4.0 EXISTING RESOURCE INFORMATION

When planning future water supply options, the existing historic and environmental resources of the county must be taken into consideration. As required by the Regulation[103], the following sections of the plan detail the geologic, hydrologic, historic, and environmental conditions of Goochland County.

4.1 Geologic, Hydrologic and Meteorological Conditions[104]

4.1.1 Geologic Conditions[105]

Goochland County is wholly within the Piedmont Physiographic Province. In Virginia, this province lies between the Blue Ridge Province to the west and the Coastal Plain Province to the east. A geological map of Goochland County is provided in **Figure 10**.

The Piedmont Physiographic Province is a rolling to hilly area that extends from the Fall Line on the east to the foot of the Blue Ridge Mountains on the west. The Fall Line is a low-profile, east-facing scarp that separates crystalline rocks of the Piedmont Province (west) from Cretaceous-age (>65 million years) to Quarternary-age (current), less-resistant, marine and terrigenous sediments of the Coastal Plain Province (east).

The crystalline rocks of the Piedmont Province are Precambrian-age (>570 million years) and Cambrian-age (570-225 million years) metamorphic and igneous rocks, and within the Piedmont Province are several Triassic-age (230 - 181 million years) basins that contain sedimentary rocks.

The Piedmont Province is characterized by deeply weathered bedrock and a relative paucity of solid rock outcrop. Goochland County is generally underlain by the following rock types (from west to east):

[103] 9 VAC25-780-90.
[104] 9 VAC 25-780-90 A.
[105] Soil Survey of Goochland County, Virginia. United States Department of Agriculture – Soil Conservation Services in cooperation with Virginia Polytechnic Institute and State University, 1980.

Table 54: Goochland County Geologic Regions and Rock Types[106]

Geologic Region	Geologic Age	Rock Types
Central Virginia Volcanic-Plutonic Belt	Cambrian to Ordivician	Island-arc-related metavolcanic and metasedimentary mica schist, amphibolite, slate, quartzite, and gneiss
Blue Ridge and Piedmont	Late Proterozoic to Mississippian	Intrusive igneous rocks such as granite, quartz monzonite, and granodiorite
Central Piedmont	Paleozoic	Biotite gneiss, mica schist, gabbro, and amphibolite
Goochland Terrane	Middle Proterozoic	Biotite gneiss, amphibolite, anorthosite,and some metamorphic rocks (granitic gneiss) intrusions near the eastern portion of the county
Mesozoic Basin	Triassic	Conglomerate, sandstone, siltstone, and shale

Overall regional fracture orientations would be northeast-southwest, with some localized variation possible. In-situ weathering of these rocks would produce clays and silts, with some sand possible.

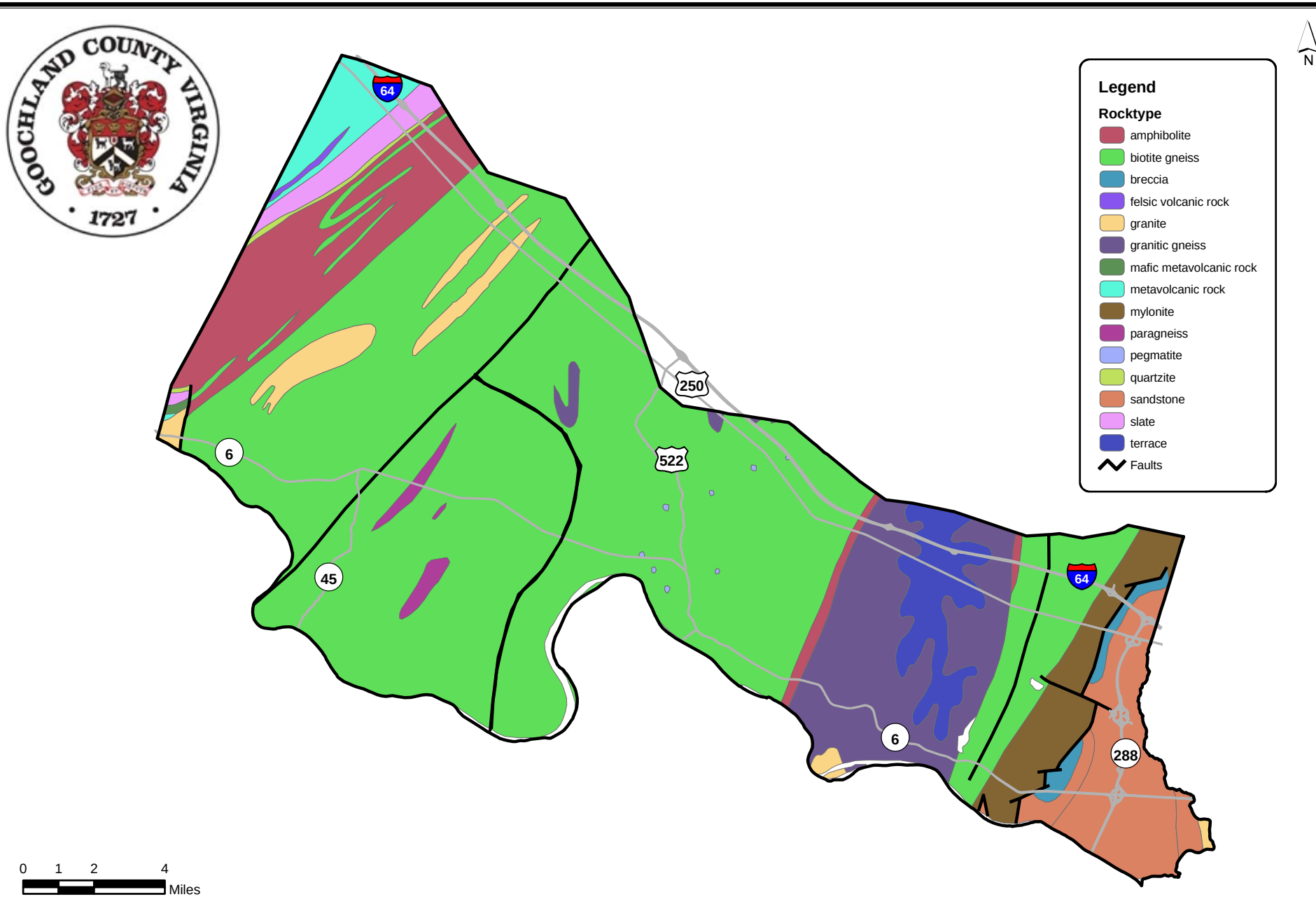
The surface features of the county are those typical of a moderately high plateau dissected by numerous streams. Areas between the streams are moderately wide, and the relief is gently rolling to rolling. Land surface is of three general types:

- Gently rolling to rolling, moderately wide, weakly dissected divides of upland;
- Narrow to moderately wide floodplains along the larger streams; and
- Hilly to steep areas along the major streams where the streams have cut deeply into the upland plateau.

Entrenchment has been rapid along the James River and its major tributaries, and steep slopes commonly rise abruptly from the floodplain.

The highest point in the county, about 525 feet above mean sea level, is in the northwestern section. The elevation of the uplands ranges from about 160 to 525 feet. The lowest point in the county is about 120 feet above mean sea level in the southeastern corner. Floodplains along the James River range from about 120 feet to 200 feet above mean sea level. The land slopes gently toward the southeast.

[106] Commonwealth of Virginia. Department of Mines, Minerals and Energy Division of Mineral Resources. Generalized Geologic Map of Virginia, 1993.



Source: Virginia Division of Mineral Resources, 1993, Geologic Map of Virginia: Virginia Division of Mineral Resources, scale 1:500,000; VDOT; Goochland County

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Geological Conditions

Goochland County, Virginia

DAA# R07246-01

FIGURE
10

4.1.2 Hydrologic Conditions - Groundwater

Throughout the Piedmont Physiographic Province of Virginia, groundwater occurs within two basic horizons, in the soils or "overburden materials" overlaying the bedrock and also within fractures present within bedrock. These two water bearing horizons are typically called the Water Table Aquifer and the Bedrock Aquifer. In many instances the Water Table Aquifer and the shallow fractures in the Bedrock Aquifer are hydraulically interconnected, and behave as a single aquifer. With increasing fracture depths in the Bedrock Aquifer, the likelihood of hydraulic interconnection with the Water Table Aquifer decreases.

Groundwater flow in the Water Table Aquifer usually conforms to the slope of the ground surface, but in a subdued manner. Groundwater gradients are typically much less than those of the ground surface. Flow in bedrock is controlled by the frequency and orientation of the bedrock fractures, which provide permeability to the bedrock. Since groundwater is essentially confined to the fractures, it is possible to drill dry wells as the result of not penetrating any water bearing fractures.

Recharge of the Water Table Aquifer is by infiltration of precipitation and runoff through the overlying soils. The underlying Bedrock Aquifer is recharged slowly by the vertical migration of infiltrating waters through the overburden and into the bedrock fractures. More rapid recharge occurs where fractured bedrock is exposed in stream beds, drainage ways, or surface water bodies such as ponds and lakes.

