conserve biological diversity in New Jersey. Designation as a Natural Heritage Priority site does not carry any specific requirements or restrictions on the land. Rather, the designation is made because of a site's high biological diversity value. Owners of NHP sites are encouraged to become informed stewards of the property and to consider working with the local community, nonprofit groups, or the state to preserve the land permanently.

NHP designations are based on the records of the Natural Heritage Database, which lists documented sightings of endangered and threatened species. Information on particular sites may also be provided by the Nature Conservancy or by the NJDEP Endangered and Nongame Species Program, and especially through the latter agency's Landscape Project.

The Aura NHP Site in Elk Township is one of only 414 NHP sites in New Jersey. (See **Map 13: Landscape Project** for its location.) The Aura NHP Site is a largely undisturbed wet woodland located along Still Run, towards the township's northern border. The majority of the site extends between Whig Lane Road in the east and State Route 55 in the west, although portions of the site encompass the upstream drainage areas of Still Run's tributaries west of State Route 55. The area has a biodiversity ranking of B4, meaning the area is of statewide importance because of its diversity of plant species.

The Natural Heritage Database also lists for Elk several threatened and endangered plant and animal species, or rare natural communities that have been found in other parts of the township. The sighting records for the plants are shown on topographic maps (no maps exist for the animal species). These indicate where the sightings occurred, although the map information is deliberately nonspecific. The principal locations of rare plants and natural communities are in the western portion of Elk, extending from the north boundary of the township to the south boundary, and about as far west as Ferrel and as far east as Hardingville. There are also some locations in the eastern portion of Elk where Aura Road intersects with Buck Road.

It is important to note that the Natural Heritage Database lists primarily those sightings that have been submitted to it, along with some ecological community data. It incorporates both historically and recently documented sightings. Areas without sightings may never have been surveyed. Conversely, land use in areas with sightings may have changed considerably over recent years, and the species once found there may be gone. Local surveys to update the

database and regular consultation of records before any development is approved are two measures that would help to increase the protection of threatened and endangered species. To report a sighting of rare wildlife, visit NJDEP's Division of Fish and Wildlife online at: http://www.state.nj.us/dep/fgw/ensp/rprtform.htm or call the Endangered and Nongame Species Program at 609-292-9400. See **Appendix B: Threatened and Endangered Species in Elk Township** for information from the Natural Heritage Database.

Source: Michael A. Hogan

Flower of the Swamp Pink, Helonias bullata, one of Elk Township's threatened species

Source: DVRPC

Vegetable farming in Elk Township

THE BUILT ENVIRONMENT

POPULATION AND HOUSING

The 1990 U.S. Census listed a population of 3,806 residents for Elk Township. By 2000, Elk's population had decreased by 7.6 percent to 3,514 residents. Despite this decline in population, Elk has grown, with a 2005 population of 3,810 and an expected 2010 population of 4,210.

According to the 2000 Census, 956 residents (27.2 percent) of Elk's population are under the age of 18. This age group represents those residents who are most physically active in the community and most likely to use public recreational facilities.

The majority of Elk's residents live in single-family detached, owner-occupied homes. The township's housing stock consists of about 80 percent single-unit homes, with mobile homes and a few multi-unit buildings making up the remainder. Most units were built before 1990, with about 25-30 percent dating back to the first half of the 20th Century. Recently, however, Elk has seen a boom in new construction. The number of housing permits issued rose sharply after 2001, peaking in 2004 at 51. Although data about the number of new homes actually constructed is not yet available, the new subdivisions in Elk, such as Hampton Hills and Meadowbrook, are associated with changes in land use patterns, demographics, and housing prices.

Between 2004 and 2008, some major planned unit developments were approved for Elk Township. A total of 947 units, mostly single family residential homes, have been approved to-date for the Grande, Latham Park, and Silvergate projects, out of a planned growth of over 2,000 units. Also planned is 821,000 square feet of commercial development, of which 299,000 square feet has been approved so far. The township does not have public utilities at this time, but public sewer and water hookups will be established for these projects. Public sewer will also be extended to the Lawns neighborhood on the eastern side of Elk Township at the same time.

Source: DVRPC

Newer houses in Elk Township

TRANSPORTATION

Elk Township is relatively accessible compared to other parts of rural southern New Jersey. The major thoroughfares of State Routes 55 and 77 (Bridgeton Pike) facilitate travel between Elk and the Philadelphia metro region, while smaller rural arterials and collectors connect to local roads within the township.

State Route 55, classified as a principal arterial highway (a high-volume road servicing longer trips), runs north-south through and along the eastern side of Elk. Constructed between 1965 and 1989, this highway dramatically increased the speed with which residents can access other parts of southern New Jersey and Pennsylvania. The north end of the SR 55 connects to SR 42, which provides access to the New Jersey Turnpike and Interstates 295 and 76. The southern end of the highway extends to south of Millville in Cumberland County. Three exits—48, 45, and 43—along Route 55 offer access to Elk. State Route 77, a rural minor arterial (highways that interconnect with and augment the principal routes), runs along the western edge of Elk. While not as large as Rte. 55, SR 77, also known as Bridgeton Pike, provides access to US Route 322, a principle east-west arterial north of Elk. Route 77 runs south through Salem and Cumberland Counties into the City of Bridgeton.

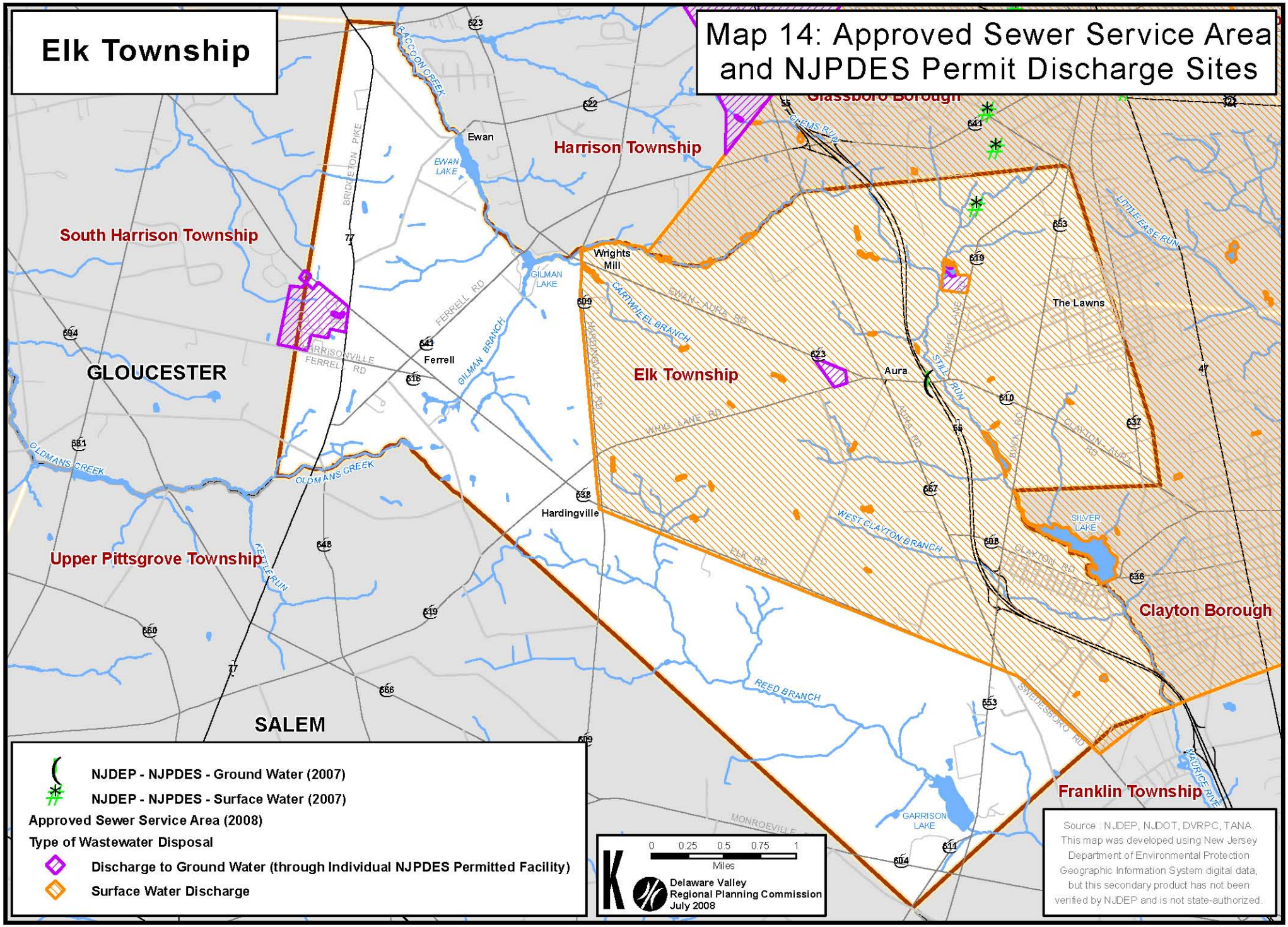
County roads handle the local traffic in Elk. County roads may once have been dirt paths created by American Indians, which became rural farming roads, and now serve as major traffic thoroughfares in the township. West of SR 55, County Routes 623 (Ewan-Aura Road) and 538 (Elk Road) run east-west through the township. Routes 641 (Ferrell Road), 609 (Hardingville Road), and 667 (Aura Road) run north-south. Routes 538, 641, and 667 are classified as major collector roads, which are main routes used for intracounty access. Route 609 is a minor collector, and Route 623 is a local road. East of SR 55, Route 553 (Buck Road) serves as a minor arterial/major collector running north-south, while Routes 619 (Whig Lane Road) and 610 (Clayton-Aura Road) provide local access. Other local roads run throughout the township to provide residents with access to their properties.

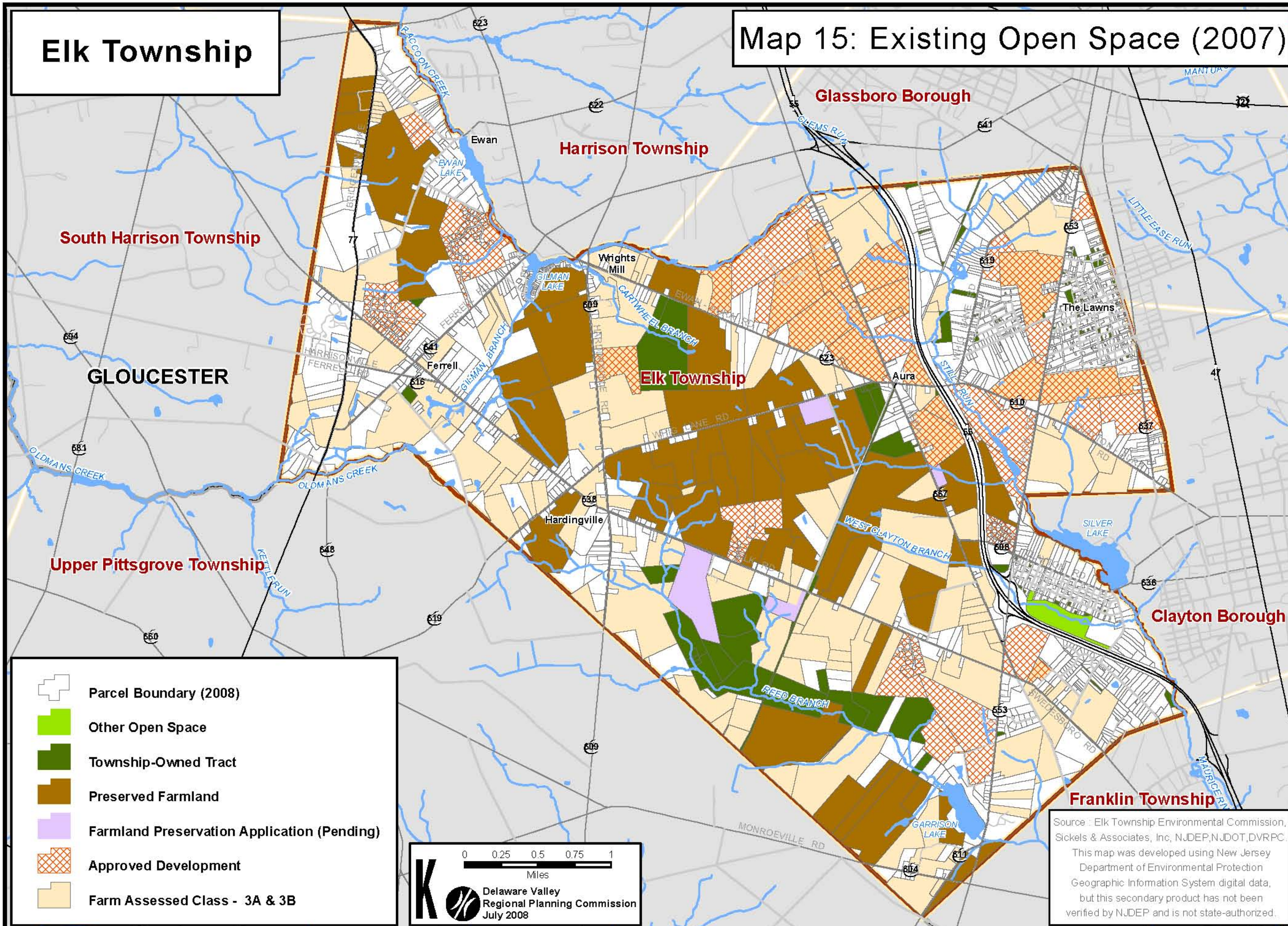
While Elk is most easily accessed by car, there are also opportunities to use public transit in the area. New Jersey Transit bus lines stop in nearby Glassboro and Clayton, and carry passengers north to Philadelphia and south to Vineland. The Reading Railroad used to run through Aura, but was abandoned in the mid-to-late 20th Century, and the tracks were removed in the 1980s. This rail bed is now a walking path where it crosses municipal open space lands.