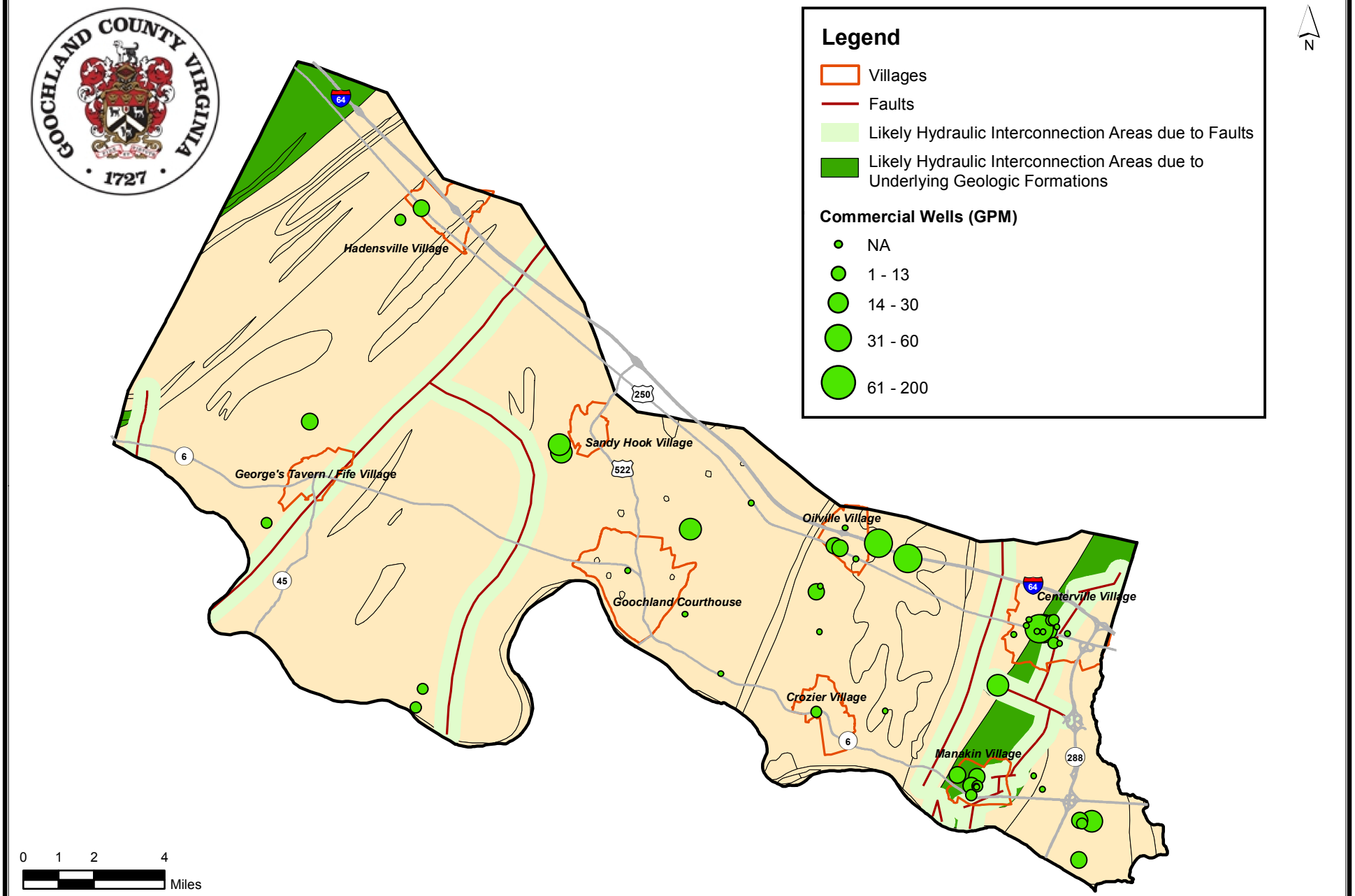
The hydrologic setting is a function of the underlying geology. Two distinctive geologic regimes occur in Goochland County; sedimentary formations occupying the Triassic Basin in the eastern portion of the County, and igneous and metamorphic formations to the west and throughout the rest of the County. With the exception of some Triassic sandstone aquifers, the County's groundwater system is dependent on fractures for groundwater production, yield and recharge.

The Piedmont Physiographic Province, generally to the west of Interstate 95 in Virginia, consists predominantly of igneous intrusions and plutons, and metamorphic formations including gneisses, schists, amphibolites, and mylonites.[107] Faults, where present, often trend in a northeast – southwest direction and are typically bound by fracture zones that extend outward from the faults. In this hydrogelogic setting, the occurrence of groundwater is a function of fracture density.

There has been little detailed geologic mapping and Bedrock Aquifer research in the Virginia Piedmont. Published geologic literature for Goochland County is limited; it consists of a Virginia Division of Mineral Resources bulletin with geologic map for Goochland County, several more detailed geologic maps (7-1/2 minute quadrangles) that include the eastern Triassic Basin and immediately surrounding areas, and several publications describing historic gold mining activities.

Based on reviews of this literature and discussions with local well drillers, the best potential for developing wells yielding 25 to 100 gallons per minute is within fault zones and mylonite formations (highly weathered and fractured metamorphic rocks resulting from faulting and other geologic deformation). These general areas are highlighted on the following figure. Detailed study is necessary to more accurately characterize their nature and extent.

[107] Generally, light to dark colored granite-like rocks.



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Ground Water Hydrology

Goochland County, Virginia

DAA# R07246-01

FIGURE
11

4.1.3 Hydrologic Conditions - Groundwater Recharge Potential

The recharge potential, also known as the available groundwater supply, can be estimated based on several known variables. These variables are the county's total surface area, average rainfall infiltration (approximately 6 inches of the annual precipitation recharges into the groundwater system), and percentage of undeveloped area. The equation for recharge potential does not take into account the geology or hydrogeologic characteristics of the area. This is a theoretical method of calculating the amount that is potentially available for extraction.

The equation and parameters are shown in the following table. Assuming that 25% of the total recharge potential can be extracted through wells, approximately 18.6 mgd of groundwater is potentially available for use. However, the cost and feasibility of withdrawing this water will require further study if it is to be used as a significant source to meet future demands in concentrated areas of development.

Table 55: Goochland County Groundwater Recharge Potential

Equation:
Recharge Potential = Total Surface Area X 43,560 ft^2 per acre X Estimated Recharge X Estimated Percentage of Undeveloped Area X 7.48 gallons per cubic foot
Known Variables:
Total County Surface Area = 298 square miles
Total County Surface Area = 184,960 acres
Estimated Annual Precipitation = 38.0 inches[108]
Estimated Variables:
0.5 feet = Estimated Recharge from Annual Precipitation
90% = Estimated Percentage of Undeveloped Area (Agriculture, Wooded)
Recharge Potential = 184,960 X 43,560 X 0.5 X .90 X 7.48 = 27,119,382,682 gallons per year
Assume 25% can be developed through the use of wells, then:
Recharge Potential = 6,779,845,670 gallons per year, or,
Recharge Potential = 18,574,920 gallons per day

[108] Soil Survey of Goochland County, Virginia. United States Department of Agriculture – Soil Conservation Services in cooperation with Virginia Polytechnic Institute and State University, 1980.

4.1.4 Hydrologic Conditions - Surface Hydrology[109]

Goochland County is, for the most part, drained by the James River and its tributaries. The James River flows toward the southeast, and its tributaries flow toward the south and southeast. The river forms the southern boundary of the county. The western section of the county is drained by Byrd Creek, and the eastern section by Tuckahoe Creek. The rest of the county is drained by Beaverdam Creek, Courthouse Creek, and Lickinghole Creek, all of which discharge into the James River. The northernmost section of Goochland County is drained by the York River and its tributaries. In total, approximately 3,550 acres (1.92%) of the county are covered by water.

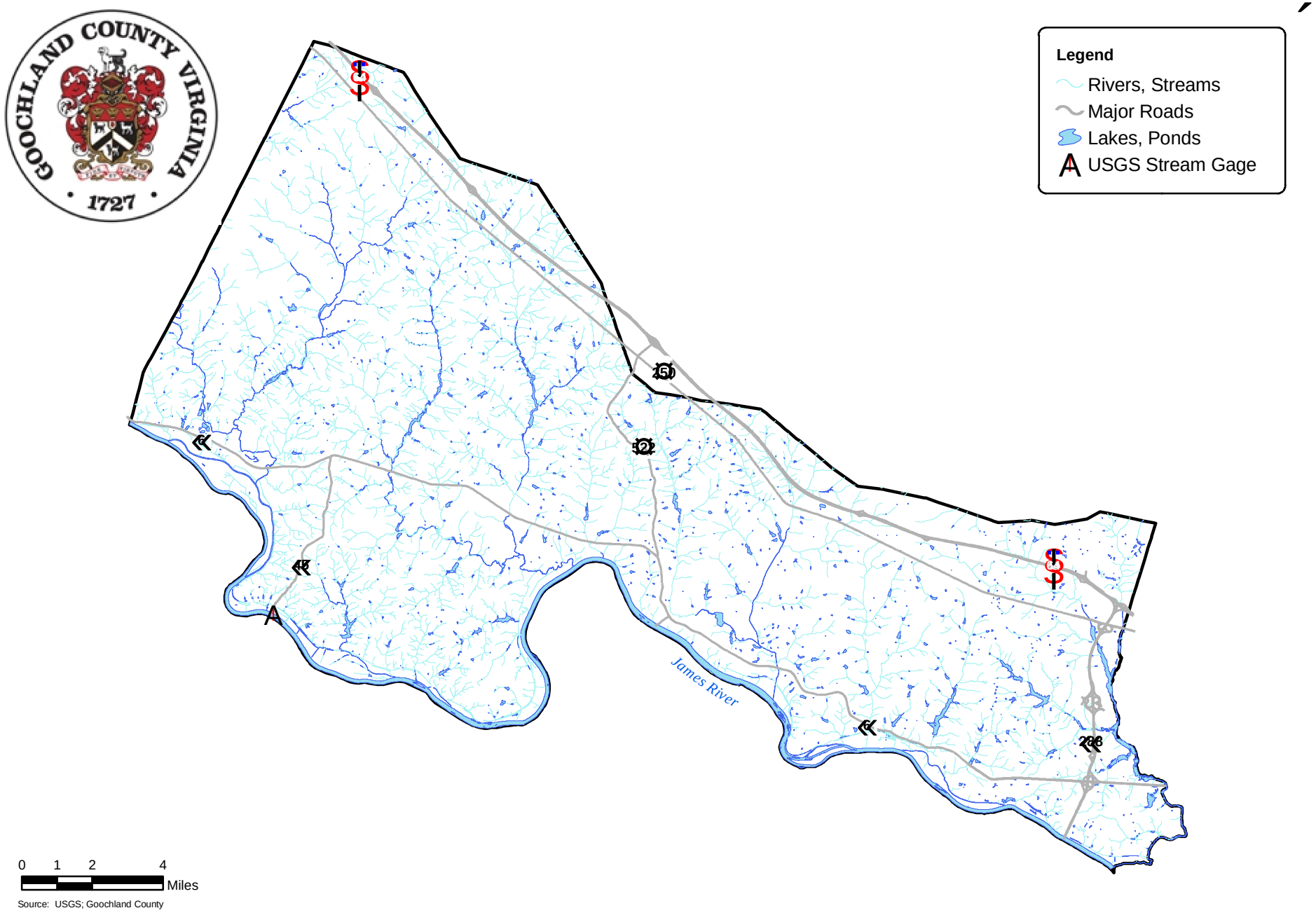
There are several USGS stream gages in Goochland County. However, only the Cartersville gage has extensive long-term data available. Other gages throughout the county do not have available information or are no longer in use. The following table depicts the location and general statistics for the Cartersville gage.

Table 56: USGS Stream Gage in Goochland County

Agency	Site Number	Location	Period of Record	Minimum Flow on Record (cfs)	Peak Stream Flow on Record (cfs)	Mean Annual Discharge (cfs)
USGS	2035000	James River at Cartersville, VA	January 1899 - October 2007	316	362,000	7,081.6

Except for some upland flats, some smaller, narrower floodplains, and some areas on the larger floodplains near the uplands, the surface drainage in the county generally is good. The drainage pattern is generally dendritic and irregularly branched. Rectangular drainage patterns occur locally when influenced by prominent fractures or faults in the underlying bedrock. The following figure depicts the surface hydrology of Goochland County.

[109] Soil Survey of Goochland County, Virginia. United States Department of Agriculture Soil Conservation Services in cooperation with Virginia Polytechnic Institute and State University, 1980.



Source: USGS; Goochland County

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Surface Hydrology

Goochland County, Virginia

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FIGURE
12

4.1.5 Hydrologic Conditions - Watersheds[110]

Goochland County, for the most part, is located within the James River watershed. Small areas of Goochland County along the northern border drain into the York River watershed. Both the James River and York River watersheds flow into the Chesapeake Bay. The following table depicts the sub-watersheds located in Goochland County:

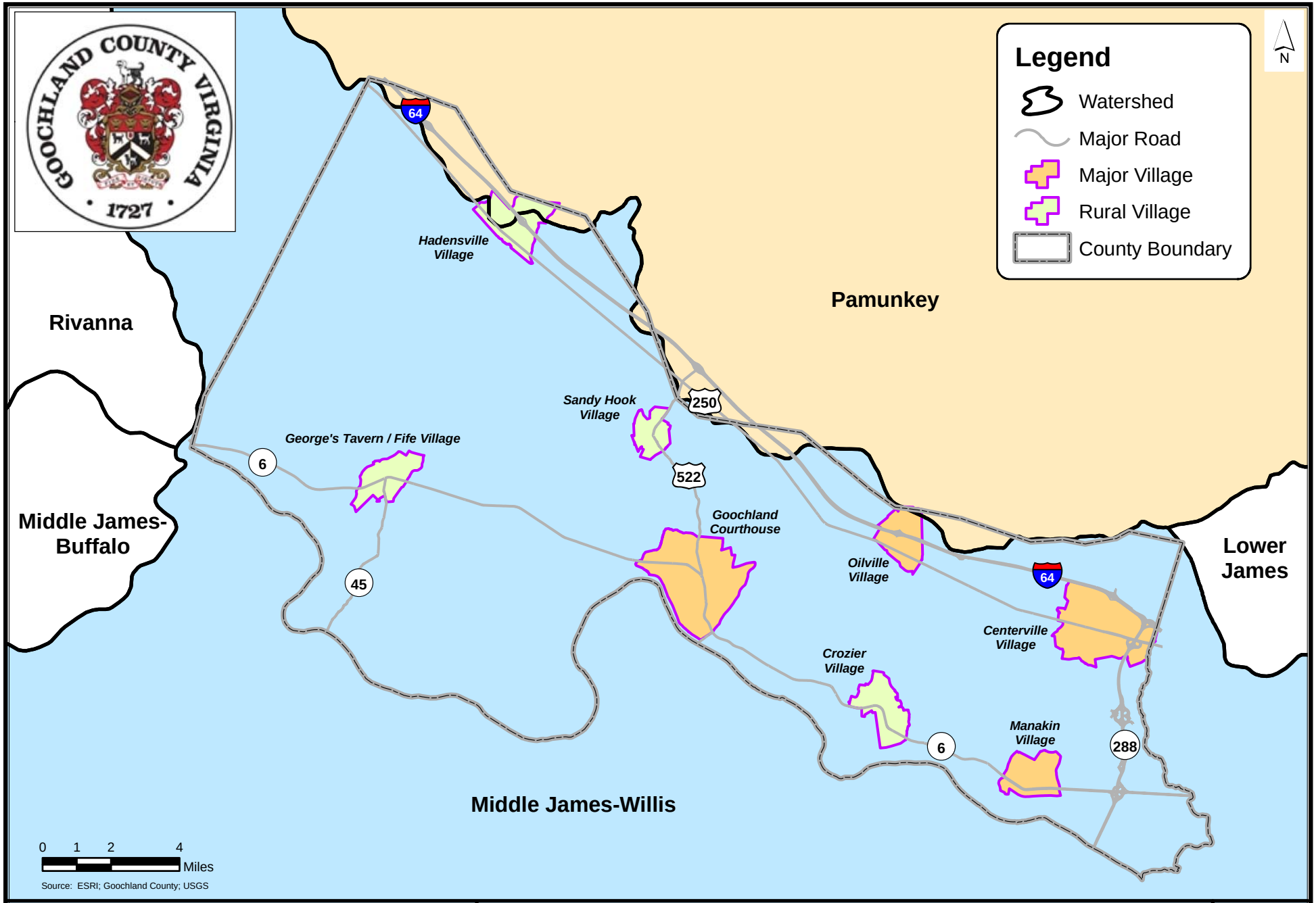
Table 57: Sub-Watersheds in Goochland County[111]

Watershed ID	Percentage of County
Lickinghole Creek	26.87
Dover Creek/ Tuckahoe Creek/ James River	22.69
Beaverdam Creek	19.26
Lower Byrd Creek/ Little Byrd Creek	17.31
Muddy Creek/ Deep Creek/ James River	8.57
Taylors Creek/ South Anna River	8.57
Upper Byrd Creek	1.96
Roundabout Creek/ Harris Creek/ South Anna River	0.01

The major watersheds and sub-watersheds are presented in the following figures.

[110]Soil Survey of Goochland County, Virginia. United States Department of Agriculture – Soil Conservation Services in cooperation with Virginia Polytechnic Institute and State University, 1980.

[111]Virginia Hydrologic Unit Atlas. Department of Conservation and Recreation – Division of Soil & Water Conservation. Information Support System Laboratory – Department of Agricultural Engineering, Virginia Tech, 1991.