MUNICIPAL SERVICES

Drinking Water

The majority of Elk Township is serviced by private drinking water wells. There is one property in Elk that is serviced by New Jersey American Water (NJAW) Company. NJAW is a locally-managed subsidiary of American Water, a national water company, and is regulated by the New Jersey Board of Public Utilities. A pipeline bringing treated NJAW water to Glassboro runs to


Elk Township
Map 14: Approved Sewer Service Area and NJPDES Permit Discharge Sites
Glassboro Borough
Harrison Township
Ewan
South Harrison Township
Wrights Mill
The Lawns
GLOUCESTER
Ferrell
Elk Township
Aura
Hardingville
Upper Pittsgrove Township
Clayton Borough
SALEM
Franklin Township
RACCOON CREEK
BRIDGETON PIKE
EWAN LAKE
GILMAN LAKE
FERRELL RD
GILMAN BRANCH
HARRISONVILLE FERRELL RD
CARTWHEEL BRANCH
EWAN-AURA RD
HARDINGVILLE RD
WHIG LANE RD
OLDMANS CREEK
KEMBLE RUN
WEST CLAYTON BRANCH
ELK RD
AURA RD
CLAYTON-AURA RD
CLAYTON RD
SILVER LAKE
REED BRANCH
SWEDESBORO RD
GARRISON LAKE
MONROEVILLE
MAURICE RIVER
CHEMS RUN
LITTLE EASE RUN
NJDEP - NJPDES - Ground Water (2007)
NJDEP - NJPDES - Surface Water (2007)
Approved Sewer Service Area (2008)
Type of Wastewater Disposal
Discharge to Ground Water (through Individual NJPDES Permitted Facility)
Surface Water Discharge
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : NJDEP, NJDOT, DVRPC, TANA
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.


Elk Township
Map 15: Existing Open Space (2007)
Glassboro Borough
Harrison Township
South Harrison Township
GLOUCESTER
Upper Pittsgrove Township
Clayton Borough
Franklin Township
Elk Township
Ewan
Wrights Mill
Ferrell
Hardingville
Aura
The Lawns
RACCOON CREEK
EWAN LAKE
GILMAN LAKE
GILMAN BRANCH
CARTWHEEL BRANCH
OLDMANS CREEK
KETTLE RUN
STILL RUN
WEST CLAYTON BRANCH
REED BRANCH
SILVER LAKE
GARRISON LAKE
LITTLE EASE RUN
CHEMS RUN
MAURICE RN
MONROEVILLE RD
SWEDESBORO RD
Parcel Boundary (2008)
Other Open Space
Township-Owned Tract
Preserved Farmland
Farmland Preservation Application (Pending)
Approved Development
Farm Assessed Class - 3A & 3B
0 0.25 0.5 0.75 1
Miles
Delaware Valley Regional Planning Commission
July 2008
Source : Elk Township Environmental Commission, Sickels & Associates, Inc, NJDEP,NJDOT,DVRPC
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

the border with Elk Township. It was constructed in preparation for the approved developments to be built in the northeast section of the township and will also service the Aura School. A purchase agreement between the Elk Township MUA (ETMUA) and New Jersey American Water has been executed and was approved by the NJDEP Bureau of Water Allocation in June 2007. This purchase agreement has a term of 20-years and provides for a maximum withdrawal of 1 million gallons per day (MGD).

In 2005, there were eight public community wells and 11 public non-community wells located within Elk Township. See **Map 10: Public Water Supply Wells** and ***Tables 16 and 17.*** These are described in the **Water Supply Wells** section of this document, pages 57-58.

Sewer

Elk Township has no installed public sewer within its territory, although it does have a large approved Sewer Service Area. The area of Elk Township east of Hardingville Road and north of Elk Road falls within the Approved Sewer Service Area, which is depicted on **Map 14: Approved Sewer Service Area.** This is the land area that DEP has "pre-approved" for the construction of municipal sewer, if a treatment method to service the area is available or can be developed that will meet DEP requirements. Elk Township also has a Municipal Utility Authority, established many years ago, to handle the development of public water and sewer. The MUA's 1991 Wastewater Management Plan for the township is out of date, however.

The Gloucester County Utilities Authority (GCUA) operates a waste water treatment plant along the Delaware River in West Deptford, New Jersey. Seventy-one miles of pipes lead to this facility, which services 13 Gloucester County municipalities in full, three municipalities in part (including Elk Township), and some industrial users.

Theoretically, sewerage from Elk Township could be carried to the GCUA treatment plant through connections to pipes in both Glassboro and Clayton. However, because it is not one of the 13 consolidated municipalities that formed the original GCUA area, the Elk MUA has only a contractual agreement with GCUA for waste flow and the amount that is currently under contract to be accommodated is only 250,000 gallons per day. This is an obstacle to the construction of the approved Planned Unit Developments in the northeast section of the township where some non-pipeline sewer infrastructure has already been installed.

Trash and Recycling

Municipal trash and recycling pickup service is available in Elk. Trash is collected every Monday on the west side of the township and every Friday on the east side. Recycling is picked up every other week by RecycleBank, a program that rewards residents for the weight of their recyclables. Yard waste is also collected biweekly. Large furniture items

are picked up on regular trash days, but residents must schedule pickups of appliances and large metal items through the Department of Public Works.

Education

Source: DVRPC

Aura School

Elk has one public school within its borders. Aura Elementary School educates about 380 students each year, providing education from the pre-kindergarten level through the sixth grade. The school offers programming in special education, basic skills instruction, reading recovery, gifted and talented, and other specialized disciplines. After completing sixth grade at the Aura Elementary School, Elk residents attend Delsea Regional School District in Franklinville for middle school and high school. Delsea Regional High school draws students from Elk and Franklin townships for a total enrollment of about 1,250 students in grades 9 through 12.

Gloucester is home to several institutions that serve post-secondary students and residents. Gloucester County College and Gloucester Country Institute of Technology are located north of Elk, in Sewell. In addition, Rutgers operates a Cooperative Research and Extension center in Clayton, which offers community programming in agriculture and horticulture as well as services to farmers.

EXISTING OPEN SPACE

Source: DVRPC

Baseball Field at the Recreation Park

Elk's parks and recreations areas are maintained by the Elk Township Department of Public works and managed by the Recreation Committee. Elk's two parks provide space for many of the recreational activities organized by the Recreation Committee and for residents to relax and enjoy the outdoors. The Elk Township Recreation Park is home to baseball fields and a soccer field, and is heavily used for youth sports leagues and township events. Ina B. Hull Park, located on Stanger Avenue, is smaller. Activities organized by the Recreation Committee include summer camps, Elk Community Day, the annual Easter Egg Hunt and Arbor Day celebration, and various programs for senior citizens. Elk Township also contains the Elephant Swamp. There is a recreational trail for both walking and biking on a former railroad bed.

Most of the open space in Elk Township is preserved farmland, of which there are 2,586 acres. Additionally, there are 107 acres of farmland that have pending preservation applications. Elk Township also owns several parcels of open space encompassing approximately 614 acres. There are 43.64 acres of other open space in Elk Township. See **Map 15: Existing Open Space (2007)**.

HISTORIC RESOURCES

Although Elk Township does not have any properties on the National or State Registers of Historic Places, protection and preservation of historic structures, lands, and views are of high importance to local residents. There are various sites that may have the potential to be listed as local, state, or national landmarks, but have not been nominated by local citizens or identified by the State Historic Preservation Office (SHPO) for such a designation. The township appears to have both 18th and 19th century structures, and an historic survey would be merited.

A community can protect particular historic assets through ordinances that limit the exterior changes that can be made to historic properties in a designated area. In addition, a municipality can obtain technical assistance and federal and state funding for community-based preservation activities if it becomes a Certified Local Government (CLG). This program is jointly administered by the National Park Service and SHPO. To participate, a municipality must maintain a historic preservation commission, survey local historic properties, provide opportunities for public participation in preservation activities, and develop and enforce local preservation laws. To date, the only CLG municipality in Gloucester County is Harrison Township.

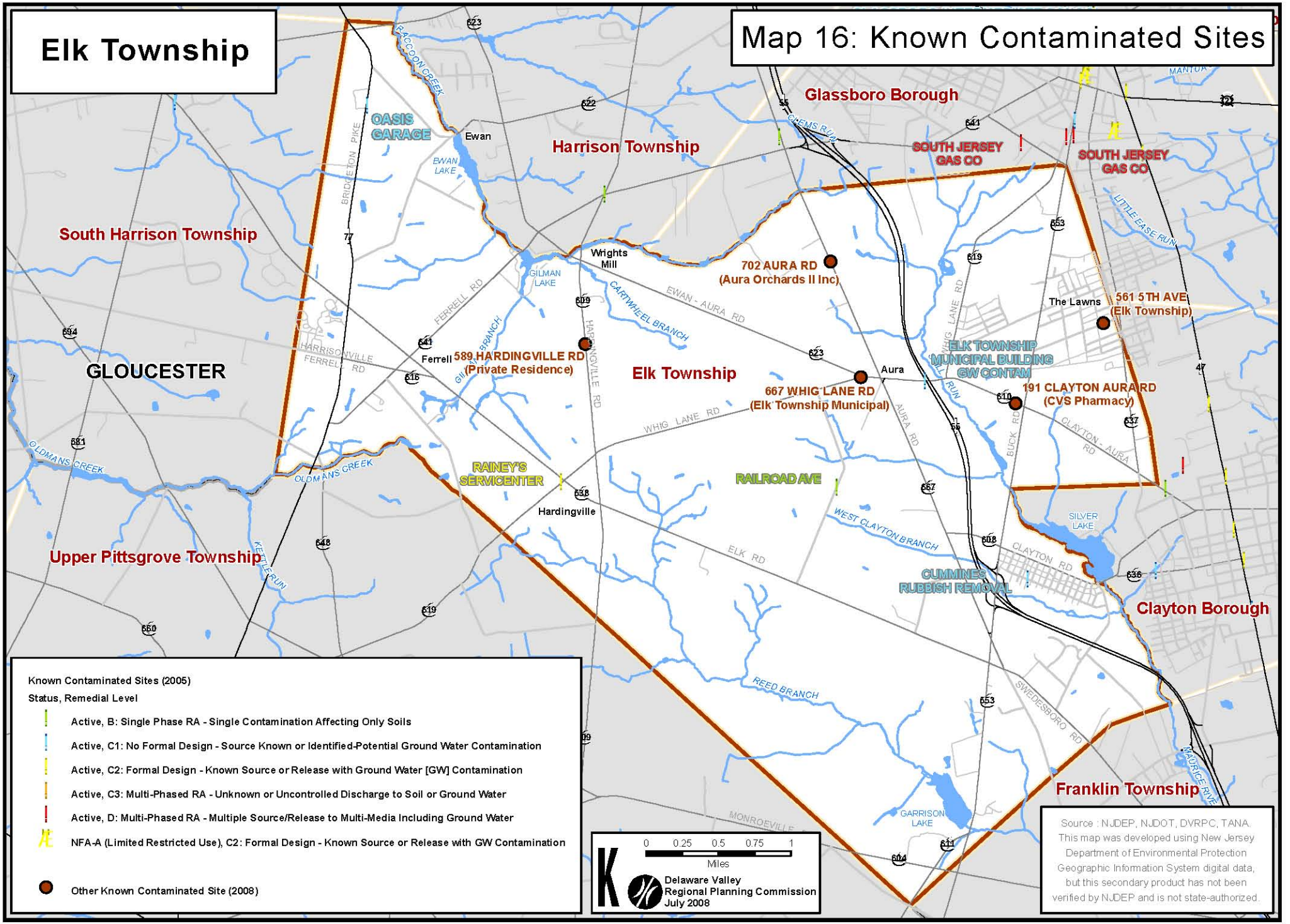
There are also federal incentives for individuals, organizations, or firms who own historic properties and are interested in historic preservation. Interested parties can take advantage of the Rehabilitation Investment Tax Credit, a federal tax incentive to encourage the preservation and reuse of older income-producing properties, including offices, apartment buildings, and retail stores.

Source: DVRPC

Aura Methodist Church

Elk Township

Map 16: Known Contaminated Sites



Known Contaminated Sites (2005)

Status, Remedial Level

- Active, B: Single Phase RA - Single Contamination Affecting Only Soils
- Active, C1: No Formal Design - Source Known or Identified-Potential Ground Water Contamination
- Active, C2: Formal Design - Known Source or Release with Ground Water [GW] Contamination
- Active, C3: Multi-Phased RA - Unknown or Uncontrolled Discharge to Soil or Ground Water
- Active, D: Multi-Phased RA - Multiple Source/Release to Multi-Media Including Ground Water
- NFA-A (Limited Restricted Use), C2: Formal Design - Known Source or Release with GW Contamination
- Other Known Contaminated Site (2008)

0 0.25 0.5 0.75 1 Miles

Delaware Valley Regional Planning Commission
July 2008

Source : NJDEP, NJDOT, DVRPC, TANA.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

ENVIRONMENTAL ISSUES

KNOWN CONTAMINATED SITES

NJDEP's 2006 Inventory of Known Contaminated Sites reported approximately 417 such sites in Gloucester County. Nine of these sites are located in Elk Township. See **Map 16: Known Contaminated Sites** for the location of these sites. There are many more in the municipalities surrounding Elk Township. Franklin Township has 26 contaminated sites, South Harrison has seven, Clayton Borough has eight, Harrison Township contains 27, and Glassboro Borough has 25.

The New Jersey *Known Contaminated Sites List* includes former factory sites, landfills, locations of current or former leaking underground storage tanks, sites where chemicals or wastes were once routinely discharged, and places where accidents have resulted in spills and pollution. Contamination may have affected soil, groundwater, surface water, or a combination of site conditions. The most dangerous sites, from a human health standpoint, can be listed as Superfund sites, which make them eligible for federal cleanup funds. Although Gloucester County has 19 current and nominated Superfund sites, Elk Township has none.

Other sites are handled by state or individual programs, or through private funds. The program's role is not limited to the oversight and cleanup of sites with confirmed contamination, but also includes cases where contamination is suspected but not yet confirmed. There are seven such sites under investigation as suspected sites in Elk township. The following table lists only the known contaminated sites that are pending or currently under remediation in Elk.

A case manager is assigned to every Known Contaminated Site case and can provide further information on each site. The Case Manager can be reached by contacting NJDEP's Site Remediation Program's lead agency, which is listed in the table for each site. Contact information can be found at: http://www.state.nj.us/dep/srp/kcs-nj/Gloucester, or see Sources: Section 7: Environmental Issues.

See ***Table 20: Known Contaminated Sites in Elk Township*** on the following page.

Table 20: Known Contaminated Sites in Elk Township

Site ID	218211	352341	182350	73590	61787	198545	74991	17230	167988	7994
PI Number	421898	434871	003606	G000035048	G000061713	261333	G000041864	000063	232615	030709
PI Name	191 Clayton Aura Road/ CVS Pharmacy #75139	Private Residence	Aura Orchards II Inc.	Cummine's Rubbish Removal	Elk Township Municipal Building GW Contamination	Elk Twp PCE Groundwater Contamination	Railroad Avnue	Rainey's Servicenter	Camco Management LLC / DEEUGENIO Property	South Jersey Gas Co
Municipality	Elk Twp	Elk Twp	Elk Twp	Elk Twp	Elk Twp	Elk Twp	Elk Twp	Elk Twp	Elk Twp	Glassboro
Line1 Address	191 Clayton Aura Road	Hardingville Rd	702 AURA RD	CARL ST & 6TH AVE	667 WHIG LANE RD	561 5TH AVE	RAILROAD AVE	SWEDESBORO FRANKLINVILLE RD (Rtes 538 and 619)	AURA RD	Zane and Union Streets
Zip Code	08028	08343	08028	08028	08028	08028	08028	08343	08062	08028
Activity Number (CF)	BFO070001	BFO070001	BFO000001	BFO000001	PFR000003	PFR050001	PFR050001	USR000001	BFO040001	RPC000003
Document Title	07030805340 2S 191 CLAYTON AURA	0611200945 28S HO UST	AURA ORCHARDS	CUMMINES RUBBISH REMOVAL	ELK TOWNSHIP MUN BLDG/POETS	05-08-17-1532-41 PCE GW CONTAM	Elk Twp Rec Field (RR Ave) DN	91-08-06-1104 BUST C2	040708000928 S PESTICIDES	Glassboro Coal Gas
Bureau	BFO-S	BFO-S	BFO-S	BFO-S	BOMM	OWR	BOMM	BUST	BFO-S	BCM
Case Manager	RATHBUN, RYAN	BRANDT, CRYSTAL	RANGE, LINDA	MALKIN, JON	MUMFORD, MINDY	SEIGEL, DIANE	HOCH, ROBERT	BILODEAU, COLLEEN	RANGE, LINDA	Keune, Brian
Phone	(609) 584 - 4166	(609) 584 - 4129	(609) 584 - 4155	(609) 584 - 4157	(609) 777 - 1976	(609) 292 - 9999	(609) 292 - 1943	(609) 633 - 1326	(609) 584 - 4155	(609) 292 - 1659
Case Status	Assigned to Program	Assigned to Program	Assigned to Program	Assigned to Program	Assigned to Program	Assigned to Program	Completed-Area of Concern Restricted Use	Assigned to Program	Assigned to Program	Assigned to Program
Case Types (Start Date)	MOA (2/22/2007)	Homeowner (4/20/2007), MOA (4/20/2007), Nonreg UST (4/20/2007)	Developer (4/6/2000), MOA (3/2/2000)	Other (8/5/1998)	Fixed Fee Case, IEC, Publicly Funded, UNK SO (5/1/2001)	Homeowner (8/19/2005), IEC (8/19/2005), Publicly Funded (8/19/2005), UNK SO (8/19/2005)	DER/DN (10/18/2001), Fixed Fee Case (12/15/2005)	Regulated UST (8/6/1991)	Developer (7/12/2004), MOA (7/12/2004)	ACO (2/20/1990), Coal Gas (2/20/1990)
Remedial Level	C2	C1	C1	C1	C1	C2	B:	C1, C2	B	D

Source: NJDEP, May 2008

See Keys on next page

Key to Remedial Levels

Remedial Level	Explanation of site complexity
B	A single-phase remedial action in emergency area of site
C1	A remedial action with simple sites; one or two contaminants localized to soil and the immediate spill or discharge area.
C2	A remedial action with more complicated contaminants localized to soil and the immediate spill or discharge area

Key to Lead Agencies

Acronyms	Bureau	Telephone No.
BFO-S	Bureau of Field Operations - Southern	(609) 584-4150
BOMM	Bureau of Operation, Maintenance & Monitoring	(609) 984-2990
OWR	Office of Wellfield Remediation	(609) 984-2990
BSCM	Southern Case Management (formerly BUST - Bureau of Underground Storage Tanks)	(609) 292-8761

An example of a case study for one Known Contaminated Site in Elk Township is summarized in the following table and described just below the table.

Table 21: Site Summary: Elk Township Municipal Building Groundwater Contamination

Location: Whig Lane Road Elk Township, Gloucester
Lead agency: Bureau of Operation, Maintenance & Monitoring
MEDIA AFFECTED CONTAMINANTS STATUS
Groundwater 1,2,3-Trichloropropane Confirmed
Potable Water 1,2,3-Trichloropropane Treating
FUNDING SOURCES AMOUNT AUTHORIZED (*as of 2003*)
Spill Fund $48,000
1981 Bond Fund $12,000
Corporate Business Tax $50,000

Source: NJDEP

SITE DESCRIPTION/RESOLUTION OF ENVIRONMENTAL CONCERNS:

Routine sampling of public non-community supply wells by NJDEP's Bureau of Safe Drinking Water in 2000 revealed the potable well at the Elk Township Municipal Building was contaminated with 1,2,3-trichloropropane at levels exceeding New Jersey's drinking water guideline for this compound. The source of the contamination is unknown. NJDEP's Remedial Response Element conducted sampling during 2002 that identified 15 additional private potable wells in the area that were contaminated with 1,2,3- trichloropropane at levels exceeding the drinking water guideline. Point-of-Entry Treatment (POET) systems were installed on the municipal building well and private potable wells with funds provided by NJDEP to supply potable water for the occupants. Due to the scattered locations of the contaminated wells, NJDEP will continue to provide POET systems to residents as needed and monitor selected wells to evaluate contaminant migration. For more information contact the community relations coordinator, Amanda Coombs at (609) 341-3118.

Trichloropropane exposure may occur from drinking water or from breathing contaminated air. This is mostly likely to occur near facilities that produce the chemical, or near hazardous waste sites. People who are exposed to trichloropropane can have eye and throat irritation. This chemical has been found in at least 20 of 1,416 National Priorities List sites identified by the Environmental Protection Agency. It is mainly used to make other chemicals. Some of it is also used as an industrial solvent, paint and varnish remover, and cleaning and degreasing agent.

OTHER ENVIRONMENTAL CONCERNS

Radon

Radon is an invisible and odorless radioactive gas that comes from the natural decay of uranium found in nearly all soils. It moves up through the ground to the surrounding air, and into all types of homes through cracks and other holes in foundations. A build-up of radon-contaminated air (internal alpha particle exposure hazard) within a home can pose a long-term health hazard to residents, specifically for lung cancer. The only method of detection is to conduct a test for alpha particles in the air within a home. Fortunately, radon testing is inexpensive. All radon test results conducted in the state are reported to DEP by certified companies, which perform the tests or manufacture the test kits. This data is used to classify municipalities into a three-tier system, which identifies the potential for homes with indoor radiation problems.

NJDEP classifies municipalities into three categories – high (Tier 1), moderate (Tier 2), or low (Tier 3) – as to the risk of having high radon levels. Elk is listed as a Tier 2 municipality with moderate potential of having dangerous radon levels in homes.