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Major Watersheds

Goochland County, Virginia

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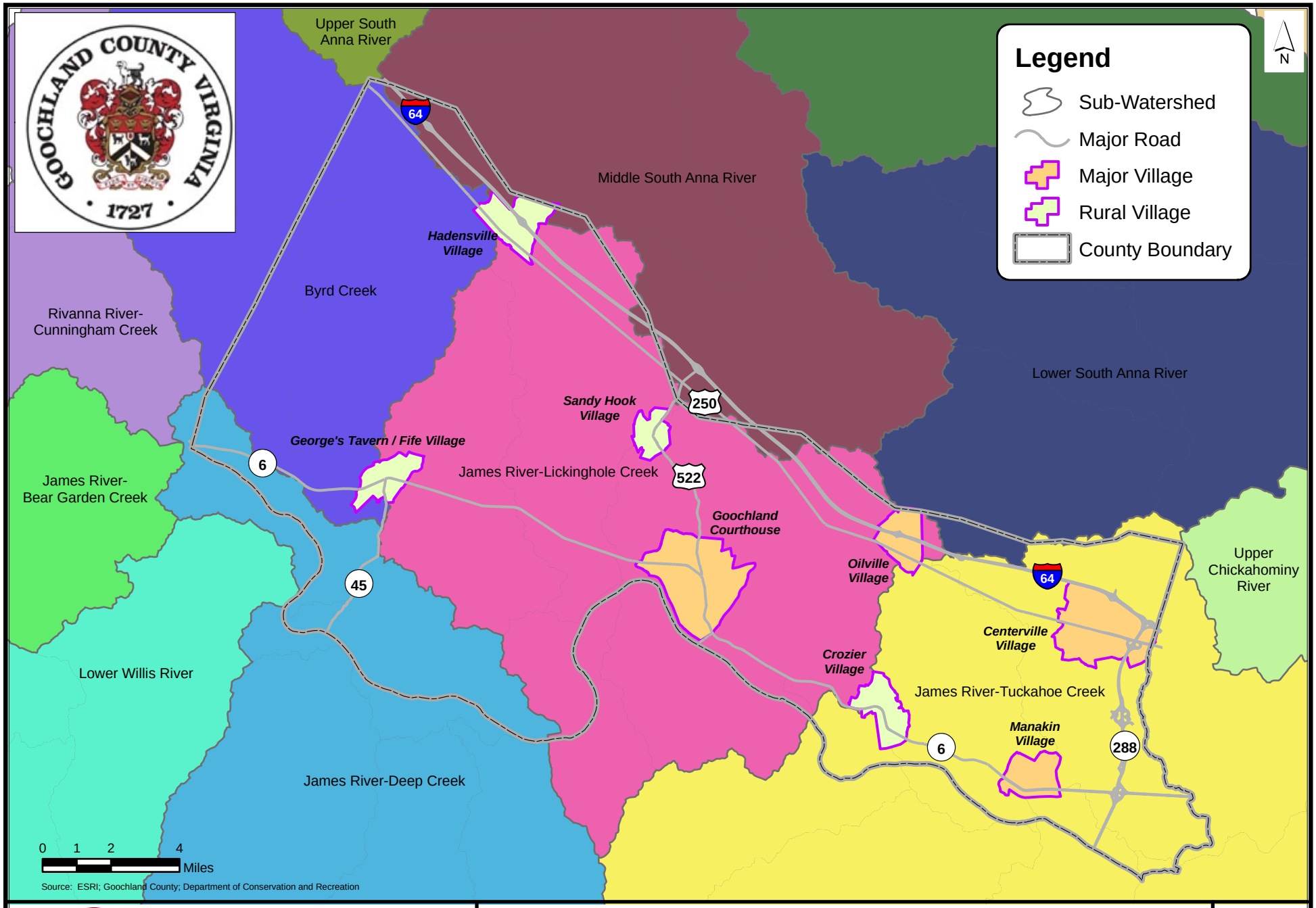
FIGURE
13



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Sub-Watersheds

Goochland County, Virginia

DAA# R07246-01

FIGURE
14

4.1.6 Hydrologic Conditions - Water Supply

According to records from the Virginia Department of Health and the Department of Environmental Quality, there are no water supply reservoirs in Goochland County. However, there are several regulated dams in Goochland County that are used only for recreational purposes. The table below shows all of the regulated water impoundments located within the County:

Table 58: Regulated Dams

Regulated Dam	Owner/Location
Dover Lake	Sabot Hill Farm
Pruitts Dam	Sandy Hook
Westview Dam	Westview on the James
E.G. Bowles Dam	Oilville
Lake Dillon Dam	Boy Scouts of America
Broad Branch Dam	Kinloch Lake Association
Rivergate Lake Dam	Patterson Avenue
Stoney Pond Dam	Manakin-Sabot
Picketts Creek	Clover Forest
Hermitage Country Club	Manakin-Sabot

As detailed in **Section 3.0** of this Plan, the majority of the population in Goochland County obtains water from self-supplied residential wells. These self-supplied groundwater users are generally located in the western and central region of the county where more rural development is prominent. There are also five community well systems in Goochland County that mainly serve residential users. However, large community systems such as the Eastern Goochland System, James River Correctional Center, and the Courthouse System distribute water to a large number of commercial, industrial, and residential users.

The Eastern Goochland System purchases water from Henrico County, which withdraws directly from the James River. Henrico County's raw water is treated using conventional flocculation, sedimentation, ozone treatment, and filtration.[112] The treated water is distributed to the Eastern Goochland System through four metered points: River Road, Centerville, Patterson Avenue, and Ridgefield Parkway.

[112] Contractual Water Agreement between County of Henrico and the County of Goochland. See **Appendix D.**

The James River Correctional Center Water Treatment Plant withdraws surface water from the James River and is treated by conventional flocculation, sedimentation, and filtration processes. The Courthouse System purchases treated water from the Department of Corrections.[113]

According to the Comprehensive Plan, "Water shortages currently exist for large segments of the county using wells. This problem is periodically amplified due to drought conditions and can be reduced or eliminated by expanding utility service areas."[114] The expansion of water systems and alternative water supply options for Goochland County are discussed in **Section 8.0** of this Plan.

4.1.7 Meteorological Conditions

According to the USDA Soil Conservation Service, Goochland County is hot in summer and rather cold in winter. Precipitation is well distributed through the year and is normally adequate for all crops. Winter precipitation frequently occurs as snow, but the ground does not usually stay covered for more than a few days at a time. [115]

In winter, the average temperature is 37 degrees F, and the average daily minimum temperature is 26 degrees. The lowest temperature on record, which occurred on January 18, 1957, is -7 degrees. In summer, the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on September 8, 1954, is 105 degrees.

Of the total annual precipitation, 22 inches, or 52 percent, usually falls in April through September, which includes the growing season for most crops. Average seasonal snowfall is 5 inches. The average relative humidity in mid-afternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about

[113] Contractual Water Agreement between the Virginia Department of Corrections and the County of Goochland. See **Appendix B**.
[114] Goochland County 2028 Comprehensive Plan.
[115] Soil Survey of Goochland County, Virginia. United States Department of Agriculture – Soil Conservation Services in cooperation with Virginia Polytechnic Institute and State University, 1980.

85 percent. The percentage of possible sunshine is 65 in summer and 50 in winter. The prevailing wind is from the west. Average wind speed is highest, 9 miles per hour, in March.

4.2 Existing Environmental Conditions that Pertain to or May Affect In-Stream Flow, In-Stream Uses, and Sources that Provide the Current Supply[116]

4.2.1 State or Federal Listed Threatened or Endangered Species or Habitats of Concern[117]

The Virginia Department of Game and Inland Fisheries and the Department of Conservation and Recreation list eight threatened or endangered species as "known or likely to occur" within Goochland County:

- Federal and state endangered James Spinymussel (Pleurobema collina);
- State threatened Bald Eagle (Haliaeetus leucocephalus);
- State endangered Brook Floater (Alasmidonta varicosa);
- State threatened Migrant Loggerhead Shrike (Lanius ludovicianus migrans), Atlantic Pigtoe (Fusconaia masoni), Loggerhead Shrike (Lanius ludovicianus), Green Floater (Lasmigona subviridis), and Upland Sandpiper (Bartramia longicauda).

The James Spinymussel resides in waters with slow to moderate current with sand and gravel substrates. The James Spinymussel is part of the Virginia Wildlife Action Plan, listed as needing critical conservation. Bald Eagles generally nest along rivers. The Brook Floater is a species of mollusk found in fast-flowing, clean water with gravel and sand substrates. Both the Bald Eagle and the Brook Floater are part of the Virginia Wildlife Action Plan, listed as needing very high conservation. Further water supply strains and drawdown of the James River could adversely impact its aquatic ecosystem.

The Department of Conservation and Recreation recommends coordination with the Virginia Department of Game and Inland Fisheries to ensure compliance with protected species legislation. To minimize adverse impacts to the aquatic ecosystem as a result of any proposed activities, the Department of Conservation

[116] 9 VAC 25-780-90 B.
[117] 9 VAC 25-780-90 B.1.

and Recreation also recommends the implementation of and strict adherence to erosion and sediment control measures during all land disturbing activities.

4.2.2 Anadromous, Trout and other Significant Fisheries[118]

The Virginia Fish and Wildlife Information Service database maintained by VDGIF indicates that a portion of the James River along Goochland County (south of Route 522) has been designated as a confirmed Anadromous Fish Use Area. The designation is due to the documentation of anadromous and semi-anadromous species (for example alewife, striped bass, blueback herring, yellow perch, American shad, and hickory shad).

The James River north of Route 522 is designated as having the potential as an Anadromous Fish Use Area. However, the database does not indicate the presence of trout within Goochland County. No other significant fisheries were reported using the VDGIF database.[119]

4.2.3 River Segments that have Recreational Significance including Scenic River Status[120]

The Virginia Scenic Rivers program began in 1970 with passage by the General Assembly of the Virginia State Scenic River Act (Code of Virginia: Title 10.1, Chapter 4 Sections 10.1-400 through 10.1-418). Since then, 22 river segments totaling approximately 505.85 miles have been designated state scenic rivers (as of July 16, 2007). The intent of the Virginia Scenic Rivers program is to identify, designate and help protect rivers and streams that possess outstanding scenic, recreational, historic and natural characteristics of statewide significance for future generations. According to the Virginia Department of Conservation and Recreation, a section of the James River from Columbia to Maidens along the southwestern border of Goochland County, qualifies for designation as a Virginia Scenic River, but has not yet been designated. Another section of the James River

[118] 9 VAC 25-780-90 B.2.
[119] VDGIF. Virginia Department of Game and Inland Fisheries. Virginia Fish and Wildlife Information Services Search for Goochland County, VA.
[120] 9 VAC 25-780-90 B.3.

from Maidens to Watkins Landing has potential components to be designated as a Virginia Scenic River, but also has not yet been officially designated as a scenic river.