The criteria for a Tier 2 municipality designation is that 5 to 25 percent, of 25 or more homes tested, have radon concentrations greater than or equal to 4.0 picocuries per liter in air. The level at which homeowners should take immediate action is 4.0 picocuries per liter in air. If radon levels are high in a home, NJDEP suggests that the homeowner take the following actions: (1) prevent radon from entering the house by repairing cracks and insulation and (2) dilute radon concentrations currently in the house by installing a radon extraction system and/or frequently ventilating indoor air. NJDEP maintains www.njradon.org as an information source for concerned citizens. Free information packets are available upon request. All companies conducting radon testing and mitigations are certified by NJDEP and listed on their website.

Historic Pesticides

New Jersey is one of the first states in the nation to address issues relating to toxic pesticide residuals, such as dichloro-diphenyl-trichloroethane (better known as DDT), arsenic, and lead that remain in the soil from past agricultural operations. In 1996, NJDEP convened a task force to study the extent of the historic pesticide problem in New Jersey and to develop strategies for protecting human health. The task force's findings were issued in an April 1999 report (see *Sources*). While the task force examined 18 agricultural sites throughout New Jersey, it is estimated that 5 percent of the state's land area is impacted by residues from agricultural pesticides.

The primary human health concern of residual contamination is the ingestion of contaminated soil. Therefore, small children who may ingest soil are at the greatest health risk. This issue may affect residents of homes and subdivisions built on former cropland and orchards. Homeowners can take precautions such as maintaining grass coverage and washing hands and toys after playing in exposed soil. Where documented, developers must now address this problem by testing and removing the existing topsoil and bringing in clean topsoil before construction commences.

Radionuclides

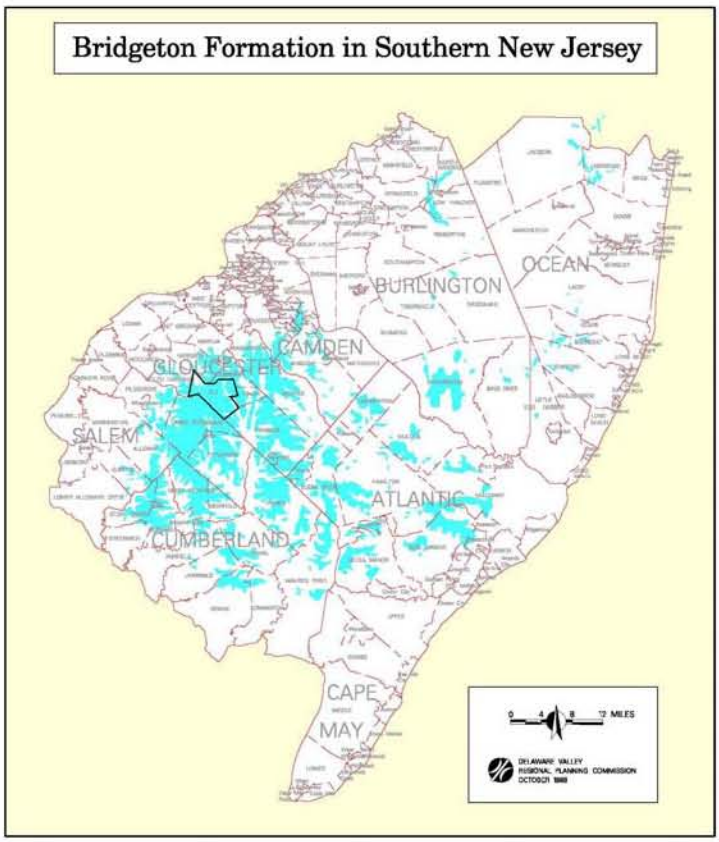
A radionuclide is an atom with an unstable nucleus. Over time such atoms undergo radioactive decay and emit potentially harmful ionizing radiation. According to the EPA, most drinking water sources have very low levels of these naturally occurring radioactive contaminants, although manmade contamination can also occur. Some people who drink water containing radionuclides in excess over many years may have an increased risk of getting cancer (especially bone and sinus cancer). In extreme cases, toxic effects to the kidneys have also been reported. In general, the health risks are apparently fairly low, but the Private Well Testing Act lists it as a substance that must be tested for in Gloucester County water.

During routine testing between 1988 and 1996, the New Jersey Department of Environmental Protection and the U.S. Geological Survey discovered elevated levels of naturally occurring radionuclides—particularly radium-226 and radium-228—in shallow groundwater in Southern New Jersey. In some cases, the level of radium found in the tested wells was higher than the U.S. Environmental Protection Agency's Maximum Contaminant Level for radium, which is 5 pCi/L (picocuries per liter).

According to the U.S. Geological Survey, there are four factors that predispose wells to higher concentrations of total radium: 1) If wells are over outcrops of the Bridgeton Formation, 2) If they are in or near agricultural areas, 3) If they have acidic groundwater (i.e., the pH is less than 5), and 4) If they have nitrate concentrations of more than 5 milligrams per liter. There are areas of Elk Township and the surrounding region that fit this description, especially the first and second factors.

Because of the correlation between high gross alpha-particle activity and radium, the New Jersey Department of Environmental Protection recommends that public supply utilities and homeowners whose wells draw from the Kirkwood-Cohansey aquifer test their water for gross alpha-particle activity, which is cheaper than testing for total radium concentration.

To reduce levels below the maximum contamination level, various treatment systems are available that can be installed in a residence, including ion exchange, lime softening, and reverse osmosis. These systems will also reduce nitrate concentrations and high ion l levels, two other conditions sometimes found in Elk Township wells.



Source: DVRPC from NJ Geological Service

Figure 12: Bridgeton Formation.
This figure shows the location of the Bridgeton Formation in southern New Jersey in blue. Elk Township is outlined in black.

SOURCES OF INFORMATION

SECTION 1: INTRODUCTION

The New Jersey State Development and Redevelopment Plan. New Jersey State Planning Commission. Adopted March 1, 2001.

SECTION 2: HISTORY

Cammarota, Ann Marie T. Pavements in the garden: the suburbanization of southern New Jersey, adjacent to the city of Philadelphia, 1769 - to the present. Madison: FDU Press, 2001.

Everts & Steward. Combination Atlas Map of Salem & Gloucester Counties New Jersey. Compiled, drawn and published from personal examination and surveys by Everts & Steward. Philadelphia, PA, 1876.

Kraft, Herbert C. The Lenape: Archaeology, History, and Ethnography. Newark, New Jersey Historical Society, 1986.

Simpson, Hazel B. Under Four Flags: Old Gloucester County 1686 – 1964: A History of Gloucester County New Jersey. Woodbury, NJ, Board of Chosen Freeholders, Gloucester County, New Jersey, 1965.

Widmer, Kemble. The New Jersey Historical Series, Vol. 19: The Geology and Geography of New Jersey. Princeton, NJ: D. Van Nostrand Company, 1964.

Elk Township (and Diskworks). Elk Township History. 27 December 2004 www.diskworks.com/gilman.html and www.elktownship.com/history.html

Elk Township. Town History. 2008. www.elktownshipnj.gov/muni/elktownship/home/history.html

SECTION 3: ELK TOWNSHIP LOCATION, SIZE, AND LAND USE

Association of New Jersey Environmental Commissions (ANJEC):
-*Acting Locally: Municipal Tools for Environmental Protection*. Mendham, NJ: ANJEC, 2002.
-*The Environmental Manual for Municipal Officials*. Mendham, NJ: ANJEC, 1998.

Delaware Valley Regional Planning Commission.
- Destination 2030: The Year *2030 Plan for the Delaware Valley.* Delaware Valley Regional Planning Commission. www.dvrpc.org/LongRange.htm
- Locally Funded Open Space Programs www.dvrpc.org/planning/environmental/openspace/local.htm
- *Environmental Resource Inventory for the Township of Harrison*, Delaware Valley Regional Planning Commission, April 2005.
-*Conservation Element, Plumsted Township Master Plan*, Delaware Valley Regional Planning Commission, October 2003.

SECTION 4: NATURAL RESOURCES

Delaware Valley Regional Planning Commission.
- *A Teacher's Guide to the Watersheds of Gloucester County*, Delaware Valley Regional Planning Commission, September 2004. www.dvrpc.org/planning/environmental/water/teachers.htm

Honachefsky, William B. *Ecologically Based Municipal Land Use Planning*. Boca Raton, FL: Lewis Publishers (CRC Press), 2000.

Lewis, Jean C., Joseph J. Hochreiter Jr., Gary J. Barton, Jane Kozinski, and Frederick J. Spitz. Hydrogeology of, and Groundwater Quality in, the Potomac–Raritan–Magothy Aquifer System in the Logan Township Region, Gloucester and Salem Counties, New Jersey.

Mapping New Jersey's Vernal Ponds. Grant F. Walton Center for Remote Sensing and Spatial Analysis at Rutgers University. 5 August 2004. www.dbcrssa.rutgers.edu/ims/vernal/

Navoy, Anthony S. "Gloucester County Ground-Water Resources and Issues." Watershed News Early Spring 2001, The Newsletter of the Federation of Gloucester County Watersheds and the South Jersey Land Trust, Gloucester Co., April 2001. www.sjlandwater.org.

New Jersey Department of Environmental Protection (NJDEP):
- Ambient Lake Monitoring Project. Bureau of Freshwater and Biological Monitoring. New Jersey Department of Environmental Protection. Division of Water Monitoring and Standards. www.state.nj.us/dep/wmm/bfbm/lakes.html.
- www.state.nj.us/dep/gis – For Geographic Information System maps and table data.
- www.state.nj.us/dep/landuse – For information on wetlands and flood hazard area regulations and permits.
- www.dbcrssa.rutgers.edu/ims/vernal – For mapping and data on Vernal Pools.
- www.state.nj.us/dep/dwq/database.htm --For information about NJPDES Active Permits
- www.state.nj.us/dep/dwq – To reach the Division of Water Quality.
- The Clean Water Book: Lifestyle Choices for Water Resource Protection, Trenton, NJ, 1997.
- A Homeowner's Manual for Septic Systems, Division of Water Quality, Bureau of Nonpoint Pollution Control. Trenton, NJ, 1999.
- 2005 Air Quality Report. Trenton: NJDEP, 2005. www.state.nj.us/dep/airmon/05rpt.htm
- Aquifer Recharge Mapping www.state.nj.us/dep/njgs/enviroed/aqfrchrg.htm
-Total Maximum Daily Loads (TMDLs) . www.nj.gov/dep/watershedmgt/tmdl.htm
-Stormwater and Nonpoint Source pollution. http://njstormwater.org/

New Jersey Natural Resources Conservation Service. "New Jersey Soils of Statewide Importance," September 24, 1990, available online at www.nj.nrcs.usda.gov/technical/soils/njfarmindex.html.

Rangelands West. Overview of the Clean Water Act. 27 August 2004. http://ag.arizona.edu/agnic/policy/cwahome.html.

Soil Survey Staff, Natural Resources Conservation Service, U.S. Department of Agriculture.

-"Hydric Soils." Available online: http://soils.usda.gov/use/hydric/ (Accessed July 3, 2008).
-"Soil Data Mart." Available online: http://soildatamart.nrcs.usda.gov/State.aspx (Accessed July 3, 2008).
-"Soil Series Name Search." Available online: http://soils.usda.gov/technical/classification/osd/index.html (Accessed July 3, 2008).

Tedrow, J.C.F. "Greensand and Greensand Soils of New Jersey: A Review." Rutgers Cooperative Extension, 2002.

U.S. Department of Agriculture.
- Environmental Quality Incentives Program. Natural Resources Conservation Service, www.nrcs.usda.gov/programs/eqip/
- Environmental Quality Incentives Program. Natural Resources Conservation Service, www.nrcs.usda.gov/programs/crp/
- Soil Survey of Gloucester, New Jersey. Soil Conservation Service, in cooperation with N.J. Agricultural Experiment Station, Cook College, Rutgers, the State University, June 1962.

United States Environmental Protection Agency (EPA)
-EPA's Draft Report on the Environment 2003: Technical Document. EPA 600-R-03-050. Washington: EPA, 2003. www.epa.gov/indicators
-The Plain English Guide to the Clean Air Act. EPA-456/K-07-001. Washington: EPA, 2007.
-Air Quality Index Summary Report. www.epa.gov/air/data/reports.html

United States Geological Society (USGS).
-Water Resources. Site Information for the Nation. http://waterdata.usgs.gov/nwis/si
-Water-Resources Investigations Report 90-4142. West Trenton, NJ, 1991.

Watt, Martha K. A Hydrologic Primer for New Jersey Watershed Management. West Trenton, NJ: US Geological Survey, Water-Resources Investigation Report 00-4140. Available at http//nj.usgs.gov/publications/WRIR/00–4140.pdf

Winter, Thomas, et al. Groundwater and Surface Water: A Single Resource. Denver, CO: US Geological Survey, 1998.

Zapecza, Otto S. Hydrogeologic Framework of the New Jersey Coastal Plain. US Geological Survey Professional Paper 1404-B. Washington D.C: United States Government Printing Office, 1989.

SECTION 5: BIOLOGICAL RESOURCES

Arndt, Rudolf G. "Annotated checklist and Distribution of new Jersey Freshwater Fishes, with comments on Abundance." The Bulletin [of the] New Jersey Academy of Science, V. 49, No. 1, Spring, 2004.

Britton, Nathaniel, and Addison Brown. An Illustrated Flora of the Northern United States and Canada. New York: Dover, 1970.

Brown, Lauren. Grasses: An Identification Guide. New York: Houghton Mifflin, 1979.

Brown, Stephanie. "Elephant Swamp Eyed for Upgrade." Gloucester County Times [New Jersey], 21 July 2007. A3.

Burton, Dr. Maurice, and Robert Burton, eds. The International Wildlife Encyclopedia: Vol. 5. New York: Marshall Cavendish, 1969.

Caduto, Michael. Pond and Brook: A Guide to Nature in Freshwater Environments. Hanover: University Press of New England, 1990.

Collins, Beryl Robichaud, and Karl H. Anderson. Plant Communities of New Jersey: A Study in Landscape Diversity. New Brunswick, NJ: Rutgers University Press, 1994.

Commonwealth of Australia. Department of the Environment, Sport and Territories. Biodiversity Series Paper No. 1: Biodiversity and its Value. 1993.

Dahl, T.E. Status and Trends of Wetlands in the Conterminous United States 1986 to 1997. Washington D.C.: US Department of the Interior, US Fishand Wildlife Service, 1991.

Franklin Township Environmental Commission. Environmental Resource Inventory for Franklin Township, Gloucester New Jersey. Philadelphia, PA: DVRPC, February 4, 2002.

Food and Agricultural Organization of the United States. Biological Diversity in Food and Agriculture. 22 July 2004 www.fao.org/biodiversity/index.asp

Great Egg Harbor Watershed Association. Rare and Endangered Species. 19 July 2004 www.greategg.org/plants_and_animals/rare_and_endangered_species.htm

Lane, Alexander. "The Birds Have Flown." Star-Ledger [Newark], 4 July 2004.

Martin, Alexander, Herbert Zim, and Arnold Nelson. American Wildlife and Plants. New York: Dover, 1951.

Martine, Christopher T. Trees of New Jersey and the Mid-Atlantic States. Jackson, NJ: NJ Department of Environmental Protection, Division of Parks and Forestry, New Jersey Forest Service, 2003.

Maryland Department of Natural Resources, Wildlife and Heritage Services. Swamp Pink. By Johanna Thomas. 16 July 2004 www.dnr.state.md.us/wildlife/swamppink.html

New Jersey Department of Environmental Protection, Division of Fish, Game, and Wildlife. Governors Report on Deer Management in New Jersey. NJDEP, October 2004.

New Jersey Department of Environmental Protection. New Jersey Stormwater Best Management Practices Manual. 23 April 2007. www.state.nj.us/dep/stormwater/bmp_manual2.htm

Niles, L. J., M. Valent, J. Tash, and J. Myers. New Jersey's The Landscape Project: Wildlife Habitat Mapping for Community Land–Use Planning and Endangered species Conservation. Project report. Endangered and Nongame Species Program, New Jersey Division of Fish & Wildlife, NJ Department of Environmental Protection, 2001.

Nutty Birdwatcher. Eastern Forests: Pine Barrens and Pinelands. 30 Aug. 2004 www.birdnature.com/pines.html

Rutgers and New Jersey Agricultural Experiment Station. Deer and People in New Jersey. 14 October 2004 www.deer.rutgers.edu/

State of Connecticut. Department of Environmental Protection. Learn About CT's Wildlife. 15 Aug. 2004 http://dep.state.ct.us/burnatr/wildlife/learn.htm

Stokes, Donald, and Lillian Stokes. Stokes Nature Guides: A Guide to Bird Behavior Vol. III. New York: Little, Brown and Company, 1989.

Stokes, Donald and Lillian Stokes. Stokes Nature Guides: Animal Tracking and Behavior. New York: Little, Brown and Company, 1986.

Tyning, Thomas F. Stokes Nature Guides: A Guide to Amphibians and Reptiles. Boston, MA: Little, Brown, and Company, 1990.

Union of Concerned Scientists. Backgrounder: The Science of Biodiversity. 26 July 2004 www.ucsusa.org/global_environment/archive/page.cfm?pageID=392

U.S. Department of Agriculture.
- Important Trees of the Eastern Forest. Atlanta, GA: USDA, 1968.
- A Community Based Approach to Dealing with Canada Goose Damage. Animal Plant Health Inspection Service, September 1999.
- Controlling Canada Goose Damage. Animal Plant Health Inspection Service, September 1999.
- New Jersey Annual Precipitation. Natural Resources Conservation Service, Apr. 1998. 5 Aug. 2004 ftp://ftp.ftw.nrcs.usda.gov/pub/ams/prism/ maps/nj.pdf

U.S. Department of the Interior, Fish and Wildlife Service, New Jersey Field Office. John C. Staples Letter to Matthew R. Woolford of Acer Associates, Inc. 2007. Refer to 2008-I-0084.

Wernert, Susan, et. al., eds. Reader's Digest: North American Wildlife. Pleasantville, NY: Reader's Digest, 1982.

The Xerces Society. Why are Invertebrates Important? 30 Aug. 2004 http://xerces.org/why_conserve_inverts.htm

Zim, Herbert and Alexander Martin. Trees: A Guide to Familiar American Trees. New York: Simon and Schuster, 1956.

SECTION 6: THE BUILT ENVIRONMENT

U.S. Census Bureau. Your Gateway to Census 2000. www.census.gov/main/www/cen2000.html

Phila. Roads (and NYC Roads). New Jersey Turnpike (I-95): Historic Overview. 21 October 2004. www.nycroads.com/roads/nj-turnpike/

Phila. Roads.
-NJ 55 Freeway: Historic Overview. 21 October 2004 www.phillyroads.com/roads/NJ-55/
-US 322 Freeway (New Jersey, unbuilt): Historic Overview. 21 October 2004. www.phillyroads.com/roads/US-322_NJ/
-NJ 42 Freeway: Historic Overview. 21 October 2004 www.phillyroads.com/roads/NJ-42/

Delsea Regional High School. http://education.state.nj.us/rc/rc06/narrative/15/4940/15-4940-050.html

SECTION 7: ENVIRONMENTAL ISSUES

New Jersey Department of Environmental Protection.
- Known Contaminated Sites. 10 August 2004 www.state.nj.us/dep/srp/kcs–nj/
- Bureau of Underground Storage Tanks (BUST). 30 August 2004 www.nj.gov/dep/srp/bust/bust.htm

To learn more about a contaminated site, contact one of the lead agencies overseeing the case or visit the web site: www.state.nj.us/dep/srp/. Site Remediation and Waste Management, formerly known as the Site Remediation Program, is a program unit within NJDEP that provides financial aid and technical guidance in cleaning up the state's more serious contaminated sites that pose a danger to human health and the environment. SRWM maintains an inventory of 38,000 sites, of which 25,000 require no further remediation action. The bureaus within SRWM are listed below for easy reference:

Bureau	Acronym	Telephone No.	Bureau	Acronym	Telephone No.
Case Management	BCM	(609) 633-1455	Field Operation - Case Assignment Section	BFO-CA	(609) 292-2943
Construction	BC	(609) 984-2991	Field Operations - Initial Notice	BFO-IN	(609) 633-0708
Emergency Response Region I	BER-I	(973) 669-3955	Field Operations - Northern Field Office	BFO-N	(973) 669-3960
Emergency Response Region II	BER-II	(609) 584-4130	Field Operations - Southern Field Office	BFO-S	(609) 584-4150
Environmental Evaluation, Cleanup and Responsibility Assessment	BEECRA	(609) 777-0899	Fund Management, Compliance and Recovery	BFMCR	(609) 633-0719
Environmental Measurements and Site Assessment	EMSA	(609) 584-4280	Site Management	BSM	(609) 984-2990
Underground Storage Tanks	BUST	(609) 292-8761			

U.S. Geological Survey. Radium-226 and Radium-228 in Shallow Groundwater, Southern New Jersey. June 1998. http://nj.usgs.gov/publications/FS/fs-062-98.pdf

Gloucester County Utilities Authority. www.gcuanj.com/

CITATIONS

P.L. 93-205. *Federal Endangered Species Act of 1973 (ESA).*

P.L. 95-217. *Federal Clean Water Act*

P.L. 96-510. *Federal Comprehensive, Environmental Response, Compensations and Liability Act of 1980 (CERCLA).*

P.L. 105-312. *Federal Migratory Bird Treaty Act of 1918.*

N.J.S.A. 13:1B-15.151 et seq. *New Jersey Endangered Plant Species Act.*

N.J.S.A. 23:2A et seq. *New Jersey Endangered and Nongame Species Conservation Act of 1973.*

N.J.S.A. 58:10A-1 et seq. *New Jersey Water Pollution Control Act.*

N.J.S.A 58:16A-50 et seq. *New Jersey Flood Hazard Area Control Act.*

N.J.A.C. 7:7A et seq. *New Jersey Freshwater Wetlands Protection Act Rules.*

N.J.A.C 7:8 et seq. *Stormwater Management Rules*

N.J.A.C. 7:9B-1.12. *New Jersey Surface Water Quality Standards.*

N.J.A.C. 7:9E. *Private Well Testing Act*

N.J.A.C. 7:13 et seq. *New Jersey Flood Hazard Area Control*.

N.J.A.C. 7:14A-2 et seq. *New Jersey Pollution Discharge Elimination System – General Program Requirements*.

N.J.A.C 7:15 et seq. *Water Quality Management Planning Rule*

N.J.A.C. 10:1B. *Open Public Records Act of 2002*

This page left blank intentionally.

APPENDICES

Appendix A: Vertebrate Animals Known or Probable in Elk Township

Appendix B: Endangered and Threatened Species in Elk Township

Appendix C: Federal and State Conservation Programs for Farmers

Appendix D: Private Well Testing Act

Appendix E: Vernal Pools in Elk Township

Appendix F: State Threatened and Endangered Species

This page left blank intentionally.