According to the 2007 Virginia Outdoors Plan (VOP), set forth by the Virginia Department of Conservation and Recreation, several natural areas in Goochland have been recommended for outdoor recreation and land conservation. The VOP states one such area located along the eastern border of Goochland County, "…the old canal locks and railroad embankments, recalling Gayton Coal Mines and other historic interests, plus the heavily wooded swamps and ravines along Tuckahoe Creek would provide a natural setting for outdoor recreational and ecological study serving Henrico and Goochland counties."[121]

4.2.4 Sites of Historical Significance[122]

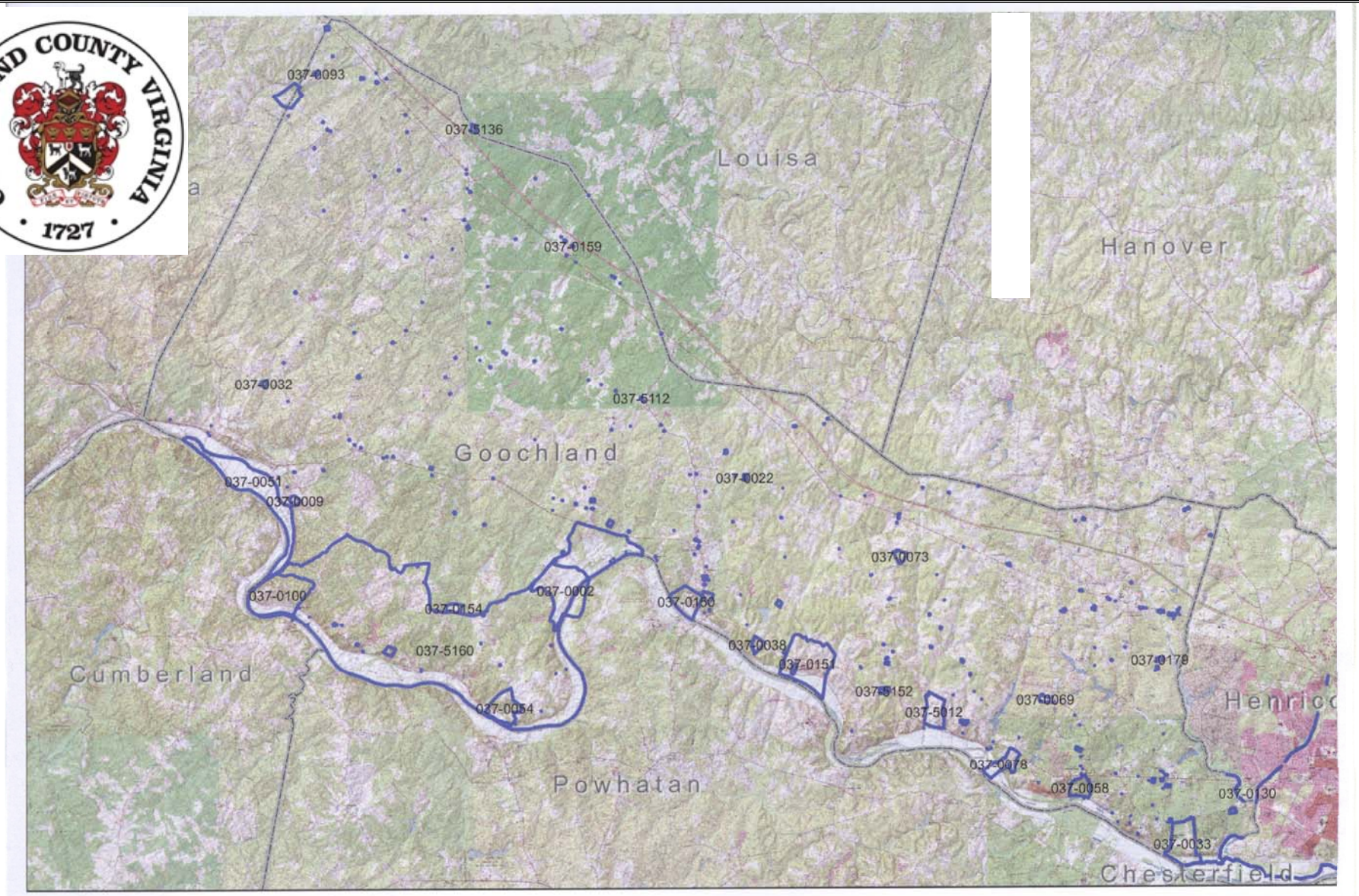
The Virginia Department of Historic Resources lists approximately 326 historic architectural sites in Goochland County; of these, 21 are on the National Register of Historic Places. The following table lists the sites listed on the National Register of Historic Places in Goochland County.

[121] Virginia Outdoors Plan. Prepared by the Virginia Department of Conservation and Recreation (VDCR), 2007.
[122] 9 VAC 25-780-90 B.4.

Table 59: Historic Places

VDHR ID	Site	Quadrangle
037-0100	Howard's Neck	Cartersville
037-0003	Bolling Island Plantation	Cartersville
037-5010	Tanglewood Ordinary	Perkinsville
037-0069	Rochambeau Farm	Hylas
037-0002	Bolling Hall	Goochland
037-0004	Brightly	Goochland
037-0073	Springdale	Perkinsville
037-0035	Woodlawn (Taylor Home)	Hylas
037-5012	Dover Slave Quarter Complex (Brookview Farm)	Perkinsville
037-0038	Mount Bernard Complex (Lightfoot's Beaverdam Plantation/Kameschatka)	Perkinsville
037-0016	Byrd Presbyterian Church	Goochland
037-0023	Powell's Tavern (Double House)	Midlothian
037-0078	Ben Dover	Midlothian
037-0015	Lockkeeper's House	Goochland
037-0136	Goochland County Court Square	Goochland
037-0163	Jackson Blacksmith Shop	Goochland
037-5051	Second Union Colored School (Rosenwald)	Caledonia
037-0033	Tuckahoe	Midlothian
037-0054	Rock Castle/Queen Anne Cottage	Goochland
037-0009	Elk Hill (Harrison's)	Cartersville
037-0032	Tinsleyville Tavern	Columbia

The following figure depicts all of the architectural sites in Goochland County.



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Architectural Sites

Goochland County, Virginia

DAA# R07246-01

FIGURE
15

4.2.5 Sites of Archaeological Significance[123]

There are approximately 363 known archaeological sites in Goochland County; only two are listed as eligible for the National Register of Historic Places. The following table details the two Nationally Registered archeological sites in Goochland County. [124]

Table 60: Sites of Archaeological Significance in Goochland County

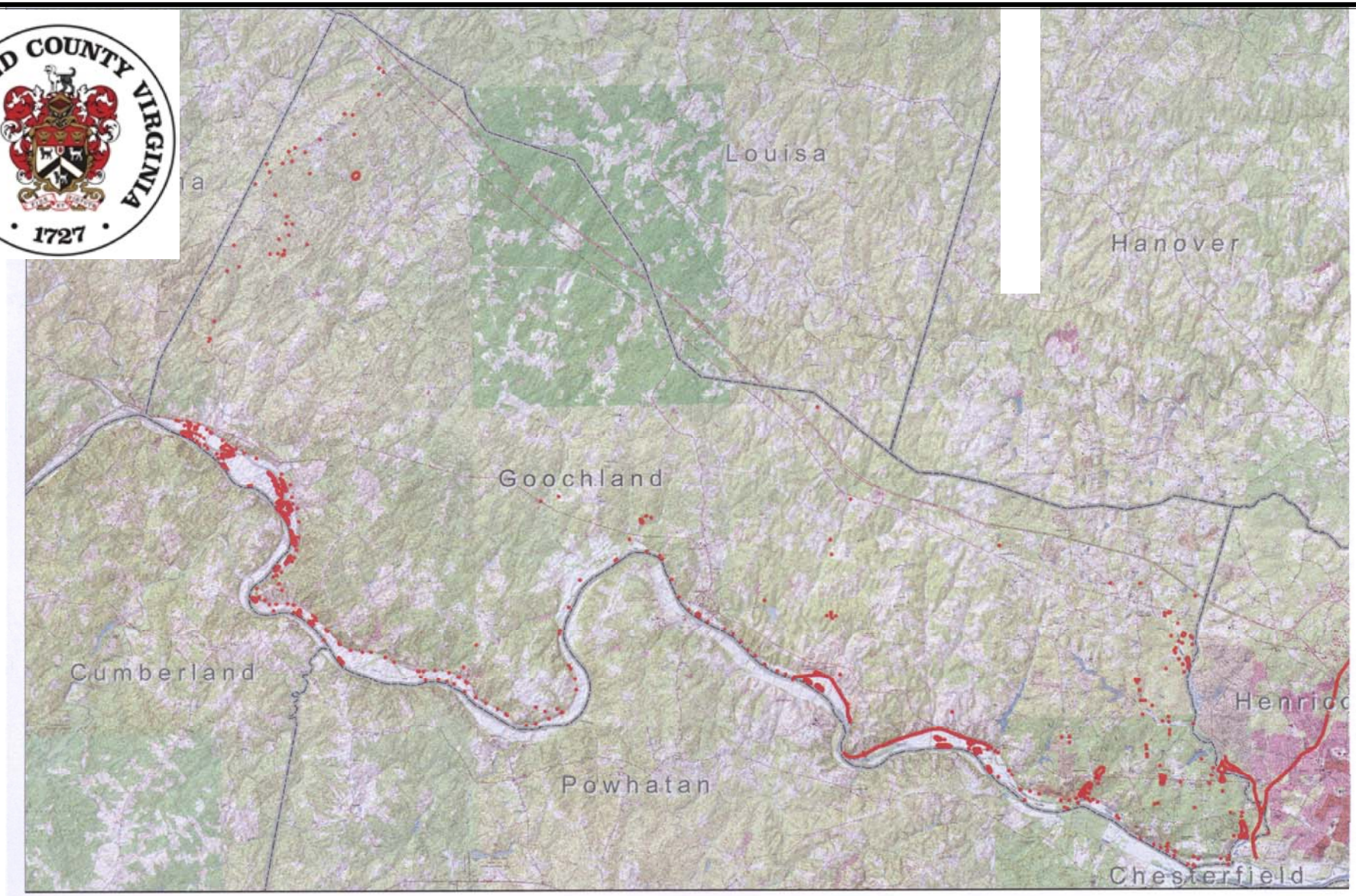
VDHR ID	Site	Quadrangle
44GO0357	Woodland Settlement Camp	Hylas
44GO0256	Woodward Pits, Coal Mine	Midlothian

Most of the archaeological sites in Goochland are thought to be from the Late Woodland phase, which is generally viewed as a stage dating from about 1000 B.C. to A.D. 1000. Native Indian artifacts uncovered include a wide range of pottery forms, stone artifacts, and bone tools such as awls, fishhooks, needles, and turtle shell cups. Jewelry for the wealthy was made from imported shell and copper. Ceremonial and symbolic objects of stone, copper, and shell were also discovered. All of the known archaeological sites located in Goochland County are shown on the following figure.