APPENDIX A: VERTEBRATE ANIMALS KNOWN OR PROBABLE IN ELK TOWNSHIP

Species	General Habitat	Township Locations
Mammals		
Opossum	All Habitats	Throughout
Short-tailed Shrew	Woodlands	Throughout
Eastern Mole	Uplands	Throughout
Star-nosed Mole	Uplands	Throughout, Occasional
Little Brown Bat	Uplands	Throughout
Eastern Pipistrel	Uplands	Throughout
Eastern Cottontail	All Habitats	Throughout, Common
Eastern Chipmunk	Woodlands	Throughout
Woodchuck	Woodlands and Fields	Throughout
Gray Squirrel	Woodlands	Throughout, Common
White-footed Mouse	Woodlands	Throughout
Jumping Mouse	Fields	Throughout
Meadow Vole	Open Fields	Throughout
Red-backed Vole	Woodlands	Throughout
Muskrat	Wetlands	Throughout
Brown Rat	Wetlands, Homes, Farms	Throughout
House Mouse	Homes and residential areas	Throughout
Red Fox	All Habitats	Throughout
Raccoon	All Habitats	Throughout, Common
Long-tailed Weasel	Wetlands	Throughout
Striped Skunk	Uplands	Throughout, Common
White-tailed Deer	All Habitats	Throughout, Common
Mink	Wetlands	Throughout
Coyote	Woodlands and Fields	Throughout
Birds		
Great Blue Heron	Open Marsh, Lake Edges	Throughout
Great Egret	Open Marsh, Lake Edges	Throughout
Snowy Egret	Open Marsh, Lake Edges	Throughout
Green-backed Heron	Open Marsh, Lake Edges	Throughout
Mute Swan	Open Water	Large Lakes
Snow Goose	Winter Migrant in Fields	Open farms
Canada Goose	Open Water, Fields	Throughout
Wood Duck	Forested Wetlands	Throughout
Green-winged Teal	Wetlands	Winter Migrant
Black Duck	Marsh, Lakes	Throughout
Mallard	Wetlands	Throughout
Gadwall	Open Water	Winter Migrant
Blue-winged Teal	Wetlands	Winter Migrant
Northern Shoveler Duck	Open Water	Winter Migrant
Ring-necked Duck	Open Water	Winter Migrant
Greater & Lesser Scaup	Open Water	Winter Migrant
Bufflehead	Open Water	Winter Migrant
Hooded Merganser	Open Water	Winter Migrant
Ruddy Duck	Open Water	Winter Migrant
Black Vulture	Open fields	Throughout
Turkey Vulture	All Habitats	Throughout
Osprey	Open Water	Lakes and ponds
Northern Harrier	Open Fields	Throughout
Bald Eagle	Lakes, waterways, open fields	Throughout
Sharp-shinned Hawk	Woodlands	Throughout
Cooper's Hawk	Woodlands	Throughout
Red-shouldered Hawk	Wetland Forests	Throughout; Endangered
Broad-winged Hawk	Woodlands	Throughout

Species	General Habitat	Township Locations
Red-tailed Hawk	All Habitats	Throughout
American Kestrel	Open Fields	Throughout
Ringed-neck Pheasant	Old Fields, Farms	Released; Throughout
Wild Turkey	Woodlands	Throughout
Bobwhite	Old Field, Woodlands	Throughout
Killdeer	Bare Ground, Lake Edges	Throughout
Lesser Yellowlegs	Lake Edges	Throughout
Solitary Sandpiper	Lake Edges	Throughout
Spotted Sandpiper	Lake Edges	Throughout
American Woodcock	Wetland Forests	Throughout
Laughing Gull	Open Water, Parking Lots	Summer Visitor
Ring-billed Gull	Open Water, Parking Lots	Throughout
Herring Gull	Open Water, Dumps	Winter Visitor
Rock Dove	Houses and Bridges	Residential areas
Mourning Dove	Woodlands	Throughout, Common
Black-billed Cuckoo	Woodlands	Occasional
Yellow-billed Cuckoo	Woodlands	Throughout
Barn Owl	Farmland	Throughout
Eastern Screech Owl	Woodlands	Throughout
Great Horned Owl	Woodlands	Throughout
Barred Owl	Wetland Forests	Wooded Wetlands
Saw-whet Owl	Wetland Forests	Wooded Wetlands
Common Nighthawk	Upland Woodlands	Summer Night Sky
Chimney Swift	Bridges, House Chimneys	Residential areas
Ruby-throated Hummingbird	Woodlands and Fields	Throughout
Belted Kingfisher	Wetlands	Throughout
Red-headed Woodpecker	Upland Forest	Raccoon Creek forests
Red-bellied Woodpecker	Woodlands	Throughout
Yellow-bellied Sapsucker	Woodlands	Fall Migrant
Downy Woodpecker	Woodlands	Throughout
Hairy Woodpecker	Woodlands	Throughout
Northern Flicker	Woodlands	Throughout; Common
Wood Pee-wee	Woodlands	Upland Woods
Eastern Phoebe	Woodlands	Throughout
Great Crested Flycatcher	Woodlands	Upland Woods
Eastern Kingbird	Fields, Farmland	Throughout
Purple Martin	Open Fields, Wetlands	Agricultural areas
Tree Swallow	Wetlands	Throughout
Barn Swallow	Buildings, Bridges	Throughout
Blue Jay	Woodland	Throughout; Common
American Crow	All Habitats	Throughout, Common
Carolina Chickadee	Woodlands	Throughout, Common
Eastern Tufted Titmouse	Woodlands	Throughout, Common
White Breasted Nuthatch	Woodlands	Throughout
Brown Creeper	Woodlands	Throughout
Carolina Wren	Edge of Woodlands	Edges, Yards
House Wren	Edge of Woodlands	Throughout
Golden and Ruby crowned Kinglets	Woodlands	Winter Migrant
Eastern Bluebird	Edge of Woodlands	Throughout
Wood Thrush	Woodlands	Throughout
American Robin	All Habitats	Throughout, Common
Catbird	Edge of Woodlands	Throughout
Mockingbird	Edge of Woodlands	Throughout, Common
Brown Thrasher	Woodlands	Throughout
Cedar Waxwing	Old Fields, Young Woodlands	Throughout
Starling	All Habitats	Residential areas; Pest
White Eyed Vireo	Woodlands	Throughout
Philadelphia Vireo	Woodlands	Migrant
Red-eyed Vireo	Woodlands	Wetland Forests
Yellow Warbler	Upland Forest	Throughout

Species	General Habitat	Township Locations
Chestnut-sided Warbler	Woodlands	Migrant
Black-throated Blue Warbler	Woodlands	Migrant
Yellow-rumped Warbler	Woodlands	Throughout
Pine Warbler	Woodlands	Throughout
Prairie Warbler	Shrubby Areas	Throughout
Palm Warbler	Pine Woodlands	Throughout
Black and White Warbler	Pine Woodlands	Migrant
American Redstart	Rich Woodlands	Throughout
Ovenbird	Woodlands	Throughout
Yellowthroat	Shrubby Areas	Throughout
Scarlet Tanager	Woodlands	Throughout
Cardinal	Edge of Woodlands	Throughout; Common
Indigo Bunting	Edges of Old Fields	Throughout
Chipping Sparrow	Woodlands	Throughout
Field Sparrow	Old Fields	Throughout
Song Sparrow	Old Fields	Throughout
White-throated Sparrow	Woodlands	Winter Migrant
Dark-eyed Junco	Woodlands	Winter Migrant
Common Grackle	All Habitats	Throughout; Common
Brown-headed Cowbird	Open Areas	Throughout; Pest
Orioles: Orchard and Baltimore	Woodlands	Throughout
House Finch	Open Areas	Throughout
Pine Siskin	Woodlands	Winter Migrant
American Goldfinch	Open Areas, Old Fields	Throughout
House Sparrow	Old Fields	Residential areas; Common
Reptiles		
Bog Turtle	Muddy Agricultural Fields/Wetlands	Endangered
Common Snapping Turtle	Ponds and Lakes	Throughout
Stinkpot Turtle	Wetlands	Throughout
Spotted Turtle	Freshwater Wetlands and Ponds	Throughout
Eastern Box Turtle	Uplands	Throughout
Red-bellied Turtle	Lakes and Ponds	Throughout
Eastern Painted Turtle	Lakes and Ponds	Throughout
Northern Fence Lizard	Uplands	Throughout
Northern Water Snake	Wetlands	Throughout
Garter Snake	All Habitats	Throughout
Eastern Ribbon Snake	Wetlands	Throughout
Southern Ring neck Snake	Woodlands	Throughout
Northern Black Racer	Edge of Woodlands	Throughout
Rough Green Snake	Woodlands	Throughout
Black Rat Snake	All Habitats	Throughout
Amphibians		
Red-backed Salamander	Woodlands	Throughout
Fowlers Toad	Uplands	Throughout
Spring Peeper	Wetlands	Throughout
Bull Frog	Lakes and Ponds	Throughout
Green Frogs	Wetlands	Throughout
Wood Frog	Woodlands	Throughout
Southern Leopard Frog	Wetlands	Throughout
Fishes		
American Brook Lamprey (*Lampetra appendix*)	Streams	Streams
Sea Lamprey (*Petromyzon marinus*)	Streams	Streams
American Eel (*Anguilla rostrata*)	Streams	Streams
Blueback Herring (*Alosa aestivalis*)	Streams	Streams
Alewife (*Alosa pseudoharengus*)	Streams	Streams
Goldfish (*Carassius auratus*)	Streams	Streams

Species	General Habitat	Township Locations
Satinfin Shiner (*Cyprinella analostana*)	Streams	Streams
Common Carp (*Cyprinus carpio*)	Streams	Streams
Eastern Silvery Minnow (*Hybognathus regius*)	Streams	Streams
Common Shiner (*Luxilus cornutus*)	Streams	Streams
Golden Shiner (*Notemigonous crysoleucas*)	Streams	Streams
Comely Shiner (*Notropis amoenus*)	Streams	Streams
Bridle Shiner (*Notrophis bifrenatus*)	Streams	Streams
Spottail Shiner (*Notropis hudsonius*)	Streams	Streams
Swallowtail Shiner (*Notropis procne*)	Streams	Streams
Fallfish (*Semotilus corporalis*)	Streams	Streams
White Sucker (*Catostomus commersonnii*)	Streams	Streams
Creek Chubsucker (*Erimyzon oblongus*)	Streams	Streams
Brown Bullhead (*Ameiurus nebulosus*)	Streams	Streams
Channel Catfish (*Ictalurus punctatus*)	Streams	Streams
Tadpole Madtom (*Noturus gyrinus*)	Streams	Streams
Margined Madtom (*Noturus insignis*)	Streams	Streams
Redfin Pickerel (*Esox americanus*)	Streams	Streams
Chain Pickerel (*Esox niger*)	Streams	Streams
Eastern Mudminow (*Umbra pygmaca*)	Streams	Streams
Brook Trout (*Salvelinus fontinalis*)	Streams	Streams
Pirate Perch (*Aphredoderus sayanus*)	Streams	Streams
Banded Killfish (*Fundulus diaphanus*)	Streams	Streams
White Perch (*Morone americana*)	Streams	Streams
Mud Sunfish (*Acantharchus pomotis*)	Streams	Streams
Bluespotted Sunfish (*Enneacanthus chaetodon*)	Streams	Streams
Redbreast Sunfish (*Lepomis auritus*)	Streams	Streams
Pumpkinseed (*Lepomis gibbosus*)	Streams	Streams
Bluegill (*Lepomis macrohirus*)	Streams	Streams
Largemouth Bass (*Micropterus salmoides*)	Streams	Streams
Black Crappie (*Pomoxis nigromaculatus*)	Streams	Streams
Swamp Darter (*Etheostoma fusiforme*)	Streams	Streams
Tessellated Darter (*Etheostoma olmstedi*)	Streams	Streams
Yellow Perch (*Perca flavescens*)	Streams	Streams

APPENDIX B: ENDANGERED AND THREATENED SPECIES IN ELK TOWNSHIP

Scientific name	Common Name	Federal Status*	NJ Status*	State Rank**
Vascular Plants				
Carex barrattii	Barratt's Sedge			S4
Coreopsis rosea	Rose-color Coreopsis			S2
Helonias bullata	Swamp-pink	LT	E	S3
Lysimachia hybrida	Lowland Loosestrife			S3
Utricularia biflora	Two-flower Bladderwort		E	S1
Vertebrates				
Falco sparverius	American kestrel		INC/S	S3B,S**?**N
Dolichonyx oryzivorus	Bobolink		T/T	S2B
Accipiter cooperii	Cooper's Hawk		T/T	S3B,S4N
Terrapene carolina carolina	Eastern Box Turtle		Special Concern	S3
Lampropeltis g. getula	Eastern Kingsnake		U	S3
Sturnella magna	Eastern Meadowlark		D/S	S3B, S4N
Ammodramus savannarum	Grasshopper Sparrow		T/S	S2B
Buteo lineatus	Red-shouldered Hawk		E/T	S1B,S2N
Passerculus sandwichensis	Savannah Sparrow		T/T	S2B,S4N
Clemmys guttata	Spotted Turtle		Special Concern	S3
Pooecetes gramineus	Vesper Sparrow		E	S1B,S2N
Icteria virens	Yellow-breasted Chat		Special Concern	S3B