Should any archaeological resources be discovered during water supply projects, the county should notify VDHR as soon as practicable.

[123] 9 VAC 25-780-90 B.4.

[124] McCary, Ben. 1957 reprinted 2007. Indians in Seventeenth Century Virginia. The Virginia 350th Anniversary Celebration Corp Publication, 93 pages.



Project: Goochland County Water Supply Plan
Firm: Draper Aden Associates
Quad/County: Goochland County
Date Created: 09/19/07
Created By: BSB

0 1.25 2.5 5 Miles

Goochland_Arch

County Boundaries

N W E S

Source: Virginia Department of Historic Resources

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Archaeological Sites

Goochland County, Virginia

DAA# R07246-01

FIGURE
16

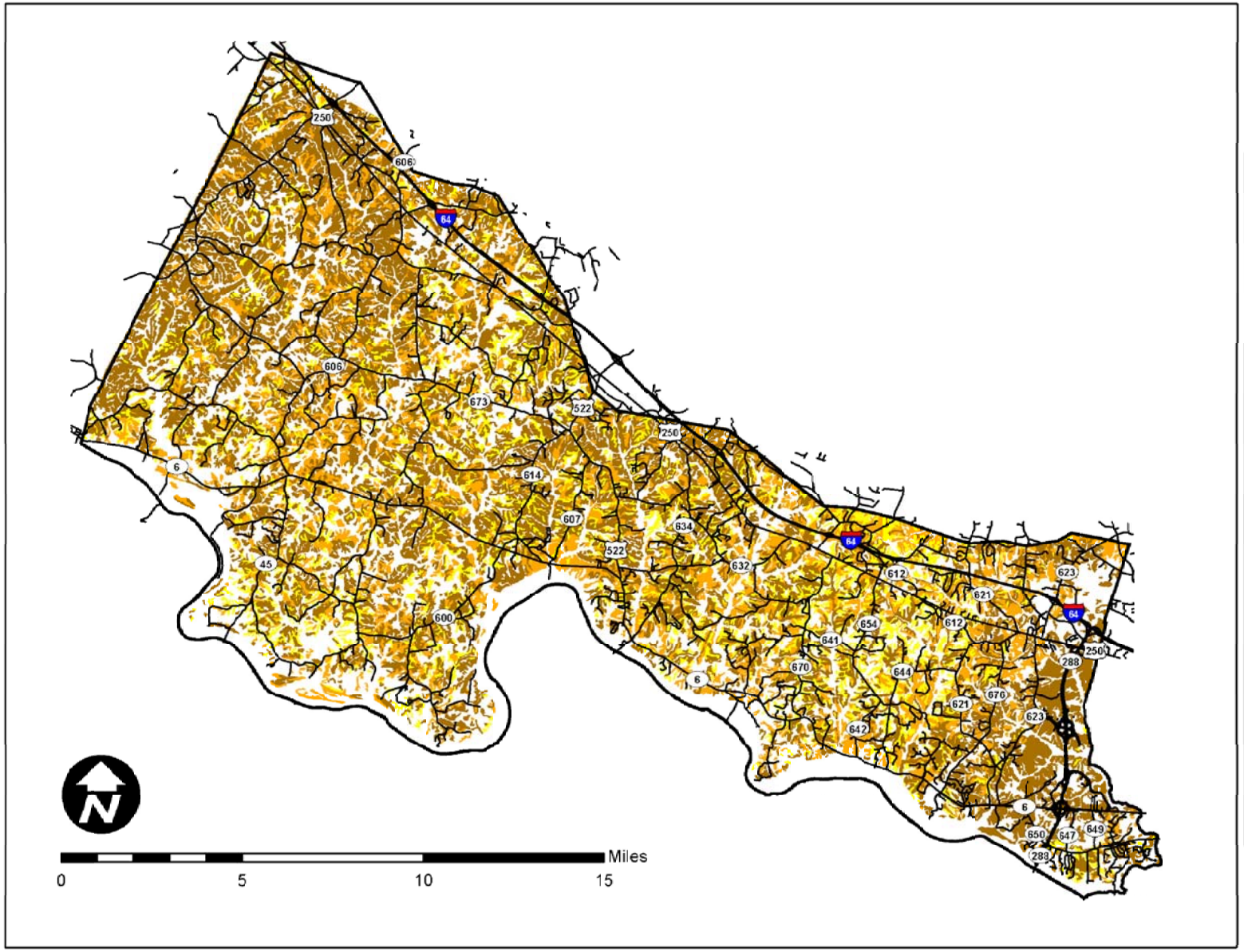
4.2.6 Unusual Geologic Formations or Special Soil Types[125]

According to the USDA Soil Survey, many soil types in Goochland County are susceptible to severe limitations for septic drain fields. Also, poorly drained soils or those susceptible to shrink swell require special attention with respect to buildings and roads. Steep slopes and flooding, in conjunction with soil limitations, introduce the potential for contamination of both private wells and streams. The soil limitations in Goochland County are presented in the following figure.

According to the Virginia Division of Mineral Resources, there are abandoned copper, lead, zinc, gold, and coal mines located throughout the county.[126] Historically, there have been several gold mines in the western region of the county and coal mines in the eastern region of the county, near Manakin.

The Virginia Department of Conservation and Recreation Natural Heritage database does not indicate the presence of any significant geologic formations identified by the 2007 Virginia Outdoors Plan under VDCR's jurisdiction in the county.

[125] 9 VAC 25-780-90 B.5.
[126] Virginia Division of Mineral Resources - Publication 93, dated 1989.



Legend

Roads

Slight

Moderate

Severe

Source: Goochland County, NRCS SSURGO Soils Data

March 4, 2003

Source: Goochland County Comp. Plan

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Soil Limitations

Goochland County, Virginia

DAA# R07246-01

FIGURE
17

4.2.7 Wetlands[127]

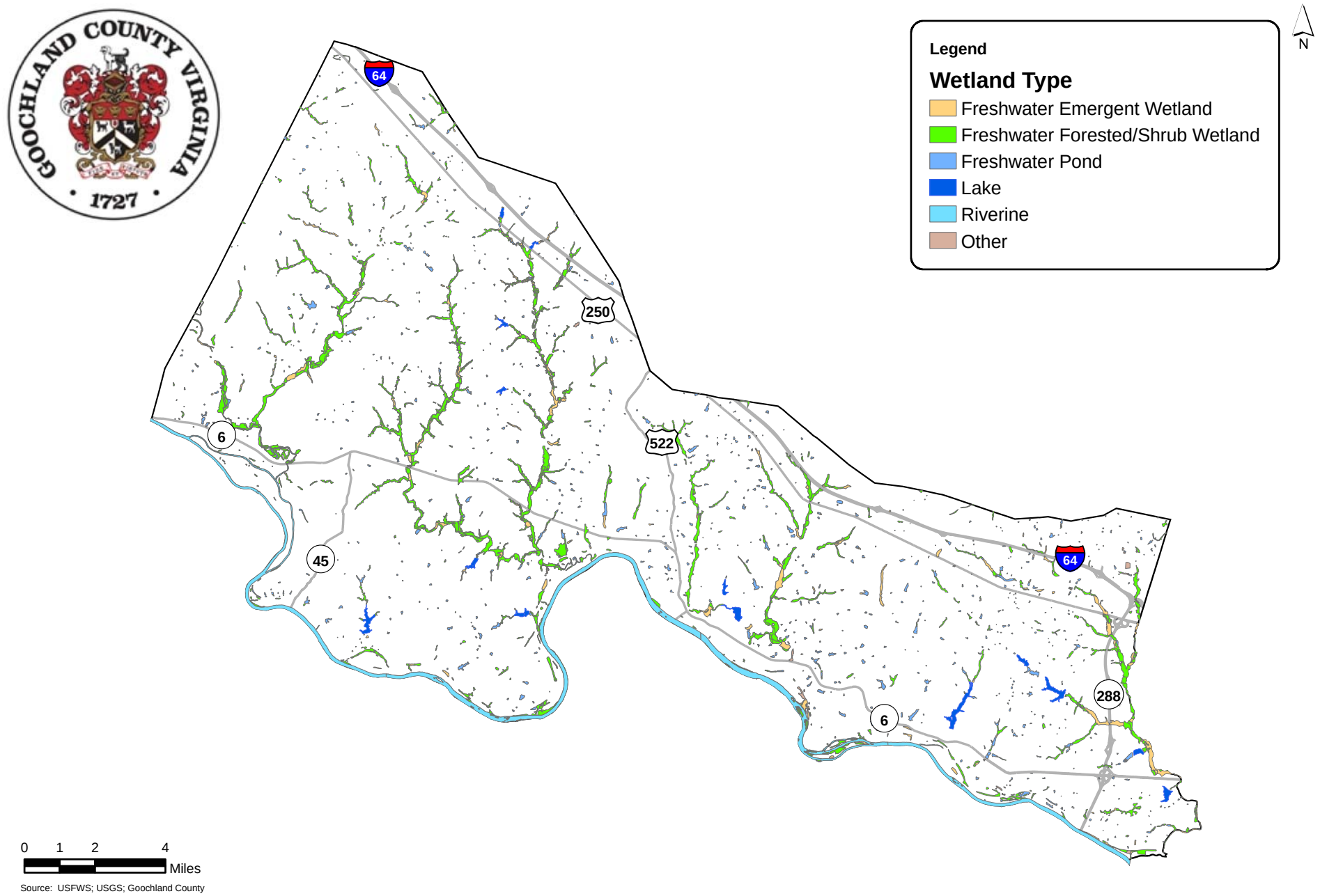
It is estimated that there are approximately 19,386 acres of non-tidal wetlands within Goochland County. Existing wetlands in Goochland County are presented in **Figure 18.**