*** Key to Federal and State Status Codes**

?	Either it has not been determined if the record is indicative of significant habitat, or the identification of the species or community may be confusing or disputed.
B	Refers to the breeding population of the element in the state.
D	Declining species – species that exhibited a continued decline in population numbers of the years.
E	Endangered species – one whose prospects for survival within the state are in immediate danger due to one or many factors.
INC	Increasing species – population has exhibited a significant increase
N	Refers to the non-breeding population of the element in the state.
S	Stable species
T	Threatened species – may become endangered if conditions surrounding the species begin to or continue to deteriorate

**** Key to State Element Rank**

S1	Critically imperiled in NJ because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres).
S2	Imperiled in NJ because of rarity (6 to 20 occurrences).
S3	Rare in state with 21 to 50 occurrences. Includes elements which are widely distributed but with small populations/acreage, or with restricted distribution but locally abundant.
S4	Apparently secure in state, with many occurrences.
S5	Demonstrably secure in state and essentially ineradicable under present conditions.
SX	Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. No longer a conservation priority.
SH	Element of historical occurrence in New Jersey. No extant occurrences are known, but not all historical occurrences have been surveyed, and unsearched potential habitat remains. Remains a conservation priority.

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program to map critical habitat for rare animal species. Some of the rare species data in the Landscape Project is in the Natural Heritage Database, while other records were obtained from other sources. Natural Heritage Database response letters will list all species (if any) found during a search of the Landscape Project. However, any reports that are included with the response letter will only reference specific records if they are in the Natural Heritage Database. This office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

APPENDIX C: FEDERAL AND STATE CONSERVATION PROGRAMS FOR FARMERS

Several financial and economic incentive programs, and technical assistance, are available to help farmers plan and use conservation practices on their farms. The United States Department of Agriculture Natural Resources Conservation Service (NRCS) has a Farm Service Agency office in Woodstown, Salem County, that serves Gloucester County. NRCS staff members are available to work with farmers to help identify their conservation goals and then craft appropriate conservation plans to meet those goals.

Numerous programs provide financial incentives to help farmers voluntarily engage in these practices. Financial incentives can include rental payments to farmers for reserved land, easement payments, and cost sharing – up to 100% for some programs – to develop and follow conservation plans.

The **Conservation Reserve Program (CRP)** is offered by NRCS and administered by the Farm Service Agency. It provides technical and financial aid and gives farmers assistance in complying with federal, state, and tribal environmental laws. The primary environmental goals of this program include reducing soil erosion, reducing sedimentation in streams and lakes, improving water quality, establishing wildlife habitat, and enhancing forest and wetland resources. Website: http://www.nrcs.usda.gov/programs/crp/.

The State of New Jersey partnered with the USDA to help farmers protect water quality by establishing a $100 million **Conservation Reserve Enhancement Program (CREP)**, which is the New Jersey version of the federal program**.** Under an agreement signed by Governor McGreevy in February 2004, the USDA provides $77 million and the state contributes $23 million for New Jersey farmers to install stream buffers, in order to reduce the flow of nonpoint source pollution into the state's waterways. New Jersey's goal is to enroll 30,000 acres of agricultural land into this state-federal program over a 10-year period. Types of buffers to be installed include trees, shrubs, vegetative filter strips, contour grass strips, and grass waterways. Under the program, a landowner installs and maintains approved practices through a 10 or 15-year rental contract agreement. A landowner entering the state Farmland Preservation Program or Green Acres Program also may opt for a permanent easement under the Conservation Reserve Enhancement Program. This would provide additional payment for permanent maintenance of approved conservation practices. The program will pay landowners annual rental and incentive payments for participating in the program, as well as 100% of the cost to establish approved practices. Additional information can be found at www.fsa.usda.gov or contact the local FSA office or Soil and Water Conservation District Office.

Another program targeted for wetlands preservation is called the **Wetlands Reserve Program (WRP)**. WRP is a voluntary resource conservation program that provides landowners with the opportunity to receive financial incentive to restore, protect, and

enhance wetlands in exchange for returning marginal land from agriculture. WRP is made possible by a reauthorization in the Farm Security and Rural Investment Act of 2002 known as the Farm Bill. The program has three enrollment options: permanent easement, 30-year easement, or restoration cost-share agreement, which has a minimum 10-year commitment. Applications are accepted on a continuous basis and may be obtained and filed at any time. Please see the website for more details: www.nrcs.usda.gov/programs/farmbill/2002/

The **Grassland Reserve Program (GRP)** is another conservation program authorized by the Farm Bill 2002. GRP is a voluntary program that protects grasslands, pasturelands, and rangelands without prohibiting grazing. Participants voluntarily put limitations on the future land use of their land while retaining the ability and right to conduct grazing practices, hay production, mow or harvest for seed production, conduct fire rehabilitation, and construct firebreaks and fences. There are four enrollment options: permanent easement; 30-year easement; rental agreement, which is available in 10, 15, 20 or 30-year contracts; and restoration agreement. Participants are compensated in different ways according to the enrollment option. For more information and application procedures visit the GRP website: www.fsa.usda.gov/dafp/GRP/default1.htm

The **Wildlife Habitat Incentives Program (WHIP)** is similar to those above in that it is also a USDA voluntary program, but differs in that WHIP targets landowners who want to preserve and protect fish and wildlife habitat on non-federal lands. The program provides technical and cost sharing provisions to protect these environments. Enrollment consists of a cost share agreement lasting from 5 to 10 years. In New Jersey, NRCS has received over $900,000 to implement WHIP since 1998, where the majority of funds have been used for cost share payments to landowners. A state plan has been developed in New Jersey and targets several areas as priority wildlife habitat areas. NRCS has also targeted a priority species – the bog turtle – for protection. For more information visit the NRCS New Jersey website: www.nj.nrcs.usda.gov

The **Environmental Quality Incentives Program (EQIP)** is also a part of the reauthorized Farm Bill of 2002. EQIP is a voluntary program that focuses on conservation that promotes both agricultural production and environmental quality. The program itself offers technical and financial assistance with installation and implementation of structural and management practices on agricultural land. EQIP features a minimum contract term compared to other programs lasting a maximum of 10 years. Landowners are eligible for incentive and cost share payments of up to 75% and sometimes up to 90% while still engaging in livestock or agricultural production activities. For more information please visit the website: www.nrcs.usda.gov/programs/eqip

The **Conservation Security Program (CSP)** is a voluntary program administered by the NRCS and authorized by the Farm Bill 2002. This program is intended to promote conservation and improvement of soil, water, air, energy, plant and animal life, etc. on tribal and private working lands. Working lands refer to a variety of land types including crop land, grass land, prairie land, improved pasture, and range land. In some cases,

forested lands would also be included in this category. CSP is available in 50 states, as well as the Caribbean and Pacific Basin areas, and provides equal access to funding. For more information please visit the website: www.nrcs.usda.gov/programs/csp/

The **Forestland Enhancement Program (FLEP)** is also authorized through the Farm Bill 2002 and replaces the Stewardship Incentives Program (SIP) and the Forestry Incentives Program (FIP). FLEP is a voluntary program for landowners of non-industrial private forest and provides technical, educational and cost-sharing assistance in an effort to promote the conservation of these forested areas. Landowners must have a forest management plan and are limited to 1,000 acres per year for the cost-share practices. For more information about this program please visit the website: http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml and the National Association of State Foresters website to find your local agency: www.stateforesters.org

The **Farm and Ranch Lands Protection Program (FRPP)** is a voluntary land conservation program that assists farmers to keep their lands for agricultural purposes. FRPP provides matching funds to those provided by state, tribal, local government or non-government organizations offering farm and ranch protection programs designed to purchase conservation easements. The FRPP is authorized by the Farm Bill 2002 and managed by the NRCS. Conservation easements are purchased by the state, tribal, or local entity. Participating landowners agree not to convert their land to non-agricultural uses, as well as to develop a conservation plan for any highly erodable lands. Landowners do, however, maintain all of their rights to utilize their land for agricultural purposes. For more information about FRPP please visit the website: www.nrcs.usda.gov/programs/farmbill/2002/ and search for the Farm and Ranch Lands Protection Program.

The **State Agricultural Development Committee (SADC) in New Jersey** has made soil and water conservation grants available as part of the Farmland Preservation Program. The grants give landowners up to 50% of costs associated with approved soil and water conservation projects. Farms are only eligible if they are already enrolled in a permanent or 8-year easement program. Soil projects can include measures to prevent or control erosion, control pollution on agricultural land, and improve water management for agricultural purposes. Projects must be completed within three years of SADC funding approval. However, under special circumstances the grant may be renewed for an additional year. For more information contact the local Soil Conservation District or the State Agricultural Development Committee at (609) 984-2504 or visit the website: http://www.state.nj.us/agriculture/sadc/sadc.htm for additional details.

The **Landowner Incentive Program (LIP)** is a preservation program for private landowners who wish to protect and conserve rare wildlife habitat and species. LIP is funded by the U.S. Fish and Wildlife Service and administered by the New Jersey Department of Environmental Protection's Division of Fish and Wildlife Endangered Nongame Species Program. Participating landowners receive both technical and financial assistance through this competitive grant program. Last year $1.12 million was awarded for a variety of preservation programs including habitat improvements, habitat

management and habitat protection projects. Generally a five-year minimum commitment is required and longer terms are preferred. A 25% cost share is required of the landowner. While the LIP is seeking funding for additional habitat protection projects, it may be another year before grants are available. Interested landowners are encouraged to contact Kim Korth, ENSP assistant zoologist at (609) 984-1581 for additional details. To learn more about the program in general visit the website: http://www.state.nj.us/dep/fgw/ensp/lip_prog.htm or http://www.state.nj.us/dep/fgw/ensp/pdf/lip_broch.pdf

APPENDIX D: PRIVATE WELL TESTING ACT

The Private Well Testing Act (*N.J.S.A. 58:12A-26 et seq.*), passed in 2002 and administered by NJDEP, requires that well water be tested for contaminants when properties served by certain types of drinking water wells are sold or leased. The law does not prohibit the sale of property if the water fails one or more drinking water test standards. Rather, the fundamental goal of the PWTA is to ensure that purchasers and lessees of properties served by private potable wells are fully aware of the quality of the untreated drinking water sources prior to sale or lease. The state law allows the buyer and seller to determine which party will pay for the test, as well as what actions, if any, need to be taken if test results indicate a contaminant is present in the water above an applicable standard. However, individual county health rules may mandate that certain actions are required in order for a real estate transaction to be finalized.

The PWTA program requires that water be tested for primary contaminants (health-based) and secondary parameters (aesthetic characteristics). Primary contaminants are contaminants that may cause a potential health risk if consumed on a regular basis above the established maximum contaminant level (MCL). New Jersey regulates 18 primary contaminants, five more than federal EPA requirements. Primary contaminants include bacteriological (fecal coliform and *E. coli*), Volatile Organic Compounds (VOCs), inorganics (arsenic, lead, mercury, and nitrates), and Radiological (radium decay) substances. A certified laboratory must collect a water sample at a point before the water goes through any treatment. This sample represents the condition of the groundwater in the aquifer, which may be different from water out of a kitchen faucet. Property owners may choose to also have the tap water tested to assure that filters or treatments are working effectively.