4.2.8 Riparian Buffers[128]

A riparian forest buffer encompasses the area from the streambank in the floodplain to, and including, an area of trees, shrubs, and herbaceous vegetation located upslope from the body of water. Buffers are established and managed to reduce the impact of adjacent land use. The design of a buffer serves several important functions: it preserves the stream's natural characteristics, protects water quality, and improves habitat for plants and animals on land and in the water.[129]

Continued development and clearing of land along streams and other waterways induces the potential for excess nutrient and sediment runoff. Retention of a vegetated buffer along streams can act as a natural filter to control runoff. According to the Comprehensive Plan, to help protect sensitive areas from new development, the county has proposed to "establish riparian buffers along all surface water bodies to protect water resources from additional nutrient and sediment loadings. These buffers should restrict development at least 100 feet from the edge of perennial streams and at least 50 feet from the edge of intermittent streams." [130]

[127] 9 VAC 25-780-90-B.6.
[128] 9 VAC 25-780-90-B.7.
[129] U.S. Dept. of Agriculture, Forest Service. 1966. Riparian Forest Buffers.
[130] Goochland County 2028 Comprehensive Plan.



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Goochland County, Virginia

DAA# R07246-01

FIGURE
18

4.2.9 Conservation Easements[131]

A conservation easement, or conservation restriction, is a legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land in order to protect its conservation value. In Virginia, most conservation easements are held by the Virginia Outdoors Foundation, a state agency founded in 1966. As of 2008, in Goochland County, over 2,580 acres of conservation easements exist. These conservation easements are tabulated below:

Table 61: Summary of Land Conservation Easements[132]

Property	Acreage	Holder(s)
On Beaverdam Creek	111.34	Virginia Outdoors Foundation
Ben Dover (part)	91.08	Virginia Outdoors Foundation
Bolling Island	47.1	Department of Historic Resources
Brookview	300.26	Department of Historic Resources, Virginia Outdoors Foundation
Elgin	200	Virginia Outdoors Foundation
Henebry Farm	44.6	Virginia Outdoors Foundation
On Lickinghole Creek	179.64	James River Association, Capital Regional Land Conservancy*, Virginia Outdoors Foundation
Midway	188.875	James River Association, Capital Regional Land Conservancy*
Rock Castle	297.35	Department of Historic Resources
Tuckahoe Plantation	336.85	Department of Historic Resources
Payne	392	Virginia Outdoors Foundation
Rochambeau Farm	34.36	Department of Historic Resources
Williams Property	56.873	Goochland County
Subdivision Conservation Easements[133]		
The Preserve at Parker's Hill	50.956	
The Preserve at Deerfield	48.166	
The Preserve at Manakin-Sabot	43.038	
Somerset	55.83	
Sabot Creek	62.79	
Autumn Breeze	16.3	
Tyler's Creek	22.129	
Melrose Trace	0.897	
TOTAL	**2,580.43**	

*Formerly, the Goochland Land Alliance.

[131] 9 VAC 25-780-90 B.7.

[132] Goochland Land Alliance. Goochland County Easements. Compiled from easement presentation on Goochland Land Alliance.

[133] Easements are held by the Goochland County and Goochland County Public Recreational Facilities Authority.

4.2.10 Land Use and Land Coverage[134]

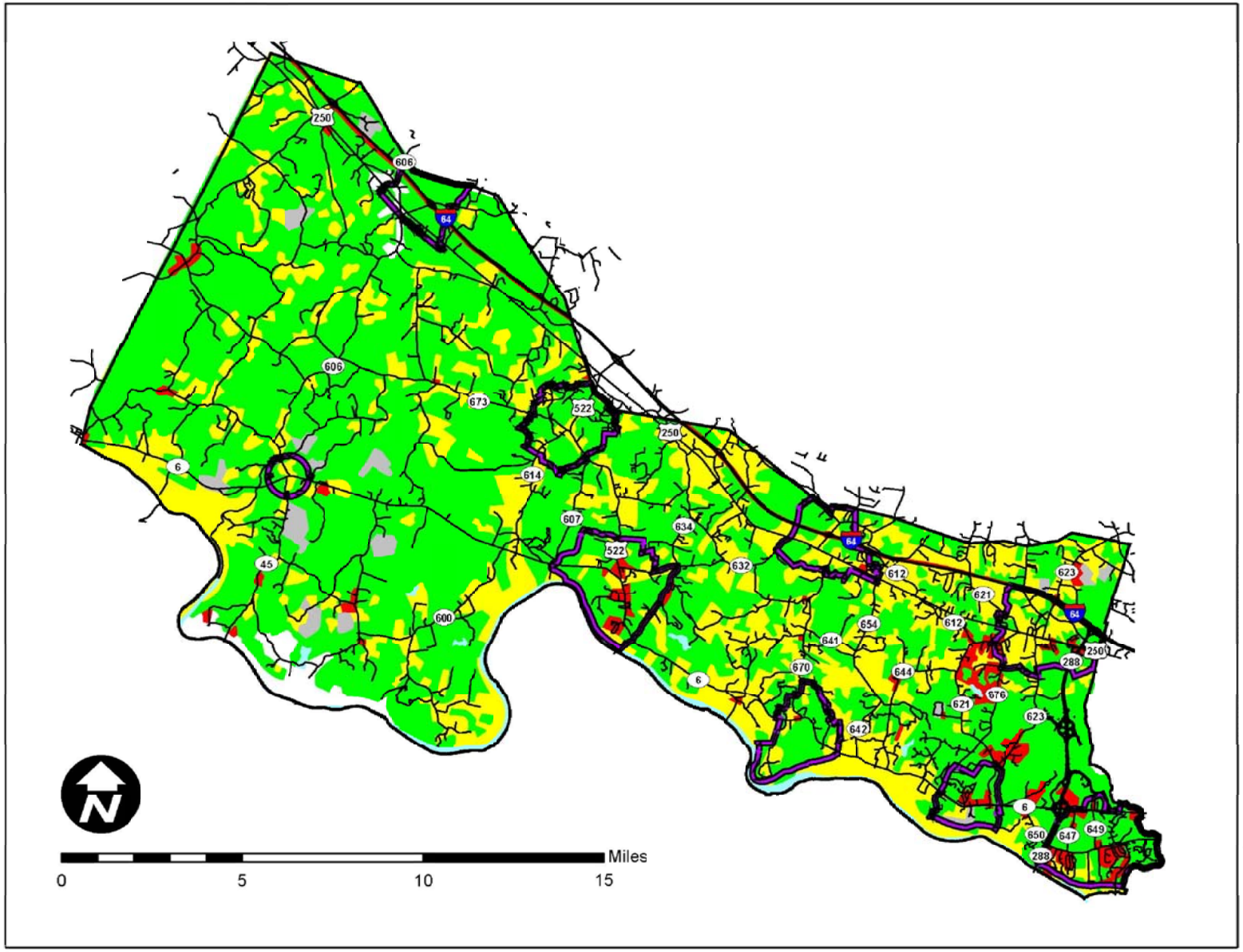
According to the USDA Soil Survey of Goochland County, farming is the dominant enterprise in the county, although urban expansion from Richmond and Henrico County is replacing agriculturally related activities in the eastern section of the county with housing, recreational facilities, and small industry. Most farms produce beef cattle, corn, and soybeans. A few produce poultry and dairy cattle. The county is about 65% woodland.

According to the Comprehensive Plan, population growth is spread across the entire county, including areas outside the villages and the Tuckahoe Creek Service District.

Commercial and industrial uses slated for the West Creek Office Park will increase the demand for residential development and retail services in the eastern part of Goochland County as well as Powhatan, Chesterfield, Henrico, and Hanover Counties.

Due to the location of the county in the Richmond metropolitan area and the continuing outward expansion of the suburban and urban growth, requests for new development are expected to increase.[135] The existing land use in Goochland County is depicted in the following figure.