Volatile Organic Compounds regulated by NJDEP

- Benzene
- Carbon Tetrachloride
- meta-Dichlorobenzene
- ortho-Dichlorobenzene
- para-Dichlorobenzene
- 1, 1-Dichloroethane
- 1, 2-Dichloroethane
- 1, 1-Dichloroethylene
- *cis* – 1, 2-Dichloroethylene
- *trans* – 1, 2-Dichloroethylene
- 1, 2-Dichloropropane
- Ethylbenzene
- Methyl tertiary butyl ether
- Methylene Chloride
- Monochlorobenzene
- Naphthalene
- Styrene
- 1, 1, 2, 2-Tetrachloroethane
- Tetrachloroethylene
- Toluene
- 1, 2, 4-Trichlorobenzene
- 1, 1, 1-Trichloroethane
- 1, 2, 2-Trichloroethane
- Trichloroethylene
- Vinyl Chloride
- Xylenes (Total)

The PWTA program requires tests for three naturally occurring secondary parameters: pH, iron, and manganese. Secondary drinking water standards address aesthetics such as corrosivity, taste, and color, and testing for these parameters determines if water is suitable for laundering, plumbing, and showering. For example, due to the nature of soils and geology in southern New Jersey, the groundwaters tend to be acidic (pH below 7), while groundwaters in the northern part are neutral (pH=7) to basic (pH above 7). If the pH is too low (less than 6.5) water has a bitter metallic taste, and causes corrosion of pipes and fixtures. If the pH is too high (greater than 8.5) the water has a slippery feel, it tastes like soda, and deposits can form on plumbing fixtures.

Test results are reported by the lab to the person who requested the testing, to NJDEP, and to the local health authority. Suspicious or unexpected results are neither confirmed nor verified by NJDEP. Local health authorities will investigate suspect results, if necessary.

In February 2004, NJDEP released an online report summarizing the initial well test results reported to the agency during the PWTA program's first six months (September 2002 to March 2003). Results for 5,179 wells are included, which represent approximately 1 percent of private wells used as potable water supplies in New Jersey. The compilation of water test results is organized by county and municipality but does not include the names of specific property owners, their addresses, or well locations, because releasing that information is prohibited by law. About 92 percent of the 5,179 wells passed all the required (health-based) standards, with the exception of lead. Of the 8 percent (417 wells) of wells sampled that exceeded the maximum contaminant level for primary contaminants, the most common reason for failure statewide was nitrate (inorganics), followed by fecal coliform (bacteriological), and VOCs. Nitrates are found in groundwater due to a number of factors, including natural deposits, runoff from fertilizer, leaching from septic tanks, and from sewage pipes.

More wells in northern New Jersey were found to have fecal coliform or *E. coli* bacteria than in southern New Jersey. The northern/southern difference is probably due to the different geology in these regions. Northern New Jersey is characterized by limestone subject to solution cavities, fractured bedrock, or gravel water-bearing zones, while the southern part of the state is composed mainly of coastal plain sand and gravel, which appears to provide better protection of groundwater from fecal contaminants.

For those wells in the counties where mercury testing is required, 14 wells failed for mercury. Nine southern counties, including Burlington, Camden, Gloucester, and Salem, are required to test for mercury, which has been linked to neurological problems.

APPENDIX E: VERNAL POOLS IN ELK TOWNSHIP

ID NUMBER	X COORDINATE (UTM)	Y COORDINATE (UTM)
2713	482892.56249100000	4392503.49991000000
2714	482799.93749100000	4392396.49991000000
2715	483478.68749100000	4392373.49991000000
2716	483334.49999100000	4392320.99991000000
4423	481786.06249100000	4392546.99991000000
4424	483404.43749100000	4392115.49991000000
4428	482718.84374100000	4392871.99991000000
4429	482876.28124100000	4392791.49991000000
4430	482819.74999100000	4393312.99991000000
4431	483019.53124100000	4393217.49991000000
4432	483171.09374100000	4392758.99991000000
4433	483185.65624100000	4392666.49991000000
4071	488934.62499100000	4392707.49991000000
4084	488858.62499100000	4391617.99991000000
4096	488558.49999100000	4391829.49991000000
4100	487886.06249100000	4391997.49991000000
4101	487945.59374100000	4392214.49991000000
4102	488047.46874100000	4392001.49991000000
4103	487689.40624100000	4392173.49991000000
4104	485333.34374100000	4392352.99991000000
4037	490468.96874000000	4393067.49991000000
4092	489397.78124000000	4393325.99991000000
4093	489411.40624000000	4393092.99991000000
4094	489473.59374000000	4393014.99991000000
4098	489402.15624000000	4390962.49991000000
4072	488500.40624100000	4390484.49991000000
4073	488389.28124100000	4390382.49991000000
4074	488705.43749100000	4390505.49991000000
4075	488762.34374100000	4390394.49991000000
4076	487575.74999100000	4390157.99991000000
4077	487864.90624100000	4390556.99991000000
4078	487990.43749100000	4390060.49991000000
4079	488147.87499100000	4390029.99991000000
4080	488281.46874100000	4389907.99991000000
4081	488150.49999100000	4389877.49991000000
4082	488716.09374100000	4389700.99991000000
4083	486079.71874100000	4389965.49991000000
4085	488201.90624100000	4388293.49991000000
4086	487213.24999100000	4389975.99991000000
4087	487012.18749100000	4390018.49991000000
4088	487857.90624100000	4390753.49991000000
4089	487945.21874100000	4390748.49991000000
4095	487854.93749100000	4389781.49991000000
4097	485916.96874100000	4390410.49991000000
4099	489364.40624000000	4390344.99991000000

This page left blank intentionally.

APPENDIX F: STATE THREATENED AND ENDANGERED SPECIES

Birds			
Endangered		**Threatened**	
American Bittern	*Botaurus lentiginosos*	Bobolink	*Dolichonyx oryzivorus* BR
Eagle, bald	*Haliaeetus leucocephalus* BR **	Eagle, bald	*Haliaeetus leucocephalus* NB **
Falcon, peregrine	*Falco peregrinus*	Hawk, Cooper's	*Accipiter cooperii*
Goshawk, northern	*Accipiter gentilis* BR	Hawk, red-shouldered	*Buteo lineatus* NB
Grebe, pied-billed	*Podilymbus podiceps**	Night-heron, black-crowned	*Nycticorax nycticorax* BR
Harrier, northern	*Circus cyaneus* BR	Night-heron, yellow-crowned	*Nyctanassa violaceus*
Hawk, red-shouldered	*Buteo lineatus* BR	Knot, red	*Calidris canutus* BR
Owl, short-eared	*Asio flammeus* BR	Osprey	*Pandion haliaetus* BR
Plover, piping	*Charadrius melodus***	Owl, barred	*Strix varia*
Sandpiper, upland	*Batramia longicauda*	Owl, long-eared	*Asio otus*
Shrike, loggerhead	*Lanius ludovicianus*	Rail, black	*Laterallus jamaicensis*
Skimmer, black	*Rynchops niger* BR	Skimmer, black	*Rynchops niger* NB
Sparrow, Henslow's	*Ammodramus henslowii*	Sparrow, grasshopper	*Ammodramus savannarum* BR
Sparrow, vesper	*Pooecetes gramineus* BR	Sparrow, Savannah	*Passerculus sandwichensis* BR
Tern, least	*Sterna antillarum*	Sparrow, vesper	*Pooecetes gramineus* NB
Tern, roseate	*Sterna dougallii***	Woodpecker, red-headed	*Melanerpes erythrocephalus*
Wren, sedge	*Cistothorus platensis*		

Reptiles			
Endangered		**Threatened**	
Rattlesnake, timber	*Crotalus h. horridus*	Snake, northern pine	*Pituophis m. melanoleucus*
Snake, corn	*Elaphe g. guttata*	Turtle, Atlantic green	*Chelonia mydas***
Snake, queen	*Regina septemvittata*	Turtle, wood	*Clemmys insculpta*
Turtle, bog	*Clemmys muhlenbergii***		
Atlantic hawksbill	*Eretmochelys imbricata***		
Atlantic leatherback	*Dermochelys coriacea***		
Atlantic loggerhead	*Caretta caretta***		
Atlantic Ridley	*Lepidochelys kempi***		

Amphibians			
Endangered		**Threatened**	
Salamander, blue-spotted	*Ambystoma laterale*	Salamander, eastern mud	*Pseudotriton montanus*
Salamander, eastern tiger	*Ambystoma tigrinum*	Salamander, long-tailed	*Eurycea longicauda*
Treefrog, southern gray	*Hyla chrysocelis*	Treefrog, pine barrens	*Hyla andersonii*
Invertebrates			
Endangered		**Threatened**	
Beetle, American burying	*Nicrophorus mericanus***	Elfin, frosted (butterfly)	*Callophrys irus*
Beetle, northeastern beach tiger	*Cincindela d. dorsalis***	Floater, triangle (mussel)	*Alasmidonta undulata*
Copper, bronze	*Lycaena hyllus*	Fritillary, silver-bordered (butterfly)	*Bolaria selene myrina*
Floater, brook (mussel)	*Alasmidonta varicosa*	Lampmussel, eastern (mussel)	*Lampsilis radiata*
Floater, green (mussel)	*Lasmigona subviridis*	Lampmussel, yellow (mussel)	*Lampsilis cariosa*
Satyr, Mitchell's (butterfly)	*Neonympha m. mitchellii***	Mucket, tidewater (mussel)	*Leptodea ochracea*
Skipper, arogos (butterfly)	*Atrytone arogos arogos*	Pondmussel, eastern (mussel)	*Ligumia nasuta*
Skipper, Appalachian grizzled (butterfly)	*Pyrgus wyandot*	White, checkered (butterfly)	*Pontia protodice*
Wedgemussel, dwarf	*Alasmidonta heterodon***		
Mammals		**Fishes**	
Endangered		**Endangered**	
Bat, Indiana	*Myotis sodalis***	Sturgeon, shortnose	*Acipenser brevirostrum***
Bobcat	*Lynx rufus*		
Whale, black right	*Balaena glacialis***		
Whale, blue	*Balaenoptera musculus***		
Whale, fin	*Balaenoptera physalus***		
Whale, humpback	*Megaptera novaeangliae***		
Whale, sei	*Balaenoptera borealis***		
Whale, sperm	*Physeter macrocephalus***		
Woodrat, Allegheny	*Neotoma floridana magister*		

**** Also on the federal Endangered and Threatened list**

INDEX

P

R

S

T

U

V

W

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title: ***Environmental Resource Inventory for the Township of Elk, Gloucester County, New Jersey***

Date Published: **December 2008**
Publication No. **08010**

Geographic Area Covered: Elk Township, Gloucester County, New Jersey

Key Words: Conservation, conservation planning, endangered species, Elk township, environment, environmental resource inventory, environmental commission, Gloucester County, master planning, natural resources, threatened species, wildlife.

ABSTRACT

This publication documents the natural and community resources of Elk Township, Gloucester County, New Jersey. The natural resource information includes descriptions, tables and maps of land use; soils; steep slopes; drinking water aquifers and wells; surface waters including watersheds, streams, lakes, wetlands, and floodplains; impacts on water resources; groundwater; vegetation including forests and grasslands; animal communities; threatened and endangered species; NJ Landscape Project, Heritage Priority Sites; and known contaminated sites. Community resources that are briefly described include population, transportation, township utilities and services, and protected open space. A short history of the community is also included.

For More Information Contact:

Delaware Valley Regional Planning Commission
190 North Independence West
Philadelphia, PA 19106-1572
Phone: 215-592-1800
Fax: 215-592-9125
Internet: www.dvrpc.org

Staff Contacts:	**Email**
Suzanne McCarthy, Project Planner & Manager	smccarthy@dvrpc.org
Kenneth Thompson, GIS Analyst	kthompson@dvrpc.org

for the TOWNSHIP of

ELK

GLOUCESTER COUNTY, NEW JERSEY

Delaware Valley
Regional Planning
Commission

190 N. Independence Mall West
8th Floor
Philadelphia, PA 19106-1520
215.592.1800
www.dvrpc.org