[134] 9 VAC 25-780-90-B.8.
[135] Goochland County 2028 Comprehensive Plan.



GOOCHLAND COUNTY VIRGINIA 1727

Legend

- Roads
- Village Boundary
- Urban Areas
- Agricultural Land
- Forest Land
- Water
- Barren/Stip Mine

Source: Goochland County, VA Department of Forestry

March 4, 2003

Source: Goochland County 2023 Comprehensive Plan

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Goochland County, Virginia

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FIGURE 19

4.2.11 Presence of Impaired Streams and Type of Impairment[136]

The Virginia Fish and Wildlife Information Service database maintained by the Virginia Department of Game and Inland Fisheries (VDGIF) indicates that there are no "federally" threatened and endangered waters located within Goochland County. The James River is listed as "state" threatened and endangered water adjacent to Goochland County from the Fluvanna County border south toward Sabot Island near Little River. Additionally, the Virginia Department of Health has declared a fish consumption advisory for this same section of the James River.

The Virginia Department of Environmental Quality and the Department of Conservation and Recreation has compiled a list of streams in Goochland County that are impaired for failure to meet the Primary Contact (Recreational) designated use, because of bacterial standard violations:

Table 62: Impaired Waters of Goochland County[137]

Waterbody Name	Size (miles)	County	Cause
Byrd Creek	25.97	Goochland, Fluvanna, Louisa	Bacteria
Little Byrd Creek	1.5	Goochland, Fluvanna	Bacteria
Big & Little Lickinghole Creeks	29.54	Goochland	Bacteria
Beaverdam Creek	8.73	Goochland, Louisa	Bacteria
James River	22.87	Goochland, Fluvanna, Cumberland, Powhatan	Bacteria
James River	3.64	Goochland, Powhatan	Bacteria

The VDGIF database lists several "impediments" located within the county, mostly relating to dams on tributaries of the James River, which would impede the migration of aquatic species upstream from the James River.

The Virginia Department of Environmental Quality has a separate designation for waters of concern where indicators show an apparent decline in water quality. These waters are not impaired and are included only for informational purposes. The VDEQ lists the following Goochland County streams as waters of concern:

[136] 9 VAC 25-780-90 B.9.

[137] Virginia Department of Environmental Quality and Department of Conservation and Recreation. Virginia's 2006 NPS Impaired Rivers Ranking. Compiled from the Virginia's 2006 Nonpoint Source Pollution Priorities.

Table 63: Waters of Concern of Goochland County[138]

Waterbody Name	Size (miles)	County	Cause	Source
James River	22.87	Goochland, Cumberland, Powhatan	Nutrients - Total Phosphorus	Unknown
Beaverdam Creek	8.73	Goochland	Phosphorus	Unknown
Major Tuckahoe Creek Tributaries	11.76	Goochland, Henrico	Dissolved Oxygen, Fecal Coliform	NPS – urban
James River	2.0	Goochland	Cadmium	Unknown

4.2.12 Location of Point Source Discharges[139]

Point sources are fixed locations from which pollutants are emptied into a waterbody. A point source can be any single source of pollution, such as a pipe from a sewage treatment plant or a ditch. The following table reveals the point source discharge sites in Goochland County. The general location for each point source discharge site in Goochland County is shown in **Figure 20.**

Table 64: Point Source Discharge Sites[140]

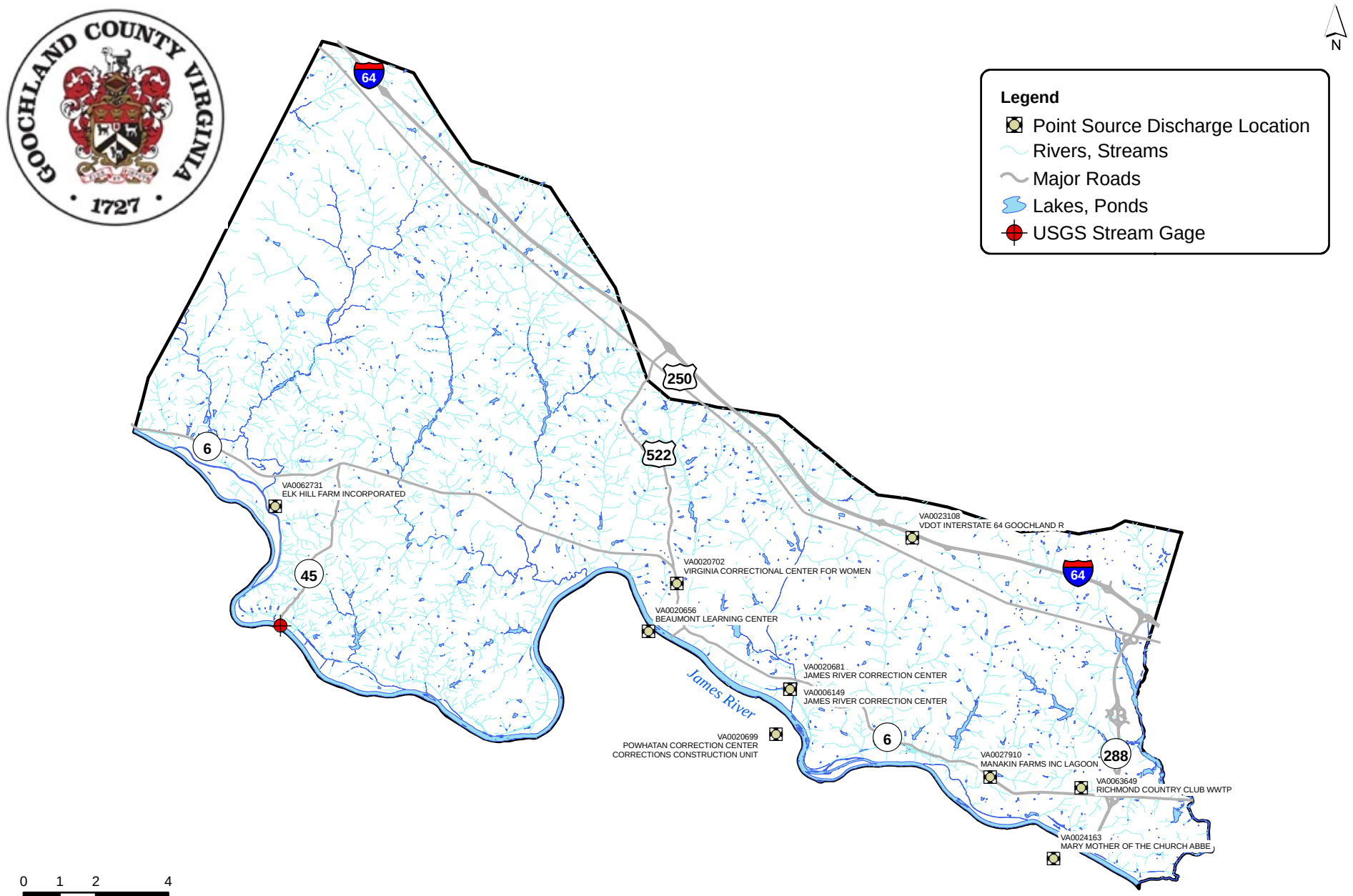
NPDES ID	Facility Name	Original Permit Issued Date	Permit Expiration Date	SIC Code	SIC Description	USGS HUC
VA0062731	Elk Hill Farm Incorporated	Aug-01-1977	Apr-26-2014	8361	Residential Care	2080205
VA0006149	James River Correctional Center	Jul-24-1974	Jul-27-2015	4941	Water Supply	2080205
VA0020681	James River Correctional Center	Jun-04-1975	Jun-05-2013	4952	Sewerage Systems	2080205
VA0027910	Manakin Farms Inc. Lagoon	Aug-01-1975	Sep-29-2013	4952	Sewerage Systems	2080205
VA0024163	Mary Mother of the Church Abbey (Benedictine)	June-04-1975	May-10-2014	8661	Religious Organizations	2080205
VA0063649	Richmond Country Club	Jan-31-1979	Jun-22-2014	7997	Membership, Sports and Rec Clubs	2080205
VA0023108	VDOT Interstate 64 (Rest Area)	Aug-01-1975	Jun-30-2012	4785	Fixed Facilities and Inspection; Weighing Services for Motor Vehicle Transportation	2080205
VA0020702	Virginia Correctional Center for Women	Aug-01-1975	Aug-19-2014	9223	Correctional Institutions	2080205

[138] VDEQ. Waters of Concern. Compiled from the 2002 Total Maximum Daily Load (TMDL) Priority List.
[139] 9 VAC 25-780-90 B.10.
[140] U.S. EPA. Water Discharge Permits. Compiled from the EPA Envirofacts Warehouse Database, accessed May 16, 2011.

4.2.13 Other Potential Threats to the Existing Water Quantity and Quality[141]

According to the Comprehensive Plan, water shortages occur in areas where residents and businesses rely on wells, particularly during prolonged periods of drought. Further, water quality is increasingly becoming an important development consideration. Retention of aquifer recharge areas will be increasingly important to maintain acceptable water quality. As shown in section 2.11 of this Plan, the majority of the current water sources are highly susceptible to contamination due to surrounding land uses. This problem is expected to increase, especially in the eastern end of the county, with commercial, industrial, and dense residential development.[142] Further, non-point sources of pollution including run-off from commercial, residential, and agricultural areas has the potential to influence the water quality in streams and the James River.

[141] 9 VAC 25-780 B.11.
[142]Goochland County 2028 Comprehensive Plan.



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Point Source Discharge Sites

Goochland County, Virginia

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FIGURE
20